

# Safety Standard Certified Ceramic Capacitors/ High Voltage Ceramic Capacitors



#### **EU RoHS Compliant**

- All the products in this catalog comply with EU RoHS.
- EU RoHS is "the European Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment."
- For more details, please refer to our website 'Murata's Approach for EU RoHS' (<http://www.murata.com/info/rohs.html>).

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## ● Part Numbering

### Safety Standard Certified Ceramic Capacitors

(Part Number)

|    |   |    |    |     |   |    |   |   |   |
|----|---|----|----|-----|---|----|---|---|---|
| DE | 2 | E3 | KY | 102 | M | N3 | A |   | F |
| ①  | ② | ③  | ④  | ⑤   | ⑥ | ⑦  | ⑧ | ⑨ | ⑩ |

#### ① Product ID

| Product ID |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| DE         | Safety Standard Certified Ceramic Capacitors/<br>High Voltage Ceramic Capacitors |

#### ② Series Category

| Code | Outline         | Contents                                                                            |
|------|-----------------|-------------------------------------------------------------------------------------|
| 1    | Safety Standard | Class X1, Y1                                                                        |
| 2    | Certified       | Class X1, Y2                                                                        |
| J    | 250Vac (r.m.s.) | -Products based on the<br>Electrical Appliance and<br>Material Safety Law of Japan- |

For Electrical Appliance and Material Safety Law of Japan, the first three digits (①Product ID and ②Series Category) express "Series Name."

For Safety Certified Capacitors, the first three digits express product code. The fourth figure expresses certified type shown in ④Safety Standard Certified Type column.

#### ③ Temperature Characteristics

| Code | Temperature Characteristics | Cap. Change or Temp. Coeff. | Temperature Range |
|------|-----------------------------|-----------------------------|-------------------|
| B3   | B                           | ±10%                        | -25 to +85°C      |
| E3   | E                           | +20%, -55%                  |                   |
| F3   | F                           | +30%, -80%                  |                   |
| 1X   | SL                          | +350 to -1000ppm/°C         | +20 to +85°C      |

#### ④ Rated Voltage/Safety Standard Certified Type

| Code | Rated Voltage                                                                   |
|------|---------------------------------------------------------------------------------|
| E2   | 250Vac (r.m.s.)                                                                 |
| KH   | X1, Y2; 250Vac (r.m.s.)<br>(Safety Standard Certified Type KH)                  |
| KY   | X1, Y2; 250Vac (r.m.s.), 300Vac (r.m.s.)<br>(Safety Standard Certified Type KY) |
| KX   | X1, Y1; 250Vac (r.m.s.), 300Vac (r.m.s.)<br>(Safety Standard Certified Type KX) |

#### ⑤ Capacitance

Expressed by three figures. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two numbers.

#### ⑥ Capacitance Tolerance

| Code | Capacitance Tolerance |
|------|-----------------------|
| J    | ±5%                   |
| K    | ±10%                  |
| M    | ±20%                  |
| Z    | +80%, -20%            |

#### ⑦ Lead Style

| Code | Lead Style            | Dimensions (mm) |                |                    |
|------|-----------------------|-----------------|----------------|--------------------|
|      |                       | Lead Spacing    | Lead Diameter  | Pitch of Component |
| A2   | Vertical Crimp Long   | 5               | ø0.6±0.05      | —                  |
| A3   |                       | 7.5             |                |                    |
| A4   |                       | 10              |                |                    |
| A5   |                       | 10              | ø0.6+0.1,—0.05 |                    |
| B2   | Vertical Crimp Short  | 5               | ø0.6±0.05      | —                  |
| B3   |                       | 7.5             |                |                    |
| B4   |                       | 10              |                |                    |
| B5   |                       | 10              | ø0.6+0.1,—0.05 |                    |
| C3   | Straight Long         | 7.5             | ø0.6±0.05      | —                  |
| D3   | Straight Short        | 7.5             | ø0.6±0.05      | —                  |
| N2   | Vertical Crimp Taping | 5               | ø0.6±0.05      | 12.7               |
| N3   |                       | 7.5             |                | 15                 |
| N4   |                       | 10              |                | 25.4               |
| N5   |                       | 10              | ø0.6+0.1,—0.05 | 25.4               |
| N7   |                       | 7.5             | ø0.6±0.05      | 30                 |
| P3   | Straight Taping       | 7.5             | ø0.6±0.05      | 15                 |

#### ⑧ Packaging

| Code | Packaging        |
|------|------------------|
| A    | Ammo Pack Taping |
| B    | Bulk             |

#### ⑨ Individual Specification Code

For part number that cannot be identified without "Individual Specification," it is added at the end of part number, expressed by three-digit alphanumerics.

#### ⑩ Halogen-free Compatible Product

## High Voltage Ceramic Capacitors (500V-6.3kV)

(Part Number)

|    |   |    |    |     |   |    |   |   |
|----|---|----|----|-----|---|----|---|---|
| DE | B | B3 | 3A | 102 | K | N2 | A |   |
| ①  | ② | ③  | ④  | ⑤   | ⑥ | ⑦  | ⑧ | ⑨ |

### ① Product ID

| Product ID |                                                                                             |
|------------|---------------------------------------------------------------------------------------------|
| DE         | High Voltage Ceramic Capacitors (500V-6.3kV) / Safety Standard Certified Ceramic Capacitors |

### ② Series Category

| Code | Outline      | Contents                                                         |
|------|--------------|------------------------------------------------------------------|
| A    | High Voltage | Class 1 (Char. SL) DC1-3.15kV Rated                              |
| B    |              | Class 2 DC1-3.15kV Rated                                         |
| C    |              | Class 1, 2 DC6.3kV Rated                                         |
| H    |              | High Temperature Guaranteed, Low-dissipation Factor (Char. R, C) |
| S    |              | High Temperature Guaranteed, Low-dissipation Factor (Char. D)    |
| F    |              | LCD Backlight Inverter Circuit                                   |

The first three digits (①Product ID and ②Series Category) express "Series Name."

### ③ Temperature Characteristics

| Code | Temperature Characteristics | Cap. Change or Temp. Coeff. | Temperature Range |
|------|-----------------------------|-----------------------------|-------------------|
| B3   | B                           | ±10%                        | -25 to +85°C      |
| E3   | E                           | +20%, -55%                  |                   |
| F3   | F                           | +30%, -80%                  |                   |
| C3   | C                           | ±20%                        | -25 to +85°C      |
|      |                             | +15%, -30%                  | +85 to +125°C     |
| R3   | R                           | ±15%                        | -25 to +85°C      |
|      |                             | +15%, -30%                  | +85 to +125°C     |
| D3   | D                           | +20%, -30%                  | -25 to +125°C     |
| 1X   | SL                          | +350 to -1000ppm/°C         | +20 to +85°C      |
| 2C   | CH                          | 0±60ppm/°C                  | +20 to +85°C      |

### ④ Rated Voltage

| Code | Rated Voltage |
|------|---------------|
| 2H   | 500Vdc        |
| 3A   | 1kVdc         |
| 3D   | 2kVdc         |
| 3F   | 3.15kVdc      |
| 3J   | 6.3kVdc       |
| LH   | 6.3kVp-p      |

### ⑤ Capacitance

Expressed by three figures. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two numbers.

### ⑥ Capacitance Tolerance

| Code | Capacitance Tolerance |
|------|-----------------------|
| C    | ±0.25pF               |
| D    | ±0.5pF                |
| J    | ±5%                   |
| K    | ±10%                  |
| Z    | +80%, -20%            |

### ⑦ Lead Style

| Code  | Lead Style            | Dimensions (mm) |               |                     |
|-------|-----------------------|-----------------|---------------|---------------------|
|       |                       | Lead Spacing    | Lead Diameter | Pitch of Components |
| A2    | Vertical Crimp Long   | 5               | ø0.6±0.05     | —                   |
| A3    |                       | 7.5             |               |                     |
| A4    |                       | 10              |               |                     |
| B2/J2 | Vertical Crimp Short  | 5               | ø0.6±0.05     | —                   |
| B3/J3 |                       | 7.5             |               |                     |
| B4    |                       | 10              |               |                     |
| C1    | Straight Long         | 5               | ø0.5±0.05     | —                   |
| C3    |                       | 7.5             | ø0.6±0.05     |                     |
| C4    |                       | 10              |               |                     |
| CD    |                       | 7.5             | ø0.5±0.05     |                     |
| D1    | Straight Short        | 5               | ø0.5±0.05     | —                   |
| D3    |                       | 7.5             | ø0.6±0.05     |                     |
| DD    |                       | 7.5             | ø0.5±0.05     |                     |
| N2    | Vertical Crimp Taping | 5               | ø0.6±0.05     | 12.7                |
| N3    |                       | 7.5             |               | 15                  |
| N7    |                       | 7.5             |               | 30                  |
| P2    | Straight Taping       | 5               | ø0.6±0.05     | 12.7                |
| P3    |                       | 7.5             |               | 15                  |

### ⑧ Packaging

| Code | Packaging        |
|------|------------------|
| A    | Ammo Pack Taping |
| B    | Bulk             |

### ⑨ Individual Specification Code

For part number that cannot be identified without "Individual Specification," it is added at the end of part number, expressed by three-digit alphanumerics.

## Safety Standard Certified Ceramic Capacitors for Automotive

(Part Number)

|    |   |    |    |     |   |    |   |   |
|----|---|----|----|-----|---|----|---|---|
| DE | 6 | E3 | KJ | 102 | M | N3 | A |   |
| ①  | ② | ③  | ④  | ⑤   | ⑥ | ⑦  | ⑧ | ⑨ |

### ① Product ID

| Product ID |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| DE         | Safety Standard Certified Ceramic Capacitors/<br>High Voltage Ceramic Capacitors |

### ② Series Category

| Code | Outline                      | Contents     |
|------|------------------------------|--------------|
| 6    | Safety Standard<br>Certified | Class X1, Y2 |

The first three digits express product code. The fourth figure expresses certified type shown in ④ Safety Standard Certified Type column.

### ③ Temperature Characteristics

| Code | Temperature<br>Characteristics | Cap. Change<br>or Temp. Coeff. | Temperature<br>Range |
|------|--------------------------------|--------------------------------|----------------------|
| B3   | B                              | ±10%                           | -25 to +85℃          |
| E3   | E                              | +20%, -55%                     |                      |

### ④ Rated Voltage/Safety Standard Certified Type

| Code | Rated Voltage                                                   |
|------|-----------------------------------------------------------------|
| KJ   | X1, Y2; 300Vac (r.m.s.),<br>(Safety Standard Certified Type KJ) |

### ⑤ Capacitance

Expressed by three figures. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros that follow the two numbers.

### ⑥ Capacitance Tolerance

| Code | Capacitance Tolerance |
|------|-----------------------|
| K    | ±10%                  |
| M    | ±20%                  |

### ⑦ Lead Style

| Code | Lead<br>Style            | Dimensions (mm) |               |                        |
|------|--------------------------|-----------------|---------------|------------------------|
|      |                          | Lead<br>Spacing | Lead Diameter | Pitch of<br>Components |
| A3   | Vertical Crimp<br>Long   | 7.5             | ø0.6±0.05     | —                      |
| B3   | Vertical Crimp<br>Short  |                 |               | —                      |
| N3   | Vertical Crimp<br>Taping |                 |               | 15                     |

### ⑧ Packaging

| Code | Packaging        |
|------|------------------|
| A    | Ammo Pack Taping |
| B    | Bulk             |

### ⑨ Individual Specification Code

For part number that cannot be identified without "Individual Specification," it is added at the end of part number, expressed by three-digit alphanumerics.

# Safety Standard Certified Ceramic Capacitors

**muRata**

1

## Type KY (Basic Insulation) -Class X1, Y2- (Recommend)

### ■ Features

1. Compact size; diameter 25% less than Type KH.
2. Operating temperature range guaranteed up to 125 degrees C.
3. Dielectric strength:  
AC2000V (for lead spacing F=5mm)  
AC2600V (for lead spacing F=7.5mm)
4. Class X1/Y2 capacitors certified by  
UL/CSA/VDE/BSI/SEMKO/DEMKO/FIMKO/NEMKO/  
ESTI/NSW/CQC.
5. Coated with flame-retardant epoxy resin  
(conforming to UL94V-0 standard).  
We recommend a halogen-free product\* as our  
standard item.  
\* Cl=900ppm max., Br=900ppm max. and  
Cl+Br=1500ppm max.
6. Taping available for automatic insertion.
7. AC300V Rated Voltage item are newly added.

### ■ Applications

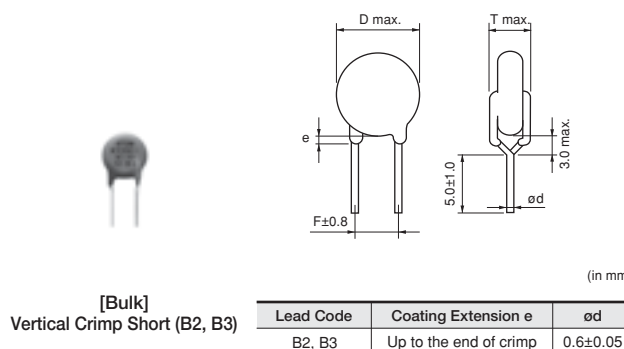
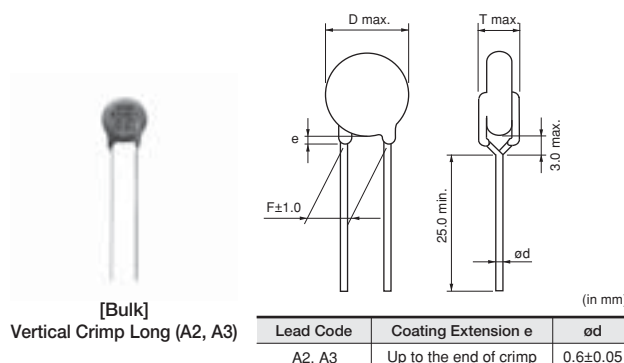
1. Ideal for use as X/Y capacitors for AC line filters  
and primary-secondary coupling on switching power  
supplies and AC adapters.
2. Ideal for use on D-A isolation and noise absorption  
for DAA modems without transformers.

Do not use these products in any automotive  
power train or safety equipment including battery  
chargers for electric vehicles and plug-in hybrids.  
Only Murata products clearly stipulated as  
"for Automotive use" on its catalog can be used  
for automobile applications such as power train and  
safety equipment.

### ■ Standard Certification

|       | Standard No.                                        | Certified No.                    | Rated Voltage   |
|-------|-----------------------------------------------------|----------------------------------|-----------------|
| UL    | UL60384-14                                          | E37921                           | 250Vac (r.m.s.) |
| CSA   | CSA E60384-14                                       | 1283280                          |                 |
| VDE   | IEC 60384-14<br>EN 60384-14                         | 40006273                         |                 |
| BSI   | EN 60065 (8.8, 14.2)<br>IEC 60384-14<br>EN 60384-14 | KM 37901                         |                 |
| SEMKO | IEC 60384-14<br>EN 60384-14                         | 1207848                          |                 |
| DEMKO |                                                     | D01002                           |                 |
| FIMKO |                                                     | 24197                            |                 |
| NEMKO |                                                     | P12215094                        |                 |
| ESTI  |                                                     | 12.0102                          |                 |
| NSW   | IEC 60384-14<br>AS3250                              | 6824                             |                 |
| CQC   | GB/T14472                                           | CQC06001017446<br>CQC06001017447 |                 |

- The certification number might change due to revision of the application standard and changes in the range of acquisition.
- Please contact us when the certification of South Korean Safety Standard is necessary.



|       | Standard No.                                        | Certified No.                    | Rated Voltage   |
|-------|-----------------------------------------------------|----------------------------------|-----------------|
| UL    | UL60384-14                                          | E37921                           | 300Vac (r.m.s.) |
| CSA   | CSA E60384-14                                       | 1283280                          |                 |
| VDE   | IEC 60384-14<br>EN 60384-14                         | 40006273                         |                 |
| BSI   | EN 60065 (8.8, 14.2)<br>IEC 60384-14<br>EN 60384-14 | KM 37901                         |                 |
| SEMKO | IEC 60384-14<br>EN 60384-14                         | 1207848                          |                 |
| DEMKO |                                                     | D01002                           |                 |
| FIMKO |                                                     | 24197                            |                 |
| NEMKO |                                                     | P12215094                        |                 |
| ESTI  |                                                     | 12.0102                          |                 |
| NSW   | IEC 60384-14<br>AS3250                              | 6824                             |                 |
| CQC   | IEC 60384-14                                        | CQC12001079706<br>CQC12001079940 |                 |

- The certification number might change due to revision of the application standard and changes in the range of acquisition.

## ■ Marking

| Example | Item                                                                                    |
|---------|-----------------------------------------------------------------------------------------|
|         | ① Type Designation KY                                                                   |
|         | ② Nominal Capacitance<br>(Under 100pF: Actual value,<br>100pF and over: 3 digit system) |
|         | ③ Capacitance Tolerance                                                                 |
|         | ④ Company Name Code<br>Ⓒ8 : Made in Taiwan Ⓒ15 : Made in Thailand                       |
|         | ⑤ Manufactured Date Code                                                                |
|         | Class Code X1Y2                                                                         |
|         | Rated Voltage Mark 250~, 300~                                                           |
|         | Halogen Free Mark HF                                                                    |
|         |                                                                                         |
|         |                                                                                         |

## Rated Voltage 250Vac

### ● Lead Spacing F=7.5mm

| Part Number        | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|--------------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE21XKY100J□□□M02F | 250Vac(r.m.s.)   | SL          | 10pF±5%     | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE21XKY150J□□□M02F | 250Vac(r.m.s.)   | SL          | 15pF±5%     | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE21XKY220J□□□M02F | 250Vac(r.m.s.)   | SL          | 22pF±5%     | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE21XKY330J□□□M02F | 250Vac(r.m.s.)   | SL          | 33pF±5%     | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE21XKY470J□□□M02F | 250Vac(r.m.s.)   | SL          | 47pF±5%     | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE21XKY680J□□□M02F | 250Vac(r.m.s.)   | SL          | 68pF±5%     | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY101K□□□M02F | 250Vac(r.m.s.)   | B           | 100pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY151K□□□M02F | 250Vac(r.m.s.)   | B           | 150pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY221K□□□M02F | 250Vac(r.m.s.)   | B           | 220pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY331K□□□M02F | 250Vac(r.m.s.)   | B           | 330pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY471K□□□M02F | 250Vac(r.m.s.)   | B           | 470pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY681K□□□M02F | 250Vac(r.m.s.)   | B           | 680pF±10%   | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY102M□□□M02F | 250Vac(r.m.s.)   | E           | 1000pF±20%  | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY152M□□□M02F | 250Vac(r.m.s.)   | E           | 1500pF±20%  | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY222M□□□M02F | 250Vac(r.m.s.)   | E           | 2200pF±20%  | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY332M□□□M02F | 250Vac(r.m.s.)   | E           | 3300pF±20%  | 9.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY472M□□□M02F | 250Vac(r.m.s.)   | E           | 4700pF±20%  | 10.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2F3KY103M□□□M02F | 250Vac(r.m.s.)   | F           | 10000pF±20% | 14.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Individual specification code "M02" expresses "simplicity marking and guarantee of dielectric strength between lead wires: AC2600V."

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KY) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

### ● Lead Spacing F=5mm

| Part Number        | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|--------------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE21XKY100J□□□M01F | 250Vac(r.m.s.)   | SL          | 10pF±5%     | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE21XKY150J□□□M01F | 250Vac(r.m.s.)   | SL          | 15pF±5%     | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE21XKY220J□□□M01F | 250Vac(r.m.s.)   | SL          | 22pF±5%     | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE21XKY330J□□□M01F | 250Vac(r.m.s.)   | SL          | 33pF±5%     | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE21XKY470J□□□M01F | 250Vac(r.m.s.)   | SL          | 47pF±5%     | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE21XKY680J□□□M01F | 250Vac(r.m.s.)   | SL          | 68pF±5%     | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2B3KY101K□□□M01F | 250Vac(r.m.s.)   | B           | 100pF±10%   | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2B3KY151K□□□M01F | 250Vac(r.m.s.)   | B           | 150pF±10%   | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2B3KY221K□□□M01F | 250Vac(r.m.s.)   | B           | 220pF±10%   | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2B3KY331K□□□M01F | 250Vac(r.m.s.)   | B           | 330pF±10%   | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2B3KY471K□□□M01F | 250Vac(r.m.s.)   | B           | 470pF±10%   | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2B3KY681K□□□M01F | 250Vac(r.m.s.)   | B           | 680pF±10%   | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2E3KY102M□□□M01F | 250Vac(r.m.s.)   | E           | 1000pF±20%  | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |

Continued on the following page. ↗

Continued from the preceding page.

| Part Number        | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|--------------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE2E3KY152M□□□M01F | 250Vac(r.m.s.)   | E           | 1500pF±20%  | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2E3KY222M□□□M01F | 250Vac(r.m.s.)   | E           | 2200pF±20%  | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2E3KY332M□□□M01F | 250Vac(r.m.s.)   | E           | 3300pF±20%  | 9.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DE2E3KY472M□□□M01F | 250Vac(r.m.s.)   | E           | 4700pF±20%  | 10.0mm max. | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Individual specification code "M01" expresses "simplicity marking and guarantee of dielectric strength between lead wires: AC2000V."

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KY) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

## Rated Voltage 300Vac

### ● Lead Spacing F=7.5mm

| Part Number        | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|--------------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE2B3KY101K□□□U02F | 300Vac(r.m.s.)   | B           | 100pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY151K□□□U02F | 300Vac(r.m.s.)   | B           | 150pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY221K□□□U02F | 300Vac(r.m.s.)   | B           | 220pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY331K□□□U02F | 300Vac(r.m.s.)   | B           | 330pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY471K□□□U02F | 300Vac(r.m.s.)   | B           | 470pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KY681K□□□U02F | 300Vac(r.m.s.)   | B           | 680pF±10%   | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY102M□□□U02F | 300Vac(r.m.s.)   | E           | 1000pF±20%  | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY152M□□□U02F | 300Vac(r.m.s.)   | E           | 1500pF±20%  | 7.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY222M□□□U02F | 300Vac(r.m.s.)   | E           | 2200pF±20%  | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY332M□□□U02F | 300Vac(r.m.s.)   | E           | 3300pF±20%  | 9.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KY472M□□□U02F | 300Vac(r.m.s.)   | E           | 4700pF±20%  | 10.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2F3KY103M□□□U02F | 300Vac(r.m.s.)   | F           | 10000pF±20% | 14.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Individual specification code "U02" expresses "simplicity marking and guarantee of dielectric strength between lead wires: AC2600V."

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KY) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

# Safety Standard Certified Ceramic Capacitors

**muRata**

## Type KH (Basic Insulation) -Class X1, Y2-

2

### ■ Features

1. Operating temperature range guaranteed up to 125 degrees C.
2. Dielectric strength: AC2600V
3. Class X1/Y2 capacitors certified by UL/CSA/VDE/BSI/SEMKO/DEMKO/FIMKO/NEMKO/ESTI/NSW.
4. Coated with flame-retardant epoxy resin (conforming to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.  
\* Cl=900ppm max., Br=900ppm max. and Cl+Br=1500ppm max.
5. Taping available for automatic insertion.

### ■ Applications

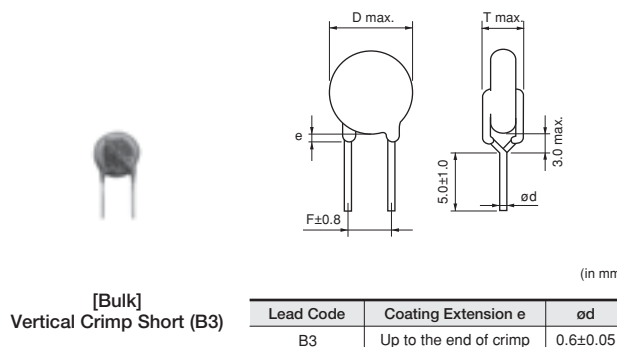
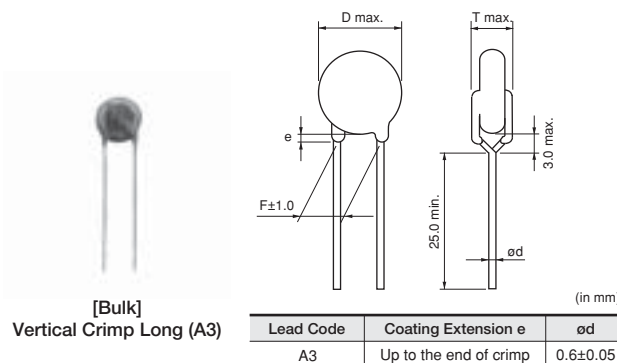
Ideal for use as X/Y capacitors for AC line filters and primary-secondary coupling on switching power supplies and AC adapters.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.

### ■ Standard Certification

|       | Standard No.                                        | Certified No. | Rated Voltage   |
|-------|-----------------------------------------------------|---------------|-----------------|
| UL    | UL60384-14                                          | E37921        | 250Vac (r.m.s.) |
| CSA   | CSA E60384-14                                       | 1343805       |                 |
| VDE   | IEC 60384-14<br>EN 60384-14                         | 40002796      |                 |
| BSI   | EN 60065 (8.8, 14.2)<br>IEC 60384-14<br>EN 60384-14 | KM 37901      |                 |
| SEMKO | IEC 60384-14<br>EN 60384-14                         | 1200285       |                 |
| DEMKO |                                                     | D01006        |                 |
| FIMKO |                                                     | 24195         |                 |
| NEMKO |                                                     | P12215095     |                 |
| ESTI  |                                                     | 12.0104       |                 |
| NSW   | IEC 60384-14<br>AS3250                              | 6529          |                 |

- The certification number might change due to revision of the application standard and changes in the range of acquisition.
- Please contact us when the certification of Chinese Safety Standard or South Korean Safety Standard is necessary.



### ■ Marking

| Example | Item                                                            |
|---------|-----------------------------------------------------------------|
|         | ① Type Designation KH                                           |
|         | ② Nominal Capacitance (Marked with 3 figures)                   |
|         | ③ Capacitance Tolerance                                         |
|         | ④ Company Name Code<br>☞8: Made in Taiwan ☞15: Made in Thailand |
|         | ⑤ Manufactured Date Code                                        |
|         | UL Approval Mark                                                |
|         | CSA Approval Mark                                               |
|         | VDE Approval Mark                                               |
|         | BSI Approval Mark                                               |
|         | SEMKO Approval Mark                                             |
|         | DEMKO Approval Mark                                             |
|         | FIMKO Approval Mark                                             |
|         | NEMKO Approval Mark                                             |
|         | ESTI Approval Mark                                              |
|         | Class Code X1Y2                                                 |
|         | Rated Voltage Mark 250~                                         |

| Part Number    | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE2B3KH101K□□□ | 250Vac(r.m.s.)   | B           | 100pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KH151K□□□ | 250Vac(r.m.s.)   | B           | 150pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KH221K□□□ | 250Vac(r.m.s.)   | B           | 220pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KH331K□□□ | 250Vac(r.m.s.)   | B           | 330pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KH471K□□□ | 250Vac(r.m.s.)   | B           | 470pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2B3KH681K□□□ | 250Vac(r.m.s.)   | B           | 680pF±10%   | 9.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KH102M□□□ | 250Vac(r.m.s.)   | E           | 1000pF±20%  | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KH152M□□□ | 250Vac(r.m.s.)   | E           | 1500pF±20%  | 9.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KH222M□□□ | 250Vac(r.m.s.)   | E           | 2200pF±20%  | 10.0mm max. | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KH332M□□□ | 250Vac(r.m.s.)   | E           | 3300pF±20%  | 12.0mm max. | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2E3KH472M□□□ | 250Vac(r.m.s.)   | E           | 4700pF±20%  | 13.0mm max. | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE2F3KH103M□□□ | 250Vac(r.m.s.)   | F           | 10000pF±20% | 16.0mm max. | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N7A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KH) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

# Safety Standard Certified Ceramic Capacitors

**muRata**

## Type KX New Small Size (Reinforced Insulation) -Class X1, Y1- (Recommend)

### ■ Features

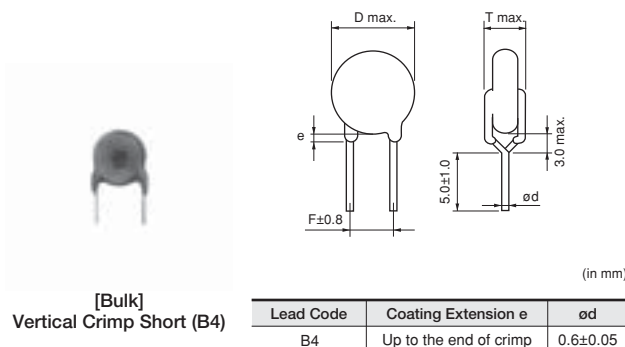
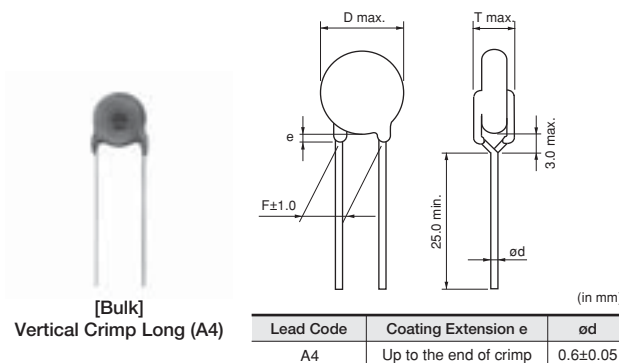
1. We design capacitors much more compact in size than current Type KX, having reduced the diameter by 20% max.
2. Operating temperature range guaranteed up to 125 degrees C.
3. Dielectric strength: AC4000V
4. Class X1/Y1 capacitors certified by UL/CSA/VDE/BSI/SEMCO/DEMCO/FIMKO/NEMKO/ESTI/IMQ/CQC.
5. Can be use with a component in appliances requiring reinforced insulation and double insulation based on UL1492, IEC60065 and IEC60950.
6. Coated with flame-retardant epoxy resin (conforming to UL94V-0 standard).  
We recommend a halogen-free product\* as our standard item.  
\* Cl=900ppm max., Br=900ppm max. and Cl+Br=1500ppm max.
7. Taping available for automatic insertion.
8. AC300V Rated Voltage item are newly added.

### ■ Applications

1. Ideal for use as X/Y capacitors for AC line filters and primary-secondary coupling on switching power supplies and AC adapters.
2. Ideal for use on D-A isolation and noise absorption for DAA modems without transformers.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.

\*: Small sized Type KX differs from current Type KX in electrical characteristics, such as the voltage dependency, capacitance temperature dependency, and Dielectric strength.  
Therefore, before replacing current Type KX, please make a performance check by equipment. Please also refer to Notice (Rating) item 2, "Performance Check by Equipment," below.



