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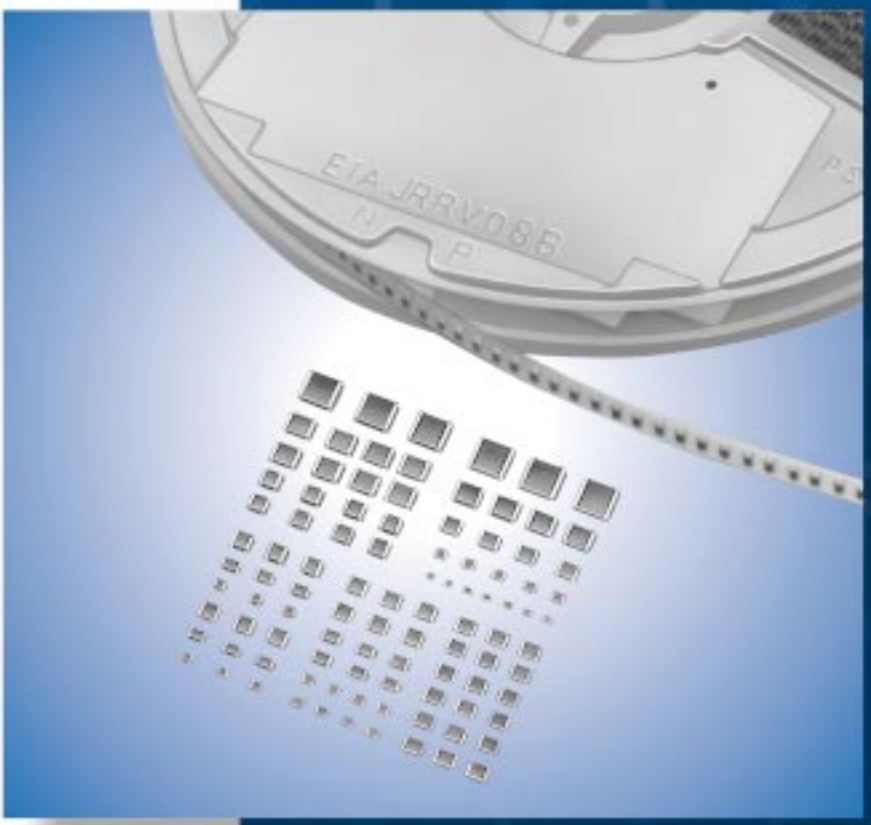
# Chip Monolithic Ceramic Capacitors



Innovator in Electronics

Murata
Manufacturing Co., Ltd.

Cat.No.C02E-10

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- Please refer to "Specifications and Test Methods" at the end of each chapter of 5 – 17 .

## ● Part Numbering

### Chip Monolithic Ceramic Capacitors

(Part Number)

| GR | M | 18 | 8 | B1 | 1H | 102 | K | A01 | K |
|---|---|---|---|---|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ | ❻ | ❼ | ❽ | ❾ | ❿ |

❶Product ID

❷Series

| Product ID | Code | Series |
|---|---|---|
| GR | M | Tin Plated Layer |
| | 4 | Only for Information Devices / Tip & Ring |
| ER | F | High Frequency and high Power Type |
| | H | High Frequency and High Power Type (Ribbon Terminal) |
| | A | High Frequency Type |
| | D | High Frequency Type (Ribbon Terminal) |
| GQ | M | High Frequency for Flow/Reflow Soldering |
| GM | A | Monolithic Microchip |
| GN | M | Capacitor Array |
| LL | L | Low ESL Wide Width Type |
| GJ | M | High Frequency Low Loss Type Tin Plated Type |
| | 6 | High Frequency Low Loss Type |
| GA | 2 | for AC250V (r.m.s.) |
| | 3 | Safety Standard Recognized Type |
| GC | P | Automotive Soldering Electrode |
| | M | Automotive Tin Plated Layer |

❸Dimension (L×W)

| Code | Dimension (L×W) | EIA |
|---|---|---|
| 03 | 0.6×0.3 mm | 0201 |
| 05 | 0.5×0.5 mm | 0202 |
| 08 | 0.8×0.8 mm | 0303 |
| 11 | 1.25×1.0 mm | 0504 |
| 15 | 1.0×0.5 mm | 0402 |
| 18 | 1.6×0.8 mm | 0603 |
| 1D | 1.4×1.4 mm | |
| 1X | Depends on individual standards. | |
| 21 | 2.0×1.25 mm | 0805 |
| 22 | 2.8×2.8 mm | 1111 |
| 31 | 3.2×1.6 mm | 1206 |
| 32 | 3.2×2.5 mm | 1210 |
| 3X | Depends on individual standards. | |
| 42 | 4.5×2.0 mm | 1808 |
| 43 | 4.5×3.2 mm | 1812 |
| 52 | 5.7×2.8 mm | 2211 |
| 55 | 5.7×5.0 mm | 2220 |

❹Dimension (T)

| Code | Dimension (T) |
|---|---|
| 2 | 2-elements (Array Type) |
| 3 | 0.3 mm |
| 4 | 4-elements (Array Type) |
| 5 | 0.5 mm |
| 6 | 0.6 mm |
| 7 | 0.7 mm |
| 8 | 0.8 mm |
| 9 | 0.85 mm |
| A | 1.0 mm |
| B | 1.25 mm |
| C | 1.6 mm |
| D | 2.0 mm |
| E | 2.5 mm |
| F | 3.2 mm |
| M | 1.15 mm |
| N | 1.35 mm |
| R | 1.8 mm |
| S | 2.8 mm |
| Q | 1.5 mm |
| X | Depends on individual standards. |

With the array type GNM series, "Dimension(T)" indicates the number of elements.

Continued on the following page.

Continued from the preceding page.

❺Temperature Characteristics

| Code | Temperature Characteristics | Temperature Range | Capacitance Change or Temperature Coefficient | Operating Temperature Range |
|---|---|---|---|---|
| **1X** | SL | 20 to 85°C | +350 to -1000ppm/°C | -55 to 125°C |
| **2C** | CH | -55 to 125°C | 0±60ppm/°C | -55 to 125°C |
| **2P** | PH | -25 to 85°C | -150±60ppm/°C | -25 to 85°C |
| **2R** | RH | -25 to 85°C | -220±60ppm/°C | -25 to 85°C |
| **2S** | SH | -25 to 85°C | -330±60ppm/°C | -25 to 85°C |
| **2T** | TH | -25 to 85°C | -470±60ppm/°C | -25 to 85°C |
| **3C** | CJ | -55 to 125°C | 0±120ppm/°C | -55 to 125°C |
| **3P** | PJ | -25 to 85°C | -150±120ppm/°C | -25 to 85°C |
| **3R** | RJ | -25 to 85°C | -220±120ppm/°C | -25 to 85°C |
| **3S** | SJ | -25 to 85°C | -330±120ppm/°C | -25 to 85°C |
| **3T** | TJ | -25 to 85°C | -470±120ppm/°C | -25 to 85°C |
| **3U** | UJ | -25 to 85°C | -750±120ppm/°C | -25 to 85°C |
| **4C** | CK | -55 to 125°C | 0±250ppm/°C | -55 to 125°C |
| **5C** | C0G | -55 to 125°C | 0±30ppm/°C | -55 to 125°C |
| **6C** | C0H/CH *1 | -55 to 125°C | 0±60ppm/°C | -55 to 125°C |
| **6P** | P2H | -55 to 85°C | -150±60ppm/°C | -55 to 125°C |
| **6R** | R2H | -55 to 85°C | -220±60ppm/°C | -55 to 125°C |
| **6S** | S2H | -55 to 85°C | -330±60ppm/°C | -55 to 125°C |
| **6T** | T2H | -55 to 85°C | -470±60ppm/°C | -55 to 125°C |
| **7C** | CJ *1 | -55 to 125°C | 0±120ppm/°C | -55 to 125°C |
| **7U** | U2J | -55 to 85°C | -750±120ppm/°C | -55 to 125°C |
| **8C** | CK *1 | -55 to 125°C | 0±250ppm/°C | -55 to 125°C |
| **B1** | B *2 | -25 to 85°C | ±10% | -25 to 85°C |
| **B3** | B | -25 to 85°C | ±10% | -25 to 85°C |
| **E4** | Z5U | 10 to 85°C | +22, -56% | 10 to 85°C |
| **F1** | F *2 | -25 to 85°C | +30, -80% | -25 to 85°C |
| **F5** | Y5V | -30 to 85°C | +22, -82% | -30 to 85°C |
| **R1** | R *2 | -55 to 125°C | ±15% | -55 to 125°C |
| **R3** | R | -55 to 125°C | ±15% | -55 to 125°C |
| **R6** | X5R | -55 to 85°C | ±15% | -55 to 85°C |
| **R7** | X7R | -55 to 125°C | ±15% | -55 to 125°C |
| **C8** | X6S | -55 to 105°C | ±22% | -55 to 105°C |
| **9E** | ZLM | -25 to 20°C | -4700+100/-2500ppm/°C | -25 to 85°C |
| | | 20 to 85°C | -4700+500/-1000ppm/°C | |

*1 ER series only.
*2 Add 50% of the rated voltage.

Continued on the following page.

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❻Rated Voltage

| Code | Rated Voltage |
|---|---|
| **0G** | DC4V |
| **0J** | DC6.3V |
| **1A** | DC10V |
| **1C** | DC16V |
| **1E** | DC25V |
| **1H** | DC50V |
| **2A** | DC100V |
| **2D** | DC200V |
| **2E** | DC250V |
| **YD** | DC300V |
| **2H** | DC500V |
| **2J** | DC630V |
| **3A** | DC1kV |
| **3D** | DC2kV |
| **3F** | DC3.15kV |
| **E2** | AC250V |
| **GB** | X2; AC250V (Safety Standard Recognized Type GB) |
| **GC** | X1, Y2; AC250V (Safety Standard Recognized Type GC) |
| **GD** | Y3; AC250V (Safety Standard Recognized Type GD) |
| **GF** | Y2; AC250V (Safety Standard Recognized Type GF) |

❼Capacitance

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.

Ex.)

| Code | Capacitance |
|---|---|
| **R50** | 0.5pF |
| **1R0** | 1.0pF |
| **100** | 10pF |
| **103** | 10000pF |

❽Capacitance Tolerance

| Code | Capacitance Tolerance | TC | Series | Capacitance Step | |
|---|---|---|---|---|---|
| **B** | ±0.1pF | CΔ | **GJM** | ≦5pF | E24 Series,1pF |
| **C** | ±0.25pF | CΔ–SL | **GRM/ERF/ERH/ERA/ERD/GQM** | ≦5pF | * 1pF |
| | | CΔ | **GJM** | <10pF | E24 Series,1pF |
| **D** | ±0.5pF | CΔ–SL | **GRM** | 6.0 to 9.0pF | * 1pF |
| | | CΔ | **ERF/ERH/ERA/ERD/GQM/GJM** | 5.1 to 9.1pF | E24 Series |
| **G** | ±2% | CΔ | **GJM** | ≧10pF | E12 Series |
| | | CΔ | **GQM** | ≧10pF | E24 Series |
| **J** | ±5% | CΔ–SL | **GRM/GA3** | ≧10pF | E12 Series |
| | | CΔ | **ERF/ERH/ERA/ERD/GQM/GJM** | ≧10pF | E24 Series |
| **K** | ±10% | B,R,X7R,X5R,ZLM | **GRM/GA3** | E6 Series | |
| | | | **GR4** | E12 Series | |
| **M** | ±20% | Z5U | **GRM** | E3 Series | |
| | | B,R,X7R | **GMA/LLL** | E6 Series | |
| | | X7R | **GA2** | E3 Series | |
| **Z** | +80%, -20% | F,Y5V | **GRM** | E3 Series | |
| **R** | Depends on individual standards. | | | | |

***** E24 series is also available.

❾Individual Specification Code

| Code | Series | Individual Specification | Temperature Characteristics Type *4 | Inner Electrode | Undercoat Metal of Outer Electrode |
|---|---|---|---|---|---|
| **A01** | **GRM** *1 | Standard Type | TC | Base Metal | Base Metal |
| | **GRM** *1/**LLL**/**GNM** | | HiK | | |
| **A11** | **GRM** *1 | Special Dimension Type (Tolerances of L×W×T are ±0.15mm) | HiK | Base Metal | Base Metal |
| **A12** | **GRM** *1 | Special Characteristics (Applied Voltage is ×1.25 of Rated Voltage at High Temperature Load Test) | HiK | Base Metal | Base Metal |
| **A35/A39** | **GRM** *1 | Special Dimension Type | HiK | Base Metal | Base Metal |

Continued on the following page.

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| Code | Series | Individual Specification | Temperature Characteristics Type *4 | Inner Electrode | Undercoat Metal of Outer Electrode |
|---|---|---|---|---|---|
| **A61/A88/A92/A93** | **GRM** *1 | Special Characteristics (Under special control) | HiK | Base Metal | Base Metal |
| **B01** | **GJM/GQM** | Standard Type | TC | Base Metal (Cu) | Base Metal |
| **C01** | **GRM** *1 | Standard Type | HiK | Base Metal | Precious Metal |
| **C11** | **GRM** *1 | Special Dimension Type (Tolerances of L×W are ±0.2mm, others) | HiK | Base Metal | Precious Metal |
| **C12** | **GRM** *1 | Special Dimension Type (Length is 3.2±0.2, Width is 1.6±0.2mm, Thickness is 1.2 ±0.1mm) | HiK | Base Metal | Precious Metal |
| **D01** | **ERA/ERD/ERF/ERH** | Standard Type (Non-coated type for ERH series) | TC | Precious Metal | Precious Metal |
| | **GRM** *1/**GNM** | | TC | | |
| | **GRM** *1/**GMA/LLL/GNM** | | HiK | | |
| **D02** | **ERH** | Standard Type (Coated with Resin) | TC | Precious Metal | Precious Metal |
| **DB4** | **GJM** | Special Dimension Type (Thickness is 0.25±0.05mm) | TC | Precious Metal | Precious Metal |
| **E01** | **GRM** *1 | Standard Type (Thin Layer Large Capacitance Type) | HiK | Base Metal | Base Metal |
| **E19/E34** | **GRM** *1 | Special Characteristics (Under Special Control) | HiK | Base Metal | Base Metal |
| **E20** | **GRM** *1 | Special Dimension Type | HiK | Base Metal | Base Metal |
| **E39** | **GRM** *1 | Special Dimension Type | HiK | Base Metal | Base Metal |
| **V01** | **GRM** *2 | Standard Type (New Ceramic Material) | TC | Precious Metal | Precious Metal |
| **W01** | **GRM** *3/**GR4/GA2/GA3** | Tolerance of Thickness is +0/-0.3mm | HiK | Base Metal | Base Metal |
| | **GRM** *3 | | TC | | |
| **W02** | **GA3** | Tolerance of Thickness is ±0.2mm | HiK | Base Metal | Base Metal |
| **W03** | **GRM** *3 | Tolerance of Thickness is ±0.2mm | HiK | Base Metal | Base Metal |
| **W07** | **GRM** *3 | Tolerance of Thickness is ±0.1mm | HiK | Base Metal | Base Metal |
| **Y01** | **GRM** *3 | Tolerance of Thickness is +0/-0.3mm | TC | Precious Metal | Precious Metal |
| | **GRM** *3 | | HiK | | |
| **Y02** | **GA3** | Tolerance of Thickness is ±0.3mm | HiK | Precious Metal | Precious Metal |
| | **GRM** *3/**GA3** | | TC | | |
| **Y06** | **GA3** | Thickness is 2.7±0.3mm | HiK | Precious Metal | Precious Metal |
| **Y21** | **GRM** *2 | Standard Type | TC | Precious Metal | Precious Metal |
| **Z01** | **GRM** *1 | Standard Type (New Ceramic Material) | TC | Precious Metal | Precious Metal |

***1** Apply to rated voltage 100V and under. ***2** Apply to rated voltage 200/500V. ***3** Apply to rated voltage 250V, 630V to 3.15kV.
***4** "TC" means Temperature Compensating Type and "HiK" means High Dielectric Type.

⓾Packaging

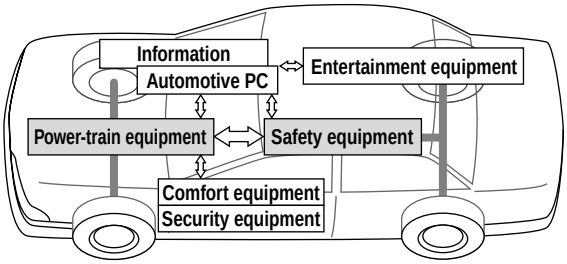
| Code | Packaging |
|---|---|
| **L** | ø178mm Plastic Taping |
| **D** | ø178mm Paper Taping |
| **K** | ø330mm Plastic Taping |
| **J** | ø330mm Paper Taping |
| **E** | ø178mm Special Packaging |
| **F** | ø330mm Special Packaging |
| **B** | Bulk |
| **C** | Bulk Case |
| **T** | Bulk Tray |

# Selection Guide of Chip Monolithic Ceramic Capacitors

**Start**

**Application**

- **General Electronics** → **Function and Circuit**
  - **Filtering**
    - **Synchronize Circuit**
    - **Oscillation Circuit**
      - Soldering Electrode C0G Char. **GRM_5C Series** 0.5pF–47000pF
      - Capacitor Arrays C0G Char. **GNM_5C Series** 10pF–360pF
    - **Temperature Compensation**
      - Soldering Electrode for temperature compensation **GRM_ Series** 0.5pF–47000pF
      - Capacitor Arrays for temperature compensation **GNM_5C Series** 10pF–360pF
  - **Bypassing**
    - **De-coupling**
      - Soldering Electrodes Y5V Char. **GRM_F5 Series** 2200pF–22μF
      - Microchip Y5V Char. **GMA_F5 Series** 4700pF–0.1μF
      - Capacitor Arrays Y5V Char. **GNM_F5 Series** 22000pF–0.15μF
      - Low-ESL Y5V Char. **LLL31_F5 Series** 0.22μF–1.0μF
  - **Coupling**
    - **Time Constant Circuits**
      - Soldering Electrode X5R/X7R Char. **GRM_R6,R7 Series** 220pF–10μF
      - Soldering Electrode C0G/C0H Char. **GRM_6C Series** 0.5pF–47000pF
      - Thin Layer Large-capacitance Type X5R Char. **GRM_R6 Series** 47000pF–100μF
      - Microchip **GMA_R7 Series** 470pF–10000pF
      - Capacitor Arrays **GNM Series** 390pF–1.0μF
      - Low-ESL **LLL Series** 2200pF–1.0μF
- **Specific Applications**
  - **High Frequency**
    - High-frequency/ High-power type Soldering Electrode **ERF Series** 0.75pF–1000pF
    - High-frequency/ High-Power Ribbon Terminal type **ERH Series** 0.75pF–1000pF
    - High-frequency type **ERA Series** 0.75pF–1000pF
    - High-frequency Ribbon Terminal type **ERD Series** 0.75pF–1000pF
    - High-frequency for flow/reflow soldering **GQM Series** 0.5pF–100pF
  - **Ultra Thin Circuit**
    - Thin type Soldering Electrode **GRM15X Series** 0.5pF–4700pF
    - **Low Dissipation**
      - **GJM Series** 0.5pF–18pF
    - **Ultrasonic Sensors**
      - ZLM Char. **GRM2199E Series** 1000pF/1500pF
  - **Medium Voltage**
    - 630V/1kV/2kV/3.15kV Low-dissipation **GRM Series** 10pF–1000pF
    - 250V/630V/1kV High-capacitance **GRM Series** 220pF–1μF
    - 2kV Only for Information Devices/Tip & Ring **GR4 Series** 100pF–4700pF
  - **Safety Standard Recognized**
    - AC250V which meet Japanese Law **GA2 Series** 470pF–0.1μF
    - UL/IEC Safety Standard Recognized **GA3 Series** 10pF–33000pF
  - **Automotive ( Power-train, Safety equipment )**
    - **GCMSeries*** 0.5pF–2.2μF




*For other automotive equipment such as comfort, security, information, entertainment, GRM series (for general electronics) are available.

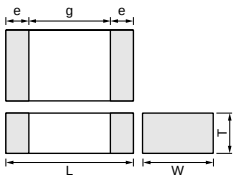
# Chip Monolithic Ceramic Capacitors



## for Flow/Reflow Soldering GRM15/18/21/31 Series

### ■ Features

1. Terminations are made of metal highly resistant to migration.
2. The GRM series is a complete line of chip ceramic capacitors in 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 500V ratings. These capacitors have temperature characteristics ranging from C0G to Y5V.
3. A wide selection of sizes is available, from the miniature LxWxT: 1.0x0.5x0.5mm to LxWxT: 3.2x1.6x1.15mm.
   GRM18, 21 and GRM31 types are suited to flow and reflow soldering.
   GRM15 type is applied to only reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
5. The GRM series is available in paper or plastic embossed tape and reel packaging for automatic placement. Bulk case packaging is also available for GRM15, GRM18 and GRM21.




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e | g min. |
| **GRM155** | 1.0 ±0.05 | 0.5 ±0.05 | 0.5 ±0.05 | 0.15 to 0.3 | 0.4 |
| **GRM188*** | 1.6 ±0.1 | 0.8 ±0.1 | 0.8 ±0.1 | 0.2 to 0.5 | 0.5 |
| **GRM216** | 2.0 ±0.1 | 1.25 ±0.1 | 0.6 ±0.1 | 0.2 to 0.7 | 0.7 |
| **GRM219** | | | 0.85 ±0.1 | | |
| **GRM21A** | | | 1.0 +0/-0.2 | | |
| **GRM21B** | | | 1.25 ±0.1 | | |
| **GRM316** | 3.2 ±0.15 | 1.6 ±0.15 | 0.6 ±0.1 | 0.3 to 0.8 | 1.5 |
| **GRM319** | | | 0.85 ±0.1 | | |
| **GRM31M** | | | 1.15 ±0.1 | | |
| **GRM31C** | 3.2 ±0.2 | 1.6 ±0.2 | 1.6 ±0.2 | | |

∗ Bulk Case : 1.6 ±0.07(L)×0.8 ±0.07(W)×0.8 ±0.07(T)

### ■ Applications

General electronic equipment

## Temperature Compensating Type GRM15 Series (1.0x0.5 mm) 50V/25V

| Part Number | **GRM15** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 1.00x0.50 [0402] | | | | | | | |
| TC | C0G (**5C**) | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 0.50pF(**R50**) | 0.50(**5**) | | | | | | | |
| 0.75pF(**R75**) | 0.50(**5**) | | | | | | | |
| 1.0pF(**1R0**) | 0.50(**5**) | | | | | | | |
| 2.0pF(**2R0**) | 0.50(**5**) | | | | | | | |
| 3.0pF(**3R0**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 4.0pF(**4R0**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 5.0pF(**5R0**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 6.0pF(**6R0**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 7.0pF(**7R0**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 8.0pF(**8R0**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 9.0pF(**9R0**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 10pF(**100**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 12pF(**120**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 15pF(**150**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 18pF(**180**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 22pF(**220**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 27pF(**270**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 33pF(**330**) | 0.50(**5**) | | 0.50(**5**) | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |

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| Part Number | GRM15 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 1.00x0.50 [0402] | | | | | | | |
| TC | C0G (**5C**) | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 39pF(**390**) | 0.50(**5**) | | | 0.50(**5**) | | | 0.50(**5**) | 0.50(**5**) |
| 47pF(**470**) | 0.50(**5**) | | | | 0.50(**5**) | | 0.50(**5**) | 0.50(**5**) |
| 56pF(**560**) | 0.50(**5**) | | | | 0.50(**5**) | | 0.50(**5**) | 0.50(**5**) |
| 68pF(**680**) | 0.50(**5**) | | | | 0.50(**5**) | | 0.50(**5**) | 0.50(**5**) |
| 82pF(**820**) | 0.50(**5**) | | | | 0.50(**5**) | | 0.50(**5**) | 0.50(**5**) |
| 100pF(**101**) | 0.50(**5**) | | | | 0.50(**5**) | | 0.50(**5**) | 0.50(**5**) |
| 120pF(**121**) | 0.50(**5**) | | | | 0.50(**5**) | | | 0.50(**5**) |
| 150pF(**151**) | 0.50(**5**) | | | | 0.50(**5**) | | | 0.50(**5**) |
| 180pF(**181**) | 0.50(**5**) | | | | 0.50(**5**) | | | 0.50(**5**) |
| 220pF(**221**) | 0.50(**5**) | | | | | 0.50(**5**) | | |
| 270pF(**271**) | 0.50(**5**) | | | | | 0.50(**5**) | | |
| 330pF(**331**) | 0.50(**5**) | | | | | 0.50(**5**) | | |
| 390pF(**391**) | 0.50(**5**) | | | | | 0.50(**5**) | | |
| 470pF(**471**) | 0.50(**5**) | | | | | | | |
| 560pF(**561**) | 0.50(**5**) | | | | | | | |
| 680pF(**681**) | 0.50(**5**) | | | | | | | |
| 820pF(**821**) | 0.50(**5**) | | | | | | | |
| 1000pF(**102**) | 0.50(**5**) | | | | | | | |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

## Temperature Compensating Type GRM18 Series (1.60x0.80 mm) 200V/100V/50V/25V

| Part Number | GRM18 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 1.60x0.80 [0603] | | | | | | | | | | | |
| TC | C0G (**5C**) | | | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 0.50pF(**R50**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | | | | | |
| 0.75pF(**R75**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | | | | | |
| 1.0pF(**1R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | | | | | |
| 2.0pF(**2R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | | | | | |
| 3.0pF(**3R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 4.0pF(**4R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 5.0pF(**5R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 6.0pF(**6R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 7.0pF(**7R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 8.0pF(**8R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 9.0pF(**9R0**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 10pF(**100**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) |
| 12pF(**120**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 15pF(**150**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 18pF(**180**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 22pF(**220**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 27pF(**270**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 33pF(**330**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 39pF(**390**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 47pF(**470**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |
| 56pF(**560**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | | | 0.80(**8**) | 0.80(**8**) |

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| Part Number | GRM18 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 1.60x0.80 [0603] | | | | | | | | | | | |
| TC | C0G (**5C**) | | | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 68pF(**680**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 82pF(**820**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 100pF(**101**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 120pF(**121**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 150pF(**151**) | | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 180pF(**181**) | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 220pF(**221**) | | 0.80(**8**) | 0.80(**8**) | | | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 270pF(**271**) | | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 330pF(**331**) | | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 390pF(**391**) | | 0.80(**8**) | 0.80(**8**) | | | | | 0.80(**8**) | 0.80(**8**) | | 0.80(**8**) | 0.80(**8**) |
| 470pF(**471**) | | 0.80(**8**) | 0.80(**8**) | | | | | | 0.80(**8**) | | | 0.80(**8**) |
| 560pF(**561**) | | 0.80(**8**) | 0.80(**8**) | | | | | | 0.80(**8**) | | | 0.80(**8**) |
| 680pF(**681**) | | | 0.80(**8**) | | | | | | 0.80(**8**) | | | 0.80(**8**) |
| 820pF(**821**) | | | 0.80(**8**) | | | | | | | 0.80(**8**) | | |
| 1000pF(**102**) | | | 0.80(**8**) | | | | | | | 0.80(**8**) | | |
| 1200pF(**122**) | | | 0.80(**8**) | | | | | | | 0.80(**8**) | | |
| 1500pF(**152**) | | | 0.80(**8**) | | | | | | | 0.80(**8**) | | |
| 1800pF(**182**) | | | 0.80(**8**) | | | | | | | | | |
| 2200pF(**222**) | | | 0.80(**8**) | | | | | | | | | |
| 2700pF(**272**) | | | 0.80(**8**) | | | | | | | | | |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

## Temperature Compensating Type GRM21 Series (2.00x1.25 mm) 200V/100V/50V/25V

| Part Number | GRM21 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 2.00x1.25 [0805] | | | | | | | | | | | | |
| TC | C0G (**5C**) | | | C0H (**6C**) | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | |
| 12pF(**120**) | 0.85(**9**) | | | | | | | | | | | | |
| 15pF(**150**) | 0.85(**9**) | | | | | | | | | | | | |
| 18pF(**180**) | 0.85(**9**) | | | | | | | | | | | | |
| 22pF(**220**) | 0.85(**9**) | | | | | | | | | | | | |
| 27pF(**270**) | 0.85(**9**) | | | | | | | | | | | | |
| 33pF(**330**) | 0.85(**9**) | | | | | | | | | | | | |
| 39pF(**390**) | 0.85(**9**) | | | | | | | | | | | | |
| 47pF(**470**) | 0.85(**9**) | | | | | | | | | | | | |
| 56pF(**560**) | 0.85(**9**) | | | | | | | | | | | | |
| 68pF(**680**) | 1.25(**B**) | 0.85(**9**) | | | | | | | | | | | |
| 82pF(**820**) | 1.25(**B**) | 0.85(**9**) | | | | | | | | | | | |
| 100pF(**101**) | 1.25(**B**) | 0.60(**6**) | | | | | | | | | | | |
| 120pF(**121**) | 1.25(**B**) | 0.60(**6**) | | | | | | 0.85(**9**) | | | | | |
| 150pF(**151**) | 1.25(**B**) | 0.60(**6**) | | | | | | 1.25(**B**) | | | | | |
| 180pF(**181**) | 1.25(**B**) | 0.60(**6**) | | | 0.85(**9**) | | | 1.25(**B**) | | | | | |
| 220pF(**221**) | 1.25(**B**) | 0.60(**6**) | | | 0.85(**9**) | 0.85(**9**) | | 1.25(**B**) | | | | | |
| 270pF(**271**) | | 0.60(**6**) | | | 0.85(**9**) | 0.85(**9**) | 0.85(**9**) | 1.25(**B**) | | | | | |
| 330pF(**331**) | | 0.60(**6**) | | | 0.85(**9**) | 0.85(**9**) | 0.85(**9**) | 1.25(**B**) | | | | | |
| 390pF(**391**) | | 0.60(**6**) | | | 1.25(**B**) | 0.85(**9**) | 0.85(**9**) | 1.25(**B**) | | | | | |

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| Part Number | GRM21 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 2.00x1.25 [0805] | | | | | | | | | | | | |
| TC | C0G (**5C**) | | | C0H (**6C**) | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | |
| 470pF(**471**) | | 0.60(**6**) | | | 1.25(**B**) | 0.85(**9**) | 0.85(**9**) | 1.25(**B**) | 0.85(**9**) | | | | |
| 560pF(**561**) | | 0.60(**6**) | | | 1.25(**B**) | 1.25(**B**) | 1.25(**B**) | | 0.85(**9**) | | | 1.25(**B**) | |
| 680pF(**681**) | | 0.85(**9**) | | | | 1.25(**B**) | 1.25(**B**) | | 0.85(**9**) | | | 1.25(**B**) | |
| 820pF(**821**) | | 0.85(**9**) | | | | | 1.25(**B**) | | 1.25(**B**) | 0.60(**6**) | | 1.25(**B**) | 0.60(**6**) |
| 1000pF(**102**) | | 0.85(**9**) | | | | | | | 1.25(**B**) | 0.60(**6**) | | 1.25(**B**) | 0.60(**6**) |
| 1200pF(**122**) | | | | | | | | | 1.25(**B**) | 0.60(**6**) | | 1.25(**B**) | 0.60(**6**) |
| 1500pF(**152**) | | | | | | | | | 1.25(**B**) | 0.85(**9**) | | 1.25(**B**) | 0.85(**9**) |
| 1800pF(**182**) | | | 0.60(**6**) | | | | | | 1.25(**B**) | 0.85(**9**) | | 1.25(**B**) | 0.85(**9**) |
| 2200pF(**222**) | | | 0.60(**6**) | | | | | | | 0.85(**9**) | | | 0.85(**9**) |
| 2700pF(**272**) | | | 0.60(**6**) | 1.25(**B**) | | | | | | 1.25(**B**) | | | 1.25(**B**) |
| 3300pF(**332**) | | | 0.60(**6**) | 1.25(**B**) | | | | | | 1.25(**B**) | | | 1.25(**B**) |
| 3900pF(**392**) | | | 0.60(**6**) | 1.25(**B**) | | | | | | | 0.85(**9**) | | |
| 4700pF(**472**) | | | 0.60(**6**) | | | | | | | | 0.85(**9**) | | |
| 5600pF(**562**) | | | 0.85(**9**) | | | | | | | | 1.25(**B**) | | |
| 6800pF(**682**) | | | 0.85(**9**) | | | | | | | | 1.25(**B**) | | |
| 8200pF(**822**) | | | 0.85(**9**) | | | | | | | | | | |
| 10000pF(**103**) | | | 0.85(**9**) | | | | | | | 0.60(**6**) | | | 0.60(**6**) |
| 12000pF(**123**) | | | | | | | | | | 0.60(**6**) | | | 0.60(**6**) |
| 15000pF(**153**) | | | | | | | | | | 0.60(**6**) | | | 0.60(**6**) |
| 18000pF(**183**) | | | | | | | | | | 0.60(**6**) | | | 0.60(**6**) |
| 22000pF(**223**) | | | | | | | | | | 0.85(**9**) | | | 0.85(**9**) |
| 27000pF(**273**) | | | | | | | | | | 0.85(**9**) | | | 0.85(**9**) |
| 33000pF(**333**) | | | | | | | | | | 1.00(**A**) | | | 1.00(**A**) |
| 39000pF(**393**) | | | | | | | | | | 1.25(**B**) | | | 1.25(**B**) |
| 47000pF(**473**) | | | | | | | | | | 1.25(**B**) | | | 1.25(**B**) |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

## Temperature Compensating Type GRM31 Series (3.20x1.60 mm) 500V/200V/100V/50V/25V

| Part Number | GRM31 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 3.20x1.60 [1206] | | | | | | | | | | | | | |
| TC | C0G (**5C**) | | | | C0H (**6C**) | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 500 (**2H**) | 200 (**2D**) | 50 (**1H**) | 25 (**1E**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | |
| 1.0pF(**1R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 2.0pF(**2R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 3.0pF(**3R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 4.0pF(**4R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 5.0pF(**5R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 6.0pF(**6R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 7.0pF(**7R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 8.0pF(**8R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 9.0pF(**9R0**) | 1.15(**M**) | | | | | | | | | | | | | |
| 10pF(**100**) | 1.15(**M**) | | | | | | | | | | | | | |
| 12pF(**120**) | 1.15(**M**) | | | | | | | | | | | | | |
| 15pF(**150**) | 1.15(**M**) | | | | | | | | | | | | | |
| 18pF(**180**) | 1.15(**M**) | | | | | | | | | | | | | |
| 22pF(**220**) | 1.15(**M**) | | | | | | | | | | | | | |

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| Part Number | GRM31 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W [EIA] | 3.20x1.60 [1206] | | | | | | | | | | | | | |
| TC | C0G (**5C**) | | | | C0H (**6C**) | P2H (**6P**) | R2H (**6R**) | S2H (**6S**) | SL (**1X**) | | | | T2H (**6T**) | U2J (**7U**) |
| Rated Volt. | 500 (**2H**) | 200 (**2D**) | 50 (**1H**) | 25 (**1E**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | |
| 27pF(**270**) | 1.15(**M**) | | | | | | | | | | | | | |
| 33pF(**330**) | 1.15(**M**) | | | | | | | | | | | | | |
| 39pF(**390**) | 1.15(**M**) | | | | | | | | | | | | | |
| 47pF(**470**) | 1.15(**M**) | | | | | | | | | | | | | |
| 56pF(**560**) | 1.15(**M**) | | | | | | | | | | | | | |
| 68pF(**680**) | 1.15(**M**) | | | | | | | | | | | | | |
| 82pF(**820**) | 1.15(**M**) | | | | | | | | | | | | | |
| 270pF(**271**) | | 1.15(**M**) | | | | | | | | | | | | |
| 330pF(**331**) | | 1.15(**M**) | | | | | | | | | | | | |
| 390pF(**391**) | | 1.15(**M**) | | | | | | | | | | | | |
| 470pF(**471**) | | 1.15(**M**) | | | | | | | | | | | | |
| 560pF(**561**) | | | | | | | | | 1.15(**M**) | | | | | |
| 680pF(**681**) | | | | | | 0.85(**9**) | | | 1.15(**M**) | | | | | |
| 820pF(**821**) | | | | | | 0.85(**9**) | 0.85(**9**) | | 1.15(**M**) | | | | | |
| 1000pF(**102**) | | | | | | 1.15(**M**) | 1.15(**M**) | 0.85(**9**) | 1.15(**M**) | | | | | |
| 1200pF(**122**) | | | | | | 1.15(**M**) | 1.15(**M**) | 1.15(**M**) | 1.15(**M**) | | | | | |
| 1500pF(**152**) | | | | | | 1.15(**M**) | 1.15(**M**) | 1.15(**M**) | | | | | | |
| 1800pF(**182**) | | | | | | | | 1.15(**M**) | | | | | | |
| 2200pF(**222**) | | | | | | | | | | 1.15(**M**) | | | 1.15(**M**) | |
| 2700pF(**272**) | | | | | | | | | | 1.15(**M**) | | | 1.15(**M**) | |
| 3300pF(**332**) | | | | | | | | | | 1.15(**M**) | | | 1.15(**M**) | |
| 3900pF(**392**) | | | | | | | | | | 1.15(**M**) | 0.85(**9**) | | 1.15(**M**) | 0.85(**9**) |
| 4700pF(**472**) | | | | | | | | | | 1.15(**M**) | 0.85(**9**) | | | 0.85(**9**) |
| 5600pF(**562**) | | | 0.85(**9**) | | | | | | | | 0.85(**9**) | | | 0.85(**9**) |
| 6800pF(**682**) | | | 0.85(**9**) | | 0.85(**9**) | | | | | | 1.15(**M**) | | | 1.15(**M**) |
| 8200pF(**822**) | | | 0.85(**9**) | | 1.15(**M**) | | | | | | 1.15(**M**) | | | 1.15(**M**) |
| 10000pF(**103**) | | | 0.85(**9**) | | | | | | | | | 1.15(**M**) | | |
| 12000pF(**123**) | | | | | | | | | | | | 1.15(**M**) | | |
| 15000pF(**153**) | | | | | | | | | | | | 1.15(**M**) | | |
| 27000pF(**273**) | | | 0.85(**9**) | | | | | | | | | | | |
| 33000pF(**333**) | | | 0.85(**9**) | | | | | | | | | | | |
| 47000pF(**473**) | | | 1.15(**M**) | | | | | | | | | | | |
| 56000pF(**563**) | | | | | | | | | | | 0.85(**9**) | | | 0.85(**9**) |
| 68000pF(**683**) | | | | | | | | | | | 1.15(**M**) | | | 1.15(**M**) |
| 82000pF(**823**) | | | | | | | | | | | 1.15(**M**) | | | 1.15(**M**) |
| 0.10µF(**104**) | | | | 1.60(**C**) | | | | | | | 1.15(**M**) | | | 1.15(**M**) |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

## High Dielectric Constant Type X5R (R6) Characteristics

| TC | X5R (**R6**) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part Number | GRM15 | | GRM18 | | GRM21 | | GRM31 | |
| L x W [EIA] | 1.00x0.50 [0402] | | 1.60x0.80 [0603] | | 2.00x1.25 [0805] | | 3.20x1.60 [1206] | |
| Rated Volt. | 16 (**1C**) | 10 (**1A**) | 10 (**1A**) | 6.3 (**0J**) | 10 (**1A**) | 6.3 (**0J**) | 10 (**1A**) | 6.3 (**0J**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 68000pF(**683**) | | 0.50(**5**) | | | | | | |
| 0.10µF(**104**) | 0.50(**5**) | 0.50(**5**) | | | | | | |
| 0.33µF(**334**) | | | 0.80(**8**) | | | | | |

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| TC | X5R (**R6**) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Part Number | **GRM15** | | **GRM18** | | **GRM21** | | **GRM31** | |
| L x W [EIA] | 1.00x0.50 [0402] | | 1.60x0.80 [0603] | | 2.00x1.25 [0805] | | 3.20x1.60 [1206] | |
| Rated Volt. | 16 (**1C**) | 10 (**1A**) | 10 (**1A**) | 6.3 (**0J**) | 10 (**1A**) | 6.3 (**0J**) | 10 (**1A**) | 6.3 (**0J**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 0.47µF(**474**) | | | 0.80(**8**) | | | | | |
| 0.68µF(**684**) | | | 0.80(**8**) | | | | | |
| 1.0µF(**105**) | | | 0.80(**8**) | 0.80(**8**) | 0.85(**9**) | | | |
| 1.5µF(**155**) | | | | | | 0.85(**9**) | | |
| 2.2µF(**225**) | | | | | 1.25(**B**) | 1.25(**B**) | 0.85(**9**) | |
| 3.3µF(**335**) | | | | | | 1.25(**B**) | 1.30(**X**) | |
| 4.7µF(**475**) | | | | | | 1.25(**B**) | 1.60(**C**) | 1.15(**M**) |
| 10µF(**106**) | | | | | | | 1.60(**C**) | 1.60(**C**) |

The part numbering code is shown in each ( ).
3.3µF and 4.7µF, 6.3V rated are GRM21 series of L: 2±0.15, W: 1.25±0.15, T: 1.25±0.15.
T: 1.15±0.1mm is also available for GRM31 1.0µF for 16V.
L: 3.2±0.2, W: 1.6±0.2 for GRM31 16V 1.0µF type. Also L: 3.2±0.2, W: 1.6±0.2, T: 1.15±0.15 for GRM31 16V 1.5µF and 2.2µF type.
Dimensions are shown in mm and Rated Voltage in Vdc.

## High Dielectric Constant Type X7R (R7) Characteristics

| TC | X7R (**R7**) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part Number | **GRM15** | | | | **GRM18** | | | | | **GRM21** | | | | **GRM31** | | | | |
| L x W [EIA] | 1.00x0.50 [0402] | | | | 1.60x0.80 [0603] | | | | | 2.00x1.25 [0805] | | | | 3.20x1.60 [1206] | | | | |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | |
| 220pF (**221**) | 0.50 (**5**) | | | | | 0.80 (**8**) | | | | | | | | | | | | |
| 330pF (**331**) | 0.50 (**5**) | | | | | 0.80 (**8**) | | | | | | | | | | | | |
| 470pF (**471**) | 0.50 (**5**) | | | | | 0.80 (**8**) | | | | | | | | | | | | |
| 680pF (**681**) | 0.50 (**5**) | | | | | 0.80 (**8**) | | | | | | | | | | | | |
| 1000pF (**102**) | 0.50 (**5**) | | | | | 0.80 (**8**) | | | | | | | | | | | | |
| 1500pF (**152**) | 0.50 (**5**) | | | | | 0.80 (**8**) | | | | | | | | | | | | |
| 2200pF (**222**) | 0.50 (**5**) | | | | 0.80 (**8**) | 0.80 (**8**) | | | | | | | | | | | | |
| 3300pF (**332**) | 0.50 (**5**) | | | | 0.80 (**8**) | 0.80 (**8**) | | | | | | | | | | | | |
| 4700pF (**472**) | 0.50 (**5**) | | | | | 0.80 (**8**) | | | | 0.85 (**9**) | | | | | | | | |
| 6800pF (**682**) | | 0.50 (**5**) | | | | 0.80 (**8**) | | | | 0.85 (**9**) | | | | | | | | |
| 10000pF (**103**) | | 0.50 (**5**) | | | | 0.80 (**8**) | | | | 1.25 (**B**) | | | | | | | | |
| 15000pF (**153**) | | | 0.50 (**5**) | | | 0.80 (**8**) | | | | | | | | | | | | |
| 22000pF (**223**) | | | 0.50 (**5**) | | | 0.80 (**8**) | | | | | | | | | | | | |
| 33000pF (**333**) | | | | 0.50 (**5**) | | 0.80 (**8**) | 0.80 (**8**) | | | | 0.85 (**9**) | | | 1.15 (**M**) | | | | |

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| TC | X7R (**R7**) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part Number | **GRM15** | | | | **GRM18** | | | | | **GRM21** | | | | **GRM31** | | | | | |
| L x W [EIA] | 1.00x0.50 [0402] | | | | 1.60x0.80 [0603] | | | | | 2.00x1.25 [0805] | | | | 3.20x1.60 [1206] | | | | | |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | | |
| 47000pF (**473**) | | | | 0.50 (**5**) | | 0.80 (**8**) | 0.80 (**8**) | | | | 1.25 (**B**) | | | 1.15 (**M**) | | | | | |
| 68000pF (**683**) | | | | | | 0.80 (**8**) | 0.80 (**8**) | | | | 1.25 (**B**) | | | | | | | | |
| 0.10µF (**104**) | | | 0.50 (**5**) | 0.50 (**5**) | | 0.80 (**8**) | 0.80 (**8**) | 0.80 (**8**) | | | 1.25 (**B**) | 1.25 (**B**) | | | | | | | |
| 0.15µF (**154**) | | | | | | | 0.80 (**8**) | | 0.80 (**8**) | | 1.25 (**B**) | 1.25 (**B**) | | | | | | | |
| 0.22µF (**224**) | | | | | | | | 0.80 (**8**) | 0.80 (**8**) | | 1.25 (**B**) | 0.85 (**9**) | | | | | | | |
| 0.33µF (**334**) | | | | | | | | | | | 0.85 (**9**) | 1.25 (**B**) | | | 0.85 (**9**) | | | | |
| 0.47µF (**474**) | | | | | | | | | | | 1.25 (**B**) | 1.25 (**B**) | 0.85 (**9**) | | 1.15 (**M**) | | | | |
| 0.68µF (**684**) | | | | | | | | | | | | | 0.85 (**9**) | | | 0.85 (**9**) | | | |
| 1.0µF (**105**) | | | | | | | | | | | | | 1.25 (**B**) | | 1.15 (**M**) | 1.15 (**M**) | 0.85 (**9**) | 0.85 (**9**) | |
| 1.5µF (**155**) | | | | | | | | | | | | | | | 1.60 (**C**) | | 1.15 (**M**) | | |
| 2.2µF (**225**) | | | | | | | | | | | | | | | 1.60 (**C**) | | 1.15 (**M**) | 0.85 (**9**) | |
| 3.3µF (**335**) | | | | | | | | | | | | | | | | 1.60 (**C**) | | | |
| 4.7µF (**475**) | | | | | | | | | | | | | | | | 1.60 (**C**) | | | |

The part numbering code is shown in each ( ).
The tolerance will be changed to L: 3.2±0.2, W: 1.6±0.2 for GRM31 16V 1.0µF type. Also L: 3.2±0.2, W: 1.6±0.2, T: 1.15±0.15 for GRM31 16V 1.5µF and 2.2µF type.
Dimensions are shown in mm and Rated Voltage in Vdc.

## High Dielectric Constant Type Y5V (F5) Characteristics

| TC | Y5V (**F5**) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part Number | **GRM15** | | | **GRM18** | | | | | **GRM21** | | | | | **GRM31** | | | | |
| L x W [EIA] | 1.00x0.50 [0402] | | | 1.60x0.80 [0603] | | | | | 2.00x1.25 [0805] | | | | | 3.20x1.60 [1206] | | | | |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 6.3 (**0J**) | |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | |
| 2200pF (**222**) | 0.50 (**5**) | | | | | | | | | | | | | | | | | |
| 4700pF (**472**) | 0.50 (**5**) | | | 0.80 (**8**) | | | | | | | | | | | | | | |
| 10000pF (**103**) | 0.50 (**5**) | | | | 0.80 (**8**) | | | | | | | | | | | | | |
| 22000pF (**223**) | | 0.50 (**5**) | | | 0.80 (**8**) | | | | | | | | | | | | | |
| 47000pF (**473**) | | | 0.50 (**5**) | | 0.80 (**8**) | | | | | | | | | | | | | |
| 0.10µF (**104**) | | 0.50 (**5**) | 0.50 (**5**) | | 0.80 (**8**) | 0.80 (**8**) | | | 0.85 (**9**) | | | | | | | | | |

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| TC | Y5V (**F5**) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part Number | **GRM15** | | | **GRM18** | | | | | **GRM21** | | | | **GRM31** | | | | |
| L x W [EIA] | 1.00x0.50 [0402] | | | 1.60x0.80 [0603] | | | | | 2.00x1.25 [0805] | | | | 3.20x1.60 [1206] | | | | |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 6.3 (**0J**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | |
| 0.22µF (**224**) | | | | | | | 0.80 (**8**) | | 1.25 (**B**) | 0.85 (**9**) | | | | | | | |
| 0.47µF (**474**) | | | | | | | 0.80 (**8**) | 0.80 (**8**) | | 1.25 (**B**) | | | 1.15 (**M**) | | | | |
| 1.0µF (**105**) | | | | | | | 0.80 (**8**) | 0.80 (**8**) | | 0.85 (**9**) | 0.85 (**9**) | 0.85 (**9**) | | 1.15 (**M**) | 0.85 (**9**) | | |
| 2.2µF (**225**) | | | | | | | | | | 1.25 (**B**) | 1.25 (**B**) | 1.25 (**B**) | | | 1.15 (**M**) | 0.85 (**9**) | |
| 4.7µF (**475**) | | | | | | | | | | | | 1.25 (**B**) | | 1.15 (**M**) | 1.15 (**M**) | 1.15 (**M**) | |
| 10µF (**106**) | | | | | | | | | | | | | | 1.60 (**C**) | | 1.15 (**M**) | 1.15 (**M**) |

The part numbering code is shown in each ( ).
T: 1.25±0.1mm is also available for GRM21 25V or 16V 1.0µF type.
Dimensions are shown in mm and Rated Voltage in Vdc.

