

● Part Numbering

Safety Standard Recognized Ceramic Capacitors

(Part Number)

DE	2	E3	KH	102	M	N3	A	
①	②	③	④	⑤	⑥	⑦	⑧	⑨

① Product ID

Product ID	
DE	High Voltage (250V - 6.3kV) / Safety Standard Recognized Ceramic Capacitors

② Series Category

Code	Outline	Contents
1	Safety Standard	IEC60384-14 Class X1, Y1
2	Recognized	IEC60384-14 Class X1, Y2
J	AC250V (r.m.s.)	"Products which are based on the Electrical Appliance and Material Safety Law of Japan"

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

In case of Safety Recognized Capacitors, first three digits express product code. The following fourth figure expresses recognized type shown in ④Safety Standard Recognized 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 Recognized Type

Code	Rated Voltage
E2	AC250V
KH	X1, Y2; AC250V, (Safety Standard Recognized Type KH)
KY	X1, Y2; AC250V, (Safety Standard Recognized Type KY)
KX	X1, Y1; AC250V, (Safety Standard Recognized 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 which follow the two numbers. If there is a decimal point, it is expressed by the capital letter "R". In this case, all figures are significant digits.

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 Components
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

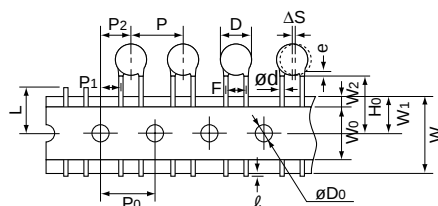
Code	Packaging
A	Ammo Pack
B	Bulk

⑨ Individual Specification

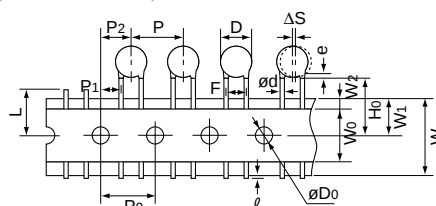
In case part number cannot be identified without "Individual Specification", it is added at the end of part number. Expressed by three figures.

■ Taping Specifications

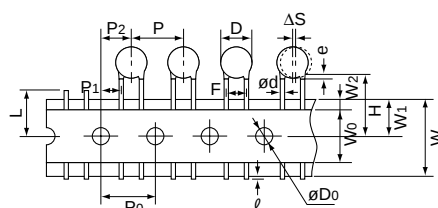
- 12.7mm pitch / lead spacing 5mm taping
Vertical crimp type
(Lead Code : N2)



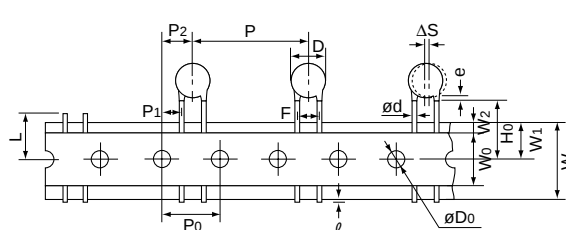
- 15mm pitch / lead spacing 7.5mm taping
Vertical crimp type
(Lead Code : N3)



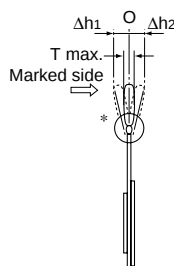
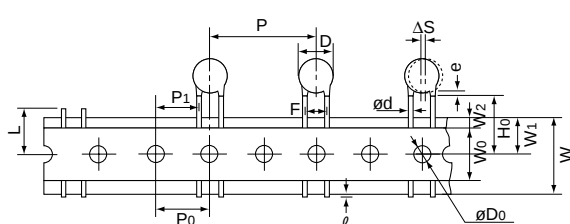
- 15mm pitch / lead spacing 7.5mm taping
Straight type
(Lead Code : P3)



- 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)



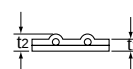
Lead Code
N2, N3, N4, N7



Lead Code
P3



Lead Code
N5



Item	Code	N2	N3	P3	N7	N4	N5
Pitch of component	P	12.7	15.0	15.0	30.0	25.4	
Pitch of sprocket hole	P ₀	12.7±0.3	15.0±0.3	15.0±0.3	15.0±0.3	12.7±0.3	
Lead spacing	F	5.0 ^{+0.8} _{-0.2}	7.5±1.0	7.5±1.0	7.5±1.0	10.0±1.0	
Length from hole center to component center	P ₂	6.35±1.3	7.5±1.5	7.5±1.5	7.5±1.5	—	
Length from hole center to lead	P ₁	3.85±0.7	3.75±1.0	3.75±1.0	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 hold	W ₁	9.0±0.5					
Lead distance between reference and bottom planes	H ₀	18.0 ^{+2.0} ₋₀		—		18.0 ^{+2.0} ₋₀	
	H	—		20.0 ^{+1.5} _{-1.0}		—	
Protrusion length	ℓ	+0.5 to -1.0					
Diameter of sprocket hole	øD ₀	4.0±0.1					
Lead diameter	ød	0.6±0.05					0.6 ^{+0.1} _{-0.05}
Total tape thickness	t ₁	0.6±0.3					
Total thickness, tape and lead wire	t ₂	1.5 max.					
Body thickness	T	See the individual product specifications					
Portion to cut in case of defect	L	11.0 ⁺⁰ _{-1.0}					
Hold down tape width	W ₀	11.5 min.					
Hold down tape position	W ₂	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	Δh ₁	1.0 max.		2.0 max.			
Deviation across tape, rear	Δh ₂						