## ■ Standard Certification Rated Voltage (AC250V) B, E Char.

|       | Standard No.                                        | Certified No.                    |
|-------|-----------------------------------------------------|----------------------------------|
| UL    | UL60384-14                                          | E37921                           |
| CSA   | CSA E60384-14                                       | 1343810                          |
| VDE   | IEC 60384-14<br>EN 60384-14                         | 40002831                         |
| BSI   | EN 60065 (8.8, 14.2)<br>IEC 60384-14<br>EN 60384-14 | KM 37901                         |
| SEMKO | IEC 60384-14<br>EN 60384-14                         | 1200074                          |
| DEMKO |                                                     | D01004                           |
| FIMKO |                                                     | 24191                            |
| NEMKO |                                                     | P12215096                        |
| ESTI  |                                                     | 12.0094                          |
| IMQ   | EN 60384-14                                         | V4069                            |
| CQC   | GB/T14472                                           | CQC02001001556<br>CQC04001011643 |

- The certification number might change due to revision of the application standard and changes in the range of acquisition.
- Please contact us when the certification of South Korean Safety Standard is necessary.

## ■ Standard Certification Rated Voltage (AC300V) B, E Char.

|       | Standard No.                                        | Certified No.                    |
|-------|-----------------------------------------------------|----------------------------------|
| UL    | UL60384-14                                          | E37921                           |
| CSA   | CSA E60384-14                                       | 1343810                          |
| VDE   | IEC 60384-14<br>EN 60384-14                         | 40002831                         |
| BSI   | EN 60065 (8.8, 14.2)<br>IEC 60384-14<br>EN 60384-14 | KM 37901                         |
| SEMKO | IEC 60384-14<br>EN 60384-14                         | 1200074                          |
| DEMKO |                                                     | D01004                           |
| FIMKO |                                                     | 24191                            |
| NEMKO |                                                     | P12215096                        |
| ESTI  |                                                     | 12.0094                          |
| IMQ   | EN 60384-14                                         | V4069                            |
| CQC   | IEC 60384-14                                        | CQC12001079735<br>CQC12001079941 |

- The certification number might change due to revision of the application standard and changes in the range of acquisition.

## ■ Marking Rated Voltage (AC250V) B, E Char.

| Example | Item                                                              |
|---------|-------------------------------------------------------------------|
|         | ① Type Designation KX                                             |
|         | ② Nominal Capacitance (3 digit system)                            |
|         | ③ Capacitance Tolerance                                           |
|         | ④ Company Name Code<br>Ⓒ8 : Made in Taiwan Ⓒ15 : Made in Thailand |
|         | ⑤ Manufactured Date Code                                          |
|         | Class Code X1Y1                                                   |
|         | Rated Voltage Mark 250~                                           |
|         | Halogen Free Mark HF                                              |

## ■ Marking Rated Voltage (AC300V) B, E Char.

| Example | Item                                                              |
|---------|-------------------------------------------------------------------|
|         | ① Type Designation KX                                             |
|         | ② Nominal Capacitance (3 digit system)                            |
|         | ③ Capacitance Tolerance                                           |
|         | ④ Company Name Code<br>Ⓒ8 : Made in Taiwan Ⓒ15 : Made in Thailand |
|         | ⑤ Manufactured Date Code                                          |
|         | Class Code X1Y1                                                   |
|         | Rated Voltage Mark 300~                                           |
|         | Halogen Free Mark HF                                              |

## Rated Voltage 250Vac

| Part Number        | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|--------------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE1B3KX101K□□□N01F | 250Vac(r.m.s.)   | B           | 100pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX151K□□□N01F | 250Vac(r.m.s.)   | B           | 150pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX221K□□□N01F | 250Vac(r.m.s.)   | B           | 220pF±10%   | 8.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX331K□□□N01F | 250Vac(r.m.s.)   | B           | 330pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX471K□□□N01F | 250Vac(r.m.s.)   | B           | 470pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX681K□□□N01F | 250Vac(r.m.s.)   | B           | 680pF±10%   | 8.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX102M□□□N01F | 250Vac(r.m.s.)   | E           | 1000pF±20%  | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX152M□□□N01F | 250Vac(r.m.s.)   | E           | 1500pF±20%  | 8.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX222M□□□N01F | 250Vac(r.m.s.)   | E           | 2200pF±20%  | 9.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX332M□□□N01F | 250Vac(r.m.s.)   | E           | 3300pF±20%  | 10.0mm max. | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX472M□□□N01F | 250Vac(r.m.s.)   | E           | 4700pF±20%  | 12.0mm max. | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KX) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

Please contact us when less than 100pF capacitance product is necessary.

## Rated Voltage 300Vac

| Part Number        | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|--------------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE1B3KX101K□□□P01F | 300Vac(r.m.s.)   | B           | 100pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX151K□□□P01F | 300Vac(r.m.s.)   | B           | 150pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX221K□□□P01F | 300Vac(r.m.s.)   | B           | 220pF±10%   | 8.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX331K□□□P01F | 300Vac(r.m.s.)   | B           | 330pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX471K□□□P01F | 300Vac(r.m.s.)   | B           | 470pF±10%   | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1B3KX681K□□□P01F | 300Vac(r.m.s.)   | B           | 680pF±10%   | 8.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX102M□□□P01F | 300Vac(r.m.s.)   | E           | 1000pF±20%  | 7.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX152M□□□P01F | 300Vac(r.m.s.)   | E           | 1500pF±20%  | 8.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX222M□□□P01F | 300Vac(r.m.s.)   | E           | 2200pF±20%  | 9.0mm max.  | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX332M□□□P01F | 300Vac(r.m.s.)   | E           | 3300pF±20%  | 10.0mm max. | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |
| DE1E3KX472M□□□P01F | 300Vac(r.m.s.)   | E           | 4700pF±20%  | 12.0mm max. | 10.0                | 7.0mm max.       | A4B                    | B4B                     | N4A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KX) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

# Safety Standard Certified Ceramic Capacitors

**muRata**

## Type KX (Reinforced Insulation) -Class X1, Y1-

### ■ Features

- Operating temperature range guaranteed up to 125 degrees C.
- Dielectric strength: AC4000V
- Class X1/Y1 capacitors certified by UL/CSA/VDE/BSI/SEMKO/DEMKO/FIMKO/NEMKO/ESTI/IMQ.
- Can be use with a component in appliances requiring reinforced insulation and double insulation based on UL1492, IEC60065 and IEC60950.
- Coated with flame-retardant epoxy resin (conforming to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.  
\* Cl=900ppm max., Br=900ppm max. and Cl+Br=1500ppm max.
- Taping available for automatic insertion.

### ■ Applications

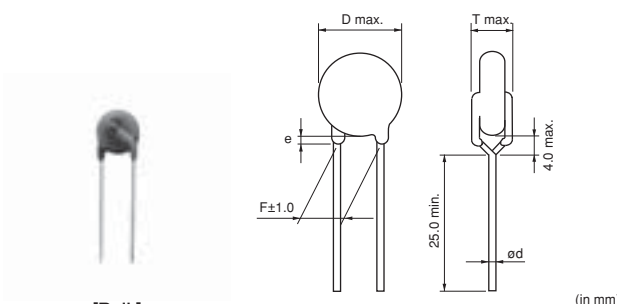
Ideal for use as X/Y capacitors for AC line filters and primary-secondary coupling on switching power supplies and AC adapters.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.

### ■ Standard Certification

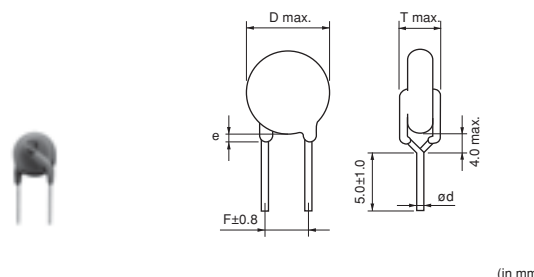
|       | Standard No.                                        | Certified No. | Rated Voltage   |
|-------|-----------------------------------------------------|---------------|-----------------|
| UL    | UL60384-14                                          | E37921        | 250Vac (r.m.s.) |
| CSA   | CSA E60384-14                                       | 1343810       |                 |
| VDE   | IEC 60384-14<br>EN 60384-14                         | 40002831      |                 |
| BSI   | EN 60065 (8.8, 14.2)<br>IEC 60384-14<br>EN 60384-14 | KM 37901      |                 |
| SEMKO | IEC 60384-14<br>EN 60384-14                         | 1200074       |                 |
| DEMKO |                                                     | D01004        |                 |
| FIMKO |                                                     | 24191         |                 |
| NEMKO |                                                     | P12215096     |                 |
| ESTI  |                                                     | 12.0094       |                 |
| IMQ   | EN 60384-14                                         | V4069         |                 |

- The certification number might change due to revision of the application standard and changes in the range of acquisition.
- Please contact us when the certification of Chinese Safety Standard or South Korean Safety Standard is necessary.



[Bulk]  
Vertical Crimp Long (A5)

| Lead Code | Coating Extension e    | ød                                  |
|-----------|------------------------|-------------------------------------|
| A5        | Up to the end of crimp | 0.6± <sup>0.1</sup> <sub>0.05</sub> |



[Bulk]  
Vertical Crimp Short (B5)

| Lead Code | Coating Extension e    | ød                                  |
|-----------|------------------------|-------------------------------------|
| B5        | Up to the end of crimp | 0.6± <sup>0.1</sup> <sub>0.05</sub> |

### ■ Marking

| Example | Item                                                                                        |
|---------|---------------------------------------------------------------------------------------------|
|         | ① Type Designation KX                                                                       |
|         | ② Nominal Capacitance<br>(Under 100pF: Actual value, 100pF and over: Marked with 3 figures) |
|         | ③ Capacitance Tolerance                                                                     |
|         | ④ Company Name Code<br>Ⓞ8 : Made in Taiwan Ⓞ15 : Made in Thailand                           |
|         | ⑤ Manufactured Date Code                                                                    |
|         | UL Approval Mark                                                                            |
|         | CSA Approval Mark                                                                           |
|         | VDE Approval Mark                                                                           |
|         | BSI Approval Mark BSI                                                                       |
|         | SEMKO Approval Mark                                                                         |
|         | DEMKO Approval Mark                                                                         |
|         | FIMKO Approval Mark                                                                         |
|         | NEMKO Approval Mark                                                                         |
|         | ESTI Approval Mark                                                                          |
|         | IMQ Approval Mark                                                                           |
|         | Class Code X1Y1                                                                             |
|         | Rated Voltage Mark 250~                                                                     |

| Part Number       | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|-------------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE1B3KX101K□□□    | 250Vac(r.m.s.)   | B           | 100pF±10%   | 9.0mm max.  | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1B3KX151K□□□    | 250Vac(r.m.s.)   | B           | 150pF±10%   | 9.0mm max.  | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1B3KX221K□□□    | 250Vac(r.m.s.)   | B           | 220pF±10%   | 9.0mm max.  | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1B3KX331K□□□    | 250Vac(r.m.s.)   | B           | 330pF±10%   | 9.0mm max.  | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1B3KX471K□□□    | 250Vac(r.m.s.)   | B           | 470pF±10%   | 9.0mm max.  | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1B3KX681K□□□    | 250Vac(r.m.s.)   | B           | 680pF±10%   | 10.0mm max. | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1E3KX102M□□□A01 | 250Vac(r.m.s.)   | E           | 1000pF±20%  | 8.0mm max.  | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1E3KX152M□□□A01 | 250Vac(r.m.s.)   | E           | 1500pF±20%  | 9.0mm max.  | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1E3KX222M□□□A01 | 250Vac(r.m.s.)   | E           | 2200pF±20%  | 10.0mm max. | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1E3KX332M□□□A01 | 250Vac(r.m.s.)   | E           | 3300pF±20%  | 12.0mm max. | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1E3KX392M□□□A01 | 250Vac(r.m.s.)   | E           | 3900pF±20%  | 13.0mm max. | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |
| DE1E3KX472M□□□A01 | 250Vac(r.m.s.)   | E           | 4700pF±20%  | 15.0mm max. | 10.0                | 8.0mm max.       | A5B                    | B5B                     | N5A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KX) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

## Type KY/KH/KX Specifications and Test Methods

Operating Temperature Range: -40 to +125°C (Except for UL/VDE, -25 to +125°C)

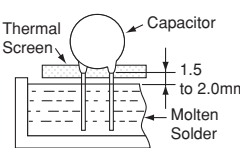
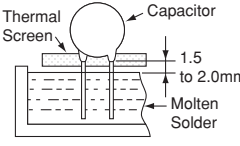
| No.   | Item                                                                               |                    | Specifications                                                                                                                                                                                                                                                                                                                                                               | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
|-------|------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------|-------------|------------------------------------------------------------------------------------|-------------|-----------------|-------------|---------------------------------------|-------------------------|----|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|---|------|---|-------|---|------|---|------|---|------|
| 1     | Appearance and Dimensions                                                          |                    | No visible defect, and dimensions are within specified range.                                                                                                                                                                                                                                                                                                                | The capacitor should be visually inspected for evidence of defect.<br>Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 2     | Marking                                                                            |                    | To be easily legible                                                                                                                                                                                                                                                                                                                                                         | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 3     | Capacitance                                                                        |                    | Within specified tolerance                                                                                                                                                                                                                                                                                                                                                   | The capacitance, dissipation factor and Q should be measured at 20°C with 1±0.1kHz (char. SL: 1±0.1MHz) and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 4     | Dissipation Factor (D.F.)<br>Q                                                     |                    | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.≤2.5%</td></tr><tr><td>F</td><td>D.F.≤5.0%</td></tr><tr><td>SL</td><td>Q≥400+20C*(C&lt;30pF)<br/>Q≥1000 (C≥30pF)</td></tr></table>                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Char.              | Specifications | B, E        | D.F.≤2.5%                                                                          | F           | D.F.≤5.0%       | SL          | Q≥400+20C*(C<30pF)<br>Q≥1000 (C≥30pF) |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| Char. | Specifications                                                                     |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| B, E  | D.F.≤2.5%                                                                          |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| F     | D.F.≤5.0%                                                                          |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| SL    | Q≥400+20C*(C<30pF)<br>Q≥1000 (C≥30pF)                                              |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 5     | Insulation Resistance (I.R.)                                                       |                    | 10000MΩ min.                                                                                                                                                                                                                                                                                                                                                                 | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.<br>The voltage should be applied to the capacitor through a resistor of 1MΩ.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 6     | Dielectric Strength                                                                | Between Lead Wires | No failure                                                                                                                                                                                                                                                                                                                                                                   | <p>The capacitor should not be damaged when the test voltages from Table 1 are applied between the lead wires for 60 sec.</p> <p>&lt;Table 1&gt;</p> <table><tr><th>Type</th><th>Test Voltage</th></tr><tr><td>KY</td><td>For lead spacing F=5mm AC2000V(r.m.s.)<br/>For lead spacing F=7.5mm AC2600V(r.m.s.)</td></tr><tr><td>KH</td><td>AC2600V(r.m.s.)</td></tr><tr><td>KX</td><td>AC4000V(r.m.s.)</td></tr></table>                                                                                                                                                                                                                                                                                                                                                            | Type               | Test Voltage   | KY          | For lead spacing F=5mm AC2000V(r.m.s.)<br>For lead spacing F=7.5mm AC2600V(r.m.s.) | KH          | AC2600V(r.m.s.) | KX          | AC4000V(r.m.s.)                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
|       |                                                                                    | Type               | Test Voltage                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| KY    | For lead spacing F=5mm AC2000V(r.m.s.)<br>For lead spacing F=7.5mm AC2600V(r.m.s.) |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| KH    | AC2600V(r.m.s.)                                                                    |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| KX    | AC4000V(r.m.s.)                                                                    |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
|       |                                                                                    | Body Insulation    | No failure                                                                                                                                                                                                                                                                                                                                                                   | <p>First, the terminals of the capacitor should be connected together. Then, as shown in the figure at right, a metal foil should be closely wrapped around the body of the capacitor to the distance of about 3 to 6mm from each terminal.</p> <p>Then, the capacitor should be inserted into a container filled with metal balls of about 1mm diameter. Finally, AC voltage from Table 2 is applied for 60 sec. between the capacitor lead wires and metal balls.</p> <p>&lt;Table 2&gt;</p> <table><tr><th>Type</th><th>Test Voltage</th></tr><tr><td>KY</td><td>AC2600V(r.m.s.)</td></tr><tr><td>KH</td><td>AC2600V(r.m.s.)</td></tr><tr><td>KX</td><td>AC4000V(r.m.s.)</td></tr></table>  | Type               | Test Voltage   | KY          | AC2600V(r.m.s.)                                                                    | KH          | AC2600V(r.m.s.) | KX          | AC4000V(r.m.s.)                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| Type  | Test Voltage                                                                       |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| KY    | AC2600V(r.m.s.)                                                                    |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| KH    | AC2600V(r.m.s.)                                                                    |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| KX    | AC4000V(r.m.s.)                                                                    |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 7     | Temperature Characteristics                                                        |                    | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E</td><td>Within ±20%</td></tr><tr><td>F</td><td>Within ±30%</td></tr></table> (Temp. range: -25 to +85°C)<br><br><table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to -1000ppm/°C</td></tr></table> (Temp. range: +20 to +85°C) | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Capacitance Change | B              | Within ±10% | E                                                                                  | Within ±20% | F               | Within ±30% | Char.                                 | Temperature Coefficient | SL | +350 to -1000ppm/°C | <p>The capacitance measurement should be made at each step specified in Table 3.</p> <p>&lt;Table 3&gt;</p> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>20±2</td></tr><tr><td>2</td><td>-25±2</td></tr><tr><td>3</td><td>20±2</td></tr><tr><td>4</td><td>85±2</td></tr><tr><td>5</td><td>20±2</td></tr></table> | Step | Temperature (°C) | 1 | 20±2 | 2 | -25±2 | 3 | 20±2 | 4 | 85±2 | 5 | 20±2 |
| Char. | Capacitance Change                                                                 |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| B     | Within ±10%                                                                        |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| E     | Within ±20%                                                                        |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| F     | Within ±30%                                                                        |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| Char. | Temperature Coefficient                                                            |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| SL    | +350 to -1000ppm/°C                                                                |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| Step  | Temperature (°C)                                                                   |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 1     | 20±2                                                                               |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 2     | -25±2                                                                              |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 3     | 20±2                                                                               |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 4     | 85±2                                                                               |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 5     | 20±2                                                                               |                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |
| 8     | Solderability of Leads                                                             |                    | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                                                                                                                                                                                                          | <p>The lead wire of a capacitor should be dipped into molten solder for 2±0.5 sec.</p> <p>The depth of immersion is up to about 1.5 to 2.0mm from the root of lead wires.</p> <p>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br/>H63 Eutectic Solder 235±5°C</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                |             |                                                                                    |             |                 |             |                                       |                         |    |                     |                                                                                                                                                                                                                                                                                                                                             |      |                  |   |      |   |       |   |      |   |      |   |      |

\*1 "C" expresses nominal capacitance value (pF).

Continued on the following page. 

## Type KY/KH/KX Specifications and Test Methods

Continued from the preceding page.

| No. | Item                           | Specifications      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----|--------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9   | Soldering Effect (Non-Preheat) | Appearance          | <p>As shown in the figure, the lead wires should be immersed in solder of <math>350\pm10^{\circ}\text{C}</math> or <math>260\pm5^{\circ}\text{C}</math> up to 1.5 to 2.0mm from the root of terminal for <math>3.5\pm0.5</math> sec. (<math>10\pm1</math> sec. for <math>260\pm5^{\circ}\text{C}</math>).</p> <p>Pre-treatment:<br/>Capacitor should be stored at <math>85\pm2^{\circ}\text{C}</math> for 1 hr., then placed at room condition*2 for <math>24\pm2</math> hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*2</p>       |
|     |                                | Capacitance Change  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 10  | Soldering Effect (On-Preheat)  | Appearance          | <p>First the capacitor should be stored at <math>120+0/-5^{\circ}\text{C}</math> for <math>60+0/-5</math> sec.</p> <p>Then, as in the figure, the lead wires should be immersed in solder of <math>260+0/-5^{\circ}\text{C}</math> up to 1.5 to 2.0mm from the root of terminal for <math>7.5+0/-1</math> sec.</p> <p>Pre-treatment:<br/>Capacitor should be stored at <math>85\pm2^{\circ}\text{C}</math> for 1 hr., then placed at room condition*2 for <math>24\pm2</math> hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*2</p>  |
|     |                                | Capacitance Change  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 11  | Vibration Resistance           | Appearance          | <p>The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz.</p> <p>Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.</p>                                                                                                                                                                                                                                                                                                                                                                   |
|     |                                | Capacitance         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | D.F.<br>Q           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 12  | Humidity (Under Steady State)  | Appearance          | <p>Set the capacitor for <math>500\pm12</math> hrs. at <math>40\pm2^{\circ}\text{C}</math> in 90 to 95% relative humidity.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*2</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|     |                                | Capacitance Change  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | D.F.<br>Q           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 13  | Humidity Loading               | Appearance          | <p>Apply the rated voltage for <math>500\pm12</math> hrs. at <math>40\pm2^{\circ}\text{C}</math> in 90 to 95% relative humidity.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*2</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | Capacitance Change  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | D.F.<br>Q           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

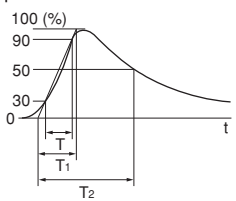
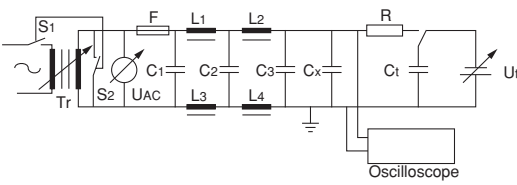
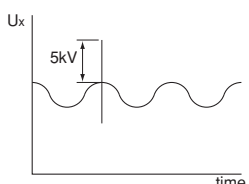
\*1 "C" expresses nominal capacitance value (pF).

\*2 "Room condition" Temperature: 15 to  $35^{\circ}\text{C}$ , Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ➤

## Type KY/KH/KX Specifications and Test Methods

Continued from the preceding page.

| No.                                                                                                       | Item                       | Specifications      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                                                                                           |
|-----------------------------------------------------------------------------------------------------------|----------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------|
| 14                                                                                                        | Life                       | Appearance          | No marked defect                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                                                                                           |
|                                                                                                           |                            | Capacitance Change  | Within $\pm 20\%$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                                                                                           |
|                                                                                                           |                            | I.R.                | 3000M $\Omega$ min.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                                                                                           |
|                                                                                                           |                            | Dielectric Strength | Per Item 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                                                                                           |
|                                                                                                           |                            |                     | <p>Impulse Voltage</p> <p>Each individual capacitor should be subjected to a 5kV (Type KX: 8kV) impulses for three times. Then the capacitors are applied to life test.</p> <div><p>Front time (<math>T_1</math>) = <math>1.2\mu s = 1.67T</math><br/>Time to half-value (<math>T_2</math>) = <math>50\mu s</math></p></div> <p>Apply a voltage from Table 4 for 1000 hrs. at <math>125\pm 2/-0^\circ C</math>, and relative humidity of 50% max.</p> <p style="text-align: center;">&lt;Table 4&gt;</p> <table><tr><th>Applied Voltage</th></tr><tr><td>170% of Rated Voltage except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec.</td></tr></table> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*2</p>                                                                                                                                                                                 | Applied Voltage | 170% of Rated Voltage except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec. |
| Applied Voltage                                                                                           |                            |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                                                                                           |
| 170% of Rated Voltage except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec. |                            |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                                                                                           |
| 15                                                                                                        | Robustness of Terminations | Tensile             | Lead wire should not be cut off. Capacitor should not be broken.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                                                                                           |
|                                                                                                           |                            | Bending             | Each lead wire should be subjected to 5N of weight and bent $90^\circ$ at the point of egress, in one direction, then returned to its original position and bent $90^\circ$ in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                           |
| 16                                                                                                        | Active Flammability        |                     | <p>The capacitor should be individually wrapped in at least one but not more than two complete layers of cheesecloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The UAC should be maintained for 2 min. after the last discharge.</p> <div><p>Oscilloscope</p></div> <p><math>C_{1,2}</math> : <math>1\mu F \pm 10\%</math>      <math>C_3</math> : <math>0.033\mu F \pm 5\%</math> 10kV<br/><math>L_1</math> to 4 : <math>1.5mH \pm 20\%</math> 16A Rod core choke<br/><math>C_t</math> : <math>3\mu F \pm 5\%</math> 10kV      R : <math>100\Omega \pm 2\%</math><br/><math>C_x</math> : Capacitor under test      UAC : <math>U_R \pm 5\%</math><br/>F : Fuse, Rated 10A      <math>U_R</math> : Rated Voltage<br/>      <math>U_t</math> : Voltage applied to <math>C_t</math></p> <div></div> |                 |                                                                                                           |

\*2 "Room condition" Temperature: 15 to  $35^\circ\text{C}$ , Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. 

## Type KY/KH/KX Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                                                                                                                                                                                                                           | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|-----------------------------------------------------|-------------|------|-------------|----|-------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------|------|------------|---|------------|----|-----------------------------------------------------|------|-------------|---------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|------------|---|----------|----|---|------------|---|---|----------|----|---|------------|---|------|------------------|------------|-----------------|---|---------|----|-------------|---|-----|----|------------|
| 17                  | Passive Flammability                                                                                                                                                                                                           | <p>The burning time should not exceed 30 sec.</p> <p>The tissue paper should not ignite.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>The capacitor under test should be held in the flame in the position that best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec.</p> <p>Length of flame : 12±1mm</p> <p>Gas burner : Length 35mm min.<br/>Inside Dia. 0.5±0.1mm<br/>Outside Dia. 0.9mm max.</p> <p>Gas : Butane gas Purity 95% min.</p>  |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 18                  | Temperature and Immersion Cycle                                                                                                                                                                                                | <table><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E, F</td><td>Within ±20%</td></tr><tr><td>SL</td><td>Within ± 5%</td></tr></table></td></tr><tr><td>D.F. Q</td><td><table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤5.0%</td></tr><tr><td>F</td><td>D.F. ≤7.5%</td></tr><tr><td>SL</td><td>Q≥275+5/2C*<sup>1</sup>(C&lt;30pF)<br/>Q≥350 (C≥30pF)</td></tr></table></td></tr><tr><td>I.R.</td><td>3000MΩ min.</td></tr><tr><td>Dielectric Strength</td><td>Per Item 6</td></tr></table> | Appearance                                                                                                                                                                                                                                                                                                                                                                                                                                                | No marked defect | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E, F</td><td>Within ±20%</td></tr><tr><td>SL</td><td>Within ± 5%</td></tr></table> | Char.       | Capacitance Change | B                                                   | Within ±10% | E, F | Within ±20% | SL | Within ± 5% | D.F. Q | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤5.0%</td></tr><tr><td>F</td><td>D.F. ≤7.5%</td></tr><tr><td>SL</td><td>Q≥275+5/2C*<sup>1</sup>(C&lt;30pF)<br/>Q≥350 (C≥30pF)</td></tr></table> | Char. | Specifications | B, E | D.F. ≤5.0% | F | D.F. ≤7.5% | SL | Q≥275+5/2C* <sup>1</sup> (C<30pF)<br>Q≥350 (C≥30pF) | I.R. | 3000MΩ min. | Dielectric Strength | Per Item 6 | <p>The capacitor should be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles.</p> <p>&lt;Temperature Cycle&gt;</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-40+0/-3</td><td>30</td></tr><tr><td>2</td><td>Room temp.</td><td>3</td></tr><tr><td>3</td><td>125+3/-0</td><td>30</td></tr><tr><td>4</td><td>Room temp.</td><td>3</td></tr></table> <p>Cycle time: 5 cycles</p> <p>&lt;Immersion Cycle&gt;</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th><th>Immersion Water</th></tr><tr><td>1</td><td>65+5/-0</td><td>15</td><td>Clean water</td></tr><tr><td>2</td><td>0±3</td><td>15</td><td>Salt water</td></tr></table> <p>Cycle time: 2 cycles</p> <p>Pre-treatment:<br/>Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*<sup>2</sup> for 24±2 hrs.</p> <p>Post-treatment:<br/>Capacitor should be stored for 24±2 hrs. at room condition.*<sup>2</sup></p> | Step | Temperature (°C) | Time (min) | 1 | -40+0/-3 | 30 | 2 | Room temp. | 3 | 3 | 125+3/-0 | 30 | 4 | Room temp. | 3 | Step | Temperature (°C) | Time (min) | Immersion Water | 1 | 65+5/-0 | 15 | Clean water | 2 | 0±3 | 15 | Salt water |
| Appearance          | No marked defect                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Capacitance Change  | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E, F</td><td>Within ±20%</td></tr><tr><td>SL</td><td>Within ± 5%</td></tr></table>                                     | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                                                                                        | B                | Within ±10%        | E, F                                                                                                                                                                                       | Within ±20% | SL                 | Within ± 5%                                         |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Char.               | Capacitance Change                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| B                   | Within ±10%                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| E, F                | Within ±20%                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| SL                  | Within ± 5%                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| D.F. Q              | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤5.0%</td></tr><tr><td>F</td><td>D.F. ≤7.5%</td></tr><tr><td>SL</td><td>Q≥275+5/2C*<sup>1</sup>(C&lt;30pF)<br/>Q≥350 (C≥30pF)</td></tr></table> | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                            | B, E             | D.F. ≤5.0%         | F                                                                                                                                                                                          | D.F. ≤7.5%  | SL                 | Q≥275+5/2C* <sup>1</sup> (C<30pF)<br>Q≥350 (C≥30pF) |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Char.               | Specifications                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| B, E                | D.F. ≤5.0%                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| F                   | D.F. ≤7.5%                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| SL                  | Q≥275+5/2C* <sup>1</sup> (C<30pF)<br>Q≥350 (C≥30pF)                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                | 3000MΩ min.                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Dielectric Strength | Per Item 6                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Step                | Temperature (°C)                                                                                                                                                                                                               | Time (min)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 1                   | -40+0/-3                                                                                                                                                                                                                       | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 2                   | Room temp.                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 3                   | 125+3/-0                                                                                                                                                                                                                       | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 4                   | Room temp.                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Step                | Temperature (°C)                                                                                                                                                                                                               | Time (min)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Immersion Water                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 1                   | 65+5/-0                                                                                                                                                                                                                        | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Clean water                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 2                   | 0±3                                                                                                                                                                                                                            | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Salt water                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |                    |                                                                                                                                                                                            |             |                    |                                                     |             |      |             |    |             |        |                                                                                                                                                                                                                                |       |                |      |            |   |            |    |                                                     |      |             |                     |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |                  |            |   |          |    |   |            |   |   |          |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |

\*1 "C" expresses nominal capacitance value (pF).

\*2 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

# AC250V Ceramic Capacitor Non Safety Certified Type

**muRata**

## DEJ Series Based on the Electrical Appliance and Material Safety Law of Japan

### ■ Features

1. This type is based on the electrical appliance and material safety law of Japan (separated table 4).
2. Coated with flame-retardant epoxy resin (conforming to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.