## High Dielectric Constant Type Z5U (E4) Characteristics

| TC | Z5U (**E4**) | | |
|---|---|---|---|
| Part Number | **GRM18** | **GRM21** | **GRM31** |
| L x W [EIA] | 1.60x0.80 [0603] | 2.00x1.25 [0805] | 3.20x1.60 [1206] |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | |
| 10000pF(**103**) | 0.80(**8**) | | |
| 22000pF(**223**) | 0.80(**8**) | | |
| 47000pF(**473**) | | 0.60(**6**) | |
| 0.10µF(**104**) | | 0.85(**9**) | |
| 0.22µF(**224**) | | | 0.85(**9**) |

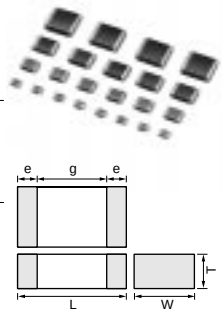
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

# Chip Monolithic Ceramic Capacitors

## for Reflow Soldering GRM32/43/55 Series



| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| **GRM329** | 3.2 ±0.3 | 2.5 ±0.2 | 0.85 ±0.1 | 0.3 | 1.0 |
| **GRM32M** | | | 1.15 ±0.1 | | |
| **GRM32N** | | | 1.35 ±0.15 | | |
| **GRM32R** | | | 1.8 ±0.2 | | |
| **GRM32E** | | | 2.5 ±0.2 | | |
| **GRM43M** | 4.5 ±0.4 | 3.2 ±0.3 | 1.15 ±0.1 | 0.3 | 2.0 |
| **GRM43N** | | | 1.35 ±0.15 | | |
| **GRM43R** | | | 1.8 ±0.2 | | |
| **GRM43D** | | | 2.0 ±0.2 | | |
| **GRM43E** | | | 2.5 ±0.2 | | |
| **GRM55M** | 5.7 ±0.4 | 5.0 ±0.4 | 1.15 ±0.1 | 0.3 | 2.0 |
| **GRM55N** | | | 1.35 ±0.15 | | |
| **GRM55C** | | | 1.6 ±0.2 | | |
| **GRM55R** | | | 1.8 ±0.2 | | |
| **GRM55D** | | | 2.0 ±0.2 | | |
| **GRM55E** | | | 2.5 ±0.2 | | |




### ■ Features

1. Terminations are made of metal highly resistant to migration.
2. The GRM series is a complete line of chip ceramic capacitors in 10V, 16V, 25V, 50V, 100V and 200V ratings.
   These capacitors have temperature characteristics ranging from C0G to Y5V.
3. This series consists of type LxWxT: 3.2x2.5x0.85mm to LxWxT: 5.7x5.0x2.5mm. These are suited to only reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
5. The GRM series is available in paper or plastic embossed tape and reel packaging for automatic placement.

### ■ Applications

General electronic equipment

## Temperature Compensating Type GRM32/43/55 Series

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM32N5C2D561JV01** | C0G (EIA) | 200 | 560 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM32N5C2D681JY21** | C0G (EIA) | 200 | 680 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM32N5C2D821JY21** | C0G (EIA) | 200 | 820 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM32N5C2D102JY21** | C0G (EIA) | 200 | 1000 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM43R5C2D122JV01** | C0G (EIA) | 200 | 1200 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM43R5C2D152JV01** | C0G (EIA) | 200 | 1500 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM43R5C2D182JY21** | C0G (EIA) | 200 | 1800 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM43R5C2D222JY21** | C0G (EIA) | 200 | 2200 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM43R5C2D272JY21** | C0G (EIA) | 200 | 2700 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM55N5C2D332JY21** | C0G (EIA) | 200 | 3300 ±5% | 5.70 | 5.00 | 1.35 |
| **GRM55R5C2D392JY21** | C0G (EIA) | 200 | 3900 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R5C2D472JY21** | C0G (EIA) | 200 | 4700 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R5C2D562JY21** | C0G (EIA) | 200 | 5600 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM32N1X2D152JV01** | SL (JIS) | 200 | 1500 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM43N1X2D182JV01** | SL (JIS) | 200 | 1800 ±5% | 4.50 | 3.20 | 1.35 |
| **GRM43N1X2D222JV01** | SL (JIS) | 200 | 2200 ±5% | 4.50 | 3.20 | 1.35 |
| **GRM43R1X2D272JV01** | SL (JIS) | 200 | 2700 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM43R1X2D332JV01** | SL (JIS) | 200 | 3300 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM43R1X2D392JV01** | SL (JIS) | 200 | 3900 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM55N1X2D472JV01** | SL (JIS) | 200 | 4700 ±5% | 5.70 | 5.00 | 1.35 |
| **GRM55R1X2D562JV01** | SL (JIS) | 200 | 5600 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R1X2D682JV01** | SL (JIS) | 200 | 6800 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R1X2D822JV01** | SL (JIS) | 200 | 8200 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM32N1X2A562JZ01** | SL (JIS) | 100 | 5600 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM32N1X2A682JZ01** | SL (JIS) | 100 | 6800 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM43N1X2A822JZ01** | SL (JIS) | 100 | 8200 ±5% | 4.50 | 3.20 | 1.35 |
| **GRM43R1X2A103JZ01** | SL (JIS) | 100 | 10000 ±5% | 4.50 | 3.20 | 1.80 |

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| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM43R1X2A123JZ01** | SL (JIS) | 100 | 12000 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM43R1X2A153JZ01** | SL (JIS) | 100 | 15000 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM55M1X2A183JZ01** | SL (JIS) | 100 | 18000 ±5% | 5.70 | 5.00 | 1.15 |
| **GRM55N1X2A223JZ01** | SL (JIS) | 100 | 22000 ±5% | 5.70 | 5.00 | 1.35 |
| **GRM55R1X2A273JZ01** | SL (JIS) | 100 | 27000 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R1X2A333JZ01** | SL (JIS) | 100 | 33000 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R1X2A393JZ01** | SL (JIS) | 100 | 39000 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM32N1X1H103JZ01** | SL (JIS) | 50 | 10000 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM32N1X1H123JZ01** | SL (JIS) | 50 | 12000 ±5% | 3.20 | 2.50 | 1.35 |
| **GRM43R1X1H153JZ01** | SL (JIS) | 50 | 15000 ±5% | 4.50 | 3.20 | 1.80 |
| **GRM55M1X1H183JZ01** | SL (JIS) | 50 | 18000 ±5% | 5.70 | 5.00 | 1.15 |
| **GRM55N1X1H223JZ01** | SL (JIS) | 50 | 22000 ±5% | 5.70 | 5.00 | 1.35 |
| **GRM55R1X1H273JZ01** | SL (JIS) | 50 | 27000 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R1X1H333JZ01** | SL (JIS) | 50 | 33000 ±5% | 5.70 | 5.00 | 1.80 |
| **GRM55R1X1H393JZ01** | SL (JIS) | 50 | 39000 ±5% | 5.70 | 5.00 | 1.80 |

## High Dielectric Constant Type Type GRM32 Series (3.20x2.50mm)

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM32ER61A106KC01** | X5R (EIA) | 10 | 10µF ±10% | 3.20 | 2.50 | 2.50 |
| **GRM32NR72A683KA01** | X7R (EIA) | 100 | 68000pF ±10% | 3.20 | 2.50 | 1.35 |
| **GRM32NR72A104KA01** | X7R (EIA) | 100 | 0.10µF ±10% | 3.20 | 2.50 | 1.35 |
| **GRM32ER72A105KA01** | X7R (EIA) | 100 | 1.0µF ±10% | 3.20 | 2.50 | 2.50 |
| **GRM32NR71H684KA01** | X7R (EIA) | 50 | 0.68µF ±10% | 3.20 | 2.50 | 1.35 |
| **GRM32RR71H105KA01** | X7R (EIA) | 50 | 1.0µF ±10% | 3.20 | 2.50 | 1.80 |
| **GRM32RR71E225KC01** | X7R (EIA) | 25 | 2.2µF ±10% | 3.20 | 2.50 | 1.80 |
| **GRM32MR71C225KC01** | X7R (EIA) | 16 | 2.2µF ±10% | 3.20 | 2.50 | 1.15 |
| **GRM32NR71C335KC01** | X7R (EIA) | 16 | 3.3µF ±10% | 3.20 | 2.50 | 1.35 |
| **GRM32RR71C475KC01** | X7R (EIA) | 16 | 4.7µF ±10% | 3.20 | 2.50 | 1.80 |
| **GRM32ER71H475KA88** | X7R (EIA) | 16 | 4.7µF ±10% | 3.20 | 2.50 | 2.50 |
| **GRM32NF52A104ZA01** | Y5V (EIA) | 100 | 0.10µF +80/-20% | 3.20 | 2.50 | 1.35 |
| **GRM32RF51H105ZA01** | Y5V (EIA) | 50 | 1.0µF +80/-20% | 3.20 | 2.50 | 1.8 |
| **GRM32DF51H106ZA01** | Y5V (EIA) | 50 | 10µF +80/-20% | 3.20 | 2.50 | 2.00 |
| **GRM329F51E475ZA01** | Y5V (EIA) | 25 | 4.7µF +80/-20% | 3.20 | 2.50 | 0.85 |
| **GRM32NF51E106ZA01** | Y5V (EIA) | 25 | 10µF +80/-20% | 3.20 | 2.50 | 1.35 |
| **GRM32NF51C106ZA01** | Y5V (EIA) | 16 | 10µF +80/-20% | 3.20 | 2.50 | 1.35 |

## High Dielectric Constant Type Type GRM43 Series (4.50x3.20mm)

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (µF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM43RR72A154KA01** | X7R (EIA) | 100 | 0.15 ±10% | 4.50 | 3.20 | 1.80 |
| **GRM43RR72A224KA01** | X7R (EIA) | 100 | 0.22 ±10% | 4.50 | 3.20 | 1.80 |
| **GRM43DR72A474KA01** | X7R (EIA) | 100 | 0.47 ±10% | 4.50 | 3.20 | 2.00 |
| **GRM43ER72A225KA01** | X7R (EIA) | 100 | 2.2 ±10% | 4.50 | 3.20 | 2.50 |
| **GRM43ER71H225KA01** | X7R (EIA) | 50 | 2.2 ±10% | 4.50 | 3.20 | 2.50 |

# High Dielectric Constant Type Type GRM55 Series (5.70x5.00mm)

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (μF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM55DR61H106KA01** | X5R (EIA) | 50 | 10.0 ±10% | 5.70 | 5.00 | 2.00 |
| **GRM55DR72A105KA01** | X7R (EIA) | 100 | 1.0 ±10% | 5.70 | 5.00 | 2.00 |
| **GRM55ER72A475KA01** | X7R (EIA) | 100 | 4.7 ±10% | 5.70 | 5.00 | 2.50 |
| **GRM55RR71H105KA01** | X7R (EIA) | 50 | 1.0 ±10% | 5.70 | 5.00 | 1.80 |
| **GRM55RR71H155KA01** | X7R (EIA) | 50 | 1.5 ±10% | 5.70 | 5.00 | 1.80 |
| **GRM55ER71H475KA01** | X7R (EIA) | 50 | 4.7 ±10% | 5.70 | 5.00 | 2.50 |
| **GRM55RF52A474ZA01** | Y5V (EIA) | 100 | 0.47 +80/-20% | 5.70 | 5.00 | 1.80 |

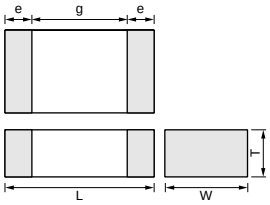
# Chip Monolithic Ceramic Capacitors

## Ultra-small GRM03 Series



### ■ Features

1. Small chip size (LxWxT: 0.6x0.3x0.3mm).
2. Terminations are made of metal highly resistant to migration.
3. GRM03 type is suited to only reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
5. GRM03 series are suited to miniature micro wave module, portable equipment and high frequency circuits.




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e | g min. |
| **GRM033** | 0.6 ±0.03 | 0.3 ±0.03 | 0.3 ±0.03 | 0.1 to 0.2 | 0.2 |

### ■ Applications

1. Miniature micro wave module
2. Portable equipment
3. High frequency circuit

| Part Number | **GRM03** | | | | |
|---|---|---|---|---|---|
| L x W | 0.6x0.3 | | | | |
| TC | C0G (**5C**) | X5R (**R6**) | X7R (**R7**) | | Y5V (**F5**) |
| Rated Volt. | 25 (**1E**) | 10 (**1A**) | 16 (**1C**) | 6.3 (**0J**) | 10 (**1A**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | |
| 0.50pF(**R50**) | 0.3(**3**) | | | | |
| 1.0pF(**1R0**) | 0.3(**3**) | | | | |
| 2.0pF(**2R0**) | 0.3(**3**) | | | | |
| 3.0pF(**3R0**) | 0.3(**3**) | | | | |
| 4.0pF(**4R0**) | 0.3(**3**) | | | | |
| 5.0pF(**5R0**) | 0.3(**3**) | | | | |
| 6.0pF(**6R0**) | 0.3(**3**) | | | | |
| 7.0pF(**7R0**) | 0.3(**3**) | | | | |
| 8.0pF(**8R0**) | 0.3(**3**) | | | | |
| 9.0pF(**9R0**) | 0.3(**3**) | | | | |
| 10pF(**100**) | 0.3(**3**) | | | | |
| 12pF(**120**) | 0.3(**3**) | | | | |
| 15pF(**150**) | 0.3(**3**) | | | | |
| 18pF(**180**) | 0.3(**3**) | | | | |
| 22pF(**220**) | 0.3(**3**) | | | | |
| 27pF(**270**) | 0.3(**3**) | | | | |
| 33pF(**330**) | 0.3(**3**) | | | | |
| 39pF(**390**) | 0.3(**3**) | | | | |
| 47pF(**470**) | 0.3(**3**) | | | | |
| 56pF(**560**) | 0.3(**3**) | | | | |
| 68pF(**680**) | 0.3(**3**) | | | | |
| 82pF(**820**) | 0.3(**3**) | | | | |
| 100pF(**101**) | 0.3(**3**) | | 0.3(**3**) | | |
| 150pF(**151**) | | | 0.3(**3**) | | |
| 220pF(**221**) | | | 0.3(**3**) | | |
| 330pF(**331**) | | | 0.3(**3**) | | |
| 470pF(**471**) | | | 0.3(**3**) | | |
| 680pF(**681**) | | | 0.3(**3**) | | |

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| Part Number | GRM03 | | | | |
|---|---|---|---|---|---|
| L x W | 0.6x0.3 | | | | |
| TC | C0G (**5C**) | X5R (**R6**) | X7R (**R7**) | | Y5V (**F5**) |
| Rated Volt. | 25 (**1E**) | 10 (**1A**) | 16 (**1C**) | 6.3 (**0J**) | 10 (**1A**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | |
| 1000pF(**102**) | | | 0.3(**3**) | | |
| 1500pF(**152**) | | 0.3(**3**) | | 0.3(**3**) | |
| 2200pF(**222**) | | 0.3(**3**) | | 0.3(**3**) | 0.3(**3**) |
| 3300pF(**332**) | | 0.3(**3**) | | 0.3(**3**) | |
| 4700pF(**472**) | | 0.3(**3**) | | 0.3(**3**) | 0.3(**3**) |
| 6800pF(**682**) | | 0.3(**3**) | | 0.3(**3**) | |
| 10000pF(**103**) | | 0.3(**3**) | | 0.3(**3**) | 0.3(**3**) |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

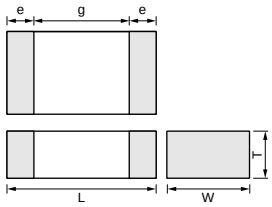
# Chip Monolithic Ceramic Capacitors

## Thin Type (Flow/Reflow)



■ Features

1. This series is suited to flow and reflow soldering. Capacitor terminations are made of metal highly resistant to migration.
2. Large capacitance values enable excellent bypass effects to be realized.
3. Its thin package makes this series ideally suited for the production of small electronic products and for mounting underneath ICs.




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e | g min. |
| **GRM15X** | 1.0 ±0.05 | 0.5 ±0.05 | 0.25 ±0.05 | 0.1 to 0.3 | 0.4 |

■ Applications

Thin equipment such as IC cards

### Temperature Compensating Type

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM15X5C1H1R0CDB4** | C0G (EIA) | 50 | 1.0 ±0.25pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H2R0CDB4** | C0G (EIA) | 50 | 2.0 ±0.25pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H3R0CDB4** | C0G (EIA) | 50 | 3.0 ±0.25pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H4R0CDB4** | C0G (EIA) | 50 | 4.0 ±0.25pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H5R0CDB4** | C0G (EIA) | 50 | 5.0 ±0.25pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H6R0DDB4** | C0G (EIA) | 50 | 6.0 ±0.5pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H7R0DDB4** | C0G (EIA) | 50 | 7.0 ±0.5pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H8R0DDB4** | C0G (EIA) | 50 | 8.0 ±0.5pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H9R0DDB4** | C0G (EIA) | 50 | 9.0 ±0.5pF | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H100JDB4** | C0G (EIA) | 50 | 10 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H120JDB4** | C0G (EIA) | 50 | 12 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H150JDB4** | C0G (EIA) | 50 | 15 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H180JDB4** | C0G (EIA) | 50 | 18 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H220JDB4** | C0G (EIA) | 50 | 22 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H270JDB4** | C0G (EIA) | 50 | 27 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H330JDB4** | C0G (EIA) | 50 | 33 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H390JDB4** | C0G (EIA) | 50 | 39 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H470JDB4** | C0G (EIA) | 50 | 47 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H560JDB4** | C0G (EIA) | 50 | 56 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H680JDB4** | C0G (EIA) | 50 | 68 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H820JDB4** | C0G (EIA) | 50 | 82 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1H101JDB4** | C0G (EIA) | 50 | 100 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1E121JDB4** | C0G (EIA) | 25 | 120 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1E151JDB4** | C0G (EIA) | 25 | 150 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1E181JDB4** | C0G (EIA) | 25 | 180 ±5% | 1.00 | 0.50 | 0.25 |
| **GRM15X5C1E221JDB4** | C0G (EIA) | 25 | 220 ±5% | 1.00 | 0.50 | 0.25 |

### High Dielectric Constant Type

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM15XR71H221KA86** | X7R (EIA) | 50 | 220 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71H331KA86** | X7R (EIA) | 50 | 330 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71H471KA86** | X7R (EIA) | 50 | 470 ±10% | 1.00 | 0.50 | 0.25 |

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| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM15XR71H681KA86** | X7R (EIA) | 50 | 680 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71H102KA86** | X7R (EIA) | 50 | 1000 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71H152KA86** | X7R (EIA) | 50 | 1500 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71E182KA86** | X7R (EIA) | 25 | 1800 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71E222KA86** | X7R (EIA) | 25 | 2200 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71C332KA86** | X7R (EIA) | 16 | 3300 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71C472KA86** | X7R (EIA) | 16 | 4700 ±10% | 1.00 | 0.50 | 0.25 |
| **GRM15XR71C682KA86** | X7R (EIA) | 16 | 6800 ±10% | 1.00 | 0.50 | 0.25 |

# GRM Series Specifications and Test Methods

| No. | Item | | Specifications | | Test Method |
|---|---|---|---|---|---|
| | | | Temperature Compensating Type | High Dielectric Type | |
| 1 | Operating Temperature | | −55 to +125℃ | R6 : −55 to +85℃<br>R7 : −55 to +125℃<br>E4 : +10 to +85℃<br>F5 : −30 to +85℃ | |
| 2 | Rated Voltage | | See the previous page. | | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range. |
| 3 | Appearance | | No defects or abnormalities | | Visual inspection |
| 4 | Dimensions | | Within the specified dimensions | | Using calipers on micrometer |
| 5 | Dielectric Strength | | No defects or abnormalities | | No failure should be observed when *300% of the rated voltage (C0Δ to U2J and SL) or *250% of the rated voltage (X5R, X7R, Z5U and Y5V) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. *200% for 500V |
| 6 | Insulation Resistance | | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging. |
| 7 | Capacitance | | Within the specified tolerance | | The capacitance/Q/D.F. should be measured at 25℃ at the frequency and voltage shown in the table. |
| 8 | Q/ Dissipation Factor (D.F.) | | 30pFmin. : Q≧1000<br>30pFmax. : Q≧400+20C<br>C : Nominal Capacitance (pF) | [R6, R7]<br>W.V. : 25Vmin. : 0.025max.<br>W.V. : 16/10V : 0.035max.<br>W.V. : 6.3V<br>0.05max.(C<3.3μF)<br>0.1max.(C≧3.3μF)<br>[E4]<br>W.V. : 25Vmin. : 0.025max.<br>[F5]<br>W.V. : 25Vmin.<br>: 0.05max.(C<0.10μF)<br>: 0.09max.(C≧0.10μF)<br>W.V. : 16V/10V : 0.125max.<br>W.V. : 6.3Vmax. : 0.15max. | |
| 9 | Capacitance Temperature Characteristics | Capacitance Change | Within the specified tolerance (Table A) | R6 : Within±15% (−55 to +85℃)<br>R7 : Within±15% (−55 to +125℃)<br>E4 : Within +22/−56% (+10 to +85℃)<br>F5 : Within +22/−82% (−30 to +85℃) | The capacitance change should be measured after 5 min. at each specified temperature stage.<br>(1) Temperature Compensating Type<br>The temperature coefficient is determined using the Capacitance measured in step 3 as a reference.<br>When cycling the temperature sequentially from step 1 through 5 (C0Δ : +25℃ to +125℃ : other temp. coeffs. : +25℃ to +85℃) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.<br>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3. |
| | | Temperature Coefficient | Within the specified tolerance (Table A) | — | |
| | | Capacitance Drift | Within ±0.2% or ±0.05pF (Whichever is larger.)<br>*Does not apply to 1X/25V | — | |

| Item \ Char. | Frequency | Voltage |
|---|---|---|
| ΔC to 7U, 1X (1000pF and below) | 1±0.1MHz | 0.5 to 5Vrms |
| ΔC to 7U, 1X (more than 1000pF) | 1±0.1kHz | 1±0.2Vrms |
| R6, R7, F5 (10μF and below) | 1±0.1kHz | 1±0.2Vrms |
| R6, R7, F5 (more than 10μF) | 120±24Hz | 0.5±0.1Vrms |
| E4 | 1±0.1kHz | 0.5±0.05Vrms |

| Step | Temperature(℃) |
|---|---|
| 1 | 25±2 |
| 2 | −55±3 (for ΔC to 7U/1X/R6/R7)<br>−30±3 (for F5)<br>10±3 (for E4) |
| 3 | 25±2 |
| 4 | 125±3 (for ΔC/R7)<br>85±3 (for other TC) |
| 5 | 25±2 |

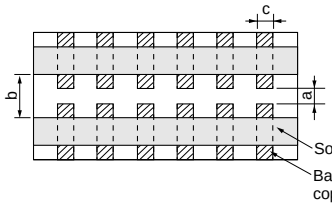
(2) High Dielectric Constant Type
The ranges of capacitance change compared with the above 25℃ value over the temperature ranges shown in the table should be within the specified ranges.

Continued on the following page.

# GRM Series Specifications and Test Methods

Continued from the preceding page.

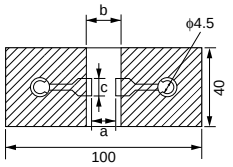
| No. | Item | | Specifications: Temperature Compensating Type | Specifications: High Dielectric Type | Test Method |
|---|---|---|---|---|---|
| 10 | Adhesive Strength of Termination | | No removal of the terminations or other defect should occur. | | Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N✻ force in parallel with the test jig for 10±1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. ✻2N (GR□03) 5N (GR□15, GRM18) |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |
| | | Capacitance | Within the specified tolerance | | |
| | | Q/D.F. | 30pFmin. : Q≧1000<br>30pFmax. : Q≧400+20C<br>C : Nominal Capacitance (pF) | [R6, R7]<br>W.V. : 25Vmin. : 0.025max.<br>W.V. : 16/10V : 0.035max.<br>W.V. : 6.3V :<br>0.05max. (C<3.3μF)<br>0.1max. (C≧3.3μF)<br>[E4]<br>W.V. : 25Vmin. : 0.025max.<br>[F5]<br>W.V. : 25Vmin.<br>: 0.05max. (C<0.10μF)<br>: 0.09max. (C≧0.10μF)<br>W.V. : 16V/10V : 0.125max.<br>W.V. : 6.3Vmax. : 0.15max. | |
| 12 | Deflection | | No crack or marked defect should occur. | | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |




| Type | a | b | c |
|---|---|---|---|
| GR□03 | 0.3 | 0.9 | 0.3 |
| GR□15 | 0.4 | 1.5 | 0.5 |
| GRM18 | 1.0 | 3.0 | 1.2 |
| GRM21 | 1.2 | 4.0 | 1.65 |
| GRM31 | 2.2 | 5.0 | 2.0 |
| GRM32 | 2.2 | 5.0 | 2.9 |
| GRM43 | 3.5 | 7.0 | 3.7 |
| GRM55 | 4.5 | 8.0 | 5.6 |

(in mm)

Fig. 1




t : 1.6mm (GR□03/15 : 0.8mm)

| Type | a | b | c |
|---|---|---|---|
| GR□03 | 0.3 | 0.9 | 0.3 |
| GR□15 | 0.4 | 1.5 | 0.5 |
| GRM18 | 1.0 | 3.0 | 1.2 |
| GRM21 | 1.2 | 4.0 | 1.65 |
| GRM31 | 2.2 | 5.0 | 2.0 |
| GRM32 | 2.2 | 5.0 | 2.9 |
| GRM43 | 3.5 | 7.0 | 3.7 |
| GRM55 | 4.5 | 8.0 | 5.6 |

(in mm)

Fig. 2

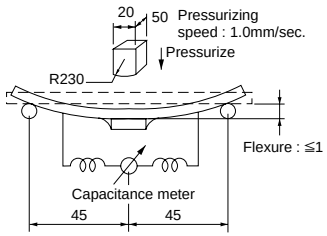



Fig. 3

Continued on the following page.

# GRM Series Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications: Temperature Compensating Type | Specifications: High Dielectric Type | Test Method |
|---|---|---|---|---|---|
| 13 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rin in weight proportion).<br>Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃. |
| 14 | Resistance to Soldering Heat | | The measured and observed characteristics should satisfy the specifications in the following table. | | Preheat the capacitor at 120 to 150℃ for 1 minute.<br>Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), then measure.<br><br>•Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for one hour and then let sit for 48±4 hours at room temperature.<br>Perform the initial measurement.<br><br>✻Preheating for GRM32/43/55<br>Step 1: 100℃ to 120℃, 1 min.<br>Step 2: 170℃ to 200℃, 1 min. |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | R6, R7 : Within ±7.5%<br>E4, F5 : Within ±20% | |
| | | Q/D.F. | 30pFmin. : Q≧1000<br>30pFmax. : Q≧400+20C<br>C : Nominal Capacitance (pF) | [R6, R7]<br>W.V. : 25Vmin. : 0.025max.<br>W.V. : 16/10V : 0.035max.<br>W.V. : 6.3V :<br>0.05max. (C<3.3μF)<br>0.1max. (C≧3.3μF)<br>[E4]<br>W.V. : 25Vmin. : 0.025max.<br>[F5]<br>W.V. : 25Vmin.<br>: 0.05max. (C<0.10μF)<br>: 0.09max. (C≧0.10μF)<br>W.V. : 16V/10V : 0.125max.<br>W.V. : 6.3Vmax. : 0.15max. |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |
| 15 | Temperature Cycle | | The measured and observed characteristics should satisfy the specifications in the following table. | | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours (temperature compensating type) or 48±4 hour (high dielectric constant type) at room temperature, then measure.<br>Step 1: Temp. (℃) Min. Operating Temp.+0/−3, Time (min.) 30±3<br>Step 2: Temp. (℃) Room Temp., Time (min.) 2 to 3<br>Step 3: Temp. (℃) Max. Operating Temp.+3/−0, Time (min.) 30±3<br>Step 4: Temp. (℃) Room Temp., Time (min.) 2 to 3<br><br>•Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for one hour and then let sit for 48±4 hours at room temperature.<br>Perform the initial measurement. |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | R6, R7 : Within ±7.5%<br>E4, F5 : Within ±20% | |
| | | Q/D.F. | 30pFmin. : Q≧1000<br>30pFmax. : Q≧400+20C<br>C : Nominal Capacitance (pF) | [R6, R7]<br>W.V. : 25Vmin. : 0.025max.<br>W.V. : 16/10V : 0.035max.<br>W.V. : 6.3V<br>0.05max. (C<3.3μF)<br>0.1max. (C≧3.3μF)<br>[E4]<br>W.V. : 25Vmin. : 0.025max.<br>[F5]<br>W.V. : 25Vmin.<br>: 0.05max. (C<0.10μF)<br>: 0.09max. (C≧0.10μF)<br>W.V. : 16V/10V : 0.125max.<br>W.V. : 6.3Vmax. : 0.15max. |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |

Continued on the following page.

# GRM Series Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | | Test Method |
|---|---|---|---|---|---|
| | | | Temperature Compensating Type | High Dielectric Type | |
| 16 | Humidity Steady State | | The measured and observed characteristics should satisfy the specifications in the following table. | | Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours.<br>Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | R6, R7 : Within ±12.5%<br>E4, F5 : Within ±30% | |
| | | Q/D.F. | 30pF and over : Q≧350<br>10pF and over<br>30pF and below :<br>Q≧275+5C/2<br>10pF and below :<br>Q≧200+10C<br>C : Nominal Capacitance (pF) | [R6, R7]<br>W.V. : 25Vmin. : 0.05max.<br>W.V. : 16/10V : 0.05max.<br>W.V. : 6.3V<br>0.075max. (C<3.3μF)<br>0.125max. (C≧3.3μF)<br>[E4]<br>W.V. : 25Vmin. : 0.05max.<br>[F5]<br>W.V. : 25Vmin.<br>: 0.075max. (C<0.10μF)<br>: 0.125max. (C≧0.10μF)<br>W.V. : 16V/10V : 0.15max.<br>W.V. : 6.3Vmax. : 0.2max. | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |
| 17 | Humidity Load | | The measured and observed characteristics should satisfy the specifications in the following table. | | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA.<br><br>•Initial measurement for F5/10V max.<br>Apply the rated DC voltage for 1 hour at 40±2℃.<br>Remove and let sit for 48±4 hours at room temperature.<br>Perform initial measurement. |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±7.5% or ±0.75pF (Whichever is larger) | R6, R7 : Within ±12.5%<br>E4 : Within ±30%<br>F5 : Within ±30%<br>[W.V. : 10Vmax.]<br>F5 : Within +30/−40% | |
| | | Q/D.F. | 30pF and over : Q≧200<br>30pF and below :<br>Q≧100+10C/3<br>C : Nominal Capacitance (pF) | [R6, R7]<br>W.V. : 25Vmin. : 0.05max.<br>W.V. : 16/10V : 0.05max.<br>W.V. : 6.3V<br>0.075max. (C<3.3μF)<br>0.125max. (C≧3.3μF)<br>[E4]<br>W.V. : 25Vmin. : 0.05max.<br>[F5]<br>W.V. : 25Vmin.<br>: 0.075max. (C<0.10μF)<br>: 0.125max. (C≧0.10μF)<br>W.V. : 16V/10V : 0.15max.<br>W.V. : 6.3Vmax. : 0.2max. | |
| | | I.R. | More than 500MΩ or 25Ω • F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |

Continued on the following page.

# GRM Series Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications: Temperature Compensating Type | Specifications: High Dielectric Type | Test Method |
|---|---|---|---|---|---|
| 18 | High Temperature Load | | The measured and observed characteristics should satisfy the specifications in the following table. | | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.<br>The charge/discharge current is less than 50mA.<br>•Initial measurement for high dielectric constant type.<br>Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3℃. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.<br><br>∗150% for 500V and C≧10μF |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±3% or ±0.3pF (Whichever is larger) | R6, R7 : Within ±12.5%<br>E4 : Within ±30%<br>F5 : Within ±30% (Cap<1.0μF)<br>F5 : Within +30/−40% (Cap≧1.0μF) | |
| | | Q/D.F. | 30pF and over : Q≧350<br>10pF and over<br>30pF and below :<br>Q≧275+5C/2<br>10pF and below :<br>Q≧200+10C<br>C : Nominal Capacitance (pF) | [R6, R7]<br>W.V. : 25Vmin. : 0.05max.<br>W.V. : 16/10V : 0.05max.<br>W.V. : 6.3V<br>0.075max. (C<3.3μF)<br>0.125max. (C≧3.3μF)<br>[E4]<br>W.V. : 25Vmin. : 0.05max<br>[F5]<br>W.V. : 25Vmin.<br>: 0.075max. (C<0.10μF)<br>: 0.125max. (C≧0.10μF)<br>W.V. : 16V/10V : 0.15max.<br>W.V. : 6.3Vmax. : 0.2max. | |
| | | I.R. | More than 1,000MΩ or 50Ω•F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |

Table A

| Char. Code | Nominal Values (ppm/℃)* | Capacitance Change from 25℃ (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | −55 | | −30 | | −10 | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0 ± 30 | 0.58 | −0.24 | 0.40 | −0.17 | 0.25 | −0.11 |
| 6C | 0 ± 60 | 0.87 | −0.48 | 0.59 | −0.33 | 0.38 | −0.21 |
| 6P | −150 ± 60 | 2.33 | 0.72 | 1.61 | 0.50 | 1.02 | 0.32 |
| 6R | −220 ± 60 | 3.02 | 1.28 | 2.08 | 0.88 | 1.32 | 0.56 |
| 6S | −330 ± 60 | 4.09 | 2.16 | 2.81 | 1.49 | 1.79 | 0.95 |
| 6T | −470 ± 60 | 5.46 | 3.28 | 3.75 | 2.26 | 2.39 | 1.44 |
| 7U | −750 ±120 | 8.78 | 5.04 | 6.04 | 3.47 | 3.84 | 2.21 |
| 1X | +350 to −1000 | − | − | − | − | − | − |

∗Nominal values denote the temperature coefficient within a range of 25℃ to 125℃ (for ΔC)/85℃ (for other TC).

# Chip Monolithic Ceramic Capacitors

## Thin Layer Large-capacitance Type



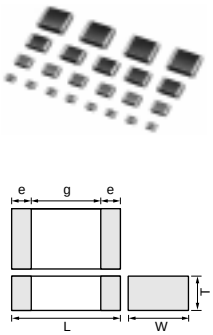
### ■ Features

1. Smaller size and higher capacitance value.
2. High reliability and no polarity.
3. Excellent pulse responsibility and noise reduction due to the low impedance at high frequency.

### ■ Applications

General electronic equipment

| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| GRM033 | 0.6 ±0.03 | 0.3 ±0.03 | 0.3 ±0.03 | 0.1 to 0.2 | 0.2 |
| GRM155 | 1.0 ±0.05 | 0.5 ±0.05 | 0.5 ±0.05 | 0.15 to 0.3 | 0.4 |
| GRM185 | 1.6 ±0.1 | 0.8 ±0.1 | 0.5 +0/-0.2 | 0.2 to 0.5 | 0.5 |
| GRM188 | 1.6 ±0.1 | 0.8 ±0.1 | 0.8 ±0.1 | 0.2 to 0.5 | 0.5 |
| GRM216 | 2.0 ±0.1 | 1.25 ±0.1 | 0.6 ±0.1 | 0.2 to 0.7 | 0.7 |
| GRM219 | | | 0.85 ±0.1 | | |
| GRM21B | | | 1.25 ±0.1 | | |
| GRM316 | 3.2 ±0.15 | 1.6 ±0.15 | 0.6 ±0.1 | 0.3 to 0.8 | 1.5 |
| GRM319 | | | 0.85 ±0.1 | | |
| GRM31M | 3.2 ±0.2 | 1.6 ±0.2 | 1.6 ±0.2 | 0.3 to 0.8 | 1.5 |
| GRM31C | | | 1.15 ±0.1 | | |
| GRM32D | 3.2 ±0.3 | 2.5 ±0.2 | 2.0 ±0.2 | 0.3 | 1.0 |
| GRM32E | | | 2.5 ±0.2 | | |
| GRM43D | 4.5 ±0.4 | 3.2 ±0.3 | 2.0 ±0.2 | 0.3 | 2.0 |
| GRM43E | | | 2.5 ±0.2 | | |
| GRM43S | | | 2.8 ±0.2 | | |
| GRM55F | 5.7 ±0.4 | 5.0 ±0.4 | 3.2 ±0.2 | 0.3 | 2.0 |




| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM188R61C105KE93** | X5R (EIA) | 16 | 1.0µF ±10% | 1.60 | 0.80 | 0.80 |
| **GRM219R61C225KA88** | X5R (EIA) | 16 | 2.2µF ±10% | 2.00 | 1.25 | 0.85 |
| **GRM319R61C475KA88** | X5R (EIA) | 16 | 4.7µF ±10% | 3.20 | 1.60 | 0.85 |
| **GRM32ER61C226KE20** | X5R (EIA) | 16 | 22µF ±10% | 3.20 | 2.50 | 2.50 |
| **GRM185R61A105KE36** | X5R (EIA) | 10 | 1.0µF ±10% | 1.60 | 0.80 | 0.50 |
| **GRM155R61A154KE19** | X5R (EIA) | 10 | 1.5µF ±10% | 1.00 | 0.50 | 0.50 |
| **GRM155R61A224KE19** | X5R (EIA) | 10 | 2.2µF ±10% | 1.00 | 0.50 | 0.50 |
| **GRM188R61A225KE34** | X5R (EIA) | 10 | 2.2µF ±10% | 1.60 | 0.80 | 0.80 |
| **GRM188R61A225ME34** | X5R (EIA) | 10 | 2.2µF ±10% | 1.60 | 0.80 | 0.80 |
| **GRM216R61A225KE24** | X5R (EIA) | 10 | 2.2µF ±10% | 2.00 | 1.25 | 0.60 |
| **GRM219R61A225KA01** | X5R (EIA) | 10 | 2.2µF ±10% | 2.00 | 1.25 | 0.85 |
| **GRM219R61A335KE19** | X5R (EIA) | 10 | 3.3µF ±10% | 2.00 | 1.25 | 0.85 |
| **GRM316R61A335KE19** | X5R (EIA) | 10 | 3.3µF ±10% | 3.20 | 1.60 | 0.60 |
| **GRM219R61A475KE19** | X5R (EIA) | 10 | 4.7µF ±10% | 2.00 | 1.25 | 0.85 |
| **GRM219R61A475KE34** | X5R (EIA) | 10 | 4.7µF ±10% | 2.00 | 1.25 | 0.85 |
| **GRM316R61A475KE19** | X5R (EIA) | 10 | 4.7µF ±10% | 3.20 | 1.60 | 0.60 |
| **GRM319R61A475KA01** | X5R (EIA) | 10 | 4.7µF ±10% | 3.20 | 1.60 | 0.85 |
| **GRM31MR61A106KE19** | X5R (EIA) | 10 | 10µF ±10% | 3.20 | 1.60 | 1.15 |
| **GRM033R60J153KE01** | X5R (EIA) | 6.3 | 15000pF ±10% | 0.6 | 0.3 | 0.3 |
| **GRM033R60J223KE01** | X5R (EIA) | 6.3 | 22000pF ±10% | 0.6 | 0.3 | 0.3 |
| **GRM033R60J333KE01** | X5R (EIA) | 6.3 | 33000pF ±10% | 0.6 | 0.3 | 0.3 |
| **GRM033R60J393KE19** | X5R (EIA) | 6.3 | 39000pF ±10% | 0.6 | 0.3 | 0.3 |
| **GRM033R60J473KE19** | X5R (EIA) | 6.3 | 47000pF ±10% | 0.6 | 0.3 | 0.3 |
| **GRM033R60J104KE19** | X5R (EIA) | 6.3 | 0.10µF ±10% | 0.6 | 0.3 | 0.3 |
| **GRM155R60J154KE01** | X5R (EIA) | 6.3 | 0.15µF ±10% | 1.00 | 0.50 | 0.50 |
| **GRM155R60J224KE01** | X5R (EIA) | 6.3 | 0.22µF ±10% | 1.00 | 0.50 | 0.50 |
| **GRM155R60J334KE01** | X5R (EIA) | 6.3 | 0.33µF ±10% | 1.00 | 0.50 | 0.50 |
| **GRM155R60J474KE19** | X5R (EIA) | 6.3 | 0.47µF ±10% | 1.00 | 0.50 | 0.50 |
| **GRM155R60J105KE19** | X5R (EIA) | 6.3 | 1.0µF ±10% | 1.00 | 0.50 | 0.50 |
| **GRM185R60J105KE21** | X5R (EIA) | 6.3 | 1.0µF ±10% | 1.60 | 0.80 | 0.50 |
| **GRM185R60J105KE26** | X5R (EIA) | 6.3 | 1.0µF ±10% | 1.60 | 0.80 | 0.50 |
| **GRM185R60J225KE26** | X5R (EIA) | 6.3 | 2.2µF ±10% | 1.60 | 0.80 | 0.50 |
| **GRM188R60J225KE01** | X5R (EIA) | 6.3 | 2.2µF ±10% | 1.60 | 0.80 | 0.80 |
| **GRM188R60J225KE19** | X5R (EIA) | 6.3 | 2.2µF ±10% | 1.60 | 0.80 | 0.80 |
| **GRM188R60J475KE19** | X5R (EIA) | 6.3 | 4.7µF ±10% | 1.60 | 0.80 | 0.80 |
| **GRM219R60J475KE01** | X5R (EIA) | 6.3 | 4.7µF ±10% | 2.00 | 1.25 | 0.85 |
| **GRM219R60J106KE19** | X5R (EIA) | 6.3 | 10µF ±10% | 2.00 | 1.25 | 0.85 |
| **GRM219R60J106ME19** | X5R (EIA) | 6.3 | 10µF ±20% | 2.00 | 1.25 | 0.85 |

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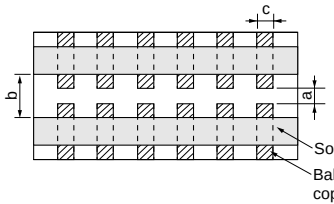
| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM21BR60J106KE01** | X5R (EIA) | 6.3 | 10µF ±10% | 2.00 | 1.25 | 1.25 |
| **GRM21BR60J106KE19** | X5R (EIA) | 6.3 | 10µF ±10% | 2.00 | 1.25 | 1.25 |
| **GRM21BR60J106ME01** | X5R (EIA) | 6.3 | 10µF ±20% | 2.00 | 1.25 | 1.25 |
| **GRM21BR60J106ME19** | X5R (EIA) | 6.3 | 10µF +10/-20% | 2.00 | 1.25 | 1.25 |
| **GRM21BR60J226ME39** | X5R (EIA) | 6.3 | 22µF ±20% | 2.00 | 1.25 | 1.25 |
| **GRM31CR60J226ME19** | X5R (EIA) | 6.3 | 22µF ±20% | 3.20 | 1.60 | 1.60 |
| **GRM32DR60J226KA01** | X5R (EIA) | 6.3 | 22µF ±10% | 3.20 | 2.50 | 2.00 |
| **GRM32DR60J336ME19** | X5R (EIA) | 6.3 | 33µF ±10% | 3.20 | 2.50 | 2.00 |
| **GRM32ER60J476ME20** | X5R (EIA) | 6.3 | 47µF ±20% | 3.20 | 2.50 | 2.50 |
| **GRM32ER60J107ME20** | X5R (EIA) | 6.3 | 100µF ±20% | 3.20 | 2.50 | 2.50 |
| **GRM43SR60J107ME20** | X5R (EIA) | 6.3 | 100µF ±20% | 4.50 | 3.20 | 2.80 |
| **GRM32ER71A226KE20** | X7R (EIA) | 10 | 22µF ±10% | 3.20 | 2.50 | 2.50 |
| **GRM32ER71A226ME20** | X7R (EIA) | 10 | 22µF ±20% | 3.20 | 2.50 | 2.50 |
| **GRM188F51A225ZE01** | Y5V (EIA) | 10 | 2.2µF +80/-20% | 1.60 | 0.80 | 0.80 |
| **GRM188F50J225ZE01** | Y5V (EIA) | 6.3 | 2.2µF +80/-20% | 1.60 | 0.80 | 0.80 |
| **GRM21BF50J106ZE01** | Y5V (EIA) | 6.3 | 10µF +80/-20% | 2.00 | 1.25 | 1.25 |

# Specifications and Test Methods



| No. | Item | Specifications | Test Method |
|---|---|---|---|
| 1 | Operating Temperature Range | R6 : −55℃ to +85℃<br>R7 : −55℃ to +125℃<br>F5 : −30℃ to +85℃<br>C8 : −55℃ to +105℃ | |
| 2 | Rated Voltage | See the previous pages. | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range. |
| 3 | Appearance | No defects or abnormalities | Visual inspection |
| 4 | Dimensions | Within the specified dimension | Using calipers |
| 5 | Dielectric Strength | No defects or abnormalities | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. |
| 6 | Insulation Resistance | 50Ω • F min. | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 1 minute of charging. |
| 7 | Capacitance | Within the specified tolerance | The capacitance/D.F. should be measured at 25℃ at the frequency and voltage shown in the table.<br>Capacitance / Frequency / Voltage<br>C≦10μF (10V min.)*1 / 1±0.1kHz / 1.0±0.2Vrms*1<br>C≦10μF (6.3V max.) / 1±0.1kHz / 0.5±0.1Vrms<br>C>10μF / 120±24Hz / 0.5±0.1Vrms<br>*1 Table 1 items are applied to 0.5+/-0.1Vrms.<br>Table 1: GRM155R61A124~224K, GRM185R61A105K, GRM188R61A225K, GRM219R61A475K |
| 8 | Dissipation Factor (D.F.) | R6 / R7 / C8 : 0.1 max.<br>F5 : 0.2 max. | |
| 9 | Capacitance Temperature Characteristics | Char. / Temp. Range / Reference Temp. / Cap. Change<br>R6 / −55 to +85℃ / 25℃ / Within±15%<br>R7 / −55 to +125℃ / 25℃ / Within±15%<br>F5 / −30 to +85℃ / 25℃ / Within+22/–82%<br>C8 / −55 to +105℃ / 25℃ / Within±22% | The capacitance change should be measured after 5 min. at each specified temperature stage.<br>The ranges of capacitance change compared with the 25℃ value over the temperature ranges shown in the table should be within the specified ranges.<br>Measuring Voltage : GRM43 R6 0J/1A 336/476 : 1.0+/–0.2Vrms |
| 10 | Adhesive Strength of Termination | No removal of the terminations or other defects should occur. | Solder the capacitor to the test jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply *2 10N force in parallel with the test jig for 10±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>*2 5N (GR□15, GRM18) / 2N (GR□03)<br>  <br>Type / a / b / c<br>GR□03 / 0.3 / 0.9 / 0.3<br>GR□15 / 0.4 / 1.5 / 0.5<br>GRM18 / 1.0 / 3.0 / 1.2<br>GRM21 / 1.2 / 4.0 / 1.65<br>GRM31 / 2.2 / 5.0 / 2.0<br>GRM32 / 2.2 / 5.0 / 2.9<br>GRM43 / 3.5 / 7.0 / 3.7<br>GRM55 / 4.5 / 8.0 / 5.6<br>(in mm)<br>Fig.1 |

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 11 | Vibration | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours). |
| | | Capacitance | Within the specified tolerance | |
| | | D.F. | R6 / R7 / C8 : 0.1 max.<br>F5 : 0.2 max. | |
| 12 | Deflection | | No cracking or marking defects should occur. | Solder the capacitor to the test jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig.3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 13 | Solderability of Termination | | 75% of the terminations is to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).<br>Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃. |
| 14 | Resistance to Soldering Heat | Appearance | No marking defects | Preheat the capacitor at 120 to 150℃ for 1 minute.<br>Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 48±4 hours, then measure.<br><br>•Initial measurement<br>Perform a heat treatment at 150 $^{+}_{-}{}^{0}_{10}$℃ for one hour and then let sit for 48±4 hours at room temperature.<br>Perform the initial measurement. |
| | | Capacitance Change | R6 / R7 / C8 : Within ±7.5%<br>F5 : Within ±20% | |
| | | D.F. | R6 / R7 / C8 : 0.1 max.<br>F5 : 0.2 max. | |
| | | I.R. | 50Ω • F min. | |
| | | Dielectric Strength | No failure | |
| 15 | Temperature Sudden Change | Appearance | No marking defects | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 48±4 hours at room temperature, then measure.<br><br>•Initial measurement<br>Perform a heat treatment at 150$^{+}_{-}{}^{0}_{10}$℃ for one hour and then let sit for 48±4 hours at room temperature.<br>Perform the initial measurement. |
| | | Capacitance Change | R6 / R7 / C8 : Within ±7.5%<br>F5 : Within ±20% | |
| | | D.F. | R6 / R7 / C8 : 0.1 max.<br>F5 : 0.2 max. | |
| | | I.R. | 50Ω • F min. | |
| | | Dielectric Strength | No failure | |