(in mm)

Continued on the following page.

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■ Packaging Styles

Bulk	Taping
Polyethylene Bag 	Ammo Pack 

■ Minimum Quantity (Order in Sets Only)

[Bulk] 1,000 pcs.

[Taping] (pcs.)

Lead Code	Type KY	Type KH	Type KX	DEJ Series
N2	1,000	—	—	1,500
N3, P3	900	900	—	1,000
N7	—	400	—	—
N4, N5	—	—	500	—

■ Minimum Order Quantity

[Bulk] 3,000 pcs.

[Taping] (pcs.)

Lead Code	Type KY	Type KH	Type KX	DEJ Series
N2	3,000	—	—	3,000
N3, P3	2,700	2,700	—	3,000
N7	—	2,000	—	—
N4, N5	—	—	2,000	—

"Minimum Quantity" means the numbers of units of each delivery or order.

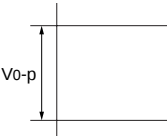
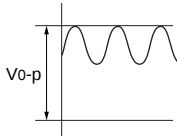
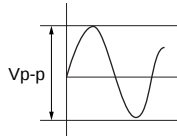
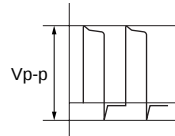
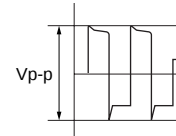
The quantity should be an integral multiple of the "minimum quantity".

(In case of bulk packaging, minimum quantities differ from packing quantities in a bulk bag.)

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} which 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 at an atmosphere temperature of 25°C. When measuring, use a thermocouple of small thermal capacity-K of $\varnothing 0.1\text{mm}$ 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.

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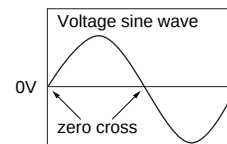
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(2) Voltage Applied Method

When the withstanding voltage is applied, 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 arise, and therefore, a defect may be caused.

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



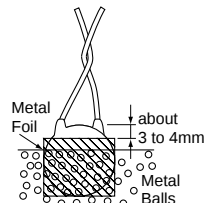
4. Fail-Safe

When capacitor would be 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 would 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.

■ Apply to Type KY/KH/KX

Operating Temperature Range : -25 to +125°C (-25 to +85°C in case of the standard of UL)

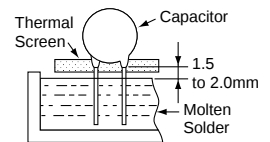
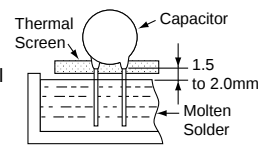
No.	Item		Specifications	Testing Method																								
1	Appearance and Dimensions		No marked defect on appearance form and dimensions are within specified range.	The capacitor should be visually inspected for evidence of defect. Dimensions should be measured with slide calipers.																								
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.) 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<30pF) 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) Q≥1000 (C≥30pF)																
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5	Insulation Resistance (I.R.)		10000MΩ min.																									
6	Dielectric Strength	Between Lead Wires	No failure	The capacitor should not be damaged when test voltages of Table 1 are applied between the lead wires for 60 sec. <Table.1> <table><tr><th>Type</th><th>Test Voltage</th></tr><tr><td>KY</td><td>In case of lead spacing F=5mm AC2000V (r.m.s.) In case of 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	In case of lead spacing F=5mm AC2000V (r.m.s.) In case of lead spacing F=7.5mm AC2600V (r.m.s.)	KH	AC2600V (r.m.s.)	KX	AC4000V (r.m.s.)																
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KH	AC2600V (r.m.s.)																											
KX	AC4000V (r.m.s.)																											
		Body Insulation	No failure	First, the terminals of the capacitor should be connected together. Then, as shown in 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. Then, the capacitor should be inserted into a container filled with metal balls of about 1mm diameter. Finally, AC voltage of Table 2 is applied for 60 sec. between the capacitor lead wires and metal balls. <Table.2> <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.)																
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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% -55%</td></tr><tr><td>F</td><td>Within +30% -80%</td></tr></table> Temperature characteristic guarantee is -25 to +85°C <table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to -1000ppm/°C</td></tr></table> Temperature characteristic guarantee is +20 to +85°C	Char.	Capacitance Change	B	Within ±10%	E	Within +20% -55%	F	Within +30% -80%	Char.	Temperature Coefficient	SL	+350 to -1000ppm/°C	The capacitance measurement should be made at each step specified in Table 3. <Table.3> <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%																											
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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.	The lead wire of a capacitor should be dipped into molten solder for 2±0.5 sec. The depth of immersion is up to about 1.5 to 2.0mm from the root of lead wires. Temp. of solder: Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C H63 Eutectic Solder 235±5°C																								