\* Cl=900ppm max., Br=900ppm max. and  
Cl+Br=1500ppm max.

3. Taping available for automatic insertion.

### ■ Applications

Ideal for use on AC line filters and primary-secondary coupling for switching power supplies and AC adapters.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids.  
Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.



### ■ Marking

| Temp. Char.                   |         | E, F                                                            |
|-------------------------------|---------|-----------------------------------------------------------------|
| Nominal Body Diameter         | ø7-8mm  | 102Z<br>250~<br>16                                              |
|                               | ø9-11mm | 332Z<br>250~<br>16                                              |
| Nominal Capacitance           |         | Marked with 3 figures                                           |
| Capacitance Tolerance         |         | Marked with code                                                |
| Rated Voltage                 |         | Marked with code                                                |
| Manufacturer's Identification |         | Marked with  (omitted for nominal body diameter ø8mm and under) |
| Manufactured Date Code        |         | Abbreviation                                                    |

| Part Number    | AC Rated Voltage | Temp. Char. | Capacitance     | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping (1) | Lead Package Taping (2) |
|----------------|------------------|-------------|-----------------|-------------|---------------------|------------------|------------------------|-------------------------|-------------------------|-------------------------|
| DEJE3E2102Z□□□ | 250Vac(r.m.s.)   | E           | 1000pF+80/-20%  | 7.0mm max.  | 7.5                 | 4.0mm max.       | C3B                    | D3B                     | N2A                     | P3A                     |
| DEJE3E2222Z□□□ | 250Vac(r.m.s.)   | E           | 2200pF+80/-20%  | 8.0mm max.  | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N2A                     | N3A                     |
| DEJE3E2332Z□□□ | 250Vac(r.m.s.)   | E           | 3300pF+80/-20%  | 9.0mm max.  | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N2A                     | N3A                     |
| DEJE3E2472Z□□□ | 250Vac(r.m.s.)   | E           | 4700pF+80/-20%  | 11.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N2A                     | N3A                     |
| DEJF3E2472Z□□□ | 250Vac(r.m.s.)   | F           | 4700pF+80/-20%  | 8.0mm max.  | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N2A                     | N3A                     |
| DEJF3E2103Z□□□ | 250Vac(r.m.s.)   | F           | 10000pF+80/-20% | 11.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N2A                     | N3A                     |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Taping (1): Lead spacing F=5.0mm, Taping (2): Lead spacing F=7.5mm.

## DEJ Series Specifications and Test Methods

Operating Temperature Range: -25 to +85°C

| No.                 | Item                         |                    | Specifications                                                                                                                                                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
|---------------------|------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------|---------------------|--------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|---|------|---|-------|---|------|---|------|---|------|
| 1                   | Appearance and Dimensions    |                    | No visible defect, and dimensions are within specified range.                                                                                                     | The capacitor should be visually inspected for evidence of defect.<br>Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 2                   | Marking                      |                    | To be easily legible                                                                                                                                              | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 3                   | Capacitance                  |                    | Within specified tolerance                                                                                                                                        | The capacitance should be measured at 20°C with 1±0.1kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 4                   | Dissipation Factor (D.F.)    |                    | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>E</td><td>D.F. ≤2.5%</td></tr><tr><td>F</td><td>D.F. ≤5.0%</td></tr></table>                         | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Specifications     | E       | D.F. ≤2.5%          | F      | D.F. ≤5.0%          | The dissipation factor should be measured at 20°C with 1±0.1kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                          |      |                  |   |      |   |       |   |      |   |      |   |      |
| Char.               | Specifications               |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| E                   | D.F. ≤2.5%                   |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| F                   | D.F. ≤5.0%                   |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 5                   | Insulation Resistance (I.R.) |                    | 10000MΩ min.                                                                                                                                                      | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 6                   | Dielectric Strength          | Between Lead Wires | No failure                                                                                                                                                        | The capacitor should not be damaged when AC1500V(r.m.s.) are applied between the lead wires for 60 sec.<br><br>First, the terminals of the capacitor should be connected together. Then, as shown in the figure at right, the capacitor should be immersed into 10% salt solution up to a position of about 3 to 4mm apart from the terminals.<br>Finally, AC1500V(r.m.s.) is applied for 60 sec. between the capacitor lead wires and electrode plate.<br> |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
|                     |                              | Body Insulation    | No failure                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 7                   | Temperature Characteristics  |                    | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>E</td><td>Within +20%<br/>-30%</td></tr><tr><td>F</td><td>Within +30%<br/>-80%</td></tr></table> | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Capacitance Change | E       | Within +20%<br>-30% | F      | Within +30%<br>-80% | The capacitance measurement should be made at each step specified in Table 1.<br><br><Table 1> <table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>20±2</td></tr><tr><td>2</td><td>-25±2</td></tr><tr><td>3</td><td>20±2</td></tr><tr><td>4</td><td>85±2</td></tr><tr><td>5</td><td>20±2</td></tr></table> | Step | Temperature (°C) | 1 | 20±2 | 2 | -25±2 | 3 | 20±2 | 4 | 85±2 | 5 | 20±2 |
| Char.               | Capacitance Change           |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| E                   | Within +20%<br>-30%          |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| F                   | Within +30%<br>-80%          |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| Step                | Temperature (°C)             |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 1                   | 20±2                         |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 2                   | -25±2                        |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 3                   | 20±2                         |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 4                   | 85±2                         |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 5                   | 20±2                         |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 8                   | Discharge Test               | Appearance         | No marked defect                                                                                                                                                  | As in Figure 1, discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified.<br><br><br>Fig.1<br><br>Ct: Capacitor under test      R2: 100MΩ<br>S: High-voltage switch      R3: Surge resistance<br>R1: 1000Ω<br><table><tr><td>Cd</td><td>0.001μF</td></tr><tr><td>Vs</td><td>DC10kV</td></tr></table>                                                                                                     | Cd                 | 0.001μF | Vs                  | DC10kV |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
|                     |                              | Cd                 | 0.001μF                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
|                     |                              | Vs                 | DC10kV                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| I.R.                | 1000MΩ min.                  |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| Dielectric Strength | Per Item 6                   |                    |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |
| 9                   | Solderability of Leads       |                    | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                               | The lead wire of a capacitor should be dipped into molten solder for 2±0.5 sec.<br>The depth of immersion is up to about 1.5 to 2.0mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                                                                                                                                                                                                                                  |                    |         |                     |        |                     |                                                                                                                                                                                                                                                                                                                                |      |                  |   |      |   |       |   |      |   |      |   |      |

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## DEJ Series Specifications and Test Methods

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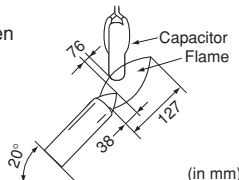
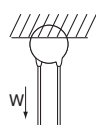
| No. | Item                           | Specifications      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|--------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10  | Soldering Effect (Non-Preheat) | Appearance          | <p>As shown in the figure, the lead wires should be immersed in solder of <math>350\pm10^{\circ}\text{C}</math> up to 1.5 to 2.0mm from the root of terminal for <math>3.5\pm0.5</math> sec.</p> <p>Pre-treatment:<br/>Capacitor should be stored at <math>85\pm2^{\circ}\text{C}</math> for 1 hr., then placed at room condition*1 for <math>24\pm2</math> hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 4 to 24 hrs. at room condition.*1</p>                                                                                                                    |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 11  | Soldering Effect (On-Preheat)  | Appearance          | <p>First the capacitor should be stored at <math>120+0/-5^{\circ}\text{C}</math> for <math>60+0/-5</math> sec.</p> <p>Then, as in the figure, the lead wires should be immersed in solder of <math>260+0/-5^{\circ}\text{C}</math> up to 1.5 to 2.0mm from the root of terminal for <math>7.5+0/-1</math> sec.</p> <p>Pre-treatment:<br/>Capacitor should be stored at <math>85\pm2^{\circ}\text{C}</math> for 1 hr., then placed at room condition*1 for <math>24\pm2</math> hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 4 to 24 hrs. at room condition.*1</p>  |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 12  | Vibration Resistance           | Appearance          | <p>The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz.</p> <p>Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.</p>                                                                                                                                                                                                                                                                                                                                                                    |
|     |                                | Capacitance         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | D.F.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 13  | Solvent Resistance             | Appearance          | <p>The capacitor should be immersed into a isopropyl alcohol for <math>30\pm5</math> sec.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|     |                                | Capacitance Change  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | D.F.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 14  | Humidity (Under Steady State)  | Appearance          | <p>Set the capacitor for <math>500\pm12</math> hrs. at <math>40\pm2^{\circ}\text{C}</math> in 90 to 95% relative humidity.</p> <p>Pre-treatment:<br/>Capacitor should be stored at <math>85\pm2^{\circ}\text{C}</math> for 1 hr., then placed at room condition*1 for <math>24\pm2</math> hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*1</p>                                                                                                                                                                                                                                                                          |
|     |                                | Capacitance Change  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | D.F.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 15  | Humidity Insulation            | Appearance          | <p>The capacitor should be subjected to <math>40\pm2^{\circ}\text{C}</math>, relative humidity of 90 to 98% for 8 hrs., and then removed in room temperature for 16 hrs. until 5 cycles are completed.</p> <p>Pre-treatment:<br/>Capacitor should be stored at <math>85\pm2^{\circ}\text{C}</math> for 1 hr., then placed at room condition*1 for <math>24\pm2</math> hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*1</p>                                                                                                                                                                                              |
|     |                                | Capacitance Change  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | D.F.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | I.R.                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|     |                                | Dielectric Strength |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

\*1 "Room condition" Temperature: 15 to  $35^{\circ}\text{C}$ , Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

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## DEJ Series Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                                                                                                                                            |                                                                                                                                                                                       | Specifications                                                                                                                                                | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------|-------------|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------|---|---|---------|----|---|------------|---|------|------------------|------------|-----------------|---|---------|----|-------------|---|-----|----|------------|
| 16                  | Humidity Loading                                                                                                                                | Appearance                                                                                                                                                                            | No marked defect                                                                                                                                              | Apply the rated voltage for 500±12 hrs. at 40±2°C in 90 to 95% relative humidity.<br>Pre-treatment:<br>Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements.<br>Post-treatment:<br>Capacitor should be stored for 1 to 2 hrs. at room condition.*1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | Capacitance Change                                                                                                                                                                    | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>E</td><td>Within ±20%</td></tr><tr><td>F</td><td>Within ±30%</td></tr></table>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Char.           | Capacitance Change                                                                                  | E           | Within ±20% | F        | Within ±30%                                                                                                                                                                                                                                                  |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | Char.                                                                                                                                                                                 | Capacitance Change                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | E                                                                                                                                                                                     | Within ±20%                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | F                                                                                                                                                                                     | Within ±30%                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| D.F.                | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>E</td><td>D.F.≤5.0%</td></tr><tr><td>F</td><td>D.F.≤7.5%</td></tr></table>         | Char.                                                                                                                                                                                 | Specifications                                                                                                                                                | E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D.F.≤5.0%       | F                                                                                                   | D.F.≤7.5%   |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Char.               | Specifications                                                                                                                                  |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| E                   | D.F.≤5.0%                                                                                                                                       |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| F                   | D.F.≤7.5%                                                                                                                                       |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                | 1000MΩ min.                                                                                                                                     |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Dielectric Strength | Per Item 6                                                                                                                                      |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 17                  | Life                                                                                                                                            | Appearance                                                                                                                                                                            | No marked defect                                                                                                                                              | Apply a voltage from Table 2 for 1500 hrs. at 85±2°C, relative humidity 50% max.<br><br><Table 2><br><table><tr><th>Applied Voltage</th></tr><tr><td>AC500V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec.</td></tr></table><br>Pre-treatment:<br>Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements.<br>Post-treatment:<br>Capacitor should be stored for 4 to 24 hrs. at room condition.*1                                                                                                                                                                                                                                                                                                                                                                                                                                    | Applied Voltage | AC500V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec. |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | Applied Voltage                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | AC500V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec.                                                                                   |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | Capacitance Change                                                                                                                                                                    | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>E</td><td>Within ±20%</td></tr><tr><td>F</td><td>Within ±30%</td></tr></table>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Char.           | Capacitance Change                                                                                  | E           | Within ±20% | F        | Within ±30%                                                                                                                                                                                                                                                  |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Char.               | Capacitance Change                                                                                                                              |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| E                   | Within ±20%                                                                                                                                     |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| F                   | Within ±30%                                                                                                                                     |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                | 1000MΩ min.                                                                                                                                     |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Dielectric Strength | Per Item 6                                                                                                                                      |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 18                  | Flame Test                                                                                                                                      | The capacitor flame discontinued as follows.<br><table><tr><th>Cycle</th><th>Time (sec.)</th></tr><tr><td>1 to 2</td><td>15 max.</td></tr><tr><td>3</td><td>60 max.</td></tr></table> |                                                                                                                                                               | Cycle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Time (sec.)     | 1 to 2                                                                                              | 15 max.     | 3           | 60 max.  | The capacitor should be subjected to applied flame for 15 sec. and then removed for 15 sec. until 3 cycles are completed.<br><br><br>Gas Burner: Inside Dia. 9.5 (in mm) |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | Cycle                                                                                                                                                                                 | Time (sec.)                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 1 to 2              | 15 max.                                                                                                                                         |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 3                   | 60 max.                                                                                                                                         |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 19                  | Robustness of Terminations                                                                                                                      | Tensile                                                                                                                                                                               | Lead wire should not be cut off. Capacitor should not be broken.<br><br> | As shown in the figure at right, fix the body of the capacitor, apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N and keep it for 10±1 sec.<br><br>Each lead wire should be subjected to 5N of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | Bending                                                                                                                                                                               |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 20                  | Temperature and Immersion Cycle                                                                                                                 | Appearance                                                                                                                                                                            | No marked defect                                                                                                                                              | The capacitor should be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles.<br><br><Temperature Cycle><br><table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25+0/-3</td><td>30</td></tr><tr><td>2</td><td>Room temp.</td><td>3</td></tr><tr><td>3</td><td>85+3/-0</td><td>30</td></tr><tr><td>4</td><td>Room temp.</td><td>3</td></tr></table><br>Cycle time: 5 cycles<br><br><Immersion Cycle><br><table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th><th>Immersion Water</th></tr><tr><td>1</td><td>65+5/-0</td><td>15</td><td>Clean water</td></tr><tr><td>2</td><td>0±3</td><td>15</td><td>Salt water</td></tr></table><br>Cycle time: 2 cycles<br><br>Pre-treatment:<br>Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs.<br>Post-treatment:<br>Capacitor should be stored for 4 to 24 hrs. at room condition.*1 | Step            | Temperature (°C)                                                                                    | Time (min)  | 1           | -25+0/-3 | 30                                                                                                                                                                                                                                                           | 2 | Room temp. | 3 | 3 | 85+3/-0 | 30 | 4 | Room temp. | 3 | Step | Temperature (°C) | Time (min) | Immersion Water | 1 | 65+5/-0 | 15 | Clean water | 2 | 0±3 | 15 | Salt water |
|                     |                                                                                                                                                 | Step                                                                                                                                                                                  | Temperature (°C)                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Time (min)      |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | 1                                                                                                                                                                                     | -25+0/-3                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 30              |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | 2                                                                                                                                                                                     | Room temp.                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3               |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                     |                                                                                                                                                 | 3                                                                                                                                                                                     | 85+3/-0                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 30              |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 4                   | Room temp.                                                                                                                                      | 3                                                                                                                                                                                     |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Step                | Temperature (°C)                                                                                                                                | Time (min)                                                                                                                                                                            | Immersion Water                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 1                   | 65+5/-0                                                                                                                                         | 15                                                                                                                                                                                    | Clean water                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 2                   | 0±3                                                                                                                                             | 15                                                                                                                                                                                    | Salt water                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Capacitance Change  | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>E</td><td>Within ±20%</td></tr><tr><td>F</td><td>Within ±30%</td></tr></table> | Char.                                                                                                                                                                                 | Capacitance Change                                                                                                                                            | E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Within ±20%     | F                                                                                                   | Within ±30% |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Char.               | Capacitance Change                                                                                                                              |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| E                   | Within ±20%                                                                                                                                     |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| F                   | Within ±30%                                                                                                                                     |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| D.F.                | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>E</td><td>D.F.≤5.0%</td></tr><tr><td>F</td><td>D.F.≤7.5%</td></tr></table>         | Char.                                                                                                                                                                                 | Specifications                                                                                                                                                | E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | D.F.≤5.0%       | F                                                                                                   | D.F.≤7.5%   |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Char.               | Specifications                                                                                                                                  |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| E                   | D.F.≤5.0%                                                                                                                                       |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| F                   | D.F.≤7.5%                                                                                                                                       |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                | 1000MΩ min.                                                                                                                                     |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Dielectric Strength | Per Item 6                                                                                                                                      |                                                                                                                                                                                       |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                     |             |             |          |                                                                                                                                                                                                                                                              |   |            |   |   |         |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |

\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

## Safety Certified Ceramic Capacitors Characteristics Data (Typical Example)

### ■ Capacitance - Temperature Characteristics



### ■ Insertion Loss - Frequency Characteristics

Type KY



Type KY

Signal power: 1mW  
AC240V(r.m.s.) / 60Hz is applied on the capacitor.

- (1) DE2B3KY101KA2B\*\*\*\*
- (2) DE2B3KY221KA2B\*\*\*\*
- (3) DE2B3KY471KA2B\*\*\*\*
- (4) DE2E3KY102MA2B\*\*\*\*
- (5) DE2E3KY222MA2B\*\*\*\*
- (6) DE2E3KY472MA2B\*\*\*\*
- (7) DE2F3KY103MA3B\*\*\*\*

Type KH



Type KH

Signal power: 1mW  
AC240V(r.m.s.) / 60Hz is applied on the capacitor.

- (1) DE2B3KH101KA3B
- (2) DE2B3KH221KA3B
- (3) DE2B3KH471KA3B
- (4) DE2E3KH102MA3B
- (5) DE2E3KH222MA3B
- (6) DE2E3KH472MA3B
- (7) DE2F3KH103MA3B

Type KX New Small Size



Type KX New Small Size

Signal power: 1mW  
AC240V(r.m.s.) / 60Hz is applied on the capacitor.

- (1) DE1B3KX101KA4BN01F
- (2) DE1B3KX221KA4BN01F
- (3) DE1B3KX471KA4BN01F
- (4) DE1E3KX102MA4BN01F
- (5) DE1E3KX222MA4BN01F
- (6) DE1E3KX472MA4BN01F

Type KX



Type KX

Signal power: 1mW  
AC240V(r.m.s.) / 60Hz is applied on the capacitor.

- (1) DE1B3KX101KA5B
- (2) DE1B3KX221KA5B
- (3) DE1B3KX471KA5B
- (4) DE1E3KX102MA5BA01
- (5) DE1E3KX222MA5BA01
- (6) DE1E3KX472MA5BA01

## Safety Certified Ceramic Capacitors Characteristics Data (Typical Example)

### ■ Leakage Current Characteristics

Type KY (B char.)

AC voltage : 60Hz  
Temperature : 25°C



Type KY (E,F char.)

AC voltage : 60Hz  
Temperature : 25°C



Type KH (B char.)

AC voltage : 60Hz  
Temperature : 25°C



Type KH (E, F char.)

AC voltage : 60Hz  
Temperature : 25°C



Type KX New Small Size (B char.)

AC voltage : 60Hz  
Temperature : 25°C



Type KX New Small Size (E char.)

AC voltage : 60Hz  
Temperature : 25°C



Continued on the following page. ➤

## Safety Certified Ceramic Capacitors Characteristics Data (Typical Example)

Continued from the preceding page.

Type KX (B char.)

AC voltage : 60Hz  
 Temperature : 25°C



Type KX (E char.)

AC voltage : 60Hz  
 Temperature : 25°C



## Safety Certified Ceramic Capacitors Packaging

### ■ Taping Specifications

- 12.7mm pitch / lead spacing 5mm taping  
Vertical crimp type  
(Lead Code: N2)



- 15mm pitch / lead spacing 7.5mm taping  
Vertical crimp type  
(Lead Code: N3)



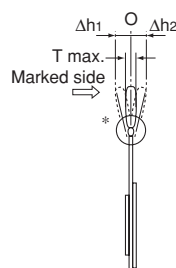
- 15mm pitch / lead spacing 7.5mm taping  
Straight type  
(Lead Code: P3)



- 30mm pitch / lead spacing 7.5mm taping  
Vertical crimp type  
(Lead Code: N7)



- 25.4mm pitch / lead spacing 10.0mm taping  
Vertical crimp type  
(Lead Code: N4, N5)



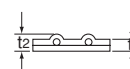
Lead Code  
N2, N3, N4, N7



Lead Code  
P3



Lead Code  
N5



| Item                                              | Code | N2                                         | N3                                   | P3 | N7                                 | N4       | N5                                   |
|---------------------------------------------------|------|--------------------------------------------|--------------------------------------|----|------------------------------------|----------|--------------------------------------|
| Pitch of component                                | P    | 12.7±1.0                                   | 15.0±2.0                             |    | 30.0±2.0                           | 25.4±2.0 |                                      |
| Pitch of sprocket hole                            | P0   | 12.7±0.3                                   | 15.0±0.3                             |    |                                    | 12.7±0.3 |                                      |
| Lead spacing                                      | F    | 5.0 <sup>+0.8</sup> <sub>-0.2</sub>        | 7.5±1.0                              |    |                                    | 10.0±1.0 |                                      |
| Length from hole center to component center       | P2   | 6.35±1.3                                   | 7.5±1.5                              |    |                                    | —        |                                      |
| Length from hole center to lead                   | P1   | 3.85±0.7                                   | 3.75±1.0                             |    |                                    | 7.7±1.5  |                                      |
| Body diameter                                     | D    | See the individual product specifications. |                                      |    |                                    |          |                                      |
| Deviation along tape, left or right               | ΔS   | 0±1.0                                      | 0±2.0                                |    |                                    |          |                                      |
| Carrier tape width                                | W    | 18.0±0.5                                   |                                      |    |                                    |          |                                      |
| Position of sprocket hole                         | W1   | 9.0±0.5                                    |                                      |    |                                    |          |                                      |
| Lead distance between reference and bottom planes | H0   | 18.0 <sup>+2.0</sup> <sub>-0</sub>         | —                                    |    | 18.0 <sup>+2.0</sup> <sub>-0</sub> |          |                                      |
|                                                   | H    | —                                          | 20.0 <sup>+1.5</sup> <sub>-1.0</sub> |    | —                                  |          |                                      |
| Protrusion length                                 | ℓ    | +0.5 to -1.0                               |                                      |    |                                    |          |                                      |
| Diameter of sprocket hole                         | øD0  | 4.0±0.1                                    |                                      |    |                                    |          |                                      |
| Lead diameter                                     | ød   | 0.6±0.05                                   |                                      |    |                                    |          | 0.6 <sup>+0.1</sup> <sub>-0.05</sub> |
| Total tape thickness                              | t1   | 0.6±0.3                                    |                                      |    |                                    |          |                                      |
| Total thickness, tape and lead wire               | t2   | 1.5 max.                                   |                                      |    |                                    |          |                                      |
| Body thickness                                    | T    | See the individual product specifications. |                                      |    |                                    |          |                                      |
| Portion to cut in case of defect                  | L    | 11.0 <sup>+0</sup> <sub>-1.0</sub>         |                                      |    |                                    |          |                                      |
| Hold down tape width                              | W0   | 11.5 min.                                  |                                      |    |                                    |          |                                      |
| Hold down tape position                           | W2   | 1.5±1.5                                    |                                      |    |                                    |          |                                      |
| Coating extension on lead                         | e    | Up to the end of crimp                     | 3.0 max.                             |    | Up to the end of crimp             |          |                                      |
| Deviation across tape, front                      | Δh1  | 1.0 max.                                   | 2.0 max.                             |    |                                    |          |                                      |
| Deviation across tape, rear                       | Δh2  |                                            |                                      |    |                                    |          |                                      |

(in mm)

Continued on the following page. ➤

## Safety Certified Ceramic Capacitors Packaging

Continued from the preceding page.

### ■ Packaging Styles

| Bulk                                                                                                  | Taping                                                                                         |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Polyethylene Bag<br> | Ammo Pack<br> |

### ■ Minimum Quantity (Order in Sets Only)

| [Bulk]                   |                     | (pcs./Bag)          |                     |
|--------------------------|---------------------|---------------------|---------------------|
|                          | Body Dia. D<br>(mm) | Lead Code<br>A□, C□ | Lead Code<br>B□, D□ |
|                          |                     | Long                | Short               |
| Type KY                  | 7                   | 250 *               | 500                 |
| Type KH                  | 8 to 11             | 250                 | 500                 |
| Type KX (New Small Size) | 12 to 14            | 200                 | 250                 |
| DEJ Series               | 15, 16              | 100                 | 200                 |
| Type KX                  | 8, 9                | 250                 | 500                 |
|                          | 10                  | 100                 | 250                 |
|                          | 12 to 15            | 100                 | 200                 |

\* Lead Spacing F=5.0mm (Code: A2): 500pcs.

| [Taping]                 |       | (pcs./Ammo Pack) |            |
|--------------------------|-------|------------------|------------|
| Lead Code                | N2    | N3, P3           | N4, N5, N7 |
| Type KY                  | 1,000 | 900              | —          |
| Type KH                  | —     | 900              | 400        |
| Type KX (New Small Size) | —     | —                | 500        |
| Type KX                  | —     | —                | 500        |
| DEJ Series               | 1,500 | 1,000            | —          |

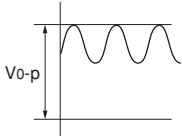
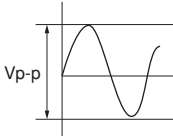
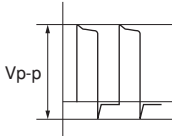
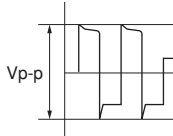
## Safety Certified Ceramic Capacitors ⚠Caution

### ■ ⚠Caution (Rating)

#### 1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the  $V_{p-p}$  value of the applied voltage or the  $V_{0-p}$  that contains DC bias within the rated voltage range.

When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

| Voltage                | DC Voltage                                                                        | DC+AC Voltage                                                                     | AC Voltage                                                                        | Pulse Voltage (1)                                                                   | Pulse Voltage (2)                                                                   |
|------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Positional Measurement |  |  |  |  |  |

#### 2. Operating Temperature and Self-generated Heat (Apply to B/E/F Char.)

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high-frequency current, pulse current or similar current, it may have self-generated heat due to dielectric loss. Applied voltage load should be such that self-generated heat is within 20°C under the condition where the capacitor is subjected to an atmospheric temperature of 25°C. When measuring, use a thermocouple of small thermal capacity-K of  $\phi 0.1$  mm under conditions where the capacitor is not affected by radiant heat from other components or wind from surroundings. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

#### 3. Test Condition for Withstanding Voltage

##### (1) Test Equipment

Test equipment for AC withstanding voltage should be used with the performance of the wave similar to 50/60Hz sine wave.

If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

Continued on the following page. 

## Safety Certified Ceramic Capacitors ⚠Caution

☐ Continued from the preceding page.

### (2) Voltage Applied Method

When the withstanding voltage is applied, the capacitor's lead or terminal should be firmly connected to the output of the withstanding voltage test equipment, and then the voltage should be raised from near zero to the test voltage.

If the test voltage without the raise from near zero voltage would be applied directly to capacitor, test voltage should be applied with the zero cross.\* At the end of the test time, the test voltage should be reduced to near zero, and then capacitor's lead or terminal should be taken off the output of the withstanding voltage test equipment.

If the test voltage without the raise from near zero voltage would be applied directly to capacitor, the surge voltage may rise, and therefore, a defect may be caused.

\*ZERO CROSS is the point where voltage sine wave passes 0V. See the figure at right.



### 4. Fail-Safe

When the capacitor is broken, failure may result in a short circuit. Be sure to provide an appropriate fail-safe function like a fuse on your product if failure could result in an electric shock, fire or fuming.

**FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY  
RESULT, WORST CASE, IN A SHORT CIRCUIT  
AND CAUSE FUMING OR PARTIAL DISPERSION  
WHEN THE PRODUCT IS USED.**

## Safety Certified Ceramic Capacitors ⚠Caution

### ■ ⚠Caution (Storage and Operating Condition)

#### Operating and Storage Environment

The insulating coating of capacitors does not form a perfect seal; therefore, do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. Also, avoid exposure to moisture. Before cleaning, bonding, or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed -10 to 40 degrees centigrade and 15 to 85%.

Use capacitors within 6 months after delivery.  
Check the solderability after 6 months or more.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

### ■ ⚠Caution (Soldering and Mounting)

#### 1. Vibration and Impact

Do not expose a capacitor or its lead wires to excessive shock or vibration during use.  
Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board.  
Please take measures to hold a capacitor on the circuit boards by adhesive, molding resin or another coating.  
Please confirm there is no influence of holding measures on the product with the intended equipment.

#### 2. Soldering

When soldering this product to a PCB/PWB, do not exceed the solder heat resistance specifications of the capacitor. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element.  
Soldering the capacitor with a soldering iron should be performed in the following conditions.  
Temperature of iron-tip: 400 degrees C. max.  
Soldering iron wattage: 50W max.  
Soldering time: 3.5 sec. max.

#### 3. Bonding, Resin Molding and Coating

For bonding, molding or coating this product, verify that these processes do not affect the quality of the capacitor by testing the performance of the bonded, molded or coated product in the intended equipment. When the amount of applications, dryness/hardening conditions of adhesives and molding resins containing organic solvents (ethyl acetate, methyl ethyl ketone, toluene, etc). are unsuitable, the outer coating resin of a capacitor is damaged by the organic solvents and it may result, worst case, in a short circuit.  
The variation in thickness of adhesive, molding resin or coating may cause outer coating resin cracking and/or ceramic element cracking of a capacitor in a temperature cycling.

4. Treatment after Bonding, Resin Molding and Coating  
When the outer coating is hot (over 100 degrees C.) after soldering, it becomes soft and fragile.  
Therefore, please be careful not to give it mechanical stress.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

### ■ ⚠Caution (Handling)

#### Vibration and Impact

Do not expose a capacitor or its lead wires to excessive shock or vibration during use.  
Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board.  
Please take measures to hold a capacitor on the circuit boards by adhesive, molding resin or another coating.

Please confirm there is no influence of holding measures on the product with the intended equipment.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

## Safety Certified Ceramic Capacitors Notice

### ■ Notice (Soldering and Mounting)

Cleaning (ultrasonic cleaning)

To perform ultrasonic cleaning, observe the following conditions.

Rinse bath capacity: Output of 20 watts per liter or less.

Rinsing time: 5 min. maximum.

Do not vibrate the PCB/PWB directly.

Excessive ultrasonic cleaning may lead to fatigue destruction of the lead wires.

### ■ Notice (Rating)

#### 1. Capacitance Change of Capacitors

##### (1) For SL char.

Capacitance might change a little depending on a surrounding temperature or an applied voltage.