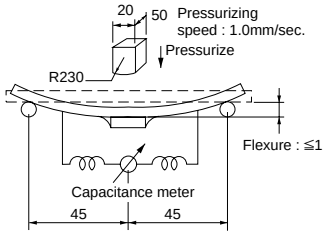
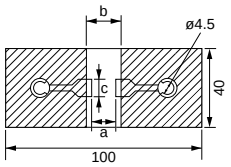



Fig.3




t : 1.6mm

(GR□03, GR□15 : t : 0.8mm)

| Type | a | b | c |
|---|---|---|---|
| GR□03 | 0.3 | 0.9 | 0.3 |
| GR□15 | 0.4 | 1.5 | 0.5 |
| GRM18 | 1.0 | 3.0 | 1.2 |
| GRM21 | 1.2 | 4.0 | 1.65 |
| GRM31 | 2.2 | 5.0 | 2.0 |
| GRM32 | 2.2 | 5.0 | 2.9 |
| GRM43 | 3.5 | 7.0 | 3.7 |
| GRM55 | 4.5 | 8.0 | 5.6 |

(in mm)

Fig.2

| Step | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Temp.(℃) | Min. Operating Temp.+0/−3 | Room Temp. | Max. Operating Temp.+3/−0 | Room Temp. |
| Time(min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 16 | High Temperature High Humidity (Steady) | Appearance | No marking defects | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50mA.<br><br>•Initial measurement<br>Perform a heat treatment at 150$^{+}_{-1}{}^{8}$℃ for one hour and then let sit for 48±4 hours at room temperature.<br>Perform the initial measurement.<br><br>•Measurement after test<br>Perform a heat treatment at 150$^{+}_{-1}{}^{8}$℃ for one hour and then let sit for 48±4 hours at room temperature, then measure |
| | | Capacitance Change | R6 / R7 / C8 : Within ±12.5%<br>F5 : Within ±30% | |
| | | D.F. | R6 / R7 / C8 : 0.2 max.<br>F5 : 0.4 max. | |
| | | I.R. | 12.5Ω • F min. | |
| 17 | Durability | Appearance | No marking defects | Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃.<br>The charge/discharge current is less than 50mA.<br><br>•Initial measurement<br>Perform a heat treatment at 150$^{+}_{-1}{}^{8}$℃ for one hour and then let sit for 48±4 hours at room temperature.<br>Perform the initial measurement.<br><br>•Measurement after test<br>Perform a heat treatment at 150$^{+}_{-1}{}^{8}$℃ for one hour and then let sit for 48±4 hours at room temperature, then measure. |
| | | Capacitance Change | R6 / R7 / C8 : Within ±12.5%<br>F5 : Within ±30% | |
| | | D.F. | R6 / R7 / C8 : 0.2 max.<br>F5 : 0.4 max. | |
| | | I.R. | 25Ω • F min. | |

# Chip Monolithic Ceramic Capacitors

## Low-dissipation Type

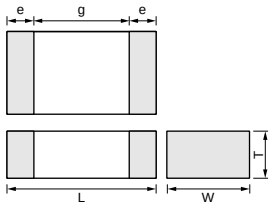


■ Features

1. Mobile telecommunication and RF module, mainly
2. Quality improvement of telephone calls, Low power consumption, yield ratio improvement

■ Applications

VCO, PA, Mobile Telecommunications




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e | g min. |
| **GJM15** | 1.0 ±0.05 | 0.5 ±0.05 | 0.5 ±0.05 | 0.15 to 0.3 | 0.4 |
| **GJM03** | 0.6 ±0.03 | 0.3 ±0.03 | 0.3 ±0.03 | 0.1 to 0.2 | 0.2 |

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GJM1555C1HR50CB01** | C0G (EIA) | 50 | 0.50 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1HR75CB01** | C0G (EIA) | 50 | 0.75 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H1R0CB01** | C0G (EIA) | 50 | 1.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H1R1CB01** | C0G (EIA) | 50 | 1.1 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H1R2CB01** | C0G (EIA) | 50 | 1.2 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H1R3CB01** | C0G (EIA) | 50 | 1.3 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H1R5CB01** | C0G (EIA) | 50 | 1.5 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H1R6CB01** | C0G (EIA) | 50 | 1.6 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H1R8CB01** | C0G (EIA) | 50 | 1.8 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H2R0CB01** | C0G (EIA) | 50 | 2.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H2R2CB01** | C0G (EIA) | 50 | 2.2 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H2R4CB01** | C0G (EIA) | 50 | 2.4 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H2R7CB01** | C0G (EIA) | 50 | 2.7 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H3R0CB01** | C0G (EIA) | 50 | 3.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H3R3CB01** | C0G (EIA) | 50 | 3.3 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H3R6CB01** | C0G (EIA) | 50 | 3.6 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H3R9CB01** | C0G (EIA) | 50 | 3.9 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H4R0CB01** | C0G (EIA) | 50 | 4.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H4R3CB01** | C0G (EIA) | 50 | 4.3 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H4R7CB01** | C0G (EIA) | 50 | 4.7 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H5R0CB01** | C0G (EIA) | 50 | 5.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H5R1CB01** | C0G (EIA) | 50 | 5.1 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H5R6CB01** | C0G (EIA) | 50 | 5.6 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H6R0CB01** | C0G (EIA) | 50 | 6.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H6R0DB01** | C0G (EIA) | 50 | 6.0 ±0.5pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H6R2CB01** | C0G (EIA) | 50 | 6.2 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H6R8CB01** | C0G (EIA) | 50 | 6.8 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H7R0CB01** | C0G (EIA) | 50 | 7.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H7R0DB01** | C0G (EIA) | 50 | 7.0 ±0.5pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H7R5CB01** | C0G (EIA) | 50 | 7.5 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H8R0CB01** | C0G (EIA) | 50 | 8.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H8R0DB01** | C0G (EIA) | 50 | 8.0 ±0.5pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H8R2CB01** | C0G (EIA) | 50 | 8.2 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H9R0CB01** | C0G (EIA) | 50 | 9.0 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H9R0DB01** | C0G (EIA) | 50 | 9.0 ±0.5pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H9R1CB01** | C0G (EIA) | 50 | 9.1 ±0.25pF | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H100JB01** | C0G (EIA) | 50 | 10 ±5% | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H100RB01** | C0G (EIA) | 50 | 10 ±2.5% | 1.00 | 0.50 | 0.50 |

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| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GJM1555C1H120JB01** | C0G (EIA) | 50 | 12 ±5% | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H150JB01** | C0G (EIA) | 50 | 15 ±5% | 1.00 | 0.50 | 0.50 |
| **GJM1555C1H180JB01** | C0G (EIA) | 50 | 18 ±5% | 1.00 | 0.50 | 0.50 |

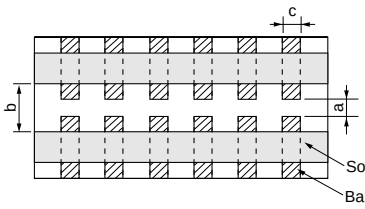
# Specifications and Test Methods



| No. | Item | | Specifications: Temperature Compensating Type | Test Method |
|---|---|---|---|---|
| 1 | Operating Temperature Range | | −55 to +125℃ | |
| 2 | Rated Voltage | | See the previous pages | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range. |
| 3 | Appearance | | No defects or abnormalities | Visual inspection |
| 4 | Dimensions | | Within the specified dimensions | Using calipers |
| 5 | Dielectric Strength | | No defects or abnormalities | No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. |
| 6 | Insulation Resistance (I.R.) | | 10,000MΩ min. or 500Ω • F min. (Whichever is smaller) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging. |
| 7 | Capacitance | | Within the specified tolerance | The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table. |
| 8 | Q | | 30pF max. : Q≧400+20C<br>C : Nominal Capacitance (pF) | |
| 9 | Capacitance Temperature Characteristics | Capacitance Change | Within the specified tolerance (Table A) | The capacitance change should be measured after 5 min. at each specified temperature stage.<br>Temperature Compensating Type<br>The temperature coefficient is determined using the capacitance measured in step 3 as a reference.<br>When cycling the temperature sequentially from step 1 through 5, (ΔC : +25℃ to+125℃ : other temp. coeffs. : +25℃ to 85℃) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.<br>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3. |
| | | Temperature Coefficient | Within the specified tolerance (Table A) | |
| | | Capacitance Drift | Within ±0.2% or ±0.05pF<br>(Whichever is larger.) | |
| 10 | Adhesive Strength of Termination | | No removal of the terminations or other defect should occur. | Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply a 5N* force in parallel with the test jig for 10±1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *2N (GJM03) |

| Item \ Char. | ΔC (1000pF and below) |
|---|---|
| Frequency | 1±0.1MHz |
| Voltage | 0.5 to 5Vr.m.s. |

| Step | Temperature (℃) |
|---|---|
| 1 | 25±2 |
| 2 | −55±3 |
| 3 | 25±2 |
| 4 | 125±3 |
| 5 | 25±2 |




| Type | a | b | c |
|---|---|---|---|
| GJM03 | 0.3 | 0.9 | 0.3 |
| GJM15 | 0.4 | 1.5 | 0.5 |

(in mm)

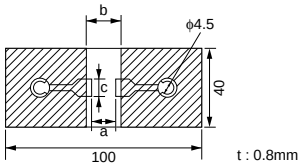
Fig. 1

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications<br>Temperature Compensating Type | Test Method |
|---|---|---|---|---|
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz.<br>The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |
| | | Capacitance | Within the specified tolerance | |
| | | Q | 30pF max. : Q≧400+20C<br>C : Nominal Capacitance (pF) | |
| 12 | Deflection | | No cracking or marking defects should occur | Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder.<br>Then apply a force in the direction shown in Fig. 3.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 13 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).<br>Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃. |
| 14 | Resistance to Soldering Heat | | The measured and observed characteristics should satisfy the specifications in the following table. | Preheat the capacitor at 120 to 150℃ for 1 minute.<br>Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds.<br>Let sit at room temperature for 24±2 hours. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF<br>(Whichever is larger) | |
| | | Q | 30pF and below : Q≧400+20C<br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 15 | Temperature Cycle | | The measured and observed characteristics should satisfy the specifications in the following table. | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table.<br>Let sit for 24±2 hours at room temperature, then measure. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF<br>(Whichever is larger) | |
| | | Q | 30pF and below : Q≧400+20C<br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 16 | Humidity, Steady State | | The measured and observed characteristics should satisfy the specifications in the following table. | Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours.<br>Remove and let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±5% or ±0.5pF<br>(Whichever is larger) | |
| | | Q | 10pF and over, 30pF and below : Q≧275+$\frac{5}{2}$C<br>10pF and below : Q≧200+10C<br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |




| Type | a | b | c |
|---|---|---|---|
| GJM03 | 0.3 | 0.9 | 0.3 |
| GJM15 | 0.4 | 1.5 | 0.5 |

(in mm)

Fig. 2

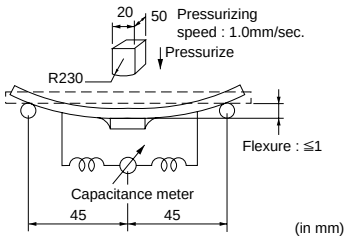



Fig. 3

| Step | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Temp. (℃) | Min. Operating Temp. $^{+0}_{-3}$ | Room Temp. | Max. Operating Temp. $^{+3}_{-0}$ | Room Temp. |
| Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications<br>Temperature Compensating Type | Test Method |
|---|---|---|---|---|
| 17 | Humidity Load | | The measured and observed characteristics should satisfy the specifications in the following table. | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours.<br>Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±7.5% or ±0.75pF<br>(Whichever is larger) | |
| | | Q | 30pF and below : Q≧100+$\frac{10}{3}$C<br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 500MΩ or 25Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 18 | High Temperature Load | | The measured and observed characteristics should satisfy the specifications in the following table. | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure.<br>The charge/discharge current is less than 50mA. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±3% or ±0.3pF<br>(Whichever is larger) | |
| | | Q | 10pF and over, 30pF and below : Q≧275+$\frac{5}{2}$C<br>10pF and below : Q≧200+10C<br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 19 | ESR | | 0.5pF≦C≦1pF : 350mΩ • pF below<br>1pF<C≦5pF : 300mΩ below<br>5pF<C≦10pF : 250mΩ below | The ESR should be measured at room Temperature. and frequency 1±0.2GHz with the equivalent of BOONTON Model 34A. |
| | | | 10pF<C≦20pF : 400mΩ below | The ESR should be measured at room Temperature. and frequency 500±50MHz with the equivalent of HP8753B. |

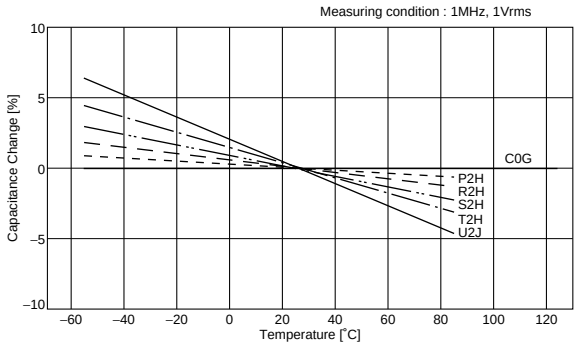
Table A

| Char. Code | Temp. Coeff. (ppm/℃) Note 1 | Capacitance Change from 25℃ Value (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | −55℃ | | −30℃ | | −10℃ | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0±30 | 0.58 | −0.24 | 0.40 | −0.17 | 0.25 | −0.11 |

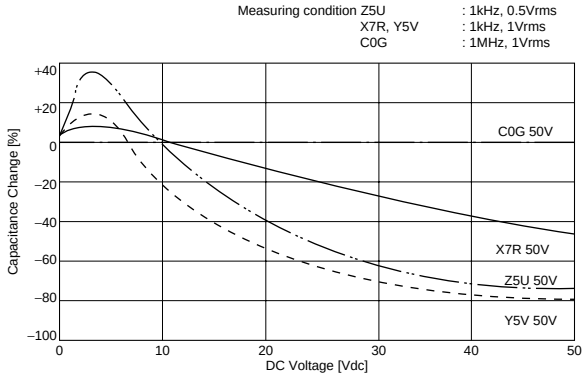
Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125℃.(for ΔC)

# GRM Series Data

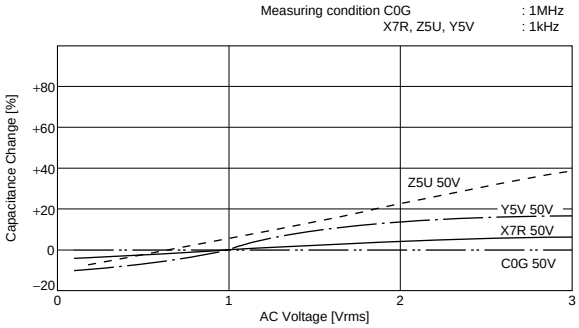
## ■ Capacitance-Temperature Characteristics



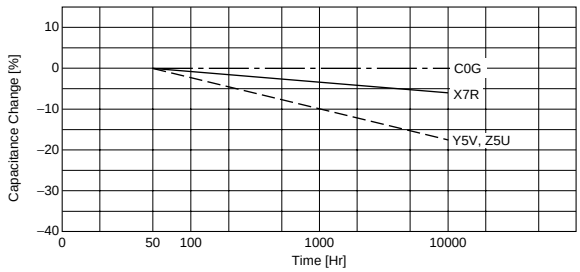

## ■ Capacitance-DC Voltage Characteristics



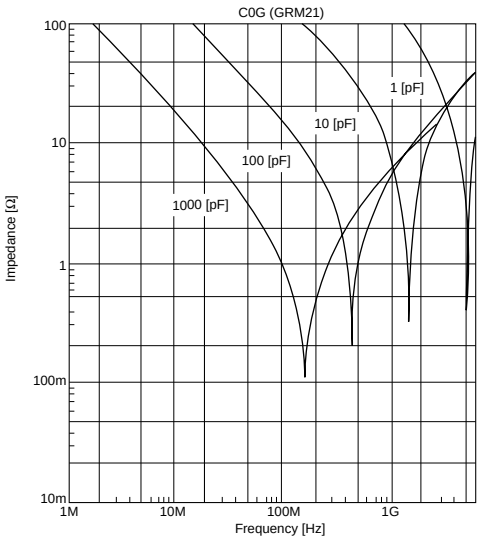

## ■ Capacitance-AC Voltage Characteristics



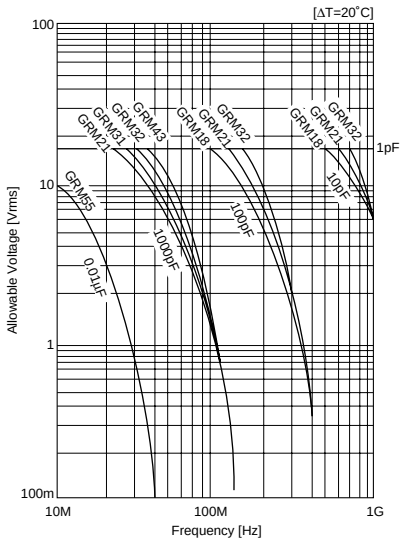

## ■ Capacitance Change-Aging




## ■ Impedance-Frequency Characteristics




## ■ Allowable Voltage-Frequency




Continued on the following page.

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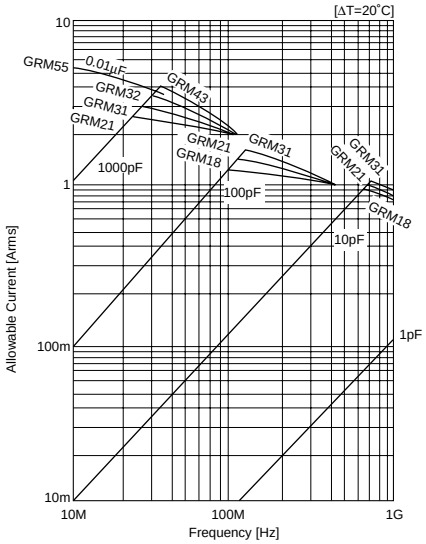
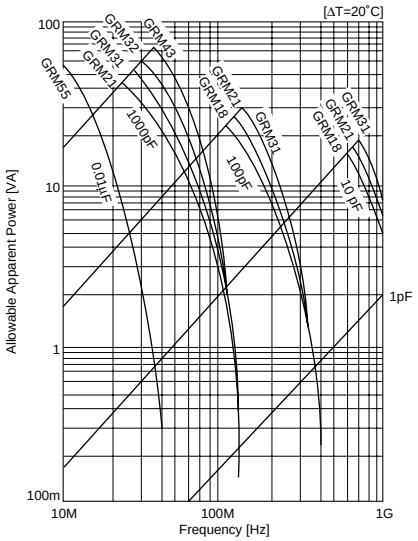
# GRM Series Data

Continued from the preceding page.

## ■ Allowable Current-Frequency




## ■ Allowable Apparent Power

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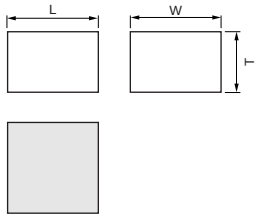
# Chip Monolithic Ceramic Capacitors

## Microchips

■ Features
1. Better microwave characteristics
2. Suitable for by-passing
3. High density mounting

■ Applications
1. Optical device for telecommunication
2. IC, IC packaging built-in
3. Measuring equipment




| Part Number | Dimensions (mm) | | |
|---|---|---|---|
| | L | W | T |
| **GMA05X** | 0.5 ±0.05 | 0.5 ±0.05 | 0.35 ±0.05 |
| **GMA085** | 0.8 ±0.05 | 0.8 ±0.05 | 0.5 ±0.1 |

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| Part Number | TC Cod (Standard) | Rated Voltage (Vdc) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GMA05XR71H471MD01** | X7R (EIA) | 50 | 470pF ±20% | 0.5 | 0.5 | 0.35 |
| **GMA05XR71C102MD01** | X7R (EIA) | 16 | 1000pF ±20% | 0.5 | 0.5 | 0.35 |
| **GMA05XR71C152MD01** | X7R (EIA) | 16 | 1500pF ±20% | 0.5 | 0.5 | 0.35 |
| **GMA05XR71C222MD01** | X7R (EIA) | 16 | 2200pF ±20% | 0.5 | 0.5 | 0.35 |
| **GMA085R71C103MD01** | X7R (EIA) | 16 | 10000pF ±20% | 0.8 | 0.8 | 0.5 |
| **GMA05XF51C472ZD01** | Y5V (EIA) | 16 | 4700pF +80/-20% | 0.5 | 0.5 | 0.35 |
| **GMA05XF51C682ZD01** | Y5V (EIA) | 16 | 6800pF +80/-20% | 0.5 | 0.5 | 0.35 |
| **GMA085F51C473ZD01** | Y5V (EIA) | 16 | 47000pF +80/-20% | 0.8 | 0.8 | 0.5 |
| **GMA05XF51A153ZD01** | Y5V (EIA) | 10 | 15000pF +80/-20% | 0.5 | 0.5 | 0.35 |
| **GMA085F51A104ZD01** | Y5V (EIA) | 10 | 0.10μF +80/-20% | 0.8 | 0.8 | 0.5 |

# Specifications and Test Methods



<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature</td><td>R7 : −55℃ to +125℃<br>F5 : −30℃ to +85℃</td><td></td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td colspan="2">Dimensions</td><td>See the previous pages.</td><td>Visual inspection</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when a voltage of 250% of the rated voltage is applied between the both terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td>10,000MΩ min.</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td>The capacitance should be measured at 25℃ with 1±0.1kHz in frequency and 1±0.2Vr.m.s. in voltage.</td></tr>
<tr><td>8</td><td colspan="2">Dissipation Factor (D.F.)</td><td>R7 : 0.035 max.<br>F5 : 0.09 max. (for 16V)<br>: 0.125 max. (for 10V)</td><td>D.F. should be measured under the same conditions at the capacitance.</td></tr>
<tr><td>9</td><td colspan="2">Capacitance Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Temp. Range</th><th>Reference Temp.</th><th>Cap. Change Rate</th></tr><tr><td>R7</td><td>−55 to +125℃</td><td>25℃</td><td>Within±15%</td></tr><tr><td>F5</td><td>−30 to +85℃</td><td>25℃</td><td>Within$\pm^{22}_{82}$%</td></tr></table></td><td>The range of capacitance change in reference to 25℃ within the temperature range shown in the table should be within the specified ranges.<br>The capacitance change should be measured after 5 min. at each specified temperature stage.</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">Mechanical Strength</td><td>Bond Strength</td><td>Pull force : 3.0g min.</td><td>MIL-STD-883 Method 2011 Condition D<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20) and bond a 20μm (0.0008 inch) gold wire to the capacitor terminal using an ultrasonic wedge bond. Then, pull wire.</td></tr>
<tr><td>Die Shear Strength</td><td>Die Shear force : 200g min.</td><td>MIL-STD-883 Method 2019<br>Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate.</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Ramp frequency from 10 to 55Hz then return to 10Hz all within 1 minute. Amplitude : 1.5 mm (0.06 inch) max. total excursion. Apply this motion for a period of 2 hours in each of 3 mutually perpendicular directions (total 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>R7 : 0.035 max.<br>F5 : 0.09 max. (for 16V)<br>: 0.125 max. (for 10V)</td></tr>
<tr><td>12</td><td colspan="2">Temperature Cycle</td><td>The measured values should satisfy the values in the following table.<table><tr><th>Item</th><th>Specifications</th></tr><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td>R7 ····· Within±7.5%<br>F5 ····· Within±20%</td></tr><tr><td>I.R.</td><td>More than 10,000MΩ</td></tr><tr><td>D.F.</td><td>R7 ····· 0.035 max.<br>F5 ····· 0.09 max.(for 16V)<br>0.125 max.(for 10V)</td></tr><tr><td>Dielectric Strength</td><td>No failure</td></tr></table></td><td>The capacitor should be set for 48±4 hours at room temperature after one hour heat of treatment at $150^{+0}_{-10}$℃, then measure for the initial measurement. Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11) and conduct the five cycles according to the temperatures and time shown in the following table. Set it for 48±4 hours at room temperature, then measure.<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp.(℃)</td><td>Min. Operating Temp.$^{+0}_{-3}$</td><td>Room Temp.</td><td>Max. Operating Temp.$^{+3}_{-0}$</td><td>Room Temp.</td></tr><tr><td>Time(min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table></td></tr>
<tr><td>13</td><td colspan="2">Humidity (Steady State)</td><td>The measured values should satisfy the values in the following table.<table><tr><th>Item</th><th>Specifications</th></tr><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td>R7 ····· Within±12.5%<br>F5 ····· Within±30%</td></tr><tr><td>I.R.</td><td>More than 1,000MΩ</td></tr><tr><td>D.F.</td><td>R7 ····· 0.05 max.<br>F5 ····· 0.125 max.(for 16V)<br>0.15 max.(for 10V)</td></tr><tr><td>Dielectric Strength</td><td>No failure</td></tr></table></td><td>Set the capacitor for 500±12 hours at 40±20℃, in 90 to 95% humidity.<br>Take it out and set it for 48±4 hours at room temperature, then measure.</td></tr>
</table>

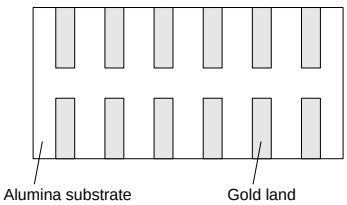
Continued on the following page.

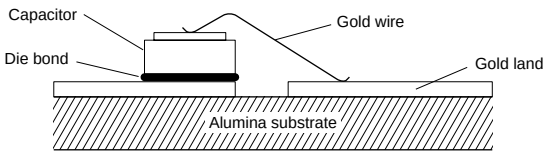
# Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>14</td><td>Humidity Load</td><td>The measured values should satisfy the values in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>R7 ····· Within±12.5%<br>F5 ····· Within$\pm^{30}_{40}$%</td></tr>
<tr><td>I.R.</td><td>More than 500MΩ</td></tr>
<tr><td>D.F.</td><td>R7 ····· 0.05 max.<br>F5 ····· 0.125 max.(for 16V)<br>0.15 max.(for 10V)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table></td><td>Apply the rated voltage for 500±12 hours at 40±20℃, in 90 to 95% humidity and set it for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.<br>• Initial measurement for Y5V<br>Perform a heat treatment at 150$^{+0}_{-10}$℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>15</td><td>High Temperature Load</td><td>The measured values should satisfy the values in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>R7 ····· Within±12.5%<br>F5 ····· Within$\pm^{30}_{40}$%</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>D.F.</td><td>R7 ····· 0.05 max.<br>F5 ····· 0.125 max.(for 16V)<br>0.15 max.(for 10V)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table></td><td>A voltage treatment should be given to the capacitor, in which a DC voltage of 200% the rated voltage is applied for one hour at the maximum operating temperature ±3℃ then it should be set for 48±4 hours at room temperature and the initial measurement should be conducted.<br>Then apply the above mentioned voltage continuously for 1000±12 hours at the same temperature, remove it from the bath, and set it for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</td></tr>
</table>

Mounting for testing : The capacitors should be mounted on the substrate as shown below using die bonding and wire bonding when tests No. 11 to 15 are performed.

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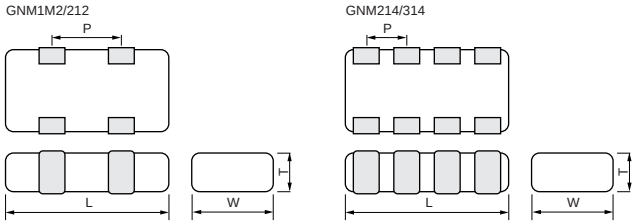
# Chip Monolithic Ceramic Capacitors

## Capacitor Arrays

■ Features
1. High density mounting due to mounting space saving
2. Mounting cost saving

■ Applications
General electronic equipment




| Part Number | Dimensions (mm) | | | |
|---|---|---|---|---|
| | L | W | T | P |
| **GNM1M2** | 1.37 ±0.15 | 1.0 ±0.15 | 0.6 ±0.1 | 0.64 ±0.05 |
| **GNM212** | 2.0 ±0.15 | 1.25 ±0.15 | 0.85 ±0.1 | 1.0 ±0.1 |
| **GNM214** | | | 0.6 ±0.1 | 0.5 ±0.05 |
| **GNM314** | 3.2 ±0.15 | 1.6 ±0.15 | 0.8 ±0.1 | 0.8 ±0.1 |
| | | | 1.0 ±0.1 | |

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## Temperature Compensating Type

| Part Number | **GNM31** | |
|---|---|---|
| L x W | 3.2x1.6 | |
| TC | C0G (**5C**) | |
| Rated Volt. | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | |
| 10pF(**100**) | 0.8(**4**) | 0.8(**4**) |
| 11pF(**110**) | 0.8(**4**) | 0.8(**4**) |
| 12pF(**120**) | 0.8(**4**) | 0.8(**4**) |
| 13pF(**130**) | 0.8(**4**) | 0.8(**4**) |
| 15pF(**150**) | 0.8(**4**) | 0.8(**4**) |
| 16pF(**160**) | 0.8(**4**) | 0.8(**4**) |
| 18pF(**180**) | 0.8(**4**) | 0.8(**4**) |
| 20pF(**200**) | 0.8(**4**) | 0.8(**4**) |
| 22pF(**220**) | 0.8(**4**) | 0.8(**4**) |
| 24pF(**240**) | 0.8(**4**) | 0.8(**4**) |
| 27pF(**270**) | 0.8(**4**) | 0.8(**4**) |
| 30pF(**300**) | 0.8(**4**) | 0.8(**4**) |
| 33pF(**330**) | 0.8(**4**) | 0.8(**4**) |
| 36pF(**360**) | 0.8(**4**) | 0.8(**4**) |
| 39pF(**390**) | 0.8(**4**) | 0.8(**4**) |
| 43pF(**430**) | 0.8(**4**) | 0.8(**4**) |
| 47pF(**470**) | 0.8(**4**) | 0.8(**4**) |
| 51pF(**510**) | 0.8(**4**) | 0.8(**4**) |
| 56pF(**560**) | 0.8(**4**) | 0.8(**4**) |
| 62pF(**620**) | 0.8(**4**) | 0.8(**4**) |
| 68pF(**680**) | 0.8(**4**) | 0.8(**4**) |
| 75pF(**750**) | 0.8(**4**) | 0.8(**4**) |
| 82pF(**820**) | 0.8(**4**) | 0.8(**4**) |
| 91pF(**910**) | 0.8(**4**) | 0.8(**4**) |
| 100pF(**101**) | 0.8(**4**) | 0.8(**4**) |
| 110pF(**111**) | 0.8(**4**) | 0.8(**4**) |
| 120pF(**121**) | 0.8(**4**) | 0.8(**4**) |
| 130pF(**131**) | 0.8(**4**) | 0.8(**4**) |
| 150pF(**151**) | 0.8(**4**) | 0.8(**4**) |
| 160pF(**161**) | | 0.8(**4**) |
| 180pF(**181**) | | 0.8(**4**) |

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| Part Number | GNM31 | |
|---|---|---|
| L x W | 3.2x1.6 | |
| TC | C0G (**5C**) | |
| Rated Volt. | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | |
| 200pF(**201**) | | 0.8(**4**) |
| 220pF(**221**) | | 0.8(**4**) |
| 240pF(**241**) | | 0.8(**4**) |
| 270pF(**271**) | | 0.8(**4**) |
| 300pF(**301**) | | 0.8(**4**) |
| 330pF(**331**) | | 0.8(**4**) |
| 360pF(**361**) | | 0.8(**4**) |

The part numbering code is shown in each ( ). The (4) code in T(mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

## High Dielectric Constant Type GNM1 Series



| Part Number | GNM1M | |
|---|---|---|
| L x W | 1.37x1.00 | |
| TC | X7R (**R7**) | |
| Rated Volt. | 16 (**1C**) | 10 (**1A**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | |
| 22000pF(**223**) | 0.6(**2**) | |
| 47000pF(**473**) | 0.6(**2**) | |
| 0.10µF(**104**) | | 0.6(**2**) |

The part numbering code is shown in each ( ). The (2) code in T(mm) means number of elements (two).
Dimensions are shown in mm and Rated Voltage in Vdc.

## High Dielectric Constant Type GNM2 Series

| Part Number | GNM21 |
|---|---|
| L x W | 2.0x1.25 |
| TC | X7R (**R7**) |
| Rated Volt. | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | |
| 1000pF(**102**) | 0.6(**4**) |
| 10000pF(**103**) | 0.6(**4**) |

The part numbering code is shown in each ( ). The (4) code in T(mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

## High Dielectric Constant Type GNM3 Series

| Part Number | GNM31 | | | | | | |
|---|---|---|---|---|---|---|---|
| L x W | 3.2x1.6 | | | | | | |
| TC | X7R (**R7**) | | | | Y5V (**F5**) | | |
| Rated Volt. | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 100 (**2A**) | 50 (**1H**) | 16 (**1C**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 220pF(**221**) | 0.8(**4**) | | | | | | |

Continued on the following page.

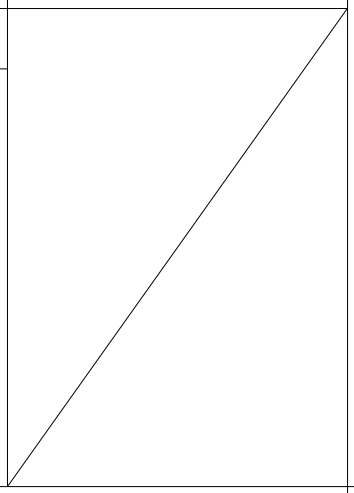
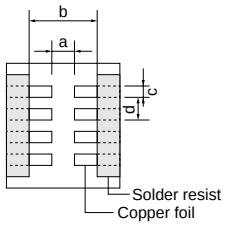
Continued from the preceding page.

| Part Number | GNM31 | | | | | | |
|---|---|---|---|---|---|---|---|
| L x W | 3.2x1.6 | | | | | | |
| TC | X7R (**R7**) | | | | Y5V (**F5**) | | |
| Rated Volt. | 100 (**2A**) | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 100 (**2A**) | 50 (**1H**) | 16 (**1C**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 270pF(**271**) | 0.8(**4**) | | | | | | |
| 330pF(**331**) | 0.8(**4**) | | | | | | |
| 390pF(**391**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 470pF(**471**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 560pF(**561**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 680pF(**681**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 820pF(**821**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 1000pF(**102**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 1200pF(**122**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 1500pF(**152**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 1800pF(**182**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 2200pF(**222**) | 0.8(**4**) | 0.8(**4**) | | | 0.8(**4**) | | |
| 2700pF(**272**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 3300pF(**332**) | 0.8(**4**) | 0.8(**4**) | | | 0.8(**4**) | | |
| 3900pF(**392**) | 0.8(**4**) | 0.8(**4**) | | | | | |
| 4700pF(**472**) | 0.8(**4**) | 0.8(**4**) | | | 0.8(**4**) | | |
| 5600pF(**562**) | | 0.8(**4**) | | | | | |
| 6800pF(**682**) | | 0.8(**4**) | | | | | |
| 8200pF(**822**) | | 0.8(**4**) | | | | | |
| 10000pF(**103**) | | 0.8(**4**) | | | | | |
| 12000pF(**123**) | | 0.8(**4**) | | | | | |
| 15000pF(**153**) | | 0.8(**4**) | | | | | |
| 18000pF(**183**) | | | 0.8(**4**) | | | | |
| 22000pF(**223**) | | | | 0.8(**4**) | | 0.8(**4**) | |
| 27000pF(**273**) | | | | 0.8(**4**) | | | |
| 33000pF(**333**) | | | | 0.8(**4**) | | 0.8(**4**) | |
| 39000pF(**393**) | | | | 0.8(**4**) | | | |
| 47000pF(**473**) | | | | 1.0(**4**) | | 0.8(**4**) | |
| 68000pF(**683**) | | | | 1.0(**4**) | | | 0.8(**4**) |
| 0.10µF(**104**) | | | | 1.0(**4**) | | | 0.8(**4**) |
| 0.15µF(**154**) | | | | | | | 0.8(**4**) |

The part numbering code is shown in each ( ). The (4) code in T(mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

# Specifications and Test Methods

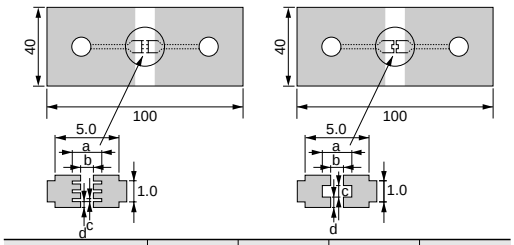
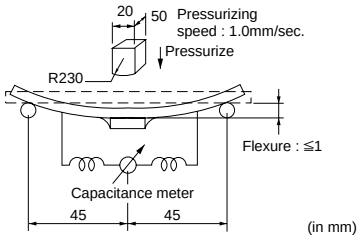


<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Item</th><th colspan="2">Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td>1</td><td>Operating Temperature Range</td><td>5C : −55℃ to +125℃</td><td>R7 : −55℃ to +125℃<br>F5 : −30℃ to +85℃</td><td></td></tr>
<tr><td>2</td><td>Rated Voltage</td><td colspan="2">See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td>Appearance</td><td colspan="2">No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td>Dimension</td><td colspan="2">Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>5</td><td>Dielectric Strength</td><td colspan="2">No defects or abnormalities</td><td>No failure should be observed when 300% of the rated voltage (5C) or 250% of the rated voltage (R7, F5) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td>Insulation Resistance</td><td colspan="2">More than 10,000MΩ or 500Ω • F<br>(Whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td>Capacitance</td><td colspan="2">Within the specified tolerance</td><td rowspan="2">The capacitance/Q/D.F. should be measured at 25℃ at the frequency and voltage shown in the table.<br><table><tr><th>Item \ Char.</th><th>5C</th><th>R7, F5</th></tr><tr><td>Frequency</td><td>1±0.1MHz</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>0.5 to 5Vr.m.s.</td><td>1.0±0.2Vr.m.s.</td></tr></table></td></tr>
<tr><td>8</td><td>Q/Dissipation Factor (D.F.)</td><td>30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br><br>C : Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>−</td></tr></table></td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Capacitance Temperature Characteristics</td><td>Capacitance Change</td><td>Within the specified tolerance (Table A)</td><td><table><tr><th>Char.</th><th>Temp. Range</th><th>Reference Temp.</th><th>Cap. Change</th></tr><tr><td>R7</td><td>−55 to +125℃</td><td rowspan="2">25℃</td><td>Within±15%</td></tr><tr><td>F5</td><td>−30 to +85℃</td><td>Within$^{+22}_{-82}$%</td></tr></table></td><td rowspan="3">The capacitance change should be measured after 5 min. at each specified temperature stage.<br>(1) Temperature Compensating Type<br>The temperature coefficient is determined using the capacitance measured in step 3 as a reference.<br>When cycling the temperature sequentially from step1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.<br>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3.<br><table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>−55±3 (for 5C/ R7), −30±3 (for F5)</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>125±3 (for 5C/R7), 85±3 (F5)</td></tr><tr><td>5</td><td>25±2</td></tr></table><br>(2) High Dielectric Constant Type<br>The ranges of capacitance change compared with the above 25℃ value over the temperature ranges shown in the table should be within the specified ranges.</td></tr>
<tr><td>Temperature Coefficient</td><td>Within the specified tolerance (Table A)</td><td rowspan="2">  </td></tr>
<tr><td>Capacitance Drift</td><td>Within ±0.2% or ±0.05 pF<br>(Whichever is larger)</td></tr>
<tr><td>10</td><td>Adhesive Strength of Termination</td><td colspan="2">No removal of the terminations or other defect should occur.<br>  <br></td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 5N force in parallel with the test jig for 10±1 sec.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>GNM1M</td><td>0.5</td><td>−</td><td>0.32</td><td>0.32</td></tr><tr><td>GNM21</td><td>0.4</td><td>1.6</td><td>0.25</td><td>0.5</td></tr><tr><td>GNM31</td><td>0.8</td><td>2.5</td><td>0.4</td><td>0.8</td></tr></table><br>(in mm)<br>Fig. 1</td></tr>
</table>

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specifications</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td colspan="2">No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz.<br>The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td colspan="2">Within the specified tolerance</td></tr>
<tr><td>Q/D.F.</td><td>30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br><br>C : Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>—</td></tr></table></td></tr>
<tr><td>12</td><td colspan="2">Deflection</td><td colspan="2">No cracking or marking defects should occur.<br><br>•GNM□□4 •GNM□□2<br>  <br><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>GNM1M</td><td>2.0±0.05</td><td>0.5±0.05</td><td>0.32±0.05</td><td>0.32±0.05</td></tr><tr><td>GNM21</td><td>2.0±0.05</td><td>0.7±0.05</td><td>0.3±0.05</td><td>0.2±0.05</td></tr><tr><td>GNM31</td><td>2.5±0.05</td><td>0.8±0.05</td><td>0.4±0.05</td><td>0.4±0.05</td></tr></table>(in mm)<br>Fig. 2</td><td>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3 for 5±1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>  <br>Fig. 3<br>t=0.8mm (GNM21), 1.6mm (GNM31)</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td colspan="2">75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃.</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Resistance to Soldering Heat</td><td></td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="5">Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), then measure.<br><br>• Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R7 : Within ±7.5%<br>F5 : Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br><br>C : Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>—</td></tr></table></td></tr>
<tr><td>I.R.</td><td colspan="2">More than 10,000MΩ or 500Ω • F (Whichever is smaller)</td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Temperature Cycle</td><td></td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="5">Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure<br><table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (℃)</td><td>Min. Operating Temp. $^{+0}_{-3}$</td><td>Room Temp.</td><td>Max. Operating Temp. $^{+3}_{-0}$</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table>• Initial measurement for high dielectric constant type<br>Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R7 : Within ±7.5%<br>F5 : Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br><br>C : Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>—</td></tr></table></td></tr>
<tr><td>I.R.</td><td colspan="2">More than 10,000MΩ or 500Ω • F (Whichever is smaller)</td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
</table>

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications: Temperature Compensating Type | Specifications: High Dielectric Type | Test Method |
|---|---|---|---|---|---|
| 16 | Humidity Steady State | | The measured and observed characteristics should satisfy the specifications in the following table. | | Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours.<br>Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | R7 : Within ±12.5%<br>F5 : Within ±30% | |
| | | Q/D.F. | 30pF and over : Q≧350<br>10pF and over, 30pF and below :<br>Q≧275+5C/2<br>10pF and below :<br>Q≧200+10C<br>C : Nominal Capacitance (pF) | Char. / 25V min. / 16V / 10V<br>R7 / 0.025 max. / 0.035 max. / 0.035 max.<br>F5 / 0.05 max. / 0.07 max. / – | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |
| 17 | Humidity Load | | The measured and observed characteristics should satisfy the specifications in the following table. | | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±7.5% or ±0.75pF (Whichever is larger) | R7 : Within ±12.5%<br>F5 : Within ±30% | |
| | | Q/D.F. | 30pF and over : Q≧200<br>30pF and below :<br>Q≧100+10C/3<br>C : Nominal Capacitance (pF) | Char. / 25V min. / 16V / 10V<br>R7 / 0.025 max. / 0.035 max. / 0.035 max.<br>F5 / 0.05 max. / 0.07 max. / – | |
| | | I.R. | More than 500MΩ or 25Ω • F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |
| 18 | High Temperature Load | | The measured and observed characteristics should satisfy the specifications in the following table. | | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.<br>The charge/discharge current is less than 50mA.<br><br>•Initial measurement for high dielectric constant type.<br>Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3℃. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement. |
| | | Appearance | No marking defects | | |
| | | Capacitance Change | Within ±3% or ±0.3pF (Whichever is larger) | R7 : Within ±12.5%<br>F5 : Within ±30% | |
| | | Q/D.F. | 30pF and over : Q≧350<br>10pF and over, 30pF and below :<br>Q≧275+5C/2<br>10pF and below :<br>Q≧200+10C<br>C : Nominal Capacitance (pF) | Char. / 25V min. / 16V / 10V<br>R7 / 0.025 max. / 0.035 max. / 0.035 max.<br>F5 / 0.05 max. / 0.07 max. / – | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | | |
| | | Dielectric Strength | No failure | | |

Table A

| Char. | Nominal Values (ppm/℃) Note 1 | Capacitance Change from 25℃ (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | −55 | | −30 | | −10 | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0±30 | 0.58 | −0.24 | 0.40 | −0.17 | 0.25 | −0.11 |

Note 1 : Nominal values denote the temperature coefficient within a range of 25℃ to 125℃.

# Chip Monolithic Ceramic Capacitors

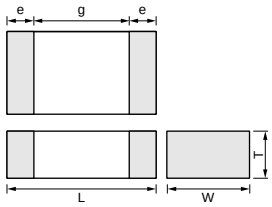
## for Ultrasonic Sensors

### ■ Features

1. Proper compensation for ultrasonic sensors
2. Small chip size and high capacitance value

### ■ Application

Ultrasonic sensor
(back sonar, corner sonar, etc.)



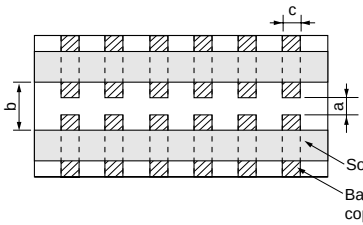

| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e | g min. |
| **GRM219** | 2.0 ±0.1 | 1.25 ±0.1 | 0.85 ±0.1 | 0.2 to 0.7 | 0.7 |

| Part Number | TC Code | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|---|---|---|---|---|---|---|
| **GRM2199E2A102KD42** | ZLM (Murata) | 100 | 1000 ±10% | 2.0 | 1.25 | 0.85 |
| **GRM2199E2A152KD42** | ZLM (Murata) | 100 | 1500 ±10% | 2.0 | 1.25 | 0.85 |

# Specifications and Test Methods

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 1 | Operating Temperature | | −25℃ to +85℃ | |
| 2 | Rated Voltage | | See the previous pages. | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range. |
| 3 | Appearance | | No defects or abnormalities | Visual inspection. |
| 4 | Dimensions | | Within the specified dimensions | Using calipers. |
| 5 | Dielectric Strength | | No defects or abnormalities | No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. |
| 6 | Insulation Resistance (I.R.) | | More than 10,000MΩ or 500Ω • F. (Whichever is smaller) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20℃ and 75%RH max. and within 2 minutes of charging. |
| 7 | Capacitance | | Within the specified tolerance | The capacitance/D.F. should be measured at 20℃ with 1±0.1kHz in frequency and 1±0.2Vr.m.s. in voltage. |
| 8 | Dissipation Factor (D.F.) | | 0.01 max. | |
| 9 | Capacitance Temperature Characteristics | | Within −4,700 $^{+1,000}_{-2,500}$ ppm/℃ (at −25 to +20℃)<br>Within −4,700 $^{+500}_{-1,000}$ ppm/℃ (at +20 to +85℃) | The temperature coefficient is determined using the capacitance measured in step 1 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient. The capacitance change should be measured after 5 min. at each specified temperature stage. |
| 10 | Adhesive Strength of Termination | | No removal of the terminations or other defect should occur. | Solder the capacitor to the test jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |
| | | Capacitance | Within the specified tolerance | |
| | | D.F. | 0.01 max. | |

| Step | Temperature(℃) |
|---|---|
| 1 | 20±2 |
| 2 | −25±3 |
| 3 | 20±2 |
| 4 | 85±3 |
| 5 | 20±2 |




| Type | a | b | c |
|---|---|---|---|
| GRM21 | 1.2 | 4.0 | 1.65 |

(in mm)

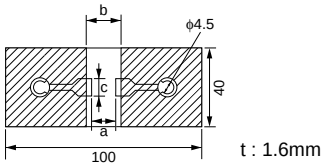
Fig.1

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 12 | Deflection | | No cracking or marking defects should occur. | Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder.<br>Then apply a force in the direction shown in Fig. 3.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 13 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃. |
| 14 | Resistance to Soldering Heat | Appearance | No defects or abnormalities | Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure. |
| | | Capacitance Change | Within ±7.5% | |
| | | D.F. | 0.01 max. | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 15 | Temperature Cycle | Appearance | No defects or abnormalities | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11).<br>Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure. |
| | | Capacitance Change | Within ±7.5% | |
| | | D.F. | 0.01 max. | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 16 | Humidity, Steady State | Appearance | No defects or abnormalities | Sit the capacitor at 40±2℃ and 90 to 95% humidity for 500±12 hours.<br>Remove and let sit for 24±2 hours at room temperature, then measure. |
| | | Capacitance Change | Within ±12.5% | |
| | | D.F. | 0.02 max. | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 17 | Humidity Load | Appearance | No defects or abnormalities | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. |
| | | Capacitance Change | Within ±12.5% | |
| | | D.F. | 0.02 max. | |
| | | I.R. | More than 500MΩ or 25Ω • F (Whichever is smaller) | |
| 18 | High Temperature Load | Appearance | No defects or abnormalities | Apply 200% of the rated voltage for 1,000±12 hours at 85±3℃. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. |
| | | Capacitance Change | Within ±12.5% | |
| | | D.F. | 0.02 max. | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | |




| Type | a | b | c |
|---|---|---|---|
| GRM21 | 1.2 | 4.0 | 1.65 |

(in mm)

Fig. 2

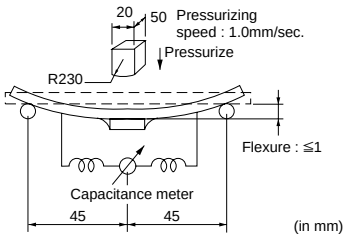



Fig.3

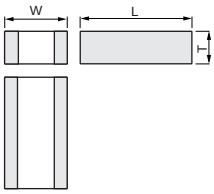
| Step | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Temp. (℃) | $-25^{+0}_{-3}$ | RoomTemp. | $85^{+3}_{-0}$ | RoomTemp. |
| Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |

# Chip Monolithic Ceramic Capacitors

## Low ESL

■ Features
1. Low ESL, good for noise reduction for high frequency
2. Small, high capacitance

■ Applications
1. High speed micro processors
2. High frequency digital equipment




| Part Number | Dimensions (mm) | | |
|---|---|---|---|
| | L | W | T |
| **LLL185** | 1.6 ±0.1 | 0.8 ±0.1 | 0.6 max. |
| **LLL216** | 2.0 ±0.1 | 1.25 ±0.1 | 0.6 ±0.1 |
| **LLL219** | | | 0.85 ±0.1 |
| **LLL317** | 3.2 ±0.15 | 1.6 ±0.15 | 0.7 ±0.1 |
| **LLL31M** | | | 1.15 ±0.1 |

### LLL18 Series

| Part Number | **LLL18** | | | | |
|---|---|---|---|---|---|
| L x W | 1.6x0.8 | | | | |
| TC | X7R (**R7**) | | | | Y5V (**F5**) |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) | 25 (**1E**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | |
| 2200pF(**222**) | 0.5(**5**) | | | | |
| 3300pF(**332**) | 0.5(**5**) | | | | |
| 4700pF(**472**) | 0.5(**5**) | | | | |
| 6800pF(**682**) | | 0.5(**5**) | | | |
| 10000pF(**103**) | | 0.5(**5**) | | | |
| 15000pF(**153**) | | 0.5(**5**) | | | |
| 22000pF(**223**) | | 0.5(**5**) | | | 0.5(**5**) |
| 33000pF(**333**) | | | 0.5(**5**) | | |
| 47000pF(**473**) | | | 0.5(**5**) | | |
| 68000pF(**683**) | | | 0.5(**5**) | | |
| 0.10µF(**104**) | | | | 0.5(**5**) | |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

### LLL21 Series

| Part Number | **LLL21** | | | |
|---|---|---|---|---|
| L x W | 2.0x1.25 | | | |
| TC | X7R (**R7**) | | | |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | |
| 4700pF(**472**) | 0.6(**6**) | | | |
| 6800pF(**682**) | 0.6(**6**) | | | |
| 10000pF(**103**) | 0.6(**6**) | | | |
| 15000pF(**153**) | 0.6(**6**) | | | |
| 22000pF(**223**) | 0.6(**6**) | | | |
| 33000pF(**333**) | 0.85(**9**) | 0.6(**6**) | 0.6(**6**) | |
| 47000pF(**473**) | | 0.6(**6**) | 0.6(**6**) | |

Continued on the following page.

