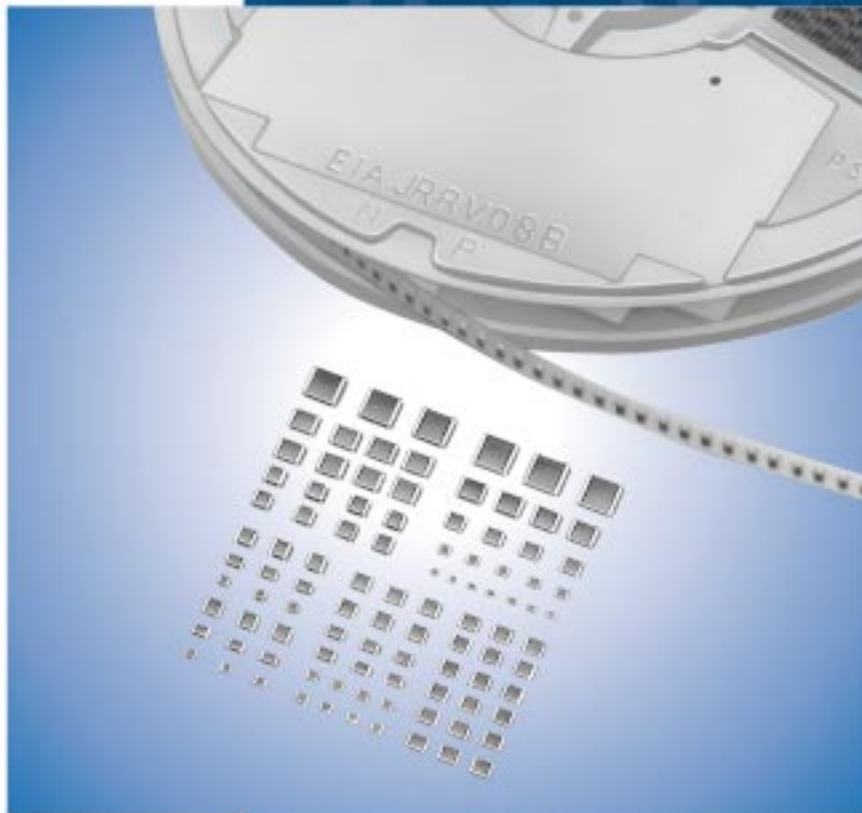


Chip Monolithic Ceramic Capacitors



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● Please refer to "Specifications and Test Methods" at the end of each chapter of **15** - **19** .

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● Part Numbering

Chip Monolithic Ceramic Capacitors

(Part Number)

| | | | | | | | | | |
|----|---|----|---|----|----|-----|---|-----|---|
| GR | M | 18 | 8 | B1 | 1H | 102 | K | A01 | K |
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | ⑩ |

① Product ID

② Series

| Product ID | Code | Series |
|------------|----------|-------------------------------------------------|
| GR | M | Tin Plated Layer |
| | 4 | Only for Information Devices / Tip & Ring |
| | 7 | Only for Camera Flash Circuit |
| ER | B | High Frequency Type |
| GQ | M | High Frequency for Flow/Reflow Soldering |
| GM | A | Monolithic Microchip |
| GN | M | Capacitor Array |
| LL | L | Low ESL Wide Width Type |
| | A | Eight-termination Low ESL Type |
| | M | Ten-termination Low ESL Type |
| GJ | M | High Frequency Low Loss Type Tin Plated Type |
| GA | 2 | for AC250V (r.m.s.) |
| | 3 | Safety Standard Recognized Type |

③ Dimension (L×W)

| Code | Dimension (L×W) | EIA |
|-----------|----------------------------------|-------|
| 02 | 0.4×0.2mm | 01005 |
| 03 | 0.6×0.3mm | 0201 |
| 05 | 0.5×0.5mm | 0202 |
| 08 | 0.8×0.8mm | 0303 |
| 11 | 1.25×1.0mm | 0504 |
| 15 | 1.0×0.5mm | 0402 |
| 18 | 1.6×0.8mm | 0603 |
| 1D | 1.4×1.4mm | |
| 1X | Depends on individual standards. | |
| 21 | 2.0×1.25mm | 0805 |
| 22 | 2.8×2.8mm | 1111 |
| 31 | 3.2×1.6mm | 1206 |
| 32 | 3.2×2.5mm | 1210 |
| 3X | Depends on individual standards. | |
| 42 | 4.5×2.0mm | 1808 |
| 43 | 4.5×3.2mm | 1812 |
| 52 | 5.7×2.8mm | 2211 |
| 55 | 5.7×5.0mm | 2220 |

④ Dimension (T)

| Code | Dimension (T) |
|----------|----------------------------------|
| 2 | 0.2mm |
| 2 | 2-elements (Array Type) |
| 3 | 0.3mm |
| 4 | 4-elements (Array Type) |
| 5 | 0.5mm |
| 6 | 0.6mm |
| 7 | 0.7mm |
| 8 | 0.8mm |
| 9 | 0.85mm |
| A | 1.0mm |
| B | 1.25mm |
| C | 1.6mm |
| D | 2.0mm |
| E | 2.5mm |
| F | 3.2mm |
| M | 1.15mm |
| N | 1.35mm |
| R | 1.8mm |
| S | 2.8mm |
| Q | 1.5mm |
| 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.

⑤ Temperature Characteristics

| Temperature Characteristic Codes | | | Temperature Characteristics | | | Operating Temperature Range |
|----------------------------------|-----------------|-----|-----------------------------|-------------------|-----------------------------------------------|-----------------------------|
| Code | Public STD Code | | Referance Temperature | Temperature Range | Capacitance Change or Temperature Coefficient | |
| 1X | SL *1 | JIS | 20°C | 20 to 85°C | +350 to -1000ppm/°C | -55 to 125°C |
| 2C | CH *1 | JIS | 20°C | 20 to 125°C | 0±60ppm/°C | -55 to 125°C |
| 2P | PH *1 | JIS | 20°C | 20 to 85°C | -150±60ppm/°C | -25 to 85°C |
| 2R | RH *1 | JIS | 20°C | 20 to 85°C | -220±60ppm/°C | -25 to 85°C |
| 2S | SH *1 | JIS | 20°C | 20 to 85°C | -330±60ppm/°C | -25 to 85°C |
| 2T | TH *1 | JIS | 20°C | 20 to 85°C | -470±60ppm/°C | -25 to 85°C |
| 3C | CJ *1 | JIS | 20°C | 20 to 125°C | 0±120ppm/°C | -55 to 125°C |
| 3P | PJ *1 | JIS | 20°C | 20 to 85°C | -150±120ppm/°C | -25 to 85°C |
| 3R | RJ *1 | JIS | 20°C | 20 to 85°C | -220±120ppm/°C | -25 to 85°C |
| 3S | SJ *1 | JIS | 20°C | 20 to 85°C | -330±120ppm/°C | -25 to 85°C |
| 3T | TJ *1 | JIS | 20°C | 20 to 85°C | -470±120ppm/°C | -25 to 85°C |
| 3U | UJ *1 | JIS | 20°C | 20 to 85°C | -750±120ppm/°C | -25 to 85°C |
| 4C | CK *1 | JIS | 20°C | 20 to 125°C | 0±250ppm/°C | -55 to 125°C |
| 5C | C0G *1 | EIA | 25°C | 25 to 125°C | 0±30ppm/°C | -55 to 125°C |
| 5G | X8G *1 | EIA | 25°C | 25 to 150°C | 0±30ppm/°C | -55 to 150°C |
| 6C | C0H *1 | EIA | 25°C | 25 to 125°C | 0±60ppm/°C | -55 to 125°C |
| 6P | P2H *1 | EIA | 25°C | 25 to 85°C | -150±60ppm/°C | -55 to 125°C |
| 6R | R2H *1 | EIA | 25°C | 25 to 85°C | -220±60ppm/°C | -55 to 125°C |
| 6S | S2H *1 | EIA | 25°C | 25 to 85°C | -330±60ppm/°C | -55 to 125°C |
| 6T | T2H *1 | EIA | 25°C | 25 to 85°C | -470±60ppm/°C | -55 to 125°C |
| 7U | U2J *1 | EIA | 25°C | 25 to 85°C | -750±120ppm/°C | -55 to 125°C |
| B1 | B *2 | JIS | 20°C | -25 to 85°C | ±10% | -25 to 85°C |
| B3 | B | JIS | 20°C | -25 to 85°C | ±10% | -25 to 85°C |
| C7 | X7S | EIA | 25°C | -55 to 125°C | ±22% | -55 to 125°C |
| C8 | X6S | EIA | 25°C | -55 to 105°C | ±22% | -55 to 105°C |
| F1 | F *2 | JIS | 20°C | -25 to 85°C | +30, -80% | -25 to 85°C |
| F5 | Y5V | EIA | 25°C | -30 to 85°C | +22, -82% | -30 to 85°C |
| L8 | X8L | EIA | 25°C | -55 to 150°C | +15, -40% | -55 to 150°C |
| R1 | R *2 | JIS | 20°C | -55 to 125°C | ±15% | -55 to 125°C |
| R3 | R | JIS | 20°C | -55 to 125°C | ±15% | -55 to 125°C |
| R6 | X5R | EIA | 25°C | -55 to 85°C | ±15% | -55 to 85°C |
| R7 | X7R | EIA | 25°C | -55 to 125°C | ±15% | -55 to 125°C |
| R9 | X8R | EIA | 25°C | -55 to 150°C | ±15% | -55 to 150°C |
| 9E | ZLM | *3 | 20°C | -25 to 20°C | -4700+100/-2500ppm/°C | -25 to 85°C |
| | | | | 20 to 85°C | -4700+500/-1000ppm/°C | |
| W0 | - | - | 25°C | -55 to 125°C | ±10% *4 | -55 to 125°C |
| | | | | | +22, -33% *5 | |


*1 Please refer to table for Capacitance Change under reference temperature.

*2 Capacitance change is specified with 50% rated voltage applied.

*3 Murata Temperature Characteristic Code.

*4 Apply DC350V bias.

*5 No DC bias.

Continued on the following page. 

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● Capacitance Change from each temperature

JIS Code

| Murata Code | Capacitance Change from 20°C (%) | | | | | |
|-------------|----------------------------------|-------|-------|-------|-------|-------|
| | -55°C | | -25°C | | -10°C | |
| | Max. | Min. | Max. | Min. | Max. | Min. |
| 1X | - | - | - | - | - | - |
| 2C | 0.82 | -0.45 | 0.49 | -0.27 | 0.33 | -0.18 |
| 2P | - | - | 1.32 | 0.41 | 0.88 | 0.27 |
| 2R | - | - | 1.70 | 0.72 | 1.13 | 0.48 |
| 2S | - | - | 2.30 | 1.22 | 1.54 | 0.81 |
| 2T | - | - | 3.07 | 1.85 | 2.05 | 1.23 |
| 3C | 1.37 | -0.90 | 0.82 | -0.54 | 0.55 | -0.36 |
| 3P | - | - | 1.65 | 0.14 | 1.10 | 0.09 |
| 3R | - | - | 2.03 | 0.45 | 1.35 | 0.30 |
| 3S | - | - | 2.63 | 0.95 | 1.76 | 0.63 |
| 3T | - | - | 3.40 | 1.58 | 2.27 | 1.05 |
| 3U | - | - | 4.94 | 2.84 | 3.29 | 1.89 |
| 4C | 2.56 | -1.88 | 1.54 | -1.13 | 1.02 | -0.75 |

EIA Code

| Murata Code | Capacitance Change from 25°C (%) | | | | | |
|-------------|----------------------------------|-------|-------|-------|-------|-------|
| | -55°C | | -30°C | | -10°C | |
| | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C/5G | 0.58 | -0.24 | 0.40 | -0.17 | 0.25 | -0.11 |
| 6C | 0.87 | -0.48 | 0.59 | -0.33 | 0.38 | -0.21 |
| 6P | 2.33 | 0.72 | 1.61 | 0.50 | 1.02 | 0.32 |
| 6R | 3.02 | 1.28 | 2.08 | 0.88 | 1.32 | 0.56 |
| 6S | 4.09 | 2.16 | 2.81 | 1.49 | 1.79 | 0.95 |
| 6T | 5.46 | 3.28 | 3.75 | 2.26 | 2.39 | 1.44 |
| 7U | 8.78 | 5.04 | 6.04 | 3.47 | 3.84 | 2.21 |

⑥ Rated 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 |
| BB | DC350V (for Camera Flash Circuit) |
| 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, X1/Y2; AC250V (Safety Standard Recognized Type GF) |

⑦ Capacitance

Expressed by three figures. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two numbers. If there is a decimal point, it is expressed by the capital letter "R". In this case, all figures are significant digits.

Ex.)

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

Continued on the following page. ☐

Continued from the preceding page.

⑧ Capacitance Tolerance

| Code | Capacitance Tolerance | TC | Series | Capacitance Step | |
|----------|-----------------------|---------------------|----------------------------------|------------------|-----------------|
| B | ±0.1pF | CΔ | GRM/GJM | ≤5pF | E24 Series, 1pF |
| C | ±0.25pF | CΔ-SL | GRM/ERB/GQM | ≤5pF | * 1pF |
| | | CΔ | GJM | <10pF | E24 Series, 1pF |
| D | ±0.5pF | CΔ-SL | GRM | 6.0 to 9.0pF | * 1pF |
| | | CΔ | ERB/GQM/GJM | 5.1 to 9.1pF | E24 Series |
| F | ±1% | CΔ | GRM03/15, GJM03/15 | 5.0 to 9.9pF | 0.1pF |
| G | ±2% | CΔ | GJM | ≥10pF | E12 Series |
| | | CΔ | GQM | ≥10pF | E24 Series |
| | | CΔ | GRM03/15, GJM03/15 | 2.0 to 9.9pF | 0.1pF |
| J | ±5% | CΔ-SL | GRM/GA3 | ≥10pF | E12 Series |
| | | CΔ | ERB/GQM/GJM | ≥10pF | E24 Series |
| | | CΔ | GRM03/15, GJM03/15 | 1.0 to 4.9pF | 0.1pF |
| K | ±10% | B, R, X7R, X5R, ZLM | GRM/GR7/GA3 | E6 Series | |
| | | | GR4 | E12 Series | |
| | | CΔ | GRM03/15, GJM03/15 | 0.2 to 1.9pF | 0.1pF |
| M | ±20% | Z5U | GRM | E3 Series | |
| | | B, R, X7R, X7S | GRM/GMA/LLL/LLA/LLM | E6 Series | |
| | | X7R | GA2 | E3 Series | |
| | | CΔ | GRM03/15, GJM03/15 | 0.1 to 0.9pF | 0.1pF |
| Z | +80%, -20% | F, Y5V | GRM | E3 Series | |
| R | | | Depends on individual standards. | | |

* E24 series is also available.

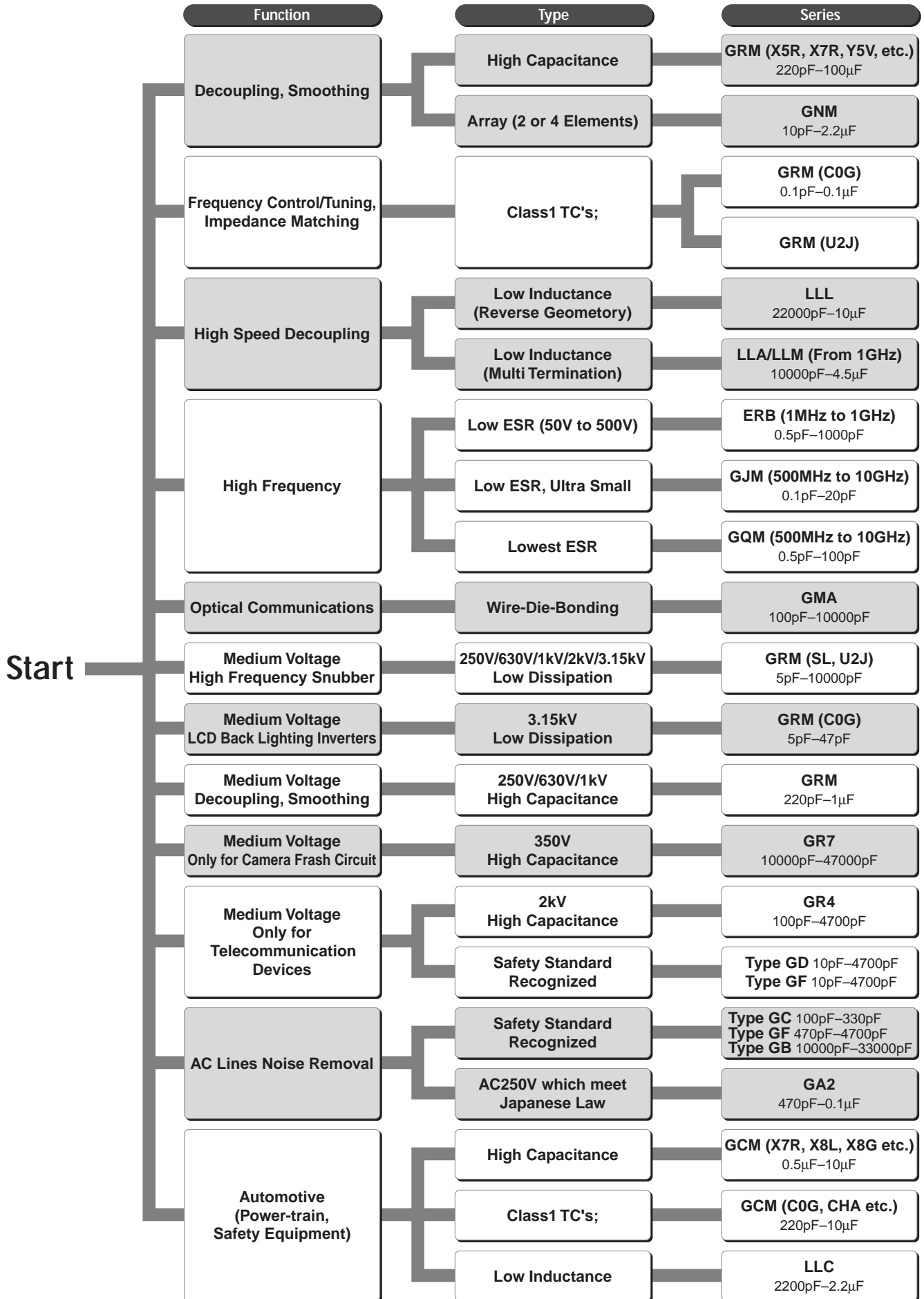
⑨ Individual Specification Code

Expressed by three figures.

⑩ Packaging

| Code | Packaging |
|----------|--------------------------|
| L | ø178mm Embossed Taping |
| D | ø178mm Paper Taping |
| K | ø330mm Embossed 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



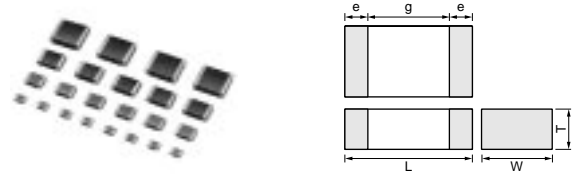
Chip Monolithic Ceramic Capacitors



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: 3.2x1.6x1.6mm.
 GRM18, 21 and GRM31 types are suited to flow and reflow soldering.
 GRM15 type is applied to only reflow soldering.



| 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 0.35 | 0.3 |
| 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 (1.00x0.50mm) 50/25V


| 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) | | | | | | | | |
| 0.30pF(R30) | 0.50(5) | | | | | | | |
| 0.40pF(R40) | 0.50(5) | | | | | | | |
| 0.50pF(R50) | 0.50(5) | | | | | | | |
| 0.60pF(R60) | 0.50(5) | | | | | | | |
| 0.70pF(R70) | 0.50(5) | | | | | | | |
| 0.75pF(R75) | 0.50(5) | | | | | | | |
| 0.80pF(R80) | 0.50(5) | | | | | | | |
| 0.90pF(R90) | 0.50(5) | | | | | | | |
| 1.0pF(1R0) | 0.50(5) | | | | | | | |
| 1.1pF(1R1) | 0.50(5) | | | | | | | |
| 1.2pF(1R2) | 0.50(5) | | | | | | | |
| 1.3pF(1R3) | 0.50(5) | | | | | | | |
| 1.4pF(1R4) | 0.50(5) | | | | | | | |
| 1.5pF(1R5) | 0.50(5) | | | | | | | |
| 1.6pF(1R6) | 0.50(5) | | | | | | | |
| 1.7pF(1R7) | 0.50(5) | | | | | | | |
| 1.8pF(1R8) | 0.50(5) | | | | | | | |
| 1.9pF(1R9) | 0.50(5) | | | | | | | |
| 2.0pF(2R0) | 0.50(5) | | | | | | | |
| 2.1pF(2R1) | 0.50(5) | | | | | | | |
| 2.2pF(2R2) | 0.50(5) | | | | | | | |
| 2.3pF(2R3) | 0.50(5) | | | | | | | |
| 2.4pF(2R4) | 0.50(5) | | | | | | | |
| 2.5pF(2R5) | 0.50(5) | | | | | | | |
| 2.6pF(2R6) | 0.50(5) | | | | | | | |

Continued on the following page.

1

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| Part Number | GRM15 | | | | | | | |
|------------------------------------------------------------------------------------------------------|------------------|-------------|-------------|-------------|------------|------------|-------------|-------------|
| L x W [EIA] | 1.00x0.50 [0402] | | | | | | | |
| TC | COG (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) | | | | | | | | |
| 2.7pF(2R7) | 0.50(5) | | | | | | | |
| 2.8pF(2R8) | 0.50(5) | | | | | | | |
| 2.9pF(2R9) | 0.50(5) | | | | | | | |
| 3.0pF(3R0) | 0.50(5) | 0.50(5) | 0.50(5) | 0.50(5) | | | 0.50(5) | 0.50(5) |
| 3.1pF(3R1) | 0.50(5) | | | | | | | |
| 3.2pF(3R2) | 0.50(5) | | | | | | | |
| 3.3pF(3R3) | 0.50(5) | | | | | | | |
| 3.4pF(3R4) | 0.50(5) | | | | | | | |
| 3.5pF(3R5) | 0.50(5) | | | | | | | |
| 3.6pF(3R6) | 0.50(5) | | | | | | | |
| 3.7pF(3R7) | 0.50(5) | | | | | | | |
| 3.8pF(3R8) | 0.50(5) | | | | | | | |
| 3.9pF(3R9) | 0.50(5) | | | | | | | |
| 4.0pF(4R0) | 0.50(5) | 0.50(5) | 0.50(5) | 0.50(5) | | | 0.50(5) | 0.50(5) |
| 4.1pF(4R1) | 0.50(5) | | | | | | | |
| 4.2pF(4R2) | 0.50(5) | | | | | | | |
| 4.3pF(4R3) | 0.50(5) | | | | | | | |
| 4.4pF(4R4) | 0.50(5) | | | | | | | |
| 4.5pF(4R5) | 0.50(5) | | | | | | | |
| 4.6pF(4R6) | 0.50(5) | | | | | | | |
| 4.7pF(4R7) | 0.50(5) | | | | | | | |
| 4.8pF(4R8) | 0.50(5) | | | | | | | |
| 4.9pF(4R9) | 0.50(5) | | | | | | | |
| 5.0pF(5R0) | 0.50(5) | 0.50(5) | 0.50(5) | 0.50(5) | | | 0.50(5) | 0.50(5) |
| 5.1pF(5R1) | 0.50(5) | | | | | | | |
| 5.2pF(5R2) | 0.50(5) | | | | | | | |
| 5.3pF(5R3) | 0.50(5) | | | | | | | |
| 5.4pF(5R4) | 0.50(5) | | | | | | | |
| 5.5pF(5R5) | 0.50(5) | | | | | | | |
| 5.6pF(5R6) | 0.50(5) | | | | | | | |
| 5.7pF(5R7) | 0.50(5) | | | | | | | |
| 5.8pF(5R8) | 0.50(5) | | | | | | | |
| 5.9pF(5R9) | 0.50(5) | | | | | | | |
| 6.0pF(6R0) | 0.50(5) | 0.50(5) | 0.50(5) | 0.50(5) | | | 0.50(5) | 0.50(5) |
| 6.1pF(6R1) | 0.50(5) | | | | | | | |
| 6.2pF(6R2) | 0.50(5) | | | | | | | |
| 6.3pF(6R3) | 0.50(5) | | | | | | | |
| 6.4pF(6R4) | 0.50(5) | | | | | | | |
| 6.5pF(6R5) | 0.50(5) | | | | | | | |
| 6.6pF(6R6) | 0.50(5) | | | | | | | |
| 6.7pF(6R7) | 0.50(5) | | | | | | | |
| 6.8pF(6R8) | 0.50(5) | | | | | | | |
| 6.9pF(6R9) | 0.50(5) | | | | | | | |
| 7.0pF(7R0) | 0.50(5) | 0.50(5) | 0.50(5) | 0.50(5) | | | 0.50(5) | 0.50(5) |
| 7.1pF(7R1) | 0.50(5) | | | | | | | |
| 7.2pF(7R2) | 0.50(5) | | | | | | | |
| 7.3pF(7R3) | 0.50(5) | | | | | | | |
| 7.4pF(7R4) | 0.50(5) | | | | | | | |
| 7.5pF(7R5) | 0.50(5) | | | | | | | |
| 7.6pF(7R6) | 0.50(5) | | | | | | | |
| 7.7pF(7R7) | 0.50(5) | | | | | | | |
| 7.8pF(7R8) | 0.50(5) | | | | | | | |

Continued on the following page. 