Please contact us if you use a strict constant time circuit.

##### (2) For B/E/F char.

Capacitors have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time. Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage. Therefore, it is not likely to be suitable for use in a constant time circuit.

Please contact us if you need detailed information.

#### 2. Performance Check by Equipment

Before using a capacitor, check that there is no problem in the equipment's performance and the specifications.

Generally speaking, CLASS 2 (B/E/F char.) ceramic capacitors have voltage dependence characteristics and temperature dependence characteristics in capacitance, so the capacitance value may change depending on the operating condition in the equipment. Therefore, be sure to confirm the apparatus performance of receiving influence in the capacitance value change of a capacitor, such as leakage current and noise suppression characteristic.

Moreover, check the surge-proof ability of a capacitor in the equipment, if needed, because the surge voltage may exceed specific value by the inductance of the circuit.

# High Voltage Ceramic Capacitors

**muRata**

## DES Series (125°C Guaranteed/Low-dissipation Factor/DC500V-1kV)

### ■ Features

1. Low dissipation factor series that can be used for power supplies with an increased switching frequency.
2. The allowable power in the 100 to 300kHz band is improved to approximately one and a half times that of the DEH series while remaining the same size.
3. Operating temperature range is guaranteed up to 125 degrees C.
4. Coated with flame-retardant epoxy resin (equivalent to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.  
\* Cl=900ppm max., Br=900ppm max. and Cl+Br=1500ppm max.
5. Taping available for automatic insertion.



### ■ Applications

Ideal for use on high-frequency pulse circuits such as snubber circuits for switching power supplies.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.

### ■ Marking

| Rated Voltage                 | DC500V                                                          | DC1kV                      |
|-------------------------------|-----------------------------------------------------------------|----------------------------|
| Nominal Body Diameter         |                                                                 |                            |
| ø6mm                          | S D<br>101<br>66                                                | S D<br>101<br>1KV 66       |
| ø7-9mm                        | S D<br>102K<br>66                                               | S D<br>471K<br>1KV 66      |
| ø10-17mm                      | S D<br>222K<br>M 66                                             | S D<br>152K<br>1KV<br>M 66 |
| Series Code                   | Abbreviation (S)                                                |                            |
| Temperature Characteristic    | Marked with code                                                |                            |
| Nominal Capacitance           | Marked with 3 figures                                           |                            |
| Capacitance Tolerance         | Marked with code (omitted for nominal body diameter ø6mm)       |                            |
| Rated Voltage                 | Marked with code (omitted for DC500V)                           |                            |
| Manufacturer's Identification | Marked with  (omitted for nominal body diameter ø9mm and under) |                            |
| Manufactured Date Code        | Abbreviation                                                    |                            |

## D Characteristics

| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DESD32H101K□□□ | 500Vdc           | 100pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H151K□□□ | 500Vdc           | 150pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H221K□□□ | 500Vdc           | 220pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H331K□□□ | 500Vdc           | 330pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H471K□□□ | 500Vdc           | 470pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H681K□□□ | 500Vdc           | 680pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H102K□□□ | 500Vdc           | 1000pF±10%  | 8.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H152K□□□ | 500Vdc           | 1500pF±10%  | 9.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H222K□□□ | 500Vdc           | 2200pF±10%  | 10.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | J2B                     | N2A                 |
| DESD32H332K□□□ | 500Vdc           | 3300pF±10%  | 12.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | J3B                     | N3A                 |
| DESD32H472K□□□ | 500Vdc           | 4700pF±10%  | 14.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | J3B                     | N7A                 |
| DESD33A101K□□□ | 1000Vdc          | 100pF±10%   | 6.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A151K□□□ | 1000Vdc          | 150pF±10%   | 6.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A221K□□□ | 1000Vdc          | 220pF±10%   | 6.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A331K□□□ | 1000Vdc          | 330pF±10%   | 6.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A471K□□□ | 1000Vdc          | 470pF±10%   | 7.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A681K□□□ | 1000Vdc          | 680pF±10%   | 8.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A102K□□□ | 1000Vdc          | 1000pF±10%  | 9.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A152K□□□ | 1000Vdc          | 1500pF±10%  | 10.0mm max. | 5.0                 | 4.5mm max.       | A2B                    | J2B                     | N2A                 |
| DESD33A222K□□□ | 1000Vdc          | 2200pF±10%  | 12.0mm max. | 7.5                 | 4.5mm max.       | A3B                    | J3B                     | N3A                 |
| DESD33A332K□□□ | 1000Vdc          | 3300pF±10%  | 14.0mm max. | 7.5                 | 4.5mm max.       | A3B                    | J3B                     | N7A                 |
| DESD33A472K□□□ | 1000Vdc          | 4700pF±10%  | 17.0mm max. | 7.5                 | 4.5mm max.       | A3B                    | J3B                     | N7A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## DES Series Specifications and Test Methods

| No.        | Item                           |                                          | Specifications                                                                                                                                                                         | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |   |   |            |      |
|------------|--------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|---|---|------------|------|
| 1          | Operating Temperature Range    |                                          | -25 to +125°C                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |
| 2          | Appearance and Dimensions      |                                          | No visible defect, and dimensions are within specified range.                                                                                                                          | The capacitor should be visually inspected for evidence of defect.<br>Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                   |      |   |   |   |   |   |            |      |
| 3          | Marking                        |                                          | To be easily legible                                                                                                                                                                   | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |   |   |            |      |
| 4          | Dielectric Strength            | Between Lead Wires                       | No failure                                                                                                                                                                             | The capacitor should not be damaged when DC voltage of 200% of the rated voltage (DC1kV) or DC voltage of 250% of the rated voltage (DC500V) is applied between the lead wires for 1 to 5 sec.<br>(Charge/Discharge current≤50mA)                                                                                                                                                                                          |      |   |   |   |   |   |            |      |
|            |                                | Body Insulation                          | No failure                                                                                                                                                                             | The capacitor is placed in the container with metal balls of diameter 1mm so that each lead wire, short circuited, is kept about 2mm off the metal balls as shown in the figure at right, and AC1250V(r.m.s.) <50/60Hz> is applied for 1 to 5 sec. between capacitor lead wires and metal balls.<br>(Charge/Discharge current≤50mA)<br> |      |   |   |   |   |   |            |      |
| 5          | Insulation Resistance (I.R.)   | Between Lead Wires                       | 10000MΩ min.                                                                                                                                                                           | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                  |      |   |   |   |   |   |            |      |
| 6          | Capacitance                    |                                          | Within specified tolerance                                                                                                                                                             | The capacitance should be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |   |            |      |
| 7          | Dissipation Factor (D.F.)      |                                          | 0.3% max.                                                                                                                                                                              | The dissipation factor should be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |
| 8          | Temperature Characteristics    |                                          | Within +20/-30%<br>(Temp. range: -25 to +125°C)                                                                                                                                        | The capacitance measurement should be made at each step specified in the Table.                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |
|            |                                |                                          | Pre-treatment: Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before measurements.                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |
|            |                                |                                          | <table><tr><th>Step</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><th>Temp. (°C)</th><td>20±2</td><td>-25±3</td><td>20±2</td><td>125±2</td><td>20±2</td></tr></table> |                                                                                                                                                                                                                                                                                                                                                                                                                            | Step | 1 | 2 | 3 | 4 | 5 | Temp. (°C) | 20±2 |
| Step       | 1                              | 2                                        | 3                                                                                                                                                                                      | 4                                                                                                                                                                                                                                                                                                                                                                                                                          | 5    |   |   |   |   |   |            |      |
| Temp. (°C) | 20±2                           | -25±3                                    | 20±2                                                                                                                                                                                   | 125±2                                                                                                                                                                                                                                                                                                                                                                                                                      | 20±2 |   |   |   |   |   |            |      |
| 9          | Strength of Lead               | Pull                                     | Lead wire should not be cut off.<br>Capacitor should not be broken.                                                                                                                    | As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N and keep it for 10±1 sec.<br>                                                                                                                                |      |   |   |   |   |   |            |      |
|            |                                | Bending                                  |                                                                                                                                                                                        | Each lead wire should be subjected to 5N of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                                                             |      |   |   |   |   |   |            |      |
| 10         | Vibration Resistance           | Appearance                               | No marked defect                                                                                                                                                                       | The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.                                                                                                         |      |   |   |   |   |   |            |      |
|            |                                | Capacitance                              | Within specified tolerance                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |
|            |                                | D.F.                                     | 0.3% max.                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |
| 11         | Solderability of Leads         |                                          | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                    | The lead wire of a capacitor should be dipped into a ethanol solution of 25wt% rosin and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                                                       |      |   |   |   |   |   |            |      |
| 12         | Soldering Effect (Non-Preheat) | Appearance                               | No marked defect                                                                                                                                                                       | The lead wire should be immersed into the melted solder of 350±10°C up to about 1.5 to 2mm from the main body for 3.5±0.5 sec.<br>Pre-treatment:<br>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br>Post-treatment:<br>Capacitor should be stored for 24±2 hrs. at room condition.*                                                          |      |   |   |   |   |   |            |      |
|            |                                | Capacitance Change                       | Within ±10%                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |
|            |                                | Dielectric Strength (Between Lead Wires) | Per item 4.                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |

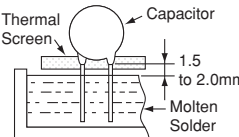


\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ➤

## DES Series Specifications and Test Methods

Continued from the preceding page.

| No.                                         | Item                             |                                             | Specifications   | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|---------------------------------------------|----------------------------------|---------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|------------|---|-------|----|---|------------|---|---|-------|----|---|------------|---|
| 13                                          | Soldering Effect<br>(On-Preheat) | Appearance                                  | No marked defect | <div>First the capacitor should be stored at 120+0/-5°C for 60+0/-5 sec.<br/>Then, as in the figure, the lead wires should be immersed in solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 sec.<br/>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br/>Post-treatment:<br/>Capacitor should be stored for 24±2 hrs. at room condition.*</div> <div></div>                                                                                   |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Dielectric Strength<br>(Between Lead Wires) | Per item 4.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 14                                          | Temperature Cycle                | Appearance                                  | No marked defect | <div>The capacitor should be subjected to 5 temperature cycles.<br/>&lt;Temperature Cycle&gt;</div> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25±3</td><td>30</td></tr><tr><td>2</td><td>Room Temp.</td><td>3</td></tr><tr><td>3</td><td>125±3</td><td>30</td></tr><tr><td>4</td><td>Room Temp.</td><td>3</td></tr></table> <div>Cycle time: 5 cycles</div> <div>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br/>Post-treatment:<br/>Capacitor should be stored for 24±2 hrs. at room condition.*</div> | Step       | Temperature (°C) | Time (min) | 1 | -25±3 | 30 | 2 | Room Temp. | 3 | 3 | 125±3 | 30 | 4 | Room Temp. | 3 |
|                                             |                                  | Step                                        | Temperature (°C) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Time (min) |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | 1                                           | -25±3            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 30         |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | 2                                           | Room Temp.       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3          |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | 3                                           | 125±3            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 30         |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 4                                           | Room Temp.                       | 3                                           |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| Capacitance Change                          | Within ±10%                      |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| D.F.                                        | 0.4% max.                        |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| I.R.                                        | 1000MΩ min.                      |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| Dielectric Strength<br>(Between Lead Wires) | Per item 4.                      |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 15                                          | Humidity (Under Steady State)    | Appearance                                  | No marked defect | <div>Set the capacitor for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.<br/>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br/>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*</div>                                                                                                                                                                                                                                                                                                                          |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | D.F.                                        | 0.4% max.        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | I.R.                                        | 1000MΩ min.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 16                                          | Humidity Loading                 | Appearance                                  | No marked defect | <div>Apply the rated voltage for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity. (Charge/Discharge current≤50mA)<br/>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br/>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*</div>                                                                                                                                                                                                                                                                                    |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | D.F.                                        | 0.6% max.        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | I.R.                                        | 1000MΩ min.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 17                                          | Life                             | Appearance                                  | No marked defect | <div>Apply a DC voltage of 200% of the rated voltage (DC500V) or DC voltage of 150% of the rated voltage (DC1kV) for 1000 +48/-0 hrs. at 125±2°C with a relative humidity of 50% max. (Charge/Discharge current≤50mA)<br/>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br/>Post-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs.</div>                                                                                                                                                         |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | D.F.                                        | 0.4% max.        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | I.R.                                        | 2000MΩ min.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

# High Voltage Ceramic Capacitors

**muRata**

## DEH Series (125°C Guaranteed/Low-dissipation Factor/DC500V-3.15kV)

### ■ Features

1. Reduced heat dissipation permitted due to small dielectric loss of the ceramic material.
2. Operating temperature range is guaranteed up to 125 degrees C.
3. Coated with flame-retardant epoxy resin (equivalent to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.  
\* Cl=900ppm max., Br=900ppm max. and  
Cl+Br=1500ppm max.
4. Taping available for automatic insertion.



### ■ Applications

Ideal for use on high-frequency pulse circuits such as a horizontal resonance circuit for CTV and snubber circuits for switching power supplies.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.



### ■ Marking

| Rated Voltage                    |             | DC500V                                                           | DC1-3.15kV                 |
|----------------------------------|-------------|------------------------------------------------------------------|----------------------------|
| Nominal Body Diameter            | Temp. Char. | C                                                                | R                          |
| ø6mm                             |             | HR<br>471<br>66                                                  |                            |
| ø7-9mm                           |             | HR C<br>152K<br>66                                               | HR R<br>102K<br>1KV 66     |
| ø10-21mm                         |             | HR C<br>472K<br>M66                                              | HR R<br>272K<br>3KV<br>M66 |
| High Temperature Guaranteed Code |             | HR                                                               |                            |
| Temperature Characteristics      |             | Marked with code (omitted for nominal body diameter ø6mm)        |                            |
| Nominal Capacitance              |             | Marked with 3 figures                                            |                            |
| Capacitance Tolerance            |             | Marked with code (omitted for nominal body diameter ø6mm)        |                            |
| Rated Voltage                    | DC500V      | Omitted                                                          |                            |
|                                  | DC1-3.15kV  | Marked with code (for DC3.15kV, marked with 3KV)                 |                            |
| Manufacturer's Identification    |             | Marked with M (omitted for nominal body diameter ø9mm and under) |                            |
| Manufactured Date Code           |             | Abbreviation                                                     |                            |

## DC500V, C Characteristics

| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEHC32H331K□□□ | 500Vdc           | 330pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEHC32H471K□□□ | 500Vdc           | 470pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEHC32H681K□□□ | 500Vdc           | 680pF±10%   | 7.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEHC32H102K□□□ | 500Vdc           | 1000pF±10%  | 8.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEHC32H152K□□□ | 500Vdc           | 1500pF±10%  | 9.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEHC32H222K□□□ | 500Vdc           | 2200pF±10%  | 10.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEHC32H332K□□□ | 500Vdc           | 3300pF±10%  | 12.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEHC32H472K□□□ | 500Vdc           | 4700pF±10%  | 14.0mm max. | 10.0                | 4.0mm max.       | A4B                    | B4B                     | -                   |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## DC1-3.15kV, R Characteristics

| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEHR33A221K□□□ | 1000Vdc          | 220pF±10%   | 7.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | B2B                     | N2A                 |
| DEHR33A331K□□□ | 1000Vdc          | 330pF±10%   | 7.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | B2B                     | N2A                 |
| DEHR33A471K□□□ | 1000Vdc          | 470pF±10%   | 7.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | B2B                     | N2A                 |
| DEHR33A681K□□□ | 1000Vdc          | 680pF±10%   | 8.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | B2B                     | N2A                 |
| DEHR33A102K□□□ | 1000Vdc          | 1000pF±10%  | 9.0mm max.  | 5.0                 | 4.5mm max.       | A2B                    | B2B                     | N2A                 |
| DEHR33A152K□□□ | 1000Vdc          | 1500pF±10%  | 11.0mm max. | 5.0                 | 4.5mm max.       | A2B                    | B2B                     | N2A                 |
| DEHR33A222K□□□ | 1000Vdc          | 2200pF±10%  | 13.0mm max. | 7.5                 | 4.5mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33A332K□□□ | 1000Vdc          | 3300pF±10%  | 15.0mm max. | 7.5                 | 4.5mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33A472K□□□ | 1000Vdc          | 4700pF±10%  | 17.0mm max. | 7.5                 | 4.5mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33D221K□□□ | 2000Vdc          | 220pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEHR33D271K□□□ | 2000Vdc          | 270pF±10%   | 7.0mm max.  | 7.5                 | 5.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEHR33D331K□□□ | 2000Vdc          | 330pF±10%   | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D391K□□□ | 2000Vdc          | 390pF±10%   | 8.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D471K□□□ | 2000Vdc          | 470pF±10%   | 9.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D561K□□□ | 2000Vdc          | 560pF±10%   | 9.0mm max.  | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D681K□□□ | 2000Vdc          | 680pF±10%   | 10.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D821K□□□ | 2000Vdc          | 820pF±10%   | 11.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D102K□□□ | 2000Vdc          | 1000pF±10%  | 12.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D122K□□□ | 2000Vdc          | 1200pF±10%  | 12.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D152K□□□ | 2000Vdc          | 1500pF±10%  | 12.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33D182K□□□ | 2000Vdc          | 1800pF±10%  | 14.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33D222K□□□ | 2000Vdc          | 2200pF±10%  | 15.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33D272K□□□ | 2000Vdc          | 2700pF±10%  | 17.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33D332K□□□ | 2000Vdc          | 3300pF±10%  | 19.0mm max. | 10.0                | 5.0mm max.       | A4B                    | B4B                     | -                   |
| DEHR33D392K□□□ | 2000Vdc          | 3900pF±10%  | 20.0mm max. | 10.0                | 5.0mm max.       | A4B                    | B4B                     | -                   |
| DEHR33D472K□□□ | 2000Vdc          | 4700pF±10%  | 21.0mm max. | 10.0                | 5.0mm max.       | A4B                    | B4B                     | -                   |
| DEHR33F151K□□□ | 3150Vdc          | 150pF±10%   | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEHR33F181K□□□ | 3150Vdc          | 180pF±10%   | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEHR33F221K□□□ | 3150Vdc          | 220pF±10%   | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEHR33F271K□□□ | 3150Vdc          | 270pF±10%   | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEHR33F331K□□□ | 3150Vdc          | 330pF±10%   | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33F391K□□□ | 3150Vdc          | 390pF±10%   | 9.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33F471K□□□ | 3150Vdc          | 470pF±10%   | 10.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33F561K□□□ | 3150Vdc          | 560pF±10%   | 10.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33F681K□□□ | 3150Vdc          | 680pF±10%   | 11.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33F821K□□□ | 3150Vdc          | 820pF±10%   | 12.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33F102K□□□ | 3150Vdc          | 1000pF±10%  | 13.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEHR33F122K□□□ | 3150Vdc          | 1200pF±10%  | 14.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33F152K□□□ | 3150Vdc          | 1500pF±10%  | 15.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33F182K□□□ | 3150Vdc          | 1800pF±10%  | 16.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |

Continued on the following page. 

Continued from the preceding page.

| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEHR33F222K□□□ | 3150Vdc          | 2200pF±10%  | 17.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEHR33F272K□□□ | 3150Vdc          | 2700pF±10%  | 19.0mm max. | 10.0                | 6.0mm max.       | A4B                    | B4B                     | -                   |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## DEH Series Specifications and Test Methods

| No.        | Item                           |                                                                                                                                                                                        | Specifications                                                                                                                                                                                                                                           | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---|--------------|---------------|------------|-------------|-----------------|------|-------------|---------------------------------------------------------------------------------|--|
| 1          | Operating Temperature Range    |                                                                                                                                                                                        | -25 to +125°C                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 2          | Appearance and Dimensions      |                                                                                                                                                                                        | No visible defect, and dimensions are within specified range.                                                                                                                                                                                            | The capacitor should be visually inspected for evidence of defect. Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                      |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 3          | Marking                        |                                                                                                                                                                                        | To be easily legible                                                                                                                                                                                                                                     | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 4          | Dielectric Strength            | Between Lead Wires                                                                                                                                                                     | No failure                                                                                                                                                                                                                                               | The capacitor should not be damaged when DC voltage of 200% of the rated voltage (DC1 to 3.15kV) or DC voltage of 250% of the rated voltage (DC500V) is applied between the lead wires for 1 to 5 sec.<br>(Charge/Discharge current≤50mA)                                                                                                                                                                                  |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | Body Insulation                                                                                                                                                                        | No failure                                                                                                                                                                                                                                               | The capacitor is placed in the container with metal balls of diameter 1mm so that each lead wire, short circuited, is kept about 2mm off the metal balls as shown in the figure at right, and AC1250V(r.m.s.) <50/60Hz> is applied for 1 to 5 sec. between capacitor lead wires and metal balls.<br>(Charge/Discharge current≤50mA)<br> |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 5          | Insulation Resistance (I.R.)   | Between Lead Wires                                                                                                                                                                     | 10000MΩ min.                                                                                                                                                                                                                                             | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                  |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 6          | Capacitance                    |                                                                                                                                                                                        | Within specified tolerance                                                                                                                                                                                                                               | The capacitance should be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                             |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 7          | Dissipation Factor (D.F.)      |                                                                                                                                                                                        | Char. R: 0.2% max.<br>Char. C: 0.3% max.                                                                                                                                                                                                                 | The dissipation factor should be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                      |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 8          | Temperature Characteristics    |                                                                                                                                                                                        | <table><tr><th rowspan="2">T. C.</th><th colspan="2">Temp. Char.</th></tr><tr><th>-25 to +85°C</th><th>+85 to +125°C</th></tr><tr><td>R</td><td>Within ±15%</td><td rowspan="2">Within +15/-30%</td></tr><tr><td>C</td><td>Within ±20%</td></tr></table> | T. C.                                                                                                                                                                                                                                                                                                                                                                                                                      | Temp. Char.   |   | -25 to +85°C | +85 to +125°C | R          | Within ±15% | Within +15/-30% | C    | Within ±20% | The capacitance measurement should be made at each step specified in the Table. |  |
|            |                                |                                                                                                                                                                                        | T. C.                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                            | Temp. Char.   |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                |                                                                                                                                                                                        |                                                                                                                                                                                                                                                          | -25 to +85°C                                                                                                                                                                                                                                                                                                                                                                                                               | +85 to +125°C |   |              |               |            |             |                 |      |             |                                                                                 |  |
| R          | Within ±15%                    | Within +15/-30%                                                                                                                                                                        |                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| C          | Within ±20%                    |                                                                                                                                                                                        |                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | Pre-treatment: Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before measurements.                                                      |                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><th>Temp. (°C)</th><td>20±2</td><td>-25±3</td><td>20±2</td><td>125±2</td><td>20±2</td></tr></table> | Step                                                                                                                                                                                                                                                     | 1                                                                                                                                                                                                                                                                                                                                                                                                                          | 2             | 3 | 4            | 5             | Temp. (°C) | 20±2        | -25±3           | 20±2 | 125±2       | 20±2                                                                            |  |
| Step       | 1                              | 2                                                                                                                                                                                      | 3                                                                                                                                                                                                                                                        | 4                                                                                                                                                                                                                                                                                                                                                                                                                          | 5             |   |              |               |            |             |                 |      |             |                                                                                 |  |
| Temp. (°C) | 20±2                           | -25±3                                                                                                                                                                                  | 20±2                                                                                                                                                                                                                                                     | 125±2                                                                                                                                                                                                                                                                                                                                                                                                                      | 20±2          |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 9          | Strength of Lead               | Pull                                                                                                                                                                                   | Lead wire should not be cut off.<br>Capacitor should not be broken.                                                                                                                                                                                      | As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N (5N for lead diameter 0.5mm), and keep it for 10±1 sec.<br>                                                                                                  |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | Bending                                                                                                                                                                                |                                                                                                                                                                                                                                                          | Each lead wire should be subjected to 5N (2.5N for lead diameter 0.5mm) of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                              |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 10         | Vibration Resistance           | Appearance                                                                                                                                                                             | No marked defect                                                                                                                                                                                                                                         | The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.                                                                                                         |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | Capacitance                                                                                                                                                                            | Within specified tolerance                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | D.F.                                                                                                                                                                                   | Char. R: 0.2% max.<br>Char. C: 0.3% max.                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 11         | Solderability of Leads         |                                                                                                                                                                                        | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                                                                                      | The lead wire of a capacitor should be dipped into a ethanol solution of 25wt% rosin and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                                                       |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
| 12         | Soldering Effect (Non-Preheat) | Appearance                                                                                                                                                                             | No marked defect                                                                                                                                                                                                                                         | The lead wire should be immersed into the melted solder of 350±10°C up to about 1.5 to 2mm from the main body for 3.5±0.5 sec.<br>Pre-treatment:<br>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br>Post-treatment:<br>Capacitor should be stored for 24±2 hrs. at room condition.*                                                          |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | Capacitance Change                                                                                                                                                                     | Within ±10%                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |
|            |                                | Dielectric Strength (Between Lead Wires)                                                                                                                                               | Per item 4.                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                            |               |   |              |               |            |             |                 |      |             |                                                                                 |  |



\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

## DEH Series Specifications and Test Methods

Continued from the preceding page.

| No.                                         | Item                             |                                             | Specifications   | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|---------------------------------------------|----------------------------------|---------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|------------|---|-------|----|---|------------|---|---|-------|----|---|------------|---|
| 13                                          | Soldering Effect<br>(On-Preheat) | Appearance                                  | No marked defect | <div>First the capacitor should be stored at 120+0/-5°C for 60+0/-5 sec.</div> <div>Then, as in the figure, the lead wires should be immersed in solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 sec.</div> <div>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</div> <div>Post-treatment:<br/>Capacitor should be stored for 24±2 hrs. at room condition.*</div> <div></div>                                                                            |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Dielectric Strength<br>(Between Lead Wires) | Per item 4.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 14                                          | Temperature Cycle                | Appearance                                  | No marked defect | <div>The capacitor should be subjected to 5 temperature cycles.</div> <div>&lt;Temperature Cycle&gt;</div> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25±3</td><td>30</td></tr><tr><td>2</td><td>Room Temp.</td><td>3</td></tr><tr><td>3</td><td>125±3</td><td>30</td></tr><tr><td>4</td><td>Room Temp.</td><td>3</td></tr></table> <div>Cycle time: 5 cycles</div> <div>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</div> <div>Post-treatment:<br/>Capacitor should be stored for 24±2 hrs. at room condition.*</div> | Step       | Temperature (°C) | Time (min) | 1 | -25±3 | 30 | 2 | Room Temp. | 3 | 3 | 125±3 | 30 | 4 | Room Temp. | 3 |
|                                             |                                  | Step                                        | Temperature (°C) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Time (min) |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | 1                                           | -25±3            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 30         |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | 2                                           | Room Temp.       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3          |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | 3                                           | 125±3            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 30         |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 4                                           | Room Temp.                       | 3                                           |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| Capacitance Change                          | Within ±10%                      |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| D.F.                                        | 0.4% max.                        |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| I.R.                                        | 1000MΩ min.                      |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| Dielectric Strength<br>(Between Lead Wires) | Per item 4.                      |                                             |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 15                                          | Humidity (Under Steady State)    | Appearance                                  | No marked defect | <div>Set the capacitor for 500 +24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.</div> <div>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</div> <div>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*</div>                                                                                                                                                                                                                                                                                                                         |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | D.F.                                        | 0.4% max.        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | I.R.                                        | 1000MΩ min.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 16                                          | Humidity Loading                 | Appearance                                  | No marked defect | <div>Apply the rated voltage for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity. (Charge/Discharge current≤50mA)</div> <div>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</div> <div>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*</div>                                                                                                                                                                                                                                                                                    |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | D.F.                                        | 0.6% max.        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | I.R.                                        | 1000MΩ min.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 17                                          | Life                             | Appearance                                  | No marked defect | <div>Apply a DC voltage of 200% of the rated voltage (DC500V) or DC voltage of 150% of the rated voltage (DC1 to 3.15kV) for 1000 +48/-0 hrs. at 125±2°C with a relative humidity of 50% max. (Charge/Discharge current≤50mA)</div> <div>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</div> <div>Post-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs.</div>                                                                                                                                                 |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | Capacitance Change                          | Within ±10%      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | D.F.                                        | 0.4% max.        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                  | I.R.                                        | 2000MΩ min.      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |

\* "Room condition" Temperature: 15 to  $35^{\circ}\text{C}$ , Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

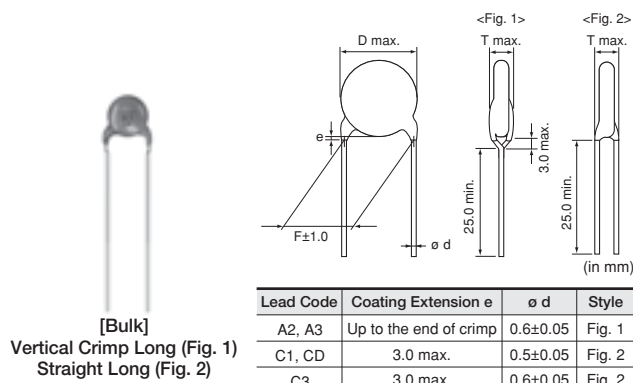
# High Voltage Ceramic Capacitors

**muRata**

## DEA Series (125°C Guaranteed/Class 1/DC1k-3.15kV)

### ■ Features

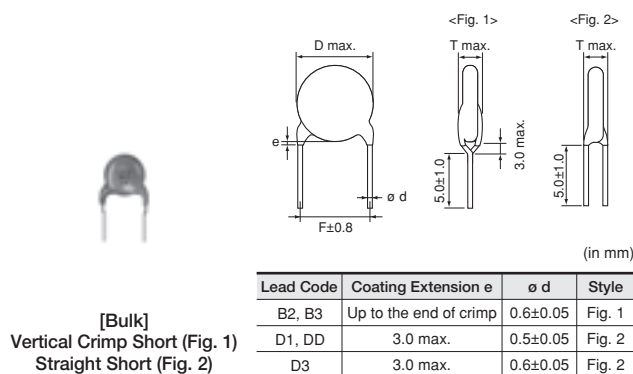
1. Temperature compensating type ceramics realize lower heat dissipation than DEH/DES series.
2. Operating temperature range is guaranteed up to 125 degrees C.
3. Coated with flame-retardant epoxy resin (equivalent to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.  
\* Cl=900ppm max., Br=900ppm max. and Cl+Br=1500ppm max.
4. Taping available for automatic insertion.



### ■ Applications

1. Ideal for use as the ballast in backlighting inverters for liquid crystal display.
2. Ideal for use on high-frequency pulse circuits such as a horizontal resonance circuit for CTV and snubber circuits for switching power supplies.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.