Continued from the preceding page.

| Part Number | LLL21 | | | |
|---|---|---|---|---|
| L x W | 2.0x1.25 | | | |
| TC | X7R (**R7**) | | | |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | |
| 68000pF(**683**) | | 0.6(**6**) | 0.6(**6**) | |
| 0.10µF(**104**) | | 0.6(**6**) | 0.6(**6**) | |
| 0.15µF(**154**) | | 0.85(**9**) | 0.6(**6**) | |
| 0.22µF(**224**) | | | 0.85(**9**) | 0.6(**6**) |
| 0.33µF(**334**) | | | | 0.6(**6**) |
| 0.47µF(**474**) | | | | 0.85(**9**) |

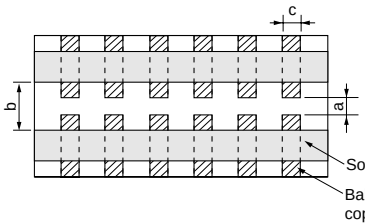
The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

## LLL31 Series

| Part Number | LLL31 | | | |
|---|---|---|---|---|
| L x W | 3.2x1.6 | | | |
| TC | X7R (**R7**) | | | |
| Rated Volt. | 50 (**1H**) | 25 (**1E**) | 16 (**1C**) | 10 (**1A**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | |
| 10000pF(**103**) | 0.7(**7**) | | | |
| 15000pF(**153**) | 0.7(**7**) | | | |
| 22000pF(**223**) | 0.7(**7**) | | | |
| 33000pF(**333**) | 0.7(**7**) | | | |
| 47000pF(**473**) | 0.7(**7**) | | | |
| 68000pF(**683**) | 0.7(**7**) | | | |
| 0.10µF(**104**) | 1.15(**M**) | 0.7(**7**) | 0.7(**7**) | |
| 0.15µF(**154**) | | 0.7(**7**) | 0.7(**7**) | |
| 0.22µF(**224**) | | 1.15(**M**) | 0.7(**7**) | |
| 0.33µF(**334**) | | 1.15(**M**) | 0.7(**7**) | |
| 0.47µF(**474**) | | 1.15(**M**) | 0.7(**7**) | |
| 0.68µF(**684**) | | | 1.15(**M**) | 0.7(**7**) |
| 1.0µF(**105**) | | | 1.15(**M**) | 0.7(**7**) |
| 1.5µF(**155**) | | | | 1.15(**M**) |
| 2.2µF(**225**) | | | | 1.15(**M**) |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

# Specifications and Test Methods

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td>Operating Temperature Range</td><td>R7 : −55℃ to +125℃<br>F5 : −30℃ to +85℃</td><td></td></tr>
<tr><td>2</td><td>Rated Voltage</td><td>See the previous pages.</td><td>The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V_{P-P}$ or $V_{O-P}$, whichever is larger, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td>Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>4</td><td>Dimensions</td><td>Within the specified dimension</td><td>Using calipers</td></tr>
<tr><td>5</td><td>Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.</td></tr>
<tr><td>6</td><td>Insulation Resistance (I.R.)</td><td>More than 10,000MΩ or 500Ω • F (Whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td>Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/D.F. should be measured at 25℃ at the frequency and voltage shown in the table.<br><table><tr><th>Item \ Char.</th><th>R7</th></tr><tr><td>Frequency</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>1±0.2Vr.m.s.</td></tr></table></td></tr>
<tr><td>8</td><td>Dissipation Factor (D.F.)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>—</td></tr></table></td></tr>
<tr><td>9</td><td>Capacitance Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Temp. Range (℃)</th><th>Reference Temp.</th><th>Cap. Change.</th></tr><tr><td>R7</td><td>−55 to +125</td><td>25℃</td><td>Within±15%</td></tr><tr><td>F5</td><td>−30 to +85</td><td>25℃</td><td>Within+22/−82%</td></tr></table></td><td>The ranges of capacitance change compared with the 25℃ value over the temperature ranges shown in the table should be within the specified ranges.<br>The capacitance change should be measured after 5 min. at each specified temperature stage.</td></tr>
<tr><td>10</td><td>Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N* force in the direction of the arrow. *5N: LLL18<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br> 

<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>LLL18</td><td>0.3</td><td>1.2</td><td>2.0</td></tr><tr><td>LLL21</td><td>0.6</td><td>1.6</td><td>2.4</td></tr><tr><td>LLL31</td><td>1.0</td><td>3.0</td><td>3.7</td></tr></table>
(in mm)<br>Fig. 1</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute.<br>This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>—</td></tr></table></td></tr>
</table>

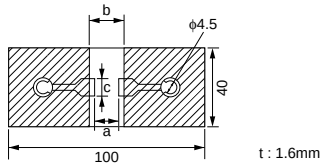
Continued on the following page.

10

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 12 | Deflection | | No crack or marked defect should occur. | Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 13 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃. |
| 14 | Resistance to Soldering Heat | Appearance | No defects or abnormalities | Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 48±4 hours , then measure.<br>•Initial measurement.<br>Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement. |
| | | Capacitance Change | R7 : Within±7.5%<br>F5 : Within±20% | |
| | | D.F. | Char. / 25V min. / 16V<br>R7 / 0.025 max. / 0.035 max.<br>F5 / 0.05 max. / — | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 15 | Temperature Cycle | Appearance | No defects or abnormalities | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 48±4 hours at room temperature, then measure.<br>Step / 1 / 2 / 3 / 4<br>Temp. (℃) / Min. Operating Temp. $^{+0}_{-3}$ / Room Temp. / Max. Operating Temp. $^{+3}_{-0}$ / Room Temp.<br>Time (min.) / 30±3 / 2 to 3 / 30±3 / 2 to 3<br>•Initial measurement.<br>Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement. |
| | | Capacitance Change | R7 : Within±7.5%<br>F5 : Within±20% | |
| | | D.F. | Char. / 25V min. / 16V<br>R7 / 0.025 max. / 0.035 max.<br>F5 / 0.05 max. / — | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 16 | Humidity, Steady State | Appearance | No defects or abnormalities | Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure. |
| | | Capacitance Change | R7 : Within±12.5%<br>F5 : Within±30% | |
| | | D.F. | Char. / 25V min. / 16V<br>R7 / 0.05 max. / 0.05 max.<br>F5 / 0.075 max. / — | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | |
| 17 | Humidity Load | Appearance | No defects or abnormalities | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA. |
| | | Capacitance Change | R7 : Within±12.5%<br>F5 : Within±30% | |
| | | D.F. | Char. / 25V min. / 16V<br>R7 / 0.05 max. / 0.05 max.<br>F5 / 0.075 max. / — | |
| | | I.R. | More than 500MΩ or 25Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |




| Type | a | b | c |
|---|---|---|---|
| LLL18 | 0.3 | 1.2 | 2.0 |
| LLL21 | 0.6 | 1.6 | 2.4 |
| LLL31 | 1.0 | 3.0 | 3.7 |

(in mm)

Fig. 2

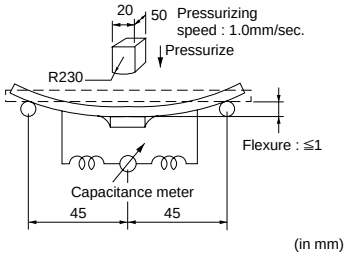



Fig. 3

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

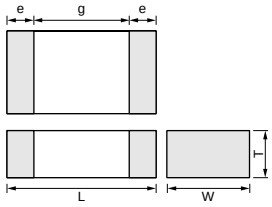
<table>
<tr><th colspan="2">No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">18</td><td rowspan="5">High Temperature Load</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="5">Apply 200% of the rated voltage for 1,000±12 hours at maximum operating temperature ±3℃. Let sit for 48±4 hours at room temperature, then measure.<br>The charge/discharge current is less than 50mA.<br><br>•Initial measurement.<br>Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3℃.<br>Remove and let sit for 48±4 hours at room temperature.<br>Perform initial measurement.</td></tr>
<tr><td>Capacitance Change</td><td>R7 : Within±12.5%<br>F5 : Within±30%</td></tr>
<tr><td>D.F.</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th></tr><tr><td>R7</td><td>0.05 max.</td><td>0.05 max.</td></tr><tr><td>F5</td><td>0.075 max.</td><td>—</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 50Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td></tr>
</table>

# Chip Monolithic Ceramic Capacitors

## High Frequency for Flow/Reflow Soldering

### ■ Features

1. HiQ and low ESR at VHF, UHF, Microwave
2. Feature improvement, low power consumption for mobile telecommunication. (Base station, terminal, etc.)




### ■ Applications

High frequency circuit (Mobile telecommunication, etc.)

| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e | g min. |
| **GQM188** | 1.6 ±0.1 | 0.8 ±0.1 | 0.8 ±0.1 | 0.2 to 0.5 | 0.5 |
| **GQM219** | 2.0 ±0.1 | 1.25 ±0.1 | 0.85 ±0.1 | 0.2 to 0.7 | 0.7 |

| Part Number | **GQM18** | | **GQM21** | |
|---|---|---|---|---|
| L x W | 1.60x0.80 | | 2.00x1.25 | |
| TC | C0G (**5C**) | | C0G (**5C**) | |
| Rated Volt. | 100 (**2A**) | 50 (**1H**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | |
| 0.50pF(**R50**) | 0.80(**8**) | | 0.85(**9**) | |
| 0.75pF(**R75**) | 0.80(**8**) | | 0.85(**9**) | |
| 1.0pF(**1R0**) | 0.80(**8**) | | 0.85(**9**) | |
| 1.1pF(**1R1**) | 0.80(**8**) | | 0.85(**9**) | |
| 1.2pF(**1R2**) | 0.80(**8**) | | 0.85(**9**) | |
| 1.3pF(**1R3**) | 0.80(**8**) | | 0.85(**9**) | |
| 1.5pF(**1R5**) | 0.80(**8**) | | 0.85(**9**) | |
| 1.6pF(**1R6**) | 0.80(**8**) | | 0.85(**9**) | |
| 1.8pF(**1R8**) | 0.80(**8**) | | 0.85(**9**) | |
| 2.0pF(**2R0**) | 0.80(**8**) | | 0.85(**9**) | |
| 2.2pF(**2R2**) | 0.80(**8**) | | 0.85(**9**) | |
| 2.4pF(**2R4**) | 0.80(**8**) | | 0.85(**9**) | |
| 2.7pF(**2R7**) | 0.80(**8**) | | 0.85(**9**) | |
| 3.0pF(**3R0**) | 0.80(**8**) | | 0.85(**9**) | |
| 3.3pF(**3R3**) | 0.80(**8**) | | 0.85(**9**) | |
| 3.6pF(**3R6**) | 0.80(**8**) | | 0.85(**9**) | |
| 3.9pF(**3R9**) | 0.80(**8**) | | 0.85(**9**) | |
| 4.0pF(**4R0**) | 0.80(**8**) | | 0.85(**9**) | |
| 4.3pF(**4R3**) | 0.80(**8**) | | 0.85(**9**) | |
| 4.7pF(**4R7**) | 0.80(**8**) | | 0.85(**9**) | |
| 5.0pF(**5R0**) | 0.80(**8**) | | 0.85(**9**) | |
| 5.1pF(**5R1**) | 0.80(**8**) | | 0.85(**9**) | |
| 5.6pF(**5R6**) | 0.80(**8**) | | 0.85(**9**) | |
| 6.0pF(**6R0**) | 0.80(**8**) | | 0.85(**9**) | |
| 6.2pF(**6R2**) | 0.80(**8**) | | 0.85(**9**) | |
| 6.8pF(**6R8**) | 0.80(**8**) | | 0.85(**9**) | |
| 7.0pF(**7R0**) | | 0.80(**8**) | 0.85(**9**) | |
| 7.5pF(**7R5**) | | 0.80(**8**) | 0.85(**9**) | |
| 8.0pF(**8R0**) | | 0.80(**8**) | 0.85(**9**) | |
| 8.2pF(**8R2**) | | 0.80(**8**) | 0.85(**9**) | |
| 9.0pF(**9R0**) | | 0.80(**8**) | 0.85(**9**) | |
| 9.1pF(**9R1**) | | 0.80(**8**) | 0.85(**9**) | |
| 10pF(**100**) | | 0.80(**8**) | 0.85(**9**) | |

Continued on the following page.

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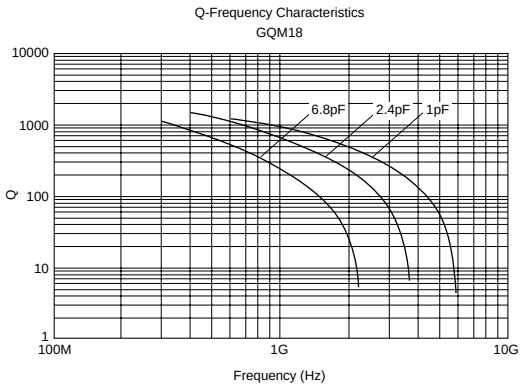
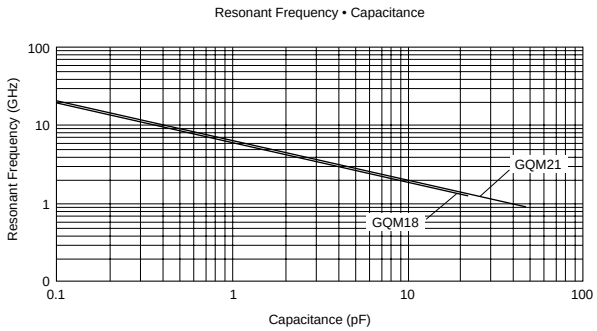
| Part Number | GQM18 | | GQM21 | |
|---|---|---|---|---|
| L x W | 1.60x0.80 | | 2.00x1.25 | |
| TC | C0G (**5C**) | | C0G (**5C**) | |
| Rated Volt. | 100 (**2A**) | 50 (**1H**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | |
| 11pF(**110**) | | 0.80(**8**) | 0.85(**9**) | |
| 12pF(**120**) | | 0.80(**8**) | 0.85(**9**) | |
| 13pF(**130**) | | 0.80(**8**) | 0.85(**9**) | |
| 15pF(**150**) | | 0.80(**8**) | 0.85(**9**) | |
| 16pF(**160**) | | 0.80(**8**) | 0.85(**9**) | |
| 18pF(**180**) | | 0.80(**8**) | 0.85(**9**) | |
| 20pF(**200**) | | 0.80(**8**) | | 0.85(**9**) |
| 22pF(**220**) | | 0.80(**8**) | | 0.85(**9**) |
| 24pF(**240**) | | 0.80(**8**) | | 0.85(**9**) |
| 27pF(**270**) | | | | 0.85(**9**) |
| 30pF(**300**) | | | | 0.85(**9**) |
| 33pF(**330**) | | | | 0.85(**9**) |
| 36pF(**360**) | | | | 0.85(**9**) |
| 39pF(**390**) | | | | 0.85(**9**) |
| 43pF(**430**) | | | | 0.85(**9**) |
| 47pF(**470**) | | | | 0.85(**9**) |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

## ■ Q-Frequency Characteristics




## ■ Resonant Frequency-Capacitance

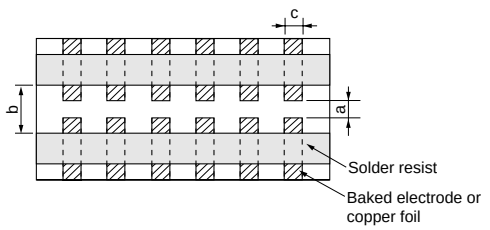



11

# Specifications and Test Methods

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 1 | Operating Temperature | | 5C : −55℃ to 125℃ | |
| 2 | Rated Voltage | | See the previous page. | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range. |
| 3 | Appearance | | No defects or abnormalities | Visual inspection |
| 4 | Dimension | | Within the specified dimensions | Using calipers |
| 5 | Dielectric Strength | | No defects or abnormalities | No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. |
| 6 | Insulation Resistance | | More than 10,000MΩ or 500Ω • F (whichever is smaller) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 75%RH max. and within 2 minutes of charging. |
| 7 | Capacitance | | Within the specified tolerance | The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table.<br>Item \ Char. : 5C (1000pF and below)<br>Frequency : 1±0.1MHz<br>Voltage : 0.5 to 5Vrms |
| 8 | Q | | 30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br>C : Nominal Capacitance (pF) | |
| 9 | Capacitance Temperature Characteristics | Capacitance Change | Within the specified tolerance (Table A) | The temperature coefficient is determined using the capacitance measured in step 3 as a reference.<br>When cycling the temperature sequentially from step 1 through 5 the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as in Table A.<br>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the steps 1, 3 and 5 by the capacitance. value in step 3. |
| | | Temperature Coefficient | Within the specified tolerance (Table A) | |
| | | Capacitance Drift | Within ±0.2% or ±0.05pF (Whichever is larger.) | |
| 10 | Adhesive Strength of Termination | | No removal of the terminations or other defect should occur. | Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>*5N (GQM188) |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute.<br>This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours). |
| | | Capacitance | Within the specified tolerance | |
| | | Q | 30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br>C : NominalCapacitance (pF) | |

| Step | Temperature (℃) |
|---|---|
| 1 | 25±2 |
| 2 | −55±3 |
| 3 | 25±2 |
| 4 | 125±3 |
| 5 | 25±2 |




| Type | a | b | c |
|---|---|---|---|
| GQM18 | 1.0 | 3.0 | 1.2 |
| GQM21 | 1.2 | 4.0 | 1.65 |
| GQM32 | 2.2 | 5.0 | 2.9 |

(in mm)

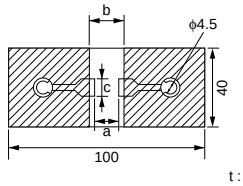
Fig .1

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 12 | Deflection | | No crack or marked defect should occur. | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2 using a eutectic solder.<br>Then apply a force in the direction shown in Fig. 3.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 13 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃. |
| 14 | Resistance to Soldering Heat | | The measured and observed characteristics should satisfy the specifications in the following table. | Preheat the capacitor at 120 to 150℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ for 10±0.5 seconds. Let sit at room temperature for 24±2 hours. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±2.5% or ±0.25 pF (Whichever is larger) | |
| | | Q | 30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br><br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 15 | Temperature Cycle | | The measured and observed characteristics should satisfy the specifications in the following table. | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).<br>Perform the five cycles according to the four heat treatments listed in the following table.<br>Let sit for 24±2 hours at room temperature, then measure. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | |
| | | Q | 30pF min. : Q≧1000<br>30pF max. : Q≧400+20C<br><br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 10,000MΩ or 500Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 16 | Humidity Steady State | | The measured and observed characteristics should satisfy the specifications in the following table. | Let the capacitor sit at 40±2℃ and 90 to 95% humidity for 500±12 hours.<br>Remove and let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | |
| | | Q | 30pF min. : Q≧350<br>10pF and over, 30pF and below : Q≧275+5C/2<br>10pF max. : Q≧200+10C<br><br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |




| Type | a | b | c |
|---|---|---|---|
| GQM18 | 1.0 | 3.0 | 1.2 |
| GQM21 | 1.2 | 4.0 | 1.65 |
| GQM32 | 2.2 | 5.0 | 2.9 |

(in mm)

Fig. 2

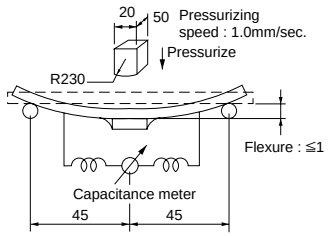



Fig. 3

| Step | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Temp. (℃) | Min. Operating Temp.+0/−3 | Room Temp. | Max. operating Temp.+3/−0 | Room Temp. |
| Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 17 | Humidity Load | | The measured and observed characteristics should satisfy the specifications in the following table. | Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature then measure. The charge/discharge current is less than 50mA. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±7.5% or ±0.75pF (Whichever is larger) | |
| | | Q | 30pF min. : Q≧200<br>30pF max. : Q≧100+10C/3<br><br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 500MΩ or 25Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |
| 18 | High Temperature Load | | The measured and observed characteristics should satisfy the specifications in the following table. | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃.<br>Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure.<br>The charge/discharge current is less than 50mA. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±3% or ±0.3pF (Whichever is larger) | |
| | | Q | 30pF min. : Q≧350<br>10pF and over, 30pF and below : Q≧275+5C/2<br>10pF max. : Q≧200+10C<br><br>C : Nominal Capacitance (pF) | |
| | | I.R. | More than 1,000MΩ or 50Ω • F (Whichever is smaller) | |
| | | Dielectric Strength | No failure | |

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Table A

| Char. | Nominal Values (ppm/℃) Note 1 | Capacitance Change from 25℃ (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | −55 | | −30 | | −10 | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0±30 | 0.58 | −0.24 | 0.40 | −0.17 | 0.25 | −0.11 |

Note1 : Nominal values denote the temperature coefficient within a range of 25℃ to 125℃ (for 5C)

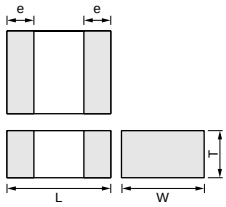
# Chip Monolithic Ceramic Capacitors

## High-Q & High Power Type

### SMD Type

■ Features (ERF Series)

1. The dielectric is composed of low dielectric loss ceramic. This series is perfectly suited to high frequency applications (VHS-microwave band).
2. The series is ultraminiature, yet has a high-power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
3. ERF1D type is designed for both flow and reflow soldering and ERF22 type is designed for reflow soldering.




| Part Number | Dimensions (mm) | | | |
|---|---|---|---|---|
| | L | W | T | e |
| **ERF1DM** | $1.4^{+0.6}_{-0.4}$ | $1.4^{+0.6}_{-0.4}$ | $1.15^{+0.50}_{-0.35}$ | $0.25^{+0.25}_{-0.15}$ |
| **ERF22X** | $2.8^{+0.6}_{-0.4}$ | $2.8^{+0.6}_{-0.4}$ | $2.3^{+0.5}_{-0.3}$ | $0.4^{+0.4}_{-0.3}$ |

■ Applications

High frequency and high power circuits

| Part Number | **ERF1D** | | **ERF22** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.40x1.40 | | 2.80x2.80 | | | | | | | | | |
| TC | C0G (**5C**) | CH (**6C**) | C0G (**5C**) | | | | | CH (**6C**) | | | | |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 0.50pF(**R50**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 0.6pF(**R60**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 0.7pF(**R70**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 0.75pF(**R75**) | | 1.15(**M**) | | | | | | 2.30(**X**) | | | | |
| 0.8pF(**R80**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 0.9pF(**R90**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.0pF(**1R0**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 1.1pF(**1R1**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.2pF(**1R2**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.3pF(**1R3**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.4pF(**1R4**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.5pF(**1R5**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 1.6pF(**1R6**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.7pF(**1R7**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.8pF(**1R8**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 1.9pF(**1R9**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 2.0pF(**2R0**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 2.1pF(**2R1**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 2.2pF(**2R2**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 2.4pF(**2R4**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 2.7pF(**2R7**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 3.0pF(**3R0**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 3.3pF(**3R3**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 3.6pF(**3R6**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 3.9pF(**3R9**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 4.0pF(**4R0**) | | 1.15(**M**) | | | | | | 2.30(**X**) | | | | |
| 4.3pF(**4R3**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 4.7pF(**4R7**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |

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| Part Number | ERF1D | | ERF22 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.40x1.40 | | 2.80x2.80 | | | | | | | | | |
| TC | C0G (**5C**) | CH (**6C**) | C0G (**5C**) | | | | | CH (**6C**) | | | | |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 5.0pF(**5R0**) | | 1.15(**M**) | | | | | | 2.30(**X**) | | | | |
| 5.1pF(**5R1**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 5.6pF(**5R6**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 6.0pF(**6R0**) | | 1.15(**M**) | | | | | | 2.30(**X**) | | | | |
| 6.2pF(**6R2**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 6.8pF(**6R8**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 7.0pF(**7R0**) | | 1.15(**M**) | | | | | | 2.30(**X**) | | | | |
| 7.5pF(**7R5**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 8.0pF(**8R0**) | | 1.15(**M**) | | | | | | 2.30(**X**) | | | | |
| 8.2pF(**8R2**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 9.0pF(**9R0**) | | 1.15(**M**) | | | | | | 2.30(**X**) | | | | |
| 9.1pF(**9R1**) | 1.15(**M**) | | 2.30(**X**) | | | | | | | | | |
| 10pF(**100**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 11pF(**110**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 12pF(**120**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 13pF(**130**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 15pF(**150**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 16pF(**160**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 18pF(**180**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 20pF(**200**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 22pF(**220**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 24pF(**240**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 27pF(**270**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 30pF(**300**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 33pF(**330**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 36pF(**360**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 39pF(**390**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 43pF(**430**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 47pF(**470**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 51pF(**510**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 56pF(**560**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 62pF(**620**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 68pF(**680**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 75pF(**750**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 82pF(**820**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 91pF(**910**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 100pF(**101**) | 1.15(**M**) | 1.15(**M**) | 2.30(**X**) | | | | | 2.30(**X**) | | | | |
| 110pF(**111**) | | | | 2.30(**X**) | | | | | 2.30(**X**) | | | |
| 120pF(**121**) | | | | 2.30(**X**) | | | | | 2.30(**X**) | | | |
| 130pF(**131**) | | | | 2.30(**X**) | | | | | 2.30(**X**) | | | |
| 150pF(**151**) | | | | 2.30(**X**) | | | | | 2.30(**X**) | | | |
| 160pF(**161**) | | | | 2.30(**X**) | | | | | 2.30(**X**) | | | |
| 180pF(**181**) | | | | 2.30(**X**) | | | | | 2.30(**X**) | | | |
| 200pF(**201**) | | | | 2.30(**X**) | | | | | 2.30(**X**) | | | |
| 220pF(**221**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 240pF(**241**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 270pF(**271**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 300pF(**301**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 330pF(**331**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 360pF(**361**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 390pF(**391**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 430pF(**431**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |

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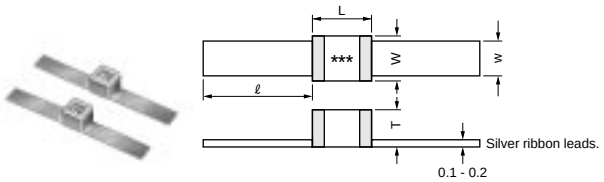
| Part Number | ERF1D | | ERF22 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.40x1.40 | | 2.80x2.80 | | | | | | | | | |
| TC | C0G (**5C**) | CH (**6C**) | C0G (**5C**) | | | | | CH (**6C**) | | | | |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 470pF(**471**) | | | | | 2.30(**X**) | | | | | 2.30(**X**) | | |
| 510pF(**511**) | | | | | | 2.30(**X**) | | | | | 2.30(**X**) | |
| 560pF(**561**) | | | | | | 2.30(**X**) | | | | | 2.30(**X**) | |
| 620pF(**621**) | | | | | | 2.30(**X**) | | | | | 2.30(**X**) | |
| 680pF(**681**) | | | | | | 2.30(**X**) | | | | | 2.30(**X**) | |
| 750pF(**751**) | | | | | | | 2.30(**X**) | | | | | 2.30(**X**) |
| 820pF(**821**) | | | | | | | 2.30(**X**) | | | | | 2.30(**X**) |
| 910pF(**911**) | | | | | | | 2.30(**X**) | | | | | 2.30(**X**) |
| 1000pF(**102**) | | | | | | | 2.30(**X**) | | | | | 2.30(**X**) |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

## Ribbon Terminal

### ■ Features (ERH Series)

1. The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high frequency applications (VHS-microwave band).
2. The series is ultraminiature, yet has a high power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
3. ERH1X/3X Series capacitors withstand high temperatures because ribbon leads are attached with silver paste.
4. ERH1X/3X Series capacitors are easily soldered and especially well suited in applications where only a soldering iron can be used.




*** : Capacitance Code

| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T max. | ℓ | w |
| **ERH1XC** | 1.6 ±0.4 | 1.4 ±0.4 | 1.6 | 5.0 min. | 1.3 ±0.4 |
| **ERH3XX** | 3.2 ±0.4 | 2.8 ±0.4 | 3.0 | 9.0 ±2.0 | 2.35 ±0.15 |

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### ■ Applications

High frequency and high power circuits

| Part Number | ERH1X | | ERH3X | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.60x1.40 | | 3.20x2.80 | | | | | | | | | |
| TC | C0G (**5C**) | CH (**6C**) | C0G (**5C**) | | | | | CH (**6C**) | | | | |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 0.50pF(**R50**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 0.6pF(**R60**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 0.7pF(**R70**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 0.75pF(**R75**) | | 1.60(**C**) | | | | | | 3.00(**X**) | | | | |
| 0.8pF(**R80**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 0.9pF(**R90**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.0pF(**1R0**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 1.1pF(**1R1**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.2pF(**1R2**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.3pF(**1R3**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.4pF(**1R4**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.5pF(**1R5**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |

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| Part Number | ERH1X | | ERH3X | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.60x1.40 | | 3.20x2.80 | | | | | | | | | |
| TC | C0G (**5C**) | CH (**6C**) | C0G (**5C**) | | | | | CH (**6C**) | | | | |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 1.6pF(**1R6**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.7pF(**1R7**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.8pF(**1R8**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 1.9pF(**1R9**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 2.0pF(**2R0**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 2.1pF(**2R1**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 2.2pF(**2R2**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 2.4pF(**2R4**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 2.7pF(**2R7**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 3.0pF(**3R0**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 3.3pF(**3R3**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 3.6pF(**3R6**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 3.9pF(**3R9**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 4.0pF(**4R0**) | | 1.60(**C**) | | | | | | 3.00(**X**) | | | | |
| 4.3pF(**4R3**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 4.7pF(**4R7**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 5.0pF(**5R0**) | | 1.60(**C**) | | | | | | 3.00(**X**) | | | | |
| 5.1pF(**5R1**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 5.6pF(**5R6**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 6.0pF(**6R0**) | | 1.60(**C**) | | | | | | 3.00(**X**) | | | | |
| 6.2pF(**6R2**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 6.8pF(**6R8**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 7.0pF(**7R0**) | | 1.60(**C**) | | | | | | 3.00(**X**) | | | | |
| 7.5pF(**7R5**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 8.0pF(**8R0**) | | 1.60(**C**) | | | | | | 3.00(**X**) | | | | |
| 8.2pF(**8R2**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 9.0pF(**9R0**) | | 1.60(**C**) | | | | | | 3.00(**X**) | | | | |
| 9.1pF(**9R1**) | 1.60(**C**) | | 3.00(**X**) | | | | | | | | | |
| 10pF(**100**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 11pF(**110**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 12pF(**120**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 13pF(**130**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 15pF(**150**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 16pF(**160**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 18pF(**180**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 20pF(**200**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 22pF(**220**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 24pF(**240**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 27pF(**270**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 30pF(**300**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 33pF(**330**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 36pF(**360**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 39pF(**390**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 43pF(**430**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 47pF(**470**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 51pF(**510**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 56pF(**560**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 62pF(**620**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 68pF(**680**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 75pF(**750**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 82pF(**820**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 91pF(**910**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |

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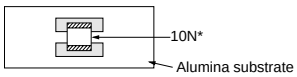
| Part Number | ERH1X | | ERH3X | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.60x1.40 | | 3.20x2.80 | | | | | | | | | |
| TC | C0G (**5C**) | CH (**6C**) | C0G (**5C**) | | | | | CH (**6C**) | | | | |
| Rated Volt. | 50 (**1H**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 500 (**2H**) | 300 (**YD**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | |
| 100pF(**101**) | 1.60(**C**) | 1.60(**C**) | 3.00(**X**) | | | | | 3.00(**X**) | | | | |
| 110pF(**111**) | | | | 3.00(**X**) | | | | | 3.00(**X**) | | | |
| 120pF(**121**) | | | | 3.00(**X**) | | | | | 3.00(**X**) | | | |
| 130pF(**131**) | | | | 3.00(**X**) | | | | | 3.00(**X**) | | | |
| 150pF(**151**) | | | | 3.00(**X**) | | | | | 3.00(**X**) | | | |
| 160pF(**161**) | | | | 3.00(**X**) | | | | | 3.00(**X**) | | | |
| 180pF(**181**) | | | | 3.00(**X**) | | | | | 3.00(**X**) | | | |
| 200pF(**201**) | | | | 3.00(**X**) | | | | | 3.00(**X**) | | | |
| 220pF(**221**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 240pF(**241**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 270pF(**271**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 300pF(**301**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 330pF(**331**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 360pF(**361**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 390pF(**391**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 430pF(**431**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 470pF(**471**) | | | | | 3.00(**X**) | | | | | 3.00(**X**) | | |
| 510pF(**511**) | | | | | | 3.00(**X**) | | | | | 3.00(**X**) | |
| 560pF(**561**) | | | | | | 3.00(**X**) | | | | | 3.00(**X**) | |
| 620pF(**621**) | | | | | | 3.00(**X**) | | | | | 3.00(**X**) | |
| 680pF(**681**) | | | | | | 3.00(**X**) | | | | | 3.00(**X**) | |
| 750pF(**751**) | | | | | | | 3.00(**X**) | | | | | 3.00(**X**) |
| 820pF(**821**) | | | | | | | 3.00(**X**) | | | | | 3.00(**X**) |
| 910pF(**911**) | | | | | | | 3.00(**X**) | | | | | 3.00(**X**) |
| 1000pF(**102**) | | | | | | | 3.00(**X**) | | | | | 3.00(**X**) |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

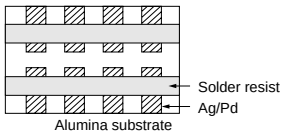
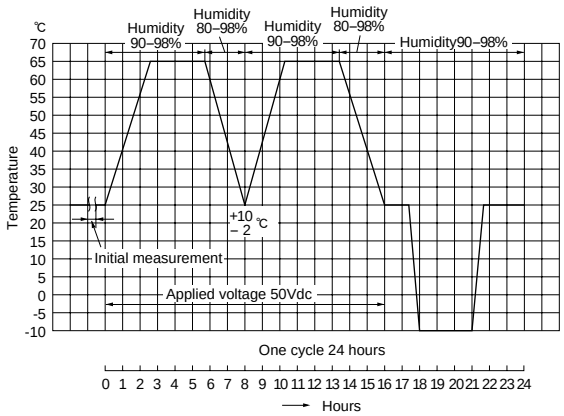
# Specifications and Test Methods

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 1 | Operating Temperature Range | | −55℃ to +125℃ | |
| 2 | Rated Voltage | | See the previous pages. | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range. |
| 3 | Appearance | | No defects or abnormalities | Visual inspection |
| 4 | Dimensions | | Within the specified dimension | Using calipers |
| 5 | Dielectric Strength | | No defects or abnormalities | No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. |
| 6 | Insulation Resistance (I.R.) | 25℃ | C≦ 470pF :1,000,000MΩ min.<br>470pF<C≦1,000pF : 100,000MΩ min. | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and 125℃ standard humidity and within 2 minutes of charging. |
| | | 125℃ | C≦ 470pF : 100,000MΩ min.<br>470pF<C≦1,000pF : 10,000MΩ min. | |
| 7 | Capacitance | | Within the specified tolerance. | The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table.<br>Item / Frequency: 1±0.1MHz / Voltage: 0.5 to 5Vr.m.s. |
| 8 | Q | | C≦ 220pF : Q≧10,000<br>220pF<C≦ 470pF : Q≧ 5,000<br>470pF<C≦1,000pF : Q≧ 3,000<br>C : Nominal Capacitance (pF) | |
| 9 | Capacitance Temperature Characteristics | Capacitance Variation Rate | Within the specified tolerance (Table A-7) | The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.<br>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3.<br>The capacitance change should be measured after 5 min. at each specified temperature stage.<br>Step / Temperature (℃): 1: 25±2; 2: −55±3; 3: 25±2; 4: 125±3; 5: 25±2 |
| | | Temperature Coefficient | Within the specified tolerance (Table A-7) | |
| | | Capacitance Drift | Within ±0.2% or ±0.05pF<br>(Whichever is larger) | |
| 10 | Terminal Strength | Adhesive Strength of Termination (for chip type) | No removal of the terminations or other defects should occur. | Solder the capacitor to the test jig (alumina substrate) shown in Fig. 1 using solder containing 2.5% silver. The soldering should be done either with an iron or in furnace and be conducted with care so the soldering is uniform and free of defects such as heat shock. Then apply a 10N* force in the direction of the arrow.<br>*ERF1D : 5N<br>  <br>Fig. 1 |
| | | Tensile Strength (for micro-strip type) | Capacitor should not be broken or damaged. | The capacitor body is fixed and a load is applied gradually in the axial direction until its value reaches 10N (5N for ERH1X). |
| | | Bending Strength of lead wire terminal (for micro-strip type) | Lead wire should not be cut or broken. | Position the main body of the capacitor so the lead wire terminal is perpendicular, and load 2.5N to the lead wire terminal. Bend the main body by 90 degrees, bend back to original position, bend 90 degrees in the reverse direction, and then bend back to original position. |

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (alumina substrate) shown in Fig. 2 using solder containing 2.5% silver. The soldering should be done either with an iron or using the reflow method and should be conducted with care so the soldering is uniform and free of defects such as heat shock. The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).<br>  <br><br>Fig. 2 |
| | | Capacitance | Within the specified tolerance | |
| | | Q | Satisfies the initial value.<br>C≦ 220pF : Q≧10,000<br>220pF<C≦ 470pF : Q≧ 5,000<br>470pF<C≦1,000pF : Q≧ 3,000<br>C : Nominal Capacitance (pF) | |
| 12 | Solderability of Termination | | 95% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5℃. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal. |
| 13 | Resistance to Soldering Heat | | The measured and observed characteristics should satisfy the specifications in the following table.<br>Item / Specifications<br>Appearance / No marked defect<br>Capacitance Change / Within ±2.5% or ±0.25pF (Whichever is larger)<br>Q / C≦ 220pF : Q≧10,000; 220pF<C≦ 470pF : Q≧ 5,000; 470pF<C≦1,000pF : Q≧ 3,000<br>I.R. / More than 30% of the initial specification value at 25℃.<br>Dielectric Strength / No failure<br>C : Nominal Capacitance (pF) | Preheat the capacitor at 80 to 100℃ for 2 minutes and then at 150 to 200℃ for 5 minutes.<br>Immerse in solder containing 2.5% silver for 3±0.5 seconds at 270±5℃. Set at room temperature for 24±2 hours, then measure. The dipping depth for microstrip type capacitors is up to 2mm from the root of the terminal. |
| 14 | Temperature Cycle | | The measured and observed characteristics should satisfy the specifications in the following table.<br>Item / Specifications<br>Appearance / No marked defect<br>Capacitance Change / Within ±1% or ±0.25pF (Whichever is larger)<br>Q / C≦ 220pF : Q≧10,000; 220pF<C≦ 470pF : Q≧ 5,000; 470pF<C≦1,000pF : Q≧ 3,000<br>I.R. / More than 30% of the initial specification value at 25℃.<br>Dielectric Strength / No failure<br>C : Nominal Capacitance (pF) | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11). Perform the five cycles according to the four heat treatments listed in the following table. Then, repeat twice the successive cycles of immersion, each cycle consisting of immersion in a fresh water at 65 $^{+5}_{-0}$℃ for 15 minutes and immersion in a saturated aqueous solution of salt at 0±3℃ for 15 minutes.<br>The capacitor is promptly washed with running water, dried with a dry cloth, and allowed to sit at room temperature for 24±2 hours.<br>Step / 1 / 2 / 3 / 4<br>Temp.(℃) / −55 $^{+0}_{-3}$ / RoomTemp. / 125 $^{+3}_{-0}$ / RoomTemp.<br>Time(min.) / 30±3 / 2 to 3 / 30±3 / 2 to 3 |
| 15 | Humidity | | The measured and observed characteristics should satisfy the specifications in the following table.<br>Item / Specifications<br>Appearance / No marked defect<br>Capacitance Change / Within ±5% or ±0.5pF (Whichever is larger)<br>Q / C≦ 220pF : Q≧10,000; 220pF<C≦ 470pF : Q≧ 5,000; 470pF<C≦1,000pF : Q≧ 3,000<br>I.R. / More than 30% of the initial specification value at 25℃.<br>C : Nominal Capacitance (pF) | Apply the 24-hour heat (−10 to +65℃) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure.<br>  <br> |

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# Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>16</td><td>High Temperature Load</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≦ 220pF : Q≧10,000<br>220pF<C≦ 470pF : Q≧ 5,000<br>470pF<C≦1,000pF : Q≧ 3,000</td></tr>
<tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>Apply 150% of the rated voltage for 2,000±12 hours at 125±3℃.<br>Remove and let sit for 24±2 hours at room temperature, then measure.<br>The charge/discharge current is less than 50mA.</td></tr>
</table>

Table A

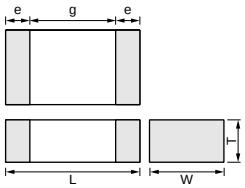
| Char. Code | Temp. Coeff. (ppm/℃) Note 1 | Capacitance Change from 25℃ Value (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | −55℃ | | −30℃ | | −10℃ | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0±30 | 0.58 | −0.24 | 0.40 | −0.17 | 0.25 | −0.11 |

Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125℃.

# Chip Monolithic Ceramic Capacitors

## High Frequency Type

### SMD Type




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T max. | e | g min. |
| **ERA11A** | 1.25 +0.5 -0.3 | 1.0 +0.5 -0.3 | 1.0±0.2 | 0.15 min. | 0.3 |
| **ERA21A** | 2.0 +0.5 -0.3 | 1.25 +0.5 -0.3 | 1.0±0.2 | 0.2 min. | 0.5 |
| **ERA21B** | | | 1.25±0.2 | | |
| **ERA32X** | 3.2 +0.6 -0.4 | 2.5 +0.5 -0.3 | 1.7±0.2 | 0.3 min. | 0.5 |

■ Features (ERA Series)

1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
2. Nickel barriered terminations of ERA series improve solderability and decrease solder leaching.
3. ERA11A/21A series are designed for both flow and reflow soldering and ERA32 series are designed for reflow soldering.

■ Applications

High frequency and high power circuits

| Part Number | ERA11 | | | | | | | | ERA21 | | | | | | | | ERA32 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.25x1.00 | | | | | | | | 2.00x1.25 | | | | | | | | 3.20x2.50 | | | | | | | |
| TC | C0G (**5C**) | | | CH (**6C**) | | | CJ (**7C**) | CK (**8C**) | C0G (**5C**) | | | CH (**6C**) | | | CJ (**7C**) | CK (**8C**) | C0G (**5C**) | | | CH (**6C**) | | | CJ (**7C**) | CK (**8C**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 200 (**2D**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 200 (**2D**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 200 (**2D**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.50pF (**R50**) | 1.00 (**A**) | | | | | | | 1.20 (**A**) | 1.00 (**A**) | | | | | | | 1.00 (**A**) | 1.70 (**X**) | | | | | | | 1.70 (**X**) |
| 0.6pF (**R60**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 0.7pF (**R70**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 0.75pF (**R75**) | | | | | | | | 1.20 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) |
| 0.8pF (**R80**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 0.9pF (**R90**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 1.0pF (**1R0**) | 1.00 (**A**) | | | | | | | 1.20 (**A**) | 1.00 (**A**) | | | | | | | 1.00 (**A**) | 1.70 (**X**) | | | | | | | 1.70 (**X**) |
| 1.1pF (**1R1**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 1.2pF (**1R2**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 1.3pF (**1R3**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 1.4pF (**1R4**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 1.5pF (**1R5**) | 1.00 (**A**) | | | | | | | 1.20 (**A**) | 1.00 (**A**) | | | | | | | 1.00 (**A**) | 1.70 (**X**) | | | | | | | 1.70 (**X**) |
| 1.6pF (**1R6**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 1.7pF (**1R7**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |
| 1.8pF (**1R8**) | 1.00 (**A**) | | | | | | | | 1.00 (**A**) | | | | | | | | 1.70 (**X**) | | | | | | | |

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| Part Number | ERA11 | | | | | | | | ERA21 | | | | | | | | ERA32 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.25x1.00 | | | | | | | | 2.00x1.25 | | | | | | | | 3.20x2.50 | | | | | | | |
| TC | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) |
| Rated Volt. | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.9pF (1R9) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 2.0pF (2R0) | 1.00 (A) | | | | | | | 1.20 (A) | 1.00 (A) | | | | | | | 1.00 (A) | 1.70 (X) | | | | | | | 1.70 (X) |
| 2.1pF (2R1) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 2.2pF (2R2) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 2.4pF (2R4) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 2.7pF (2R7) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 3.0pF (3R0) | 1.00 (A) | | | | | | 1.20 (A) | | 1.00 (A) | | | | | | 1.00 (A) | | 1.70 (X) | | | | | | 1.70 (X) | |
| 3.3pF (3R3) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 3.6pF (3R6) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 3.9pF (3R9) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 4.0pF (4R0) | | | | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | |
| 4.3pF (4R3) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 4.7pF (4R7) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 5.0pF (5R0) | | | | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | |
| 5.1pF (5R1) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 5.6pF (5R6) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 6.0pF (6R0) | | | | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | |
| 6.2pF (6R2) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 6.8pF (6R8) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 7.0pF (7R0) | | | | 1.20 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | |
| 7.5pF (7R5) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 8.0pF (8R0) | | | | 1.20 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | |
| 8.2pF (8R2) | 1.00 (A) | | | | | | | | 1.00 (A) | | | | | | | | 1.70 (X) | | | | | | | |
| 9.0pF (9R0) | | | | 1.20 (A) | 1.00 (A) | | | | | | | 1.25 (B) | | | | | | | | 1.70 (X) | | | | |
| 9.1pF (9R1) | 1.00 (A) | | | | | | | | 1.25 (B) | | | | | | | | 1.70 (X) | | | | | | | |
| 10pF (100) | 1.00 (A) | | | 1.00 (A) | 1.00 (A) | | | | 1.25 (B) | | | 1.25 (B) | | | | | 1.70 (X) | | | 1.70 (X) | | | | |

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| Part Number | ERA11 | | | | | | | | ERA21 | | | | | | | | ERA32 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.25x1.00 | | | | | | | | 2.00x1.25 | | | | | | | | 3.20x2.50 | | | | | | | |
| TC | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) |
| Rated Volt. | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | | | | | | | |
| 11pF (**110**) | 1.00 (**A**) | | | 1.00 (**A**) | 1.00 (**A**) | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 12pF (**120**) | 1.00 (**A**) | | | 1.00 (**A**) | 1.00 (**A**) | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 13pF (**130**) | 1.00 (**A**) | | | 1.00 (**A**) | 1.00 (**A**) | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 15pF (**150**) | | 1.00 (**A**) | | | 1.00 (**A**) | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 16pF (**160**) | | 1.00 (**A**) | | | 1.00 (**A**) | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.00 (**X**) | | | 1.70 (**X**) | | | | |
| 18pF (**180**) | | 1.00 (**A**) | | | 1.00 (**A**) | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 20pF (**200**) | | 1.00 (**A**) | | | 1.00 (**A**) | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 22pF (**220**) | | 1.00 (**A**) | | | 1.00 (**A**) | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 24pF (**240**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 27pF (**270**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 30pF (**300**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 33pF (**330**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 36pF (**360**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 39pF (**390**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 43pF (**430**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 47pF (**470**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 51pF (**510**) | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 56pF (**560**) | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 62pF (**620**) | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 68pF (**680**) | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 75pF (**750**) | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 82pF (**820**) | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 91pF (**910**) | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 100pF (**101**) | | | | | | | | | | | 1.00 (**A**) | | | 1.00 (**A**) | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 110pF (**111**) | | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 120pF (**121**) | | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |

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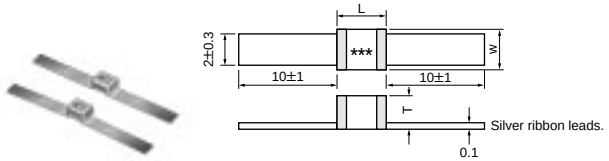
| Part Number | ERA11 | | | | | | | | ERA21 | | | | | | | | ERA32 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L x W | 1.25x1.00 | | | | | | | | 2.00x1.25 | | | | | | | | 3.20x2.50 | | | | | | | |
| TC | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) | C0G (5C) | | | CH (6C) | | | CJ (7C) | CK (8C) |
| Rated Volt. | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 200 (2D) | 200 (2D) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | | | | | | | |
| 130pF (**131**) | | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 150pF (**151**) | | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 160pF (**161**) | | | | | | | | | | | 1.25 (**B**) | | | 1.25 (**B**) | | | 1.70 (**X**) | | | 1.70 (**X**) | | | | |
| 180pF (**181**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 200pF (**201**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 220pF (**221**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 240pF (**241**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 270pF (**271**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 300pF (**301**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 330pF (**331**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 360pF (**361**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 390pF (**391**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 430pF (**431**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 470pF (**471**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 510pF (**511**) | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | | |
| 560pF (**561**) | | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | |
| 620pF (**621**) | | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | |
| 680pF (**681**) | | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | |
| 750pF (**751**) | | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | |
| 820pF (**821**) | | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | |
| 910pF (**911**) | | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | |
| 1000pF (**102**) | | | | | | | | | | | | | | | | | | | 1.70 (**X**) | | | 1.70 (**X**) | | |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

# Ribbon Terminal

## ■ Features (ERD Series)

1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
2. ERD Series capacitors withstand at high temperatures because ribbon leads are attached with silver paste.
3. ERD Series capacitors are easily soldered and are especially well suited in applications where only a soldering iron can be used.