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

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No.	Item	Specifications	Testing Method
9	Soldering Effect (Non-Preheat)	Appearance	As shown in figure, the lead wires should be immersed in solder of $350\pm 10^{\circ}\text{C}$ or $260\pm 5^{\circ}\text{C}$ up to 1.5 to 2.0mm from the root of terminal for 3.5 ± 0.5 sec. (10 ± 1 sec. for $260\pm 5^{\circ}\text{C}$). Pre-treatment: Capacitor should be stored at $85\pm 2^{\circ}\text{C}$ for 1 hr., then placed at *2room condition for 24 ± 2 hrs. before initial measurements. Post-treatment: Capacitor should be stored for 1 to 2 hrs. at *2room condition.
		Capacitance Change	
		I.R.	
		Dielectric Strength	
10	Soldering Effect (On-Preheat)	Appearance	First the capacitor should be stored at $120+0/-5^{\circ}\text{C}$ for $60+0/-5$ sec. Then, as in figure, the lead wires should be immersed in solder of $260+0/-5^{\circ}\text{C}$ up to 1.5 to 2.0mm from the root of terminal for $7.5+0/-1$ sec. Pre-treatment: Capacitor should be stored at $85\pm 2^{\circ}\text{C}$ for 1 hr., then placed at *2room condition for 24 ± 2 hrs. before initial measurements. Post-treatment: Capacitor should be stored for 1 to 2 hrs. at *2room condition.
		Capacitance Change	
		I.R.	
		Dielectric Strength	
11	Vibration Resistance	Appearance	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	
		D.F. Q	
12	Humidity (Under Steady State)	Appearance	Set the capacitor for 500 ± 12 hrs. at $40\pm 2^{\circ}\text{C}$ in 90 to 95% relative humidity. Post-treatment: Capacitor should be stored for 1 to 2 hrs. at *2room condition.
		Capacitance Change	
		D.F. Q	
		I.R.	
		Dielectric Strength	
13	Humidity Loading	Appearance	Apply the rated voltage for 500 ± 12 hrs. at $40\pm 2^{\circ}\text{C}$ in 90 to 95% relative humidity. Post-treatment: Capacitor should be stored for 1 to 2 hrs. at *2room condition.
		Capacitance Change	
		D.F. Q	
		I.R.	
		Dielectric Strength	

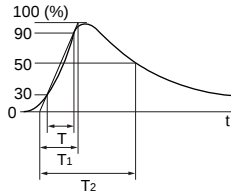
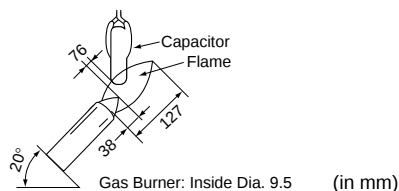
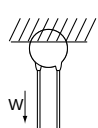
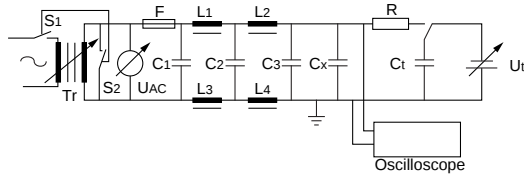
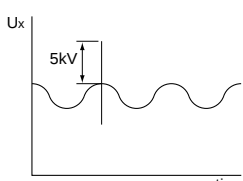


*1 "C" expresses nominal capacitance value (pF).