### ■ Marking

| Temp. Char.                   | SL                                                                  |
|-------------------------------|---------------------------------------------------------------------|
| Nominal Body Diameter         |                                                                     |
| ø4.5-5mm                      | 68<br>1KV                                                           |
| ø6mm                          | 39<br>3KV<br>66                                                     |
| ø7-9mm                        | 181J<br>2KV<br>66                                                   |
| ø10-16mm                      | 391J<br>3KV<br>M 66                                                 |
| Nominal Capacitance           | Under 100pF: Actual value, 100pF and over: Marked with 3 figures    |
| Capacitance Tolerance         | Marked with code (omitted for nominal body diameter ø6mm and under) |
| Rated Voltage                 | Marked with code (for DC3.15kV, marked with 3KV)                    |
| Manufacturer's Identification | Marked with  (omitted for nominal body diameter ø9mm and under)     |
| Manufactured Date Code        | Abbreviation (omitted for nominal body diameter ø5mm and under)     |

## SL Characteristics

| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEA1X3A100J□□□ | 1000Vdc          | 10pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A120J□□□ | 1000Vdc          | 12pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A150J□□□ | 1000Vdc          | 15pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A180J□□□ | 1000Vdc          | 18pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A220J□□□ | 1000Vdc          | 22pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A270J□□□ | 1000Vdc          | 27pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A330J□□□ | 1000Vdc          | 33pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A390J□□□ | 1000Vdc          | 39pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A470J□□□ | 1000Vdc          | 47pF±5%     | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A560J□□□ | 1000Vdc          | 56pF±5%     | 5.0mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A680J□□□ | 1000Vdc          | 68pF±5%     | 5.0mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3A820J□□□ | 1000Vdc          | 82pF±5%     | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A101J□□□ | 1000Vdc          | 100pF±5%    | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A121J□□□ | 1000Vdc          | 120pF±5%    | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A151J□□□ | 1000Vdc          | 150pF±5%    | 7.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A181J□□□ | 1000Vdc          | 180pF±5%    | 7.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A221J□□□ | 1000Vdc          | 220pF±5%    | 8.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A271J□□□ | 1000Vdc          | 270pF±5%    | 9.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A331J□□□ | 1000Vdc          | 330pF±5%    | 10.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A391J□□□ | 1000Vdc          | 390pF±5%    | 10.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A471J□□□ | 1000Vdc          | 470pF±5%    | 11.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3A561J□□□ | 1000Vdc          | 560pF±5%    | 12.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3D100J□□□ | 2000Vdc          | 10pF±5%     | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D120J□□□ | 2000Vdc          | 12pF±5%     | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D150J□□□ | 2000Vdc          | 15pF±5%     | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D180J□□□ | 2000Vdc          | 18pF±5%     | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D220J□□□ | 2000Vdc          | 22pF±5%     | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D270J□□□ | 2000Vdc          | 27pF±5%     | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D330J□□□ | 2000Vdc          | 33pF±5%     | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D390J□□□ | 2000Vdc          | 39pF±5%     | 5.0mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEA1X3D470J□□□ | 2000Vdc          | 47pF±5%     | 6.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D560J□□□ | 2000Vdc          | 56pF±5%     | 6.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D680J□□□ | 2000Vdc          | 68pF±5%     | 6.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D820J□□□ | 2000Vdc          | 82pF±5%     | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D101J□□□ | 2000Vdc          | 100pF±5%    | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D121J□□□ | 2000Vdc          | 120pF±5%    | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D151J□□□ | 2000Vdc          | 150pF±5%    | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D181J□□□ | 2000Vdc          | 180pF±5%    | 9.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D221J□□□ | 2000Vdc          | 220pF±5%    | 10.0mm max. | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D271J□□□ | 2000Vdc          | 270pF±5%    | 11.0mm max. | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEA1X3D331J□□□ | 2000Vdc          | 330pF±5%    | 12.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3D391J□□□ | 2000Vdc          | 390pF±5%    | 13.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3D471J□□□ | 2000Vdc          | 470pF±5%    | 14.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEA1X3D561J□□□ | 2000Vdc          | 560pF±5%    | 15.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEA1X3F100J□□□ | 3150Vdc          | 10pF±5%     | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEA1X3F120J□□□ | 3150Vdc          | 12pF±5%     | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEA1X3F150J□□□ | 3150Vdc          | 15pF±5%     | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEA1X3F180J□□□ | 3150Vdc          | 18pF±5%     | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEA1X3F220J□□□ | 3150Vdc          | 22pF±5%     | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEA1X3F270J□□□ | 3150Vdc          | 27pF±5%     | 6.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEA1X3F330J□□□ | 3150Vdc          | 33pF±5%     | 6.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEA1X3F390J□□□ | 3150Vdc          | 39pF±5%     | 6.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEA1X3F470J□□□ | 3150Vdc          | 47pF±5%     | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEA1X3F560J□□□ | 3150Vdc          | 56pF±5%     | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEA1X3F680J□□□ | 3150Vdc          | 68pF±5%     | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |

Continued on the following page. ↗

Continued from the preceding page.

| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEA1X3F820J□□□ | 3150Vdc          | 82pF±5%     | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3F101J□□□ | 3150Vdc          | 100pF±5%    | 9.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3F121J□□□ | 3150Vdc          | 120pF±5%    | 10.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3F151J□□□ | 3150Vdc          | 150pF±5%    | 11.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3F181J□□□ | 3150Vdc          | 180pF±5%    | 11.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3F221J□□□ | 3150Vdc          | 220pF±5%    | 12.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEA1X3F271J□□□ | 3150Vdc          | 270pF±5%    | 14.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEA1X3F331J□□□ | 3150Vdc          | 330pF±5%    | 15.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEA1X3F391J□□□ | 3150Vdc          | 390pF±5%    | 16.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## DEA Series Specifications and Test Methods

| No.        | Item                           |                                          | Specifications                                                                                                                                                                        | Test Method                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |
|------------|--------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|---|------------|------|-------|------|
| 1          | Operating Temperature Range    |                                          | -25 to +125°C                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |
| 2          | Appearance and Dimensions      |                                          | No visible defect, and dimensions are within specified range.                                                                                                                         | The capacitor should be visually inspected for evidence of defect. Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                   |      |   |   |   |   |            |      |       |      |
| 3          | Marking                        |                                          | To be easily legible                                                                                                                                                                  | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |
| 4          | Dielectric Strength            | Between Lead Wires                       | No failure                                                                                                                                                                            | The capacitor should not be damaged when DC voltage of 200% of the rated voltage is applied between the lead wires for 1 to 5 sec. (Charge/Discharge current≤50mA)                                                                                                                                                                                                                                                      |      |   |   |   |   |            |      |       |      |
|            |                                | Body Insulation                          | No failure                                                                                                                                                                            | The capacitor is placed in the container with metal balls of diameter 1mm so that each lead wire, short circuited, is kept about 2mm off the metal balls as shown in the figure at right, and AC1250V(r.m.s.) <50/60Hz> is applied for 1 to 5 sec. between capacitor lead wires and metal balls. (Charge/Discharge current≤50mA)<br> |      |   |   |   |   |            |      |       |      |
| 5          | Insulation Resistance (I.R.)   | Between Lead Wires                       | 10000MΩ min.                                                                                                                                                                          | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                               |      |   |   |   |   |            |      |       |      |
| 6          | Capacitance                    |                                          | Within specified tolerance                                                                                                                                                            | The capacitance should be measured at 20°C with 1±0.2MHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |   |            |      |       |      |
| 7          | Q                              |                                          | 400+20C**min. (30pF under)<br>1000 min. (30pF min.)                                                                                                                                   | The Q should be measured at 20°C with 1±0.2MHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                    |      |   |   |   |   |            |      |       |      |
| 8          | Temperature Characteristics    |                                          | +350 to -1000ppm/°C<br>(Temp. range: +20 to +85°C)                                                                                                                                    | The capacitance measurement should be made at each step specified in the Table.                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |
|            |                                |                                          | <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><th>Temp. (°C)</th><td>20±2</td><td>-25±3</td><td>20±2</td><td>85±2</td><td>20±2</td></tr></table> | Step                                                                                                                                                                                                                                                                                                                                                                                                                    | 1    | 2 | 3 | 4 | 5 | Temp. (°C) | 20±2 | -25±3 | 20±2 |
| Step       | 1                              | 2                                        | 3                                                                                                                                                                                     | 4                                                                                                                                                                                                                                                                                                                                                                                                                       | 5    |   |   |   |   |            |      |       |      |
| Temp. (°C) | 20±2                           | -25±3                                    | 20±2                                                                                                                                                                                  | 85±2                                                                                                                                                                                                                                                                                                                                                                                                                    | 20±2 |   |   |   |   |            |      |       |      |
| 9          | Strength of Lead               | Pull                                     | Lead wire should not be cut off.<br>Capacitor should not be broken.                                                                                                                   | As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N (5N for lead diameter 0.5mm), and keep it for 10±1 sec.<br>                                                                                               |      |   |   |   |   |            |      |       |      |
|            |                                | Bending                                  |                                                                                                                                                                                       | Each lead wire should be subjected to 5N (2.5N for lead diameter 0.5mm) of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                           |      |   |   |   |   |            |      |       |      |
| 10         | Vibration Resistance           | Appearance                               | No marked defect                                                                                                                                                                      | The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.                                                                                                      |      |   |   |   |   |            |      |       |      |
|            |                                | Capacitance                              | Within specified tolerance                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |
|            |                                | Q                                        | 400+20C**min. (30pF under)<br>1000 min. (30pF min.)                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |
| 11         | Solderability of Leads         |                                          | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                   | The lead wire of a capacitor should be dipped into a ethanol solution of 25wt% rosin and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                                                    |      |   |   |   |   |            |      |       |      |
| 12         | Soldering Effect (Non-Preheat) | Appearance                               | No marked defect                                                                                                                                                                      | The lead wire should be immersed into the melted solder of 350±10°C (Body of ø5mm and under: 270±5°C) up to about 1.5 to 2mm from the main body for 3.5±0.5 sec. (Body of ø5mm and under: 5±0.5 sec.)<br>Post-treatment:<br>Capacitor should be stored for 1 to 2 hrs. at room condition.*1                                                                                                                             |      |   |   |   |   |            |      |       |      |
|            |                                | Capacitance Change                       | Within ±2.5%                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |
|            |                                | Dielectric Strength (Between Lead Wires) | Per item 4.                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |

\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page. 

## DEA Series Specifications and Test Methods

Continued from the preceding page.

| No.                                         | Item                                                |                                             | Specifications                                      | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|---------------------------------------------|-----------------------------------------------------|---------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|------------|---|-------|----|---|------------|---|---|-------|----|---|------------|---|
| 13                                          | Soldering Effect<br>(On-Preheat)                    | Appearance                                  | No marked defect                                    | <div>First the capacitor should be stored at 120+0/-5°C for 60+0/-5 sec.</div> <div>Then, as in the figure, the lead wires should be immersed in solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 sec.</div> <div>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div> <div></div>                                                                            |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Capacitance Change                          | Within ±2.5%                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     |                                             |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 14                                          | Temperature Cycle                                   | Appearance                                  | No marked defect                                    | <div>The capacitor should be subjected to 5 temperature cycles.</div> <div>&lt;Temperature Cycle&gt;</div> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25±3</td><td>30</td></tr><tr><td>2</td><td>Room Temp.</td><td>3</td></tr><tr><td>3</td><td>125±3</td><td>30</td></tr><tr><td>4</td><td>Room Temp.</td><td>3</td></tr></table> <div>Cycle time: 5 cycles</div> <div>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div> | Step       | Temperature (°C) | Time (min) | 1 | -25±3 | 30 | 2 | Room Temp. | 3 | 3 | 125±3 | 30 | 4 | Room Temp. | 3 |
|                                             |                                                     | Step                                        | Temperature (°C)                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time (min) |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | 1                                           | -25±3                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30         |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | 2                                           | Room Temp.                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3          |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | 3                                           | 125±3                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 30         |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 4                                           | Room Temp.                                          | 3                                           |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| Capacitance Change                          | Within ±5%                                          |                                             |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| Q                                           | 275+5/2C*2min. (30pF under)<br>350 min. (30pF min.) |                                             |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| I.R.                                        | 1000MΩ min.                                         |                                             |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                         |                                             |                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 15                                          | Humidity (Under Steady State)                       | Appearance                                  | No marked defect                                    | <div>Set the capacitor for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.</div> <div>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div>                                                                                                                                                                                                                                                                                                                            |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Capacitance Change                          | Within ±5%                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Q                                           | 275+5/2C*2min. (30pF under)<br>350 min. (30pF min.) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | I.R.                                        | 1000MΩ min.                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 16                                          | Humidity Loading                                    | Appearance                                  | No marked defect                                    | <div>Apply the rated voltage for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.</div> <div>(Charge/Discharge current≤50mA)</div> <div>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div>                                                                                                                                                                                                                                                                           |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Capacitance Change                          | Within ±5%                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Q                                           | 275+5/2C*2min. (30pF under)<br>350 min. (30pF min.) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | I.R.                                        | 1000MΩ min.                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
| 17                                          | Life                                                | Appearance                                  | No marked defect                                    | <div>Apply a DC voltage of 150% of the rated voltage for 1000+48/-0 hrs. at 125±2°C with a relative humidity of 50% max. (Charge/Discharge current≤50mA)</div> <div>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div>                                                                                                                                                                                                                                                       |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Capacitance Change                          | Within ±3%                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | Q                                           | 275+5/2C*2min. (30pF under)<br>350 min. (30pF min.) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |
|                                             |                                                     | I.R.                                        | 2000MΩ min.                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                  |            |   |       |    |   |            |   |   |       |    |   |            |   |

\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

# High Voltage Ceramic Capacitors

**muRata**

## DEB Series (Class 2/DC1k-3.15kV)

### ■ Features

1. Small size and high capacitance
2. Coated with flame-retardant epoxy resin (equivalent to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.  
\* Cl=900ppm max., Br=900ppm max. and Cl+Br=1500ppm max.
3. Taping available for automatic insertion.

### ■ Applications

Ideal for use on decoupling circuits for power supplies.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.



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### ■ Marking

| Temp. Char.                   | B                                                                                                                                                  | E                        | F                   |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------|
| Nominal Body Diameter         |                                                                                                                                                    |                          |                     |
| ø4.5-5mm                      | 221<br>3KV                                                                                                                                         | 102<br>1KV               | 102<br>2KV          |
| ø6mm                          | 331<br>3KV<br>66                                                                                                                                   | 102<br>2KV<br>66         | 222<br>1KV<br>66    |
| ø7-9mm                        | 102K<br>3KV<br>66                                                                                                                                  | 102Z<br>3KV<br>66        | 472Z<br>2KV<br>66   |
| ø10-16mm                      | B<br>332K<br>3KV<br>M 66                                                                                                                           | E<br>472Z<br>3KV<br>M 66 | 103Z<br>2KV<br>M 66 |
| Temperature Characteristics   | Marked with code for char. B and E (omitted for nominal body diameter ø9mm and under)                                                              |                          |                     |
| Nominal Capacitance           | Marked with 3 figures                                                                                                                              |                          |                     |
| Capacitance Tolerance         | Marked with code (omitted for nominal body diameter ø6mm and under)                                                                                |                          |                     |
| Rated Voltage                 | Marked with code (for DC3.15kV, marked with 3KV)                                                                                                   |                          |                     |
| Manufacturer's Identification | Marked with  (omitted for nominal body diameter ø9mm and under) |                          |                     |
| Manufactured Date Code        | Abbreviation (omitted for nominal body diameter ø5mm and under)                                                                                    |                          |                     |

## B Characteristics

| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEBB33A101K□□□ | 1000Vdc          | 100pF±10%   | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33A151K□□□ | 1000Vdc          | 150pF±10%   | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33A221K□□□ | 1000Vdc          | 220pF±10%   | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33A331K□□□ | 1000Vdc          | 330pF±10%   | 4.5mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33A471K□□□ | 1000Vdc          | 470pF±10%   | 5.0mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33A681K□□□ | 1000Vdc          | 680pF±10%   | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33A102K□□□ | 1000Vdc          | 1000pF±10%  | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33A152K□□□ | 1000Vdc          | 1500pF±10%  | 8.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33A222K□□□ | 1000Vdc          | 2200pF±10%  | 9.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33A332K□□□ | 1000Vdc          | 3300pF±10%  | 10.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33A472K□□□ | 1000Vdc          | 4700pF±10%  | 12.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBB33A682K□□□ | 1000Vdc          | 6800pF±10%  | 15.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEBB33D101K□□□ | 2000Vdc          | 100pF±10%   | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33D151K□□□ | 2000Vdc          | 150pF±10%   | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33D221K□□□ | 2000Vdc          | 220pF±10%   | 4.5mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33D331K□□□ | 2000Vdc          | 330pF±10%   | 5.0mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBB33D471K□□□ | 2000Vdc          | 470pF±10%   | 6.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33D681K□□□ | 2000Vdc          | 680pF±10%   | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33D102K□□□ | 2000Vdc          | 1000pF±10%  | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33D152K□□□ | 2000Vdc          | 1500pF±10%  | 9.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33D222K□□□ | 2000Vdc          | 2200pF±10%  | 10.0mm max. | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBB33D332K□□□ | 2000Vdc          | 3300pF±10%  | 12.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBB33D472K□□□ | 2000Vdc          | 4700pF±10%  | 15.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEBB33F101K□□□ | 3150Vdc          | 100pF±10%   | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEBB33F151K□□□ | 3150Vdc          | 150pF±10%   | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEBB33F221K□□□ | 3150Vdc          | 220pF±10%   | 5.0mm max.  | 7.5                 | 6.0mm max.       | CDB                    | DDB                     | P3A                 |
| DEBB33F331K□□□ | 3150Vdc          | 330pF±10%   | 6.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEBB33F471K□□□ | 3150Vdc          | 470pF±10%   | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEBB33F681K□□□ | 3150Vdc          | 680pF±10%   | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBB33F102K□□□ | 3150Vdc          | 1000pF±10%  | 9.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBB33F152K□□□ | 3150Vdc          | 1500pF±10%  | 11.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBB33F222K□□□ | 3150Vdc          | 2200pF±10%  | 13.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBB33F332K□□□ | 3150Vdc          | 3300pF±10%  | 15.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N7A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## E Characteristics

| Part Number    | DC Rated Voltage | Capacitance     | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-----------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEBE33A102Z□□□ | 1000Vdc          | 1000pF+80/-20%  | 5.0mm max.  | 5.0                 | 4.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBE33A222Z□□□ | 1000Vdc          | 2200pF+80/-20%  | 7.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBE33A472Z□□□ | 1000Vdc          | 4700pF+80/-20%  | 9.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBE33A103Z□□□ | 1000Vdc          | 10000pF+80/-20% | 13.0mm max. | 7.5                 | 4.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBE33D102Z□□□ | 2000Vdc          | 1000pF+80/-20%  | 6.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBE33D222Z□□□ | 2000Vdc          | 2200pF+80/-20%  | 8.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBE33D472Z□□□ | 2000Vdc          | 4700pF+80/-20%  | 11.0mm max. | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBE33D103Z□□□ | 2000Vdc          | 10000pF+80/-20% | 16.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N7A                 |
| DEBE33F102Z□□□ | 3150Vdc          | 1000pF+80/-20%  | 7.0mm max.  | 7.5                 | 6.0mm max.       | C3B                    | D3B                     | P3A                 |
| DEBE33F222Z□□□ | 3150Vdc          | 2200pF+80/-20%  | 10.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |
| DEBE33F472Z□□□ | 3150Vdc          | 4700pF+80/-20%  | 13.0mm max. | 7.5                 | 6.0mm max.       | A3B                    | B3B                     | N3A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## F Characteristics

| Part Number    | DC Rated Voltage | Capacitance     | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-----------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEBF33A222Z□□□ | 1000Vdc          | 2200pF+80/-20%  | 6.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBF33A472Z□□□ | 1000Vdc          | 4700pF+80/-20%  | 7.0mm max.  | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBF33A103Z□□□ | 1000Vdc          | 10000pF+80/-20% | 10.0mm max. | 5.0                 | 4.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBF33D102Z□□□ | 2000Vdc          | 1000pF+80/-20%  | 5.0mm max.  | 5.0                 | 5.0mm max.       | C1B                    | D1B                     | P2A                 |
| DEBF33D222Z□□□ | 2000Vdc          | 2200pF+80/-20%  | 7.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBF33D472Z□□□ | 2000Vdc          | 4700pF+80/-20%  | 9.0mm max.  | 5.0                 | 5.0mm max.       | A2B                    | B2B                     | N2A                 |
| DEBF33D103Z□□□ | 2000Vdc          | 10000pF+80/-20% | 12.0mm max. | 7.5                 | 5.0mm max.       | A3B                    | B3B                     | N3A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## DEB Series Specifications and Test Methods

| No.        | Item                           |                                          | Specifications                                                                                                                                                                                                                                                                                                         | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |   |   |            |      |
|------------|--------------------------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|---|---|------------|------|
| 1          | Operating Temperature Range    |                                          | -25 to +85°C                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |
| 2          | Appearance and Dimensions      |                                          | No visible defect, and dimensions are within specified range.                                                                                                                                                                                                                                                          | The capacitor should be visually inspected for evidence of defect. Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                                |      |   |   |   |   |   |            |      |
| 3          | Marking                        |                                          | To be easily legible                                                                                                                                                                                                                                                                                                   | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                          |      |   |   |   |   |   |            |      |
| 4          | Dielectric Strength            | Between Lead Wires                       | No failure                                                                                                                                                                                                                                                                                                             | The capacitor should not be damaged when DC voltage of 200% of the rated voltage is applied between the lead wires for 1 to 5 sec. (Charge/Discharge current≤50mA)                                                                                                                                                                                                                                                                   |      |   |   |   |   |   |            |      |
|            |                                | Body Insulation                          | No failure                                                                                                                                                                                                                                                                                                             | The capacitor is placed in the container with metal balls of diameter 1mm so that each lead wire, short circuited, is kept about 2mm off the metal balls as shown in the figure at right, and DC voltage of 1.3kV is applied for 1 to 5 sec. between capacitor lead wires and metal balls. (Charge/Discharge current≤50mA) <div></div>            |      |   |   |   |   |   |            |      |
| 5          | Insulation Resistance (I.R.)   | Between Lead Wires                       | 10000MΩ min.                                                                                                                                                                                                                                                                                                           | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                            |      |   |   |   |   |   |            |      |
| 6          | Capacitance                    |                                          | Within specified tolerance                                                                                                                                                                                                                                                                                             | The capacitance should be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                       |      |   |   |   |   |   |            |      |
| 7          | Dissipation Factor (D.F.)      |                                          | Char. B, E: 2.5% max.<br>Char. F: 5.0% max.                                                                                                                                                                                                                                                                            | The dissipation factor should be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                |      |   |   |   |   |   |            |      |
| 8          | Temperature Characteristics    |                                          | Char. B: Within ±10%<br>Char. E: Within +20/-55%<br>Char. F: Within +30/-80%                                                                                                                                                                                                                                           | The capacitance measurement should be made at each step specified in the Table.                                                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |
|            |                                |                                          | Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs. before measurements. <table><tr><th>Step</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><th>Temp. (°C)</th><td>20±2</td><td>-25±3</td><td>20±2</td><td>85±2</td><td>20±2</td></tr></table> |                                                                                                                                                                                                                                                                                                                                                                                                                                      | Step | 1 | 2 | 3 | 4 | 5 | Temp. (°C) | 20±2 |
| Step       | 1                              | 2                                        | 3                                                                                                                                                                                                                                                                                                                      | 4                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5    |   |   |   |   |   |            |      |
| Temp. (°C) | 20±2                           | -25±3                                    | 20±2                                                                                                                                                                                                                                                                                                                   | 85±2                                                                                                                                                                                                                                                                                                                                                                                                                                 | 20±2 |   |   |   |   |   |            |      |
| 9          | Strength of Lead               | Pull                                     | Lead wire should not be cut off.<br>Capacitor should not be broken.                                                                                                                                                                                                                                                    | As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N (5N for lead diameter 0.5mm), and keep it for 10±1 sec. <div></div>                                                                                                    |      |   |   |   |   |   |            |      |
|            |                                | Bending                                  |                                                                                                                                                                                                                                                                                                                        | Each lead wire should be subjected to 5N (2.5N for lead diameter 0.5mm) of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                                        |      |   |   |   |   |   |            |      |
| 10         | Vibration Resistance           | Appearance                               | No marked defect                                                                                                                                                                                                                                                                                                       | The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.                                                                                                                   |      |   |   |   |   |   |            |      |
|            |                                | Capacitance                              | Within specified tolerance                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |
|            |                                | D.F.                                     | Char. B, E: 2.5% max.<br>Char. F: 5.0% max.                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |
| 11         | Solderability of Leads         |                                          | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                                                                                                                                                    | The lead wire of a capacitor should be dipped into a ethanol solution of 25wt% rosin and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                                                                 |      |   |   |   |   |   |            |      |
| 12         | Soldering Effect (Non-Preheat) | Appearance                               | No marked defect                                                                                                                                                                                                                                                                                                       | The lead wire should be immersed into the melted solder of 350±10°C (Body of ø5mm and under: 270±5°C) up to about 1.5 to 2mm from the main body for 3.5±0.5 sec. (Body of ø5mm and under: 5±0.5 sec.)<br>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br>Post-treatment: Capacitor should be stored for 4 to 24 hrs. at room condition.* |      |   |   |   |   |   |            |      |
|            |                                | Capacitance Change                       | Char. B: Within ±5%<br>Char. E: Within ±15%<br>Char. F: Within ±20%                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |
|            |                                | Dielectric Strength (Between Lead Wires) | Per item 4.                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |

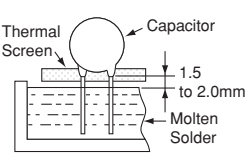


\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ➡

## DEB Series Specifications and Test Methods

Continued from the preceding page.

| No.                                         | Item                                                                 |                                             | Specifications                                                       | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|---------------------------------------------|----------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|------------|---|-------|----|---|------------|---|---|------|----|---|------------|---|------|------------------|------------|-----------------|---|---------|----|-------------|---|-----|----|------------|
| 13                                          | Soldering Effect<br>(On-Preheat)                                     | Appearance                                  | No marked defect                                                     | <p>First the capacitor should be stored at 120+0/-5°C for 60+0/-5 sec.</p> <p>Then, as in the figure, the lead wires should be immersed in solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 sec.</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment: Capacitor should be stored for 4 to 24 hrs. at room condition.*</p> <div></div>                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. B: Within ±5%<br>Char. E: Within ±15%<br>Char. F: Within ±20%  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 14                                          | Temperature and Immersion Cycle                                      | Appearance                                  | No marked defect                                                     | <p>The capacitor should be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles.</p> <p>&lt;Temperature Cycle&gt;</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25±3</td><td>30</td></tr><tr><td>2</td><td>Room Temp.</td><td>3</td></tr><tr><td>3</td><td>85±3</td><td>30</td></tr><tr><td>4</td><td>Room Temp.</td><td>3</td></tr></table> <p>Cycle time: 5 cycles</p> <p>&lt;Immersion Cycle&gt;</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th><th>Immersion Water</th></tr><tr><td>1</td><td>65+5/-0</td><td>15</td><td>Clean water</td></tr><tr><td>2</td><td>0±3</td><td>15</td><td>Salt water</td></tr></table> <p>Cycle time : 2 cycles</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment: Capacitor should be stored for 4 to 24 hrs. at room condition.*</p> | Step       | Temperature (°C) | Time (min) | 1 | -25±3 | 30 | 2 | Room Temp. | 3 | 3 | 85±3 | 30 | 4 | Room Temp. | 3 | Step | Temperature (°C) | Time (min) | Immersion Water | 1 | 65+5/-0 | 15 | Clean water | 2 | 0±3 | 15 | Salt water |
|                                             |                                                                      | Step                                        | Temperature (°C)                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Time (min) |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | 1                                           | -25±3                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 30         |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | 2                                           | Room Temp.                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3          |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | 3                                           | 85±3                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 30         |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 4                                           | Room Temp.                                                           | 3                                           |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Step                                        | Temperature (°C)                                                     | Time (min)                                  | Immersion Water                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 1                                           | 65+5/-0                                                              | 15                                          | Clean water                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 2                                           | 0±3                                                                  | 15                                          | Salt water                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Capacitance Change                          | Char. B: Within ±10%<br>Char. E: Within ±20%<br>Char. F: Within ±30% |                                             |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| D.F.                                        | Char. B, E: 4.0% max.<br>Char. F: 7.5% max.                          |                                             |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                                        | 2000MΩ min.                                                          |                                             |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                                          |                                             |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 15                                          | Humidity (Under Steady State)                                        | Appearance                                  | No marked defect                                                     | <p>Set the capacitor for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. B: Within ±10%<br>Char. E: Within ±20%<br>Char. F: Within ±30% |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | D.F.                                        | Char. B, E: 5.0% max.<br>Char. F: 7.5% max.                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | I.R.                                        | 1000MΩ min.                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 16                                          | Humidity Loading                                                     | Appearance                                  | No marked defect                                                     | <p>Apply the rated voltage for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity. (Charge/Discharge current≤50mA)</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. B: Within ±10%<br>Char. E: Within ±20%<br>Char. F: Within ±30% |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | D.F.                                        | Char. B, E: 5.0% max.<br>Char. F: 7.5% max.                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | I.R.                                        | 500MΩ min.                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 17                                          | Life                                                                 | Appearance                                  | No marked defect                                                     | <p>Apply a DC voltage of 150% of the rated voltage for 1000+48/-0 hrs. at 85±2°C with a relative humidity of 50% max. (Charge/Discharge current≤50mA)</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition* for 24±2 hrs.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. B: Within ±10%<br>Char. E: Within ±20%<br>Char. F: Within ±30% |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | D.F.                                        | Char. B, E: 4.0% max.<br>Char. F: 7.5% max.                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | I.R.                                        | 2000MΩ min.                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |

\* "Room condition" Temperature: 15 to  $35^{\circ}\text{C}$ , Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

# High Voltage Ceramic Capacitors

**muRata**

## DEC Series (Class 1, 2/DC6.3kV)

### ■ Features

Coated with flame-retardant epoxy resin  
(equivalent to UL94V-0 standard).

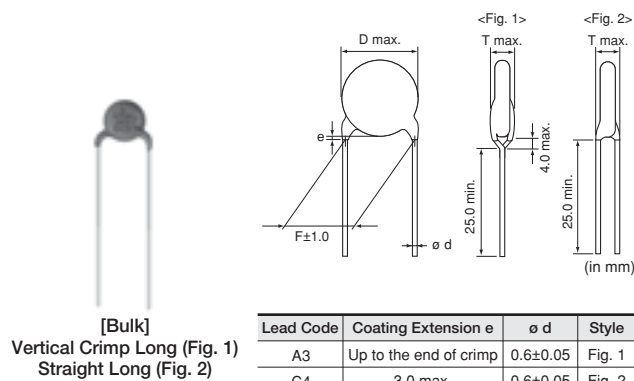
Please contact us when a halogen-free product\*  
is necessary.

\* Cl=900ppm max., Br=900ppm max. and  
Cl+Br=1500ppm max.

### ■ Applications

1. Ideal for use as the ballast in backlighting  
inverters for liquid crystal displays (SL Char.).
2. Ideal for use on high voltage circuits such as  
Cockcroft circuits (B Char.).