*** : Capacitance Code

| Part Number | Dimensions (mm) | | |
|---|---|---|---|
| | L max. | W max. | T max. |
| **ERD32D** | 4.0 | 3.0 | 2.3 |

## ■ Application

High frequency and high power circuits

| Part Number | **ERD32** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L x W | 4.00x3.00 | | | | | | | |
| TC | C0G (**5C**) | | | CH (**6C**) | | | CJ (**7C**) | CK (**8C**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 200 (**2D**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 0.50pF(**R50**) | 2.30(**D**) | | | | | | | 2.30(**D**) |
| 0.6pF(**R60**) | 2.30(**D**) | | | | | | | |
| 0.7pF(**R70**) | 2.30(**D**) | | | | | | | |
| 0.75pF(**R75**) | | | | | | | | 2.30(**D**) |
| 0.8pF(**R80**) | 2.30(**D**) | | | | | | | |
| 0.9pF(**R90**) | 2.30(**D**) | | | | | | | |
| 1.0pF(**1R0**) | 2.30(**D**) | | | | | | | 2.30(**D**) |
| 1.1pF(**1R1**) | 2.30(**D**) | | | | | | | |
| 1.2pF(**1R2**) | 2.30(**D**) | | | | | | | |
| 1.3pF(**1R3**) | 2.30(**D**) | | | | | | | |
| 1.4pF(**1R4**) | 2.30(**D**) | | | | | | | |
| 1.5pF(**1R5**) | 2.30(**D**) | | | | | | | 2.30(**D**) |
| 1.6pF(**1R6**) | 2.30(**D**) | | | | | | | |
| 1.7pF(**1R7**) | 2.30(**D**) | | | | | | | |
| 1.8pF(**1R8**) | 2.30(**D**) | | | | | | | |
| 1.9pF(**1R9**) | 2.30(**D**) | | | | | | | |
| 2.0pF(**2R0**) | 2.30(**D**) | | | | | | | 2.30(**D**) |
| 2.1pF(**2R1**) | 2.30(**D**) | | | | | | | |
| 2.2pF(**2R2**) | 2.30(**D**) | | | | | | | |
| 2.4pF(**2R4**) | 2.30(**D**) | | | | | | | |
| 2.7pF(**2R7**) | 2.30(**D**) | | | | | | | |
| 3.0pF(**3R0**) | 2.30(**D**) | | | | | | 2.30(**D**) | |
| 3.3pF(**3R3**) | 2.30(**D**) | | | | | | | |
| 3.6pF(**3R6**) | 2.30(**D**) | | | | | | | |
| 3.9pF(**3R9**) | 2.30(**D**) | | | | | | | |
| 4.0pF(**4R0**) | | | | 2.30(**D**) | | | | |
| 4.3pF(**4R3**) | 2.30(**D**) | | | | | | | |
| 4.7pF(**4R7**) | 2.30(**D**) | | | | | | | |
| 5.0pF(**5R0**) | | | | 2.30(**D**) | | | | |
| 5.1pF(**5R1**) | 2.30(**D**) | | | | | | | |
| 5.6pF(**5R6**) | 2.30(**D**) | | | | | | | |
| 6.0pF(**6R0**) | | | | 2.30(**D**) | | | | |
| 6.2pF(**6R2**) | 2.30(**D**) | | | | | | | |
| 6.8pF(**6R8**) | 2.30(**D**) | | | | | | | |
| 7.0pF(**7R0**) | | | | 2.30(**D**) | | | | |

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| Part Number | ERD32 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L x W | 4.00x3.00 | | | | | | | |
| TC | C0G (**5C**) | | | CH (**6C**) | | | CJ (**7C**) | CK (**8C**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 200 (**2D**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 7.5pF(**7R5**) | 2.30(**D**) | | | | | | | |
| 8.0pF(**8R0**) | | | | 2.30(**D**) | | | | |
| 8.2pF(**8R2**) | 2.30(**D**) | | | | | | | |
| 9.0pF(**9R0**) | | | | 2.30(**D**) | | | | |
| 9.1pF(**9R1**) | 2.30(**D**) | | | | | | | |
| 10pF(**100**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 11pF(**110**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 12pF(**120**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 13pF(**130**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 15pF(**150**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 16pF(**160**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 18pF(**180**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 20pF(**200**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 22pF(**220**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 24pF(**240**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 27pF(**270**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 30pF(**300**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 33pF(**330**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 36pF(**360**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 39pF(**390**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 43pF(**430**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 47pF(**470**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 51pF(**510**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 56pF(**560**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 62pF(**620**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 68pF(**680**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 75pF(**750**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 82pF(**820**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 91pF(**910**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 100pF(**101**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 110pF(**111**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 120pF(**121**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 130pF(**131**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 150pF(**151**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 160pF(**161**) | 2.30(**D**) | | | 2.30(**D**) | | | | |
| 180pF(**181**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 200pF(**201**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 220pF(**221**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 240pF(**241**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 270pF(**271**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 300pF(**301**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 330pF(**331**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 360pF(**361**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 390pF(**391**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 430pF(**431**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 470pF(**471**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 510pF(**511**) | | 2.30(**D**) | | | 2.30(**D**) | | | |
| 560pF(**561**) | | | 2.30(**D**) | | | 2.30(**D**) | | |
| 620pF(**621**) | | | 2.30(**D**) | | | 2.30(**D**) | | |
| 680pF(**681**) | | | 2.30(**D**) | | | 2.30(**D**) | | |
| 750pF(**751**) | | | 2.30(**D**) | | | 2.30(**D**) | | |
| 820pF(**821**) | | | 2.30(**D**) | | | 2.30(**D**) | | |

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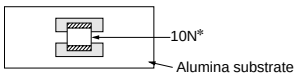
| Part Number | ERD32 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L x W | 4.00x3.00 | | | | | | | |
| TC | C0G (**5C**) | | | CH (**6C**) | | | CJ (**7C**) | CK (**8C**) |
| Rated Volt. | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 100 (**2A**) | 50 (**1H**) | 200 (**2D**) | 200 (**2D**) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 910pF(**911**) | | | 2.30(**D**) | | | 2.30(**D**) | | |
| 1000pF(**102**) | | | 2.30(**D**) | | | 2.30(**D**) | | |

The part numbering code is shown in ( ).
Dimensions are shown in mm and Rated Voltage in Vdc.

# Specifications and Test Methods

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 1 | Operating Temperature Range | | −55℃ to +125℃ | |
| 2 | Rated Voltage | | See the previous pages. | The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor.<br>When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$, whichever is larger, should be maintained within the rated voltage range. |
| 3 | Appearance | | No defects or abnormalities | Visual inspection |
| 4 | Dimensions | | Within the specified dimension | Using calipers |
| 5 | Dielectric Strength | | No defects or abnormalities | No failure should be observed when 300% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. |
| 6 | Insulation Resistance (I.R.) | | 10,000MΩ min. | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25℃ and standard humidity and within 2 minutes of charging. |
| 7 | Capacitance | | Within the specified tolerance | The capacitance/Q should be measured at 25℃ at the frequency and voltage shown in the table.<br>Item / Char. \| C0G (1,000pF and below)<br>Frequency \| 1±0.1MHz<br>Voltage \| 0.5 to 5Vr.m.s. |
| 8 | Q | | C≦ 220pF : Q≧10,000<br>220pF<C≦ 470pF : Q≧ 5,000<br>470pF<C≦1,000pF : Q≧ 3,000<br>C : Nominal Capacitance (pF) | |
| 9 | Capacitance Temperature Characteristics | Capacitance Variation Rate | Within the specified tolerance (Table A-6) | The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.<br>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3.<br>The capacitance change should be measured after 5 min. at each specified temperature stage.<br>Step \| Temperature(℃)<br>1 \| 25±2<br>2 \| −55±3<br>3 \| 25±2<br>4 \| 125±3<br>5 \| 25±2 |
| | | Temperature Coefficient | Within the specified tolerance (Table A-6) | |
| | | Capacitance Drift | Within ±0.2% or ±0.05pF<br>(Whichever is larger) | |
| 10 | Terminal Strength | Adhesive Strength of Termination (for chip type) | No removal of the terminations or other defects should occur. | Solder the capacitor to the test jig (alumina substrate) shown in Fig.1 using solder containing 2.5% silver. The soldering should be done either with an iron or in furnace and be conducted with care so the soldering is uniform and free of defects such as heat shock. Then apply a 10N* force in the direction of the arrow.<br>*5N (ERA11)<br>  <br>Fig.1 |
| | | Tensile Strength (for micro-strip type) | Capacitor should not be broken or damaged. | The capacitor body is fixed and a load is applied gradually in the axial direction until its value reaches 5N. |
| | | Bending Strength of lead wire terminal (for micro-strip type) | Lead wire should not be cut or broken. | Position the main body of the capacitor so the lead wire terminal is perpendicular, and load 2.5N to the lead wire terminal. Bend the main body by 90 degrees, bend back to original position, bend 90 degrees in the reverse direction, and then bend back to original position. |

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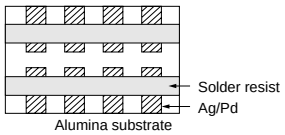
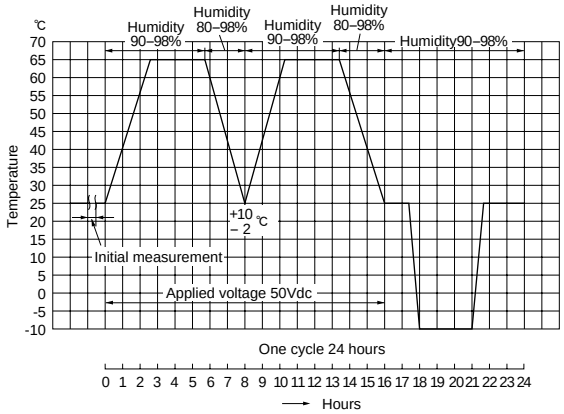
13

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (alumina substrate) shown in Fig. 2 using solder containing 2.5% silver. The soldering should be done either with an iron or using the reflow method and should be conducted with care so the soldering is uniform and free of defects such as heat shock. The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).<br>  <br><br>Fig. 2 |
| | | Capacitance | Within the specified tolerance | |
| | | Q | Satisfies the initial value.<br>C≦ 220pF : Q≧10,000<br>220pF<C≦ 470pF : Q≧ 5,000<br>470pF<C≦1,000pF : Q≧ 3,000<br>C : Nominal Capacitance (pF) | |
| 12 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5℃. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal. |
| 13 | Resistance to Soldering Heat | | The measured and observed characteristics should satisfy the specifications in the following table.<br>Item / Specifications<br>Appearance / No marked defect<br>Capacitance Change / Within ±2.5% or ±0.25pF (Whichever is larger)<br>Q / C≦ 220pF : Q≧10,000; 220pF<C≦ 470pF : Q≧ 5,000; 470pF<C≦1,000pF : Q≧ 3,000<br>Dielectric Strength / No failure<br>C : Nominal Capacitance (pF) | Preheat according to the conditions listed in the table below. Immerse in solder containing 2.5% silver for 3±0.5 seconds at 270±5℃. Set at room temperature for 24±2 hours, then measure. The dipping depth for microstrip type capacitors is up to 2mm from the root of the terminal.<br>Chip Size / Preheat Condition<br>2.0×1.25mm max. / 1minute at 120 to 150℃<br>3.2×2.5mm / Each 1 minute at 100 to 120℃ and then 170 to 200℃ |
| 14 | Temperature Cycle | | The measured and observed characteristics should satisfy the specifications in the following table.<br>Item / Specifications<br>Appearance / No marked defect<br>Capacitance Change / Within ±5% or ±0.5pF (Whichever is larger)<br>Q / C≧30pF : Q≧350; 10pF≦C<30pF : Q≧275+ 5/2 C; C<10pF : Q≧200+10C<br>I.R. / 1,000MΩ min.<br>Dielectric Strength / No failure<br>C : Nominal Capacitance (pF) | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at room temperature, then measure.<br>Step / 1 / 2 / 3 / 4<br>Temp.(℃) / −55 +0 −3 / RoomTemp. / 125 +3 −0 / RoomTemp.<br>Time(min.) / 30±3 / 2 to 3 / 30±3 / 2 to 3 |
| 15 | Humidity | | The measured and observed characteristics should satisfy the specifications in the following table.<br>Item / Specifications<br>Appearance / No marked defect<br>Capacitance Change / Within ±5% or ±0.5pF (Whichever is larger)<br>Q / C≧30pF : Q≧350; 10pF≦C<30pF : Q≧275+ 5/2 C; C<10pF : Q≧200+10C<br>I.R. / 1,000MΩ min.<br>C : Nominal Capacitance (pF) | Apply the 24-hour heat (−10 to +65℃) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure.<br>  <br> |

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# Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>16</td><td>High Temperature Load</td><td>The measured and observed characteristics should satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±3% or ±0.3pF (Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≧30pF : Q≧350<br>10pF≦C<30pF : Q≧275+$\frac{5}{2}$C<br>C<10pF : Q≧200+10C</td></tr>
<tr><td>I.R.</td><td>1,000MΩ min.</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>Apply 200% of the rated voltage for 1,000±12 hours at 125±3℃.<br>Remove and let sit for 24±2 hours at room temperature, then measure.<br>The charge/discharge current is less than 50mA.</td></tr>
</table>

Table A

| Char. Code | Temperature Coefficient (ppm/℃) Note 1 | Capacitance Change from 25℃ Value (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | −55℃ | | −30℃ | | −10℃ | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0±30 | 0.58 | −0.24 | 0.40 | −0.17 | 0.25 | −0.11 |

Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125℃.

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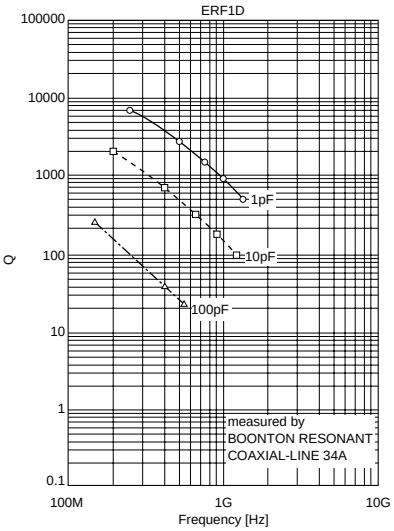
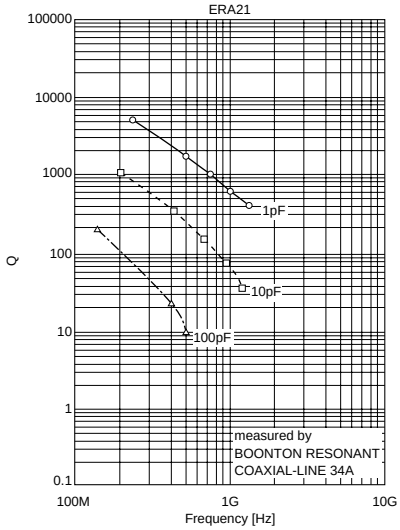
# ERA/ERD/ERF/ERH Series Data

## ■ Q-Frequency Characteristics

ERF Series

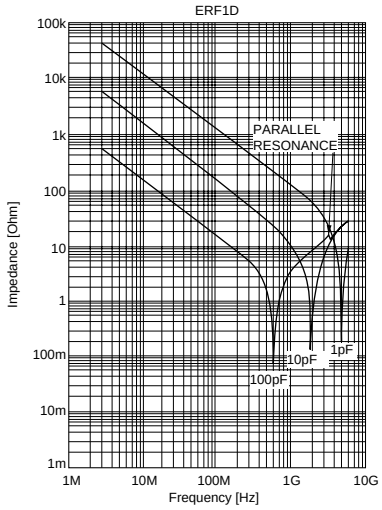



ERA Series

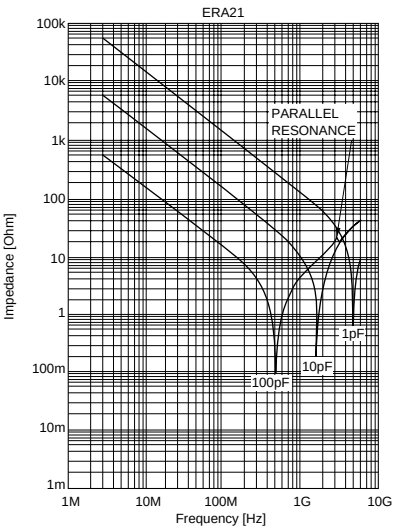



## ■ Impedance-Frequency Characteristics

ERF Series

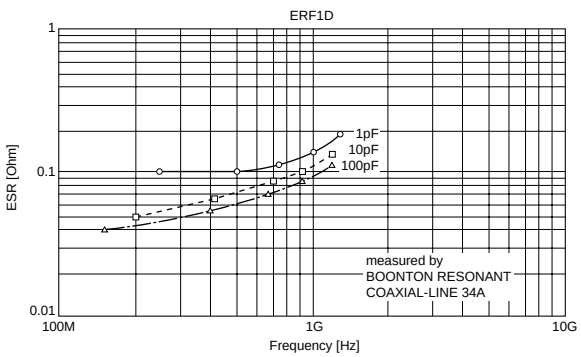



ERA Series

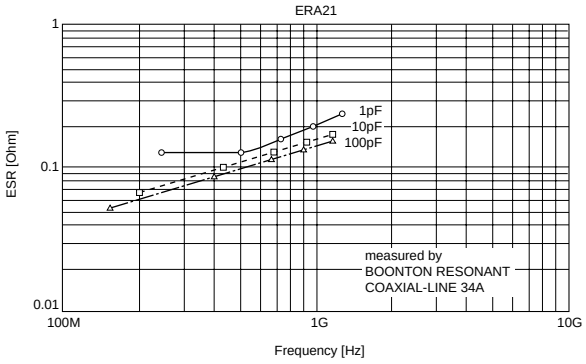



## ■ ESR-Frequency Characteristics

ERF Series




ERA Series



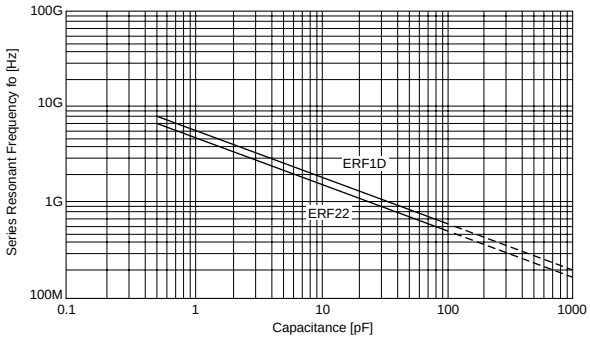

Continued on the following page.

# ERA/ERD/ERF/ERH Series Data

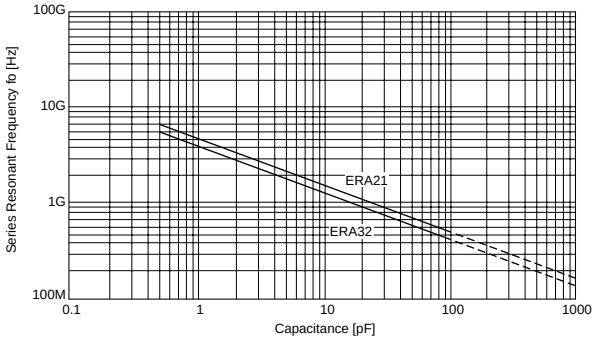
Continued from the preceding page.

## ■ Resonant Frequency-Capacitance

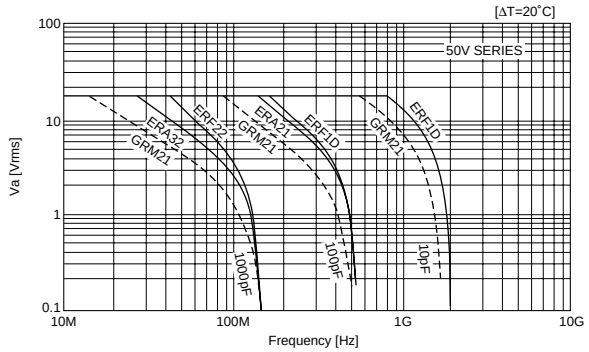
ERF Series



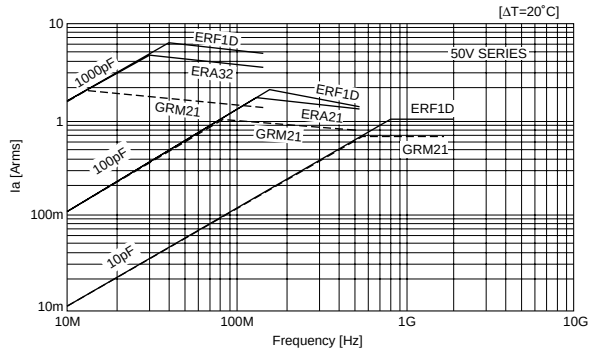

ERA Series



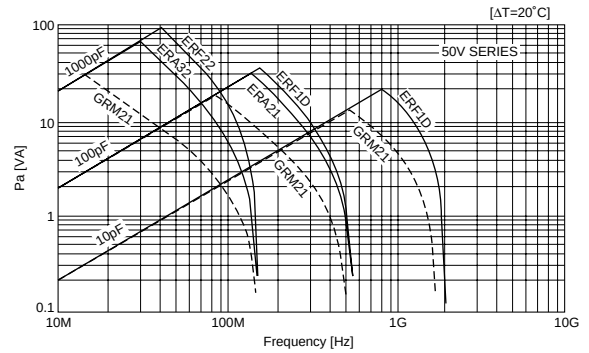

## ■ Allowable Voltage-Frequency



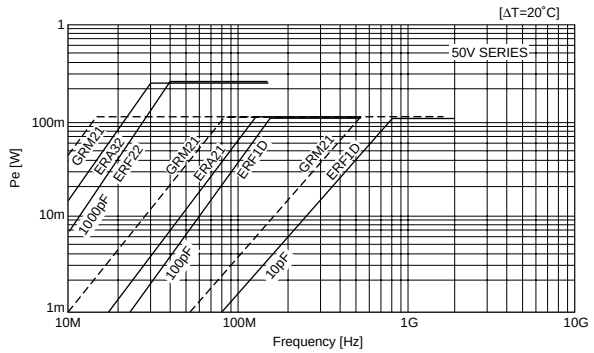

## ■ Allowable Current-Frequency




## ■ Allowable Apparent Power-Frequency




## ■ Allowable Effective Power-Frequency



# Package

## ■ Packaging Code

| Packaging Type | Tape Carrier Packaging | Bulk Case Packaging | Bulk Packaging | |
|---|---|---|---|---|
| | | | Bulk Packaging in a bag | Bulk Packaging in a tray |
| Packaging Code | **D, L, K, J, E, F** | **C** | **B** | **T** |

## ■ Minimum Quantity Guide

| Part Number | | Dimensions (mm) | | | Quantity (pcs.) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ø180mm reel | | ø330mm reel | | Bulk Case | Bulk Bag |
| | | L | W | T | Paper Tape | Plastic Tape | Paper Tape | Plastic Tape | | |
| Ultra Miniaturized | **GRM03** | 0.6 | 0.3 | 0.3 | 15,000 | - | 50,000 | - | - | 1,000 |
| For Flow/Reflow | **GRM18** | 1.6 | 0.8 | 0.8 | 4,000 | - | 10,000 | - | 15,000 | 1,000 |
| | **GRM21** | 2.0 | 1.25 | 0.6 | 4,000 | - | 10,000 | - | 10,000 | 1,000 |
| | | | | 0.85 | 4,000 | - | 10,000 | - | - | 1,000 |
| | | | | 1.0 | - | 3,000 | - | 10,000 | - | 1,000 |
| | | | | 1.25 | - | 3,000 | - | 10,000 | 5,000 [3] | 1,000 |
| | **GRM31** | 3.2 | 1.6 | 0.6 | 4,000 | - | 10,000 | - | - | 1,000 |
| | | | | 0.85 | 4,000 | - | 10,000 | - | - | 1,000 |
| | | | | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 |
| | | | | 1.6 | - | 2,000 | - | 6,000 | - | 1,000 |
| For Reflow | **GRM155** | 1.0 | 0.5 | 0.5 | 10,000 | - | 50,000 | - | 50,000 | 1,000 |
| | **GRM15X** | 1.0 | 0.5 | 0.25 | 10,000 | - | 50,000 | - | - | 1,000 |
| | **GRM32** | 3.2 | 2.5 | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 |
| | | | | 1.35 | - | 2,000 | - | 8,000 | - | 1,000 |
| | | | | 1.8/1.6 | - | 1,000 | - | 4,000 | - | 1,000 |
| | | | | 2.0 | - | 1,000 | - | 4,000 | - | 1,000 |
| | | | | 2.5 | - | 1,000 | - | 4,000 | - | 1,000 |
| | **GRM43** | 4.5 | 3.2 | 1.15 | - | 1,000 | - | 5,000 | - | 1,000 |
| | | | | 1.35/1.6 1.8/2.0 | - | 1,000 | - | 4,000 | - | 1,000 |
| | | | | 2.5 | - | 500 | - | 2,000 | - | 1,000 |
| | | | | 2.8 | - | 500 | - | 1,500 | - | 1,000 |
| | **GRM55** | 5.7 | 5.0 | 1.15 | - | 1,000 | - | 5,000 | - | 1,000 |
| | | | | 1.35/1.6 1.8/2.0 | - | 1,000 | - | 4,000 | - | 1,000 |
| | | | | 2.5 | - | 500 | - | 2,000 | - | 500 |
| | | | | 3.2 | - | 300 | - | 1,500 | - | 500 |
| High Power Type | **GJM03** | 0.6 | 0.3 | 0.3 | 15,000 | - | 50,000 | - | - | 1,000 |
| | **GJ6/GJM15** | 1.0 | 0.5 | 0.5 | 10,000 | - | 50,000 | - | 50,000 | 1,000 |
| Smoothing [1] | **GJ221** | 2.0 | 1.25 | 1.25 | - | 3,000 | - | 10,000 | - | - |
| | **GJ231** | 3.2 | 1.6 | 1.15 | - | 3,000 | - | 10,000 | - | - |
| | | | | 1.35 | - | 2,000 | - | 8,000 | - | - |
| | **GJ232** | 3.2 | 2.5 | 1.6 | - | 2,000 | - | 6,000 | - | - |
| | | | | 1.8 | - | 1,000 | - | 4,000 | - | - |
| | **GJ243** | 4.5 | 3.2 | 1.8 | - | 1,000 | - | 3,000 | - | - |
| | | | | 2.2 | - | 500 | - | 2,000 | - | - |
| High Frequency | **GQM18** | 1.6 | 0.8 | 0.8 | 4,000 | - | 10,000 | - | - | 1,000 |
| | **GQM21** | 2.0 | 1.25 | 0.85 | 4,000 | - | 10,000 | - | - | 1,000 |
| | **ERA11** | 1.25 | 1.0 | 1.0 | - | - | - | - | - | 1,000 |
| | **ERA21** | 2.0 | 1.25 | 1.0/1.25 | - | 3,000 | - | - | - | 1,000 |
| | **ERA32** | 3.2 | 2.5 | 1.7 | - | 2,000 | - | - | - | 1,000 |
| | **ERF1D** | 1.4 | 1.4 | 1.15 | - | 2,000 | - | - | - | 1,000 |
| | **ERF22** | 2.8 | 2.8 | 2.3 | - | 1,000 | - | - | - | 1,000 |
| For Ultrasonic | **GRM21** | 2.0 | 1.25 | 0.85 | 4,000 | - | 10,000 | - | - | 1,000 |
| Micro Chip | **GMA05** | 0.5 | 0.5 | 0.35 | - | - | - | - | - | 400 [2] |
| | **GMA08** | 0.8 | 0.8 | 0.5 | - | - | - | - | - | 400 [2] |
| Array | **GNM1M** | 1.37 | 1.0 | 0.6 | 4,000 | - | 10,000 | - | - | 1,000 |
| | **GNM31** | 3.2 | 1.6 | 0.8 | 4,000 | - | 10,000 | - | - | 1,000 |
| | | | | 1.0 | - | 3,000 | - | 10,000 | - | 1,000 |
| | **GNM21** | 2.0 | 1.25 | 0.6/0.85 | 4,000 | - | 10,000 | - | - | 1,000 |
| Low ESL | **LLL18** | 0.8 | 1.6 | 0.6 | 4,000 | - | 10,000 | - | - | 1,000 |
| | **LLL21** | 1.25 | 2.0 | 0.6 | - | 4,000 | - | 10,000 | - | 1,000 |
| | | | | 0.85 | - | 3,000 | - | 10,000 | - | 1,000 |
| | **LLL31** | 1.6 | 3.2 | 0.7 | - | 4,000 | - | 10,000 | - | 1,000 |
| | | | | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 |

1) Available in tape/reel only. 2) Tray 3) 3.3/4.7µF of 6.3 R6 rated are not available by bulk case.

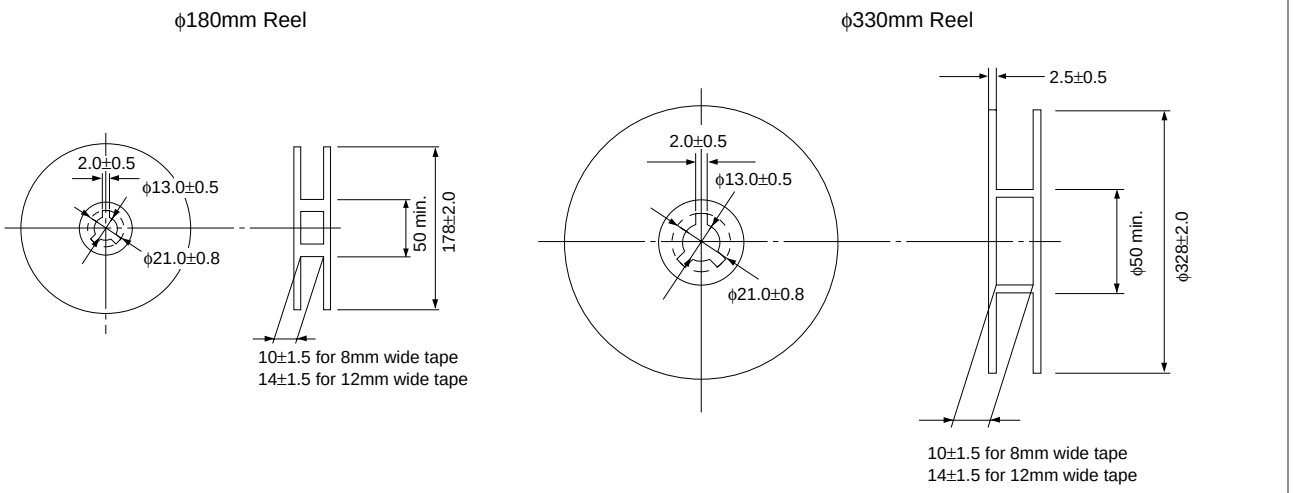
Continued on the following page.

# Package

Continued from the preceding page.

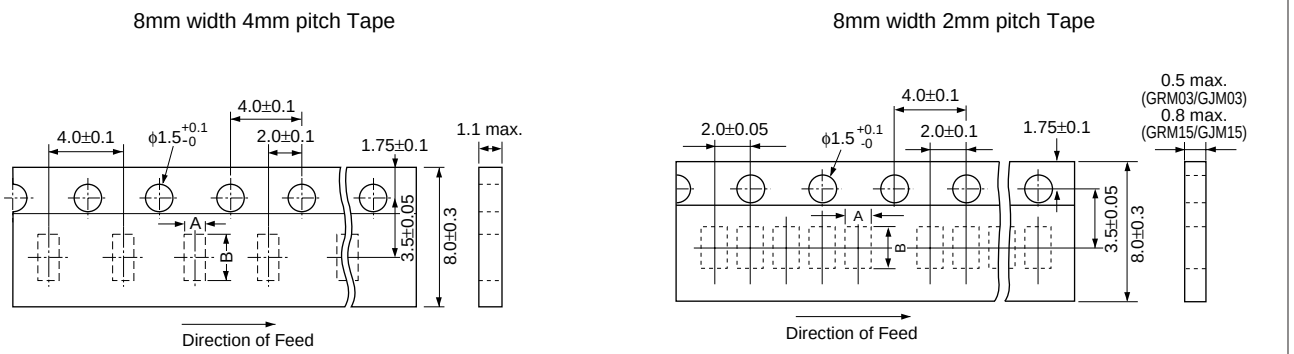
## ■ Tape Carrier Packaging

(1) Dimensions of Reel




(in mm)

(2) Dimensions of Paper Tape




| Part Number | A | B |
|---|---|---|
| **GRM18**<br>**GQM18** | 1.05±0.1 | 1.85±0.1 |
| **GNM1M** | 1.17±0.05 | 1.55±0.05 |
| **GRM21**<br>(T≦0.85mm)<br>**GQM21**<br>**GNM21** | 1.55±0.15 | 2.3±0.15 |
| **GRM31**<br>(T≦0.85mm)<br>**GNM31**<br>(T≦0.8mm) | 2.0±0.2 | 3.6±0.2 |
| **GRM32**<br>(T=0.85mm) | 2.8±0.2 | 3.6±0.2 |

| Part Number | A* | B* |
|---|---|---|
| **GJM03**<br>**GRM03** | 0.37 | 0.67 |
| **GJM15**<br>**GRM15** | 0.65 | 1.15 |

*Nominal Value

(in mm)

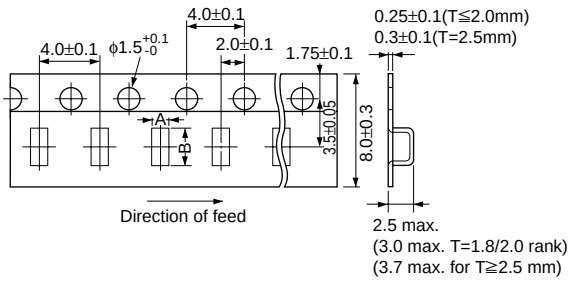
Continued on the following page.

# Package

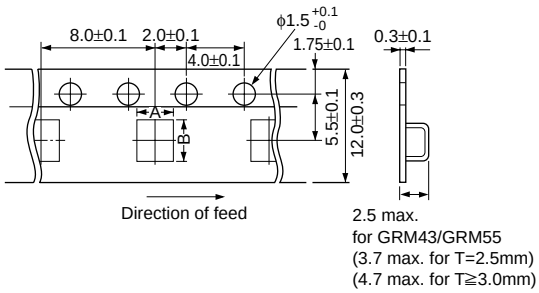
Continued from the preceding page.

(3) Dimensions of Plastic Tape

8mm width 4mm pitch Tape




12mm width 8mm pitch Tape




| Part Number | A | B |
|---|---|---|
| **LLL18** | 1.05±0.1 | 1.85±0.1 |
| **GRM21** (T≧1.0mm) **LLL21, GJ221** | 1.45±0.2 | 2.25±0.2 |
| **GRM31** (T≧1.15mm) **LLL31** **GNM31** (T≧1.0mm) **GJ231** | 1.9±0.2 | 3.5±0.2 |
| **GRM32** (T≧1.15mm) **GJ232** | 2.8±0.2 | 3.5±0.2 |
| **ERA21** | 1.8* | 2.6* |
| **ERA32** | 2.8* | 3.5* |
| **ERF1D** | 2.0* | 2.1* |
| **ERF22** | 3.1* | 3.2* |

*Nominal Value

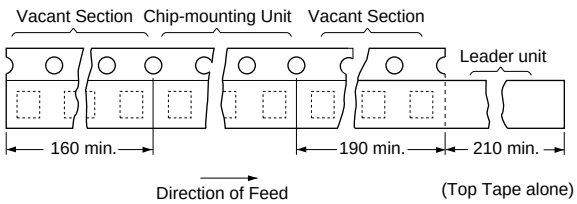
| Part Number | A* | B* |
|---|---|---|
| **GRM43, GJ243** | 3.6 | 4.9 |
| **GRM55** | 5.2 | 6.1 |

*Nominal Value

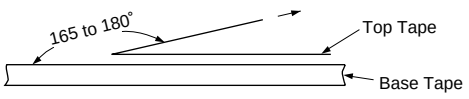
(in mm)

(4) Taping Method

① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
② Part of the leader and part of the empty tape should be attached to the end of the tape as follows.
③ The top tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
⑤ The top tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.
⑥ Cumulative tolerance of sprocket holes, 10 pitches : ±0.3mm.
⑦ Peeling off force : 0.1 to 0.6N* in the direction shown below. *GRM03, GJM03: 0.05 to 0.5N




(in mm)

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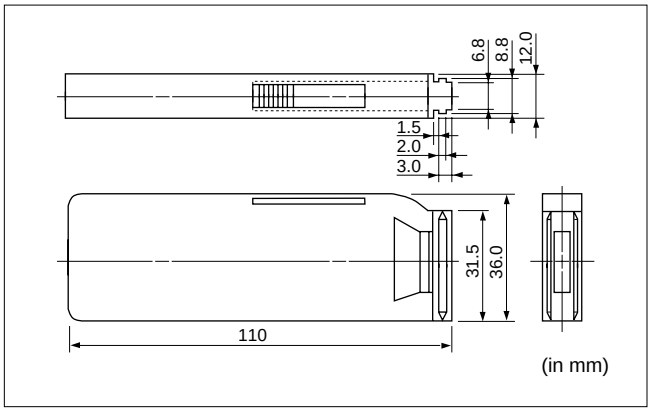
# Package

Continued from the preceding page.

## ■ Dimensions of Bulk Case Packaging

The bulk case uses antistatic materials. Please contact Murata for details.



# ⚠Caution

## ■ Storage and Operating Conditions

Chip monolithic ceramic capacitors (chips) can experience degradation of termination solderability when subjected to high temperature or humidity, or if exposed to sulfur or chlorine gases.
Storage environment must be at an ambient temperature of 5-40 degree C and an ambient humidity of 20-70%RH.
Use chip within 6 months. If 6 months or more have elapsed, check solderability before use.
(Reference Data 1. Solderability)
FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCTS IS USED.

## ■ Handling

1. Inspection
   Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints. Provide support pins on the back side of the PCB to prevent warping or flexing.
2. Board Separation (or depanalization)
   (1) Board flexing at the time of separation causes cracked chips or broken solder.
   (2) Severity of stresses imposed on the chip at the time of board break is in the order of : Pushback<Slitter<V Slot<Perforator.
   (3) Board separation must be performed using special jigs, not with hands.
3. Reel and bulk case
   In the handling of reel and case, please be careful and do not drop it.
   Please do not use chips from a case which has been dropped.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCTS IS USED.

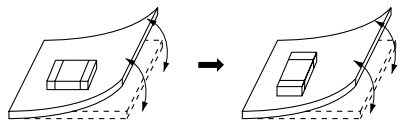
# ⚠Caution

## ■ Soldering and Mounting

### 1. Mounting Position

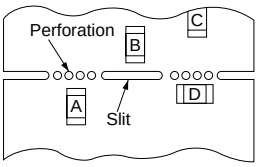
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



Locate chip horizontal to the direction in which stress acts

[Chip Mounting Close to Board Separation Point]



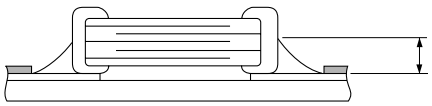

Chip arrangement
Worst A-C-(B≒D) Best

(Reference Data 2. Board bending strength for solder fillet height)
(Reference Data 3. Temperature cycling for solder fillet height)
(Reference Data 4. Board bending strength for board material)

### 2. Solder Paste Printing

- Overly thick application of solder paste results in excessive fillet height solder.
  This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked chips.
- Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.
- Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min.

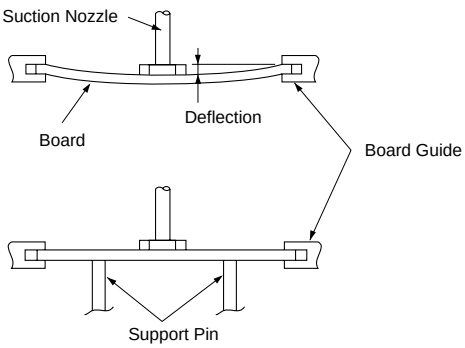
[Optimum Solder Amount for Reflow Soldering]




### 3. Chip Placing

- An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. So adjust the suction nozzle's bottom dead point by correcting warp in the board. Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board. Nozzle pressure for chip mounting must be a 1 to 3N static load.
- Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes great force on the chip during mounting, causing cracked chips. And the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked and replaced periodically.
  (Reference Data 5. Break strength)

[Incorrect]




Continued on the following page.

## ⚠Caution

Continued from the preceding page.

### 4. Reflow Soldering

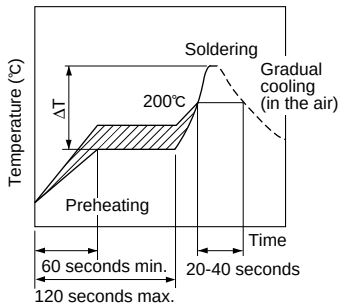
- Sudden heating of the chip results in distortion due to excessive expansion and construction forces within the chip causing cracked chips. So when preheating, keep temperature differential, ΔT, within the range shown in Table 1. The smaller the ΔT, the less stress on the chip.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and solvent within the range shown in the above table.

Table 1

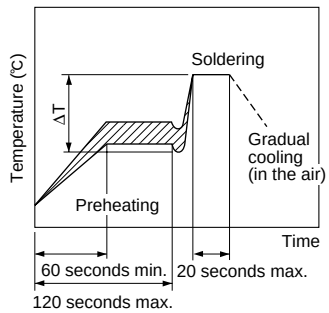
| Part Number | Temperature Differential |
|---|---|
| **GRM03/15/18/21/31**<br>**GJ615, GJ221/31**<br>**LLL18/21/31**<br>**ERA11/21/32, ERF1D**<br>**GQM18/21** | ΔT≦190℃ |
| **GRM32/43/55**<br>**GNM, GJ232/43**<br>**ERA32, ERF22** | ΔT≦130℃ |

[Standard Conditions for Reflow Soldering]

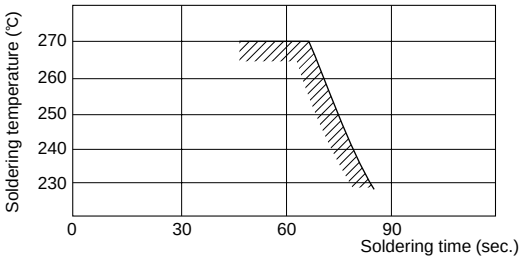
Infrared Reflow




Vapor Reflow




[Allowable Soldering Temperature and Time]




In case of repeated soldering, the accumulated soldering time must be within the range shown above.

**Inverting the PCB**

Make sure not to impose an abnormal mechanical shock on the PCB.

### 5. Leaded Component Insertion

If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break.

Before mounting leaded components, support the PCB using backup pins or special jigs to prevent warping.

Continued on the following page.

# ⚠Caution

Continued from the preceding page.

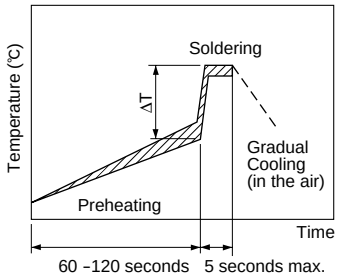
## 6. Flow Soldering

- Sudden heating of the chip results in thermal distortion causing cracked chips. And an excessively long soldering time or high soldering temperature results in leaching of the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- When preheating, keep the temperature differential between solder temperature and chip surface temperature, ΔT, within the range shown in Table 2. The smaller the ΔT, the less stress on the chip.
  When components are immersed in solvent after mounting, be sure to maintain the temperature difference between the component and solvent within the range shown in Table 2.
  Do not apply flow soldering to chips not listed in Table 5.

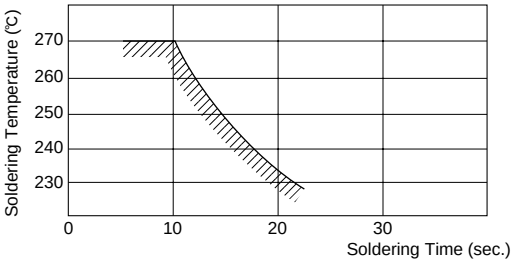
Table 2

| Part Number | Temperature Differential |
|---|---|
| **GRM18/21/31**<br>**LLL21/31**<br>**ERA11/21, ERF1D**<br>**GQM18/21** | ΔT≦150℃ |

[Standard Conditions for Flow Soldering]

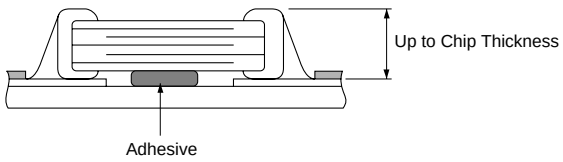



[Allowable Soldering Temperature and Time]




In case of repeated soldering, the accumulated soldering time must be within the range shown above.

- Optimum Solder Amount for Flow Soldering




Continued on the following page.

## ⚠Caution

Continued from the preceding page.

### 7. Correction with a Soldering Iron

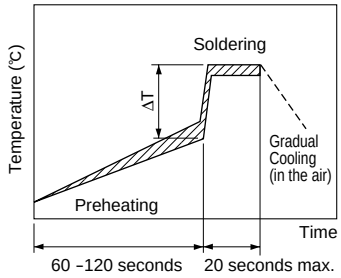
(1) For Chip Type Capacitors <Except GJ2 Series>

● Sudden heating of the chip results in distortion due to a high internal temperature differential, causing cracked chips. When preheating, keep temperature differential, ΔT, within the range shown in Table 3. The smaller the ΔT, the less stress on the chip.