Continued from the preceding page.

| Part Number | GRM15 | | | | | | | |
|------------------------------------------------------------------------------------------------------|------------------|-------------|-------------|-------------|------------|------------|-------------|-------------|
| L x W [EIA] | 1.00x0.50 [0402] | | | | | | | |
| TC | COG (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) | | | | | | | | |
| 7.9pF(7R9) | 0.50(5) | | | | | | | |
| 8.0pF(8R0) | 0.50(5) | 0.50(5) | 0.50(5) | 0.50(5) | | | 0.50(5) | 0.50(5) |
| 8.1pF(8R1) | 0.50(5) | | | | | | | |
| 8.2pF(8R2) | 0.50(5) | | | | | | | |
| 8.3pF(8R3) | 0.50(5) | | | | | | | |
| 8.4pF(8R4) | 0.50(5) | | | | | | | |
| 8.5pF(8R5) | 0.50(5) | | | | | | | |
| 8.6pF(8R6) | 0.50(5) | | | | | | | |
| 8.7pF(8R7) | 0.50(5) | | | | | | | |
| 8.8pF(8R8) | 0.50(5) | | | | | | | |
| 8.9pF(8R9) | 0.50(5) | | | | | | | |
| 9.0pF(9R0) | 0.50(5) | 0.50(5) | 0.50(5) | 0.50(5) | | | 0.50(5) | 0.50(5) |
| 9.1pF(9R1) | 0.50(5) | | | | | | | |
| 9.2pF(9R2) | 0.50(5) | | | | | | | |
| 9.3pF(9R3) | 0.50(5) | | | | | | | |
| 9.4pF(9R4) | 0.50(5) | | | | | | | |
| 9.5pF(9R5) | 0.50(5) | | | | | | | |
| 9.6pF(9R6) | 0.50(5) | | | | | | | |
| 9.7pF(9R7) | 0.50(5) | | | | | | | |
| 9.8pF(9R8) | 0.50(5) | | | | | | | |
| 9.9pF(9R9) | 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) |
| 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 (1.60x0.80mm) 200/100/50/25V

| 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) | 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) |
| 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) | 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) | | 0.80(8) |
| 820pF(821) | | 0.80(8) | 0.80(8) | | | | | | | | |
| 1000pF(102) | | 0.80(8) | 0.80(8) | | | | | | 0.80(8) | | 0.80(8) |
| 1200pF(122) | | | 0.80(8) | | | | | | 0.80(8) | | 0.80(8) |
| 1500pF(152) | | | 0.80(8) | | | | | | 0.80(8) | | 0.80(8) |
| 1800pF(182) | | | 0.80(8) | | | | | | 0.80(8) | | 0.80(8) |
| 2200pF(222) | | | 0.80(8) | | | | | | 0.80(8) | | 0.80(8) |
| 2700pF(272) | | | 0.80(8) | | | | | | 0.80(8) | | 0.80(8) |
| 3300pF(332) | | | | | | | | | 0.80(8) | | 0.80(8) |
| 3900pF(392) | | | | | | | | | 0.80(8) | | 0.80(8) |
| 4700pF(472) | | | | | | | | | 0.80(8) | | 0.80(8) |
| 5600pF(562) | | | | | | | | | 0.80(8) | | 0.80(8) |
| 6800pF(682) | | | | | | | | | 0.80(8) | | 0.80(8) |
| 8200pF(822) | | | | | | | | | 0.80(8) | | 0.80(8) |
| 10000pF(103) | | | | | | | | | 0.80(8) | | 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 (2.00x1.25mm) 200/100/50/25V

| Part Number | GRM21 | | | | | | | | | | |
|------------------------------------------------------------------------------------------------------|------------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|
| L x W [EIA] | 2.00x1.25 [0805] | | | | | | | | | | |
| 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) | 50 (1H) | 50 (1H) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | |
| 12pF(120) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 15pF(150) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 18pF(180) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 22pF(220) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 27pF(270) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 33pF(330) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 39pF(390) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 47pF(470) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 56pF(560) | 0.85(9) | 0.85(9) | | | | | | | | | |
| 68pF(680) | 1.25(B) | | | | | | | | | | |
| 82pF(820) | 1.25(B) | | | | | | | | | | |
| 100pF(101) | 1.25(B) | | | | | | | | | | |
| 120pF(121) | 1.25(B) | | | | | | 0.85(9) | | | | |
| 150pF(151) | 1.25(B) | | | | | | 1.25(B) | | | | |
| 180pF(181) | 1.25(B) | | | 0.85(9) | | | 1.25(B) | | | | |
| 220pF(221) | 1.25(B) | | | 0.85(9) | 0.85(9) | | 1.25(B) | | | | |
| 270pF(271) | | | | 0.85(9) | 0.85(9) | 0.85(9) | 1.25(B) | | | | |
| 330pF(331) | | | | 0.85(9) | 0.85(9) | 0.85(9) | 1.25(B) | | | | |
| 390pF(391) | | | | 1.25(B) | 0.85(9) | 0.85(9) | 1.25(B) | | | | |
| 470pF(471) | | | | 1.25(B) | 0.85(9) | 0.85(9) | 1.25(B) | 0.85(9) | | | |
| 560pF(561) | | | | 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) | | 0.85(9) | 0.60(6) | | | | | 1.25(B) | 0.60(6) | 1.25(B) | 0.60(6) |
| 1500pF(152) | | 0.85(9) | 0.60(6) | | | | | 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) |
| 3300pF(332) | | | 0.60(6) | | | | | | 1.25(B) | | 1.25(B) |
| 3900pF(392) | | | 0.60(6) | | | | | | | | |
| 4700pF(472) | | | 0.60(6) | | | | | | | | |
| 5600pF(562) | | | 0.85(9) | | | | | | | | |
| 6800pF(682) | | | 0.85(9) | | | | | | | | |
| 8200pF(822) | | | 0.85(9) | | | | | | | | |
| 10000pF(103) | | | 0.85(9) | | | | | | 0.60(6) | | 0.60(6) |
| 12000pF(123) | | | 0.85(9) | | | | | | 0.60(6) | | 0.60(6) |
| 15000pF(153) | | | 0.85(9) | | | | | | 0.60(6) | | 0.60(6) |
| 18000pF(183) | | | 1.25(B) | | | | | | 0.60(6) | | 0.60(6) |
| 22000pF(223) | | | 1.25(B) | | | | | | 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 (3.20x1.60mm) 500/200/100/50/25V

| 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) | 100 (2A) | 50 (1H) | 25 (1E) | 25 (1E) | 50 (1H) | 50 (1H) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 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) | | | | | | | | | | | | | |
| 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) | | | | | | | | | 0.85(9) | | | |
| 560pF(561) | | | | | | | | | 1.15(M) | 0.85(9) | | | | |
| 680pF(681) | | | | | | | 0.85(9) | | | 1.15(M) | 0.85(9) | | | |
| 820pF(821) | | | 0.85(9) | | | | 0.85(9) | 0.85(9) | | 1.15(M) | 0.85(9) | | | |
| 1000pF(102) | | | 0.85(9) | | | | | 1.15(M) | 1.15(M) | 0.85(9) | 1.15(M) | 0.85(9) | | |
| 1200pF(122) | | | 0.85(9) | | | | | 1.15(M) | 1.15(M) | 1.15(M) | 1.15(M) | 0.85(9) | | |
| 1500pF(152) | | | 0.85(9) | | | | | 1.15(M) | 1.15(M) | 1.15(M) | | 0.85(9) | | |
| 1800pF(182) | | | 0.85(9) | | | | | | | 1.15(M) | | 0.85(9) | | |
| 2200pF(222) | | | 0.85(9) | | | | | | | | 1.15(M) | | 1.15(M) | |
| 2700pF(272) | | | 0.85(9) | | | | | | | | 1.15(M) | | 1.15(M) | |
| 3300pF(332) | | | 0.85(9) | 0.85(9) | | | | | | | 1.15(M) | | 1.15(M) | |
| 3900pF(392) | | | 0.85(9) | 0.85(9) | | | | | | | 1.15(M) | 0.85(9) | 1.15(M) | 0.85(9) |
| 4700pF(472) | | | 0.85(9) | 0.85(9) | | | | | | | 1.15(M) | 0.85(9) | | 0.85(9) |
| 5600pF(562) | | | 0.85(9) | 0.85(9) | | | | | | | | 0.85(9) | | 0.85(9) |
| 6800pF(682) | | | | 0.85(9) | 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) | | 1.15(M) |
| 10000pF(103) | | | | 0.85(9) | 0.85(9) | | | | | | | | | |
| 12000pF(123) | | | | 0.85(9) | | | | | | | | | | |
| 15000pF(153) | | | | 0.85(9) | | | | | | | | | | |
| 18000pF(183) | | | | 0.85(9) | | | | | | | | | | |
| 22000pF(223) | | | | 0.85(9) | | | | | | | | | | |
| 27000pF(273) | | | | 0.85(9) | | | | | | | | | | |
| 33000pF(333) | | | | 0.85(9) | | | | | | | | | | |
| 39000pF(393) | | | | 1.15(M) | | | | | | | | | | |
| 47000pF(473) | | | | 1.15(M) | | | | | | | | | | |

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| Part Number | GRM31 | | | | | | | | | | | | | |
|------------------------------------------------------------------------------------------------------|------------------|----------|----------|---------|---------|----------|----------|----------|----------|----------|----------|---------|----------|----------|
| L x W [EIA] | 3.20x1.60 [1206] | | | | | | | | | | | | | |
| TC | COG (5C) | | | | | COH (6C) | P2H (6P) | R2H (6R) | S2H (6S) | SL (1X) | | | T2H (6T) | U2J (7U) |
| Rated Volt. | 500 (2H) | 200 (2D) | 100 (2A) | 50 (1H) | 25 (1E) | 25 (1E) | 50 (1H) | 50 (1H) | 50 (1H) | 200 (2D) | 100 (2A) | 50 (1H) | 50 (1H) | 50 (1H) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | |
| 56000pF(563) | | | | 1.60(C) | | | | | | | | | 0.85(9) | 0.85(9) |
| 68000pF(683) | | | | 1.60(C) | | | | | | | | | 1.15(M) | 1.15(M) |
| 82000pF(823) | | | | 1.60(C) | | | | | | | | | 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) | 25 (1E) | 10 (1A) | 6.3 (0J) | 10 (1A) | 6.3 (0J) | 16 (1C) | 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) | | | | | | | | |
| 0.22μF(224) | | | 0.80(8) | | | | | | | |
| 0.33μF(334) | | | | 0.80(8) | | | 0.60(6) | | | |
| 0.47μF(474) | | | | 0.80(8) | | | | | | |
| 0.68μF(684) | | | | 0.80(8) | | | | | | |
| 1.0μF(105) | | | | 0.80(8) | 0.80(8) | 0.85(9) | | | 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) | 10 (1A) | 6.3 (0J) | 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) | 0.80 (8) | | | | | | | | | | | | | | |
| 330pF (331) | 0.50 (5) | | | | 0.80 (8) | 0.80 (8) | | | | | | | | | | | | | | |
| 470pF (471) | 0.50 (5) | | | | 0.80 (8) | 0.80 (8) | | | | | | | | | | | | | | |
| 680pF (681) | 0.50 (5) | | | | 0.80 (8) | 0.80 (8) | | | | | | | | | | | | | | |

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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) | 10 (1A) | 6.3 (0J) | 100 (2A) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | | | |
| 1000pF (102) | 0.50 (5) | | | | 0.80 (8) | 0.80 (8) | | | | | | | | | | | | | | |
| 1500pF (152) | 0.50 (5) | | | | 0.80 (8) | 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) | 0.50 (5) | | | 0.80 (8) | | | | 1.25 (B) | | | | | | | | | | |
| 22000pF (223) | | 0.50 (5) | 0.50 (5) | | | 0.80 (8) | | | | 1.25 (B) | | | | | | | | | | |
| 33000pF (333) | | 0.50 (5) | 0.50 (5) | 0.50 (5) | | 0.80 (8) | 0.80 (8) | | | 1.25 (B) | 0.85 (9) | | | | | 1.15 (M) | | | | |
| 47000pF (473) | | 0.50 (5) | | 0.50 (5) | | 0.80 (8) | 0.80 (8) | | | 1.25 (B) | 1.25 (B) | | | | | 1.15 (M) | | | | |
| 68000pF (683) | | | 0.50 (5) | | | 0.80 (8) | 0.80 (8) | | | | 1.25 (B) | | | | | 1.15 (M) | | | | |
| 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) | 0.80 (8) | | 1.25 (B) | 1.25 (B) | | | | | | | | |
| 0.22μF (224) | | | | | | | 0.80 (8) | 0.80 (8) | 0.80 (8) | | 1.25 (B) | 0.85 (9) | | | | | | | | |
| 0.33μF (334) | | | | | | | | 0.80 (8) | | | 0.85 (9) | 1.25 (B) | | 0.60 (6) | | | 0.85 (9) | | | |
| 0.47μF (474) | | | | | | | | | 0.80 (8) | | 1.25 (B) | 0.85 (9) | 0.85 (9) | | | | 1.15 (M) | | 0.85 (9) | |
| 0.68μF (684) | | | | | | | | | | | | | 0.85 (9) | | | | | 0.85 (9) | | |
| 1.0μF (105) | | | | | | | | | | | | 1.25 (B) | 1.25 (B) | | | | 1.15 (M) | 1.15 (M) | 0.85 (9) | 0.85 (9) |
| 1.5μF (155) | | | | | | | | | | | | 1.25 (B) | | | | | 1.60 (C) | | 1.15 (M) | |
| 2.2μF (225) | | | | | | | | | | | | | | 1.25 (B) | 1.25 (B) | | 1.60 (C) | 1.15 (M) | 1.15 (M) | 1.15 (M) |
| 3.3μF (335) | | | | | | | | | | | | | | | | | | 1.60 (C) | 1.60 (C) | |
| 4.7μF (475) | | | | | | | | | | | | | | | | | | 1.60 (C) | 1.60 (C) | 1.60 (C) |
| 10μF (106) | | | | | | | | | | | | | | | | | | | | 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) | 10 (1A) | 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) | 0.50 (5) | | 0.80 (8) | | | | | | | | | | | | | |
| 0.10μF (104) | | 0.50 (5) | 0.50 (5) | | 0.80 (8) | 0.80 (8) | | | 0.85 (9) | | | | | | | | | |
| 0.22μF (224) | | | 0.50 (5) | | 0.80 (8) | | 0.80 (8) | | 1.25 (B) | 0.85 (9) | | | | | | | | |
| 0.47μF (474) | | | 0.50 (5) | 0.50 (5) | | 0.80 (8) | 0.80 (8) | 0.80 (8) | 0.85 (9) | 1.25 (B) | | | | 1.15 (M) | | | | |
| 1.0μF (105) | | | | | | | 0.80 (8) | 0.80 (8) | 0.85 (9) | 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) | 1.60 (C) | 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.

Chip Monolithic Ceramic Capacitors



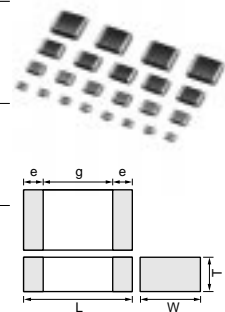
for Reflow Soldering GRM32/43/55 Series

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.

| 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 |
| GRM43R | | | 1.35 ±0.15 | | |
| GRM43D | | | 2.0 ±0.2 | | |
| GRM43E | | | 2.5 ±0.2 | | |
| GRM55M | | | 5.7 ±0.4 | | |
| 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 | | | | |



■ 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 |
| 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 |

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| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|-------------------|--------------------|---------------------|------------------|---------------|--------------|------------------|
| 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) |
|-------------------|--------------------|---------------------|-----------------|---------------|--------------|------------------|
| GRM32ER61A106KA01 | 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 |
| GRM32CR72A684KA01 | X7R (EIA) | 100 | 0.68μF ±10% | 3.20 | 2.50 | 1.60 |
| GRM32CR72A105KA35 | X7R (EIA) | 100 | 1.0μF ±10% | 3.20 | 2.50 | 1.60 |
| GRM32ER72A105KA01 | X7R (EIA) | 100 | 1.0μF ±10% | 3.20 | 2.50 | 2.50 |
| GRM32DR72A155KA35 | X7R (EIA) | 100 | 1.5μF ±10% | 3.20 | 2.50 | 2.00 |
| GRM32ER72A225KA35 | X7R (EIA) | 100 | 2.2μF ±10% | 3.20 | 2.50 | 2.50 |
| GRM32NR71H684KA01 | X7R (EIA) | 50 | 0.68μF ±10% | 3.20 | 2.50 | 1.35 |
| GRM32DR71H335KA88 | X7R (EIA) | 50 | 3.3μF ±10% | 3.20 | 2.50 | 2.00 |
| GRM32ER71H475KA88 | X7R (EIA) | 50 | 4.7μF ±10% | 3.20 | 2.50 | 2.50 |
| GRM32NR71E155KA01 | X7R (EIA) | 25 | 1.5μF ±10% | 3.20 | 2.50 | 1.35 |
| GRM32RR71E225KA01 | X7R (EIA) | 25 | 2.2μF ±10% | 3.20 | 2.50 | 1.80 |
| GRM32DR71E335KA01 | X7R (EIA) | 25 | 3.3μF ±10% | 3.20 | 2.50 | 2.00 |
| GRM32DR71E475KA61 | X7R (EIA) | 25 | 4.7μF ±10% | 3.20 | 2.50 | 2.00 |
| GRM32MR71C225KA01 | X7R (EIA) | 16 | 2.2μF ±10% | 3.20 | 2.50 | 1.15 |
| GRM32NR71C335KA01 | X7R (EIA) | 16 | 3.3μF ±10% | 3.20 | 2.50 | 1.35 |
| GRM32RR71C475KA01 | X7R (EIA) | 16 | 4.7μF ±10% | 3.20 | 2.50 | 1.80 |
| GRM32DR71C106KA01 | X7R (EIA) | 16 | 10μF ±10% | 3.20 | 2.50 | 2.00 |
| 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 | 1.80 |
| 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 |
| GRM43DR72A155KA01 | X7R (EIA) | 100 | 1.5 ±10% | 4.50 | 3.20 | 2.00 |
| GRM43ER72A225KA01 | X7R (EIA) | 100 | 2.2 ±10% | 4.50 | 3.20 | 2.50 |
| GRM43DR71H155KA01 | X7R (EIA) | 50 | 1.5 ±10% | 4.50 | 3.20 | 2.00 |
| GRM43ER71H225KA01 | X7R (EIA) | 50 | 2.2 ±10% | 4.50 | 3.20 | 2.50 |
| GRM43ER71E475KA01 | X7R (EIA) | 25 | 4.7 ±10% | 4.50 | 3.20 | 2.50 |
| GRM43RF52A224ZD01 | Y5V (EIA) | 100 | 0.22 +80/-20% | 4.50 | 3.20 | 1.80 |

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

2

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (μF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|--------------------------|--------------------|---------------------|------------------|---------------|--------------|------------------|
| GRM55DR61H106KA88 | X5R (EIA) | 50 | 10 ±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 |
| GRM55ER11H475KA01 | X7R (EIA) | 50 | 4.7 ±10% | 5.70 | 5.00 | 2.50 |
| 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 |

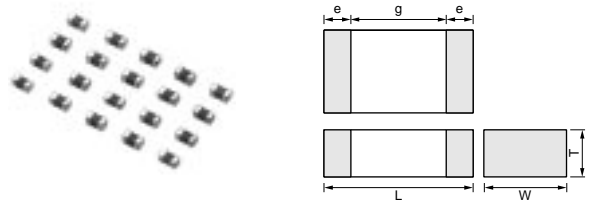
Chip Monolithic Ceramic Capacitors



Ultra-small GRM02/03 Series

■ Features

1. Small chip size (LxWxT: 0.4x0.2x0.2, 0.6x0.3x0.3 mm)
2. Terminations are made of metal highly resistant to migration.
3. GRM02, GRM03 series is suited to only reflow soldering.
4. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
5. GRM02, 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. |
| GRM022 | 0.4 ±0.02 | 0.2 ±0.02 | 0.2 ±0.02 | 0.07 to 0.14 | 0.13 |
| 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 | GRM02 | | GRM03 | | | | | | | | | | |
|------------------------------------------------------------------------------------------------------|----------|-----------------|----------------|----------|----------|----------|----------|----------|---------|---------|---------|----------|---------|
| | L x W | 0.4x0.2 [01005] | 0.6x0.3 [0201] | | | | | | | | | | |
| TC | C0G (5C) | C0G (5C) | R2H (6R) | S2H (6S) | T2H (6T) | U2J (7U) | X5R (R6) | X7R (R7) | | | | Y5V (F5) | |
| Rated Volt. | 16 (1C) | 25 (1E) | 25 (1E) | 25 (1E) | 25 (1E) | 50 (1H) | 25 (1E) | 10 (1A) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 10 (1A) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | |
| 0.30pF (R30) | | 0.3(3) | | | | | | | | | | | |
| 0.40pF (R40) | | 0.3(3) | | | | | | | | | | | |
| 0.50pF (R50) | | 0.3(3) | | | | | | | | | | | |
| 0.60pF (R60) | | 0.3(3) | | | | | | | | | | | |
| 0.70pF (R70) | | 0.3(3) | | | | | | | | | | | |
| 0.75pF (R75) | | 0.3(3) | | | | | | | | | | | |
| 0.80pF (R80) | | 0.3(3) | | | | | | | | | | | |
| 0.90pF (R90) | | 0.3(3) | | | | | | | | | | | |
| 1.0pF (1R0) | 0.2(2) | 0.3(3) | | | | | | | | | | | |
| 1.1pF (1R1) | | 0.3(3) | | | | | | | | | | | |
| 1.2pF (1R2) | | 0.3(3) | | | | | | | | | | | |
| 1.3pF (1R3) | | 0.3(3) | | | | | | | | | | | |
| 1.4pF (1R4) | | 0.3(3) | | | | | | | | | | | |
| 1.5pF (1R5) | | 0.3(3) | | | | | | | | | | | |
| 1.6pF (1R6) | | 0.3(3) | | | | | | | | | | | |
| 1.7pF (1R7) | | 0.3(3) | | | | | | | | | | | |
| 1.8pF (1R8) | | 0.3(3) | | | | | | | | | | | |
| 1.9pF (1R9) | | 0.3(3) | | | | | | | | | | | |
| 2.0pF (2R0) | 0.2(2) | 0.3(3) | | | | | | | | | | | |
| 2.1pF (2R1) | | 0.3(3) | | | | | | | | | | | |
| 2.2pF (2R2) | | 0.3(3) | | | | | | | | | | | |
| 2.3pF (2R3) | | 0.3(3) | | | | | | | | | | | |
| 2.4pF (2R4) | | 0.3(3) | | | | | | | | | | | |
| 2.5pF (2R5) | | 0.3(3) | | | | | | | | | | | |
| 2.6pF (2R6) | | 0.3(3) | | | | | | | | | | | |
| 2.7pF (2R7) | | 0.3(3) | | | | | | | | | | | |