Do not use these products in any automotive  
power train or safety equipment including battery  
chargers for electric vehicles and plug-in hybrids.  
Only Murata products clearly stipulated as  
"for Automotive use" on its catalog can be used  
for automobile applications such as power train and  
safety equipment.



### ■ Marking

| Temp. Char.                   | SL                                                                              | B                       | E                  |
|-------------------------------|---------------------------------------------------------------------------------|-------------------------|--------------------|
| Nominal Body Diameter         |                                                                                 |                         |                    |
| ø7mm                          | 10J<br>6KV                                                                      | _____                   | _____              |
| ø8-9mm                        | 47J<br>6KV<br>66                                                                | 331K<br>6KV<br>66       | _____              |
| ø10-15mm                      | 151J<br>6KV<br>M66                                                              | B<br>102K<br>6KV<br>M66 | 222Z<br>6KV<br>M66 |
| Temperature Characteristics   | Marked with code for char. B (omitted for nominal body diameter ø9mm and under) |                         |                    |
| Nominal Capacitance           | Under 100pF: Actual value, 100pF and over: Marked with 3 figures                |                         |                    |
| Capacitance Tolerance         | Marked with code                                                                |                         |                    |
| Rated Voltage                 | Marked with code (for DC6.3kV, marked with 6KV)                                 |                         |                    |
| Manufacturer's Identification | Marked with M (omitted for nominal body diameter ø9mm and under)                |                         |                    |
| Manufactured Date Code        | Abbreviation (omitted for nominal body diameter ø7mm)                           |                         |                    |

## SL Characteristics

| Part Number       | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T |
|-------------------|------------------|-------------|-------------|---------------------|------------------|
| DEC1X3J100JA3BMS1 | 6300Vdc          | 10pF±5%     | 7.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J100JC4BMS1 | 6300Vdc          | 10pF±5%     | 7.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J120JA3B    | 6300Vdc          | 12pF±5%     | 8.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J120JC4B    | 6300Vdc          | 12pF±5%     | 8.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J150JA3B    | 6300Vdc          | 15pF±5%     | 8.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J150JC4B    | 6300Vdc          | 15pF±5%     | 8.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J180JA3B    | 6300Vdc          | 18pF±5%     | 9.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J180JC4B    | 6300Vdc          | 18pF±5%     | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J220JA3B    | 6300Vdc          | 22pF±5%     | 9.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J220JC4B    | 6300Vdc          | 22pF±5%     | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J270JA3B    | 6300Vdc          | 27pF±5%     | 9.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J270JC4B    | 6300Vdc          | 27pF±5%     | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J330JA3B    | 6300Vdc          | 33pF±5%     | 9.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J330JC4B    | 6300Vdc          | 33pF±5%     | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J390JA3B    | 6300Vdc          | 39pF±5%     | 9.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J390JC4B    | 6300Vdc          | 39pF±5%     | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J470JA3B    | 6300Vdc          | 47pF±5%     | 9.0mm max.  | 7.5                 | 7.0mm max.       |
| DEC1X3J470JC4B    | 6300Vdc          | 47pF±5%     | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DEC1X3J560JC4B    | 6300Vdc          | 56pF±5%     | 10.0mm max. | 10.0                | 7.0mm max.       |
| DEC1X3J680JC4B    | 6300Vdc          | 68pF±5%     | 12.0mm max. | 10.0                | 7.0mm max.       |
| DEC1X3J820JC4B    | 6300Vdc          | 82pF±5%     | 12.0mm max. | 10.0                | 7.0mm max.       |
| DEC1X3J101JC4B    | 6300Vdc          | 100pF±5%    | 13.0mm max. | 10.0                | 7.0mm max.       |
| DEC1X3J121JC4B    | 6300Vdc          | 120pF±5%    | 14.0mm max. | 10.0                | 7.0mm max.       |
| DEC1X3J151JC4B    | 6300Vdc          | 150pF±5%    | 15.0mm max. | 10.0                | 7.0mm max.       |

## B Characteristics

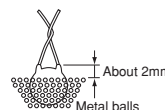
| Part Number    | DC Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T |
|----------------|------------------|-------------|-------------|---------------------|------------------|
| DECB33J101KC4B | 6300Vdc          | 100pF±10%   | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DECB33J151KC4B | 6300Vdc          | 150pF±10%   | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DECB33J221KC4B | 6300Vdc          | 220pF±10%   | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DECB33J331KC4B | 6300Vdc          | 330pF±10%   | 9.0mm max.  | 10.0                | 7.0mm max.       |
| DECB33J471KC4B | 6300Vdc          | 470pF±10%   | 10.0mm max. | 10.0                | 7.0mm max.       |
| DECB33J681KC4B | 6300Vdc          | 680pF±10%   | 11.0mm max. | 10.0                | 7.0mm max.       |
| DECB33J102KC4B | 6300Vdc          | 1000pF±10%  | 13.0mm max. | 10.0                | 7.0mm max.       |

## E Characteristics

| Part Number    | DC Rated Voltage | Capacitance    | Body Dia. D | Lead Spacing F (mm) | Body Thickness T |
|----------------|------------------|----------------|-------------|---------------------|------------------|
| DECE33J102ZC4B | 6300Vdc          | 1000pF+80/-20% | 11.0mm max. | 10.0                | 7.0mm max.       |
| DECE33J222ZC4B | 6300Vdc          | 2200pF+80/-20% | 15.0mm max. | 10.0                | 7.0mm max.       |

## DEC Series Specifications and Test Methods

| No.        | Item                           |                                          | Specifications                                                                                                                                                                        | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |   |            |      |
|------------|--------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|---|---|------------|------|
| 1          | Operating Temperature Range    |                                          | -25 to +85°C                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
| 2          | Appearance and Dimensions      |                                          | No visible defect, and dimensions are within specified range.                                                                                                                         | The capacitor should be visually inspected for evidence of defect. Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                                                                                   |      |   |   |   |   |   |            |      |
| 3          | Marking                        |                                          | To be easily legible                                                                                                                                                                  | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |   |            |      |
| 4          | Dielectric Strength            | Between Lead Wires                       | No failure                                                                                                                                                                            | The capacitor should not be damaged when DC voltage of 200% of the rated voltage is applied between the lead wires for 1 to 5 sec. (Charge/Discharge current≤50mA)                                                                                                                                                                                                                                                                                                                      |      |   |   |   |   |   |            |      |
|            |                                | Body Insulation                          | No failure                                                                                                                                                                            | The capacitor is placed in the container with metal balls of diameter 1mm so that each lead wire, short circuited, is kept about 2mm off the metal balls as shown in the figure at right, and DC voltage of 1.3kV is applied for 1 to 5 sec. between capacitor lead wires and metal balls. (Charge/Discharge current≤50mA)<br>                                                                       |      |   |   |   |   |   |            |      |
| 5          | Insulation Resistance (I.R.)   | Between Lead Wires                       | 10000MΩ min.                                                                                                                                                                          | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                                                                               |      |   |   |   |   |   |            |      |
| 6          | Capacitance                    |                                          | Within specified tolerance                                                                                                                                                            | The capacitance should be measured at 20°C with 1±0.2kHz (Char. SL: 1±0.2MHz) and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                                                     |      |   |   |   |   |   |            |      |
| 7          | Q                              |                                          | Char. SL: 400+20C*min. (30pF under) 1000 min. (30pF min.)                                                                                                                             | The dissipation factor and Q should be measured at 20°C with 1±0.2kHz (Char. SL: 1±0.2MHz) and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                                        |      |   |   |   |   |   |            |      |
|            | Dissipation Factor (D.F.)      |                                          | Char. B, E: 2.5% max.                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
| 8          | Temperature Characteristics    |                                          | Char. SL: +350 to -1000ppm/°C (Temp. range: +20 to +85°C)<br>Char. B: Within ±10%<br>Char. E: Within +20/-55%                                                                         | The capacitance measurement should be made at each step specified in the Table.                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
|            |                                |                                          | Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before measurements. (Char. B, E)                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
|            |                                |                                          | <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><th>Temp. (°C)</th><td>20±2</td><td>-25±3</td><td>20±2</td><td>85±2</td><td>20±2</td></tr></table> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Step | 1 | 2 | 3 | 4 | 5 | Temp. (°C) | 20±2 |
| Step       | 1                              | 2                                        | 3                                                                                                                                                                                     | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5    |   |   |   |   |   |            |      |
| Temp. (°C) | 20±2                           | -25±3                                    | 20±2                                                                                                                                                                                  | 85±2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 20±2 |   |   |   |   |   |            |      |
| 9          | Strength of Lead               | Pull                                     | Lead wire should not be cut off. Capacitor should not be broken.                                                                                                                      | As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N and keep it for 10±1 sec.                                                                                                                                                                                                 |      |   |   |   |   |   |            |      |
|            |                                | Bending                                  |                                                                                                                                                                                       | Each lead wire should be subjected to 5N of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                                                                                                                          |      |   |   |   |   |   |            |      |
| 10         | Vibration Resistance           | Appearance                               | No marked defect                                                                                                                                                                      | The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.                                                                                                                                                                      |      |   |   |   |   |   |            |      |
|            |                                | Capacitance                              | Within specified tolerance                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
|            |                                | Q                                        | Char. SL: 400+20C*min. (30pF under) 1000 min. (30pF min.)                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
|            |                                | D.F.                                     | Char. B, E: 2.5% max.                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
| 11         | Solderability of Leads         |                                          | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                   | The lead wire of a capacitor should be dipped into a ethanol solution of 25wt% rosin and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                                                                                                                    |      |   |   |   |   |   |            |      |
| 12         | Soldering Effect (Non-Preheat) | Appearance                               | No marked defect                                                                                                                                                                      | The lead wire should be immersed into the melted solder of 350±10°C up to about 1.5 to 2mm from the main body for 3.5±0.5 sec.<br>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements. (Char. B, E)<br>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1 (Char. SL)<br>Post-treatment: Capacitor should be stored for 4 to 24 hrs. at room condition.*1 (Char. B, E) |      |   |   |   |   |   |            |      |
|            |                                | Capacitance Change                       | Char. SL: Within ±2.5%<br>Char. B: Within ±5%<br>Char. E: Within ±15%                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |
|            |                                | Dielectric Strength (Between Lead Wires) | Per item 4.                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |   |   |   |   |   |            |      |



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\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

## DEC Series Specifications and Test Methods

Continued from the preceding page.

| No.                                         | Item                                                                 |                                             | Specifications                                                         | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|---------------------------------------------|----------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|------------|---|-------|----|---|------------|---|---|------|----|---|------------|---|------|------------------|------------|-----------------|---|---------|----|-------------|---|-----|----|------------|
| 13                                          | Soldering Effect<br>(On-Preheat)                                     | Appearance                                  | No marked defect                                                       | <p>First the capacitor should be stored at 120+0/-5°C for 60+0/-5 sec.</p> <p>Then, as in the figure, the lead wires should be immersed in solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 sec.</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements. (Char. B, E)</p> <p>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1 (Char. SL)</p> <p>Post-treatment: Capacitor should be stored for 4 to 24 hrs. at room condition.*1 (Char. B, E)</p>                                                                                                                                                                                                                                                                                                                  |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. SL: Within ±2.5%<br>Char. B: Within ±5%<br>Char. E: Within ±15%  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 14                                          | Temperature and Immersion Cycle                                      | Appearance                                  | No marked defect                                                       | <p>The capacitor should be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles.</p> <p>&lt;Temperature Cycle&gt;</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25±3</td><td>30</td></tr><tr><td>2</td><td>Room Temp.</td><td>3</td></tr><tr><td>3</td><td>85±3</td><td>30</td></tr><tr><td>4</td><td>Room Temp.</td><td>3</td></tr></table> <p>Cycle time: 5 cycles</p> <p>&lt;Immersion Cycle&gt;</p> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th><th>Immersion Water</th></tr><tr><td>1</td><td>65+5/-0</td><td>15</td><td>Clean water</td></tr><tr><td>2</td><td>0±3</td><td>15</td><td>Salt water</td></tr></table> <p>Cycle time: 2 cycles</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements. (Char. B, E)</p> <p>Post-treatment: Capacitor should be stored for 4 to 24 hrs. at room condition.*1</p> | Step       | Temperature (°C) | Time (min) | 1 | -25±3 | 30 | 2 | Room Temp. | 3 | 3 | 85±3 | 30 | 4 | Room Temp. | 3 | Step | Temperature (°C) | Time (min) | Immersion Water | 1 | 65+5/-0 | 15 | Clean water | 2 | 0±3 | 15 | Salt water |
|                                             |                                                                      | Step                                        | Temperature (°C)                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Time (min) |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | 1                                           | -25±3                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 30         |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | 2                                           | Room Temp.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3          |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | 3                                           | 85±3                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 30         |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | 4                                           | Room Temp.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3          |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Step                                        | Temperature (°C)                                                     | Time (min)                                  | Immersion Water                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 1                                           | 65+5/-0                                                              | 15                                          | Clean water                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 2                                           | 0±3                                                                  | 15                                          | Salt water                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Capacitance Change                          | Char. SL: Within ±3%<br>Char. B: Within ±10%<br>Char. E: Within ±20% |                                             |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Q                                           | Char. SL: 275+5/2C**min. (30pF under)<br>350 min. (30pF min.)        |                                             |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| D.F.                                        | Char. B, E: 4.0% max.                                                |                                             |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                                        | 2000MΩ min.                                                          |                                             |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                                          |                                             |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 15                                          | Humidity (Under Steady State)                                        | Appearance                                  | No marked defect                                                       | <p>Set the capacitor for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements. (Char. B, E)</p> <p>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. SL: Within ±5%<br>Char. B: Within ±10%<br>Char. E: Within ±20%   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Q                                           | Char. SL: 275+5/2C**min. (30pF under)<br>350 min. (30pF min.)          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | D.F.                                        | Char. B, E: 5.0% max.                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | I.R.                                        | 1000MΩ min.                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 16                                          | Humidity Loading                                                     | Appearance                                  | No marked defect                                                       | <p>Apply the rated voltage for 500+24/-0 hrs. at 40±2°C in 90 to 95% relative humidity. (Charge/Discharge current≤50mA.)</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements. (Char. B, E)</p> <p>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1 (Char. SL)</p> <p>Post-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. (Char. B, E)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. SL: Within ±7.5%<br>Char. B: Within ±10%<br>Char. E: Within ±20% |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Q                                           | Char. SL: 100+10/3C**min. (30pF under)<br>200 min. (30pF min.)         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | D.F.                                        | Char. B, E: 5.0% max.                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | I.R.                                        | 500MΩ min.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 17                                          | Life                                                                 | Appearance                                  | No marked defect                                                       | <p>Apply a DC voltage of 150% of the rated voltage for 1000+48/-0 hrs. at 85±2°C with a relative humidity of 50% max. (Charge/Discharge current≤50mA.)</p> <p>Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. before initial measurements. (Char. B, E)</p> <p>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1 (Char. SL)</p> <p>Post-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at room condition*1 for 24±2 hrs. (Char. B, E)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Capacitance Change                          | Char. SL: Within ±3%<br>Char. B: Within ±10%<br>Char. E: Within ±20%   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | Q                                           | Char. SL: 275+5/2C**min. (30pF under)<br>350 min. (30pF min.)          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | D.F.                                        | Char. B, E: 4.0% max.                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                      | I.R.                                        | 2000MΩ min.                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                  |            |   |       |    |   |            |   |   |      |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |

\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

# High Voltage Ceramic Capacitors

**muRata**

## DEF Series (Only for LCD Backlight Inverter Circuit/6.3kVp-p)

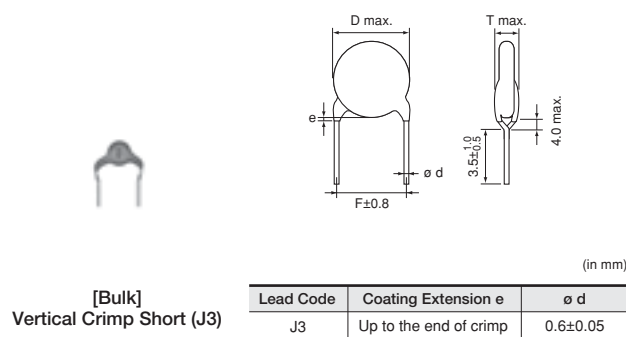
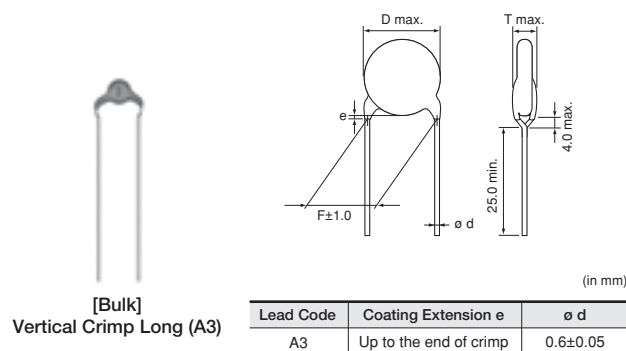
### ■ Features

1. Compact size: Diameter is 20% less than DEC series.
2. Low self-heating at high frequency and high voltage due to low dielectric loss of the ceramic material.
3. Operating temperature range is guaranteed up to 105 degrees C.
4. Coated with flame-retardant epoxy resin (equivalent to UL94V-0 standard).  
Please contact us when a halogen-free product\* is necessary.  
\* Cl=900ppm max., Br=900ppm max. and  
Cl+Br=1500ppm max.
5. Taping available for automatic insertion.

### ■ Applications

Ideal for use in LCD backlight inverters.

Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plug-in hybrids. Only Murata products clearly stipulated as "for Automotive use" on its catalog can be used for automobile applications such as power train and safety equipment.



### ■ Marking

| Temp. Char.                 | CH                                 | SL               |
|-----------------------------|------------------------------------|------------------|
| Nominal Body Diameter       |                                    |                  |
| ø7-9mm                      | 10J<br>6K~<br>66                   | 33J<br>6K~<br>66 |
| Temperature Characteristics | Upper horizontal line              | —                |
| Nominal Capacitance         | Actual value                       |                  |
| Capacitance Tolerance       | Marked with code                   |                  |
| Rated Voltage               | Marked with code (Marked with 6K~) |                  |
| Manufactured Date Code      | Abbreviation                       |                  |

### SL Characteristics

| Part Number    | Rated Voltage | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|---------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEF1XLH100J□□□ | 6300Vdc(p-p)  | 10pF±5%     | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH120J□□□ | 6300Vdc(p-p)  | 12pF±5%     | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH150J□□□ | 6300Vdc(p-p)  | 15pF±5%     | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH180J□□□ | 6300Vdc(p-p)  | 18pF±5%     | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH220J□□□ | 6300Vdc(p-p)  | 22pF±5%     | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH270J□□□ | 6300Vdc(p-p)  | 27pF±5%     | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH330J□□□ | 6300Vdc(p-p)  | 33pF±5%     | 9.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH390J□□□ | 6300Vdc(p-p)  | 39pF±5%     | 9.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF1XLH470J□□□ | 6300Vdc(p-p)  | 47pF±5%     | 9.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |

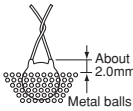
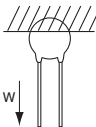
Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## CH Characteristics

| Part Number    | Rated Voltage | Capacitance  | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|---------------|--------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DEF2CLH020C□□□ | 6300Vdc(p-p)  | 2.0pF±0.25pF | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH030C□□□ | 6300Vdc(p-p)  | 3.0pF±0.25pF | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH040C□□□ | 6300Vdc(p-p)  | 4.0pF±0.25pF | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH050D□□□ | 6300Vdc(p-p)  | 5.0pF±0.5pF  | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH060D□□□ | 6300Vdc(p-p)  | 6.0pF±0.5pF  | 7.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH070D□□□ | 6300Vdc(p-p)  | 7.0pF±0.5pF  | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH080D□□□ | 6300Vdc(p-p)  | 8.0pF±0.5pF  | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH090D□□□ | 6300Vdc(p-p)  | 9.0pF±0.5pF  | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |
| DEF2CLH100J□□□ | 6300Vdc(p-p)  | 10pF±5%      | 8.0mm max.  | 7.5                 | 6.0mm max.       | A3B                    | J3B                     | N3A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the three columns on the right for the appropriate code.

## DEF Series Specifications and Test Methods

| No.        | Item                           |                                          | Specifications                                                                                                                                                                        | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                 |      |   |   |   |   |            |      |       |      |
|------------|--------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|---|------------|------|-------|------|
| 1          | Operating Temperature Range    |                                          | -25 to +105°C                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |
| 2          | Appearance and Dimensions      |                                          | No visible defect, and dimensions are within specified range.                                                                                                                         | The capacitor should be visually inspected for evidence of defect. Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                       |      |   |   |   |   |            |      |       |      |
| 3          | Marking                        |                                          | To be easily legible                                                                                                                                                                  | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                 |      |   |   |   |   |            |      |       |      |
| 4          | Dielectric Strength            | Between Lead Wires                       | No failure                                                                                                                                                                            | The capacitor should not be damaged when DC12.6kV is applied between the lead wires for 1 to 5 sec. (Charge/Discharge current≤50mA)                                                                                                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |
|            |                                | Body Insulation                          | No failure                                                                                                                                                                            | The capacitor is placed in the container with metal balls of diameter 1mm so that each lead wire, short circuited, is kept about 2.0mm off the metal balls as shown in the figure at right, and DC voltage of 1.3kV is applied for 1 to 5 sec. between capacitor lead wires and metal balls. (Charge/Discharge current≤50mA) <div></div> |      |   |   |   |   |            |      |       |      |
| 5          | Insulation Resistance (I.R.)   | Between Lead Wires                       | 10000MΩ min.                                                                                                                                                                          | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.                                                                                                                                                                                                                                                                                                                                   |      |   |   |   |   |            |      |       |      |
| 6          | Capacitance                    |                                          | Within specified tolerance                                                                                                                                                            | The capacitance should be measured at 20°C with 1±0.2MHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                              |      |   |   |   |   |            |      |       |      |
| 7          | Q                              |                                          | 400+20C*²min. (30pF under)<br>1000 min. (30pF min.)                                                                                                                                   | The Q should be measured at 20°C with 1±0.2MHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                        |      |   |   |   |   |            |      |       |      |
| 8          | Temperature Characteristics    |                                          | Char. CH: 0±60ppm/°C<br>Char. SL: +350 to -1000ppm/°C<br>(Temp. range: +20 to +85°C)                                                                                                  | The capacitance measurement should be made at each step specified in the Table.                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |
|            |                                |                                          | <table><tr><th>Step</th><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><th>Temp. (°C)</th><td>20±2</td><td>-25±3</td><td>20±2</td><td>85±2</td><td>20±2</td></tr></table> | Step                                                                                                                                                                                                                                                                                                                                                                                                                        | 1    | 2 | 3 | 4 | 5 | Temp. (°C) | 20±2 | -25±3 | 20±2 |
| Step       | 1                              | 2                                        | 3                                                                                                                                                                                     | 4                                                                                                                                                                                                                                                                                                                                                                                                                           | 5    |   |   |   |   |            |      |       |      |
| Temp. (°C) | 20±2                           | -25±3                                    | 20±2                                                                                                                                                                                  | 85±2                                                                                                                                                                                                                                                                                                                                                                                                                        | 20±2 |   |   |   |   |            |      |       |      |
| 9          | Strength of Lead               | Pull                                     | Lead wire should not be cut off.<br>Capacitor should not be broken.                                                                                                                   | As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N and keep it for 10±1 sec. <div></div>                                                                                                                         |      |   |   |   |   |            |      |       |      |
|            |                                | Bending                                  |                                                                                                                                                                                       | Each lead wire should be subjected to 5N of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                                                              |      |   |   |   |   |            |      |       |      |
| 10         | Vibration Resistance           | Appearance                               | No marked defect                                                                                                                                                                      | The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1-minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. Apply for a total of 6 hrs., 2 hrs. each in 3 mutually perpendicular directions.                                                                                                          |      |   |   |   |   |            |      |       |      |
|            |                                | Capacitance                              | Within specified tolerance                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |
|            |                                | Q                                        | 400+20C*²min. (30pF under)<br>1000 min. (30pF min.)                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |
| 11         | Solderability of Leads         |                                          | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                   | The lead wire of a capacitor should be dipped into a ethanol solution of 25wt% rosin and then into molten solder for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2.0mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                                                      |      |   |   |   |   |            |      |       |      |
| 12         | Soldering Effect (Non-Preheat) | Appearance                               | No marked defect                                                                                                                                                                      | The lead wire should be immersed into the melted solder of 350±10°C up to about 1.5 to 2.0mm from the main body for 3.5±0.5 sec.<br>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1                                                                                                                                                                                                         |      |   |   |   |   |            |      |       |      |
|            |                                | Capacitance Change                       | Within ±2.5%                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |
|            |                                | Dielectric Strength (Between Lead Wires) | Per item 4.                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                             |      |   |   |   |   |            |      |       |      |

\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

Continued on the following page. 

## DEF Series Specifications and Test Methods

Continued from the preceding page.

| No.                                         | Item                                                                                            |                                             | Specifications                                                                                  | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|---------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|------------|-----|----------|----|----------|------------|---|---|-------|----|---|------------|---|------|------------------|------------|-----------------|---|---------|----|-------------|---|-----|----|------------|
| 13                                          | Soldering Effect<br>(On-Preheat)                                                                | Appearance                                  | No marked defect                                                                                | <div>First the capacitor should be stored at 120+0/-5°C for 60+0/-5 sec.</div> <div>Then, as in the figure, the lead wires should be immersed in solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 sec.</div> <div>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div> <div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | Capacitance Change                          | Within ±2.5%                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 14                                          | Temperature and Immersion Cycle                                                                 | Appearance                                  | No marked defect                                                                                | <div>The capacitor should be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles.</div> <div>&lt;Temperature Cycle&gt;</div> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25±3</td><td>30</td></tr><tr><td>2</td><td>Room Temp.</td><td>3</td></tr><tr><td>3</td><td>105±3</td><td>30</td></tr><tr><td>4</td><td>Room Temp.</td><td>3</td></tr></table> <div>Cycle time: 5 cycles</div> <div>&lt;Immersion Cycle&gt;</div> <table><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th><th>Immersion Water</th></tr><tr><td>1</td><td>65+5/-0</td><td>15</td><td>Clean water</td></tr><tr><td>2</td><td>0±3</td><td>15</td><td>Salt water</td></tr></table> <div>Cycle time: 2 cycles</div> <div>Post-treatment: Capacitor should be stored for 4 to 24 hrs. at room condition.*1</div> | Step             | Temperature (°C) | Time (min) | 1   | -25±3    | 30 | 2        | Room Temp. | 3 | 3 | 105±3 | 30 | 4 | Room Temp. | 3 | Step | Temperature (°C) | Time (min) | Immersion Water | 1 | 65+5/-0 | 15 | Clean water | 2 | 0±3 | 15 | Salt water |
|                                             |                                                                                                 | Step                                        | Temperature (°C)                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Time (min)       |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | 1                                           | -25±3                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30               |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | 2                                           | Room Temp.                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | 3                                           | 105±3                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30               |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | 4                                           | Room Temp.                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Step                                        | Temperature (°C)                                                                                | Time (min)                                  | Immersion Water                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 1                                           | 65+5/-0                                                                                         | 15                                          | Clean water                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 2                                           | 0±3                                                                                             | 15                                          | Salt water                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Capacitance Change                          | Within ±3%                                                                                      |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Q                                           | 200+10C*2min. (10pF under)<br>275+5/2C*2min. (10pF min. and 30pF under)<br>350 min. (30pF min.) |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                                        | 2000MΩ min.                                                                                     |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Dielectric Strength<br>(Between Lead Wires) | Per item 4.                                                                                     |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 15                                          | Humidity (Under Steady State)                                                                   | Appearance                                  | No marked defect                                                                                | <div>Set the capacitor for 500 +24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.</div> <div>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | Capacitance Change                          | Within ±5%                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | Q                                           | 200+10C*2min. (10pF under)<br>275+5/2C*2min. (10pF min. and 30pF under)<br>350 min. (30pF min.) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | I.R.                                        | 1000MΩ min.                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 16                                          | Life                                                                                            | Appearance                                  | No marked defect                                                                                | <div>Apply 6.3kVp-p at the frequency in the Table for 1000+48/-0 hrs. at 105±2°C with a relative humidity of 50% max. (Charge/Discharge current≤50mA.)</div> <div>&lt;Frequency&gt;</div> <table><tr><th>Capacitance (pF)</th><th>Frequency (kHz)</th></tr><tr><td>to 10</td><td>100</td></tr><tr><td>12 to 22</td><td>45</td></tr><tr><td>27 to 47</td><td>33</td></tr></table> <div>Post-treatment: Capacitor should be stored for 1 to 2 hrs. at room condition.*1</div>                                                                                                                                                                                                                                                                                                                                                                                            | Capacitance (pF) | Frequency (kHz)  | to 10      | 100 | 12 to 22 | 45 | 27 to 47 | 33         |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | Capacitance (pF)                            | Frequency (kHz)                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | to 10                                       | 100                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
|                                             |                                                                                                 | 12 to 22                                    | 45                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| 27 to 47                                    | 33                                                                                              |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Capacitance Change                          | Within ±3%                                                                                      |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| Q                                           | 200+10C*2min. (10pF under)<br>275+5/2C*2min. (10pF min. and 30pF under)<br>350 min. (30pF min.) |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |
| I.R.                                        | 2000MΩ min.                                                                                     |                                             |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                  |            |     |          |    |          |            |   |   |       |    |   |            |   |      |                  |            |                 |   |         |    |             |   |     |    |            |

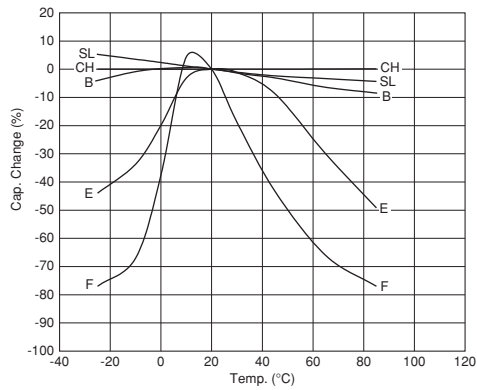
\*1 "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

\*2 "C" expresses nominal capacitance value (pF).