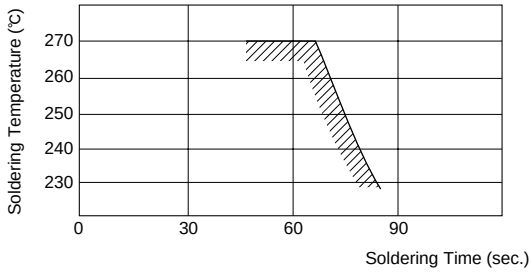
Table 3

| Part Number | Temperature Differential |
|---|---|
| **GRM15/18/21/31**<br>**GJ615**<br>**LLL18/21/31**<br>**GQM18/21**<br>**ERA11/21, ERF1D** | ΔT≦190℃ |
| **GRM32/43/55**<br>**GNM**<br>**ERA32, ERF22** | ΔT≦130℃ |

[Standard Conditions for Soldering Iron Temperature]

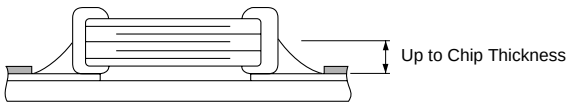



[Allowable Time and Temperature for Making Corrections with a Soldering Iron]




The accumulated soldering Time / temperature including reflow / flow soldering must be within the range shown above.

● Optimum Solder Amount when Corrections Are Made Using a Soldering Iron




(2) For GJ2 Series

● When solder GJ2 series chip capacitor, keep the following conditions.

<Soldering iron method>

| Part Number | Pre-heating | Temperature of iron tip | Soldering iron wattage | Diameter of iron tip | Soldering time | Soldering amount | Restriction |
|---|---|---|---|---|---|---|---|
| **GJ221/31/32/43** | Δ≦130℃ | 300℃ max. | 20W max. | ϕ 3mm max. | 5 sec. max. | ≦1/2 of chip thickness | Do not allow the iron tip to directly touch the ceramic element. |

(3) For Microstrip Types

● Solder 1mm away from the ribbon terminal base, being careful that the solder tip does not directly contact the capacitor. Preheating is unnecessary.

● Complete soldering within 3 seconds with a soldering tip less than 270°C in temperature.

Continued on the following page.

## ⚠Caution

Continued from the preceding page.

8. Washing

Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder. Take note not to vibrate PCBs.

Failure to follow the above cautions may result, worst case, in a short circuit and fuming when the product is used.

# Notice

## ■ Rating

Die Bonding/Wire Bonding (GMA Series)

1. Die Bonding of Capacitors

•Use the following materials Braze alloy :
Au-Si (98/2) 400 to 420 degree C in N2 atmosphere
Au-Sn (80/20) 300 to 320 degree C in N2 atmosphere
Au-Ge (88/12) 380 to 400 degree C in N2 atmosphere

•Mounting

(1) Control the temperature of the substrate so that it matches the temperature of the braze alloy.

(2) Place braze alloy on substrate and place the capacitor on the alloy. Hold the capacitor and gently apply the load. Be sure to complete the operation in 1 minute.

2. Wire Bonding

•Wire
Gold wire :
20mm (0.0008 inch), 25mm (0.001 inch) diameter

•Bonding

(1) Thermocompression, ultrasonic ball bonding.

(2) Required stage temperature : 150 to 250 degree C

(3) Required wedge or capillary weight : 0.5N to 2N.

(4) Bond the capacitor and base substrate or other devices with gold wire.

# Notice

## ■ Soldering and Mounting

### 1. PCB Design

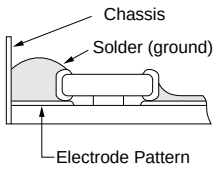
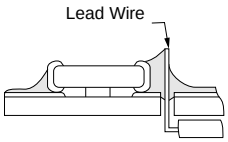
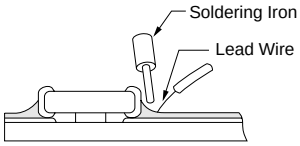
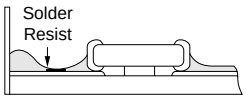
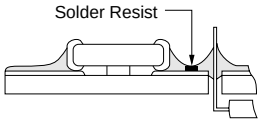
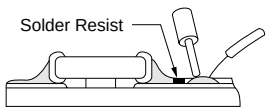
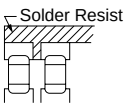
(1) Notice for Pattern Forms

Unlike leaded components, chip components are susceptible to flexing stresses since they are mounted directly on the substrate.

They are also more sensitive to mechanical and thermal stresses than leaded components.

Excess solder fillet height can multiply these stresses and cause chip cracking. When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.

Pattern Forms

| | Placing Close to Chassis | Placing of Chip Components and Leaded Components | Placing of Leaded Components after Chip Component | Lateral Mounting |
|---|---|---|---|---|
| Incorrect |  |  |  | |
| Correct |  |  |  |  |

Continued on the following page.

# Notice

Continued from the preceding page.

(2) Land Dimensions

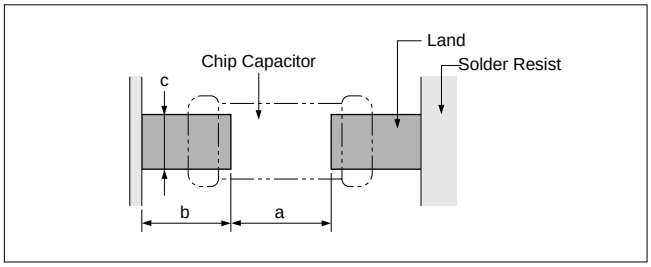



Table 1 Flow Soldering Method

| Part Number \ Dimensions | Dimensions (L×W) | a | b | c |
|---|---|---|---|---|
| **GRM18**<br>**GQM18** | 1.6×0.8 | 0.6—1.0 | 0.8—0.9 | 0.6—0.8 |
| **GRM21**<br>**GQM21** | 2.0×1.25 | 1.0—1.2 | 0.9—1.0 | 0.8—1.1 |
| **GRM31** | 3.2×1.6 | 2.2—2.6 | 1.0—1.1 | 1.0—1.4 |
| **LLL21** | 1.25×2.0 | 0.4—0.7 | 0.5—0.7 | 1.4—1.8 |
| **LLL31** | 1.6×3.2 | 0.6—1.0 | 0.8—0.9 | 2.6—2.8 |
| **ERA11** | 1.25×1.0 | 0.4—0.6 | 0.6—0.8 | 0.8—1.0 |
| **ERA21** | 2.0×1.25 | 1.0—1.2 | 0.9—1.0 | 0.8—1.0 |
| **ERF1D** | 1.4×1.4 | 0.5—0.8 | 0.8—0.9 | 1.0—1.2 |

(in mm)

Table 2 Reflow Soldering Method

| Part Number \ Dimensions | Dimensions (L×W) | a | b | c |
|---|---|---|---|---|
| **GRM03** | 0.6×0.3 | 0.2—0.3 | 0.2—0.35 | 0.2—0.4 |
| **GRM15** | 1.0×0.5 | 0.3—0.5 | 0.35—0.45 | 0.4—0.6 |
| **GRM18**<br>**GQM18** | 1.6×0.8 | 0.6—0.8 | 0.6—0.7 | 0.6—0.8 |
| **GRM21**<br>**GQM21**<br>**GJ221** | 2.0×1.25 | 1.0—1.2 | 0.6—0.7 | 0.8—1.1 |
| **GRM31**<br>**GJ231** | 3.2×1.6 | 2.2—2.4 | 0.8—0.9 | 1.0—1.4 |
| **GRM32**<br>**GJ232** | 3.2×2.5 | 2.0—2.4 | 1.0—1.2 | 1.8—2.3 |
| **GRM43**<br>**GJ243** | 4.5×3.2 | 3.0—3.5 | 1.2—1.4 | 2.3—3.0 |
| **GRM55** | 5.7×5.0 | 4.0—4.6 | 1.4—1.6 | 3.5—4.8 |
| **LLL18** | 0.8×1.6 | 0.2—0.4 | 0.3—0.4 | 1.0—1.4 |
| **LLL21** | 1.25×2.0 | 0.4—0.6 | 0.3—0.5 | 1.4—1.8 |
| **LLL31** | 1.6×3.2 | 0.6—0.8 | 0.6—0.7 | 2.6—2.8 |
| **ERA11** | 1.25×1.0 | 0.4—0.6 | 0.6—0.8 | 0.8—1.0 |
| **ERA21** | 2.0×1.25 | 1.0—1.2 | 0.6—0.8 | 0.8—1.0 |
| **ERA32** | 3.2×2.5 | 2.2—2.5 | 0.8—1.0 | 1.9—2.3 |
| **ERF1D** | 1.4×1.4 | 0.4—0.8 | 0.6—0.8 | 1.0—1.2 |
| **ERF22** | 2.8×2.8 | 1.8—2.1 | 0.7—0.9 | 2.2—2.6 |

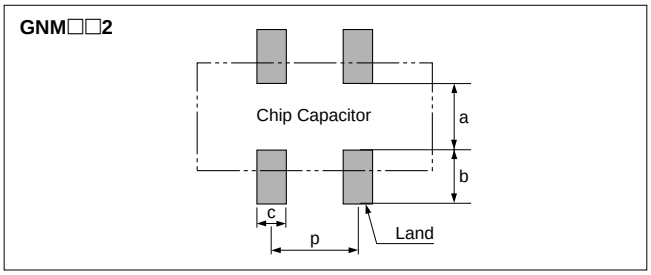
(in mm)

Continued on the following page.

# Notice

Continued from the preceding page.

● GNM Series for reflow soldering method



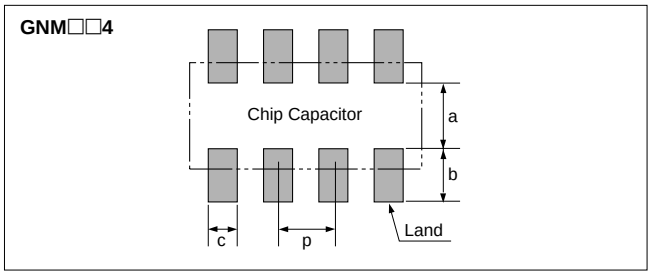
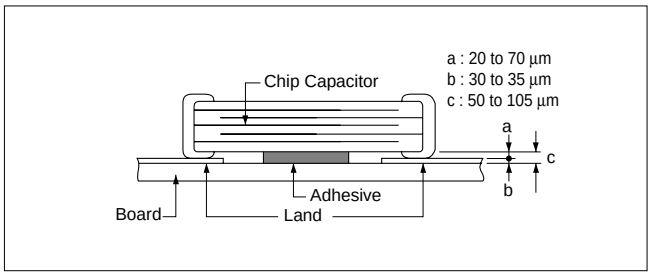




Table 3

| Part Number | Dimensions (mm) | | | | | |
|---|---|---|---|---|---|---|
| | L | W | a | b | c | p |
| **GNM1M2** | 1.37 | 1.0 | 0.45~0.5 | 0.5~0.55 | 0.3~0.35 | 0.64+/-0.1 |
| **GNM212** | 2.0 | 1.25 | 0.6~0.7 | 0.5~0.7 | 0.4~0.5 | 1.0+/-0.1 |
| **GNM214** | 2.0 | 1.25 | 0.6~0.7 | 0.5~0.7 | 0.25~0.35 | 0.5+/-0.05 |
| **GNM314** | 3.2 | 1.6 | 0.8~1.0 | 0.7~0.9 | 0.3~0.4 | 0.8+/-0.05 |

## 2. Adhesive Application

● Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered. The amount of adhesive must be more than dimension C shown in the drawing below to obtain enough bonding strength.
The chip's electrode thickness and land thickness must be taken into consideration.




● Low viscosity adhesive causes chips to slip after mounting. Adhesive must have a viscosity of 5000Pa•s (500ps) min. (at 25℃)

● Adhesive Coverage*

| Part Number | Adhesive Coverage* |
|---|---|
| **GRM18**<br>**GQM18** | 0.05mg Min. |
| **GRM21**<br>**GQM21** | 0.1mg Min. |
| **GRM31** | 0.15mg Min. |

*Nominal Value

## 3. Adhesive Curing

Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption.
Control curing temperature and time in order to prevent insufficient hardening.

### Inverting the PCB

Make sure not to impose an abnormal mechanical shock on the PCB.

Continued on the following page.

# Notice

Continued from the preceding page.

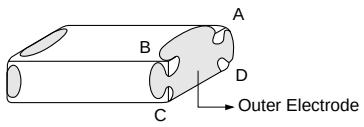
## 4. Flux Application

- An excessive amount of flux generates a large quantity of flux gas, causing deteriorated solderability. So apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).
- Flux containing too high a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaned. Use flux with a halide content of 0.2wt% max. But do not use strong acidic flux.
  Wash thoroughly because water soluble flux causes deteriorated insulation resistance between outer electrodes unless sufficiently cleaned.

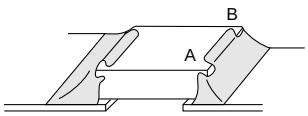
## 5. Flow Soldering

- Set temperature and time to ensure that leaching of the outer electrode does not exceed 25% of the chip end area as a single chip (full length of the edge A-B-C-D shown below) and 25% of the length A-B shown below as mounted on substrate.

[As a Single Chip]




[As Mounted on Substrate]




(Reference Data 6. Thermal shock)
(Reference Data 7. Solder heat resistance)

# Notice

## ■ Others

1. Resin Coating
   When selecting resin materials, select those with low contraction.
2. Circuit Design
   The capacitors listed in the previous sections of this catalog are not safety recognized products.
3. Remarks

The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions. Select optimum conditions for operation as they determine the reliability of the product after assembly.
The data herein are given in typical values, not guaranteed ratings.

# Reference Data

## 1. Solderability

(1) Test Method

Subject the chip capacitor to the following conditions. Then apply flux (a ethanol solution of 25% rosin) to the chip and dip it in 230℃ eutectic solder for 2 seconds.

Conditions :

Expose prepared at room temperature (for 6 months and 12 months, respectively)

Prepared at high temperature (for 100 hours at 85℃)

Prepared left at high humidity (for 100 hours under 90%RH to 95%RH at 40℃)

(2) Test Samples

GRM21 : Products for flow/reflow soldering.

(3) Acceptance Criteria

With a 60-power optical microscope, measure the surface area of the outer electrode that is covered with solder.

(4) Results

Refer to Table 1.

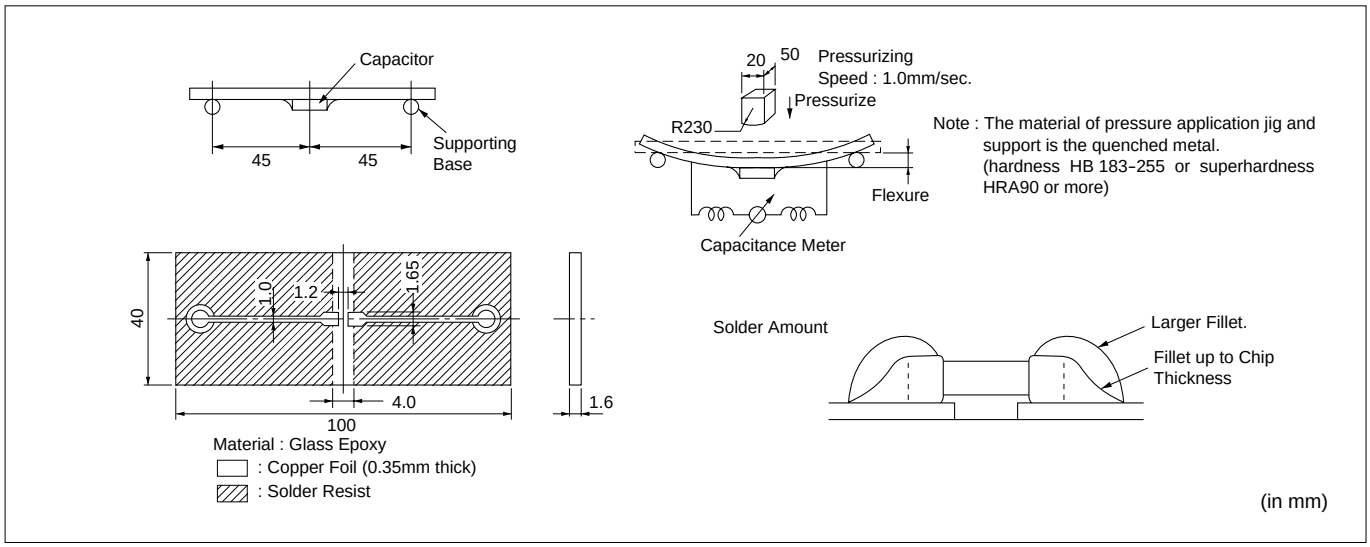
Table 1

| Sample | Initial State | Prepared at Room Temperature | | Prepared at High Temperature for 100 Hours at 85℃ | Prepared at High Humidity for 100 Hours at 90 to 95% RH and 40℃ |
|---|---|---|---|---|---|
| | | 6 months | 12 months | | |
| **GRM21** for flow/reflow soldering | 95 to 100% | 95 to 100% | 95% | 90 to 95% | 95% |

## 2. Board Bending Strength for Solder Fillet Height

(1) Test Method

Solder the chip capacitor to the test PCB with the amount of solder paste necessary to achieve the fillet heights. Then bend the PCB using the method illustrated and measure capacitance.




(2) Test Samples

GRM21 C0G/X7R/Y5V Characteristics T=0.6mm

(3) Acceptance Criteria

Products shall be determined to be defective if the change in capacitance has exceeded the values specified in Table 2.

Table 2

| Characteristics | Change in Capacitance |
|---|---|
| **C0G** | Within ±5% or ±0.5pF, whichever is greater |
| **X7R** | Within ±12.5% |
| **Y5V** | Within ±20% |

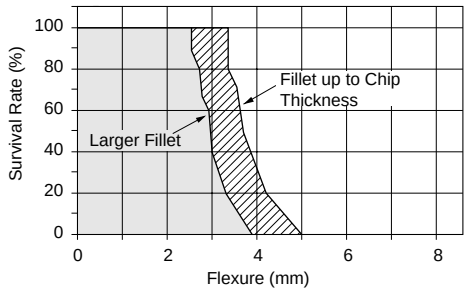
Continued on the following page.

# Reference Data

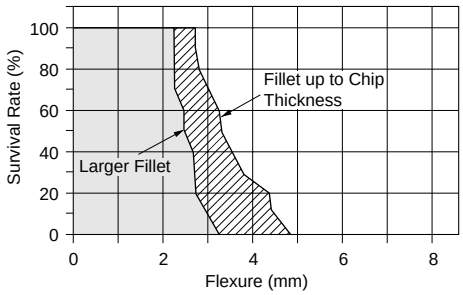
Continued from the preceding page.

(4) Results

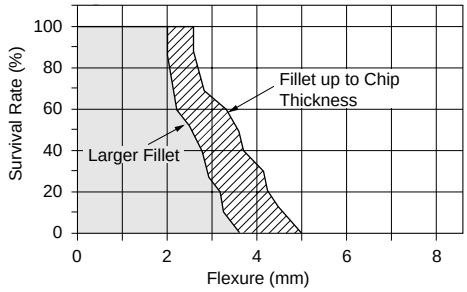
GRM21 C0G (T=0.6)




GRM21 X7R (T=0.6)




GRM21 Y5V (T=0.6)

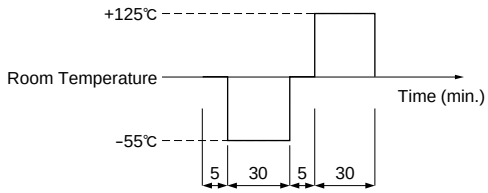



## 3. Temperature Cycling for Solder Fillet Height

(1) Test Method

Solder the chips to the substrate various test fixtures using sufficient amounts of solder to achieve the required fillet height. Then subject the fixtures to the cycle illustrated below 200 times.

[Temperature Cycling]




① Solder Amount

Alumina substrates are typically designed for reflow soldering.

Glass epoxy or paper phenol substrates are typically used for flow soldering.

② Material

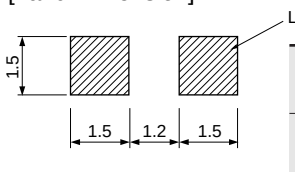
Alumina (Thickness : 0.64mm)
Glass epoxy (Thickness : 1.6 mm)
Paper phenol (Thickness : 1.6 mm)

[Solder Amount]

| Substrate | | Alumina | Glass Epoxy or Paper Phenol |
|---|---|---|---|
| Solder Amount | ❶ | 0.5T | T |
| | ❷ | 0.7T | 1.3T |
| | ❸ | T | 1.6T |
| Solder to be used | | 6×4 Eutectic solder | |

③ Land Dimension

[Land Dimension]




| | |
|---|---|
| Alumina Substrate | Ag/Pd=72/28 Thickness : 10 to 12μm |
| Glass Epoxy Substrate | Cu Thickness : 35μm |
| Paper Phenol Substrate | |

Continued on the following page.

## Reference Data

Continued from the preceding page.

(2) Test Samples

GRM40 C0G/X7R/Y5V Characteristics T=0.6mm

(3) Acceptance Criteria

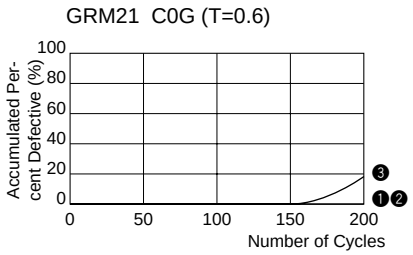
Products are determined to be defective if the change in capacitance has exceeded the values specified in Table 3.

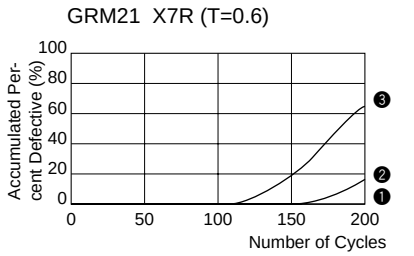
Table 3

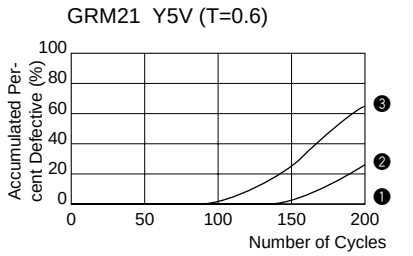
| Characteristics | Change in Capacitance |
|---|---|
| **C0G** | Within ±2.5% or ±0.25pF, whichever is greater |
| **X7R** | Within ±7.5% |
| **Y5V** | Within ±20% |

(4) Results

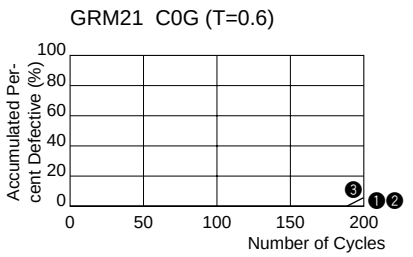
Alumina Substrate

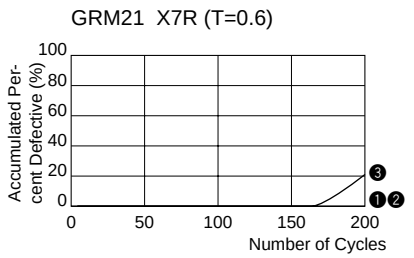


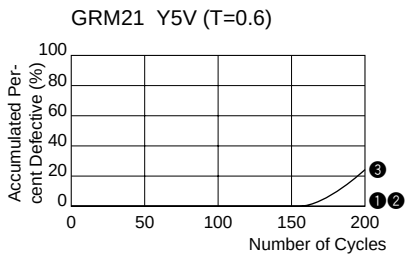



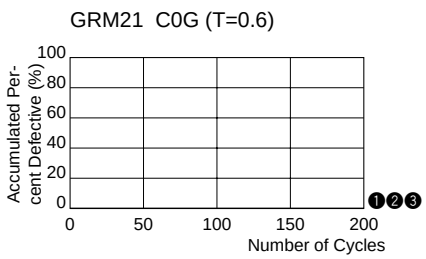

Glass Epoxy Substrate

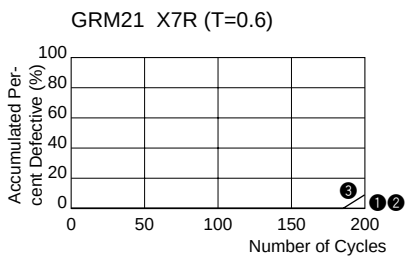


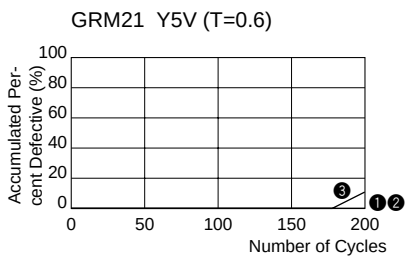




Paper Phenol Substrate




Continued on the following page.

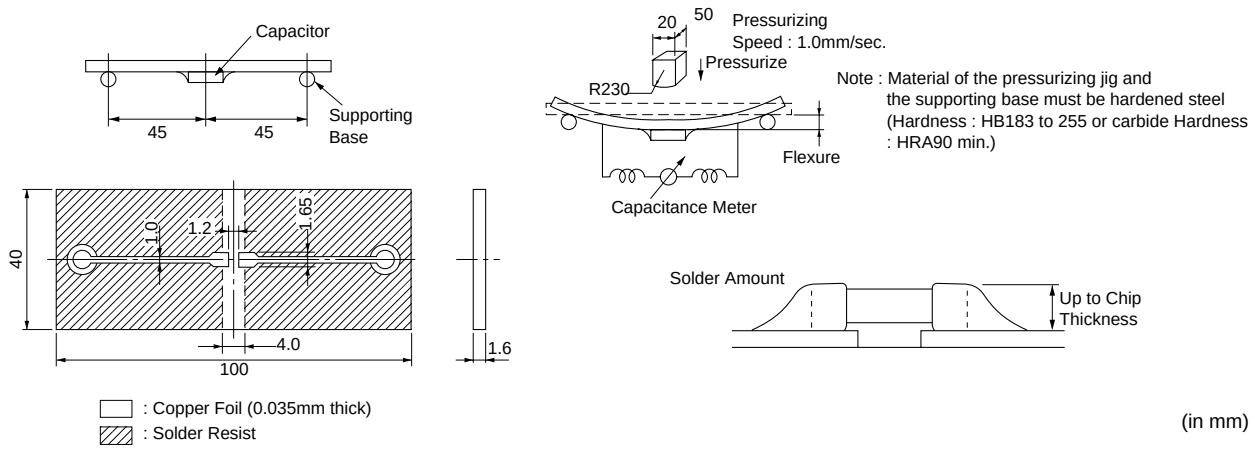
# Reference Data

Continued from the preceding page.

## 4. Board Bending Strength for Board Material

(1) Test Method

Solder the chip to the test board. Then bend the board using the method illustrated below, to measure capacitance.




(2) Test Samples

GRM21 C0G/X7R/Y5V Characteristics T=0.6mm typical

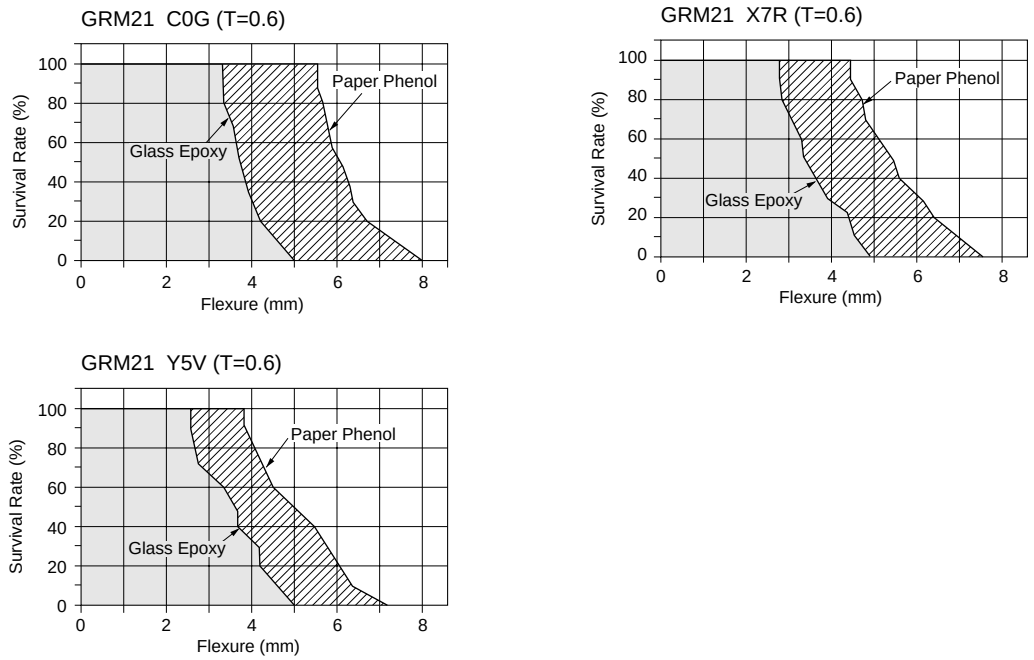
(3) Acceptance Criteria

Products shall be determined to be defective if the change in capacitance has exceeded the values specified in Table 4.

Table 4

| Characteristics | Change in Capacitance |
|---|---|
| **C0G** | Within ±5% or ±0.5pF, whichever is greater |
| **X7R** | Within ±12.5% |
| **Y5V** | Within ±20% |

(4) Results




Continued on the following page.

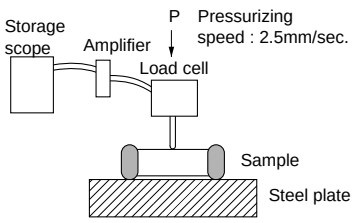
## Reference Data

Continued from the preceding page.

### 5. Break Strength

(1) Test Method

Place the chip on a steel plate as illustrated on the right. Increase load applied to a point near the center of the test sample.

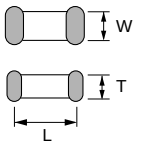



(2) Test Samples

GRM21 C0G/X7R/Y5V Characteristics
GRM31 C0G/X7R/Y5V Characteristics

(3) Acceptance Criteria

Define the load that has caused the chip to break or crack, as the bending force.




| Chip Size | L | W | γ | | |
|---|---|---|---|---|---|
| | | | C0G Charac-teristics | X7R Charac-teristics | Y5V Charac-teristics |
| **GRM21** | 1.5 | 1.2 | 300 | 180 | 160 |
| **GRM31** | 2.7 | 1.5 | | | |

(in mm)

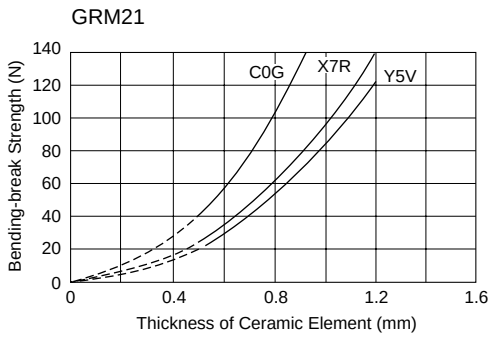
(4) Explanation

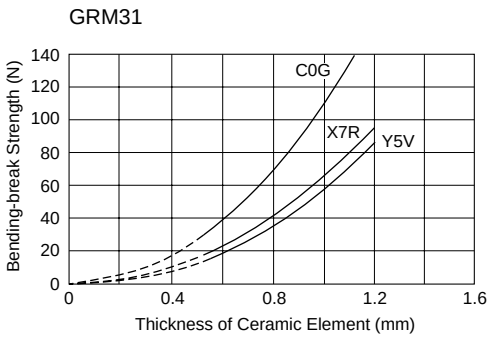
Break strength, P, is proportionate to the square of the thickness of the ceramic element and is expressed as a curve of secondary degree.
The formula is :

$$P=\frac{2\gamma WT^2}{3L} \quad (N)$$

W : Width of ceramic element (mm)
T : Thickness of element (mm)
L : Distance between fulcrums (mm)
γ : Bending stress ($N/mm^2$)

(5) Results

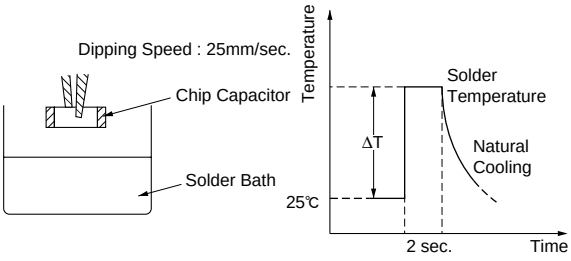



### 6. Thermal Shock

(1) Test method

After applying flux (an ethanol solution of 25% rosin), dip the chip in a solder bath (6×4 eutectic solder) in accordance with the following conditions :




(2) Test samples

GRM21 C0G/X7R/Y5V Characteristics T=0.6mm typical

(3) Acceptance criteria

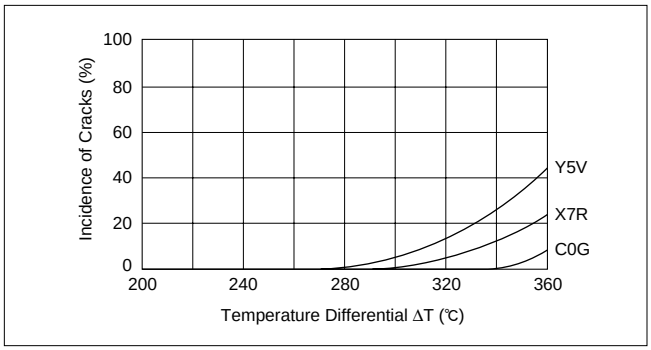
Visually inspect the test sample with a 60-power optical microscope. Chips exhibiting breaks or cracks shall be determined to be defective.

Continued on the following page.

# Reference Data

Continued from the preceding page.

(4) Results




## 7. Solder Heat Resistance

(1) Test Method

① Reflow soldering :
Apply about 300 μm of solder paste over the alumina substrate. After reflow soldering, remove the chip and check for leaching that may have occurred on the outer electrode.

② Flow soldering :
After dipping the test sample with a pair of tweezers in wave solder (eutectic solder), check for leaching that may have occurred on the outer electrode.

③ Dip soldering :
After dipping the test sample with a pair of tweezers in static solder (eutectic solder), check for leaching that may have occurred on the outer electrode.

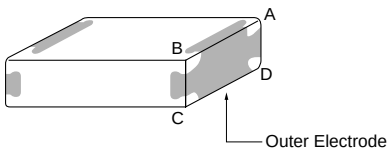
④ Flux to be used : An ethanol solution of 25% rosin.

(2) Test samples

GRM21 : For flow/reflow soldering T=0.6mm

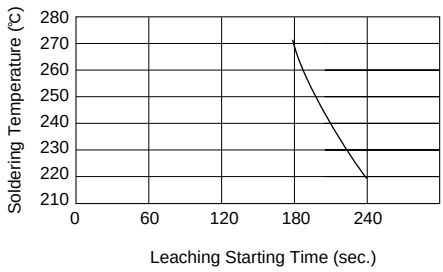
(3) Acceptance criteria

The starting time of leaching should be defined as the time when the outer electrode has lost 25 % of the total edge length of A-B-C-D as illustrated :



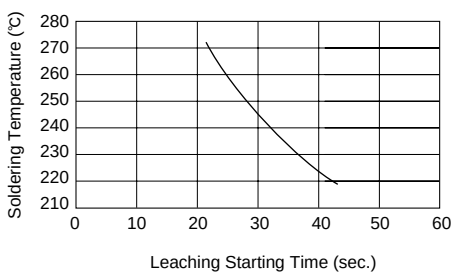

(4) Results

Reflow Soldering




Flow Soldering

Dip Soldering

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## Reference Data

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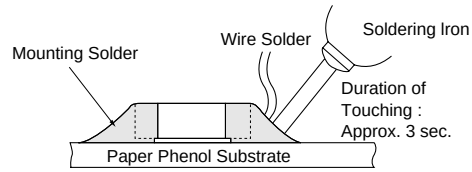
### 8. Thermal Shock when Making Corrections with a Soldering Iron

(1) Test Method

Apply a soldering iron meeting the conditions below to the soldered joint of a chip that has been soldered to a paper phenol board, while supplying wire solder. (Note: the soldering iron tip should not directly touch the ceramic element of the chip.)




| Soldering Iron | Tip diameter |
|---|---|
| Ceramic heater 20W | ϕ3mm |

(2) Test Samples

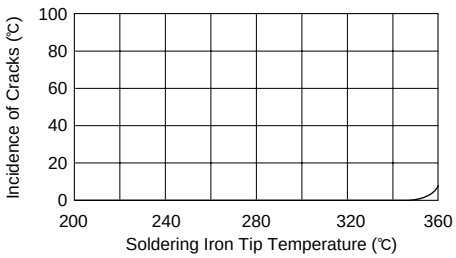
GRM21 C0G/X7R/Y5V Characteristics T=0.6mm

(3) Acceptance Criteria for Defects

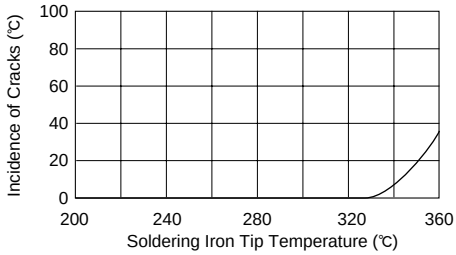
Observe the appearance of the test sample with a 60-power optical microscope. Those units displaying any breaks or cracks are determined to be defective.

(4) Results

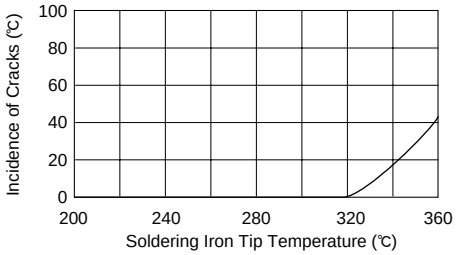
GRM21 C0G (T=0.6)




GRM21 X7R (T=0.6)

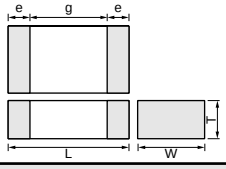



GRM21 Y5V (T=0.6)



# Chip Monolithic Ceramic Capacitors

## Medium-voltage Low Dissipation Factor




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| **GRM31A** | 3.2 ±0.2 | 1.6 ±0.2 | 1.0 +0,- 0.3 | 0.3 | 1.5* |
| **GRM31B** | | | 1.25 +0,- 0.3 | | |
| **GRM32Q** | 3.2 ±0.2 | 2.5 ±0.2 | 1.5 +0,- 0.3 | | 1.8 |
| **GRM42A** | 4.5 ±0.3 | 2.0 ±0.2 | 1.0 +0,- 0.3 | | 2.9 |
| **GRM42B** | | | 1.25 +0,- 0.3 | | |
| **GRM42D** | | | 2.0 ±0.3 | | |
| **GRM43D** | 4.5 ±0.3 | 3.2 ±0.3 | 2.0 +0,- 0.3 | | |
| **GRM43E** | | | 2.5 +0,- 0.3 | | |

* GRM31B1X3D : 1.8mm min.

### ■ Features

1. Murata's original internal electrode structure realizes high flash-over voltage.
2. A new monolithic structure for small, surface-mountable devices capable of operating at high voltage levels.
3. Sn-plated external electrodes realize good solderability.
4. Use the GRM31 type with flow or reflow soldering, and other types with reflow soldering only.
5. Low-loss and suitable for high frequency circuits.
6. The temperature characteristics C0G and SL are temperature compensating type, and R is high dielectric constant type.

### ■ Applications

1. Ideal for use on high frequency pulse circuits such as snubber circuits for switching power supplies, DC/DC converters, ballasts (inverter fluorescent lamps), etc.
2. Ideal for use as the ballast in liquid crystal back lighting inverters.
3. Please contact our sales representatives or engineers before using our products for other applications not specified above.

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GRM31AR32J101KY01D** | DC630 | R (JIS) | 100 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR32J151KY01D** | DC630 | R (JIS) | 150 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR32J221KY01D** | DC630 | R (JIS) | 220 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR32J331KY01D** | DC630 | R (JIS) | 330 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31BR32J471KY01L** | DC630 | R (JIS) | 470 ±10% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| **GRM31BR32J681KY01L** | DC630 | R (JIS) | 680 ±10% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| **GRM31BR32J102KY01L** | DC630 | R (JIS) | 1000 ±10% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| **GRM31AR33A470KY01D** | DC1000 | R (JIS) | 47 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR33A680KY01D** | DC1000 | R (JIS) | 68 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR33A101KY01D** | DC1000 | R (JIS) | 100 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR33A151KY01D** | DC1000 | R (JIS) | 150 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR33A221KY01D** | DC1000 | R (JIS) | 220 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31AR33A331KY01D** | DC1000 | R (JIS) | 330 ±10% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| **GRM31BR33A471KY01L** | DC1000 | R (JIS) | 470 ±10% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| **GRM31B1X3D100JY01L** | DC2000 | SL (JIS) | 10 ±5% | 3.2 | 1.6 | 1.25 | 1.8 | 0.3 min. |
| **GRM31B1X3D120JY01L** | DC2000 | SL (JIS) | 12 ±5% | 3.2 | 1.6 | 1.25 | 1.8 | 0.3 min. |
| **GRM31B1X3D150JY01L** | DC2000 | SL (JIS) | 15 ±5% | 3.2 | 1.6 | 1.25 | 1.8 | 0.3 min. |
| **GRM31B1X3D180JY01L** | DC2000 | SL (JIS) | 18 ±5% | 3.2 | 1.6 | 1.25 | 1.8 | 0.3 min. |
| **GRM31B1X3D220JY01L** | DC2000 | SL (JIS) | 22 ±5% | 3.2 | 1.6 | 1.25 | 1.8 | 0.3 min. |
| **GRM32Q1X3D270JY01L** | DC2000 | SL (JIS) | 27 ±5% | 3.2 | 2.5 | 1.5 | 1.8 | 0.3 min. |
| **GRM32Q1X3D330JY01L** | DC2000 | SL (JIS) | 33 ±5% | 3.2 | 2.5 | 1.5 | 1.8 | 0.3 min. |
| **GRM32Q1X3D390JY01L** | DC2000 | SL (JIS) | 39 ±5% | 3.2 | 2.5 | 1.5 | 1.8 | 0.3 min. |
| **GRM32Q1X3D470JY01L** | DC2000 | SL (JIS) | 47 ±5% | 3.2 | 2.5 | 1.5 | 1.8 | 0.3 min. |
| **GRM32Q1X3D560JY01L** | DC2000 | SL (JIS) | 56 ±5% | 3.2 | 2.5 | 1.5 | 1.8 | 0.3 min. |

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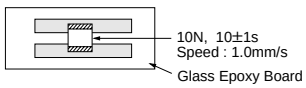
Continued from the preceding page.

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GRM32Q1X3D680JY01L** | DC2000 | SL (JIS) | 68 ±5% | 3.2 | 2.5 | 1.5 | 1.8 | 0.3 min. |
| **GRM32Q1X3D820JY01L** | DC2000 | SL (JIS) | 82 ±5% | 3.2 | 2.5 | 1.5 | 1.8 | 0.3 min. |
| **GRM43D1X3D121JY01L** | DC2000 | SL (JIS) | 120 ±5% | 4.5 | 3.2 | 2.0 | 2.9 | 0.3 min. |
| **GRM43D1X3D151JY01L** | DC2000 | SL (JIS) | 150 ±5% | 4.5 | 3.2 | 2.0 | 2.9 | 0.3 min. |
| **GRM43D1X3D181JY01L** | DC2000 | SL (JIS) | 180 ±5% | 4.5 | 3.2 | 2.0 | 2.9 | 0.3 min. |
| **GRM43D1X3D221JY01L** | DC2000 | SL (JIS) | 220 ±5% | 4.5 | 3.2 | 2.0 | 2.9 | 0.3 min. |
| **GRM42A5C3F100JW01L** | DC3150 | C0G (EIA) | 10 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| **GRM42A5C3F120JW01L** | DC3150 | C0G (EIA) | 12 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| **GRM42A5C3F150JW01L** | DC3150 | C0G (EIA) | 15 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| **GRM42A5C3F180JW01L** | DC3150 | C0G (EIA) | 18 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| **GRM42A5C3F220JW01L** | DC3150 | C0G (EIA) | 22 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| **GRM42D1X3F560JY02L** | DC3150 | SL (JIS) | 56 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| **GRM42D1X3F680JY02L** | DC3150 | SL (JIS) | 68 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| **GRM42D1X3F820JY02L** | DC3150 | SL (JIS) | 82 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| **GRM43E1X3F101JY01L** | DC3150 | SL (JIS) | 100 ±5% | 4.5 | 3.2 | 2.5 | 2.9 | 0.3 min. |

Please contact us for SL characteristics information.

DC3150V items are considered to use for the application which is not LCD back lighting inverters circuit.

# Specifications and Test Methods

| No. | Item | Specifications | | Test Method |
|---|---|---|---|---|
| | | Temperature Compensating Type (C0G, SL Char.) | High Dielectric Constant Type (R Char.) | |
| 1 | Operating Temperature Range | −55 to +125℃ | | |
| 2 | Appearance | No defects or abnormalities | | Visual inspection |
| 3 | Dimensions | Within the specified dimension | | Using calipers |
| 4 | Dielectric Strength | No defects or abnormalities | | No failure should be observed when voltage in Table is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA.<br>Rated voltage / Test voltage<br>DC630V: 150% of the rated voltage<br>DC1kV, DC2kV: 120% of the rated voltage<br>DC3.15kV: DC4095V |
| 5 | Insulation Resistance (I.R.) | More than 10,000MΩ | | The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging. |
| 6 | Capacitance | Within the specified tolerance | | The capacitance/Q/D.F. should be measured at 20℃ at the frequency and voltage shown as follows.<br>(1) Temperature Compensating Type<br>Frequency : 1±0.2MHz<br>Voltage : AC0.5 to 5V (r.m.s.)<br>(2) High Dielectric Constant Type<br>Frequency : 1±0.2kHz<br>Voltage : AC1±0.2V (r.m.s.)<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition. |
| 7 | Q/ Dissipation Factor (D.F.) | C0G char. : Q≧1,000<br>SL char. :<br>C≧30pF : Q≧1,000<br>C<30pF : Q≧400+20C*2 | D.F.≦0.01 | |
| 8 | Capacitance Temperature Characteristics | Temp. Coefficient<br>C0G char. :<br>0±30ppm/°C<br>(Temp. Range : -55 to +125°C)<br>SL char. :<br>+350 to −1,000 ppm/℃<br>(Temp. Range : +20 to +85℃) | Cap. Change<br>Within ±15% | (1) Temperature Compensating Type<br>The temperature coefficient is determined using the capacitance measured in step 3 as a reference.<br>When cycling the temperature sequentially from step 1 through 5 (SL : +20 to +85 ℃) the capacitance should be within the specified tolerance for the temperature coefficient.<br>Step / Temperature (℃)<br>1: 20±2 (25±2 for C0G char.)<br>2: Min. Operating Temp.±3<br>3: 20±2 (25±2 for C0G char.)<br>4: Max. Operating Temp.±2<br>5: 20±2 (25±2 for C0G char.)<br>(2) High Dielectric Constant Type<br>The range of capacitance change compared to the 20℃ value within −55 to +125℃ should be within the specified range.<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition. |
| 9 | Adhesive Strength of Termination | No removal of the terminations or other defect should occur. | | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder.<br>Then apply 10N force in the direction of the arrow.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>  <br><br>Fig. 1 |

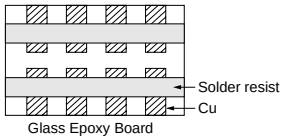
*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

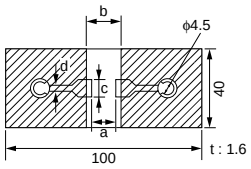
Continued on the following page.