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

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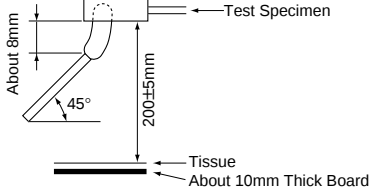
No.	Item		Specifications	Testing Method						
14	Life	Appearance	No marked defect	Impulse Voltage Each individual capacitor should be subjected to a 5kV (Type KX: 8kV) impulses for three times. After the capacitors are applied to life test.  Front time (T_1) = $1.2\mu s$ = $1.67T$ Time to half-value (T_2) = $50\mu s$ Apply a voltage of Table 4 for 1000 hrs. at $125+2/-0^{\circ}C$, and relative humidity of 50% max. <table border="1"><thead><tr><th><Table.4></th></tr><tr><th>Applied Voltage</th></tr></thead><tbody><tr><td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1 sec.</td></tr></tbody></table> Post-treatment: Capacitor should be stored for 1 to 2 hrs. at $^{+2}$room condition.	<Table.4>	Applied Voltage	AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1 sec.			
		<Table.4>								
		Applied Voltage								
		AC425V (r.m.s.), except that once each hour the voltage is increased to AC1000V (r.m.s.) for 0.1 sec.								
Capacitance Change	Within $\pm 20\%$									
I.R.	3000M Ω min.									
Dielectric Strength	Per Item 6									
15	Flame Test		The capacitor flame discontinues as follows. <table border="1"><thead><tr><th>Cycle</th><th>Time (sec.)</th></tr></thead><tbody><tr><td>1 to 4</td><td>30 max.</td></tr><tr><td>5</td><td>60 max.</td></tr></tbody></table> 	Cycle	Time (sec.)	1 to 4	30 max.	5	60 max.	The capacitor should be subjected to applied flame for 15 sec. and then removed for 15 sec. until 5 cycles are completed.
Cycle	Time (sec.)									
1 to 4	30 max.									
5	60 max.									
16	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. 						
		Bending		Each lead wire should be subjected to 5N weight and then a 90° bend, at the point of egress, in one direction, return to original position, and then apply a 90° bend in the opposite direction at the rate of one bend in 2 to 3 sec.						
17	Active Flammability		The cheese-cloth should not be on fire.	The capacitor should be individually wrapped in at least one but not more than two complete layers of cheese-cloth. 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.  $C_{1,2}$: $1\mu F\pm 10\%$ C_3 : $0.033\mu F\pm 5\%$ 10kV L_1 to 4 : $1.5mH\pm 20\%$ 16A Rod core choke C_t : $3\mu F\pm 5\%$ 10kV R : $100\Omega\pm 2\%$ C_x : Capacitor under test UAC : $U_R\pm 5\%$ F : Fuse, Rated 10A U_R : Rated Voltage U_t : Voltage applied to C_t 						

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

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

Continued on the following page. 

Continued from the preceding page.

No.	Item		Specifications	Testing Method																											
18	Passive Flammability		The burning time should not exceed 30 sec. The tissue paper should not ignite.	The capacitor under test should be held in the flame in the position which best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec. Length of flame : 12±1mm Gas burner : Length 35mm min. Inside Dia. 0.5±0.1mm Outside Dia. 0.9mm max. Gas : Butane gas Purity 95% min. 																											
19	Temperature and Immersion Cycle	Appearance	No marked defect	The capacitor should be subjected to 5 temperature cycles, then consecutively to 2 immersion cycles. <Temperature Cycle> <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>125+3/-0</td><td>30</td></tr><tr><td>4</td><td>Room temp.</td><td>3</td></tr></table> Cycle time: 5 cycle <Immersion Cycle> <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> Cycle time: 2 cycle Pre-treatment: Capacitor should be stored at 85±2°C for 1 hr., then placed at *2room condition for 24±2 hrs. Post-treatment: Capacitor should be stored for 24±2 hrs. at *2room condition.	Step	Temperature (°C)	Time (min.)	1	-25+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
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	I.R.	3000MΩ min.																													
	Dielectric Strength	Per Item 6																													

^{*1} "C" expresses nominal capacitance value (pF).

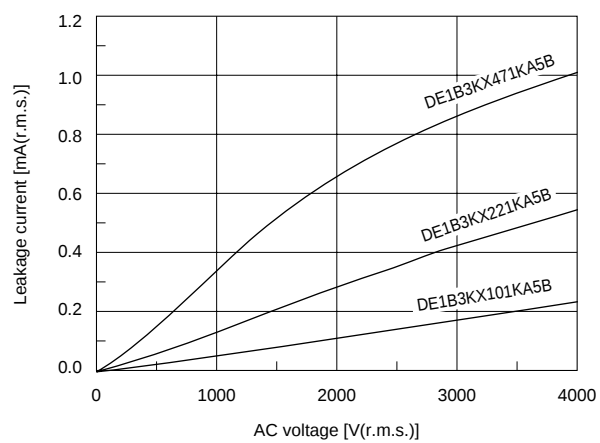
^{*2} "room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Type KY/KH/KX are recognized by UL1414 6th edition and CSA E384-14.

"Discharge Test" that was compulsory in previous safety standards(*) is not specified in new safety standards. (* UL1414 5th edition and CSA C22.2 No.1)
Therefore the description of "Discharge Test" is deleted in this catalog.

Type KX (B char.)

AC voltage : 60Hz
Temperature : 25°C



Type KX (E char.)

AC voltage : 60Hz
Temperature : 25°C