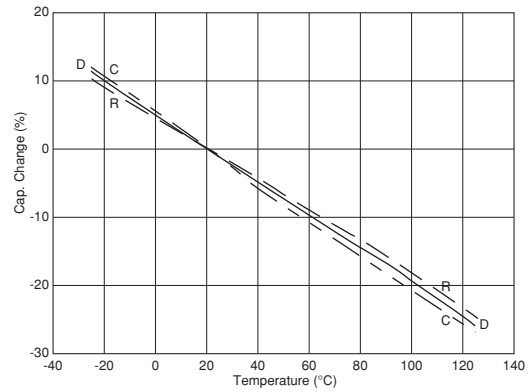
## High Voltage Ceramic Capacitors Characteristics Data (Typical Example)

### ■ Capacitance - Temperature Characteristics

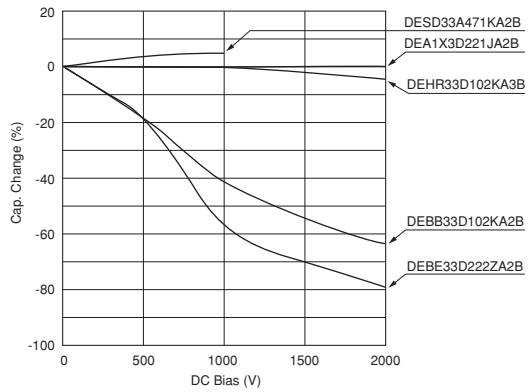
CH, SL, B, E, F char.



C, D, R char.



### ■ Capacitance - DC Bias Characteristics



## High Voltage Ceramic Capacitors Packaging

### Taping Specifications

- 15.0mm pitch / lead spacing 7.5mm taping  
Straight type  
(Lead Code: P3)



- 15.0mm pitch / lead spacing 7.5mm taping  
Vertical crimp type  
(Lead Code: N3)



- 30.0mm pitch / lead spacing 7.5mm taping  
Vertical crimp type  
(Lead Code: N7)



- 12.7mm pitch / lead spacing 5.0mm taping  
Straight type  
(Lead Code: P2)



- 12.7mm pitch / lead spacing 5.0mm taping  
Vertical crimp type  
(Lead Code: N2)



| Item                                              | Code            | P3                                                     | N3                                 | N7       | P2                                   | N2                                 |
|---------------------------------------------------|-----------------|--------------------------------------------------------|------------------------------------|----------|--------------------------------------|------------------------------------|
| Pitch of component                                | P               | 15.0±2.0                                               |                                    | 30.0±2.0 | 12.7±1.0                             |                                    |
| Pitch of sprocket hole                            | P <sub>0</sub>  | 15.0±0.3                                               |                                    |          | 12.7±0.3                             |                                    |
| Lead spacing                                      | F               | 7.5±1.0                                                |                                    |          | 5.0 <sup>+0.8</sup> <sub>-0.2</sub>  |                                    |
| Length from hole center to component center       | P <sub>2</sub>  | 7.5±1.5                                                |                                    |          | 6.35±1.3                             |                                    |
| Length from hole center to lead                   | P <sub>1</sub>  | 3.75±1.0                                               |                                    |          | 3.85±0.7                             |                                    |
| Body diameter                                     | D               | See the individual product specifications.             |                                    |          |                                      |                                    |
| Deviation along tape, left or right               | ΔS              | 0±2.0                                                  |                                    |          | 0±1.0                                |                                    |
| Carrier tape width                                | W               | 18.0±0.5                                               |                                    |          |                                      |                                    |
| Position of sprocket hole                         | W <sub>1</sub>  | 9.0±0.5                                                |                                    |          |                                      |                                    |
| Lead distance between reference and bottom planes | H               | 20.0 <sup>+1.5</sup> <sub>-1.0</sub>                   | —                                  |          | 20.0 <sup>+1.5</sup> <sub>-1.0</sub> | —                                  |
|                                                   | H <sub>0</sub>  | —                                                      | 18.0 <sup>+2.0</sup> <sub>-0</sub> |          | —                                    | 18.0 <sup>+2.0</sup> <sub>-0</sub> |
| Protrusion length                                 | ℓ               | +0.5 to -1.0                                           |                                    |          |                                      |                                    |
| Diameter of sprocket hole                         | øD <sub>0</sub> | 4.0±0.1                                                |                                    |          |                                      |                                    |
| Lead diameter                                     | ød              | 0.6±0.05                                               |                                    |          |                                      |                                    |
| Total tape thickness                              | t <sub>1</sub>  | 0.6±0.3                                                |                                    |          |                                      |                                    |
| Total thickness, tape and lead wire               | t <sub>2</sub>  | 1.5 max.                                               |                                    |          |                                      |                                    |
| Body thickness                                    | T               | See the individual product specifications.             |                                    |          |                                      |                                    |
| Portion to cut in case of defect                  | L               | 11.0 <sup>+0</sup> <sub>-1.0</sub>                     |                                    |          |                                      |                                    |
| Hold down tape width                              | W <sub>0</sub>  | 11.5 min.                                              |                                    |          |                                      |                                    |
| Hold down tape position                           | W <sub>2</sub>  | 1.5±1.5                                                |                                    |          |                                      |                                    |
| Coating extension on lead                         | e               | 3.0 max. (Vertical crimp type: Up to the end of crimp) |                                    |          |                                      |                                    |
| Deviation across tape, front                      | Δh <sub>1</sub> | 2.0 max.                                               |                                    |          | 1.0 max.                             |                                    |
| Deviation across tape, rear                       | Δh <sub>2</sub> |                                                        |                                    |          |                                      |                                    |

(in : mm)

Continued on the following page. ➤

## High Voltage Ceramic Capacitors Packaging

Continued from the preceding page.

### ■ Packaging Styles

| Bulk                                                                                                  | Taping                                                                                         |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Polyethylene Bag<br> | Ammo Pack<br> |

### ■ Minimum Quantity (Order in Sets Only)

| [Bulk]                                               |                     | (pcs./Bag)          |                         |
|------------------------------------------------------|---------------------|---------------------|-------------------------|
|                                                      | Body Dia. D<br>(mm) | Lead Code<br>A□, C□ | Lead Code<br>B□, D□, J□ |
|                                                      |                     | Long                | Short                   |
| DES Series<br>DEH Series<br>DEA Series<br>DEB Series | 4.5 to 6            | 500                 | 500                     |
|                                                      | 7                   | 250 *1              | 500                     |
|                                                      | 8 to 11             | 250                 | 500                     |
|                                                      | 12                  | 200 *2              | 250 *3                  |
|                                                      | 13, 14              | 200                 | 250                     |
|                                                      | 15 to 18            | 100                 | 200                     |
| DEC Series<br>DEF Series                             | 19 to 21            | 50                  | 100                     |
|                                                      | 7 to 9              | 250                 | 500                     |
|                                                      | 10, 11              | 100                 | —                       |
|                                                      | 12 to 15            | 100                 | —                       |

\*1 Lead Spacing F=5.0mm (Code: A2): 500pcs.

\*2 Rated Voltage DC500V (Code: 2H): 250pcs.

\*3 Rated Voltage DC500V (Code: 2H): 500pcs.

| [Taping]   |        | (pcs./Ammo Pack) |     |
|------------|--------|------------------|-----|
| Lead Code  | N2, P2 | N3, P3           | N7  |
| DES Series | 1,500  | 1,000            | 500 |
| DEH Series | 1,500  | 900 *4           | 500 |
| DEA Series | 1,500  | 900 *4           | 500 |
| DEB Series | 1,500  | 900 *4           | 500 |
| DEF Series | —      | 900              | —   |

\*4 Rated Voltage DC1kV (Code: 3A): 1,000pcs.

## High Voltage Ceramic Capacitors ⚠Caution

### ■ ⚠Caution (Rating)

#### <DES/DEH/DEA/DEB/DEC Series>

##### 1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the  $V_{p-p}$  value of the applied voltage or the  $V_{0-p}$  that contains DC bias within the rated voltage range.

When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

When using the low-dissipation DEA (SL Char.) /DEC (SL Char.) /DEH (C, R Char.) /DES (D Char.) series in a high-frequency and high-voltage circuit, be sure to read the instructions in item 4.

When DC-rated capacitors are to be used in input circuits from commercial power source (AC filter), be sure to use Safety Certified Capacitors because various regulations on withstand voltage or impulse withstand established for each type of equipment should be taken into consideration.

| Voltage                | DC Voltage                                                                        | DC+AC Voltage                                                                     | AC Voltage                                                                        | Pulse Voltage (1)                                                                   | Pulse Voltage (2)                                                                   |
|------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Positional Measurement |  |  |  |  |  |

##### 2. Operating Temperature and Self-generated Heat

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high-frequency current, pulse current or similar current, it may self-generate heat due to dielectric loss. The frequency of the applied sine wave voltage should be less than 300kHz. The applied voltage load (\*) should be such that the capacitor's self-generated heat is within 20°C in an atmospheric temperature of 25°C. When measuring, use a thermocouple of small thermal capacity-K of  $\phi 0.1\text{mm}$  in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations.

Excessive heat may lead to deterioration of the capacitor's characteristics and reliability.

(Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

\*Before using the low-dissipation DEA/DEC (SL Char.) /DEH/DES series, be sure to read the instructions in item 4.

##### 3. Fail-Safe

When the capacitor is broken, failure may result in a short circuit. Be sure to provide an appropriate fail-safe function like a fuse on your product if failure could follow an electric shock, fire or fume.

Continued on the following page. 

## High Voltage Ceramic Capacitors ⚠Caution

Continued from the preceding page.

### 4. Load Reduction and Self-generated Heat During

#### Application of High-frequency and High-voltage

Due to the low self-heating characteristics of low-dissipation capacitors, the allowable electric power of these capacitors is generally much higher than that of B characteristic capacitors. However, if the self-heating temperature is 20°C under a high-frequency voltage whose peak-to-peak value equals the capacitor's rated voltage, the capacitor's power consumption may exceed its allowable electric power.

Therefore, when using the DEA/DEC (SL Char.) /DEH /DES series in a high-frequency and high-voltage circuit with a frequency of 1kHz or higher, make sure that the Vp-p values including the DC bias, do not exceed the applied voltage value specified in Table 1. Also make sure that the self-heating temperature (the difference between the capacitor's surface temperature and the capacitor's ambient temperature) at an ambient temperature of 25°C does not exceed the value specified in Table 1.

As shown in Fig. 2, the self-heating temperature depends on the ambient temperature. Therefore, if you are not able to set the ambient temperature to approximately 25°C, please contact our sales representatives or product engineers.

We are offering free software, The Capacitor Selection Tool: by Voltage Form, which will assist you in selecting a suitable capacitor.

The software can be downloaded from Murata's Web site ([http://www.murata.com/products/design\\_support/mmcsv/index.html](http://www.murata.com/products/design_support/mmcsv/index.html)).

By inputting capacitance values and applied voltage waveform of the specific capacitor series, this software will calculate the capacitor's power consumption and list suitable capacitors.

When the result of this software is different from the measurement result of the self-heating temperature on your side, please contact our sales representatives or product engineers.

**FAILURE TO FOLLOW THE ABOVE CAUTIONS (ITEMS 1 TO 4) MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.**

<Table 1> Allowable Conditions at High frequency

| Series | Temp. Char. | DC Rated Voltage | Allowable Conditions at High-frequency *3 |                                            | Capacitor's Ambient Temp. *2 |
|--------|-------------|------------------|-------------------------------------------|--------------------------------------------|------------------------------|
|        |             |                  | Applied Voltage (Max.)                    | Self-heating Temp. (25°C Ambient Temp.) *1 |                              |
| DEH    | C           | 500V             | 500Vp-p                                   | 20°C Max.                                  | -25 to +85°C                 |
|        | R           | 1kV              | 800Vp-p                                   | 20°C Max.                                  |                              |
|        |             |                  | 1000Vp-p                                  | 5°C Max.                                   |                              |
|        |             | 2kV              | 1400Vp-p                                  | 20°C Max.                                  |                              |
|        |             |                  | 2000Vp-p                                  | 5°C Max.                                   |                              |
|        |             | 3.15kV           | 1600Vp-p                                  | 20°C Max.                                  |                              |
|        |             |                  | 3150Vp-p                                  | 5°C Max.                                   |                              |
| DEA    | SL          | 1kV              | 1000Vp-p                                  | 5°C Max.                                   |                              |
|        |             | 2kV              | 2000Vp-p                                  |                                            |                              |
|        |             | 3.15kV           | 3150Vp-p                                  |                                            |                              |
| DEC    | SL          | 6.3kV            | 6300Vp-p                                  | 5°C Max.                                   |                              |
| DES    | D           | 500V             | 500Vp-p                                   | 15°C Max.                                  |                              |
|        |             | 1kV              | 800Vp-p                                   |                                            |                              |
|        |             |                  | 1000Vp-p                                  | 5°C Max.                                   |                              |

\*1 Fig. 1 shows the relationship between the applied voltage and the allowable self-heating temperature regarding 1 to 3.15kV rated voltage of the DEH series R characteristic and 1kV rated voltage of the DES series D characteristic.

\*2 When the ambient temperature is 85 to 125°C, the applied voltage needs to be further reduced. If the DEA/DEH/DES series needs to be used at an ambient temperature of 85 to 125°C, please contact our sales representatives or product engineers.

\*3 Fig. 3 shows reference data on the allowable voltage - frequency characteristics for a sine wave voltage.

<Fig. 1> Relationship Between Applied Voltage and Self-heating Temperature (Allowable Self-heating Temp. at 25°C Ambient Temp.)



Continued on the following page. ➤

## High Voltage Ceramic Capacitors ⚠Caution

Continued from the preceding page.

<Fig. 2> Dependence of Self-heating Temperature on Ambient Temperature



Continued on the following page. ↗

## High Voltage Ceramic Capacitors ⚠Caution

Continued from the preceding page.

### <Fig. 3> Allowable Voltage (Sine Wave Voltage) - Frequency Characteristics (At Ambient Temperature of 85°C or less)

Because of the influence of harmonics, when the applied voltage is a rectangular wave or pulse wave voltage (instead of a sine wave voltage), the heat generated by the capacitor is higher than the value obtained by application of the sine wave with the same fundamental frequency.

Roughly calculated for reference, the allowable voltage for a rectangular wave or pulse wave corresponds approximately

to the allowable voltage for a sine wave whose fundamental frequency is twice as large as that of the rectangular wave or pulse wave. This allowable voltage, however, varies depending on the voltage and current waveforms.

Therefore, you are requested to make sure that the self-heating temperature is not higher than the value specified in Table 1.



Continued on the following page. ➤

## High Voltage Ceramic Capacitors ⚠Caution

Continued from the preceding page.

<Fig. 3 (continued)> Allowable Voltage (Sine Wave Voltage) -  
Frequency Characteristics  
(At Ambient Temperature of 85°C or less)

Because of the influence of harmonics, when the applied voltage is a rectangular wave or pulse wave voltage (instead of a sine wave voltage), the heat generated by the capacitor is higher than the value obtained by application of the sine wave with the same fundamental frequency.

Roughly calculated for reference, the allowable voltage for a rectangular wave or pulse wave corresponds

approximately to the allowable voltage for a sine wave whose fundamental frequency is twice as large as that of the rectangular wave or pulse wave.

This allowable voltage, however, varies depending on the voltage and current waveforms.

Therefore, you are requested to make sure that the self-heating temperature is not higher than the value specified in Table 1.



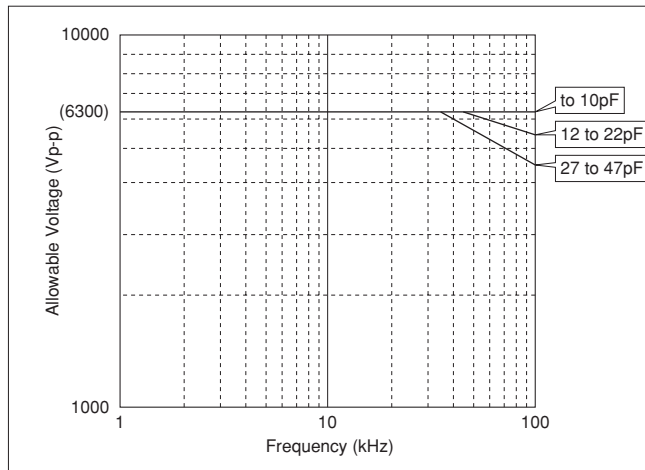
## High Voltage Ceramic Capacitors ⚠Caution

Continued from the preceding page.

### <DEF Series>

#### 1. Operating Voltage

The frequency of the applied sine wave voltage should be less than 100kHz. The applied voltage should be less than the value shown in the figure below. For non-sine wave that includes a harmonic frequency, please contact our sales representatives or product engineers.



The temperature of the surface of the capacitor:  
below the upper limit of its rated operating temperature  
range (including self-heating).

The capacitor can be applied at a maximum of  
6.3kVp-p at 100kHz when the lamp is turned on.

| Voltage                   | AC Voltage |
|---------------------------|------------|
| Positional<br>Measurement |            |

#### 2. Operating Temperature and Self-generated Heat

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high-frequency current, pulse current or similar current, it may self-generate heat due to dielectric loss. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

#### 3. Fail-Safe

When the capacitor is broken, failure may result in a short circuit. Be sure to provide an appropriate fail-safe function like a fuse on your product if failure could result in an electric shock, fire or fume.

## High Voltage Ceramic Capacitors ⚠Caution

### ■ ⚠Caution (Storage and Operating Condition)

#### Operating and Storage Environment

The insulating coating of capacitors does not form a perfect seal; therefore, do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. Also, avoid exposure to moisture. Before cleaning, bonding or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed -10 to 40 degrees centigrade and 15 to 85%.

Use capacitors within 6 months after delivery.  
Check the solderability after 6 months or more.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

### ■ ⚠Caution (Soldering and Mounting)

#### 1. Vibration and Impact

Do not expose a capacitor or its lead wires to excessive shock or vibration during use.  
Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board.  
Please take measures to hold a capacitor on the circuit boards by adhesive, molding resin or another coating.  
Please confirm there is no influence of holding measures on the product with the intended equipment.

#### 2. Soldering

When soldering this product to a PCB/PWB, do not exceed the solder heat resistance specification of the capacitor. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element.  
Soldering the capacitor with a soldering iron should be performed in following conditions.  
Temperature of iron-tip: 400 degrees C. max.  
Soldering iron wattage: 50W max.  
Soldering time: 3.5 sec. max.

#### 3. Bonding, Resin Molding and Coating

For bonding, molding or coating this product, verify that these processes do not affect the quality of the capacitor by testing the performance of the bonded, molded or coated product in the intended equipment. When the amount of applications, dryness/hardening conditions of adhesives and molding resins containing organic solvents (ethyl acetate, methyl ethyl ketone, toluene, etc). are unsuitable, the outer coating resin of a capacitor is damaged by the organic solvents and it may result, worst case, in a short circuit.  
The variation in thickness of adhesive, molding resin or coating may cause outer coating resin cracking and/or ceramic element cracking of a capacitor in a temperature cycling.

4. Treatment after Bonding, Resin Molding and Coating  
When the outer coating is hot (over 100 degrees C.) after soldering, it becomes soft and fragile.  
Therefore, please be careful not to give it mechanical stress.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

### ■ ⚠Caution (Handling)

#### Vibration and Impact

Do not expose a capacitor or its lead wires to excessive shock or vibration during use.  
Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board.  
Please take measures to hold a capacitor on the circuit boards by adhesive, molding resin or another coating.

Please confirm there is no influence of holding measures on the product with the intended equipment.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

## High Voltage Ceramic Capacitors Notice

### ■ Notice (Soldering and Mounting)

Cleaning (ultrasonic cleaning)

To perform ultrasonic cleaning, observe the following conditions.

Rinse bath capacity: Output of 20 watts per liter or less.

Rinsing time: 5 min. maximum.

Do not vibrate the PCB/PWB directly.

Excessive ultrasonic cleaning may lead to fatigue destruction of the lead wires.

### ■ Notice (Rating)

Capacitance Change of Capacitors

#### 1. DEA/DEC/DEF Series (Temp. Char. CH, SL)

Capacitance might change a little depending on the surrounding temperature or an applied voltage.

Please contact us if you intend to use this product in a strict time constant circuit.

#### 2. DEB/DEC Series (Temp. Char. B, E, F)

Capacitors have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time. Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage. Therefore, it is not likely to be suitable for use in a time constant circuit.

Please contact us if you need detailed information.

#### 3. DEH/DES Series

Capacitance might change greatly depending on the surrounding temperature or an applied voltage.

Therefore, it is not likely to be suitable for use in a time constant circuit. Please contact us if you need detailed information.

# Safety Standard Certified Ceramic Capacitors for Automotive



## Type KJ -Class X1, Y2- (For Automotive Use/AC Line Filter of PHEV/EV Charger)

### ■ Features

1. Capacitors designed for AC line filters for PHEV/EV.
2. Meet AEC-Q200
3. Heat cycle: 1000cycle (-55/+125 deg.)
4. Class X1/Y2 capacitors certified by UL/ENEC(VDE).
5. Rated Voltage: AC300V
6. Coated with flame-retardant epoxy resin (conforming to UL94V-0 standard).
7. Available product for RoHS Restriction (EU Directive 2002/95/EC).
8. Taping available for automatic insertion.

### ■ Applications

1. Ideal for use as Y capacitors for AC line filters and primary-secondary coupling on battery chargers for PHEV/EV.
2. Ideal for use as a filter capacitor for DC-DC converters for PHEV/EV and HEV.



### ■ Standard Certification

|            | Standard No. | Certified No. | Rated Voltage  |
|------------|--------------|---------------|----------------|
| UL         | UL 60384-14  | E37921        | AC300V(r.m.s.) |
| ENEC (VDE) | EN 60384-14  | 40031217      |                |

### ■ Marking

| Example | Item                                          |
|---------|-----------------------------------------------|
|         | ① Type Designation KJ                         |
|         | ② Nominal Capacitance (Marked with 3 figures) |
|         | ③ Capacitance Tolerance                       |
|         | ④ Company Name Code<br>C15: Made in Thailand  |
|         | ⑤ Manufactured Date Code                      |
|         | Class Code X1Y2                               |
|         | Rated Voltage Mark 300~                       |

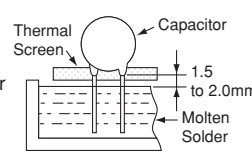
| Part Number    | AC Rated Voltage | Temp. Char. | Capacitance | Body Dia. D | Lead Spacing F (mm) | Body Thickness T | Lead Package Long Bulk | Lead Package Short Bulk | Lead Package Taping |
|----------------|------------------|-------------|-------------|-------------|---------------------|------------------|------------------------|-------------------------|---------------------|
| DE6B3KJ101K□□□ | 300Vac(r.m.s.)   | B           | 100pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6B3KJ151K□□□ | 300Vac(r.m.s.)   | B           | 150pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6B3KJ221K□□□ | 300Vac(r.m.s.)   | B           | 220pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6B3KJ331K□□□ | 300Vac(r.m.s.)   | B           | 330pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6B3KJ471K□□□ | 300Vac(r.m.s.)   | B           | 470pF±10%   | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6B3KJ681K□□□ | 300Vac(r.m.s.)   | B           | 680pF±10%   | 9.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6E3KJ102M□□□ | 300Vac(r.m.s.)   | E           | 1000pF±20%  | 7.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6E3KJ152M□□□ | 300Vac(r.m.s.)   | E           | 1500pF±20%  | 8.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6E3KJ222M□□□ | 300Vac(r.m.s.)   | E           | 2200pF±20%  | 9.0mm max.  | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6E3KJ332M□□□ | 300Vac(r.m.s.)   | E           | 3300pF±20%  | 10.0mm max. | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |
| DE6E3KJ472M□□□ | 300Vac(r.m.s.)   | E           | 4700pF±20%  | 12.0mm max. | 7.5                 | 7.0mm max.       | A3B                    | B3B                     | N3A                 |

Three blank columns are filled with the lead and packaging codes. Please refer to the 3 columns on the right for the appropriate code.

Murata part numbers might be changed depending on lead code or any other changes. Therefore, please specify only the type name (KJ) and capacitance of products in the parts list when it is required for applying safety standard of electric equipment.

## Type KJ Specifications and Test Methods

Operating Temperature Range: -40 to +125°C

| Operating Temperature Range: -25 to +85°C |                              |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
|-------------------------------------------|------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------|-----------------|-----------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|---|------|---|-------|---|------|---|------|---|------|
| No.                                       | Item                         |                     | Specifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 1                                         | Appearance and Dimensions    |                     | No visible defect, and dimensions are within specified range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | The capacitor should be visually inspected for evidence of defect.<br>Dimensions should be measured with slide calipers.                                                                                                                                                                                                                                                                                                                                                |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 2                                         | Marking                      |                     | To be easily legible                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | The capacitor should be visually inspected.                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 3                                         | Capacitance                  |                     | Within specified tolerance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The dissipation factor should be measured at 20°C with 1±0.1kHz and AC5V(r.m.s.) max.                                                                                                                                                                                                                                                                                                                                                                                   |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 4                                         | Dissipation Factor (D.F.)    |                     | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤2.5%</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Char.              | Specifications | B, E            | D.F. ≤2.5%      |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| Char.                                     | Specifications               |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| B, E                                      | D.F. ≤2.5%                   |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 5                                         | Insulation Resistance (I.R.) |                     | 10000MΩ min.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | The insulation resistance should be measured with DC500±50V within 60±5 sec. of charging.<br>The voltage should be applied to the capacitor through a resistor of 1MΩ.                                                                                                                                                                                                                                                                                                  |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 6                                         | Dielectric Strength          | Between Lead Wires  | No failure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The capacitor should not be damaged when the test voltages from Table 1 are applied between the lead wires for 60 sec.<br><br><Table 1><br><table><tr><th>Type</th><th>Test Voltage</th></tr><tr><td>KJ</td><td>AC2600V(r.m.s.)</td></tr></table>                                                                                                                                                                                                                       | Type               | Test Voltage   | KJ              | AC2600V(r.m.s.) |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
|                                           |                              | Type                | Test Voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| KJ                                        | AC2600V(r.m.s.)              |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
|                                           | Body Insulation              | No failure          | First, the terminals of the capacitor should be connected together. Then, as shown in the figure at right, a metal foil should be closely wrapped around the body of the capacitor to the distance of about 3 to 4mm from each terminal.<br>Then, the capacitor should be inserted into a container filled with metal balls of about 1mm diameter. Finally, AC voltage from Table 2 is applied for 60 sec. between the capacitor lead wires and metal balls.<br><br><Table 2><br><table><tr><th>Type</th><th>Test Voltage</th></tr><tr><td>KJ</td><td>AC2600V(r.m.s.)</td></tr></table>  | Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Test Voltage       | KJ             | AC2600V(r.m.s.) |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| Type                                      | Test Voltage                 |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| KJ                                        | AC2600V(r.m.s.)              |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 7                                         | Temperature Characteristics  |                     | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E</td><td>Within <math>\pm\frac{20}{55}\%</math></td></tr></table><br>(Temp. range: -25 to +85°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Char.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Capacitance Change | B              | Within ±10%     | E               | Within $\pm\frac{20}{55}\%$ | The capacitance measurement should be made at each step specified in Table 3.<br><br><Table 3><br><table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>20±2</td></tr><tr><td>2</td><td>-25±2</td></tr><tr><td>3</td><td>20±2</td></tr><tr><td>4</td><td>85±2</td></tr><tr><td>5</td><td>20±2</td></tr></table><br>Pre-treatment:<br>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements. | Step | Temperature (°C) | 1 | 20±2 | 2 | -25±2 | 3 | 20±2 | 4 | 85±2 | 5 | 20±2 |
| Char.                                     | Capacitance Change           |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| B                                         | Within ±10%                  |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| E                                         | Within $\pm\frac{20}{55}\%$  |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| Step                                      | Temperature (°C)             |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 1                                         | 20±2                         |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 2                                         | -25±2                        |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 3                                         | 20±2                         |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 4                                         | 85±2                         |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 5                                         | 20±2                         |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 8                                         | Solderability                |                     | Lead wire should be soldered with uniform coating on the axial direction over 3/4 of the circumferential direction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Should be placed into steam aging for 8 hrs.±15 min. After the steam aging, the lead wire of a capacitor should be dipped into an ethanol solution of 25% rosin and then into molten solder for 5+0/-0.5 sec.<br>The depth of immersion is up to about 1.5 to 2.0mm from the root of lead wires.<br>Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C<br>H63 Eutectic Solder 235±5°C                                                                             |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
| 9                                         | Resistance to Soldering Heat | Appearance          | No marked defect                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | As shown in the figure, the lead wires should be immersed in solder of 260±5°C up to 1.5 to 2.0mm from the root of terminal for 10±1 sec.<br>Pre-treatment:<br>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs. before initial measurements.<br>Post-treatment:<br>Capacitor should be stored for 1 to 2 hrs. at room condition.*<br> |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
|                                           |                              | Capacitance Change  | Within ±10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
|                                           |                              | I.R.                | 1000MΩ min.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |
|                                           |                              | Dielectric Strength | Per Item 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                |                 |                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                  |   |      |   |       |   |      |   |      |   |      |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ➤

## Type KJ Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                                                                                                    |                                                                                                     | Specifications                                                                                                                                  |       | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                                                                                                     |             |   |             |
|---------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------|-------------|---|-------------|
| 10                  | Vibration                                                                                               | Appearance                                                                                          | No marked defect                                                                                                                                |       | <p>Solder the capacitor and gum up the body to the test jig (glass epoxy board) by resin (adhesive).</p> <p>The capacitor should be firmly soldered to the supporting lead wire, 1.5mm in total amplitude, with about a 20 minutes rate of vibration change from 10Hz to 2000Hz and back to 10Hz.</p> <p>This motion should be applied 12 times in each of 3 mutually perpendicular directions (total of 36 times).</p> <p>The acceleration is 5g max.</p>                                                                                                                                                                                                                                                                                                                                                   |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | Capacitance                                                                                         | Within the specified tolerance                                                                                                                  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | D.F.                                                                                                | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤ 2.5%</td></tr></table>                                         | Char. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Specifications     | B, E                                                                                                | D.F. ≤ 2.5% |   |             |
|                     |                                                                                                         | Char.                                                                                               | Specifications                                                                                                                                  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| B, E                | D.F. ≤ 2.5%                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| 11                  | Mechanical Shock                                                                                        | Appearance                                                                                          | No marked defect                                                                                                                                |       | <p>Solder the capacitor and gum up the body to the test jig (glass epoxy board) by resin (adhesive).</p> <p>Three shocks in each direction should be applied along 3 mutually perpendicular axes to and from of the test specimen (18 shocks).</p> <p>The specified test pulse should be half-sine and should have a duration: 0.5ms, peak value: 100g and velocity change: 4.7m/s.</p>                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | Capacitance                                                                                         | Within the specified tolerance                                                                                                                  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | D.F.                                                                                                | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤ 5.0%</td></tr></table>                                         | Char. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Specifications     | B, E                                                                                                | D.F. ≤ 5.0% |   |             |
|                     |                                                                                                         | Char.                                                                                               | Specifications                                                                                                                                  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| B, E                | D.F. ≤ 5.0%                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| I.R.                | 10000MΩ min.                                                                                            |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| 12                  | Humidity (Under Steady State)                                                                           | Appearance                                                                                          | No marked defect                                                                                                                                |       | <p>Set the capacitor for 1000±12 hrs. at 85±3°C in 80 to 85% relative humidity.</p> <p>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | Capacitance Change                                                                                  | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E</td><td>Within ±15%</td></tr></table> | Char. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Capacitance Change | B                                                                                                   | Within ±10% | E | Within ±15% |
|                     |                                                                                                         | Char.                                                                                               | Capacitance Change                                                                                                                              |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | B                                                                                                   | Within ±10%                                                                                                                                     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | E                                                                                                   | Within ±15%                                                                                                                                     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| D.F.                | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤ 5.0%</td></tr></table> | Char.                                                                                               | Specifications                                                                                                                                  | B, E  | D.F. ≤ 5.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                                                                                                     |             |   |             |
| Char.               | Specifications                                                                                          |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| B, E                | D.F. ≤ 5.0%                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| I.R.                | 3000MΩ min.                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| Dielectric Strength | Per Item 6                                                                                              |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| 13                  | Humidity Loading                                                                                        | Appearance                                                                                          | No marked defect                                                                                                                                |       | <p>Apply the rated voltage for 1000±12 hrs. at 85±3°C in 80 to 85% relative humidity.</p> <p>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | Capacitance Change                                                                                  | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E</td><td>Within ±15%</td></tr></table> | Char. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Capacitance Change | B                                                                                                   | Within ±10% | E | Within ±15% |
|                     |                                                                                                         | Char.                                                                                               | Capacitance Change                                                                                                                              |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | B                                                                                                   | Within ±10%                                                                                                                                     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| E                   | Within ±15%                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| D.F.                | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F. ≤ 5.0%</td></tr></table> | Char.                                                                                               | Specifications                                                                                                                                  | B, E  | D.F. ≤ 5.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                                                                                                     |             |   |             |
| Char.               | Specifications                                                                                          |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| B, E                | D.F. ≤ 5.0%                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| I.R.                | 3000MΩ min.                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| 14                  | Life                                                                                                    | Appearance                                                                                          | No marked defect                                                                                                                                |       | <p>Impulse Voltage</p> <p>Each individual capacitor should be subjected to a 5kV impulses for three times. Then the capacitors are applied to life test.</p>  <p>Front time (T<sub>1</sub>) = 1.2μs = 1.67T<br/>Time to half-value (T<sub>2</sub>) = 50μs</p> <p>Apply a voltage from Table 4 for 1000 hrs. at 125+2/-0°C, and relative humidity of 50% max.</p> <p>&lt;Table 4&gt;</p> <table><tr><th>Applied Voltage</th></tr><tr><td>AC510V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec.</td></tr></table> <p>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1hr., then placed at room condition* for 24±2 hrs. before initial measurements.</p> <p>Post-treatment:<br/>Capacitor should be stored for 1 to 2 hrs. at room condition.*</p> | Applied Voltage    | AC510V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec. |             |   |             |
|                     |                                                                                                         | Applied Voltage                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | AC510V(r.m.s.), except that once each hour the voltage is increased to AC1000V(r.m.s.) for 0.1 sec. |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
|                     |                                                                                                         | Capacitance Change                                                                                  | Within ±20%                                                                                                                                     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| I.R.                | 3000MΩ min.                                                                                             |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |
| Dielectric Strength | Per Item 6                                                                                              |                                                                                                     |                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                     |             |   |             |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page.