14

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications: Temperature Compensating Type (C0G, SL Char.) | Specifications: High Dielectric Constant Type (R Char.) | Test Method |
|---|---|---|---|---|---|
| 10 | Vibration Resistance | Appearance | No defects or abnormalities | | Solder the capacitor to the test jig (glass epoxy board). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each 3 mutually perpendicular directions (total of 6 hrs.).   |
| | | Capacitance | Within the specified tolerance | | |
| | | Q/D.F. | C0G char. : Q≧1,000<br>SL char. :<br>C≧30pF : Q≧1,000<br>C<30pF : Q≧400+20C*2 | D.F.≦0.01 | |
| 11 | Deflection | | No cracking or marking defects should occur. | | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 12 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 2±0.5 sec. at 235±5℃. Immersing speed : 25±2.5mm/s |
| 13 | Resistance to Soldering Heat | Appearance | No marking defects | | Preheat the capacitor at 120 to 150℃* for 1 min. Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *1room condition for 24±2 hrs., then measure. •Immersing speed : 25±2.5mm/s •Pretreatment for high dielectric constant type Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition. ✻Preheating for more than 3.2×2.5mm |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | Within ±10% | |
| | | Q/D.F. | C0G char. : Q≧1,000<br>SL char. :<br>C≧30pF : Q≧1,000<br>C<30pF : Q≧400+20C*2 | D.F.≦0.01 | |
| | | I.R. | More than 10,000MΩ | | |
| | | Dielectric Strength | In accordance with item No.4 | | |




| L×W (mm) | Dimension (mm) a | b | c | d |
|---|---|---|---|---|
| 3.2×1.6 | 2.2 | 5.0 | 2.0 | 1.0 |
| 3.2×2.5 | 2.2 | 5.0 | 2.9 | |
| 4.5×2.0 | 3.5 | 7.0 | 2.4 | |
| 4.5×3.2 | 3.5 | 7.0 | 3.7 | |

Fig. 2

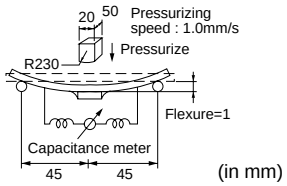



Fig. 3

| Step | Temperature | Time |
|---|---|---|
| 1 | 100℃ to 120℃ | 1 min. |
| 2 | 170℃ to 200℃ | 1 min. |

*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications: Temperature Compensating Type (C0G, SL Char.) | Specifications: High Dielectric Constant Type (R Char.) | Test Method |
|---|---|---|---|---|---|
| 14 | Temperature Cycle | Appearance | No marking defects | | Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder.<br>Perform the 5 cycles according to the 4 heat treatments listed in the following table.<br>Let sit for 24±2 hrs. at *1room condition, then measure.<br>•Pretreatment for high dielectric constant type<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition. |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | Within ±10% | |
| | | Q/D.F. | C0G char. : Q≧1,000<br>SL char. :<br>C≧30pF : Q≧1,000<br>C<30pF : Q≧400+20C*2 | D.F.≦0.01 | |
| | | I.R. | More than 10,000MΩ | | |
| | | Dielectric Strength | In accordance with item No.4 | | |
| 15 | Humidity (Steady State) | Appearance | No marking defects | | Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{0}$ hrs.<br>Remove and let sit for 24±2 hrs. at *1room condition, then measure.<br>•Pretreatment for high dielectric constant type<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition. |
| | | Capacitance Change | Within ±5.0% or ±0.5pF (Whichever is larger) | Within ±10% | |
| | | Q/D.F. | C0G char. : Q≧350<br>SL char. :<br>C≧30pF : Q≧350<br>C<30pF : Q≧275+ $\frac{5}{2}$C*2 | D.F.≦0.01 | |
| | | I.R. | More than 1,000MΩ | | |
| | | Dielectric Strength | In accordance with item No.4 | | |
| 16 | Life | Appearance | No marking defects | | Apply the voltage in following table for 1,000 $^{+48}_{0}$ hrs. at maximum operating temperature ±3℃.<br>Remove and let sit for 24±2 hrs. at *1room condition, then measure.<br>The charge/discharge current is less than 50mA.<br>•Pretreatment for high dielectric constant type<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at *1room condition. |
| | | Capacitance Change | Within ±3.0% or ±0.3pF (Whichever is larger) | Within ±10% | |
| | | Q/D.F. | C0G char. : Q≧350<br>SL char. :<br>C≧30pF : Q≧350<br>C<30pF : Q≧275+ $\frac{5}{2}$C*2 | D.F.≦0.02 | |
| | | I.R. | More than 1,000MΩ | | |
| | | Dielectric Strength | In accordance with item No.4 | | |

| Step | Temperature (℃) | Time (min.) |
|---|---|---|
| 1 | Min. Operating Temp.±3 | 30±3 |
| 2 | Room Temp. | 2 to 3 |
| 3 | Max. Operating Temp.±2 | 30±3 |
| 4 | Room Temp. | 2 to 3 |

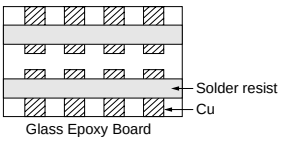



Fig. 4

| Rated voltage | Test voltage |
|---|---|
| More than DC1kV | Rated voltage |
| Less than DC1kV | 120% of the rated voltage |

*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

# Chip Monolithic Ceramic Capacitors

## Medium-voltage High-Capacitance for General-Use

### ■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
2. Sn-plated external electrodes realized good solderability.
3. Use the GRM18/21/31 types with flow or reflow soldering, and other types with reflow soldering only.

### ■ Applications

1. Ideal for use as a hot-cold coupling for DC/DC converter.
2. Ideal for use on line filters and ringer detectors for telephones, facsimiles and modems.
3. Ideal for use on diode-snubber circuits for switching power supplies.

| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e | g min. |
| **GRM188** | 1.6 ±0.1 | 0.8 ±0.1 | 0.8 ±0.1 | 0.2 to 0.5 | 0.4 |
| **GRM21A** | 2.0 ±0.2 | 1.25 ±0.2 | 1.0 +0,-0.3 | 0.3 min. | 0.7 |
| **GRM21B** | | | 1.25 ±0.2 | | |
| **GRM31B** | 3.2 ±0.2 | 1.6 ±0.2 | 1.25 +0,-0.3 | | 1.2 |
| **GRM31C** | | | 1.6 ±0.2 | | |
| **GRM32Q** | 3.2 ±0.3 | 2.5 ±0.2 | 1.5 +0,-0.3 | | |
| **GRM32D** | | | 2.0 +0,-0.3 | | |
| **GRM43Q** | 4.5 ±0.4 | 3.2 ±0.3 | 1.5 +0,-0.3 | | 2.2 |
| **GRM43D** | | | 2.0 +0,-0.3 | | |
| **GRM55D** | 5.7 ±0.4 | 5.0 ±0.4 | 2.0 +0,-0.3 | | 3.2* |

* GRM55DR73A : 2.5mm min.

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GRM188R72E221KW07D** | DC250 | X7R (EIA) | 220pF ±10% | 1.6 | 0.8 | 0.8 | 0.4 | 0.2 to 0.5 |
| **GRM188R72E331KW07D** | DC250 | X7R (EIA) | 330pF ±10% | 1.6 | 0.8 | 0.8 | 0.4 | 0.2 to 0.5 |
| **GRM188R72E471KW07D** | DC250 | X7R (EIA) | 470pF ±10% | 1.6 | 0.8 | 0.8 | 0.4 | 0.2 to 0.5 |
| **GRM188R72E681KW07D** | DC250 | X7R (EIA) | 680pF ±10% | 1.6 | 0.8 | 0.8 | 0.4 | 0.2 to 0.5 |
| **GRM188R72E102KW07D** | DC250 | X7R (EIA) | 1000pF ±10% | 1.6 | 0.8 | 0.8 | 0.4 | 0.2 to 0.5 |
| **GRM21AR72E102KW01D** | DC250 | X7R (EIA) | 1000pF ±10% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| **GRM188R72E152KW07D** | DC250 | X7R (EIA) | 1500pF ±10% | 1.6 | 0.8 | 0.8 | 0.4 | 0.2 to 0.5 |
| **GRM21AR72E152KW01D** | DC250 | X7R (EIA) | 1500pF ±10% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| **GRM188R72E222KW07D** | DC250 | X7R (EIA) | 2200pF ±10% | 1.6 | 0.8 | 0.8 | 0.4 | 0.2 to 0.5 |
| **GRM21AR72E222KW01D** | DC250 | X7R (EIA) | 2200pF ±10% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| **GRM21AR72E332KW01D** | DC250 | X7R (EIA) | 3300pF ±10% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| **GRM21AR72E472KW01D** | DC250 | X7R (EIA) | 4700pF ±10% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| **GRM21AR72E682KW01D** | DC250 | X7R (EIA) | 6800pF ±10% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| **GRM21BR72E103KW03L** | DC250 | X7R (EIA) | 10000pF ±10% | 2.0 | 1.25 | 1.25 | 0.7 | 0.3 min. |
| **GRM31BR72E153KW01L** | DC250 | X7R (EIA) | 15000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR72E223KW01L** | DC250 | X7R (EIA) | 22000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31CR72E333KW03L** | DC250 | X7R (EIA) | 33000pF ±10% | 3.2 | 1.6 | 1.6 | 1.2 | 0.3 min. |
| **GRM31CR72E473KW03L** | DC250 | X7R (EIA) | 47000pF ±10% | 3.2 | 1.6 | 1.6 | 1.2 | 0.3 min. |
| **GRM32QR72E683KW01L** | DC250 | X7R (EIA) | 68000pF ±10% | 3.2 | 2.5 | 1.5 | 1.2 | 0.3 min. |
| **GRM31CR72E104KW03L** | DC250 | X7R (EIA) | 0.10µF ±10% | 3.2 | 1.6 | 1.6 | 1.2 | 0.3 min. |
| **GRM32DR72E104KW01L** | DC250 | X7R (EIA) | 0.10µF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| **GRM43QR72E154KW01L** | DC250 | X7R (EIA) | 0.15µF ±10% | 4.5 | 3.2 | 1.5 | 2.2 | 0.3 min. |
| **GRM32DR72E224KW01L** | DC250 | X7R (EIA) | 0.22µF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| **GRM43DR72E224KW01L** | DC250 | X7R (EIA) | 0.22µF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| **GRM43DR72E334KW01L** | DC250 | X7R (EIA) | 0.33µF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| **GRM55DR72E334KW01L** | DC250 | X7R (EIA) | 0.33µF ±10% | 5.7 | 5.0 | 2.0 | 3.2 | 0.3 min. |
| **GRM43DR72E474KW01L** | DC250 | X7R (EIA) | 0.47µF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| **GRM55DR72E474KW01L** | DC250 | X7R (EIA) | 0.47µF ±10% | 5.7 | 5.0 | 2.0 | 3.2 | 0.3 min. |
| **GRM55DR72E105KW01L** | DC250 | X7R (EIA) | 1.0µF ±10% | 5.7 | 5.0 | 2.0 | 3.2 | 0.3 min. |
| **GRM31BR72J102KW01L** | DC630 | X7R (EIA) | 1000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR72J152KW01L** | DC630 | X7R (EIA) | 1500pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR72J222KW01L** | DC630 | X7R (EIA) | 2200pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |

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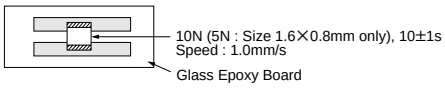
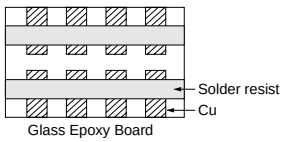
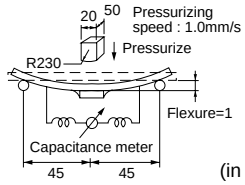
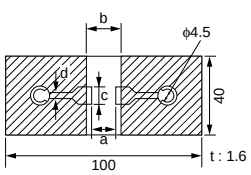
| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GRM31BR72J332KW01L** | DC630 | X7R (EIA) | 3300pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR72J472KW01L** | DC630 | X7R (EIA) | 4700pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR72J682KW01L** | DC630 | X7R (EIA) | 6800pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR72J103KW01L** | DC630 | X7R (EIA) | 10000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31CR72J153KW03L** | DC630 | X7R (EIA) | 15000pF ±10% | 3.2 | 1.6 | 1.6 | 1.2 | 0.3 min. |
| **GRM32QR72J223KW01L** | DC630 | X7R (EIA) | 22000pF ±10% | 3.2 | 2.5 | 1.5 | 1.2 | 0.3 min. |
| **GRM32DR72J333KW01L** | DC630 | X7R (EIA) | 33000pF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| **GRM32DR72J473KW01L** | DC630 | X7R (EIA) | 47000pF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| **GRM43QR72J683KW01L** | DC630 | X7R (EIA) | 68000pF ±10% | 4.5 | 3.2 | 1.5 | 2.2 | 0.3 min. |
| **GRM43DR72J104KW01L** | DC630 | X7R (EIA) | 0.10µF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| **GRM55DR72J154KW01L** | DC630 | X7R (EIA) | 0.15µF ±10% | 5.7 | 5.0 | 2.0 | 3.2 | 0.3 min. |
| **GRM55DR72J224KW01L** | DC630 | X7R (EIA) | 0.22µF ±10% | 5.7 | 5.0 | 2.0 | 3.2 | 0.3 min. |
| **GRM31BR73A102KW01L** | DC1000 | X7R (EIA) | 1000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR73A152KW01L** | DC1000 | X7R (EIA) | 1500pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR73A222KW01L** | DC1000 | X7R (EIA) | 2200pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR73A332KW01L** | DC1000 | X7R (EIA) | 3300pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM31BR73A472KW01L** | DC1000 | X7R (EIA) | 4700pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| **GRM32QR73A682KW01L** | DC1000 | X7R (EIA) | 6800pF ±10% | 3.2 | 2.5 | 1.5 | 1.2 | 0.3 min. |
| **GRM32QR73A103KW01L** | DC1000 | X7R (EIA) | 10000pF ±10% | 3.2 | 2.5 | 1.5 | 1.2 | 0.3 min. |
| **GRM32DR73A153KW01L** | DC1000 | X7R (EIA) | 15000pF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| **GRM32DR73A223KW01L** | DC1000 | X7R (EIA) | 22000pF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| **GRM43DR73A333KW01L** | DC1000 | X7R (EIA) | 33000pF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| **GRM43DR73A473KW01L** | DC1000 | X7R (EIA) | 47000pF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| **GRM55DR73A104KW01L** | DC1000 | X7R (EIA) | 0.10µF ±10% | 5.7 | 5.0 | 2.0 | 2.5 | 0.3 min. |

# Specifications and Test Methods

| No. | Item | Specifications | Test Method |
|---|---|---|---|
| 1 | Operating Temperature Range | −55 to +125℃ | − |
| 2 | Appearance | No defects or abnormalities | Visual inspection |
| 3 | Dimensions | Within the specified dimensions | Using calipers |
| 4 | Dielectric Strength | No defects or abnormalities | No failure should be observed when 150% of the rated voltage (200% of the rated voltage in case of rated voltage : DC250V, 120% of the rated voltage in case of rated voltage : DC1kV) is applied between the terminations for 1 to 5 sec., provided the charge/discharge current is less than 50mA. |
| 5 | Insulation Resistance (I.R.) | C≧0.01μF : More than 100MΩ • μF<br>C<0.01μF : More than 10,000MΩ | The insulation resistance should be measured with DC500±50V (DC250±50V in case of rated voltage : DC250V) and within 60±5 sec. of charging. |
| 6 | Capacitance | Within the specified tolerance | The capacitance/D.F. should be measured at 25℃ at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.s.)<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 7 | Dissipation Factor (D.F.) | 0.025 max. | |
| 8 | Capacitance Temperature Characteristics | Cap. Change<br>Within ±15%<br>(Temp. Range : −55 to +125℃) | The range of capacitance change compared with the 25℃ value within −55 to +125℃ should be within the specified range.<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 9 | Adhesive Strength of Termination | No removal of the terminations or other defect should occur. | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder.<br>Then apply 10N force in the direction of the arrow.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>  <br>Fig. 1 |
| 10 | Vibration Resistance | Appearance: No defects or abnormalities<br>Capacitance: Within the specified tolerance<br>D.F.: 0.025 max. | Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each 3 mutually perpendicular directions (total of 6 hrs.).<br>  |
| 11 | Deflection | No cracking or marking defects should occur. | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder.<br>Then apply a force in the direction shown in Fig. 3.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>  <br>Fig. 3 |




| L×W (mm) | Dimension (mm) | | | |
|---|---|---|---|---|
| | a | b | c | d |
| 1.6×0.8 | 1.0 | 3.0 | 1.2 | 1.0 |
| 2.0×1.25 | 1.2 | 4.0 | 1.65 | |
| 3.2×1.6 | 2.2 | 5.0 | 2.0 | |
| 3.2×2.5 | 2.2 | 5.0 | 2.9 | |
| 4.5×3.2 | 3.5 | 7.0 | 3.7 | |
| 5.7×5.0 | 4.5 | 8.0 | 5.6 | |

Fig. 2

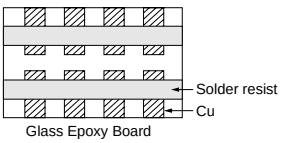
* "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

Continued on the following page.

15

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 12 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).<br>Immerse in eutectic solder solution for 2±0.5 sec. at 235±5℃.<br>Immersing speed : 25±2.5mm/s |
| 13 | Resistance to Soldering Heat | Appearance | No marking defects | Preheat the capacitor at 120 to 150℃* for 1 min.<br>Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *room condition for 24±2 hrs., then measure.<br>•Immersing speed : 25±2.5mm/s<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.<br><br>*Preheating for more than 3.2×2.5mm<br>Step / Temperature / Time<br>1 / 100℃ to 120℃ / 1 min.<br>2 / 170℃ to 200℃ / 1 min. |
| | | Capacitance Change | Within ±10% | |
| | | D.F. | 0.025 max. | |
| | | I.R. | C≧0.01μF : More than 100MΩ • μF<br>C<0.01μF : More than 10,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 14 | Temperature Cycle | Appearance | No marking defects | Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder.<br>Perform the 5 cycles according to the 4 heat treatments listed in the following table.<br>Let sit for 24±2 hrs. at *room condition, then measure.<br>Step / Temperature (℃) / Time (min.)<br>1 / Min. Operating Temp.±3 / 30±3<br>2 / Room Temp. / 2 to 3<br>3 / Max. Operating Temp.±2 / 30±3<br>4 / Room Temp. / 2 to 3<br><br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.<br>  <br><br>Fig. 4 |
| | | Capacitance Change | Within ±7.5% | |
| | | D.F. | 0.025 max. | |
| | | I.R. | C≧0.01μF : More than 100MΩ • μF<br>C<0.01μF : More than 10,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 15 | Humidity (Steady State) | Appearance | No marking defects | Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{0}$ hrs.<br>Remove and let sit for 24±2 hrs. at *room condition, then measure.<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±15% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | C≧0.01μF : More than 10MΩ • μF<br>C<0.01μF : More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 16 | Life | Appearance | No marking defects | Apply 120% of the rated voltage (150% of the rated voltage in case of rated voltage : DC250V, 110% of the rated voltage in case of rated voltage : DC1kV) for 1,000 $^{+48}_{0}$ hrs. at maximum operating temperature ±3℃. Remove and let sit for 24 ±2 hrs. at *room condition, then measure.<br>The charge/discharge current is less than 50mA.<br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±15% (rated voltage : DC250V, DC630V)<br>Within ±20% (rated voltage : DC1kV) | |
| | | D.F. | 0.05 max. | |
| | | I.R. | C≧0.01μF : More than 10MΩ • μF<br>C<0.01μF : More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 17 | Humidity Loading (Application : DC250V, DC630V item) | Appearance | No marking defects | Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{0}$ hrs.<br>Remove and let sit for 24±2 hrs. at *room condition, then measure.<br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±15% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | C≧0.01μF : More than 10MΩ • μF<br>C<0.01μF : More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |

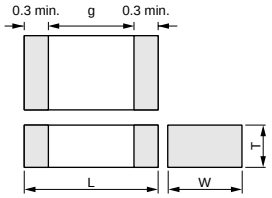
* "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

# Chip Monolithic Ceramic Capacitors

## Only for Information Devices/Tip & Ring

### ■ Features

1. These items are designed specifically for tele-communication devices (IEEE802.3) in Ethernet LAN.
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
3. Sn-plated external electrodes realizes good solderability.
4. Only for reflow soldering.
5. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.




| Part Number | Dimensions (mm) | | | |
|---|---|---|---|---|
| | L | W | T | g min. |
| **GR442Q** | 4.5 ±0.3 | 2.0 ±0.2 | 1.5 +0, -0.3 | 2.5 |
| **GR443D** | 4.5 ±0.4 | 3.2 ±0.3 | 2.0 +0, -0.3 | 2.2* |
| **GR443Q** | | | 1.5 +0, -0.3 | 2.5 |

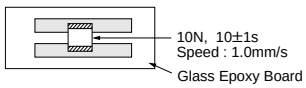
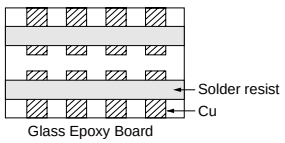
* GR443DR73D : 2.5mm min.

### ■ Applications

Ideal for use on telecommunication devices in Ethernet LAN.

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GR442QR73D101KW01L** | DC2000 | X7R (EIA) | 100 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D121KW01L** | DC2000 | X7R (EIA) | 120 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D151KW01L** | DC2000 | X7R (EIA) | 150 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D181KW01L** | DC2000 | X7R (EIA) | 180 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D221KW01L** | DC2000 | X7R (EIA) | 220 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D271KW01L** | DC2000 | X7R (EIA) | 270 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D331KW01L** | DC2000 | X7R (EIA) | 330 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D391KW01L** | DC2000 | X7R (EIA) | 390 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D471KW01L** | DC2000 | X7R (EIA) | 470 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D561KW01L** | DC2000 | X7R (EIA) | 560 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D681KW01L** | DC2000 | X7R (EIA) | 680 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D821KW01L** | DC2000 | X7R (EIA) | 820 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D102KW01L** | DC2000 | X7R (EIA) | 1000 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D122KW01L** | DC2000 | X7R (EIA) | 1200 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR442QR73D152KW01L** | DC2000 | X7R (EIA) | 1500 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GR443QR73D182KW01L** | DC2000 | X7R (EIA) | 1800 ±10% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GR443QR73D222KW01L** | DC2000 | X7R (EIA) | 2200 ±10% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GR443QR73D272KW01L** | DC2000 | X7R (EIA) | 2700 ±10% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GR443QR73D332KW01L** | DC2000 | X7R (EIA) | 3300 ±10% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GR443QR73D392KW01L** | DC2000 | X7R (EIA) | 3900 ±10% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GR443DR73D472KW01L** | DC2000 | X7R (EIA) | 4700 ±10% | 4.5 | 3.2 | 2.0 | 2.5 | 0.3 min. |

# Specifications and Test Methods

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 1 | Operating Temperature Range | | −55 to +125℃ | − |
| 2 | Appearance | | No defects or abnormalities | Visual inspection |
| 3 | Dimensions | | Within the specified dimensions | Using calipers |
| 4 | Dielectric Strength | | No defects or abnormalities | No failure should be observed when voltage in table is applied between the terminations, provided the charge/discharge current is less than 50mA.<br>Rated voltage: DC2kV; Test Voltage: 120% of the rated voltage; Time: 60±1 sec.<br>Test Voltage: AC1500V (r.m.s.); Time: 60±1 sec. |
| 5 | Pulse Voltage (Application : DC2kV item) | | No self healing break downs or flash-overs have taken place in the capacitor. | 10 impulse of alternating polarity is subjected.<br>(5 impulse for each polarity)<br>The interval between impulse is 60 sec.<br>Applied Voltage : 2.5kV zero to peak |
| 6 | Insulation Resistance (I.R.) | | More than 6,000MΩ | The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging. |
| 7 | Capacitance | | Within the specified tolerance | The capacitance/D.F. should be measured at 25℃ at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.s.)<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 8 | Dissipation Factor (D.F.) | | 0.025 max. | |
| 9 | Capacitance Temperature Characteristics | | Cap. Change<br>within ±15%<br>(Temp. Range : −55 to +125℃) | The range of capacitance change compared with the 25℃ value within the specified range.<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 10 | Adhesive Strength of Termination | | No removal of the terminations or other defect should occur. | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder.<br>Then apply 10N force in the direction of the arrow.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>  <br>Fig. 1 |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each 3 mutually perpendicular directions (total of 6 hrs.).<br>  |
| | | Capacitance | Within the specified tolerance | |
| | | D.F. | 0.025 max. | |

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

Continued on the following page.

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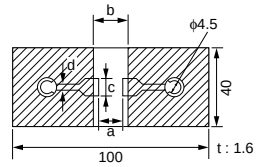
# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 12 | Deflection | | No cracking or marking defects should occur. | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder.<br>Then apply a force in the direction shown in Fig. 3.<br>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. |
| 13 | Solderability of Termination | | 75% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).<br>Immerse in eutectic solder solution for 2±0.5 sec. at 235±5℃.<br>Immersing speed : 25±2.5mm/s |
| 14 | Resistance to Soldering Heat | Appearance | No marking defects | Preheat the capacitor at 120 to 150℃* for 1 min.<br>Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *room condition for 24±2 hrs., then measure.<br>•Immersing speed : 25±2.5mm/s<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.<br><br>*Preheating for more than 3.2×2.5mm |
| | | Capacitance Change | Within ±10% | |
| | | D.F. | 0.025 max. | |
| | | I.R. | More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 15 | Temperature Cycle | Appearance | No marking defects | Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder.<br>Perform the 5 cycles according to the 4 heat treatments listed in the following table.<br>Let sit for 24±2 hrs. at *room condition, then measure. |
| | | Capacitance Change | Within ±15% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | More than 3,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | •Pretreatment<br>Perform a heat treatment at 150 $^{+}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 16 | Humidity (Steady State) | Appearance | No marking defects | Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{0}$ hrs.<br>Remove and let sit for 24±2 hrs. at *room condition, then measure.<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±15% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |




| L×W (mm) | Dimension (mm) | | | |
|---|---|---|---|---|
| | a | b | c | d |
| 4.5×2.0 | 3.5 | 7.0 | 2.4 | 1.0 |
| 4.5×3.2 | 3.5 | 7.0 | 3.7 | |

Fig. 2

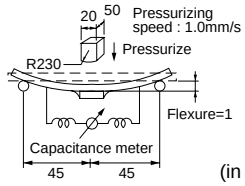



Fig. 3

| Step | Temperature | Time |
|---|---|---|
| 1 | 100℃ to 120℃ | 1 min. |
| 2 | 170℃ to 200℃ | 1 min. |

| Step | Temperature (℃) | Time (min.) |
|---|---|---|
| 1 | Min. Operating Temp.±3 | 30±3 |
| 2 | Room Temp. | 2 to 3 |
| 3 | Max. Operating Temp.±2 | 30±3 |
| 4 | Room Temp. | 2 to 3 |

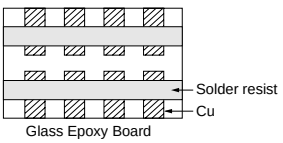



Fig. 4

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

Continued on the following page.

16

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 17 | Life | Appearance | No marking defects | Apply 110% of the rated voltage for 1,000 $^{+48}_{0}$ hrs. at maximum operating temperature ±3℃. Remove and let sit for 24 ±2 hrs. at *room condition, then measure.<br>The charge/discharge current is less than 50mA.<br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±20% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | More than 2,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 18 | Humidity Loading (Application : DC250V item) | Appearance | No marking defects | Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{0}$ hrs.<br>Remove and let sit for 24±2 hrs. at *room condition, then measure.<br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±15% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | More than 10MΩ • μF | |
| | | Dielectric Strength | In accordance with item No.4 | |

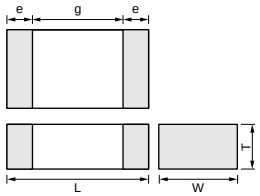
* "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

# Chip Monolithic Ceramic Capacitors

## AC250V Type (Which Meet Japanese Law)

### ■ Features

1. Chip monolithic ceramic capacitor for AC lines.
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
3. Sn-plated external electrodes realizes good solderability.
4. Only for reflow soldering.
5. Capacitance 0.01 to 0.1 uF for connecting lines and 470 to 4700 pF for connecting lines to earth.




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| **GA242Q** | 4.5 ±0.3 | 2.0 ±0.2 | 1.5 +0, -0.3 | 0.3 | 2.5 |
| **GA243D** | 4.5 ±0.4 | 3.2 ±0.3 | 2.0 +0, -0.3 | | |
| **GA243Q** | | | 1.5 +0, -0.3 | | |
| **GA255D** | 5.7 ±0.4 | 5.0 ±0.4 | 2.0 +0, -0.3 | | |

### ■ Applications

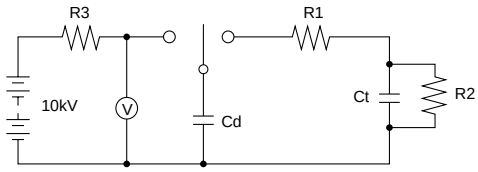
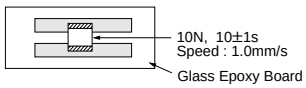
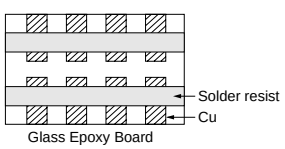
Noise suppression filters for switching power supplies, telephones, facsimiles, modems.

### ■ Reference Standard

GA2 series obtains no safety approval.
This series is based on JIS C 5102, JIS C 5150, and the standards of the electrical appliance and material safety law of Japan (separated table 4).

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GA242QR7E2471MW01L** | AC250 (r.m.s.) | X7R (EIA) | 470pF ±20% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA242QR7E2102MW01L** | AC250 (r.m.s.) | X7R (EIA) | 1000pF ±20% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA243QR7E2222MW01L** | AC250 (r.m.s.) | X7R (EIA) | 2200pF ±20% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GA243QR7E2332MW01L** | AC250 (r.m.s.) | X7R (EIA) | 3300pF ±20% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GA243DR7E2472MW01L** | AC250 (r.m.s.) | X7R (EIA) | 4700pF ±20% | 4.5 | 3.2 | 2.0 | 2.5 | 0.3 min. |
| **GA243QR7E2103MW01L** | AC250 (r.m.s.) | X7R (EIA) | 10000pF ±20% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GA243QR7E2223MW01L** | AC250 (r.m.s.) | X7R (EIA) | 22000pF ±20% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GA243DR7E2473MW01L** | AC250 (r.m.s.) | X7R (EIA) | 47000pF ±20% | 4.5 | 3.2 | 2.0 | 2.5 | 0.3 min. |
| **GA255DR7E2104MW01L** | AC250 (r.m.s.) | X7R (EIA) | 0.10µF ±20% | 5.7 | 5.0 | 2.0 | 2.5 | 0.3 min. |

# Specifications and Test Methods

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 1 | Operating Temperature Range | | −55 to +125℃ | − |
| 2 | Appearance | | No defects or abnormalities | Visual inspection |
| 3 | Dimensions | | Within the specified dimensions | Using calipers |
| 4 | Dielectric Strength | | No defects or abnormalities | No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA.<br>Nominal Capacitance: Test voltage<br>C≧10,000pF: AC575V (r.m.s.)<br>C<10,000pF: AC1500V (r.m.s.) |
| 5 | Insulation Resistance (I.R.) | | More than 2,000MΩ | The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging. |
| 6 | Capacitance | | Within the specified tolerance | The capacitance/D.F. should be measured at 25℃ at a frequency of 1±0.2kHz and a voltage of AC1±0.2V (r.m.s.)<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 7 | Dissipation Factor (D.F.) | | 0.025 max. | |
| 8 | Capacitance Temperature Characteristics | | Cap. Change<br>Within ±15%<br>(Temp. Range : −55 to +125℃) | The range of capacitance change compared with the 25℃ value within −55 to +125℃ should be within the specified range.<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 9 | Discharge Test (Application: Nominal Capacitance C<10,000pF) | Appearance | No defects or abnormalities | As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified.<br>  <br>Ct : Capacitor under test Cd : 0.001μF<br>R1 : 1,000Ω R2 : 100MΩ R3 : Surge resistance |
| 10 | Adhesive Strength of Termination | | No removal of the terminations or other defects should occur. | Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br>  <br>Fig. 1 |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each 3 mutually perpendicular directions (total of 6 hrs.).<br>  |
| | | Capacitance | Within the specified tolerance | |
| | | D.F. | 0.025 max. | |

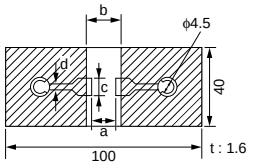
* "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

Continued on the following page.

17

# Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>12</td><td colspan="2">Deflection</td><td>No cracking or marking defects should occur.<br> 

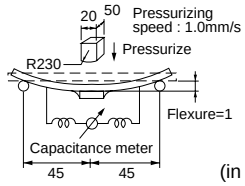
<table>
<tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="3">1.0</td></tr>
<tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr>
</table>
Fig. 2</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br> 

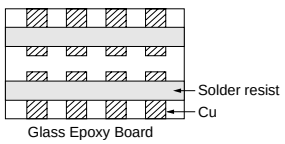
Fig. 3</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).<br>Immerse in eutectic solder solution for 2±0.5 sec. at 235±5℃.<br>Immersing speed : 25±2.5mm/s</td></tr>
<tr><td rowspan="5">14</td><td rowspan="5">Humidity Insulation</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">The capacitor should be subjected to 40±2℃, relative humidity of 90 to 98% for 8 hrs., and then removed in *room condition for 16 hrs. until 5 cycles.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Preheat the capacitor as table.<br>Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *room condition for 24±2 hrs., then measure.<br>•Immersing speed : 25±2.5mm/s<br>•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.<br>✻Preheating
<table>
<tr><th>Step</th><th>Temperature</th><th>Time</th></tr>
<tr><td>1</td><td>100℃ to 120℃</td><td>1 min.</td></tr>
<tr><td>2</td><td>170℃ to 200℃</td><td>1 min.</td></tr>
</table></td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>More than 2,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder.<br>Perform the 5 cycles according to the 4 heat treatments listed in the following table.<br>Let sit for 24±2 hrs. at *room condition, then measure.
<table>
<tr><th>Step</th><th>Temperature (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr>
<tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr>
<tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr>
</table>
•Pretreatment<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition.<br> 

Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td>Within ±15%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 2,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

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

Continued on the following page.

# Specifications and Test Methods

Continued from the preceding page.

| No. | Item | | Specifications | Test Method |
|---|---|---|---|---|
| 17 | Humidity (Steady State) | Appearance | No marking defects | Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for $500^{+24}_{0}$ hrs.<br>Remove and let sit for 24±2 hrs. at *room condition, then measure.<br>•Pretreatment<br>Perform a heat treatment at $150^{+}_{-10}{}^{0}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±15% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 18 | Life | Appearance | No marking defects | Apply voltage and time as Table at 85±2℃. Remove and let sit for 24 ±2 hrs. at *room condition, then measure. The charge / discharge current is less than 50mA.<br>Nominal Capacitance / Test Time / Test voltage<br>C≧10,000pF / $1,000^{+48}_{0}$ hrs. / AC300V (r.m.s.)<br>C<10,000pF / $1,500^{+48}_{0}$ hrs. / AC500V (r.m.s.) *<br>✻ Except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.<br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±20% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |
| 19 | Humidity Loading | Appearance | No marking defects | Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for $500^{+24}_{0}$ hrs.<br>Remove and let sit for 24±2 hrs. at *room condition, then measure.<br>•Pretreatment<br>Apply test voltage for 60±5 min. at test temperature.<br>Remove and let sit for 24±2 hrs. at *room condition. |
| | | Capacitance Change | Within ±15% | |
| | | D.F. | 0.05 max. | |
| | | I.R. | More than 1,000MΩ | |
| | | Dielectric Strength | In accordance with item No.4 | |

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

# Chip Monolithic Ceramic Capacitors

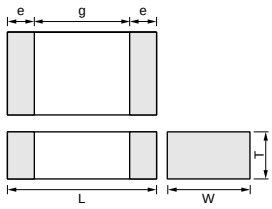
## Safety Standard Recognized Type GC (UL, IEC60384-14 Class X1/Y2)

### ■ Features

1. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC lines.
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
3. Compared to lead type capacitors, this new capacitor is greatly downsized and low-profiled to 1/10 or less in volume, and 1/4 or less in height.
4. The type GC can be used as an X1-class and Y2-class capacitor, line-by-pass capacitor of UL1414.
5. +125 degree C guaranteed.
6. Only for reflow soldering.

### ■ Applications

1. Ideal for use as Y capacitor or X capacitor for various switching power supplies
2. Ideal for modem applications




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| **GA355D** | 5.7 ±0.4 | 5.0 ±0.4 | 2.0 ±0.3 | 0.3 | 4.0 |

### ■ Standard Recognition

| | Standard No. | Status of Recognition | | Rated Voltage |
|---|---|---|---|---|
| | | Type GB | Type GC | |
| UL | UL1414 | — | ◎* | AC250V (r.m.s.) |
| BSI | EN132400 | — | ◎ | |
| VDE | | ◎ | ◎ | |
| SEV | | ◎ | ◎ | |
| SEMKO | | ◎ | ◎ | |
| EN132400 Class | | X2 | X1, Y2 | |

*: Line-By-Pass only

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GA355DR7GC101KY02L** | AC250 (r.m.s.) | X7R (EIA) | 100 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC151KY02L** | AC250 (r.m.s.) | X7R (EIA) | 150 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC221KY02L** | AC250 (r.m.s.) | X7R (EIA) | 220 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC331KY02L** | AC250 (r.m.s.) | X7R (EIA) | 330 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC471KY02L** | AC250 (r.m.s.) | X7R (EIA) | 470 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC681KY02L** | AC250 (r.m.s.) | X7R (EIA) | 680 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC102KY02L** | AC250 (r.m.s.) | X7R (EIA) | 1000 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC152KY02L** | AC250 (r.m.s.) | X7R (EIA) | 1500 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC222KY02L** | AC250 (r.m.s.) | X7R (EIA) | 2200 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC332KY02L** | AC250 (r.m.s.) | X7R (EIA) | 3300 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GC472KY02L** | AC250 (r.m.s.) | X7R (EIA) | 4700 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |

⚠Note Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this PDF catalog to prevent smoking and/or burning, etc.
This catalog has only typical specifications. Therefore, you are requested to approve our product specifications or to transact the approval sheet for product specificaions before ordering.



# Chip Monolithic Ceramic Capacitors

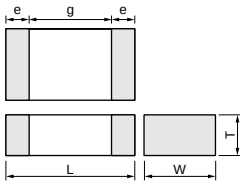
## Safety Standard Recognized Type GD (IEC60384-14 Class Y3)

### ■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
2. The type GD can be used as a Y3-class capacitor.
3. Available for equipment based on IEC/EN60950 and UL1950.
4. +125 degree C guaranteed.
5. Only for reflow soldering.
6. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.

### ■ Applications

1. Ideal for use on line filters and couplings for DAA modems without transformers.
2. Ideal for use on line filters for information equipment.




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| **GA342D** | 4.5 ±0.3 | 2.0 ±0.2 | 2.0 ±0.2* | 0.3 | 2.5 |
| **GA342Q** | | | 1.5 +0, -0.3 | | |
| **GA343D** | 4.5 ±0.4 | 3.2 ±0.3 | 2.0 +0, -0.3 | | |
| **GA343Q** | | | 1.5 +0, -0.3 | | |

* GA342D1X : 2.0±0.3

### ■ Standard Recognition

| | Standard No. | Class | Status of Recognition | Rated Voltage |
|---|---|---|---|---|
| | | | Type GD | |
| SEMKO | EN132400 | Y3 | ◎ | AC250V (r.m.s.) |

Applications

| Size | Switching power supplies | Communication network devices such as a modem |
|---|---|---|
| 4.5×3.2mm and under | — | ◎ |

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GA342D1XGD100JY02L** | AC250 (r.m.s.) | SL (JIS) | 10 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD120JY02L** | AC250 (r.m.s.) | SL (JIS) | 12 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD150JY02L** | AC250 (r.m.s.) | SL (JIS) | 15 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD180JY02L** | AC250 (r.m.s.) | SL (JIS) | 18 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD220JY02L** | AC250 (r.m.s.) | SL (JIS) | 22 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD270JY02L** | AC250 (r.m.s.) | SL (JIS) | 27 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD330JY02L** | AC250 (r.m.s.) | SL (JIS) | 33 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD390JY02L** | AC250 (r.m.s.) | SL (JIS) | 39 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD470JY02L** | AC250 (r.m.s.) | SL (JIS) | 47 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD560JY02L** | AC250 (r.m.s.) | SL (JIS) | 56 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD680JY02L** | AC250 (r.m.s.) | SL (JIS) | 68 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGD820JY02L** | AC250 (r.m.s.) | SL (JIS) | 82 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342QR7GD101KW01L** | AC250 (r.m.s.) | X7R (EIA) | 100 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GD151KW01L** | AC250 (r.m.s.) | X7R (EIA) | 150 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GD221KW01L** | AC250 (r.m.s.) | X7R (EIA) | 220 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GD331KW01L** | AC250 (r.m.s.) | X7R (EIA) | 330 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GD471KW01L** | AC250 (r.m.s.) | X7R (EIA) | 470 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GD681KW01L** | AC250 (r.m.s.) | X7R (EIA) | 680 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GD102KW01L** | AC250 (r.m.s.) | X7R (EIA) | 1000 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GD152KW01L** | AC250 (r.m.s.) | X7R (EIA) | 1500 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA343QR7GD182KW01L** | AC250 (r.m.s.) | X7R (EIA) | 1800 ±10% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GA343QR7GD222KW01L** | AC250 (r.m.s.) | X7R (EIA) | 2200 ±10% | 4.5 | 3.2 | 1.5 | 2.5 | 0.3 min. |
| **GA343DR7GD472KW01L** | AC250 (r.m.s.) | X7R (EIA) | 4700 ±10% | 4.5 | 3.2 | 2.0 | 2.5 | 0.3 min. |

# Chip Monolithic Ceramic Capacitors

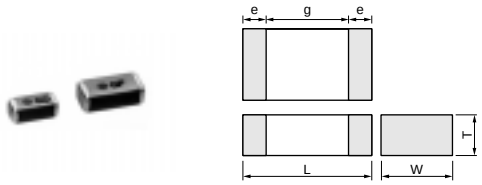
## Safety Standard Recognized Type GF (IEC60384-14 Class Y2)

### ■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
2. The type GF can be used as a Y2-class capacitor.
3. Available for equipment based on IEC/EN60950 and UL1950. Besides, the GA352/355 types are available for equipment based on IEC/EN60065, UL1492, and UL6500.
4. +125 degree C guaranteed.
5. Only for reflow soldering.
6. The low-profile type (thickness: 1.5mm max.) is available. Fit for use on thinner type equipment.

### ■ Applications

1. Ideal for use on line filters and couplings for DAA modems without transformers.
2. Ideal for use on line filters for information equipment.
3. Ideal for use as Y capacitor or X capacitor for various switching power supplies. (GA352/355 types only)




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| **GA342D** | 4.5 ±0.3 | 2.0 ±0.2 | 2.0 ±0.2* | 0.3 | 2.5 |
| **GA342Q** | | | 1.5 +0, -0.3 | | |
| **GA352Q** | 5.7 ±0.4 | 2.8 ±0.3 | 1.5 +0, -0.3 | | 4.0 |
| **GA355Q** | | 5.0 ±0.4 | 1.5 +0, -0.3 | | |

* GA342D1X : 2.0±0.3

### ■ Standard Recognition

| | Standard No. | Class | Status of Recognition | | Rated Voltage |
|---|---|---|---|---|---|
| | | | Type GF | | |
| | | | Size : 4.5×2.0mm | Size : 5.7×2.8mm and over | |
| UL | UL1414 | X1, Y2 | — | ◎ | AC250V (r.m.s.) |
| SEMKO | EN132400 | Y2 | ◎ | ◎ | |

Applications

| Size | Switching power supplies | Communication network devices such as a modem |
|---|---|---|
| 4.5×2.0mm | — | ◎ |
| 5.7×2.8mm and over | ◎ | ◎ |

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GA342D1XGF100JY02L** | AC250 (r.m.s.) | SL (JIS) | 10 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF120JY02L** | AC250 (r.m.s.) | SL (JIS) | 12 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF150JY02L** | AC250 (r.m.s.) | SL (JIS) | 15 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF180JY02L** | AC250 (r.m.s.) | SL (JIS) | 18 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF220JY02L** | AC250 (r.m.s.) | SL (JIS) | 22 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF270JY02L** | AC250 (r.m.s.) | SL (JIS) | 27 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF330JY02L** | AC250 (r.m.s.) | SL (JIS) | 33 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF390JY02L** | AC250 (r.m.s.) | SL (JIS) | 39 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF470JY02L** | AC250 (r.m.s.) | SL (JIS) | 47 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF560JY02L** | AC250 (r.m.s.) | SL (JIS) | 56 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF680JY02L** | AC250 (r.m.s.) | SL (JIS) | 68 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342D1XGF820JY02L** | AC250 (r.m.s.) | SL (JIS) | 82 ±5% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342QR7GF101KW01L** | AC250 (r.m.s.) | X7R (EIA) | 100 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342QR7GF151KW01L** | AC250 (r.m.s.) | X7R (EIA) | 150 ±10% | 4.5 | 2.0 | 1.5 | 2.5 | 0.3 min. |
| **GA342DR7GF221KW02L** | AC250 (r.m.s.) | X7R (EIA) | 220 ±10% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA342DR7GF331KW02L** | AC250 (r.m.s.) | X7R (EIA) | 330 ±10% | 4.5 | 2.0 | 2.0 | 2.5 | 0.3 min. |
| **GA352QR7GF471KW01L** | AC250 (r.m.s.) | X7R (EIA) | 470 ±10% | 5.7 | 2.8 | 1.5 | 4.0 | 0.3 min. |
| **GA352QR7GF681KW01L** | AC250 (r.m.s.) | X7R (EIA) | 680 ±10% | 5.7 | 2.8 | 1.5 | 4.0 | 0.3 min. |
| **GA352QR7GF102KW01L** | AC250 (r.m.s.) | X7R (EIA) | 1000 ±10% | 5.7 | 2.8 | 1.5 | 4.0 | 0.3 min. |
| **GA352QR7GF152KW01L** | AC250 (r.m.s.) | X7R (EIA) | 1500 ±10% | 5.7 | 2.8 | 1.5 | 4.0 | 0.3 min. |
| **GA355QR7GF182KW01L** | AC250 (r.m.s.) | X7R (EIA) | 1800 ±10% | 5.7 | 5.0 | 1.5 | 4.0 | 0.3 min. |
| **GA355QR7GF222KW01L** | AC250 (r.m.s.) | X7R (EIA) | 2200 ±10% | 5.7 | 5.0 | 1.5 | 4.0 | 0.3 min. |
| **GA355QR7GF332KW01L** | AC250 (r.m.s.) | X7R (EIA) | 3300 ±10% | 5.7 | 5.0 | 1.5 | 4.0 | 0.3 min. |

# Chip Monolithic Ceramic Capacitors

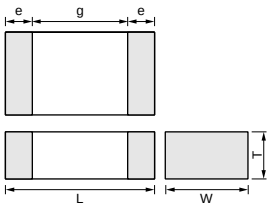
## Safety Standard Recognized Type GB (IEC60384-14 Class X2)

### ■ Features

1. Chip monolithic ceramic capacitor (certified as conforming to safety standards) for AC lines.
2. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
3. Compared to lead type capacitors, this new capacitor is greatly downsized and low-profiled to 1/10 or less in volume, and 1/4 or less in height.
4. The type GB can be used as an X2-class capacitor.
5. +125 degree C guaranteed.
6. Only for reflow soldering.