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| Part Number | GRM02 | | GRM03 | | | | | | | | | | |
|------------------------------------------------------------------------------------------------------|-----------------|----------|----------------|----------|----------|----------|---------|----------|----------|---------|---------|----------|----------|
| L x W | 0.4x0.2 [01005] | | 0.6x0.3 [0201] | | | | | | | | | | |
| TC | C0G (5C) | C0G (5C) | R2H (6R) | S2H (6S) | T2H (6T) | U2J (7U) | | X5R (R6) | X7R (R7) | | | | Y5V (F5) |
| Rated Volt. | 16 (1C) | 25 (1E) | 25 (1E) | 25 (1E) | 25 (1E) | 50 (1H) | 25 (1E) | 10 (1A) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 10 (1A) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | |
| 2.8pF(2R8) | | 0.3(3) | | | | | | | | | | | |
| 2.9pF(2R9) | | 0.3(3) | | | | | | | | | | | |
| 3.0pF(3R0) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 3.1pF(3R1) | | 0.3(3) | | | | | | | | | | | |
| 3.2pF(3R2) | | 0.3(3) | | | | | | | | | | | |
| 3.3pF(3R3) | | 0.3(3) | | | | | | | | | | | |
| 3.4pF(3R4) | | 0.3(3) | | | | | | | | | | | |
| 3.5pF(3R5) | | 0.3(3) | | | | | | | | | | | |
| 3.6pF(3R6) | | 0.3(3) | | | | | | | | | | | |
| 3.7pF(3R7) | | 0.3(3) | | | | | | | | | | | |
| 3.8pF(3R8) | | 0.3(3) | | | | | | | | | | | |
| 3.9pF(3R9) | | 0.3(3) | | | | | | | | | | | |
| 4.0pF(4R0) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 4.1pF(4R1) | | 0.3(3) | | | | | | | | | | | |
| 4.2pF(4R2) | | 0.3(3) | | | | | | | | | | | |
| 4.3pF(4R3) | | 0.3(3) | | | | | | | | | | | |
| 4.4pF(4R4) | | 0.3(3) | | | | | | | | | | | |
| 4.5pF(4R5) | | 0.3(3) | | | | | | | | | | | |
| 4.6pF(4R6) | | 0.3(3) | | | | | | | | | | | |
| 4.7pF(4R7) | | 0.3(3) | | | | | | | | | | | |
| 4.8pF(4R8) | | 0.3(3) | | | | | | | | | | | |
| 4.9pF(4R9) | | 0.3(3) | | | | | | | | | | | |
| 5.0pF(5R0) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 5.1pF(5R1) | | 0.3(3) | | | | | | | | | | | |
| 5.2pF(5R2) | | 0.3(3) | | | | | | | | | | | |
| 5.3pF(5R3) | | 0.3(3) | | | | | | | | | | | |
| 5.4pF(5R4) | | 0.3(3) | | | | | | | | | | | |
| 5.5pF(5R5) | | 0.3(3) | | | | | | | | | | | |
| 5.6pF(5R6) | | 0.3(3) | | | | | | | | | | | |
| 5.7pF(5R7) | | 0.3(3) | | | | | | | | | | | |
| 5.8pF(5R8) | | 0.3(3) | | | | | | | | | | | |
| 5.9pF(5R9) | | 0.3(3) | | | | | | | | | | | |
| 6.0pF(6R0) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 6.1pF(6R1) | | 0.3(3) | | | | | | | | | | | |
| 6.2pF(6R2) | | 0.3(3) | | | | | | | | | | | |
| 6.3pF(6R3) | | 0.3(3) | | | | | | | | | | | |
| 6.4pF(6R4) | | 0.3(3) | | | | | | | | | | | |
| 6.5pF(6R5) | | 0.3(3) | | | | | | | | | | | |
| 6.6pF(6R6) | | 0.3(3) | | | | | | | | | | | |
| 6.7pF(6R7) | | 0.3(3) | | | | | | | | | | | |
| 6.8pF(6R8) | | 0.3(3) | | | | | | | | | | | |
| 6.9pF(6R9) | | 0.3(3) | | | | | | | | | | | |
| 7.0pF(7R0) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 7.1pF(7R1) | | 0.3(3) | | | | | | | | | | | |
| 7.2pF(7R2) | | 0.3(3) | | | | | | | | | | | |
| 7.3pF(7R3) | | 0.3(3) | | | | | | | | | | | |
| 7.4pF(7R4) | | 0.3(3) | | | | | | | | | | | |
| 7.5pF(7R5) | | 0.3(3) | | | | | | | | | | | |
| 7.6pF(7R6) | | 0.3(3) | | | | | | | | | | | |
| 7.7pF(7R7) | | 0.3(3) | | | | | | | | | | | |
| 7.8pF(7R8) | | 0.3(3) | | | | | | | | | | | |
| 7.9pF(7R9) | | 0.3(3) | | | | | | | | | | | |

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| Part Number | GRM02 | | GRM03 | | | | | | | | | | |
|------------------------------------------------------------------------------------------------------|-----------------|----------|----------------|----------|----------|----------|---------|----------|----------|---------|---------|----------|----------|
| L x W | 0.4x0.2 [01005] | | 0.6x0.3 [0201] | | | | | | | | | | |
| TC | C0G (5C) | C0G (5C) | R2H (6R) | S2H (6S) | T2H (6T) | U2J (7U) | | X5R (R6) | X7R (R7) | | | | Y5V (F5) |
| Rated Volt. | 16 (1C) | 25 (1E) | 25 (1E) | 25 (1E) | 25 (1E) | 50 (1H) | 25 (1E) | 10 (1A) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 10 (1A) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | |
| 8.0pF(8R0) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 8.1pF(8R1) | | 0.3(3) | | | | | | | | | | | |
| 8.2pF(8R2) | | 0.3(3) | | | | | | | | | | | |
| 8.3pF(8R3) | | 0.3(3) | | | | | | | | | | | |
| 8.4pF(8R4) | | 0.3(3) | | | | | | | | | | | |
| 8.5pF(8R5) | | 0.3(3) | | | | | | | | | | | |
| 8.6pF(8R6) | | 0.3(3) | | | | | | | | | | | |
| 8.7pF(8R7) | | 0.3(3) | | | | | | | | | | | |
| 8.8pF(8R8) | | 0.3(3) | | | | | | | | | | | |
| 8.9pF(8R9) | | 0.3(3) | | | | | | | | | | | |
| 9.0pF(9R0) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 9.1pF(9R1) | | 0.3(3) | | | | | | | | | | | |
| 9.2pF(9R2) | | 0.3(3) | | | | | | | | | | | |
| 9.3pF(9R3) | | 0.3(3) | | | | | | | | | | | |
| 9.4pF(9R4) | | 0.3(3) | | | | | | | | | | | |
| 9.5pF(9R5) | | 0.3(3) | | | | | | | | | | | |
| 9.6pF(9R6) | | 0.3(3) | | | | | | | | | | | |
| 9.7pF(9R7) | | 0.3(3) | | | | | | | | | | | |
| 9.8pF(9R8) | | 0.3(3) | | | | | | | | | | | |
| 9.9pF(9R9) | | 0.3(3) | | | | | | | | | | | |
| 10pF(100) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 12pF(120) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 15pF(150) | 0.2(2) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | | | | | | |
| 18pF(180) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 22pF(220) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 27pF(270) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 33pF(330) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 39pF(390) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 47pF(470) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 56pF(560) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 68pF(680) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 82pF(820) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | | | | | |
| 100pF(101) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) | | 0.3(3) | | 0.3(3) | 0.3(3) | | | |
| 150pF(151) | | | | | | | | | 0.3(3) | 0.3(3) | | | |
| 220pF(221) | | | | | | | | | 0.3(3) | 0.3(3) | | | |
| 330pF(331) | | | | | | | | | 0.3(3) | 0.3(3) | | | |
| 470pF(471) | | | | | | | | | 0.3(3) | 0.3(3) | | | |
| 680pF(681) | | | | | | | | | 0.3(3) | 0.3(3) | | | |
| 1000pF(102) | | | | | | | | | 0.3(3) | 0.3(3) | | | |
| 1500pF(152) | | | | | | | | 0.3(3) | 0.3(3) | | | 0.3(3) | |
| 2200pF(222) | | | | | | | | 0.3(3) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) |
| 3300pF(332) | | | | | | | | 0.3(3) | | 0.3(3) | 0.3(3) | 0.3(3) | |
| 4700pF(472) | | | | | | | | 0.3(3) | | 0.3(3) | 0.3(3) | 0.3(3) | 0.3(3) |
| 6800pF(682) | | | | | | | | 0.3(3) | | 0.3(3) | 0.3(3) | | |
| 10000pF(103) | | | | | | | | 0.3(3) | | 0.3(3) | 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

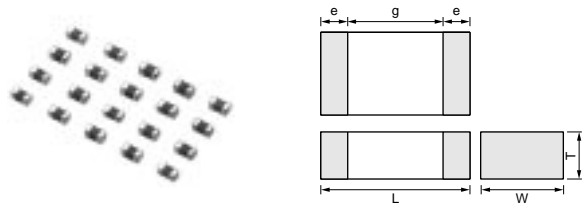


Tight Tolerance GRM03/15 Series

4

■ Features

1. Terminations are made of metal highly resistant to migration.
2. A wide selection of sizes is available, from the miniature LxWxT: 0.6x0.3x0.3mm or LxWxT: 1.0x0.5x0.5mm.
3. The GRM03 type is a complete line of chip ceramic capacitors in 25V ratings, The GRM15 type is a complete line of chip ceramic capacitors in 50V ratings.
4. These capacitors have temperature characteristics ranging COG.
5. GRM03 and GRM15 type are applied to only reflow soldering.
6. Stringent dimensional tolerances allow highly reliable, high speed automatic chip placement on PCBs.
7. The GRM series is available in paper tape and reel packaging for automatic placement.



| 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 |
| GRM155 | 1.0±0.05 | 0.5±0.05 | 0.5±0.05 | 0.15 to 0.3 | 0.4 |

■ Applications

General electronic equipment


Temperature Compensating Type GRM03/15 Series

| Part Number | GRM03 | | GRM15 | |
|----------------------------------------------------|------------------|---------|------------------|--|
| L x W [EIA] | 0.60x0.30 [0201] | | 1.00x0.50 [0402] | |
| TC | COG (5C) | | COG (5C) | |
| Rated Volt. | 25 (1E) | | 50 (1H) | |
| Capacitance, Capacitance Tolerance and T Dimension | | | | |
| 0.10pF(R10) | M, N | 0.30(3) | 0.50(5) | |
| 0.20pF(R20) | K, M | 0.30(3) | 0.50(5) | |
| 0.30pF(R30) | K, M | 0.30(3) | 0.50(5) | |
| 0.40pF(R40) | K, M | 0.30(3) | 0.50(5) | |
| 0.50pF(R50) | K, M | 0.30(3) | 0.50(5) | |
| 0.60pF(R60) | K, M | 0.30(3) | 0.50(5) | |
| 0.70pF(R70) | K, M | 0.30(3) | 0.50(5) | |
| 0.80pF(R80) | K, M | 0.30(3) | 0.50(5) | |
| 0.90pF(R90) | K, M | 0.30(3) | 0.50(5) | |
| 1.0pF(1R0) | J, K | 0.30(3) | 0.50(5) | |
| 1.1pF(1R1) | J, K | 0.30(3) | 0.50(5) | |
| 1.2pF(1R2) | J, K | 0.30(3) | 0.50(5) | |
| 1.3pF(1R3) | J, K | 0.30(3) | 0.50(5) | |
| 1.4pF(1R4) | J, K | 0.30(3) | 0.50(5) | |
| 1.5pF(1R5) | J, K | 0.30(3) | 0.50(5) | |
| 1.6pF(1R6) | J, K | 0.30(3) | 0.50(5) | |
| 1.7pF(1R7) | J, K | 0.30(3) | 0.50(5) | |
| 1.8pF(1R8) | J, K | 0.30(3) | 0.50(5) | |
| 1.9pF(1R9) | J, K | 0.30(3) | 0.50(5) | |

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


Continued on the following page.



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| Part Number | GRM03 | | GRM15 | |
|----------------------------------------------------|------------------|---------|------------------|--|
| L x W [EIA] | 0.60x0.30 [0201] | | 1.00x0.50 [0402] | |
| TC | COG (5C) | | COG (5C) | |
| Rated Volt. | 25 (1E) | | 50 (1H) | |
| Capacitance, Capacitance Tolerance and T Dimension | | | | |
| 2.0pF(2R0) | G, J | 0.30(3) | 0.50(5) | |
| 2.1pF(2R1) | G, J | 0.30(3) | 0.50(5) | |
| 2.2pF(2R2) | G, J | 0.30(3) | 0.50(5) | |
| 2.3pF(2R3) | G, J | 0.30(3) | 0.50(5) | |
| 2.4pF(2R4) | G, J | 0.30(3) | 0.50(5) | |
| 2.5pF(2R5) | G, J | 0.30(3) | 0.50(5) | |
| 2.6pF(2R6) | G, J | 0.30(3) | 0.50(5) | |
| 2.7pF(2R7) | G, J | 0.30(3) | 0.50(5) | |
| 2.8pF(2R8) | G, J | 0.30(3) | 0.50(5) | |
| 2.9pF(2R9) | G, J | 0.30(3) | 0.50(5) | |
| 3.0pF(3R0) | G, J | 0.30(3) | 0.50(5) | |
| 3.1pF(3R1) | G, J | 0.30(3) | 0.50(5) | |
| 3.2pF(3R2) | G, J | 0.30(3) | 0.50(5) | |
| 3.3pF(3R3) | G, J | 0.30(3) | 0.50(5) | |
| 3.4pF(3R4) | G, J | 0.30(3) | 0.50(5) | |
| 3.5pF(3R5) | G, J | 0.30(3) | 0.50(5) | |
| 3.6pF(3R6) | G, J | 0.30(3) | 0.50(5) | |
| 3.7pF(3R7) | G, J | 0.30(3) | 0.50(5) | |
| 3.8pF(3R8) | G, J | 0.30(3) | 0.50(5) | |
| 3.9pF(3R9) | G, J | 0.30(3) | 0.50(5) | |
| 4.0pF(4R0) | G, J | 0.30(3) | 0.50(5) | |
| 4.1pF(4R1) | G, J | 0.30(3) | 0.50(5) | |
| 4.2pF(4R2) | G, J | 0.30(3) | 0.50(5) | |
| 4.3pF(4R3) | G, J | 0.30(3) | 0.50(5) | |
| 4.4pF(4R4) | G, J | 0.30(3) | 0.50(5) | |
| 4.5pF(4R5) | G, J | 0.30(3) | 0.50(5) | |
| 4.6pF(4R6) | G, J | 0.30(3) | 0.50(5) | |
| 4.7pF(4R7) | G, J | 0.30(3) | 0.50(5) | |
| 4.8pF(4R8) | G, J | 0.30(3) | 0.50(5) | |
| 4.9pF(4R9) | G, J | 0.30(3) | 0.50(5) | |
| 5.0pF(5R0) | F, G | 0.30(3) | 0.50(5) | |
| 5.1pF(5R1) | F, G | 0.30(3) | 0.50(5) | |
| 5.2pF(5R2) | F, G | 0.30(3) | 0.50(5) | |
| 5.3pF(5R3) | F, G | 0.30(3) | 0.50(5) | |
| 5.4pF(5R4) | F, G | 0.30(3) | 0.50(5) | |
| 5.5pF(5R5) | F, G | 0.30(3) | 0.50(5) | |
| 5.6pF(5R6) | F, G | 0.30(3) | 0.50(5) | |
| 5.7pF(5R7) | F, G | 0.30(3) | 0.50(5) | |
| 5.8pF(5R8) | F, G | 0.30(3) | 0.50(5) | |
| 5.9pF(5R9) | F, G | 0.30(3) | 0.50(5) | |
| 6.0pF(6R0) | F, G | 0.30(3) | 0.50(5) | |
| 6.1pF(6R1) | F, G | 0.30(3) | 0.50(5) | |
| 6.2pF(6R2) | F, G | 0.30(3) | 0.50(5) | |
| 6.3pF(6R3) | F, G | 0.30(3) | 0.50(5) | |
| 6.4pF(6R4) | F, G | 0.30(3) | 0.50(5) | |
| 6.5pF(6R5) | F, G | 0.30(3) | 0.50(5) | |
| 6.6pF(6R6) | F, G | 0.30(3) | 0.50(5) | |
| 6.7pF(6R7) | F, G | 0.30(3) | 0.50(5) | |
| 6.8pF(6R8) | F, G | 0.30(3) | 0.50(5) | |
| 6.9pF(6R9) | F, G | 0.30(3) | 0.50(5) | |

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

Continued on the following page. 

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| Part Number | | GRM03 | GRM15 |
|----------------------------------------------------|------|------------------|------------------|
| L x W [EIA] | | 0.60x0.30 [0201] | 1.00x0.50 [0402] |
| TC | | COG (5C) | COG (5C) |
| Rated Volt. | | 25 (1E) | 50 (1H) |
| Capacitance, Capacitance Tolerance and T Dimension | | | |
| 7.0pF(7R0) | F, G | 0.30(3) | 0.50(5) |
| 7.1pF(7R1) | F, G | 0.30(3) | 0.50(5) |
| 7.2pF(7R2) | F, G | 0.30(3) | 0.50(5) |
| 7.3pF(7R3) | F, G | 0.30(3) | 0.50(5) |
| 7.4pF(7R4) | F, G | 0.30(3) | 0.50(5) |
| 7.5pF(7R5) | F, G | 0.30(3) | 0.50(5) |
| 7.6pF(7R6) | F, G | 0.30(3) | 0.50(5) |
| 7.7pF(7R7) | F, G | 0.30(3) | 0.50(5) |
| 7.8pF(7R8) | F, G | 0.30(3) | 0.50(5) |
| 7.9pF(7R9) | F, G | 0.30(3) | 0.50(5) |
| 8.0pF(8R0) | F, G | 0.30(3) | 0.50(5) |
| 8.1pF(8R1) | F, G | 0.30(3) | 0.50(5) |
| 8.2pF(8R2) | F, G | 0.30(3) | 0.50(5) |
| 8.3pF(8R3) | F, G | 0.30(3) | 0.50(5) |
| 8.4pF(8R4) | F, G | 0.30(3) | 0.50(5) |
| 8.5pF(8R5) | F, G | 0.30(3) | 0.50(5) |
| 8.6pF(8R6) | F, G | 0.30(3) | 0.50(5) |
| 8.7pF(8R7) | F, G | 0.30(3) | 0.50(5) |
| 8.8pF(8R8) | F, G | 0.30(3) | 0.50(5) |
| 8.9pF(8R9) | F, G | 0.30(3) | 0.50(5) |
| 9.0pF(9R0) | F, G | 0.30(3) | 0.50(5) |
| 9.1pF(9R1) | F, G | 0.30(3) | 0.50(5) |
| 9.2pF(9R2) | F, G | 0.30(3) | 0.50(5) |
| 9.3pF(9R3) | F, G | 0.30(3) | 0.50(5) |
| 9.4pF(9R4) | F, G | 0.30(3) | 0.50(5) |
| 9.5pF(9R5) | F, G | 0.30(3) | 0.50(5) |
| 9.6pF(9R6) | F, G | 0.30(3) | 0.50(5) |
| 9.7pF(9R7) | F, G | 0.30(3) | 0.50(5) |
| 9.8pF(9R8) | F, G | 0.30(3) | 0.50(5) |
| 9.9pF(9R9) | F, G | 0.30(3) | 0.50(5) |

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

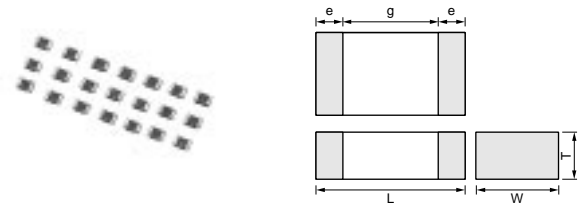
Chip Monolithic Ceramic Capacitors



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) | EIA |
|--------------------------|--------------------|---------------------|------------------|---------------|--------------|------------------|------|
| GRM15X5C1H1R0CDB4 | COG (EIA) | 50 | 1.0 ±0.25pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H2R0CDB4 | COG (EIA) | 50 | 2.0 ±0.25pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H3R0CDB4 | COG (EIA) | 50 | 3.0 ±0.25pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H4R0CDB4 | COG (EIA) | 50 | 4.0 ±0.25pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H5R0CDB4 | COG (EIA) | 50 | 5.0 ±0.25pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H6R0DDB4 | COG (EIA) | 50 | 6.0 ±0.5pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H7R0DDB4 | COG (EIA) | 50 | 7.0 ±0.5pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H8R0DDB4 | COG (EIA) | 50 | 8.0 ±0.5pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H9R0DDB4 | COG (EIA) | 50 | 9.0 ±0.5pF | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H100JDB4 | COG (EIA) | 50 | 10 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H120JDB4 | COG (EIA) | 50 | 12 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H150JDB4 | COG (EIA) | 50 | 15 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H180JDB4 | COG (EIA) | 50 | 18 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H220JDB4 | COG (EIA) | 50 | 22 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H270JDB4 | COG (EIA) | 50 | 27 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H330JDB4 | COG (EIA) | 50 | 33 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H390JDB4 | COG (EIA) | 50 | 39 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H470JDB4 | COG (EIA) | 50 | 47 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H560JDB4 | COG (EIA) | 50 | 56 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H680JDB4 | COG (EIA) | 50 | 68 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H820JDB4 | COG (EIA) | 50 | 82 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1H101JDB4 | COG (EIA) | 50 | 100 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1E121JDB4 | COG (EIA) | 25 | 120 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1E151JDB4 | COG (EIA) | 25 | 150 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1E181JDB4 | COG (EIA) | 25 | 180 ±5% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15X5C1E221JDB4 | COG (EIA) | 25 | 220 ±5% | 1.00 | 0.50 | 0.25 | 0402 |