## Type KJ Specifications and Test Methods

Continued from the preceding page.

| No.                 | Item                                                                                                                                                                          |            | Specifications                                                                    | Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|-------------|---|----------|----|---|------------|---|---|----------|----|---|------------|---|
| 15                  | Robustness of Terminations                                                                                                                                                    | Tensile    | Lead wire should not be cut off. Capacitor should not be broken.                  | As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N and keep it for 10±1 sec.<br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
|                     |                                                                                                                                                                               | Bending    |                                                                                   | Each lead wire should be subjected to 5N of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| 16                  | Active Flammability                                                                                                                                                           |            | The cheesecloth should not catch on fire.                                         | <p>The capacitor should be individually wrapped in at least one, but not more than two, complete layers of cheesecloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The UAC should be maintained for 2 min. after the last discharge.</p>  <p>C<sub>1,2</sub> : 1μF±10%                      C<sub>3</sub> : 0.033μF±5% 10kV<br/>L<sub>1</sub> to 4 : 1.5mH±20% 16A Rod core choke<br/>C<sub>t</sub> : 3μF±5% 10kV                  R : 100Ω±2%<br/>C<sub>x</sub> : Capacitor under test        UAC : U<sub>R</sub>±5%<br/>F : Fuse, Rated 10A                U<sub>R</sub> : Rated Voltage<br/>                                              U<sub>t</sub> : Voltage applied to C<sub>t</sub></p>  |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| 17                  | Passive Flammability                                                                                                                                                          |            | The burning time should not exceed 30 sec.<br>The tissue paper should not ignite. | <p>The capacitor under test should be held in the flame in the position that best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec.</p> <p>Length of flame : 12±1mm<br/>Gas burner : Length 35mm min.<br/>                        Inside Dia. 0.5±0.1mm<br/>                        Outside Dia. 0.9mm max.<br/>Gas : Butane gas Purity 95% min.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| 18                  | Temperature Cycle                                                                                                                                                             | Appearance | No marked defect                                                                  | <p>The capacitor should be subjected to 1000 temperature cycles.</p> <table><thead><tr><th>Step</th><th>Temperature (°C)</th><th>Time (min)</th></tr></thead><tbody><tr><td>1</td><td>-55±0/-3</td><td>30</td></tr><tr><td>2</td><td>Room temp.</td><td>3</td></tr><tr><td>3</td><td>125±3/-0</td><td>30</td></tr><tr><td>4</td><td>Room temp.</td><td>3</td></tr></tbody></table> <p>Cycle time: 1000 cycles</p> <p>Pre-treatment:<br/>Capacitor should be stored at 125±3°C for 1 hr., then placed at room condition* for 24±2 hrs.</p> <p>Post-treatment:<br/>Capacitor should be stored for 24±2 hrs. at room condition.*</p>                                                                                                                                                                                                                                                                                                              | Step        | Temperature (°C) | Time (min)  | 1 | -55±0/-3 | 30 | 2 | Room temp. | 3 | 3 | 125±3/-0 | 30 | 4 | Room temp. | 3 |
|                     |                                                                                                                                                                               | Step       | Temperature (°C)                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Time (min)  |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
|                     |                                                                                                                                                                               | 1          | -55±0/-3                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 30          |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
|                     |                                                                                                                                                                               | 2          | Room temp.                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3           |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
|                     |                                                                                                                                                                               | 3          | 125±3/-0                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 30          |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| 4                   | Room temp.                                                                                                                                                                    | 3          |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| Capacitance Change  | <table><thead><tr><th>Char.</th><th>Capacitance Change</th></tr></thead><tbody><tr><td>B</td><td>Within ±10%</td></tr><tr><td>E</td><td>Within ±20%</td></tr></tbody></table> | Char.      | Capacitance Change                                                                | B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Within ±10% | E                | Within ±20% |   |          |    |   |            |   |   |          |    |   |            |   |
| Char.               | Capacitance Change                                                                                                                                                            |            |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| B                   | Within ±10%                                                                                                                                                                   |            |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| E                   | Within ±20%                                                                                                                                                                   |            |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| D.F.                | <table><thead><tr><th>Char.</th><th>Specifications</th></tr></thead><tbody><tr><td>B, E</td><td>D.F. ≤5.0%</td></tr></tbody></table>                                          | Char.      | Specifications                                                                    | B, E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | D.F. ≤5.0%  |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| Char.               | Specifications                                                                                                                                                                |            |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| B, E                | D.F. ≤5.0%                                                                                                                                                                    |            |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| I.R.                | 3000MΩ min.                                                                                                                                                                   |            |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |
| Dielectric Strength | Per Item 6                                                                                                                                                                    |            |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                  |             |   |          |    |   |            |   |   |          |    |   |            |   |

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Continued on the following page. ➤

## Type KJ Specifications and Test Methods

Continued from the preceding page.

| No.   | Item                                                                                                                  |                    | Specifications                                                                                                                                                                    |       | Test Method                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|-------|-----------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-----------------------------|------------|---|----------|----|---|----------|----|
| 19    | High Temperature Exposure (Storage)                                                                                   | Capacitance Change | Within $\pm 20\%$                                                                                                                                                                 |       | Set the capacitor for 1000 $\pm$ 12 hrs. at 150 $\pm$ 3 $^{\circ}$ C.                                                                                                                                                                                                                                                                                                                 |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | D.F.               | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.<math>\leq</math>5.0%</td></tr></table>                                                             | Char. | Specifications                                                                                                                                                                                                                                                                                                                                                                        | B, E                                                                                                                                   | D.F. $\leq$ 5.0%  | Pre-treatment:<br>Capacitor should be stored at 125 $\pm$ 3 $^{\circ}$ C for 1 hr., then placed at room condition* for 24 $\pm$ 2 hrs. |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Char.              | Specifications                                                                                                                                                                    |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| B, E  | D.F. $\leq$ 5.0%                                                                                                      |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| I.R.  | 1000M $\Omega$ min.                                                                                                   |                    | Post-treatment:<br>Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.*                                                                                             |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| 20    | Thermal Shock                                                                                                         | Appearance         | No marked defect except color change of outer coating.                                                                                                                            |       | The capacitor should be subjected to 300 cycles.                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within <math>\pm 10\%</math></td></tr><tr><td>E</td><td>Within <math>\pm 20\%</math></td></tr></table> | Char. | Capacitance Change                                                                                                                                                                                                                                                                                                                                                                    | B                                                                                                                                      | Within $\pm 10\%$ | E                                                                                                                                      | Within $\pm 20\%$ | <table><tr><th>Step</th><th>Temperature (<math>^{\circ}</math>C)</th><th>Time (min)</th></tr><tr><td>1</td><td>-55+0/-3</td><td>30</td></tr><tr><td>2</td><td>125+3/-0</td><td>30</td></tr></table> |  | Step | Temperature ( $^{\circ}$ C) | Time (min) | 1 | -55+0/-3 | 30 | 2 | 125+3/-0 | 30 |
|       |                                                                                                                       | Char.              | Capacitance Change                                                                                                                                                                |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | B                  | Within $\pm 10\%$                                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| E     | Within $\pm 20\%$                                                                                                     |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| Step  | Temperature ( $^{\circ}$ C)                                                                                           | Time (min)         |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| 1     | -55+0/-3                                                                                                              | 30                 |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| 2     | 125+3/-0                                                                                                              | 30                 |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| D.F.  | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.<math>\leq</math>5.0%</td></tr></table> | Char.              | Specifications                                                                                                                                                                    | B, E  | D.F. $\leq$ 5.0%                                                                                                                                                                                                                                                                                                                                                                      | Pre-treatment:<br>Capacitor should be stored at 125 $\pm$ 3 $^{\circ}$ C for 1 hr., then placed at room condition* for 24 $\pm$ 2 hrs. |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| Char. | Specifications                                                                                                        |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| B, E  | D.F. $\leq$ 5.0%                                                                                                      |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| I.R.  | 3000M $\Omega$ min.                                                                                                   |                    | Post-treatment:<br>Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.*                                                                                             |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| 21    | Resistance to Solvents                                                                                                | Appearance         | No marked defect                                                                                                                                                                  |       | Per MIL-STD-202 Method 215<br>Solvent 1: 1 part (by volume) of isopropyl alcohol<br>3 parts (by volume) of mineral spirits<br>Solvent 2: Terpene defluxer<br>Solvent 3: 42 parts (by volume) of water<br>1 part (by volume) of propylene glycol monomethyl ether<br>1 part (by volume) of monoethanolomine                                                                            |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within <math>\pm 10\%</math></td></tr><tr><td>E</td><td>Within <math>\pm 20\%</math></td></tr></table> | Char. |                                                                                                                                                                                                                                                                                                                                                                                       | Capacitance Change                                                                                                                     | B                 | Within $\pm 10\%$                                                                                                                      | E                 | Within $\pm 20\%$                                                                                                                                                                                   |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Char.              | Capacitance Change                                                                                                                                                                |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | B                  | Within $\pm 10\%$                                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| E     | Within $\pm 20\%$                                                                                                     |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| D.F.  | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.<math>\leq</math>5.0%</td></tr></table> | Char.              | Specifications                                                                                                                                                                    | B, E  | D.F. $\leq$ 5.0%                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| Char. | Specifications                                                                                                        |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| B, E  | D.F. $\leq$ 5.0%                                                                                                      |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| I.R.  | 3000M $\Omega$ min.                                                                                                   |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| 22    | Biased Humidity                                                                                                       | Appearance         | No marked defect                                                                                                                                                                  |       | Apply the rated voltage and DC1.3+0.2/-0V (add 6.8k $\Omega$ resistor) at 85 $\pm$ 3 $^{\circ}$ C and 80 to 85% humidity for 1000 $\pm$ 12 hrs.<br><br>Pre-treatment:<br>Capacitor should be stored at 125 $\pm$ 3 $^{\circ}$ C for 1hr., then placed at room condition* for 24 $\pm$ 2 hrs.<br>Post-treatment:<br>Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.* |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within <math>\pm 10\%</math></td></tr><tr><td>E</td><td>Within <math>\pm 15\%</math></td></tr></table> | Char. |                                                                                                                                                                                                                                                                                                                                                                                       | Capacitance Change                                                                                                                     | B                 | Within $\pm 10\%$                                                                                                                      | E                 | Within $\pm 15\%$                                                                                                                                                                                   |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Char.              | Capacitance Change                                                                                                                                                                |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | B                  | Within $\pm 10\%$                                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| E     | Within $\pm 15\%$                                                                                                     |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| D.F.  | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.<math>\leq</math>5.0%</td></tr></table> | Char.              | Specifications                                                                                                                                                                    | B, E  | D.F. $\leq$ 5.0%                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| Char. | Specifications                                                                                                        |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| B, E  | D.F. $\leq$ 5.0%                                                                                                      |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| I.R.  | 3000M $\Omega$ min.                                                                                                   |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| 23    | Moisture Resistance                                                                                                   | Appearance         | No marked defect                                                                                                                                                                  |       | Apply 24 hrs. of heat (25 to 65 $^{\circ}$ C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.<br><br>Pre-treatment:<br>Capacitor should be stored at 125 $\pm$ 3 $^{\circ}$ C for 1 hr., then placed at room condition* for 24 $\pm$ 2 hrs.<br>Post-treatment:<br>Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.*                            |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Capacitance Change | <table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>B</td><td>Within <math>\pm 10\%</math></td></tr><tr><td>E</td><td>Within <math>\pm 20\%</math></td></tr></table> | Char. |                                                                                                                                                                                                                                                                                                                                                                                       | Capacitance Change                                                                                                                     | B                 | Within $\pm 10\%$                                                                                                                      | E                 | Within $\pm 20\%$                                                                                                                                                                                   |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | Char.              | Capacitance Change                                                                                                                                                                |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
|       |                                                                                                                       | B                  | Within $\pm 10\%$                                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| E     | Within $\pm 20\%$                                                                                                     |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| D.F.  | <table><tr><th>Char.</th><th>Specifications</th></tr><tr><td>B, E</td><td>D.F.<math>\leq</math>5.0%</td></tr></table> | Char.              | Specifications                                                                                                                                                                    | B, E  | D.F. $\leq$ 5.0%                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| Char. | Specifications                                                                                                        |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| B, E  | D.F. $\leq$ 5.0%                                                                                                      |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |
| I.R.  | 3000M $\Omega$ min.                                                                                                   |                    |                                                                                                                                                                                   |       |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                   |                                                                                                                                        |                   |                                                                                                                                                                                                     |  |      |                             |            |   |          |    |   |          |    |

Temperature  $^{\circ}$ C

Humidity 90-98% Humidity 80-98% Humidity 90-98% Humidity 80-98% Humidity 90-98%

Initial measurement

One cycle 24 hours

Hours

Set the capacitor for 1000 $\pm$ 12 hrs. at 150 $\pm$ 3°C.

Pre-treatment:

Capacitor should be stored at 125 $\pm$ 3°C for 1 hr., then placed at room condition\* for 24 $\pm$ 2 hrs.

Post-treatment:

Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.\*

The capacitor should be subjected to 300 cycles.

| Step | Temperature (°C) | Time (min) |
|------|------------------|------------|
| 1    | -55 $\pm$ 0/-3   | 30         |
| 2    | 125 $\pm$ 3/0    | 30         |

Pre-treatment:

Capacitor should be stored at 125 $\pm$ 3°C for 1 hr., then placed at room condition\* for 24 $\pm$ 2 hrs.

Post-treatment:

Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.\*

Per MIL-STD-202 Method 215

Solvent 1: 1 part (by volume) of isopropyl alcohol  
3 parts (by volume) of mineral spirits

Solvent 2: Terpene defluxer

Solvent 3: 42 parts (by volume) of water  
1 part (by volume) of propylene glycol  
monomethyl ether  
1 part (by volume) of monoethanolamine

Apply the rated voltage and DC1.3 $\pm$ 0.2/-0V (add 6.8k $\Omega$  resistor) at 85 $\pm$ 3°C and 80 to 85% humidity for 1000 $\pm$ 12 hrs.

Pre-treatment:

Capacitor should be stored at 125 $\pm$ 3°C for 1hr., then placed at room condition\* for 24 $\pm$ 2 hrs.

Post-treatment:

Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.\*

Apply 24 hrs. of heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.

Pre-treatment:

Capacitor should be stored at 125 $\pm$ 3°C for 1 hr., then placed at room condition\* for 24 $\pm$ 2 hrs.

Post-treatment:

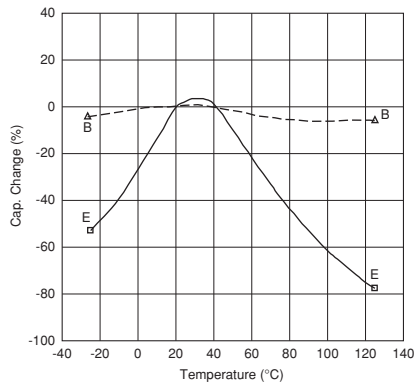
Capacitor should be stored for 24 $\pm$ 2 hrs. at room condition.\*



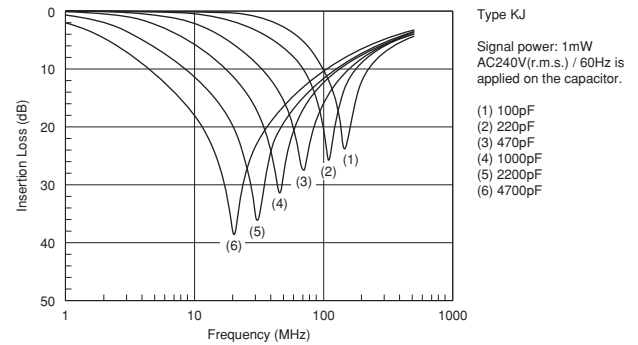
\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

## Safety Certified Ceramic Capacitors for Automotive Characteristics Data (Typical Example)

### ■ Capacitance - Temperature Characteristics



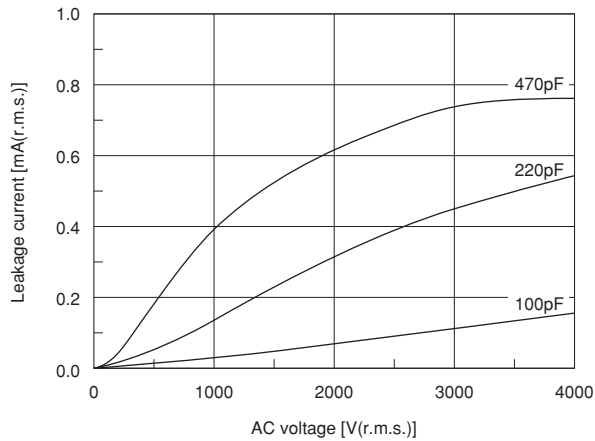
### ■ Insertion Loss - Frequency Characteristics



### ■ Leakage Current Characteristics

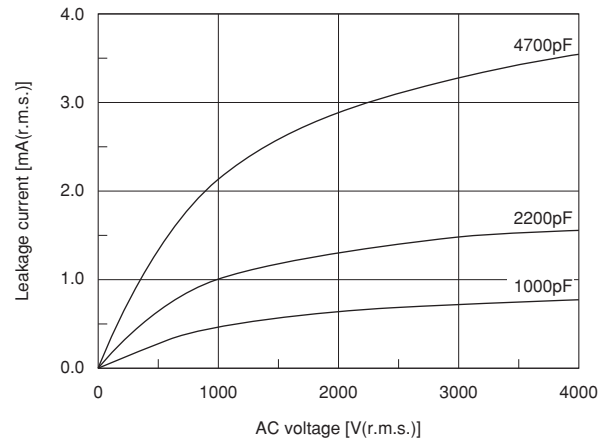
Type KJ (B char.)

AC voltage : 60Hz  
 Temperature : 25°C



Type KJ (E char.)

AC voltage : 60Hz  
 Temperature : 25°C



## Safety Certified Ceramic Capacitors for Automotive Packaging

### ■ Taping Specifications

- 15mm pitch / lead spacing 7.5mm taping
- Vertical crimp type
- (Lead Code: N3)



| Item                                              | Code            | N3                                         |
|---------------------------------------------------|-----------------|--------------------------------------------|
| Pitch of component                                | P               | 15.0±2.0                                   |
| Pitch of sprocket hole                            | P <sub>0</sub>  | 15.0±0.3                                   |
| Lead spacing                                      | F               | 7.5±1.0                                    |
| Length from hole center to component center       | P <sub>2</sub>  | 7.5±1.5                                    |
| Length from hole center to lead                   | P <sub>1</sub>  | 3.75±1.0                                   |
| Body diameter                                     | D               | See the individual product specifications. |
| Deviation along tape, left or right               | ΔS              | 0±2.0                                      |
| Carrier tape width                                | W               | 18.0±0.5                                   |
| Position of sprocket hole                         | W <sub>1</sub>  | 9.0±0.5                                    |
| Lead distance between reference and bottom planes | H <sub>0</sub>  | 18.0 <sup>+2.0</sup> <sub>-0</sub>         |
| Protrusion length                                 | ℓ               | +0.5 to -1.0                               |
| Diameter of sprocket hole                         | ØD <sub>0</sub> | 4.0±0.1                                    |
| Lead diameter                                     | Ød              | 0.6±0.05                                   |
| Total tape thickness                              | t <sub>1</sub>  | 0.6±0.3                                    |
| Total thickness, tape and lead wire               | t <sub>2</sub>  | 1.5 max.                                   |
| Body thickness                                    | T               | 7.0 max.                                   |
| Portion to cut in case of defect                  | L               | 11.0 <sup>+0</sup> <sub>-1.0</sub>         |
| Hold down tape width                              | W <sub>0</sub>  | 11.5 min.                                  |
| Hold down tape position                           | W <sub>2</sub>  | 1.5±1.5                                    |
| Coating extension on lead                         | e               | Up to the end of crimp                     |
| Deviation across tape, front                      | Δh <sub>1</sub> | 2.0 max.                                   |
| Deviation across tape, rear                       | Δh <sub>2</sub> |                                            |

(in mm)

### ■ Packaging Styles

| Bulk                                                                                                    | Taping                                                                                           |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Polyethylene Bag<br> | Ammo Pack<br> |

### ■ Minimum Quantity (Order in Sets Only)

| [Bulk]              | (pcs./Bag)      |                 |
|---------------------|-----------------|-----------------|
| Body Dia. D<br>(mm) | Lead Code<br>A3 | Lead Code<br>B3 |
|                     | Long            | Short           |
| 7 to 10             | 250             | 500             |
| 12                  | 200             | 250             |

[Taping]

Lead Code: N3

700pcs./Ammo Pack

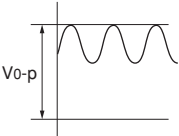
## Safety Certified Ceramic Capacitors for Automotive ⚠Caution

### ■ ⚠Caution (Rating)

#### 1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the  $V_{p-p}$  value of the applied voltage or the  $V_{o-p}$  that contains DC bias within the rated voltage range.

When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

| Voltage                | DC Voltage                                                                        | DC+AC Voltage                                                                     | AC Voltage                                                                        | Pulse Voltage (1)                                                                   | Pulse Voltage (2)                                                                   |
|------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Positional Measurement |  |  |  |  |  |

#### 2. Operating Temperature and Self-generated Heat

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high-frequency current, pulse current or similar current, it may have self-generated heat due to dielectric loss. Applied voltage load should be such that self-generated heat is within 20°C under the condition where the capacitor is subjected to an atmospheric temperature of 25°C. When measuring, use a thermocouple of small thermal capacity-K of  $\phi 0.1\text{mm}$  under conditions where the capacitor is not affected by radiant heat from other components or wind from surroundings. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

#### 3. Test Condition for Withstanding Voltage

##### (1) Test Equipment

Test equipment for AC withstanding voltage should be used with the performance of the wave similar to 50/60Hz sine wave.

If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

Continued on the following page. 

## Safety Certified Ceramic Capacitors for Automotive ⚠Caution

☐ Continued from the preceding page.

### (2) Voltage Applied Method

When the withstanding voltage is applied, the capacitor's lead or terminal should be firmly connected to the output of the withstanding voltage test equipment, and then the voltage should be raised from near zero to the test voltage.

If the test voltage without the raise from near zero voltage would be applied directly to capacitor, test voltage should be applied with the zero cross.\* At the end of the test time, the test voltage should be reduced to near zero, and then capacitor's lead or terminal should be taken off the output of the withstanding voltage test equipment.

If the test voltage without the raise from near zero voltage would be applied directly to capacitor, the surge voltage may rise, and therefore, a defect may be caused.

\*ZERO CROSS is the point where voltage sine wave passes 0V. See the figure at right.



### 4. Fail-Safe

When the capacitor is broken, failure may result in a short circuit. Be sure to provide an appropriate fail-safe function like a fuse on your product if failure could result in an electric shock, fire or fuming.

**FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY  
RESULT, WORST CASE, IN A SHORT CIRCUIT  
AND CAUSE FUMING OR PARTIAL DISPERSION  
WHEN THE PRODUCT IS USED.**

## Safety Certified Ceramic Capacitors for Automotive ⚠Caution

### ■ ⚠Caution (Storage and Operating Condition)

#### Operating and Storage Environment

The insulating coating of capacitors does not form a perfect seal; therefore, do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. Also, avoid exposure to moisture. Before cleaning, bonding, or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed -10 to 40 degrees centigrade and 15 to 85%.

Use capacitors within 6 months after delivery.

Check the solderability after 6 months or more.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

### ■ ⚠Caution (Soldering and Mounting)

#### 1. Vibration and Impact

Do not expose a capacitor or its lead wires to excessive shock or vibration during use.

Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board.

Please take measures to hold a capacitor on the circuit boards by adhesive, molding resin or another coating.

Please confirm there is no influence of holding measures on the product with the intended equipment.

#### 2. Soldering

When soldering this product to a PCB/PWB, do not exceed the solder heat resistance specifications of the capacitor. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element.

Soldering the capacitor with a soldering iron should be performed in the following conditions.

Temperature of iron-tip: 400 degrees C. max.

Soldering iron wattage: 50W max.

Soldering time: 3.5 sec. max.

#### 3. Bonding, Resin Molding and Coating

For bonding, molding or coating this product, verify that these processes do not affect the quality of the capacitor by testing the performance of the bonded, molded or coated product in the intended equipment. When the amount of applications, dryness/hardening conditions of adhesives and molding resins containing organic solvents (ethyl acetate, methyl ethyl ketone, toluene, etc). are unsuitable, the outer coating resin of a capacitor is damaged by the organic solvents and it may result, worst case, in a short circuit.

The variation in thickness of adhesive, molding resin or coating may cause outer coating resin cracking and/or ceramic element cracking of a capacitor in a temperature cycling.

#### 4. Treatment after Bonding, Resin Molding and Coating

When the outer coating is hot (over 100 degrees C.) after soldering, it becomes soft and fragile.

Therefore, please be careful not to give it mechanical stress.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

### ■ ⚠Caution (Handling)

#### Vibration and Impact

Do not expose a capacitor or its lead wires to excessive shock or vibration during use.

Excessive shock or vibration may cause fatigue destruction of lead wires mounted on the circuit board.

Please take measures to hold a capacitor on the circuit boards by adhesive, molding resin or another coating.

Please confirm there is no influence of holding measures on the product with the intended equipment.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

## Safety Certified Ceramic Capacitors for Automotive Notice

### ■ Notice (Soldering and Mounting)

Cleaning (ultrasonic cleaning)

To perform ultrasonic cleaning, observe the following conditions.

Rinse bath capacity: Output of 20 watts per liter or less.

Rinsing time: 5 min. maximum.

Do not vibrate the PCB/PWB directly.

Excessive ultrasonic cleaning may lead to fatigue destruction of the lead wires.

### ■ Notice (Rating)

#### 1. Capacitance Change of Capacitors

Capacitors have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time. Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage. Therefore, it is not likely to be suitable for use in a constant time circuit.

Please contact us if you need detailed information.

#### 2. Performance Check by Equipment

Before using a capacitor, check that there is no problem in the equipment's performance and the specifications.

Generally speaking, CLASS 2 ceramic capacitors have voltage dependence characteristics and temperature dependence characteristics in capacitance. Therefore, the capacitance value may change depending on the operating condition in the equipment. Therefore, be sure to confirm the apparatus performance of receiving influence in the capacitance value change of a capacitor, such as leakage current and noise suppression characteristic.

Moreover, check the surge-proof ability of a capacitor in the equipment, if needed, because the surge voltage may exceed specific value by the inductance of the circuit.

## Safety Certified Ceramic Capacitors/High Voltage Ceramic Capacitors ISO9000 Certifications

Manufacturing plants that produce the products in this catalog have obtained the ISO9000 quality system certificate.

| Plant                                | Applied Standard |
|--------------------------------------|------------------|
| Izumo Murata Manufacturing Co., Ltd. | ISO9001          |
| Murata Electronics (Thailand), Ltd.  | ISO9001          |
| Taiwan Murata Electronics Co., Ltd.  | ISO9001          |

⚠Note:

1. Export Control

<For customers outside Japan>

No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.

<For customers in Japan>

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- |                             |                                                                                                      |
|-----------------------------|------------------------------------------------------------------------------------------------------|
| ① Aircraft equipment        | ② Aerospace equipment                                                                                |
| ③ Undersea equipment        | ④ Power plant equipment                                                                              |
| ⑤ Medical equipment         | ⑥ Transportation equipment (vehicles, trains, ships, etc.)                                           |
| ⑦ Traffic signal equipment  | ⑧ Disaster prevention / crime prevention equipment                                                   |
| ⑨ Data-processing equipment | ⑩ Application of similar complexity and/or reliability requirements to the applications listed above |

3. Product specifications in this catalog are as of December 2013. They are subject to change or our products in it may be discontinued without advance notice.

Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.

4. Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

5. This catalog has only typical specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.



**Head Office**  
1-10-1, Higashi Kotari, Nagaokakyo-shi, Kyoto 617-8555, Japan  
Phone: 81-75-951-9111

**International Division**  
3-29-12, Shibuya, Shibuya-ku, Tokyo 150-0002, Japan  
Phone: 81-3-5469-6123 Fax: 81-3-5469-6155 E-mail: intl@murata.co.jp

<http://www.murata.com/>