### ■ Applications

Ideal for use as X capacitor for various switching power supplies.




| Part Number | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | T | e min. | g min. |
| **GA355D** | 5.7 ±0.4 | 5.0 ±0.4 | 2.0 ±0.3 | 0.3 | 4.0 |
| **GA355X** | | | 2.7 ±0.3 | | |

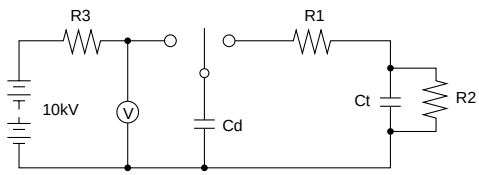
### ■ Standard Recognition

| | Standard No. | Status of Recognition | | Rated Voltage |
|---|---|---|---|---|
| | | Type GB | Type GC | |
| UL | UL1414 | — | ◎* | AC250V (r.m.s.) |
| BSI | EN132400 | — | ◎ | |
| VDE | | ◎ | ◎ | |
| SEV | | ◎ | ◎ | |
| SEMKO | | ◎ | ◎ | |
| EN132400 Class | | X2 | X1, Y2 | |

*: Line-By-Pass only

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|---|---|---|---|---|---|---|---|---|
| **GA355DR7GB103KY02L** | AC250 (r.m.s.) | X7R (EIA) | 10000 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GB153KY02L** | AC250 (r.m.s.) | X7R (EIA) | 15000 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355DR7GB223KY02L** | AC250 (r.m.s.) | X7R (EIA) | 22000 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |
| **GA355XR7GB333KY06L** | AC250 (r.m.s.) | X7R (EIA) | 33000 ±10% | 5.7 | 5.0 | 2.7 | 4.0 | 0.3 min. |

# GA3 Series Specifications and Test Methods

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td>Operating Temperature Range</td><td>−55 to +125℃</td><td>−</td></tr>
<tr><td>2</td><td>Appearance</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>3</td><td>Dimensions</td><td>Within the specified dimensions</td><td>Using calipers</td></tr>
<tr><td>4</td><td>Dielectric Strength</td><td>No defects or abnormalities</td><td>No failure should be observed when voltage in table is applied between the terminations for 60±1 sec., provided the charge/discharge current is less than 50mA.<br><table><tr><th></th><th>Test voltage</th></tr><tr><td>Type GB</td><td>DC1075V</td></tr><tr><td>Type GC/GD/GF</td><td>AC1500V (r.m.s.)</td></tr></table></td></tr>
<tr><td>5</td><td>Pulse Voltage (Application: Type GD/GF)</td><td>No self healing break downs or flash-overs have taken place in the capacitor.</td><td>10 impulse of alternating polarity is subjected.<br>(5 impulse for each polarity)<br>The interval between impulse is 60 sec.<br>Applied Voltage : 2.5kV zero to peak</td></tr>
<tr><td>6</td><td>Insulation Resistance (I.R.)</td><td>More than 6,000MΩ</td><td>The insulation resistance should be measured with DC500±50V and within 60±5 sec. of charging.</td></tr>
<tr><td>7</td><td>Capacitance</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/Q/D.F. should be measured at 20℃ at a frequency of 1±0.2kHz (SL char. : 1±0.2MHz) and a voltage of AC1±0.2V (r.m.s.).<br>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.</td></tr>
<tr><td>8</td><td>Dissipation Factor (D.F.)<br>Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.025</td></tr><tr><td>SL</td><td>Q≧400+20C*2 (C<30pF)<br>Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>9</td><td>Capacitance Temperature Characteristics</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr></table>Temperature characteristic guarantee is −55 to +125℃<br><table><tr><th>Char.</th><th>Temperature Coefficient</th></tr><tr><td>SL</td><td>+350 to -1000ppm/℃</td></tr></table>Temperature characteristic guarantee is +20 to +85℃</td><td>The range of capacitance change compared with the 25℃ (SL char. : 20℃) value within −55 to +125℃ should be within the specified range.<br>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Discharge Test (Application: Type GC)</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">As in Fig., discharge is made 50 times at 5 sec. intervals from the capacitor (Cd) charged at DC voltage of specified.<br> 

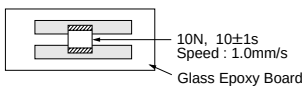
Ct : Capacitor under test Cd : 0.001μF<br>R1 : 1,000Ω R2 : 100MΩ R3 : Surge resistance</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td>11</td><td>Adhesive Strength of Termination</td><td>No removal of the terminations or other defect should occur.</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 10N force in the direction of the arrow. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br> 

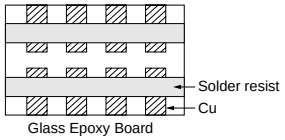
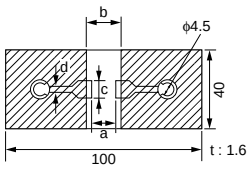
Fig. 1</td></tr>
</table>

*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

# GA3 Series Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="3">12</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="3">Solder the capacitor to the test jig (glass epoxy board).<br>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 min. This motion should be applied for a period of 2 hrs. in each 3 mutually perpendicular directions (total of 6 hrs.).<br> 
</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.<br>Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.025</td></tr><tr><td>SL</td><td>Q≧400+20C*2 (C<30pF)<br>Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>13</td><td colspan="2">Deflection</td><td>No cracking or marking defects should occur.<br> 

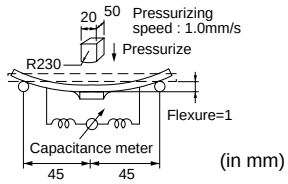
<table><tr><th rowspan="2">L×W (mm)</th><th colspan="4">Dimension (mm)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>4.5×2.0</td><td>3.5</td><td>7.0</td><td>2.4</td><td rowspan="4">1.0</td></tr><tr><td>4.5×3.2</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>5.7×2.8</td><td>4.5</td><td>8.0</td><td>3.2</td></tr><tr><td>5.7×5.0</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table>
Fig. 2</td><td>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 2 using a eutectic solder. Then apply a force in the direction shown in Fig. 3. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.<br> 

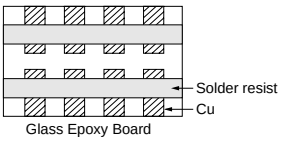
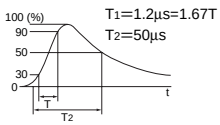
Fig. 3</td></tr>
<tr><td>14</td><td colspan="2">Solderability of Termination</td><td>75% of the terminations are to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion).<br>Immerse in eutectic solder solution for 2±0.5 sec. at 235±5℃.<br>Immersing speed : 25±2.5mm/s</td></tr>
<tr><td rowspan="4">15</td><td rowspan="4">Resistance to Soldering Heat</td><td>Appearance</td><td>No marking defects</td><td rowspan="4">Preheat the capacitor as table. Immerse the capacitor in eutectic solder solution at 260±5℃ for 10±1 sec. Let sit at *1room condition for 24±2 hrs., then measure.<br>•Immersing speed : 25±2.5mm/s<br>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 $^{+0}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.<br><br>*Preheating<table><tr><th>Step</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>100℃ to 120℃</td><td>1 min.</td></tr><tr><td>2</td><td>170℃ to 200℃</td><td>1 min.</td></tr></table></td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±10%</td></tr><tr><td>SL</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

# GA3 Series Specifications and Test Methods

Continued from the preceding page.

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder.<br>Perform the 5 cycles according to the 4 heat treatments listed in the following table.<br>Let sit for 24±2 hrs. at *1room condition, then measure.<br><table><tr><th>Step</th><th>Temperature (℃)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. Operating Temp.±3</td><td>30±3</td></tr><tr><td>2</td><td>Room Temp.</td><td>2 to 3</td></tr><tr><td>3</td><td>Max. Operating Temp.±2</td><td>30±3</td></tr><tr><td>4</td><td>Room Temp.</td><td>2 to 3</td></tr></table>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 $^{+}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.<br>  <br><br>Fig. 4</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>D.F.<br>Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧400+20C*2 (C<30pF)<br>Q≧1000 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">17</td><td rowspan="5">Humidity (Steady State)</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Let the capacitor sit at 40±2℃ and relative humidity of 90 to 95% for 500±12 hrs.<br>Remove and let sit for 24±2 hrs. at *1room condition, then measure.<br>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 $^{+}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ±5.0% or ±0.5pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>D.F.<br>Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)<br>Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
<tr><td rowspan="5">18</td><td rowspan="5">Life</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Impulse Voltage<br>Each individual capacitor should be subjected to a 2.5kV (Type GC/GF : 5kV) Impulses (the voltage value means zero to peak) for three times. Then the capacitors are applied to life test.<br>  <br><br>Apply voltage as Table for 1,000 hrs. at 125 $^{+2}_{-0}$℃, relative humidity 50% max.<br><table><tr><th>Type</th><th>Applied voltage</th></tr><tr><td>GB</td><td>AC312.5V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr><tr><td>GC<br>GD<br>GF</td><td>AC425V (r.m.s.), except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec.</td></tr></table>Let sit for 24±2 hrs. at *1room condition, then measure.<br>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 $^{+}_{-10}$℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±20%</td></tr><tr><td>SL</td><td>Within ±3.0% or ±0.3pF (Whichever is larger)</td></tr></table></td></tr>
<tr><td>D.F.<br>Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)<br>Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

Continued on the following page.

# GA3 Series Specifications and Test Methods

Continued from the preceding page.

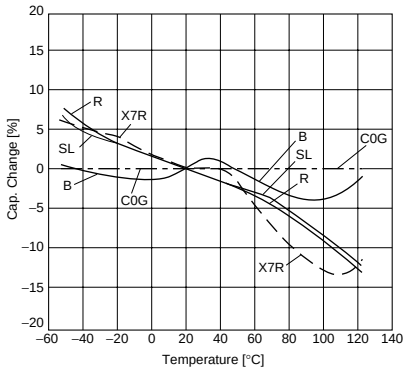
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td rowspan="5">19</td><td rowspan="5">Humidity Loading</td><td>Appearance</td><td>No marking defects</td><td rowspan="5">Apply the rated voltage at 40±2℃ and relative humidity of 90 to 95% for 500 $^{+24}_{0}$ hrs. Remove and let sit for 24±2 hrs. at *1room condition, then measure.<br>•Pretreatment for X7R char.<br>Perform a heat treatment at 150 $^{+}_{-10}$ ℃ for 60±5 min. and then let sit for 24±2 hrs. at *1room condition.</td></tr>
<tr><td>Capacitance Change</td><td><table><tr><th>Char.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>SL</td><td>Within ±5.0% or ±0.5pF<br>(Whichever is larger)</td></tr></table></td></tr>
<tr><td>D.F.<br>Q</td><td><table><tr><th>Char.</th><th>Specification</th></tr><tr><td>X7R</td><td>D.F.≦0.05</td></tr><tr><td>SL</td><td>Q≧275+5/2C*2 (C<30pF)<br>Q≧350 (C≧30pF)</td></tr></table></td></tr>
<tr><td>I.R.</td><td>More than 3,000MΩ</td></tr>
<tr><td>Dielectric Strength</td><td>In accordance with item No.4</td></tr>
</table>

*1 "Room condition" Temperature : 15 to 35℃, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa
*2 "C" expresses nominal capacitance value (pF).

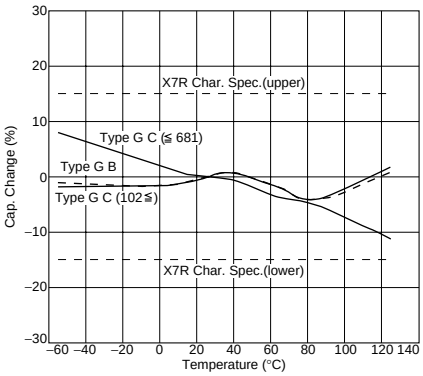
# GRM/GR4/GA2/GA3 Series Data (Typical Example)

## ■ Capacitance-Temperature Characteristics

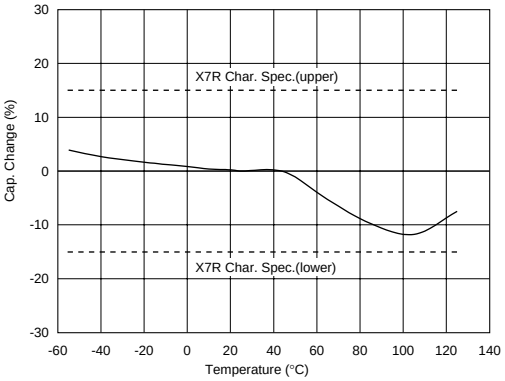
GRM/GR4/GA2 Series




GA3 Series (type GB/GC)

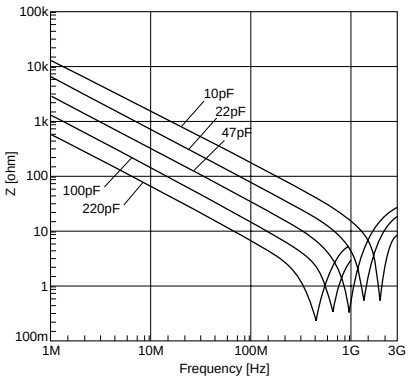



GA3 Series (type GD/GF)

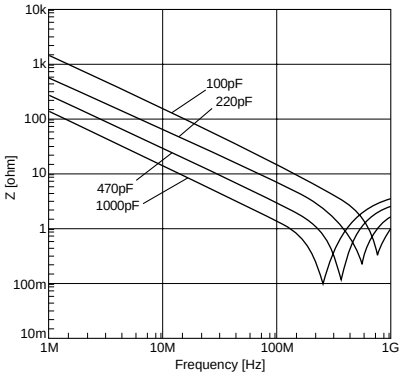



## ■ Impedance-Frequency Characteristics

GRM Series (SL Characteristics)




GRM Series (R Characteristics)



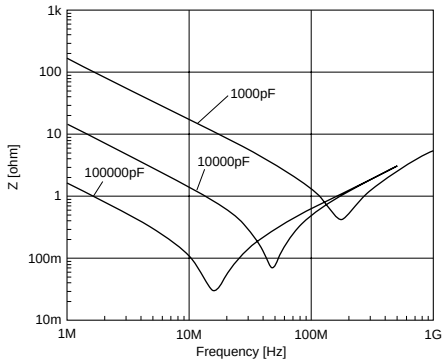

Continued on the following page.

# GRM/GR4/GA2/GA3 Series Data (Typical Example)

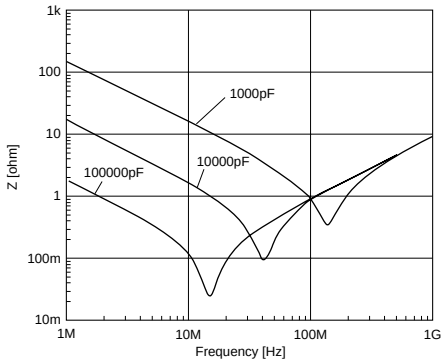
Continued from the preceding page.

## ■ Impedance-Frequency Characteristics

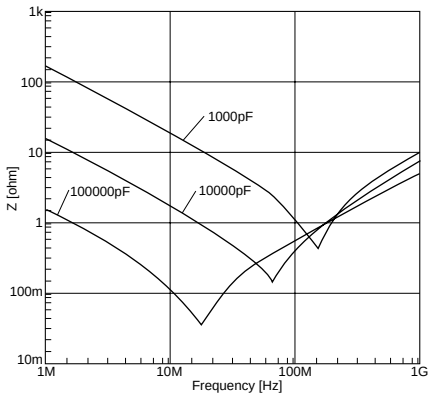
GRM Series (X7R Char. 250V)



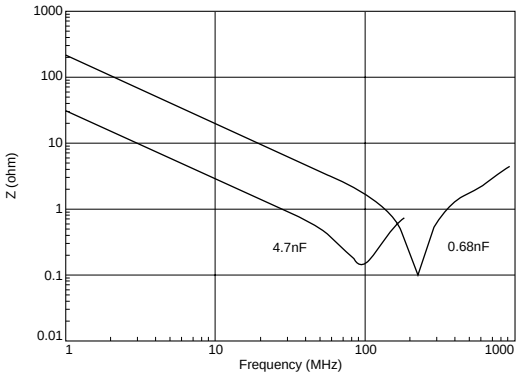

GRM Series (X7R Char. 630V)



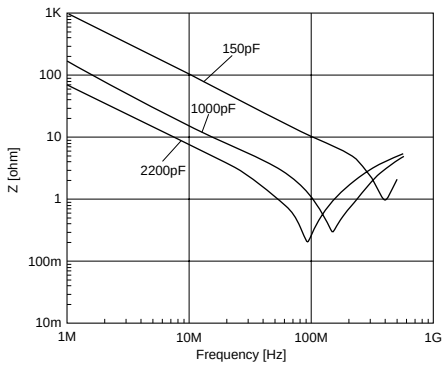

GA2 Series



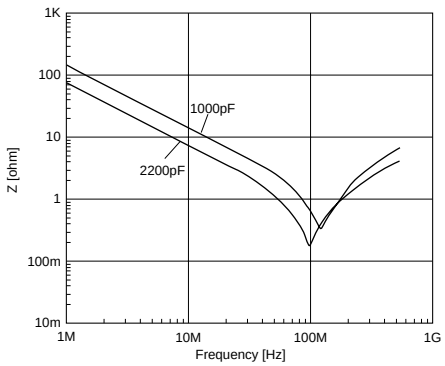

GA3 Series (Type GC)




GA3 Series (Type GD)




GA3 Series (Type GF)



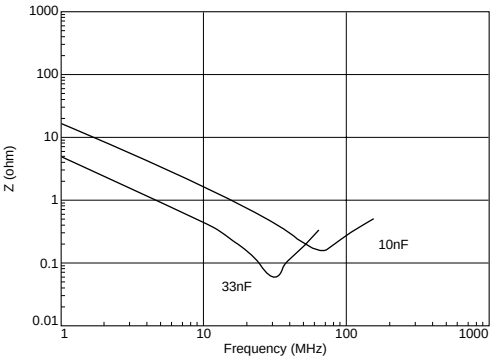

Continued on the following page.

# GRM/GR4/GA2/GA3 Series Data (Typical Example)

Continued from the preceding page.

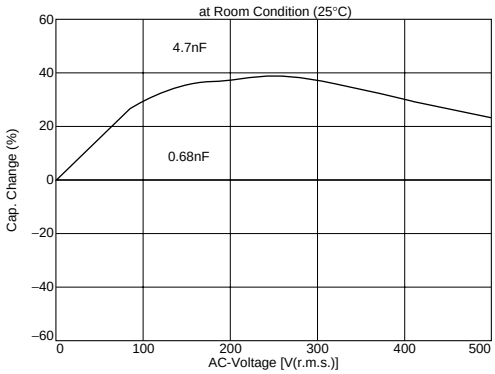
## ■ Impedance-Frequency Characteristics

GA3 Series (Type GB)

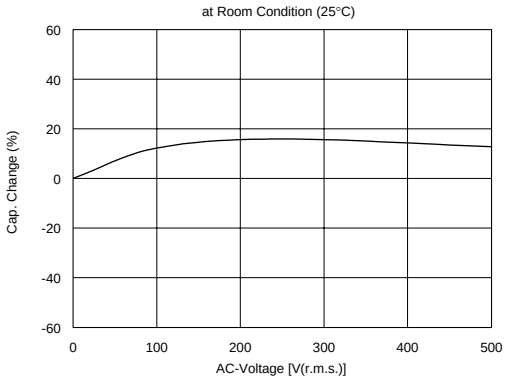



## ■ Capacitance-AC Voltage Characteristics

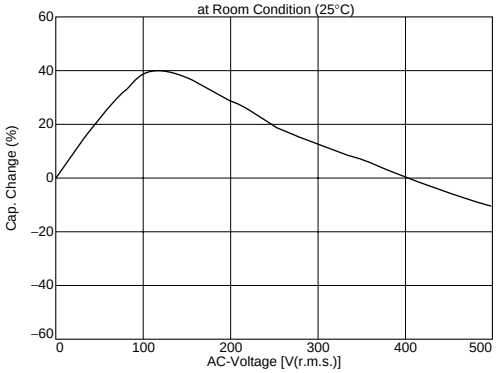
GA3 Series (Type GC)




GA3 Series (Type GD/GF, X7R char.)




GA3 Series (Type GB)



# Package

Taping is standard packaging method.

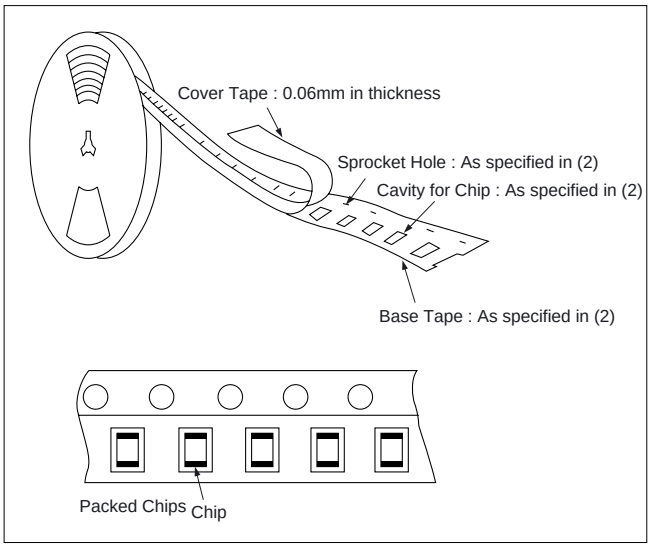
## ■ Minimum Quantity Guide

| Part Number | | Dimensions (mm) | | | Quantity (pcs.) | |
|---|---|---|---|---|---|---|
| | | | | | ϕ180mm reel | |
| | | L | W | T | Paper Tape | Plastic Tape |
| Medium-voltage | **GRM18** | 1.6 | 0.8 | 0.8 | 4,000 | - |
| | **GRM21** | 2.0 | 1.25 | 1.0 | 4,000 | - |
| | | | | 1.25 | - | 3,000 |
| | **GRM31/GR431** | 3.2 | 1.6 | 1.0 | 4,000 | - |
| | | | | 1.25 | - | 3,000 |
| | | | | 1.6 | - | 2,000 |
| | **GRM32/GR432** | 3.2 | 2.5 | 1.5 | - | 2,000 |
| | | | | 2.0 | - | 1,000 |
| | **GRM42/GR442** | 4.5 | 2.0 | 1.0 | - | 3,000 |
| | | | | 1.25 | - | 2,000 |
| | | | | 1.5 | - | 2,000 |
| | | | | 2.0 | - | 2,000 |
| | **GRM43/GR443** | 4.5 | 3.2 | 1.5 | - | 1,000 |
| | | | | 2.0 | - | 1,000 |
| | | | | 2.5 | - | 500 |
| | **GRM55/GR455** | 5.7 | 5.0 | 2.0 | - | 1,000 |
| AC250V | **GA242** | 4.5 | 2.0 | 1.5 | - | 2,000 |
| | **GA243** | 4.5 | 3.2 | 1.5 | - | 1,000 |
| | | | | 2.0 | - | 1,000 |
| | **GA255** | 5.7 | 5.0 | 2.0 | - | 1,000 |
| Safety Std. Recognition | **GA342** | 4.5 | 2.0 | 1.5 | - | 2,000 |
| | | | | 2.0 | - | 2,000 |
| | **GA343** | 4.5 | 3.2 | 1.5 | - | 1,000 |
| | | | | 2.0 | - | 1,000 |
| | **GA352** | 5.7 | 2.8 | 1.5 | - | 1,000 |
| | | | | 2.0 | - | 1,000 |
| | **GA355** | 5.7 | 5.0 | 1.5 | - | 1,000 |
| | | | | 2.0 | - | 1,000 |
| | | | | 2.7 | - | 500 |

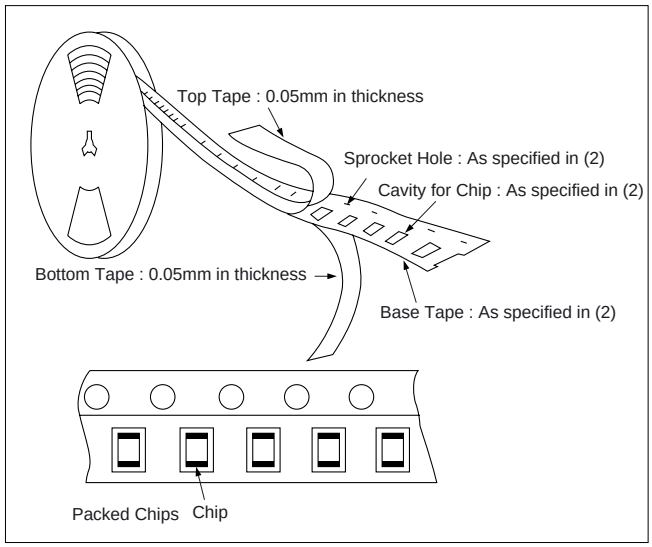
## ■ Tape Carrier Packaging

(1) Appearance of Taping

① Plastic Tape




② Paper Tape




Continued on the following page.

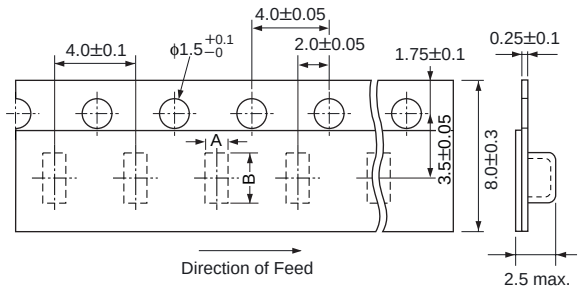
# Package

Continued from the preceding page.

## (2) Dimensions of Tape

### ① Plastic Tape

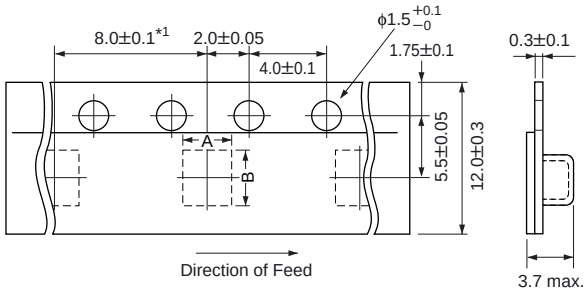
8mm width 4mm pitch Tape




| Part Number | A* | B* |
|---|---|---|
| **GRM21** (T≦1.25mm) | 1.45 | 2.25 |
| **GRM31/GR431** (T≦1.25mm) | 2.0 | 3.6 |
| **GRM32/GR432** | 2.9 | 3.6 |

*Nominal Value

12mm width 8mm/4mm pitch Tape




| Part Number | A* | B* |
|---|---|---|
| **GRM42/GR442/GA242/GA342** | 2.5 | 5.1 |
| **GRM43/GR443/GA243/GA343** | 3.6 | 4.9 |
| **GA252/GA352** | 3.2 | 6.1 |
| **GRM55/GR455/ GA255/GA355** | 5.4 | 6.1 |

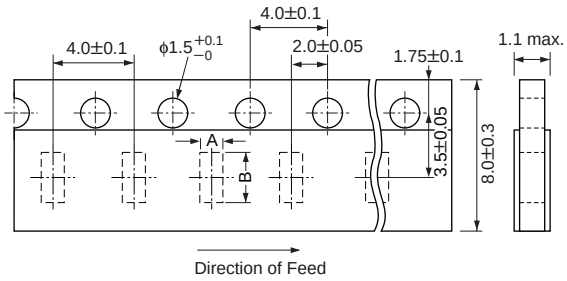
*1 4.0±0.1mm in case of GRM42/GR442/GA242/GA342

*Nominal Value

(in mm)

### ② Paper Tape

8mm width 4mm pitch Tape

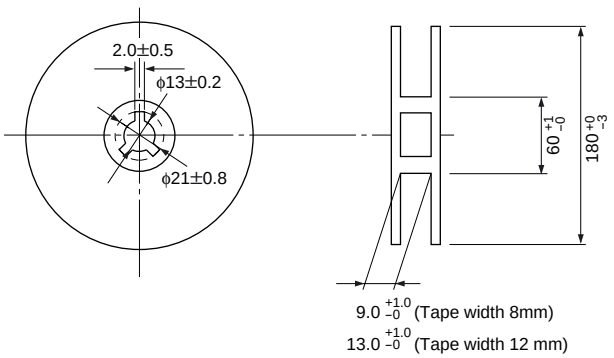



| Part Number | A* | B* |
|---|---|---|
| **GRM18** | 1.05 | 1.85 |
| **GRM21** (T=1.0mm) | 1.45 | 2.25 |
| **GRM31** (T=1.0mm) | 2.0 | 3.6 |

*Nominal value

(in mm)

## (3) Dimensions of Reel




(in mm)

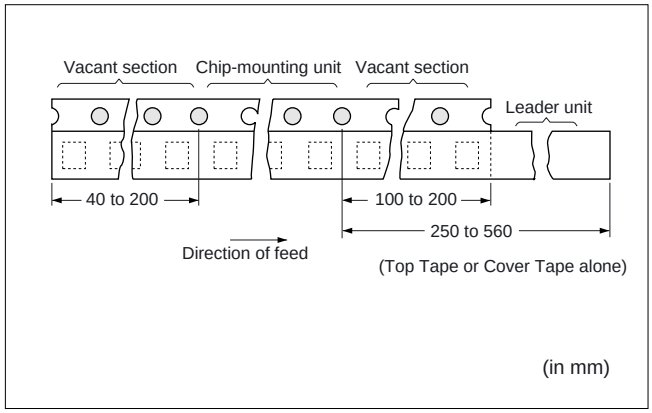
Continued on the following page.

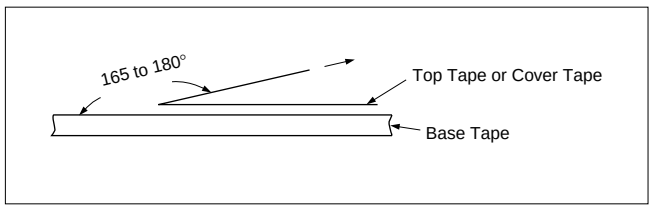
# Package

Continued from the preceding page.

(4) Taping Method

① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
② Part of the leader and part of the empty tape shall be attached to the end of the tape as shown at right.
③ The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.
④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.
⑤ The top tape or cover tape and bottom tape shall not protrude beyond the edges of the tape and shall not cover sprocket holes.
⑥ Cumulative tolerance of sprocket holes, 10 pitches : ±0.3mm.
⑦ Peeling off force : 0.1 to 0.7N in the direction shown at right.



# ⚠Caution

## ■ Storage and Operating Conditions

Operating and storage environment

Do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. And 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 5 to 40 degrees centigrade and 20 to 70%. Use capacitors within 6 months. 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.

## ■ Handling

1. Vibration and impact
   Do not expose a capacitor to excessive shock or vibration during use.
2. Do not directly touch the chip capacitor, especially the ceramic body. Residue from hands/fingers may create a short circuit environment.

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.

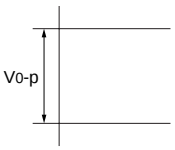
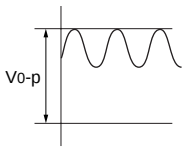
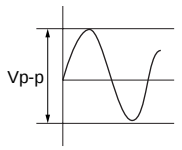
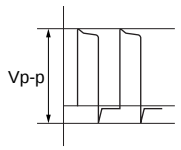
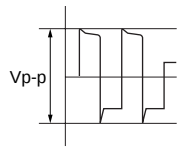
# ⚠Caution

## ■ Caution (Rating)

### 1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the Vo-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

(1) In case of X7R char. and GA3 series SL 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 the like, it may have the self-generated heat due to dielectric-loss.

Applied voltage should be the load such as self-generated heat is within 20°C on the condition of atmosphere temperature 25°C. When measuring, use a thermocouple of small thermal capacity-K of ø0.1mm 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.)

(2) In case of C0G/R char.

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range.

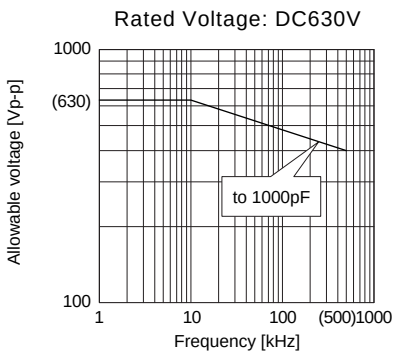
Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high-frequency current, pulse current or similar current, it may self-generate heat due to dielectric loss.

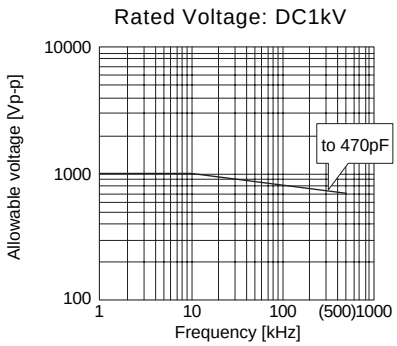
The frequency of the applied sine wave voltage should be less than 500kHz (less than 100kHz in case of rated voltage: DC3.15kV). The applied voltage should be less than the value shown in figure at right.

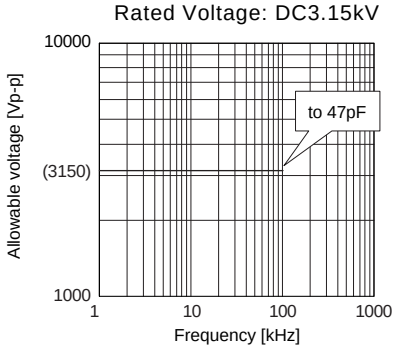
In case of non-sine wave which include a harmonic frequency, please contact our sales representatives or product engineers. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running.

Otherwise, accurate measurement cannot be ensured.)

The temperature of the surface of capacitor: 125˚C (including self-heating)




The sine-wave frequency VS allowable voltage

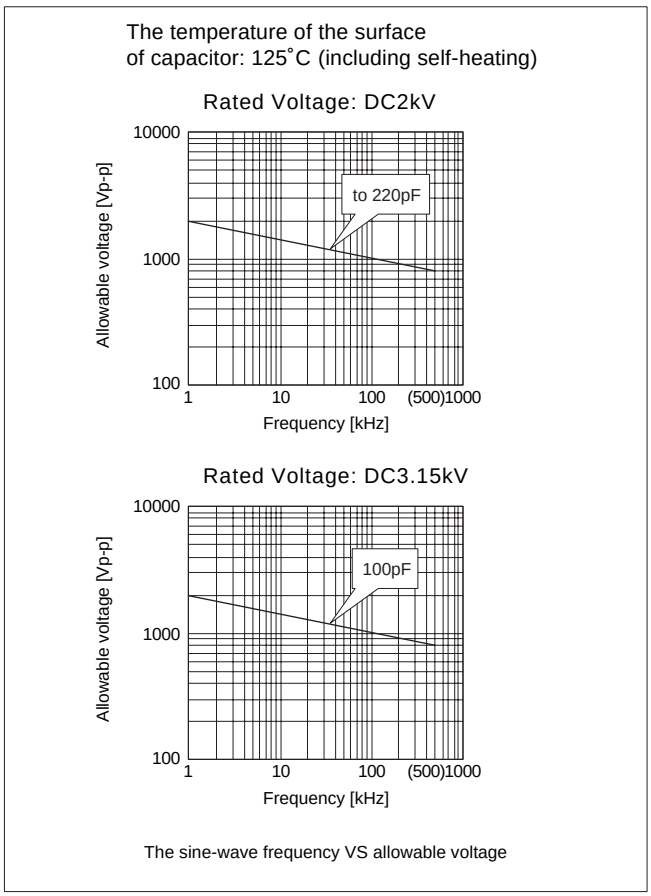
Continued on the following page.

## ⚠Caution

Continued from the preceding page.

(3) In case of GRM series SL 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 self-generate heat due to dielectric loss.
The frequency of the applied sine wave voltage should be less than 500kHz. The applied voltage should be less than the value shown in figure at right.
In case of non-sine wave which include a harmonic frequency, please contact our sales representatives or product engineers. 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.)




The sine-wave frequency VS allowable voltage

3. Test condition for AC withstanding Voltage

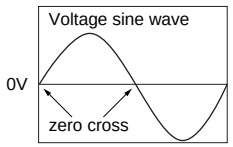
(1) Test Equipment

Tests for AC withstanding voltage should be made with equipment capable of creating a wave similar to a 50/60 Hz sine wave.
If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

(2) Voltage applied method

The capacitor's leads or terminals 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 is applied directly to the capacitor without raising it from near zero, it 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 the capacitor's leads or terminals should be taken off the output of the withstanding voltage test equipment. If the test voltage is applied directly to the capacitor without raising it from near zero, surge voltage may occur and cause a defect.

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




Continued on the following page.

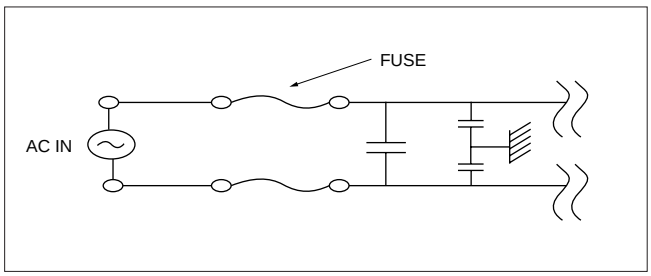
## ⚠Caution

Continued from the preceding page.

4. Fail-Safe

Failure of a capacitor may result in a short circuit. Be sure to provide an appropriate fail-safe function such as a fuse on your product to help eliminate possible electric shock, fire, or fumes.

Please consider using fuses on each AC line if the capacitors are used between the AC input lines and earth (line bypass capacitors), to prepare for the worst case, such as a short circuit.




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

## ■ Caution (Soldering and Mounting)

1. Vibration and Impact

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

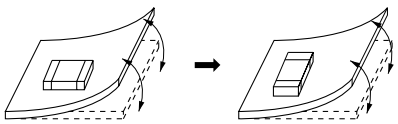
2. Circuit Board Material

In case that chip size is 4.5×3.2mm or more, a metal-board or metal-frame such as Aluminum board is not available because soldering heat causes expansion and shrinkage of a board or frame, which will cause a chip to crack.

3. Land Layout for Cropping PC Board

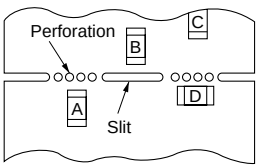
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



Locate chip horizontal to the direction in which stress acts.

[Chip Mounting Close to Board Separation Point]




Chip arrangement
Worst A>C>B~D Best

Continued on the following page.

## ⚠Caution

Continued from the preceding page.

4. Soldering (Prevention of the thermal shock)

If a chip component is heated or cooled abruptly during soldering, it may crack due to the thermal shock. To prevent this, follow our recommendations below for adequate soldering conditions.

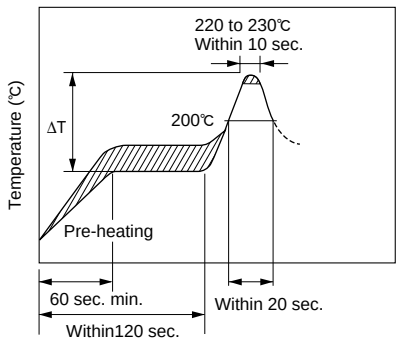
Carefully perform pre-heating so that temperature difference (ΔT) between the solder and component surface is in the following range. When components are immersed in solvent after mounting, pay special attention to keep the temperature difference within 100˚C.

| Soldering Method \ Chip Size | 3.2×1.6mm and under | 3.2×2.5mm and over |
|---|---|---|
| Reflow Method or Soldering Iron Method | ΔT≦190˚C | ΔT≦130˚C |
| Flow Method or Dip Soldering Method | ΔT≦150˚C | —— |

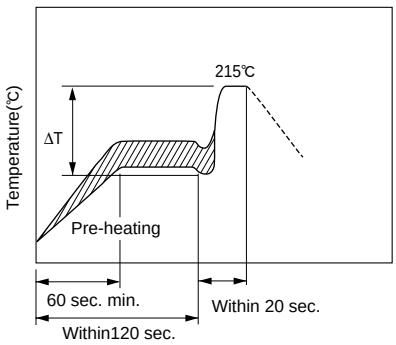
When correcting chips with a soldering iron, no preheating is required if the chip is listed in following table and the following conditions are met.
Preheating should be performed on chips not listed in following table.

| Item | Conditions | |
|---|---|---|
| Chip Size | ≦2.0×1.25mm | 3.2×1.6mm |
| Temperature of Iron tip | 300˚C max. | 270˚C max. |
| Soldering Iron Wattage | 20W max. | |
| Diameter of Iron tip | ϕ 3.0mm max. | |
| Soldering Time | 3 sec. max. | |
| Caution | Do not allow the iron tip to directly touch the ceramic element. | |

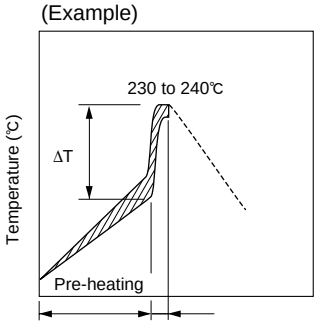
Infrared Reflow Soldering Conditions (Example)



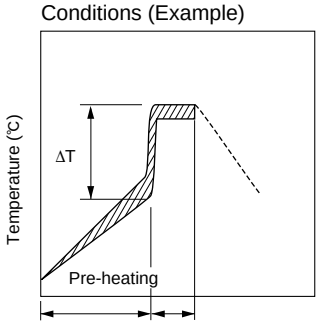

Vapor Reflow Soldering (VPS) Conditions (Example)




Flow Soldering Conditions (Example)




Dip Soldering/Soldering Iron Conditions (Example)




5. Soldering Method

GR/GA products whose sizes are 3.2X1.6mm and under for flow and reflow soldering, and other sizes for reflow soldering.

Be sure to contact our sales representatives or engineers in case that GR/GA products (size 3.2X2.5mm and over) are to be mounted with flow soldering. It may crack due to the thermal shock.

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

# Notice

## ■ Notice (Soldering and Mounting)

### 1. Mounting of Chips

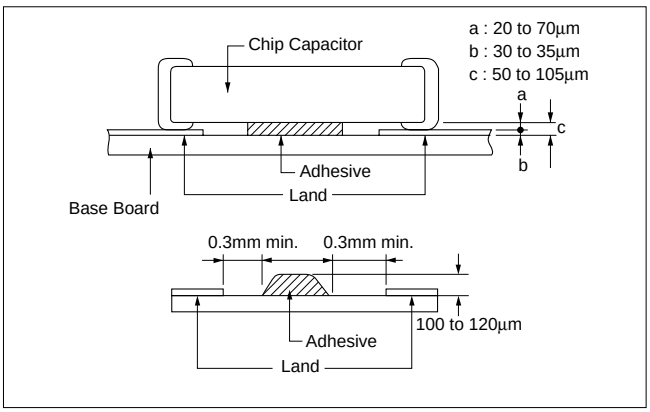
● Mechanical shock of the chip placer

When the positioning claws and pick-up nozzle are worn, the load is applied to the chip while positioning is concentrated in one position, thus causing cracks, breakage, faulty positioning accuracy, etc.

Careful checking and maintenance are necessary to prevent unexpected trouble.

An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. Please set the suction nozzle's bottom dead point on the upper surface of the board.

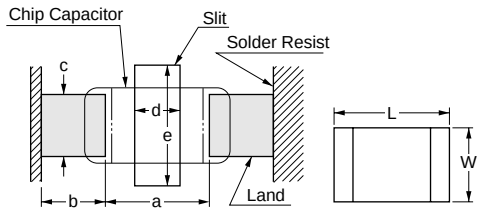
Termination Thickness of Chip Capacitor and Desirable Thickness of Adhesives Applied




### 2. Construction of Board Pattern

After installing chips, if solder is excessively applied to the circuit board, mechanical stress will cause destruction resistance characteristics to lower. To prevent this, be extremely careful in determining shape and dimension before designing the circuit board diagram.

Construction and Dimensions of Pattern (Example)




Preparing slit helps flux cleaning and resin coating on the back of the capacitor.

Flow Soldering

| L×W | a | b | c |
|---|---|---|---|
| 1.6×0.8 | 0.6-1.0 | 0.8-0.9 | 0.6-0.8 |
| 2.0×1.25 | 1.0-1.2 | 0.9-1.0 | 0.8-1.1 |
| 3.2×1.6 | 2.2-2.6 | 1.0-1.1 | 1.0-1.4 |

Reflow Soldering

| L×W | a | b | c | d | e |
|---|---|---|---|---|---|
| 1.6×0.8 | 0.6-0.8 | 0.6-0.7 | 0.6-0.8 | - | - |
| 2.0×1.25 | 1.0-1.2 | 0.9-1.0 | 0.8-1.1 | - | - |
| 3.2×1.6 | 2.2-2.4 | 0.8-0.9 | 1.0-1.4 | 1.0-2.0 | 3.2-3.7 |
| 3.2×2.5 | 2.0-2.4 | 1.0-1.2 | 1.8-2.3 | 1.0-2.0 | 4.1-4.6 |
| 4.5×2.0 | 2.8-3.4 | 1.2-1.4 | 1.4-1.8 | 1.0-2.8 | 3.6-4.1 |
| 4.5×3.2 | 2.8-3.4 | 1.2-1.4 | 2.3-3.0 | 1.0-2.8 | 4.8-5.3 |
| 5.7×2.8 | 4.0-4.6 | 1.4-1.6 | 2.1-2.6 | 1.0-4.0 | 4.4-4.9 |
| 5.7×5.0 | 4.0-4.6 | 1.4-1.6 | 3.5-4.8 | 1.0-4.0 | 6.6-7.1 |

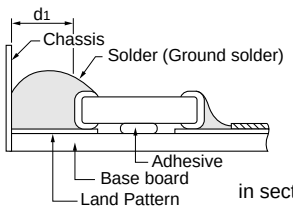
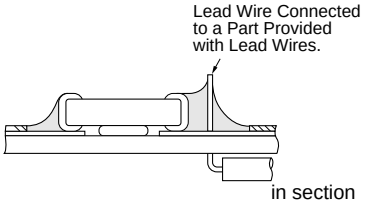
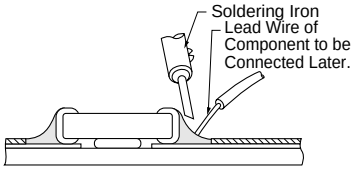
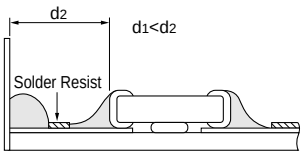
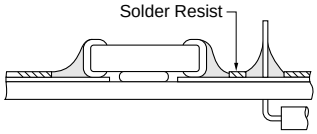
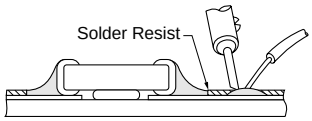
(in mm)

Continued on the following page.

# Notice

Continued from the preceding page.

## Land Layout to Prevent Excessive Solder

| | Mounting Close to a Chassis | Mounting with Leaded Components | Mounting Leaded Components Later |
|---|---|---|---|
| Examples of Arrangements to be Avoided |  |  |  |
| Examples of Improvements by the Land Division |  |  |  |

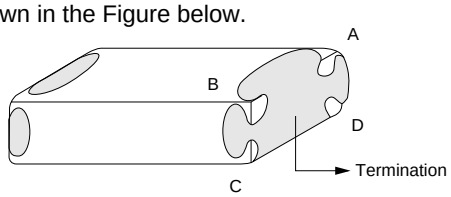
## 3. Soldering

(1) Care for minimizing loss of the terminations.

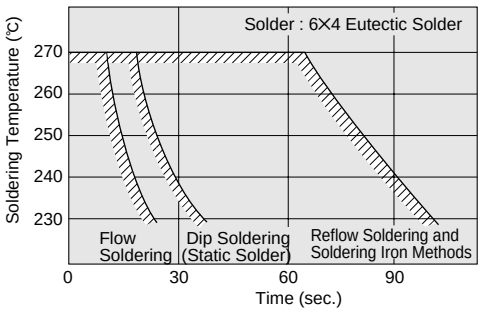
The information below illustrates the soldering conditions needed to minimize the loss of the effective area on the terminations.

Depending on the conditions of the soldering temperature and/or immersion (melting time), effective areas may be lost in some part of the terminations.

To prevent this, be careful in soldering so that any possible loss of the effective area on the terminations will securely remain at a maximum of 25% on all edge length A-B-C-D-A of part with A, B, C, D, shown in the Figure below.




Soldering Allowance Time




In case of repeated soldering, the accumulated soldering time must be within the range shown above.

(2) Flux

- Use rosin-type flux and do not use a highly acidic flux (any containing a minimum of 0.2wt% chlorine).

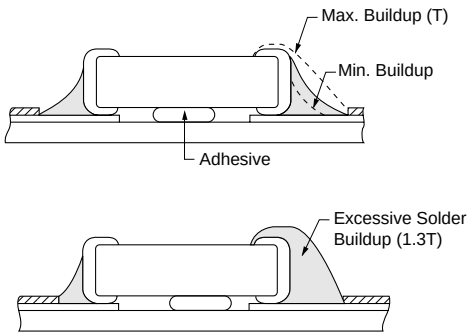
(3) Solder Buildup

① Flow soldering and iron soldering

When soldering, use less than the maximum and more than the minimum solder buildup as shown in the illustration to the right.

During the soldering process, insure that the solder is securely placed.

[Solder Buildup by Flow Method and Soldering Iron Method]




Continued on the following page.

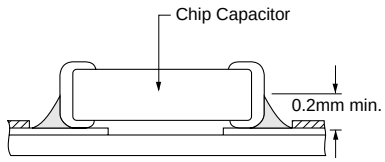
# Notice

Continued from the preceding page.

② Reflow soldering

When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations.

[Solder Buildup by Reflow Method]




## 4. 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 PWBs.

## 5. Resin Coating

- When selecting resin materials, select those with low contraction and low moisture absorption coefficient (generally epoxy resin is used).
- Buffer coat can decrease the influence of the resin shrinking (generally silicone resin).

# Notice

## ■ Rating

Capacitance change of capacitor

1. In case of X7R 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. So, it is not likely to be suitable for use in a time constant circuit.
   Please contact us if you need detailed information.
2. In case of C0G/R/SL char.
   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.

# ISO 9000 Certifications

| Plant | Certified Date | Organization | Registration No. |
|---|---|---|---|
| Fukui Murata Manufacturing Co., Ltd. | Apr. 2, '97 | UL *1 ISO9001 | A5287 |
| Izumo Murata Manufacturing Co., Ltd. | Jul. 25, '97 | | A5587 |
| Murata Electronics Singapore (Pte.) Ltd. | Nov. 3, '99 | PSB *2 ISO9001 | 99-2-1085 |
| Murata Manufacturing (UK) Ltd. | Jun. 24, '98 | BSI *3 ISO9001 | FM 22169 |
| Murata Amazonia Industria Comercio Ltda. | Jul. 28, '98 | FUNDACAO VANZOLINI ISO9002 | SQ-480-675/98 |
| Murata Electronics North America State College Plant | Mar. 7, '96 | UL *1 ISO9001 | A1734 |
| Beijing Murata Electronics Co., Ltd. | Dec. 10, '98 | UL *1 ISO9002 | A7123 |

*1 UL : Underwriters Laboratories Inc.
*2 PSB : Singapore Productivity and Standards Board
*3 BSI : British Standards Institution

## ⚠Note:

1. Export Control
   〈For customers outside Japan〉
   Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.
   〈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 to 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 in the above
3. Product specifications in this catalog are as of August 2003. 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 because there is no space for detailed 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.

**Murata Manufacturing Co., Ltd.**

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