High Dielectric Constant Type

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | EIA |
|--------------------------|--------------------|---------------------|------------------|---------------|--------------|------------------|------|
| GRM15XR71H221KA86 | X7R (EIA) | 50 | 220 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71H331KA86 | X7R (EIA) | 50 | 330 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71H471KA86 | X7R (EIA) | 50 | 470 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71H681KA86 | X7R (EIA) | 50 | 680 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71H102KA86 | X7R (EIA) | 50 | 1000 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71H152KA86 | X7R (EIA) | 50 | 1500 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71E222KA86 | X7R (EIA) | 25 | 2200 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71C332KA86 | X7R (EIA) | 16 | 3300 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71C472KA86 | X7R (EIA) | 16 | 4700 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR71C682KA86 | X7R (EIA) | 16 | 6800 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR61A223KA86 | X5R (EIA) | 10 | 22000 ±10% | 1.00 | 0.50 | 0.25 | 0402 |
| GRM15XR61A333KA86 | X5R (EIA) | 10 | 33000 ±10% | 1.00 | 0.50 | 0.25 | 0402 |

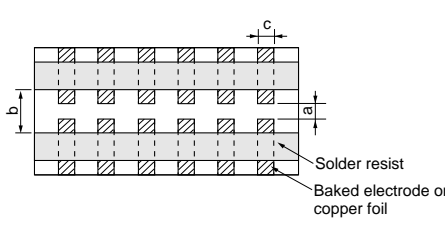
GRM Series Specifications and Test Methods

| No. | Item | Specifications | | Test Method | | | | | | | | | | | | | | | | |
|-----------|------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------|----------------------------------------------------------------|----|------|--|--|--|-----------|----------|----------|----------|---------|--------------|-----------|--------------|
| | | Temperature Compensating Type | High Dielectric Type | | | | | | | | | | | | | | | | | |
| 1 | Operating Temperature Range | -55 to +125°C | B1, B3, F1, R6 : -25 to +85°C R1, R7 : -55 to +125°C E4 : +10 to +85°C F5 : -30 to +85°C | Reference temperature : 25°C (2Δ, 3Δ, 4Δ, B1, B3, F1, R1, R6 : 20°C) | | | | | | | | | | | | | | | | |
| 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 (temperature compensating type) or 250% of the rated voltage (high dielectric constant type) 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 | C ≤ 0.047μF : More than 10,000MΩ C > 0.047μF : 500Ω · F C : Nominal Capacitance | | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20/25°C and 75%RH max. and within 2 minutes of charging, provided the charge/discharge current is less than 50mA. | | | | | | | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | | The capacitance/Q/D.F. should be measured at 20/25°C at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | | |
| 8 | Q/ Dissipation Factor (D.F.) | 30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400 + 20C$ C : Nominal Capacitance (pF) | [B1, B3, R1, R6, R7, E4, C8] W.V. : 25V min. : 0.025 max. W.V. : 16/10V : 0.035 max. W.V. : 6.3/4V : 0.05 max. (C < 3.3μF) : 0.1 max. (C ≥ 3.3μF) [F1, F5] W.V. : 25V min. : 0.05 max. (C < 0.1μF) : 0.09 max. (C ≥ 0.1μF) W.V. : 16/10V : 0.125 max. W.V. : 6.3V : 0.15 max. | <table border="1"> <thead> <tr> <th>Char.</th> <th>ΔC to ΔU, 1X (1000pF and below)</th> <th>ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1</th> <th>E4</th> </tr> </thead> <tbody> <tr> <td>Item</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Frequency</td> <td>1±0.1MHz</td> <td>1±0.1kHz</td> <td>1±0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> <td>1±0.2Vrms</td> <td>0.5±0.05Vrms</td> </tr> </tbody> </table> | Char. | ΔC to ΔU, 1X (1000pF and below) | ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1 | E4 | Item | | | | Frequency | 1±0.1MHz | 1±0.1kHz | 1±0.1kHz | Voltage | 0.5 to 5Vrms | 1±0.2Vrms | 0.5±0.05Vrms |
| Char. | ΔC to ΔU, 1X (1000pF and below) | ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1 | E4 | | | | | | | | | | | | | | | | | |
| Item | | | | | | | | | | | | | | | | | | | | |
| Frequency | 1±0.1MHz | 1±0.1kHz | 1±0.1kHz | | | | | | | | | | | | | | | | | |
| Voltage | 0.5 to 5Vrms | 1±0.2Vrms | 0.5±0.05Vrms | | | | | | | | | | | | | | | | | |

Continued on the following page.

GRM Series Specifications and Test Methods

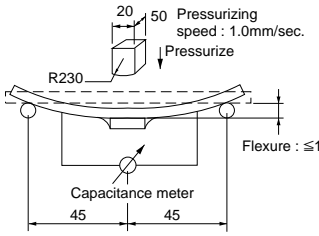
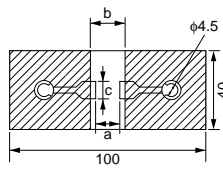
Continued from the preceding page.

| No. | Item | Specifications | | Test Method | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|----------------------|---|-------------------------------|---------|------|----------------------------------------------------------|-------|-------------------------------|-----|---------------------------------------------------------|--------------------------|-----|-------------------------------|-----|---------------------------------------------------|-----|-------------------------------|-----|--------------------------------------------------|-----|-----|------|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|
| | | Temperature Compensating Type | High Dielectric Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | No bias | B1, B3 : Within $\pm 10\%$ (–25 to +85°C) R1, R7 : Within $\pm 15\%$ (–55 to +125°C) R6 : Within $\pm 15\%$ (–55 to +85°C) E4 : Within +22/–56% (+10 to +85°C) F1 : Within +30/–80% (–25 to +85°C) F5 : Within +22/–82% (–30 to +85°C) C8 : Within $\pm 22\%$ (–55 to +105°C) | The capacitance change should be measured after 5 min. at each specified temp. stage. (1) Temperature Compensating Type 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 (5C : +25 to +125°C/ ΔC : +20 to +125°C : other temp. coeffs. : +25 to +85°C/+20 to +85°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 50% of the Rated Voltage | B1 : Within +10/–30% R1 : Within +15/–40% F1 : Within +30/–95% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Drift | Within $\pm 0.2\%$ or $\pm 0.05\text{pF}$ (Whichever is larger.) *Not apply to 1X/25V | *Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/–10°C for one hour and then set for 24 \pm 2 hours at room temperature. Perform the initial measurement. | (2) High Dielectric Constant Type The ranges of capacitance change compared with the 20°C value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Applying Voltage (V)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temperature ± 2</td> <td rowspan="3">No bias</td> </tr> <tr> <td>2</td> <td>–55\pm3 (for ΔC)/–25\pm3 (for other TC)</td> </tr> <tr> <td>3</td> <td>Reference Temperature ± 2</td> </tr> <tr> <td>4</td> <td>125\pm3 (for ΔC)/85\pm3 (for other TC)</td> <td rowspan="5">50% of the rated voltage</td> </tr> <tr> <td>5</td> <td>Reference Temperature ± 2</td> </tr> <tr> <td>6</td> <td>–55\pm3 (for R1)/ –25\pm3 (for B1, F1)</td> </tr> <tr> <td>7</td> <td>Reference Temperature ± 2</td> </tr> <tr> <td>8</td> <td>125\pm3 (for R1)/ 85\pm3 (for B1, F1)</td> </tr> </tbody> </table> | Step | Temperature (°C) | Applying Voltage (V) | 1 | Reference Temperature ± 2 | No bias | 2 | –55 \pm 3 (for ΔC)/–25 \pm 3 (for other TC) | 3 | Reference Temperature ± 2 | 4 | 125 \pm 3 (for ΔC)/85 \pm 3 (for other TC) | 50% of the rated voltage | 5 | Reference Temperature ± 2 | 6 | –55 \pm 3 (for R1)/ –25 \pm 3 (for B1, F1) | 7 | Reference Temperature ± 2 | 8 | 125 \pm 3 (for R1)/ 85 \pm 3 (for B1, F1) | | | | | | | | | | | | | | | | |
| Step | Temperature (°C) | Applying Voltage (V) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Reference Temperature ± 2 | No bias | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | –55 \pm 3 (for ΔC)/–25 \pm 3 (for other TC) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Reference Temperature ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 125 \pm 3 (for ΔC)/85 \pm 3 (for other TC) | 50% of the rated voltage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Reference Temperature ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | –55 \pm 3 (for R1)/ –25 \pm 3 (for B1, F1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Reference Temperature ± 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 125 \pm 3 (for R1)/ 85 \pm 3 (for B1, F1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10 \pm 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. *1N (GRM02), 2N (GR□03), 5N (GR□15, GRM18) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | |  <p>Fig. 1a</p> | | | <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM02</td> <td>0.2</td> <td>0.56</td> <td>0.23</td> </tr> <tr> <td>GR□03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GR□15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> | Type | a | b | c | GRM02 | 0.2 | 0.56 | 0.23 | 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 |
| Type | a | b | c | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GRM02 | 0.2 | 0.56 | 0.23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Appearance | No defects or abnormalities | | Solder the capacitor on 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vibration Resistance | Q/D.F. | 30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20C$ | [B1, B3, R1, R6, R7, E4, C8] W.V. : 25V min. : 0.025 max. W.V. : 16/10V : 0.035 max. W.V. : 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≥3.3μF) [F1, F5] W.V. : 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V. : 16/10V : 0.125 max. W.V. : 6.3V : 0.15 max. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C : Nominal Capacitance (pF) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Deflection | No crack or marked defect should occur. | | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a 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. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | |  <p style="text-align: center;">Fig. 3a</p> | | |  <p style="text-align: center;">Fig. 2a t : 1.6mm (GR□02/03/15 : t : 0.8mm)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM02</td> <td>0.2</td> <td>0.56</td> <td>0.23</td> </tr> <tr> <td>GR□03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GR□15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> <p style="text-align: right;">(in mm)</p> | Type | a | b | c | GRM02 | 0.2 | 0.56 | 0.23 | 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 |
| Type | a | b | c | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GRM02 | 0.2 | 0.56 | 0.23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | The measured and observed characteristics should satisfy the specifications in the following table. | | Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | | | B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4 : Within ±20% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Resistance to Soldering Heat | Q/D.F. | | | 30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20C$ | [B1, B3, R1, R6, R7, E4, C8] W.V. : 25V min. : 0.025 max. W.V. : 16/10V : 0.035 max. W.V. : 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≥3.3μF) [F1, F5] W.V. : 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V. : 16/10V : 0.125 max. W.V. : 6.3V : 0.15 max. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | C : Nominal Capacitance (pF) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement. •Preheating for GRM32/43/55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dielectric Strength | No defects | | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Step | Temperature | Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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 | | | | | | | | | | | | | | | | |
| 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 shown in the following table. Set for 24±2 hours at room temperature, then measure. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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> </tbody> </table> •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement. | Step | 1 | 2 | 3 | 4 | Temp. (°C) | 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 |
| | | Step | 1 | | 2 | 3 | 4 | | | | | | | | | | | | |
| | | Temp. (°C) | 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 | | | | | | | | | | | | |
| | | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | | B1, B3, R1, R6, R7, C8 : Within ±7.5% F1, F5, E4 : Within ±20% | | | | | | | | | | | | | | |
| Q/D.F. | 30pF and over : Q≥1000 30pF and below : Q≥400+20C C : Nominal Capacitance (pF) | [B1, B3, R1, R6, R7, E4, C8] W.V. : 25V min. : 0.025 max. W.V. : 16/10V : 0.035 max. W.V. : 6.3/4V : 0.05 max. (C<3.3μF) : 0.1 max. (C≥3.3μF) [F1, F5] W.V. : 25V min. : 0.05 max. (C<0.1μF) : 0.09 max. (C≥0.1μF) W.V. : 16/10V : 0.125 max. W.V. : 6.3V : 0.15 max. | | | | | | | | | | | | | | | | | |
| I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | | |
| | Dielectric Strength | No defects | | | | | | | | | | | | | | | | | |
| 16 | Humidity (Steady State) | The measured and observed characteristics should satisfy the specifications in the following table. | | Set the capacitor at 40±2°C and in 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure. | | | | | | | | | | | | | | | |
| | | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | | B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5 : Within ±30% | | | | | | | | | | | | | | |
| | | Q/D.F. | 30pF and over : Q≥350 10pF and over : Q≥275+2.5C 30pF and below : Q≥200+10C C : Nominal Capacitance (pF) | | [B1, B3, R1, R6, R7, E4, C8] W.V. : 25V min. : 0.05 max. W.V. : 16/10V : 0.05 max. W.V. : 6.3/4V : 0.075 max. (C<3.3μF) : 0.125 max. (C≥3.3μF) [F1, F5] W.V. : 25V min. : 0.075 max. (C<0.1μF) : 0.125 max. (C≥0.1μF) W.V. : 16/10V : 0.15 max. W.V. : 6.3V : 0.2 max. | | | | | | | | | | | | | | |
| | | I.R. | More than 1,000MΩ or 50Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | |
| | | | Dielectric Strength | | No defects | | | | | | | | | | | | | | |

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 | |
| 17 | | The measured and observed characteristics should satisfy the specifications in the following table. | | Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for F1, F5/10V max. Apply the rated DC voltage for 1 hour at 40±2°C. Remove and set for 24±2 hours at room temperature. Perform initial measurement. |
| | Appearance | No defects or abnormalities | | |
| | Capacitance Change | Within ±7.5% or ±0.75pF (Whichever is larger) | B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5, E4 : Within ±30% [W.V. : 10V max.] F1, F5 : Within +30/-40% | |
| | Q/D.F. | 30pF and over : Q≥200 30pF and below : Q≥100+10C/3 C : Nominal Capacitance (pF) | [B1, B3, R1, R6, R7, E4, C8] W.V. : 25V min. : 0.05 max. W.V. : 16/10V : 0.05 max. W.V. : 6.3V : 0.075 max. (C<3.3μF) : 0.125 max. (C≥3.3μF) [F1, F5] W.V. : 25V min. : 0.075 max. (C<0.1μF) : 0.125 max. (C≥0.1μF) W.V. : 16/10V : 0.15 max. W.V. : 6.3V : 0.2 max. | |
| | I.R. | More than 500MΩ or 25Ω · F (Whichever is smaller) | | |
| 18 | | The measured and observed characteristics should satisfy the specifications in the following table. | | Apply *200% of the rated voltage at the maximum operating temperature ±3°C for 1000±12 hours. Set for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage at the maximum operating temperature ±3°C for one hour. Remove and set for 24±2 hours at room temperature. Perform initial measurement. *150% for 500V |
| | Appearance | No defects or abnormalities | | |
| | Capacitance Change | Within ±3% or ±0.3pF (Whichever is larger) | B1, B3, R1, R6, R7, C8 : Within ±12.5% F1, F5, E4 : Within ±30% [Except 10V max. and. C≥1.0μF] F1, F5 : Within +30/-40% [10V max. and C≥1.0μF] | |
| | Q/D.F. | 30pF and over : Q≥350 10pF and over : Q≥275+2.5C 30pF and below : Q≥200+10C C : Nominal Capacitance (pF) | [B1, B3, R1, R6, R7, E4, C8] W.V. : 25V min. : 0.05 max. W.V. : 16/10V : 0.05 max. W.V. : 6.3V : 0.075 max. (C<3.3μF) : 0.125 max. (C≥3.3μF) [F1, F5] W.V. : 25V min. : 0.075 max. (C<0.1μF) : 0.125 max. (C≥0.1μF) W.V. : 16/10V : 0.15 max. W.V. : 6.3V : 0.2 max. | |
| | I.R. | More than 1,000MΩ or 50Ω · F (Whichever is smaller) | | |

Chip Monolithic Ceramic Capacitors



Large Capacitance Type

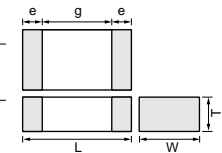
■ Features

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
4. Ta replacement

■ 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 0.35 | 0.3 |
| GRM185 | 1.6 ±0.1 | 0.8 ±0.1 | 0.5 ±0.05 | 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 | 3.2 ±0.15 | 1.6 ±0.15 | 1.25 ±0.1 | 0.3 to 0.8 | 1.5 |
| GRM316 | | | 0.6 ±0.1 | | |
| GRM319 | 3.2 ±0.15 | 1.6 ±0.15 | 0.85 ±0.1 | 0.3 to 0.8 | 1.5 |
| GRM31M | | | 1.15 ±0.1 | | |
| GRM219 | 3.2 ±0.2 | 1.6 ±0.2 | 1.6 ±0.2 | 0.3 | 1.0 |
| GRM31C | 3.2 ±0.3 | 2.5 ±0.2 | 1.6 ±0.2 | | |
| GRM32C | 3.2 ±0.3 | 2.5 ±0.2 | 2.0 ±0.2 | 0.3 | 1.0 |
| GRM32D | | | 2.5 ±0.2 | | |
| GRM32E | 4.5 ±0.4 | 3.2 ±0.3 | 2.0 ±0.2 | 0.3 | 2.0 |
| GRM43D | | | 2.5 ±0.2 | | |
| GRM43E | 5.7 ±0.4 | 5.0 ±0.4 | 2.8 ±0.2 | 0.3 | 2.0 |
| GRM43S | | | 3.2 ±0.2 | | |
| GRM55F | 5.7 ±0.4 | 5.0 ±0.4 | 3.2 ±0.2 | 0.3 | 2.0 |




6

High Dielectric Constant Type X5R (R6) Characteristics

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) |
|-------------------|--------------------|---------------------|-------------|---------------|--------------|------------------|
| GRM188R61E474KA12 | X5R (EIA) | 25 | 0.47μF ±10% | 1.60 | 0.80 | 0.80 |
| GRM188R61E105KA12 | X5R (EIA) | 25 | 1.0μF ±10% | 1.60 | 0.80 | 0.80 |
| GRM21BR61E105KA99 | X5R (EIA) | 25 | 1.0μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM219R61E225KA12 | X5R (EIA) | 25 | 2.2μF ±10% | 2.00 | 1.25 | 0.85 |
| GRM21BR61E225KA12 | X5R (EIA) | 25 | 2.2μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM21BR61E335KA12 | X5R (EIA) | 25 | 3.3μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM21BR61E475KA12 | X5R (EIA) | 25 | 4.7μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM319R61E475KA12 | X5R (EIA) | 25 | 4.7μF ±10% | 3.20 | 1.60 | 0.85 |
| GRM31CR61E106KA12 | X5R (EIA) | 25 | 10μF ±10% | 3.20 | 1.60 | 1.60 |
| GRM32ER61E226KE15 | X5R (EIA) | 25 | 22μF ±10% | 3.20 | 2.50 | 2.50 |
| GRM188R61C474KA93 | X5R (EIA) | 16 | 0.47μF ±10% | 1.60 | 0.80 | 0.80 |
| GRM185R61C105KE44 | X5R (EIA) | 16 | 1.0μF ±10% | 1.60 | 0.80 | 0.50 |
| GRM188R61C105KA93 | X5R (EIA) | 16 | 1.0μF ±10% | 1.60 | 0.80 | 0.80 |
| GRM216R61C105KA88 | X5R (EIA) | 16 | 1.0μF ±10% | 2.00 | 1.25 | 0.60 |
| GRM188R61C225KE15 | X5R (EIA) | 16 | 2.2μF ±10% | 1.60 | 0.80 | 0.80 |
| GRM219R61C225KA88 | X5R (EIA) | 16 | 2.2μF ±10% | 2.00 | 1.25 | 0.85 |
| GRM21BR61C225KA88 | X5R (EIA) | 16 | 2.2μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM316R61C225KA88 | X5R (EIA) | 16 | 2.2μF ±10% | 3.20 | 1.60 | 0.60 |
| GRM21BR61C335KA88 | X5R (EIA) | 16 | 3.3μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM21BR61C475KA88 | X5R (EIA) | 16 | 4.7μF ±10% | 2.00 | 1.25 | 1.25 |
| 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 |
| GRM43ER61C226KE01 | X5R (EIA) | 16 | 22μF ±10% | 4.50 | 3.20 | 2.50 |
| GRM32ER61C476KE15 | X5R (EIA) | 16 | 47μF ±10% | 3.20 | 2.50 | 2.50 |
| GRM155R61A154KE19 | X5R (EIA) | 10 | 0.15μF ±10% | 1.00 | 0.50 | 0.50 |
| GRM155R61A224KE19 | X5R (EIA) | 10 | 0.22μF ±10% | 1.00 | 0.50 | 0.50 |
| GRM185R61A105KE36 | X5R (EIA) | 10 | 1.0μF ±10% | 1.60 | 0.80 | 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 |
| GRM316R61A225KA01 | X5R (EIA) | 10 | 2.2μF ±10% | 3.20 | 1.60 | 0.60 |
| GRM219R61A335KE19 | X5R (EIA) | 10 | 3.3μF ±10% | 2.00 | 1.25 | 0.85 |
| GRM21BR61A335KA73 | X5R (EIA) | 10 | 3.3μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM316R61A335KE19 | X5R (EIA) | 10 | 3.3μF ±10% | 3.20 | 1.60 | 0.60 |
| GRM219R61A475KE34 | X5R (EIA) | 10 | 4.7μF ±10% | 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) |
|-------------------|--------------------|---------------------|--------------|---------------|--------------|------------------|
| GRM21BR61A475KA73 | X5R (EIA) | 10 | 4.7μF ±10% | 2.00 | 1.25 | 1.25 |
| 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 |
| GRM21BR61A106KE19 | X5R (EIA) | 10 | 10μF ±10% | 2.00 | 1.25 | 1.25 |
| GRM21BR61A106ME19 | X5R (EIA) | 10 | 10μF ±20% | 2.00 | 1.25 | 1.25 |
| GRM319R61A106KA19 | X5R (EIA) | 10 | 10μF ±10% | 3.20 | 1.60 | 0.85 |
| GRM31MR61A106KE19 | X5R (EIA) | 10 | 10μF ±10% | 3.20 | 1.60 | 1.15 |
| GRM32NR61A226KE19 | X5R (EIA) | 10 | 22μF ±10% | 3.20 | 2.50 | 1.35 |
| GRM32ER61A476KE20 | X5R (EIA) | 10 | 47μF ±10% | 3.20 | 2.50 | 2.50 |
| GRM43ER61A476KE19 | X5R (EIA) | 10 | 47μF ±10% | 4.50 | 3.20 | 2.50 |
| GRM033R60J153KE01 | X5R (EIA) | 6.3 | 15000pF ±10% | 0.60 | 0.30 | 0.30 |
| GRM033R60J223KE01 | X5R (EIA) | 6.3 | 22000pF ±10% | 0.60 | 0.30 | 0.30 |
| GRM033R60J333KE01 | X5R (EIA) | 6.3 | 33000pF ±10% | 0.60 | 0.30 | 0.30 |
| GRM033R60J393KE19 | X5R (EIA) | 6.3 | 39000pF ±10% | 0.60 | 0.30 | 0.30 |
| GRM033R60J473KE19 | X5R (EIA) | 6.3 | 47000pF ±10% | 0.60 | 0.30 | 0.30 |
| GRM033R60J683KE19 | X5R (EIA) | 6.3 | 68000pF ±10% | 0.60 | 0.30 | 0.30 |
| GRM033R60J104KE19 | X5R (EIA) | 6.3 | 0.10μF ±10% | 0.60 | 0.30 | 0.30 |
| 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 |
| GRM219R60J475KE19 | X5R (EIA) | 6.3 | 4.7μF ±10% | 2.00 | 1.25 | 0.85 |
| GRM219R60J475KE32 | 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 |
| 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 ±20% | 2.00 | 1.25 | 1.25 |
| GRM319R60J106KE01 | X5R (EIA) | 6.3 | 10μF ±10% | 3.20 | 1.60 | 0.85 |
| GRM319R60J106KE19 | X5R (EIA) | 6.3 | 10μF ±10% | 3.20 | 1.60 | 0.85 |
| GRM31MR60J106KE19 | X5R (EIA) | 6.3 | 10μF ±10% | 3.20 | 1.60 | 1.15 |
| GRM31CR60J156KE19 | X5R (EIA) | 6.3 | 15μF ±10% | 3.20 | 1.60 | 1.60 |
| GRM21BR60J226ME39 | X5R (EIA) | 6.3 | 22μF ±20% | 2.00 | 1.25 | 1.25 |
| GRM31CR60J226KE19 | X5R (EIA) | 6.3 | 22μF ±10% | 3.20 | 1.60 | 1.60 |
| 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 |
| GRM43DR60J336KE01 | X5R (EIA) | 6.3 | 33μF ±10% | 4.50 | 3.20 | 2.00 |
| GRM31CR60J476ME19 | X5R (EIA) | 6.3 | 47μF ±20% | 3.20 | 1.60 | 1.60 |
| GRM32ER60J476ME20 | X5R (EIA) | 6.3 | 47μF ±20% | 3.20 | 2.50 | 2.50 |
| GRM43ER60J476KE01 | X5R (EIA) | 6.3 | 47μF ±10% | 4.50 | 3.20 | 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 |
| GRM188R60G106ME47 | X5R (EIA) | 4 | 10μF ±20% | 1.60 | 0.80 | 0.80 |

6

High Dielectric Constant Type X6S/X7R/X7S (C8/R7/C7) Characteristics

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (μF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|-------------------|--------------------|---------------------|------------------|---------------|--------------|------------------|
| GRM188C80G475KE19 | X6S(EIA) | 4 | 4.7 ±10% | 1.60 | 0.80 | 0.80 |
| GRM21BR71E225KA73 | X7R (EIA) | 25 | 2.2 ±10% | 2.00 | 1.25 | 1.25 |
| GRM55ER71E156KA01 | X7R (EIA) | 25 | 15 ±10% | 5.70 | 5.00 | 2.50 |
| GRM31CR71C106KAC7 | X7R (EIA) | 16 | 10 ±10% | 3.20 | 1.60 | 1.60 |
| GRM32ER71A226KE20 | X7R (EIA) | 10 | 22 ±10% | 3.20 | 2.50 | 2.50 |
| GRM32ER71A226ME20 | X7R (EIA) | 10 | 22 ±20% | 3.20 | 2.50 | 2.50 |
| GRM43ER71A226KE01 | X7R (EIA) | 10 | 22 ±10% | 4.50 | 3.20 | 2.50 |
| GRM21BC71A335KA73 | X7S(EIA) | 10 | 3.3 ±10% | 2.00 | 1.25 | 1.25 |
| GRM21BC71A475KA73 | X7S(EIA) | 10 | 4.7 ±10% | 2.00 | 1.25 | 1.25 |

6

High Dielectric Constant Type Y5V (F5) Characteristics

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance (μF) | Length L (mm) | Width W (mm) | Thickness T (mm) |
|-------------------|--------------------|---------------------|------------------|---------------|--------------|------------------|
| GRM188F51A225ZE01 | Y5V (EIA) | 10 | 2.2 +80/-20% | 1.60 | 0.80 | 0.80 |
| GRM188F51A475ZE20 | Y5V (EIA) | 10 | 4.7 +80/-20% | 1.60 | 0.80 | 0.80 |
| GRM31CF51A226ZE01 | Y5V (EIA) | 10 | 22 +80/-20% | 3.20 | 1.60 | 1.60 |
| GRM32CF51A226ZA01 | Y5V (EIA) | 10 | 22 +80/-20% | 3.20 | 2.50 | 1.60 |
| GRM155F50J105ZE01 | Y5V (EIA) | 6.3 | 1.0 +80/-20% | 1.00 | 0.50 | 0.50 |
| GRM188F50J225ZE01 | Y5V (EIA) | 6.3 | 2.2 +80/-20% | 1.60 | 0.80 | 0.80 |
| GRM188F50J475ZE20 | Y5V (EIA) | 6.3 | 4.7 +80/-20% | 1.60 | 0.80 | 0.80 |
| GRM21BF50J106ZE01 | Y5V (EIA) | 6.3 | 10 +80/-20% | 2.00 | 1.25 | 1.25 |
| GRM31CF50J226ZE01 | Y5V (EIA) | 6.3 | 22 +80/-20% | 3.20 | 1.60 | 1.60 |
| GRM32EF50J107ZE20 | Y5V (EIA) | 6.3 | 100 +80/-20% | 3.20 | 2.50 | 2.50 |

Specifications and Test Methods

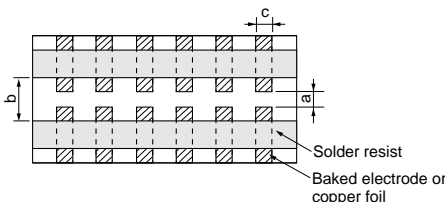
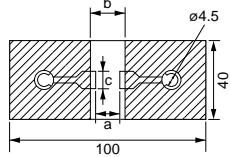
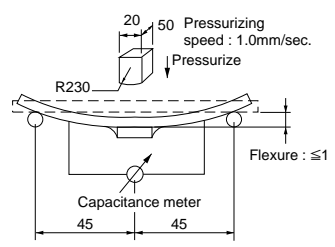
| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | | | | | | |
|--------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|----------------------|---------------------|--------------------------|-------------|--------------------|---------------------------------------------------------------------|-------------|--------------------------|----------|--------------------------------------------------------------------|--------------------------|---|------|---|--------------------|---|------|---|-------------------|
| 1 | Operating Temperature Range | B1, B3, F1 : -25 to +85°C R6 : -55 to +85°C F5 : -30 to +85°C C8 : -55 to +105°C, C7 : -55 to +125°C | Reference temperature : 25°C (B1, B3, F1 : 20°C) | | | | | | | | | | | | | | | | | | | | | |
| 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 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 | More than 50Ω · F | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at reference temperature and 75%RH max. and within 1 minutes of charging, provided the charge/discharge current is less than 50mA. | | | | | | | | | | | | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance *Table 1 <u>GRM155 B3/R6 1A 124 to 224</u> <u>GRM185 B3/R6 1A 105</u> <u>GRM188 B3/R6 1C/1A 225</u> <u>GRM219 B3/R6 1A 475</u> <u>GRM21B B3/R6 1C/1A 106</u> | The capacitance should be measured at reference temperature at the frequency and voltage shown in the table. <table border="1" style="margin-left: auto; margin-right: auto;"><thead><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr></thead><tbody><tr><td>C≤10μF (10V min.)*1</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>C≤10μF (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr><tr><td>C>10μF</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr></tbody></table> *1 However the voltage is 0.5±0.1Vrms about Table 1 items on the left side. | Capacitance | Frequency | Voltage | C≤10μF (10V min.)*1 | 1±0.1kHz | 1.0±0.2Vrms | C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | C>10μF | 120±24Hz | 0.5±0.1Vrms | | | | | | | | | |
| Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (10V min.)*1 | 1±0.1kHz | 1.0±0.2Vrms | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | |
| C>10μF | 120±24Hz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Dissipation Factor (D.F.) | B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max. *Table 1 <u>GRM155 B3/R6 1A 124 to 224</u> <u>GRM185 B3/R6 1A 105</u> <u>GRM188 B3/R6 1C/1A 225</u> <u>GRM219 B3/R6 1A 475</u> <u>GRM21B B3/R6 1C/1A 106</u> | The D.F. should be measured at reference temperature at the frequency and voltage shown in the table. <table border="1" style="margin-left: auto; margin-right: auto;"><thead><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr></thead><tbody><tr><td>C≤10μF (10V min.)*1</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>C≤10μF (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr><tr><td>C>10μF</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr></tbody></table> *1 However the voltage is 0.5±0.1Vrms about Table 1 items on the left side. | Capacitance | Frequency | Voltage | C≤10μF (10V min.)*1 | 1±0.1kHz | 1.0±0.2Vrms | C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | C>10μF | 120±24Hz | 0.5±0.1Vrms | | | | | | | | | |
| Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (10V min.)*1 | 1±0.1kHz | 1.0±0.2Vrms | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | |
| C>10μF | 120±24Hz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | |
| 9 | No bias | B1, B3 : Within ±10% (-25 to +85°C) F1 : Within +30/-80% (-25 to +85°C) R6 : Within ±15% (-55 to +85°C) F5 : Within +22/-82% (-30 to +85°C) C7 : Within ±22% (-55 to +125°C) C8 : Within ±22% (-55 to +105°C) | The capacitance change should be measured after 5 min. at each specified temp. stage. The ranges of capacitance change compared with the reference temperature value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage. *GRM43 B1/R6 0J/1A 336/476 only : 1.0±0.2Vrms <table border="1" style="margin-left: auto; margin-right: auto;"><thead><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr></thead><tbody><tr><td>1</td><td>Reference temperature ±2</td><td rowspan="3">No bias</td></tr><tr><td>2</td><td>-55±3 (for R6, C7, C8)/ -25±3 (for B1, B3, F1) -30±3 (for F5)</td></tr><tr><td>3</td><td>Reference temperature ±2</td></tr><tr><td>4</td><td>85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8)</td><td rowspan="5">50% of the rated voltage</td></tr><tr><td>5</td><td>20±2</td></tr><tr><td>6</td><td>-25±3 (for B1, F1)</td></tr><tr><td>7</td><td>20±2</td></tr><tr><td>8</td><td>85±3 (for B1, F1)</td></tr></tbody></table> •Initial measurement for high dielectric constant type Perform a heat treatment at 150 +0/-10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement. | Step | Temperature (°C) | Applying Voltage (V) | 1 | Reference temperature ±2 | No bias | 2 | -55±3 (for R6, C7, C8)/ -25±3 (for B1, B3, F1) -30±3 (for F5) | 3 | Reference temperature ±2 | 4 | 85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8) | 50% of the rated voltage | 5 | 20±2 | 6 | -25±3 (for B1, F1) | 7 | 20±2 | 8 | 85±3 (for B1, F1) |
| | Step | Temperature (°C) | | Applying Voltage (V) | | | | | | | | | | | | | | | | | | | | |
| 1 | Reference temperature ±2 | No bias | | | | | | | | | | | | | | | | | | | | | | |
| 2 | -55±3 (for R6, C7, C8)/ -25±3 (for B1, B3, F1) -30±3 (for F5) | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Reference temperature ±2 | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8) | 50% of the rated voltage | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 20±2 | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | -25±3 (for B1, F1) | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 20±2 | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 85±3 (for B1, F1) | | | | | | | | | | | | | | | | | | | | | | | |
| 50% of the Rated Voltage | B1: Within +10/-30% F1: Within +30/-95% | | | | | | | | | | | | | | | | | | | | | | | |

Continued on the following page.

6

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|------|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|-------|-----|-----|-----|
| 10 | Adhesive Strength of Termination | No removal of the terminations or other defects should occur. | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an 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. *5N : GR□15/GRM18, 2N : GR□33 <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GR□03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GR□15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> | 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 |
| | | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  <p>Fig. 1a</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Vibration | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | D.F. | B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Deflection | No cracking or marking defects should occur. | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a 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.  <p>Fig. 2a</p> <p>t : 1.6mm</p> <p>(GR□03, GR□15 : t : 0.8mm)</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GR□03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GR□15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> <p>(in mm)</p> | 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 |
| | | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  <p>Fig.3a</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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) . Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | |
|-------------|-----------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------|---|--------------|------------|----------------------------|--------------|----------------------------|------------|-------------|------------|--------|------------|--------|
| 14 | Resistance to Soldering Heat | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | |
| | | Capacitance Change | B1, B3, R6, C7, C8 : Within $\pm 7.5\%$ F1, F5 : Within $\pm 20\%$ | | | | | | | | | | | | | | | |
| | | Q/D.F. | B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max. | | | | | | | | | | | | | | | |
| | | I.R. | More than $50\Omega \cdot F$ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | No defects | | | | | | | | | | | | | | | |
| | | | <p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270\pm5°C for 10\pm0.5 seconds. Set at room temperature for 24\pm2 hours, then measure.</p> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24\pm2 hours. Perform the initial measurement.</p> <p>*Preheating for GRM32/43/55</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | |
| Step | Temperature | Time | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | |
| 15 | Temperature Sudden Change | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | |
| | | Capacitance Change | B1, B3, R6, C7, C8 : Within $\pm 7.5\%$ F1, F5 : Within $\pm 20\%$ | | | | | | | | | | | | | | | |
| | | D.F. | B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max. | | | | | | | | | | | | | | | |
| | | I.R. | More than $50\Omega \cdot F$ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | No defects | | | | | | | | | | | | | | | |
| | | | <p>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 shown in the following table. Set for 24\pm2 hours at room temperature, then measure.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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\pm3</td> <td>2 to 3</td> <td>30\pm3</td> <td>2 to 3</td> </tr> </tbody> </table> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24\pm2 hours. Perform the initial measurement.</p> | Step | 1 | 2 | 3 | 4 | Temp. (°C) | Min. Operating Temp. +0/−3 | Room Temp. | Max. Operating Temp. +3/−0 | Room Temp. | Time (min.) | 30 \pm 3 | 2 to 3 | 30 \pm 3 | 2 to 3 |
| Step | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | |
| Temp. (°C) | Min. Operating Temp. +0/−3 | Room Temp. | Max. Operating Temp. +3/−0 | Room Temp. | | | | | | | | | | | | | | |
| Time (min.) | 30 \pm 3 | 2 to 3 | 30 \pm 3 | 2 to 3 | | | | | | | | | | | | | | |
| 16 | High Temperature High Humidity (Steady) | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | |
| | | Capacitance Change | B1, B3, R6, C7, C8 : Within $\pm 12.5\%$ F1, F5 : Within $\pm 30\%$ | | | | | | | | | | | | | | | |
| | | D.F. | B1, B3, R6, C7, C8 : 0.2 max. F1, F5 : 0.4 max. | | | | | | | | | | | | | | | |
| | | I.R. | More than $12.5\Omega \cdot F$ | | | | | | | | | | | | | | | |
| | | | <p>Apply the rated voltage at 40\pm2°C and 90 to 95% humidity for 500\pm12 hours. The charge/discharge current is less than 50mA.</p> <p>•Initial measurement Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24\pm2 hours at room temperature. Perform the initial measurement.</p> <p>•Measurement after test Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24\pm2 hours at room temperature, then measure.</p> | | | | | | | | | | | | | | | |
| 17 | Durability | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | |
| | | Capacitance Change | B1, B3, R6, C7, C8 : Within $\pm 12.5\%$ F1, F5 : Within $\pm 30\%$ | | | | | | | | | | | | | | | |
| | | D.F. | B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.4 max. | | | | | | | | | | | | | | | |
| | | I.R. | More than $25\Omega \cdot F$ | | | | | | | | | | | | | | | |
| | | | <p>Apply 150% of the rated voltage for 1000\pm12 hours at the maximum operating temperature $\pm 3^\circ\text{C}$. Let sit for 24\pm2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p> <p>•Initial measurement Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24\pm2 hours at room temperature. Perform the initial measurement.</p> <p>•Measurement after test Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24\pm2 hours at room temperature, then measure.</p> | | | | | | | | | | | | | | | |

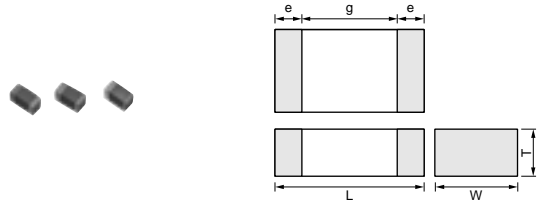
Chip Monolithic Ceramic Capacitors



High-Q GJM Series

■ Features

1. Mobile Telecommunication and RF module, mainly
2. Quality improvement of telephone call, Low power Consumption, yield ratio improvement



■ Applications

VCO, PA, Mobile Telecommunication


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

7

| Part Number | GJM03 | GJM15 |
|------------------------------------------------------------------------------------------------------|--------------------|--------------------|
| L x W [EIA] | 0.60x0.30 [0201] | 1.00x0.50 [0402] |
| TC | COG (5C) | COG (5C) |
| Rated Volt. | 25 (1E) | 50 (1H) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | |
| 0.30pF(R30) | 0.30(3) | 0.50(5) |
| 0.40pF(R40) | 0.30(3) | 0.50(5) |
| 0.50pF(R50) | 0.30(3) | 0.50(5) |
| 0.60pF(R60) | 0.30(3) | 0.50(5) |
| 0.70pF(R70) | 0.30(3) | 0.50(5) |
| 0.75pF(R75) | 0.30(3) | 0.50(5) |
| 0.80pF(R80) | 0.30(3) | 0.50(5) |
| 0.90pF(R90) | 0.30(3) | 0.50(5) |
| 1.0pF(1R0) | 0.30(3) | 0.50(5) |
| 1.1pF(1R1) | 0.30(3) | 0.50(5) |
| 1.2pF(1R2) | 0.30(3) | 0.50(5) |
| 1.3pF(1R3) | 0.30(3) | 0.50(5) |
| 1.4pF(1R4) | 0.30(3) | 0.50(5) |
| 1.5pF(1R5) | 0.30(3) | 0.50(5) |
| 1.6pF(1R6) | 0.30(3) | 0.50(5) |
| 1.7pF(1R7) | 0.30(3) | 0.50(5) |
| 1.8pF(1R8) | 0.30(3) | 0.50(5) |
| 1.9pF(1R9) | 0.30(3) | 0.50(5) |
| 2.0pF(2R0) | 0.30(3) | 0.50(5) |
| 2.1pF(2R1) | 0.30(3) | 0.50(5) |
| 2.2pF(2R2) | 0.30(3) | 0.50(5) |
| 2.3pF(2R3) | 0.30(3) | 0.50(5) |
| 2.4pF(2R4) | 0.30(3) | 0.50(5) |
| 2.5pF(2R5) | 0.30(3) | 0.50(5) |
| 2.6pF(2R6) | 0.30(3) | 0.50(5) |
| 2.7pF(2R7) | 0.30(3) | 0.50(5) |
| 2.8pF(2R8) | 0.30(3) | 0.50(5) |
| 2.9pF(2R9) | 0.30(3) | 0.50(5) |
| 3.0pF(3R0) | 0.30(3) | 0.50(5) |
| 3.1pF(3R1) | 0.30(3) | 0.50(5) |
| 3.2pF(3R2) | 0.30(3) | 0.50(5) |
| 3.3pF(3R3) | 0.30(3) | 0.50(5) |
| 3.4pF(3R4) | 0.30(3) | 0.50(5) |

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| Part Number | GJM03 | GJM15 |
|------------------------------------------------------------------------------------------------------|------------------|------------------|
| L x W [EIA] | 0.60x0.30 [0201] | 1.00x0.50 [0402] |
| TC | COG (5C) | COG (5C) |
| Rated Volt. | 25 (1E) | 50 (1H) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | |
| 3.5pF(3R5) | 0.30(3) | 0.50(5) |
| 3.6pF(3R6) | 0.30(3) | 0.50(5) |
| 3.7pF(3R7) | 0.30(3) | 0.50(5) |
| 3.8pF(3R8) | 0.30(3) | 0.50(5) |
| 3.9pF(3R9) | 0.30(3) | 0.50(5) |
| 4.0pF(4R0) | 0.30(3) | 0.50(5) |
| 4.1pF(4R1) | 0.30(3) | 0.50(5) |
| 4.2pF(4R2) | 0.30(3) | 0.50(5) |
| 4.3pF(4R3) | 0.30(3) | 0.50(5) |
| 4.4pF(4R4) | 0.30(3) | 0.50(5) |
| 4.5pF(4R5) | 0.30(3) | 0.50(5) |
| 4.6pF(4R6) | 0.30(3) | 0.50(5) |
| 4.7pF(4R7) | 0.30(3) | 0.50(5) |
| 4.8pF(4R8) | 0.30(3) | 0.50(5) |
| 4.9pF(4R9) | 0.30(3) | 0.50(5) |
| 5.0pF(5R0) | 0.30(3) | 0.50(5) |
| 5.1pF(5R1) | 0.30(3) | 0.50(5) |
| 5.2pF(5R2) | 0.30(3) | 0.50(5) |
| 5.3pF(5R3) | 0.30(3) | 0.50(5) |
| 5.4pF(5R4) | 0.30(3) | 0.50(5) |
| 5.5pF(5R5) | 0.30(3) | 0.50(5) |
| 5.6pF(5R6) | 0.30(3) | 0.50(5) |
| 5.7pF(5R7) | 0.30(3) | 0.50(5) |
| 5.8pF(5R8) | 0.30(3) | 0.50(5) |
| 5.9pF(5R9) | 0.30(3) | 0.50(5) |
| 6.0pF(6R0) | 0.30(3) | 0.50(5) |
| 6.1pF(6R1) | 0.30(3) | 0.50(5) |
| 6.2pF(6R2) | 0.30(3) | 0.50(5) |
| 6.3pF(6R3) | 0.30(3) | 0.50(5) |
| 6.4pF(6R4) | 0.30(3) | 0.50(5) |
| 6.5pF(6R5) | 0.30(3) | 0.50(5) |
| 6.6pF(6R6) | 0.30(3) | 0.50(5) |
| 6.7pF(6R7) | 0.30(3) | 0.50(5) |
| 6.8pF(6R8) | 0.30(3) | 0.50(5) |
| 6.9pF(6R9) | | 0.50(5) |
| 7.0pF(7R0) | | 0.50(5) |
| 7.1pF(7R1) | | 0.50(5) |
| 7.2pF(7R2) | | 0.50(5) |
| 7.3pF(7R3) | | 0.50(5) |
| 7.4pF(7R4) | | 0.50(5) |
| 7.5pF(7R5) | | 0.50(5) |
| 7.6pF(7R6) | | 0.50(5) |
| 7.7pF(7R7) | | 0.50(5) |
| 7.8pF(7R8) | | 0.50(5) |
| 7.9pF(7R9) | | 0.50(5) |
| 8.0pF(8R0) | | 0.50(5) |
| 8.1pF(8R1) | | 0.50(5) |
| 8.2pF(8R2) | | 0.50(5) |
| 8.3pF(8R3) | | 0.50(5) |
| 8.4pF(8R4) | | 0.50(5) |
| 8.5pF(8R5) | | 0.50(5) |
| 8.6pF(8R6) | | 0.50(5) |

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| Part Number | GJM03 | GJM15 |
|------------------------------------------------------------------------------------------------------|------------------|------------------|
| L x W [EIA] | 0.60x0.30 [0201] | 1.00x0.50 [0402] |
| TC | COG (5C) | COG (5C) |
| Rated Volt. | 25 (1E) | 50 (1H) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | |
| 8.7pF(8R7) | | 0.50(5) |
| 8.8pF(8R8) | | 0.50(5) |
| 8.9pF(8R9) | | 0.50(5) |
| 9.0pF(9R0) | | 0.50(5) |
| 9.1pF(9R1) | | 0.50(5) |
| 9.2pF(9R2) | | 0.50(5) |
| 9.3pF(9R3) | | 0.50(5) |
| 9.4pF(9R4) | | 0.50(5) |
| 9.5pF(9R5) | | 0.50(5) |
| 9.6pF(9R6) | | 0.50(5) |
| 9.7pF(9R7) | | 0.50(5) |
| 9.8pF(9R8) | | 0.50(5) |
| 9.9pF(9R9) | | 0.50(5) |
| 10pF(100) | | 0.50(5) |
| 12pF(120) | | 0.50(5) |
| 15pF(150) | | 0.50(5) |
| 18pF(180) | | 0.50(5) |
| 20pF(200) | | 0.50(5) |

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

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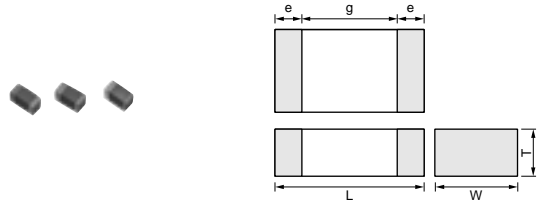
Chip Monolithic Ceramic Capacitors



Tight Tolerance High-Q GJM Series

■ Features

1. Mobile Telecommunication and RF module, mainly
2. Quality improvement of telephone call, Low power Consumption, yield ratio improvement



■ Applications

VCO, PA, Mobile Telecommunication

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

| Part Number | GJM03 | | GJM15 | |
|----------------------------------------------------|------------------|---------|------------------|--|
| L x W [EIA] | 0.60x0.30 [0201] | | 1.00x0.50 [0402] | |
| TC | COG (5C) | | COG (5C) | |
| Rated Volt. | 25 (1E) | | 50 (1H) | |
| Capacitance, Capacitance Tolerance and T Dimension | | | | |
| 0.20pF(R20) | M, N | 0.30(3) | 0.50(5) | |
| 0.30pF(R30) | K, M | 0.30(3) | 0.50(5) | |
| 0.40pF(R40) | K, M | 0.30(3) | 0.50(5) | |
| 0.50pF(R50) | K, M | 0.30(3) | 0.50(5) | |
| 0.60pF(R60) | K, M | 0.30(3) | 0.50(5) | |
| 0.70pF(R70) | K, M | 0.30(3) | 0.50(5) | |
| 0.80pF(R80) | K, M | 0.30(3) | 0.50(5) | |
| 0.90pF(R90) | K, M | 0.30(3) | 0.50(5) | |
| 1.0pF(1R0) | K, M | 0.30(3) | 0.50(5) | |
| 1.1pF(1R1) | K, M | 0.30(3) | 0.50(5) | |
| 1.2pF(1R2) | K, M | 0.30(3) | 0.50(5) | |
| 1.3pF(1R3) | K, M | 0.30(3) | 0.50(5) | |
| 1.4pF(1R4) | K, M | 0.30(3) | 0.50(5) | |
| 1.5pF(1R5) | K, M | 0.30(3) | 0.50(5) | |
| 1.6pF(1R6) | K, M | 0.30(3) | 0.50(5) | |
| 1.7pF(1R7) | K, M | 0.30(3) | 0.50(5) | |
| 1.8pF(1R8) | K, M | 0.30(3) | 0.50(5) | |
| 1.9pF(1R9) | K, M | 0.30(3) | 0.50(5) | |
| 2.0pF(2R0) | G, J | 0.30(3) | 0.50(5) | |
| 2.1pF(2R1) | G, J | 0.30(3) | 0.50(5) | |
| 2.2pF(2R2) | G, J | 0.30(3) | 0.50(5) | |
| 2.3pF(2R3) | G, J | 0.30(3) | 0.50(5) | |
| 2.4pF(2R4) | G, J | 0.30(3) | 0.50(5) | |
| 2.5pF(2R5) | G, J | 0.30(3) | 0.50(5) | |
| 2.6pF(2R6) | G, J | 0.30(3) | 0.50(5) | |
| 2.7pF(2R7) | G, J | 0.30(3) | 0.50(5) | |
| 2.8pF(2R8) | G, J | 0.30(3) | 0.50(5) | |
| 2.9pF(2R9) | G, J | 0.30(3) | 0.50(5) | |
| 3.0pF(3R0) | G, J | 0.30(3) | 0.50(5) | |
| 3.1pF(3R1) | G, J | 0.30(3) | 0.50(5) | |
| 3.2pF(3R2) | G, J | 0.30(3) | 0.50(5) | |
| 3.3pF(3R3) | G, J | 0.30(3) | 0.50(5) | |
| 3.4pF(3R4) | G, J | 0.30(3) | 0.50(5) | |

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| Part Number | GJM03 | | GJM15 | |
|----------------------------------------------------|------------------|---------|------------------|--|
| L x W [EIA] | 0.60x0.30 [0201] | | 1.00x0.50 [0402] | |
| TC | COG (5C) | | COG (5C) | |
| Rated Volt. | 25 (1E) | | 50 (1H) | |
| Capacitance, Capacitance Tolerance and T Dimension | | | | |
| 3.5pF(3R5) | G, J | 0.30(3) | 0.50(5) | |
| 3.6pF(3R6) | G, J | 0.30(3) | 0.50(5) | |
| 3.7pF(3R7) | G, J | 0.30(3) | 0.50(5) | |
| 3.8pF(3R8) | G, J | 0.30(3) | 0.50(5) | |
| 3.9pF(3R9) | G, J | 0.30(3) | 0.50(5) | |
| 4.0pF(4R0) | G, J | 0.30(3) | 0.50(5) | |
| 4.1pF(4R1) | G, J | 0.30(3) | 0.50(5) | |
| 4.2pF(4R2) | G, J | 0.30(3) | 0.50(5) | |
| 4.3pF(4R3) | G, J | 0.30(3) | 0.50(5) | |
| 4.4pF(4R4) | G, J | 0.30(3) | 0.50(5) | |
| 4.5pF(4R5) | G, J | 0.30(3) | 0.50(5) | |
| 4.6pF(4R6) | G, J | 0.30(3) | 0.50(5) | |
| 4.7pF(4R7) | G, J | 0.30(3) | 0.50(5) | |
| 4.8pF(4R8) | G, J | 0.30(3) | 0.50(5) | |
| 4.9pF(4R9) | G, J | 0.30(3) | 0.50(5) | |
| 5.0pF(5R0) | F, G | 0.30(3) | 0.50(5) | |
| 5.1pF(5R1) | F, G | 0.30(3) | 0.50(5) | |
| 5.2pF(5R2) | F, G | 0.30(3) | 0.50(5) | |
| 5.3pF(5R3) | F, G | 0.30(3) | 0.50(5) | |
| 5.4pF(5R4) | F, G | 0.30(3) | 0.50(5) | |
| 5.5pF(5R5) | F, G | 0.30(3) | 0.50(5) | |
| 5.6pF(5R6) | F, G | 0.30(3) | 0.50(5) | |
| 5.7pF(5R7) | F, G | 0.30(3) | 0.50(5) | |
| 5.8pF(5R8) | F, G | 0.30(3) | 0.50(5) | |
| 5.9pF(5R9) | F, G | 0.30(3) | 0.50(5) | |
| 6.0pF(6R0) | F, G | 0.30(3) | 0.50(5) | |
| 6.1pF(6R1) | F, G | 0.30(3) | 0.50(5) | |
| 6.2pF(6R2) | F, G | 0.30(3) | 0.50(5) | |
| 6.3pF(6R3) | F, G | 0.30(3) | 0.50(5) | |
| 6.4pF(6R4) | F, G | 0.30(3) | 0.50(5) | |
| 6.5pF(6R5) | F, G | 0.30(3) | 0.50(5) | |
| 6.6pF(6R6) | F, G | 0.30(3) | 0.50(5) | |
| 6.7pF(6R7) | F, G | 0.30(3) | 0.50(5) | |
| 6.8pF(6R8) | F, G | 0.30(3) | 0.50(5) | |
| 6.9pF(6R9) | F, G | | 0.50(5) | |
| 7.0pF(7R0) | F, G | | 0.50(5) | |
| 7.1pF(7R1) | F, G | | 0.50(5) | |
| 7.2pF(7R2) | F, G | | 0.50(5) | |
| 7.3pF(7R3) | F, G | | 0.50(5) | |
| 7.4pF(7R4) | F, G | | 0.50(5) | |
| 7.5pF(7R5) | F, G | | 0.50(5) | |
| 7.6pF(7R6) | F, G | | 0.50(5) | |
| 7.7pF(7R7) | F, G | | 0.50(5) | |
| 7.8pF(7R8) | F, G | | 0.50(5) | |
| 7.9pF(7R9) | F, G | | 0.50(5) | |
| 8.0pF(8R0) | F, G | | 0.50(5) | |
| 8.1pF(8R1) | F, G | | 0.50(5) | |
| 8.2pF(8R2) | F, G | | 0.50(5) | |
| 8.3pF(8R3) | F, G | | 0.50(5) | |
| 8.4pF(8R4) | F, G | | 0.50(5) | |
| 8.5pF(8R5) | F, G | | 0.50(5) | |
| 8.6pF(8R6) | F, G | | 0.50(5) | |

Continued on the following page. 

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| Part Number | GJM03 | GJM15 |
|----------------------------------------------------|------------------|------------------|
| L x W [EIA] | 0.60x0.30 [0201] | 1.00x0.50 [0402] |
| TC | COG (5C) | COG (5C) |
| Rated Volt. | 25 (1E) | 50 (1H) |
| Capacitance, Capacitance Tolerance and T Dimension | | |
| 8.7pF(8R7) | F, G | 0.50(5) |
| 8.8pF(8R8) | F, G | 0.50(5) |
| 8.9pF(8R9) | F, G | 0.50(5) |
| 9.0pF(9R0) | F, G | 0.50(5) |
| 9.1pF(9R1) | F, G | 0.50(5) |
| 9.2pF(9R2) | F, G | 0.50(5) |
| 9.3pF(9R3) | F, G | 0.50(5) |
| 9.4pF(9R4) | F, G | 0.50(5) |
| 9.5pF(9R5) | F, G | 0.50(5) |
| 9.6pF(9R6) | F, G | 0.50(5) |
| 9.7pF(9R7) | F, G | 0.50(5) |
| 9.8pF(9R8) | F, G | 0.50(5) |
| 9.9pF(9R9) | F, G | 0.50(5) |

The part numbering code is shown in ().

Dimensions are shown in mm and Rated Voltage in Vdc.

Specifications and Test Methods

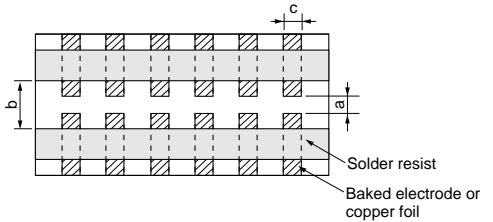

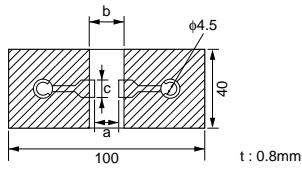
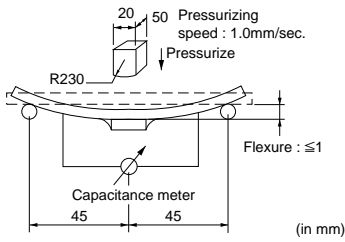
| No. | Item | Specifications | | Test Method | | | | | | | | | | |
|---------|-----------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|---------|--------------|-------|-----|-----|-----|-------|-----|
| | | Temperature Compensating Type | | | | | | | | | | | | |
| 1 | Operating Temperature Range | -55 to +125°C | | Reference Temperature : 25°C (2C, 3C, 4C : 20°C) | | | | | | | | | | |
| 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°C and 75%RH max. and within 2 minutes of charging. | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | | The capacitance/Q should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | | | |
| 8 | Q | 30pF max. : $Q \geq 400 + 20C$ C : Nominal Capacitance (pF) | | <table border="1"> <tr> <td>Frequency</td> <td>1±0.1MHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> </tr> </table> | Frequency | 1±0.1MHz | Voltage | 0.5 to 5Vrms | | | | | | |
| | | Frequency | 1±0.1MHz | | | | | | | | | | | |
| Voltage | 0.5 to 5Vrms | | | | | | | | | | | | | |
| 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. Temperature Compensating Type 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, (5C : +25 to 125°C : other temp. coeffs. : +20 to 125°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A. 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.) | | | | | | | | | | | |
| 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±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. *2N (GJM03) | | | | | | | | | | |
| | |  | | <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GJM03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GJM15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> </tbody> </table> (in mm) | Type | a | b | c | GJM03 | 0.3 | 0.9 | 0.3 | GJM15 | 0.4 |
| Type | a | b | c | | | | | | | | | | | |
| GJM03 | 0.3 | 0.9 | 0.3 | | | | | | | | | | | |
| GJM15 | 0.4 | 1.5 | 0.5 | | | | | | | | | | | |

Fig. 1

Continued on the following page. 

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | | Test Method | | | | | | | | | | | | | | | |
|-------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---|---|------------|----------------------------|------------|----------------------------|------------|-------------|------|--------|------|--------|--|
| | | Temperature Compensating Type | | | | | | | | | | | | | | | | | |
| 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 | $Q \geq 400 + 20C$ 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. 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. | | | | | | | | | | | | | | | |
| | |  <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GJM03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GJM15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> </tbody> </table> <p style="text-align: center;">(in mm)</p> | | | Type | a | b | c | GJM03 | 0.3 | 0.9 | 0.3 | GJM15 | 0.4 | 1.5 | 0.5 | | | |
| Type | a | b | c | | | | | | | | | | | | | | | | |
| GJM03 | 0.3 | 0.9 | 0.3 | | | | | | | | | | | | | | | | |
| GJM15 | 0.4 | 1.5 | 0.5 | | | | | | | | | | | | | | | | |
| | |  <p style="text-align: center;">(in mm)</p> | | Fig. 3 | | | | | | | | | | | | | | | |
| 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°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | | |
| 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°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours. | | | | | | | | | | | | | | | |
| | | Appearance | No marking defects | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | | | | | | |
| | | Q | $Q \geq 400 + 20C$ 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. 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 | $Q \geq 400 + 20C$ C : Nominal Capacitance (pF) | | | | | | | | | | | | | | | | |
| | | I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | |
| | Dielectric Strength | No failure | | | | | | | | | | | | | | | | | |
| | | <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. $+30$</td> <td>Room Temp.</td> <td>Max. Operating Temp. $+30$</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> </tbody> </table> | | Step | 1 | 2 | 3 | 4 | Temp. (°C) | Min. Operating Temp. $+30$ | Room Temp. | Max. Operating Temp. $+30$ | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 | |
| Step | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | | |
| Temp. (°C) | Min. Operating Temp. $+30$ | Room Temp. | Max. Operating Temp. $+30$ | Room Temp. | | | | | | | | | | | | | | | |
| Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 | | | | | | | | | | | | | | | |
| 16 | Humidity, Steady State | The measured and observed characteristics should satisfy the specifications in the following table. | | Let the capacitor sit at 40±2°C and 90 to 95% humidity for 500±12 hours. 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 | 10pF and over, 30pF and below : $Q \geq 275 + \frac{C}{2}$ 10pF and below : $Q \geq 200 + 10C$ C : Nominal Capacitance (pF) | | | | | | | | | | | | | | | | |
| | I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | |

Continued on the following page. ↗

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | | Test Method |
|-----|-----------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | Temperature Compensating Type | | |
| 17 | Humidity Load | The measured and observed characteristics should satisfy the specifications in the following table. | | Apply the rated voltage at 40±2°C 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 and below : $Q \geq 100 + \frac{10}{C}$ 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°C. Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. The charge/discharge current is less than 50mA. |
| | | Appearance | No marking defects | |
| | | Capacitance Change | Within ±3% or ±0.3pF (Whichever is larger) | |
| | | Q | 10pF and over, 30pF and below : $Q \geq 275 + \frac{5}{C}$ 10pF and below : $Q \geq 200 + 10C$ 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 below 1pF < C ≤ 5pF : 300mΩ below 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
(1)

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

*1 : Nominal values denote the temperature coefficient within a range of 25 to 125°C.

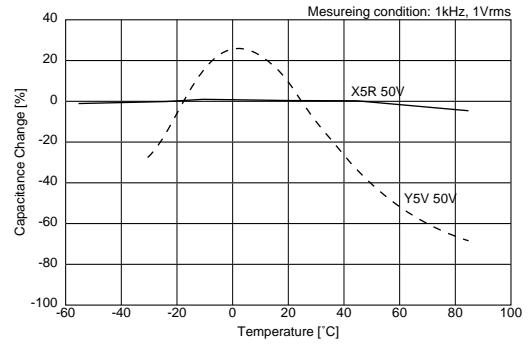
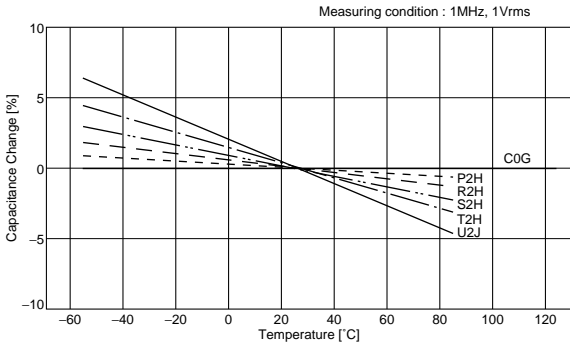
(2)

| Char. | Nominal Values (ppm/°C) *2 | Capacitance Change from 20°C Value (%) | | | | | |
|-------|----------------------------|----------------------------------------|-------|-------|-------|-------|-------|
| | | -55°C | | -25°C | | -10°C | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 2C | 0±60 | 0.82 | -0.45 | 0.49 | -0.27 | 0.33 | -0.18 |
| 3C | 0±120 | 0.37 | -0.90 | 0.82 | -0.54 | 0.55 | -0.36 |
| 4C | 0±250 | 0.56 | -0.88 | 1.54 | -1.13 | 1.02 | -0.75 |

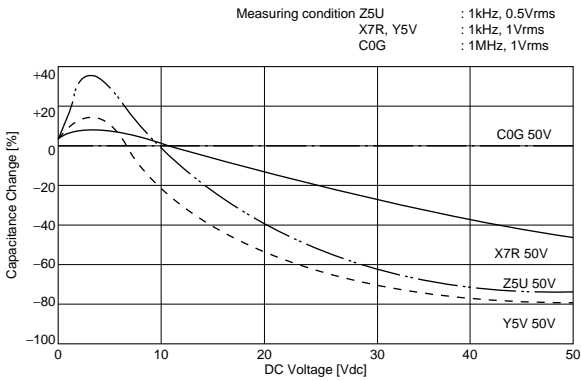
*2 : Nominal values denote the temperature coefficient within a range of 20 to 125°C.

GRM Series Data

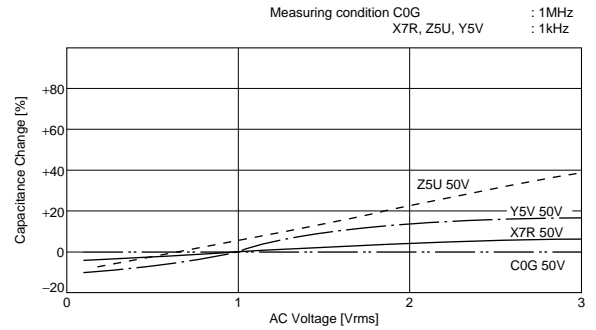
■ Capacitance-Temperature Characteristics



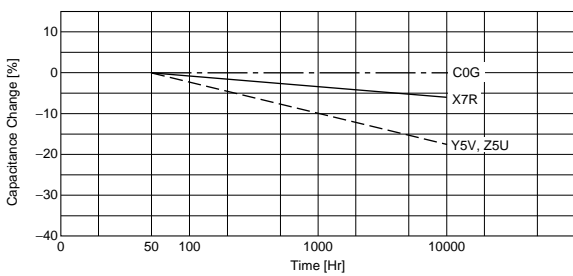
■ Capacitance-DC Voltage Characteristics



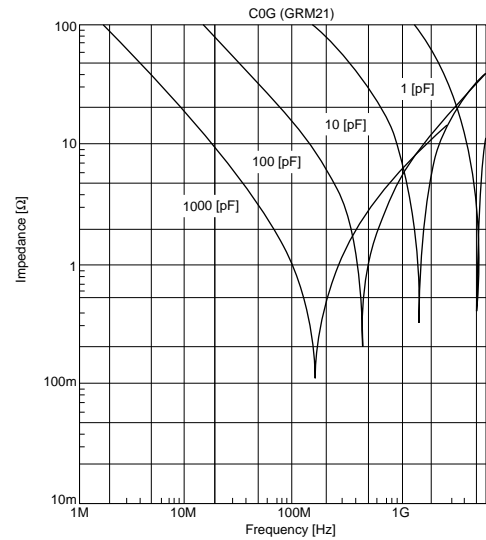
■ Capacitance-AC Voltage Characteristics



■ Capacitance Change-Aging



■ Impedance-Frequency Characteristics

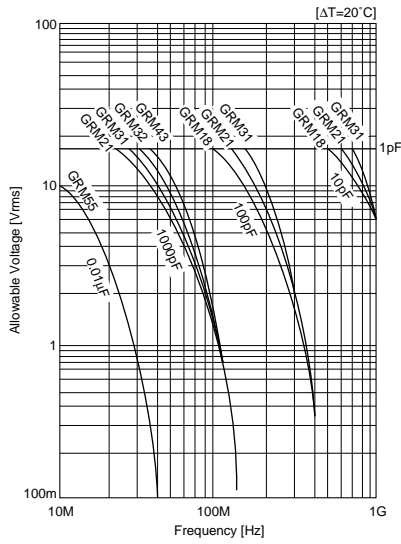


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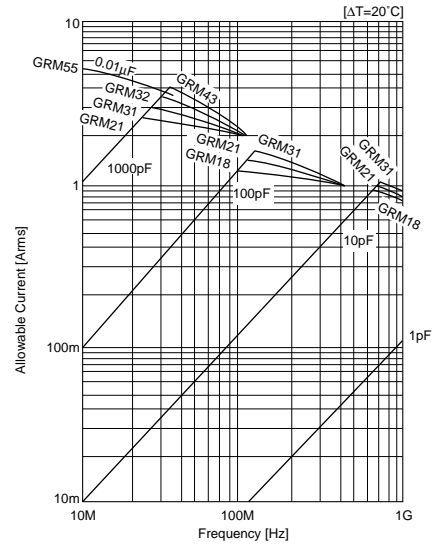
GRM Series Data

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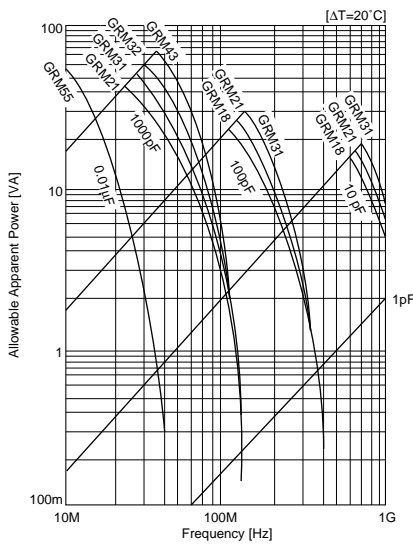
Allowable Voltage-Frequency



Allowable Current-Frequency



Allowable Apparent Power



Chip Monolithic Ceramic Capacitors



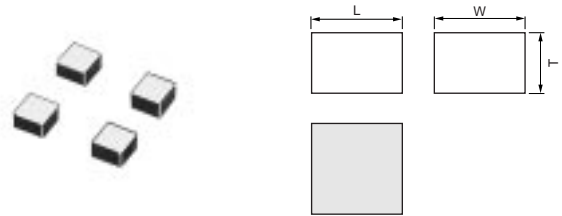
Microchips GMA Series

■ Features

1. Better micro wave 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 |

| Part Number | TC Code (Standard) | Rated Voltage (Vdc) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) |
|--------------------------|--------------------|---------------------|------------------|---------------|--------------|------------------|
| GMA05XR72A101MD01 | X7R (EIA) | 100 | 100pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA05XR72A151MD01 | X7R (EIA) | 100 | 150pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA05XR72A221MD01 | X7R (EIA) | 100 | 220pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA085R72A331MD01 | X7R (EIA) | 100 | 330pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA085R72A471MD01 | X7R (EIA) | 100 | 470pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA085R72A681MD01 | X7R (EIA) | 100 | 680pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA085R72A102MD01 | X7R (EIA) | 100 | 1000pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA05XF52A102ZD01 | Y5V (EIA) | 100 | 1000pF +80/-20% | 0.5 | 0.5 | 0.35 |
| GMA085F52A103ZD01 | Y5V (EIA) | 100 | 10000pF +80/-20% | 0.8 | 0.8 | 0.5 |
| GMA05XR71H331MD01 | X7R (EIA) | 50 | 330pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA05XR71H471MD01 | X7R (EIA) | 50 | 470pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA05XR71C681MD01 | X7R (EIA) | 16 | 680pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA05XR71C102MD01 | X7R (EIA) | 16 | 1000pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA085R71C102MD01 | X7R (EIA) | 16 | 1000pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA05XR71C152MD01 | X7R (EIA) | 16 | 1500pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA085R71C152MD01 | X7R (EIA) | 16 | 1500pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA05XR71C222MD01 | X7R (EIA) | 16 | 2200pF ±20% | 0.5 | 0.5 | 0.35 |
| GMA085R71C222MD01 | X7R (EIA) | 16 | 2200pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA085R71C332MD01 | X7R (EIA) | 16 | 3300pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA085R71C472MD01 | X7R (EIA) | 16 | 4700pF ±20% | 0.8 | 0.8 | 0.5 |
| GMA085R71C682MD01 | X7R (EIA) | 16 | 6800pF ±20% | 0.8 | 0.8 | 0.5 |
| 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 |
| GMA05XF51C103ZD01 | Y5V (EIA) | 16 | 10000pF +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 | 0.1µF +80/-20% | 0.8 | 0.8 | 0.5 |

Specifications and Test Methods

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | |
|-------------|-----------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|----------------------|-----------|-------------------------|------------|----------------------------|----------------------------------|----------------------------|-------------------------|-------------|---------------------------------|--------|------|--------|
| 1 | Operating Temperature Range | R7 : -55 to +125°C F5 : -30 to +85°C | Reference Temperature:25°C | | | | | | | | | | | | | | | |
| 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 abnormality | Visual inspection | | | | | | | | | | | | | | | |
| 4 | Dimensions | See the previous pages. | Visual inspection | | | | | | | | | | | | | | | |
| 5 | Dielectric Strength | No defects or abnormality | 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. | | | | | | | | | | | | | | | |
| 6 | Insulation Resistance | 10,000MΩ min. | 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. | | | | | | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | |
| 8 | Dissipation Factor (D.F.) | R7 : 0.035 max. F5 : 0.09 max. (for 16V) : 0.125 max. (for 10V) | <table border="1"> <tr> <td>Frequency</td> <td>1±0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>1±0.2Vrms</td> </tr> </table> | Frequency | 1±0.1kHz | Voltage | 1±0.2Vrms | | | | | | | | | | | |
| Frequency | 1±0.1kHz | | | | | | | | | | | | | | | | | |
| Voltage | 1±0.2Vrms | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | No bias R7 : Within +/-15% (-55 to +125°C) F5 : Within +22/-82% (-30 to +85°C) | <p>The capacitance change should be measured after 5min. at each specified temp. stage.</p> <ul style="list-style-type: none"> The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.* <p>In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Applying Voltage (V)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temperature±2</td> <td rowspan="4">No bias</td> </tr> <tr> <td>2</td> <td>-55±3 (for R7) -30±3 (for F5)</td> </tr> <tr> <td>3</td> <td>Reference Temperature±2</td> </tr> <tr> <td>4</td> <td>125±3 (for R7) 85±3 (for F5)</td> </tr> </tbody> </table> <p>*Initial measurement for high dielectric constant type Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p> | Step | Temperature (°C) | Applying Voltage (V) | 1 | Reference Temperature±2 | No bias | 2 | -55±3 (for R7) -30±3 (for F5) | 3 | Reference Temperature±2 | 4 | 125±3 (for R7) 85±3 (for F5) | | | |
| Step | Temperature (°C) | Applying Voltage (V) | | | | | | | | | | | | | | | | |
| 1 | Reference Temperature±2 | No bias | | | | | | | | | | | | | | | | |
| 2 | -55±3 (for R7) -30±3 (for F5) | | | | | | | | | | | | | | | | | |
| 3 | Reference Temperature±2 | | | | | | | | | | | | | | | | | |
| 4 | 125±3 (for R7) 85±3 (for F5) | | | | | | | | | | | | | | | | | |
| 10 | Mechanical Strength | Bond Strength Pull force : 3.0g min. | MIL-STD-883 Method 2011 Condition D 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. | | | | | | | | | | | | | | | |
| | | Die Shear Strength Die Shear force : 200g min. | MIL-STD-883 Method 2019 Mount the capacitor on a gold metallized alumina substrate with Au-Sn (80/20). Apply the force parallel to the substrate. | | | | | | | | | | | | | | | |
| 11 | Vibration Resistance | Appearance No defects or abnormality | 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). | | | | | | | | | | | | | | | |
| | | Capacitance Within the specified tolerance | | | | | | | | | | | | | | | | |
| | | D.F. R7 : 0.035 max. F5 : 0.09 max. (for 16V) : 0.125 max. (for 10V) | | | | | | | | | | | | | | | | |
| 12 | Temperature Cycle | Appearance No marked defect | The capacitor should be set for 48±4 hours at room temperature after one hour heat of treatment at 150+0/-10°C, 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. | | | | | | | | | | | | | | | |
| | | Capacitance Change R7 : Within ±7.5% F5 : Within ±20% | | | | | | | | | | | | | | | | |
| | | D.F. R7 : 0.035 max. F5 : 0.09 max. (for 16V) : 0.125 max. (for 10V) | | | | | | | | | | | | | | | | |
| | | I.R. 10,000MΩ min. | | | | | | | | | | | | | | | | |
| | | Dielectric Strength No failure | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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> </tbody> </table> | Step | 1 | 2 | 3 | 4 | Temp. (°C) | 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 |
| Step | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | |
| Temp. (°C) | 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 | | | | | | | | | | | | | | |

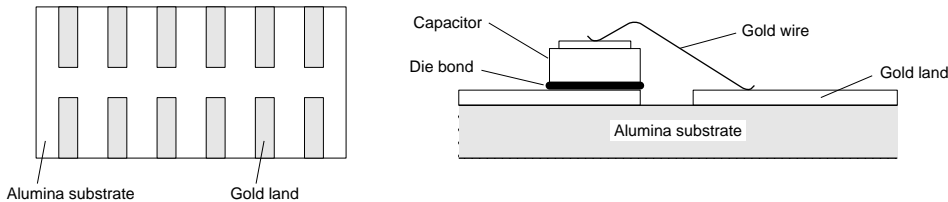
Continued on the following page. 

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method |
|-----|-------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | Humidity (Steady State) | Appearance | No marked defect |
| | | Capacitance Change | R7 : Within $\pm 12.5\%$ F5 : Within $\pm 30\%$ |
| | | D.F. | R7 : 0.05 max. F5 : 0.125 max. (for 16V) 0.15 max. (for 10V) |
| | | I.R. | 1,000M Ω min. |
| | | Dielectric Strength | No failure |
| 14 | Humidity Load | Appearance | No marked defect |
| | | Capacitance Change | R7 : Within $\pm 12.5\%$ F5 : Within $\pm 30/-40\%$ |
| | | D.F. | R7 : 0.05 max. F5 : 0.125 max. (for 16V) 0.15 max. (for 10V) |
| | | I.R. | 500M Ω min. |
| | | Dielectric Strength | No failure |
| 15 | High Temperature Load | Appearance | No marked defect |
| | | Capacitance Change | R7 : Within $\pm 12.5\%$ F5 : Within $+30/-40\%$ |
| | | D.F. | R7 : 0.05 max. F5 : 0.125 max. (for 16V) 0.15 max. (for 10V) |
| | | I.R. | 1,000M Ω min. |
| | | Dielectric Strength | No failure |
| | | | <p>Set the capacitor for 500± 12 hours at 40$\pm 20^\circ\text{C}$, in 90 to 95% humidity. Take it out and set it for 48± 4 hours at room temperature, then measure.</p> <p>Apply the rated voltage for 500± 12 hours at 40$\pm 2^\circ\text{C}$, 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.</p> <ul style="list-style-type: none"> Initial measurement for F1/F5 <p>Perform a heat treatment at 150+0/-10$^\circ\text{C}$ for one hour and then let sit for 48± 4 hours at room temperature. Perform the initial measurement.</p> <p>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 $\pm 3^\circ\text{C}$ then it should be set for 48± 4 hours at room temperature and the initial measurement should be conducted.</p> <p>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.</p> |

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.



Chip Monolithic Ceramic Capacitors



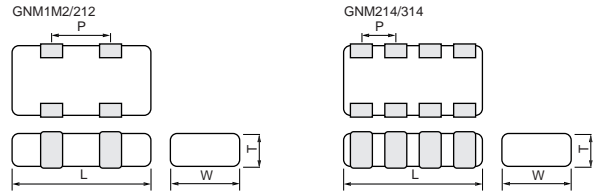
Capacitor Arrays GNM Series

■ 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 0.8 +0/-0.15 | 0.64 ±0.05 |
| GNM212 GNM214 | 2.0 ±0.15 | 1.25 ±0.15 | 0.85 ±0.1 0.6 ±0.1 | 1.0 ±0.1 0.5 ±0.05 |
| GNM314 | 3.2 ±0.15 | 1.6 ±0.15 | 0.8 ±0.1 1.0 ±0.1 | 0.8 ±0.1 |

Temperature Compensating Type

| Part Number | GNM1M | | GNM21 | GNM31 | |
|----------------------------------------------------|-------------|--------|-------------|-------------|------------|
| L x W | 1.37x1.0 | | 2.0x1.25 | 3.2x1.6 | |
| TC | COG (5C) | | COG (5C) | COG (5C) | |
| Rated Volt. | 50 (1H) | | 50 (1H) | 100 (2A) | 50 (1H) |
| Capacitance, Capacitance Tolerance and T Dimension | | | | | |
| 10pF(100) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 15pF(150) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 22pF(220) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 27pF(270) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 33pF(330) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 39pF(390) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 47pF(470) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 68pF(680) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 100pF(101) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 150pF(151) | K | 0.6(2) | 0.6(4) | 0.8(4) | 0.8(4) |
| 220pF(221) | K | 0.6(2) | 0.6(4) | | 0.8(4) |
| 270pF(271) | K | | | | 0.8(4) |
| 330pF(331) | K | | | | 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 GNM1M Series

| Part Number | GNM1M | | | | | |
|----------------------------------------------------|-------------|------------|-------------|-------------|------------|------------|
| L x W | 1.37x1.00 | | | | | |
| TC | X5R (R6) | | | X7R (R7) | | |
| Rated Volt. | 16 (1C) | 10 (1A) | 6.3 (0J) | 50 (1H) | 25 (1E) | 16 (1C) |
| Capacitance, Capacitance Tolerance and T Dimension | | | | | | |
| 1000pF(102) | K, M | | | 0.6(2) | | |
| 2200pF(222) | K, M | | | | 0.6(2) | |
| 4700pF(472) | K, M | | | | 0.6(2) | |
| 10000pF(103) | K, M | | | | 0.6(2) | |
| 22000pF(223) | K, M | | | | | 0.6(2) |

Continued on the following page.



Continued from the preceding page.

| Part Number | GNM1M | | | | | |
|----------------------------------------------------|-------------|------------|-------------|-------------|------------|------------|
| L x W | 1.37x1.00 | | | | | |
| TC | X5R (R6) | | | X7R (R7) | | |
| Rated Volt. | 16 (1C) | 10 (1A) | 6.3 (0J) | 50 (1H) | 25 (1E) | 16 (1C) |
| Capacitance, Capacitance Tolerance and T Dimension | | | | | | |
| 47000pF(473) | K, M | | | | | 0.6(2) |
| 0.10μF(104) | K, M | | 0.8(2) | | | |
| 1.0μF(105) | K, M | 0.8(2) | 0.8(2) | 0.8(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.
 Please refer to Specification and Test Methods (2) about 1.0μF products.

High Dielectric Constant Type GNM21 Series


| Part Number | GNM21 | | | | | |
|----------------------------------------------------|-------------|------------|------------|-------------|------------|---------|
| L x W | 2.0x1.25 | | | | | |
| TC | X5R (R6) | | | X7R (R7) | | |
| Rated Volt. | 16 (1C) | 10 (1A) | 50 (1H) | 25 (1E) | 16 (1C) | |
| Capacitance, Capacitance Tolerance and T Dimension | | | | | | |
| 1000pF(102) | K, M | | 0.6(4) | | | |
| 2200pF(222) | K, M | | | 0.6(4) | | |
| 4700pF(472) | K, M | | | 0.6(4) | | |
| 10000pF(103) | K, M | | | 0.6(4) | | |
| 22000pF(223) | K, M | | | | | 0.85(4) |
| 47000pF(473) | K, M | | | | | 0.85(4) |
| 0.10μF(104) | K, M | | | | | 0.85(4) |
| 0.47μF(474) | K, M | 0.85(2) | | | | |
| 1.0μF(105) | K, M | 0.85(2) | 0.85(4) | | | |
| 2.2μF(225) | K, M | | 0.85(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.
 Please refer to Specification and Test Methods (2) about X5R, 10V products.

High Dielectric Constant Type GNM31 Series

| Part Number | GNM31 | | | |
|----------------------------------------------------|-------------|------------|------------|-------------|
| L x W | 3.2x1.6 | | | |
| TC | X7R (R7) | | | X5R (R6) |
| Rated Volt. | 100 (2A) | 50 (1H) | 16 (1C) | 10 (1A) |
| Capacitance, Capacitance Tolerance and T Dimension | | | | |
| 220pF(221) | K, M | 0.8(4) | | |
| 330pF(331) | K, M | 0.8(4) | | |
| 470pF(471) | K, M | 0.8(4) | 0.8(4) | |
| 680pF(681) | K, M | 0.8(4) | 0.8(4) | |
| 1000pF(102) | K, M | 0.8(4) | 0.8(4) | |
| 1500pF(152) | K, M | 0.8(4) | 0.8(4) | |
| 2200pF(222) | K, M | 0.8(4) | 0.8(4) | |
| 3300pF(332) | K, M | 0.8(4) | 0.8(4) | |
| 4700pF(472) | K, M | 0.8(4) | 0.8(4) | |
| 6800pF(682) | K, M | | 0.8(4) | |
| 10000pF(103) | K, M | | 0.8(4) | |

Continued on the following page. 

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| Part Number | GNM31 | | | |
|----------------------------------------------------|-------------|------------|------------|-------------|
| L x W | 3.2x1.6 | | | |
| TC | X7R (R7) | | | X5R (R6) |
| Rated Volt. | 100 (2A) | 50 (1H) | 16 (1C) | 10 (1A) |
| Capacitance, Capacitance Tolerance and T Dimension | | | | |
| 15000pF(153) | K, M | 0.8(4) | | |
| 22000pF(223) | K, M | | 0.8(4) | |
| 33000pF(333) | K, M | | 0.8(4) | |
| 47000pF(473) | K, M | | 1.0(4) | |
| 68000pF(683) | K, M | | 1.0(4) | |
| 0.10μF(104) | K, M | | 1.0(4) | |
| 1.0μF(105) | K, M | | | 0.85(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.

GNM Series Specifications and Test Methods (1)

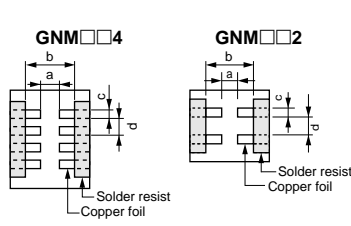
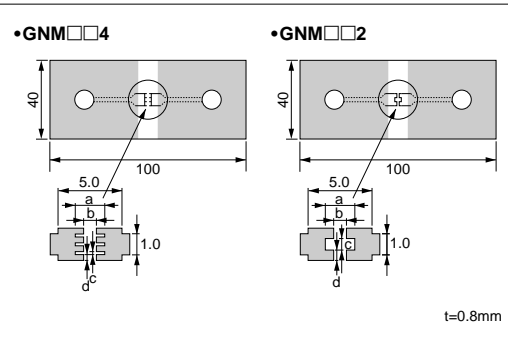
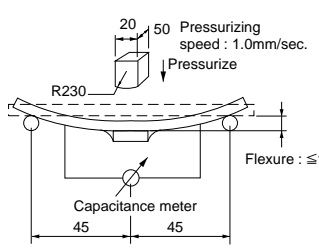
| No. | Item | Specifications | | Test Method | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|-------------|------|-----------------|------------|-------------|------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------|-----|------|-----|-----------------------------------|-----------|----------|----------|----------------------------------|--------------|-------------|-----|-----|-----|
| | | Temperature Compensating Type | High Dielectric Type | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Operating Temperature Range | 5C : -55 to +125°C | R7 : -55 to +125°C R6 : -30 to +85°C | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 (5C) or 250% of the rated voltage (R7) 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°C 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°C at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Q/ Dissipation Factor (D.F.) | 30pF min. : $Q \geq 1000$ 30pF max. : $Q \geq 400+20C$ C : Nominal Capacitance (pF) | <table border="1" style="font-size: small;"> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V</th> <th>6.3V</th> </tr> <tr> <td>R7, R6</td> <td>0.025 max.</td> <td>0.035 max.</td> <td>0.035 max.</td> <td>0.05 max.</td> </tr> </table> | Char. | 25V min. | 16V | 10V | 6.3V | R7, R6 | 0.025 max. | 0.035 max. | 0.035 max. | 0.05 max. | <table border="1" style="font-size: small;"> <tr> <th>Char.</th> <th>5C</th> <th>R7</th> </tr> <tr> <td>Item</td> <td></td> <td></td> </tr> <tr> <td>Frequency</td> <td>1±0.1MHz</td> <td>1±0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> <td>1.0±0.2Vrms</td> </tr> </table> | Char. | 5C | R7 | Item | | | Frequency | 1±0.1MHz | 1±0.1kHz | Voltage | 0.5 to 5Vrms | 1.0±0.2Vrms | | | |
| | | | Char. | 25V min. | 16V | 10V | 6.3V | | | | | | | | | | | | | | | | | | | | | | |
| R7, R6 | 0.025 max. | 0.035 max. | 0.035 max. | 0.05 max. | | | | | | | | | | | | | | | | | | | | | | | | | |
| Char. | 5C | R7 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Item | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frequency | 1±0.1MHz | 1±0.1kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage | 0.5 to 5Vrms | 1.0±0.2Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | Capacitance Change | <table border="1" style="font-size: small;"> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change</th> </tr> <tr> <td>R7</td> <td>-55°C to +125°C</td> <td rowspan="2">25°C</td> <td rowspan="2">Within ±15%</td> </tr> <tr> <td>R6</td> <td>-55°C to +85°C</td> </tr> </table> | Char. | Temp. Range | Reference Temp. | Cap. Change | R7 | -55°C to +125°C | 25°C | Within ±15% | R6 | -55°C to +85°C | The capacitance change should be measured after 5 min. at each specified temperature stage. (1) Temperature Compensating Type The temperature coefficient is determined using the capacitance measured in step 3 as a reference. 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. 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 cap. value in step 3. <table border="1" style="font-size: small; margin-top: 10px;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <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 (for F5)</td> </tr> <tr> <td>5</td> <td>20±2</td> </tr> </tbody> </table> | Step | Temperature (°C) | 1 | 25±2 | 2 | -55±3 (for 5C/R7), -30±3 (for F5) | 3 | 25±2 | 4 | 125±3 (for 5C/R7), 85±3 (for F5) | 5 | 20±2 | | | |
| | | Char. | Temp. Range | Reference Temp. | Cap. Change | | | | | | | | | | | | | | | | | | | | | | | | |
| | | R7 | -55°C to +125°C | 25°C | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | |
| R6 | -55°C to +85°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Step | Temperature (°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | -55±3 (for 5C/R7), -30±3 (for F5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 125±3 (for 5C/R7), 85±3 (for F5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 20±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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. <div style="text-align: center;">  </div> | | 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. 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. <table border="1" style="font-size: small; margin-top: 10px;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>GNM1M2</td> <td>0.5</td> <td>1.6</td> <td>0.32</td> <td>0.32</td> </tr> <tr> <td>GNM212</td> <td>0.4</td> <td>1.8</td> <td>0.15</td> <td>0.5</td> </tr> <tr> <td>GNM214</td> <td>0.6</td> <td>2.0</td> <td>0.25</td> <td>0.25</td> </tr> <tr> <td>GNM314</td> <td>0.8</td> <td>2.5</td> <td>0.4</td> <td>0.4</td> </tr> </tbody> </table> <p style="text-align: right; font-size: x-small;">(in mm)</p> | Type | a | b | c | d | GNM1M2 | 0.5 | 1.6 | 0.32 | 0.32 | GNM212 | 0.4 | 1.8 | 0.15 | 0.5 | GNM214 | 0.6 | 2.0 | 0.25 | 0.25 | GNM314 | 0.8 | 2.5 | 0.4 | 0.4 |
| Type | a | b | c | d | | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM1M2 | 0.5 | 1.6 | 0.32 | 0.32 | | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM212 | 0.4 | 1.8 | 0.15 | 0.5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM214 | 0.6 | 2.0 | 0.25 | 0.25 | | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM314 | 0.8 | 2.5 | 0.4 | 0.4 | | | | | | | | | | | | | | | | | | | | | | | | | |

Fig. 1

Continued on the following page.

GNM Series Specifications and Test Methods (1)

Continued from the preceding page.

| No. | Item | Specifications | | | | Test Method | | | | | | | | | | | | | | | | | | | | | | |
|--------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|---|--------|----------|----------|-----------|-----------|--------|----------|----------|----------|----------|--------|----------|----------|----------|----------|--------|----------|
| | | Temperature Compensating Type | High Dielectric Type | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 3 mutually perpendicular directions (total of 6 hours). | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Q/D.F. | 30pF min. : $Q \geq 1000$ 30pF max. : $Q \geq 400+20C$ C : Nominal Capacitance (pF) | Char. | 25V min. | 16V | 10V | 6.3V | | | | | | | | | | | | | | | | | | | | | |
| | | | R7, R6 | 0.025 max. | 0.035 max. | 0.035 max. | 0.05 max. | | | | | | | | | | | | | | | | | | | | | |
| 12 | Deflection | No cracking or marking defects 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 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. | | | | | | | | | | | | | | | | | | | | | | |
| | |  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>GNM1M2</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>GNM212</td> <td>2.0±0.05</td> <td>0.6±0.05</td> <td>0.5±0.05</td> <td>0.5±0.05</td> </tr> <tr> <td>GNM214</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>GNM314</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> </tbody> </table> <p style="text-align: center;">(in mm)</p> | | | | | Type | a | b | c | d | GNM1M2 | 2.0±0.05 | 0.5±0.05 | 0.32±0.05 | 0.32±0.05 | GNM212 | 2.0±0.05 | 0.6±0.05 | 0.5±0.05 | 0.5±0.05 | GNM214 | 2.0±0.05 | 0.7±0.05 | 0.3±0.05 | 0.2±0.05 | GNM314 | 2.5±0.05 |
| Type | a | b | c | d | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM1M2 | 2.0±0.05 | 0.5±0.05 | 0.32±0.05 | 0.32±0.05 | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM212 | 2.0±0.05 | 0.6±0.05 | 0.5±0.05 | 0.5±0.05 | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM214 | 2.0±0.05 | 0.7±0.05 | 0.3±0.05 | 0.2±0.05 | | | | | | | | | | | | | | | | | | | | | | | | |
| GNM314 | 2.5±0.05 | 0.8±0.05 | 0.4±0.05 | 0.4±0.05 | | | | | | | | | | | | | | | | | | | | | | | | |
| | |  | | | | Fig. 3 | | | | | | | | | | | | | | | | | | | | | | |
| 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°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | | | | | | | | | |
| 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°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure. • Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. | | | | | | | | | | | | | | | | | | | | | | |
| | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | R7, R6 : Within ±7.5% | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Q/D.F. | 30pF min. : $Q \geq 1000$ 30pF max. : $Q \geq 400+20C$ C : Nominal Capacitance (pF) | Char. | 25V min. | 16V | | 10V | 6.3V | | | | | | | | | | | | | | | | | | | | |
| | | | R7, R6 | 0.025 max. | 0.035 max. | | 0.035 max. | 0.05 max. | | | | | | | | | | | | | | | | | | | | |
| | I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Dielectric Strength | No failure | | | | | | | | | | | | | | | | | | | | | | | | | | |

Continued on the following page.

GNM Series Specifications and Test Methods (1)

Continued from the preceding page.

| No. | Item | Specifications | | | | Test Method | | | | | | | | | | | | | | | |
|---------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|------|----------|------------|------------|----------------------------|------------|----------------------------|------------|-------------|------|--------|------|--------|
| | | Temperature Compensating Type | High Dielectric Type | | | | | | | | | | | | | | | | | | |
| 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 hours (high dielectric constant type) at room temperature, then measure. <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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> </tbody> </table> <ul style="list-style-type: none"> • Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. | Step | 1 | 2 | 3 | 4 | Temp. (°C) | 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 |
| | Step | 1 | 2 | 3 | 4 | | | | | | | | | | | | | | | | |
| | Temp. (°C) | 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 | | | | | | | | | | | | | | | | |
| | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | |
| | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | R7, R6 : Within ±7.5% | | | | | | | | | | | | | | | | | | |
| Q/D.F. | 30pF min. : Q≥1000 30pF max. : Q≥400+20C | <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V</th> <th>6.3V</th> </tr> </thead> <tbody> <tr> <td>R7, R6</td> <td>0.025 max.</td> <td>0.035 max.</td> <td>0.035 max.</td> <td>0.05 max.</td> </tr> </tbody> </table> | | | Char. | 25V min. | 16V | 10V | 6.3V | R7, R6 | 0.025 max. | 0.035 max. | 0.035 max. | 0.05 max. | | | | | | | |
| | Char. | 25V min. | 16V | 10V | 6.3V | | | | | | | | | | | | | | | | |
| R7, R6 | 0.025 max. | 0.035 max. | 0.035 max. | 0.05 max. | | | | | | | | | | | | | | | | | |
| | 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. | | | | Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. | | | | | | | | | | | | | | | |
| | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | |
| | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | R7, R6 : Within ±12.5% | | | | | | | | | | | | | | | | | | |
| | Q/D.F. | 30pF and over : Q≥350 10pF and over, 30pF and below: Q≥275+5C/2 10pF and below : Q≥200+10C | <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V/6.3V</th> </tr> </thead> <tbody> <tr> <td>R7, R6</td> <td>0.05 max.</td> <td>0.05 max.</td> <td>0.05 max.</td> </tr> </tbody> </table> | | | | Char. | 25V min. | 16V | 10V/6.3V | R7, R6 | 0.05 max. | 0.05 max. | 0.05 max. | | | | | | | |
| | | Char. | 25V min. | 16V | 10V/6.3V | | | | | | | | | | | | | | | | |
| | R7, R6 | 0.05 max. | 0.05 max. | 0.05 max. | | | | | | | | | | | | | | | | | |
| | C : Nominal Capacitance (pF) | | | | | | | | | | | | | | | | | | | | |
| 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°C 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) | R7, R6 : Within ±12.5% | | | | | | | | | | | | | | | | | | |
| | Q/D.F. | 30pF and over : Q≥200 30pF and below : Q≥100+10C/3 | <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V/6.3V</th> </tr> </thead> <tbody> <tr> <td>R7, R6</td> <td>0.05 max.</td> <td>0.05 max.</td> <td>0.05 max.</td> </tr> </tbody> </table> | | | | Char. | 25V min. | 16V | 10V/6.3V | R7, R6 | 0.05 max. | 0.05 max. | 0.05 max. | | | | | | | |
| | | Char. | 25V min. | 16V | 10V/6.3V | | | | | | | | | | | | | | | | |
| | R7, R6 | 0.05 max. | 0.05 max. | 0.05 max. | | | | | | | | | | | | | | | | | |
| | C : Nominal Capacitance (pF) | | | | | | | | | | | | | | | | | | | | |
| I.R. | More than 500MΩ or 25Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | | | | |
| Dielectric Strength | No failure | | | | | | | | | | | | | | | | | | | | |

Continued on the following page.

10

GNM Series Specifications and Test Methods (1)

Continued from the preceding page.

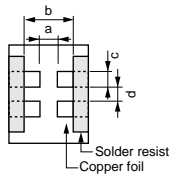
| No. | Item | Specifications | | | | Test Method | | | | | | |
|--------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|--------|-----------|-----------|-----------|
| | | Temperature Compensating Type | High Dielectric Type | | | | | | | | | |
| 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°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA. • Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 24±2 hours at room temperature. Perform initial measurement. | | | | | | |
| | Appearance | No marking defects | | | | | | | | | | |
| | Capacitance Change | Within ±3% or ±0.3pF (Whichever is larger) | R7, R6 : Within ±12.5% | | | | | | | | | |
| | Q/D.F. | 30pF and over : $Q \geq 350$ 10pF and over, 30pF and below : $Q \geq 275 + 5C/2$ 10pF and below : $Q \geq 200 + 10C$ C : Nominal Capacitance (pF) | <table border="1"> <thead> <tr> <th>Char.</th> <th>25V min.</th> <th>16V</th> <th>10V/6.3V</th> </tr> </thead> <tbody> <tr> <td>R7, R6</td> <td>0.04 max.</td> <td>0.05 max.</td> <td>0.05 max.</td> </tr> </tbody> </table> | Char. | 25V min. | | 16V | 10V/6.3V | R7, R6 | 0.04 max. | 0.05 max. | 0.05 max. |
| Char. | 25V min. | 16V | 10V/6.3V | | | | | | | | | |
| R7, R6 | 0.04 max. | 0.05 max. | 0.05 max. | | | | | | | | | |
| I.R. | More than 1,000MΩ or 50Ω · F (Whichever is smaller) | | | | | | | | | | | |

Table A

| Char. | Nominal Values (ppm/°C) Note 1 | Capacitance Change from 25°C (%) | | | | | |
|-------|--------------------------------|----------------------------------|-------|-------|-------|-------|-------|
| | | -55°C | | -30°C | | -10°C | |
| | | 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°C.

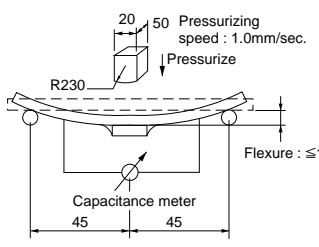
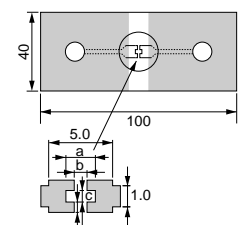
GNM Series Specifications and Test Methods (2)

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | | | | | |
|-------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|-------------|----|--------------|-------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|--------|------|-----|-------|-----|------|---|------|---|------|
| 1 | Operating Temperature Range | R6 : -55°C to +85°C | | | | | | | | | | | | | | | | | | | | | |
| 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 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°C and 75%RH max. and within 1 minutes of charging. | | | | | | | | | | | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | | | | | | |
| 8 | Dissipation Factor (D.F.) | 0.1 max. | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>R6</td> <td>1±0.1kHz</td> <td>0.5±0.1Vrms</td> </tr> </tbody> </table> | Capacitance | Frequency | Voltage | R6 | 1±0.1kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | |
| Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | |
| R6 | 1±0.1kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>R6</td> <td>-55 to +85°C</td> <td>25°C</td> <td>Within ±15%</td> </tr> </tbody> </table> | Char. | Temp. Range | Reference Temp. | Cap. Change | R6 | -55 to +85°C | 25°C | Within ±15% | <p>The capacitance change should be measured after 5 min. at each specified temperature stage.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>85±3</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table> <p>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</p> <ul style="list-style-type: none"> Initial measurement for high dielectric constant type. Perform a heat treatment at 150+0/-10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement. | Step | Temperature (°C) | 1 | 25±2 | 2 | -55±3 | 3 | 25±2 | 4 | 85±3 | 5 | 25±2 |
| Char. | Temp. Range | Reference Temp. | Cap. Change | | | | | | | | | | | | | | | | | | | | |
| R6 | -55 to +85°C | 25°C | Within ±15% | | | | | | | | | | | | | | | | | | | | |
| Step | Temperature (°C) | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 25±2 | | | | | | | | | | | | | | | | | | | | | | |
| 2 | -55±3 | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 25±2 | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 85±3 | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 25±2 | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Adhesive Strength of Termination | <p>No removal of the terminations or other defects should occur.</p> <div style="text-align: center;">  <p>Fig. 1</p> </div> | <p>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder.</p> <p>Then apply 5N 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.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>GNM1M2</td> <td>0.5</td> <td>1.6</td> <td>0.32</td> <td>0.32</td> </tr> <tr> <td>GNM212</td> <td>0.4</td> <td>1.8</td> <td>0.15</td> <td>0.5</td> </tr> </tbody> </table> <p style="text-align: right;">(in mm)</p> | Type | a | b | c | d | GNM1M2 | 0.5 | 1.6 | 0.32 | 0.32 | GNM212 | 0.4 | 1.8 | 0.15 | 0.5 | | | | | |
| Type | a | b | c | d | | | | | | | | | | | | | | | | | | | |
| GNM1M2 | 0.5 | 1.6 | 0.32 | 0.32 | | | | | | | | | | | | | | | | | | | |
| GNM212 | 0.4 | 1.8 | 0.15 | 0.5 | | | | | | | | | | | | | | | | | | | |
| 11 | Vibration | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | | | | | | | | | | | | | |
| | | D.F. | 0.1 max. | | | | | | | | | | | | | | | | | | | | |
| | | | <p>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).</p> | | | | | | | | | | | | | | | | | | | | |

Continued on the following page.

GNM Series Specifications and Test Methods (2)

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | |
|---------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|------------|---|--------|------------|----------------------|------------|----------------------|------------|-------------|----------|----------|----------|--------|
| 12 | Deflection | <p>No cracking or marking defects shall occur.</p>  <p>Fig. 3</p> | <p>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.</p>  <table border="1" data-bbox="941 672 1452 750"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>GNM1M2</td> <td>2.0±0.5</td> <td>0.5±0.05</td> <td>0.32±0.05</td> <td>0.32±0.05</td> </tr> <tr> <td>GNM212</td> <td>2.0±0.05</td> <td>0.6±0.05</td> <td>0.5±0.05</td> <td>0.5±0.05</td> </tr> </tbody> </table> <p>(in mm)</p> <p>Fig. 2</p> | Type | a | b | c | d | GNM1M2 | 2.0±0.5 | 0.5±0.05 | 0.32±0.05 | 0.32±0.05 | GNM212 | 2.0±0.05 | 0.6±0.05 | 0.5±0.05 | 0.5±0.05 | |
| Type | a | b | c | d | | | | | | | | | | | | | | | |
| GNM1M2 | 2.0±0.5 | 0.5±0.05 | 0.32±0.05 | 0.32±0.05 | | | | | | | | | | | | | | | |
| GNM212 | 2.0±0.05 | 0.6±0.05 | 0.5±0.05 | 0.5±0.05 | | | | | | | | | | | | | | | |
| 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°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | | | |
| 14 | Resistance to Soldering Heat | Appearance | No marking defects | <p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours, then measure.</p> <ul style="list-style-type: none"> Initial measurement <p>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> | | | | | | | | | | | | | | | |
| | | Capacitance Change | R6: Within ±7.5% | | | | | | | | | | | | | | | | |
| | | D.F. | 0.1 max. | | | | | | | | | | | | | | | | |
| | | I.R. | 50Ω · F min. | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | No failure | | | | | | | | | | | | | | | | |
| 15 | Temperature Cycle | Appearance | No marking defects | <p>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 at room temperature, then measure.</p> <table border="1" data-bbox="941 1299 1452 1411"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp.</td> <td>Room Temp.</td> <td>Max. Operating Temp.</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> </tbody> </table> <ul style="list-style-type: none"> Initial measurement <p>Perform a heat treatment at 150 +0/-10 °C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> | Step | 1 | 2 | 3 | 4 | Temp. (°C) | Min. Operating Temp. | Room Temp. | Max. Operating Temp. | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
| | | Step | 1 | | 2 | 3 | 4 | | | | | | | | | | | | |
| | | Temp. (°C) | Min. Operating Temp. | | Room Temp. | Max. Operating Temp. | Room Temp. | | | | | | | | | | | | |
| | | Time (min.) | 30±3 | | 2 to 3 | 30±3 | 2 to 3 | | | | | | | | | | | | |
| | | Capacitance Change | R6: Within ±12.5% | | | | | | | | | | | | | | | | |
| D.F. | 0.1 max. | | | | | | | | | | | | | | | | | | |
| I.R. | 50Ω · F min. | | | | | | | | | | | | | | | | | | |
| Dielectric Strength | No failure | | | | | | | | | | | | | | | | | | |
| 16 | High Temperature High Humidity (Steady) | Appearance | No marking defects | <p>Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50mA.</p> <ul style="list-style-type: none"> Initial measurement <p>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> <ul style="list-style-type: none"> Measurement after test <p>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</p> | | | | | | | | | | | | | | | |
| | | Capacitance Change | R6: Within ±12.5% | | | | | | | | | | | | | | | | |
| | | D.F. | 0.2 max. | | | | | | | | | | | | | | | | |
| | | I.R. | 12.5Ω · F min. | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | No failure | | | | | | | | | | | | | | | | |
| 17 | Durability | Appearance | No marking defects | <p>Apply 125% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p> <ul style="list-style-type: none"> Initial measurement <p>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> <ul style="list-style-type: none"> Measurement after test <p>Perform a heat treatment at 150 +0/-10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</p> | | | | | | | | | | | | | | | |
| | | Capacitance Change | R6: Within ±12.5% | | | | | | | | | | | | | | | | |
| | | D.F. | 0.2 max. | | | | | | | | | | | | | | | | |
| | | I.R. | 25Ω · F min. | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | No failure | | | | | | | | | | | | | | | | |

Chip Monolithic Ceramic Capacitors



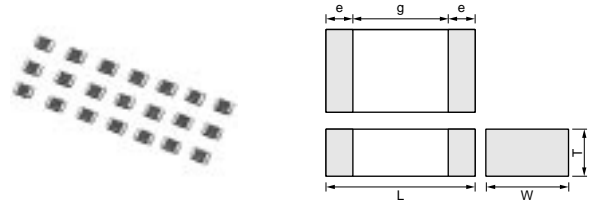
for Ultrasonic Sensors GRM Series

■ Features

1. Proper to compensate for ultrasonic sensor
2. Small chip size and high cap. value

■ Applications

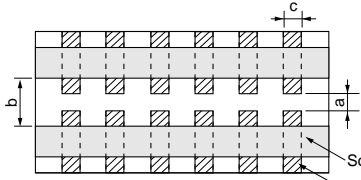
Ultrasonic sensor
 (Back sonar, Corner sonar and etc.)




| 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 |

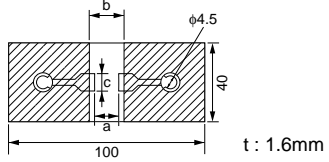
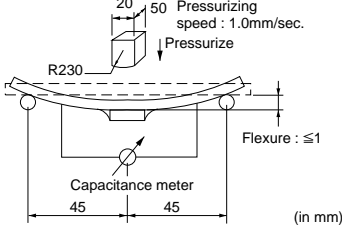
Specifications and Test Methods

| No. | Item | Specifications | Test Method | | | | | | | | | | | | |
|-------|-----------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|---|------|-------|-------|-----|------|---|------|---|------|
| 1 | Operating Temperature | -25 to +85°C | Reference Temperature: 20°C | | | | | | | | | | | | |
| 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 | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20°C 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°C with 1 ± 0.1 kHz in frequency and 1 ± 0.2 Vrms in voltage. | | | | | | | | | | | | |
| 8 | Dissipation Factor (D.F.) | 0.01 max. | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | Within $-4,700 \pm 1,999$ ppm/°C (at -25 to +20°C) Within $-4,700 \pm 999$ ppm/°C (at +20 to +85°C) | <p>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.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>20±2</td> </tr> <tr> <td>2</td> <td>-25±3</td> </tr> <tr> <td>3</td> <td>20±2</td> </tr> <tr> <td>4</td> <td>85±3</td> </tr> <tr> <td>5</td> <td>20±2</td> </tr> </tbody> </table> | Step | Temperature (°C) | 1 | 20±2 | 2 | -25±3 | 3 | 20±2 | 4 | 85±3 | 5 | 20±2 |
| Step | Temperature (°C) | | | | | | | | | | | | | | |
| 1 | 20±2 | | | | | | | | | | | | | | |
| 2 | -25±3 | | | | | | | | | | | | | | |
| 3 | 20±2 | | | | | | | | | | | | | | |
| 4 | 85±3 | | | | | | | | | | | | | | |
| 5 | 20±2 | | | | | | | | | | | | | | |
| 10 | Adhesive Strength of Termination | No removal of the terminations or other defect should occur. | <p>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.</p>  <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> </tbody> </table> <p style="text-align: right;">(in mm)</p> <p style="text-align: center;">Fig. 1</p> | Type | a | b | c | GRM21 | 1.2 | 4.0 | 1.65 | | | | |
| Type | a | b | c | | | | | | | | | | | | |
| GRM21 | 1.2 | 4.0 | 1.65 | | | | | | | | | | | | |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | | | | | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | | | | | |
| | | D.F. | 0.01 max. | | | | | | | | | | | | |
| | | | <p>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).</p> | | | | | | | | | | | | |

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. 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. | | | | | |
| | |  <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Type</th> <th style="padding: 2px;">a</th> <th style="padding: 2px;">b</th> <th style="padding: 2px;">c</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">GRM21</td> <td style="padding: 2px;">1.2</td> <td style="padding: 2px;">4.0</td> <td style="padding: 2px;">1.65</td> </tr> </tbody> </table> <p style="text-align: center;">(in mm)</p> <p style="text-align: center;">Fig. 2</p> | | Type | a | b | c | GRM21 |
| Type | a | b | c | | | | | |
| GRM21 | 1.2 | 4.0 | 1.65 | | | | | |
| | |  <p style="text-align: center;">(in mm)</p> <p style="text-align: center;">Fig. 3</p> | | | | | | |
| 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°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | |
| 14 | Resistance to Soldering Heat | Appearance | No defects or abnormalities | Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C 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 | | | | | |
| | | 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). 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 | | | | | |
| | | Dielectric Strength | No failure | | | | | |
| 16 | Humidity, Steady State | Appearance | No defects or abnormalities | Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. 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 | | | | | |
| | | Dielectric Strength | No failure | | | | | |
| 17 | Humidity Load | Appearance | No defects or abnormalities | Apply the rated voltage at 40±2°C 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 | | | | | |
| 18 | High Temperature Load | Appearance | No defects or abnormalities | Apply 200% of the rated voltage for 1,000±12 hours at 85±3°C. 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 | | | | | |

11

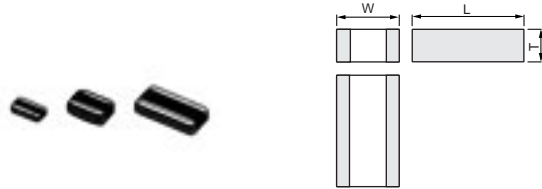
Chip Monolithic Ceramic Capacitors



Low ESL LLL/LLA/LLM Series

■ Features (Reversed geometry Low ESL Type)

1. Low ESL, good for noise reduction for high frequency
2. Small, high cap



■ Applications

1. High speed micro processor
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 |

Reversed geometry Low ESL Type

| Part Number | LLL18 | | | | | | LLL21 | | | | | | LLL31 | | | | | |
|------------------------------------------------------------------------------------------------------|----------|---------|---------|----------|----------|---------|----------|----------|----------|----------|----------|--------|----------|----------|---------|----------|----------|----------|
| L x W | 1.6x0.8 | | | | | | 2.0x1.25 | | | | | | 3.2x1.6 | | | | | |
| TC | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X5R (R6) | | |
| Rated Volt. | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 6.3 (0J) |
| 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) | | | | | | 0.6 (6) | | | | | | | | | | | |
| 6800pF (682) | | 0.5 (5) | | | | | 0.6 (6) | | | | | | | | | | | |
| 10000pF (103) | | 0.5 (5) | 0.5 (5) | | | | 0.6 (6) | | | | | | 0.7 (7) | | | | | |
| 15000pF (153) | | 0.5 (5) | 0.5 (5) | | | | 0.6 (6) | | | | | | 0.7 (7) | 0.7 (7) | | | | |
| 22000pF (223) | | 0.5 (5) | 0.5 (5) | | | | 0.6 (6) | 0.6 (6) | | | | | 0.7 (7) | 0.7 (7) | | | | |
| 33000pF (333) | | | 0.5 (5) | | | | 0.85 (9) | 0.6 (6) | 0.6 (6) | | | | 0.7 (7) | 0.7 (7) | | | | |
| 47000pF (473) | | | 0.5 (5) | | | | | 0.6 (6) | 0.6 (6) | | | | 0.7 (7) | 0.7 (7) | | | | |
| 68000pF (683) | | | 0.5 (5) | | | | | 0.6 (6) | 0.6 (6) | | | | 0.7 (7) | 0.7 (7) | | | | |
| 0.10µF (104) | | | | 0.5 (5) | | | | 0.6 (6) | 0.6 (6) | | | | 1.15 (M) | 0.7 (7) | | | | |
| 0.15µF (154) | | | | | 0.5 (5) | | | 0.85 (9) | 0.6 (6) | | | | 1.15 (M) | 0.7 (7) | | | | |
| 0.22µF (224) | | | | | 0.5 (5) | | | | | 0.6 (6) | | | | 1.15 (M) | | | | |
| 0.33µF (334) | | | | | | 0.5 (5) | | | | 0.6 (6) | | | | 1.15 (M) | 0.7 (7) | | | |
| 0.47µF (474) | | | | | | 0.5 (5) | | | 0.85 (9) | | | | | 1.15 (M) | 0.7 (7) | | | |

Continued on the following page. ↗

Continued from the preceding page.

| Part Number | LLL18 | | | | | | LLL21 | | | | | | LLL31 | | | | | | |
|------------------------------------------------------------------------------------------------------|-------------|------------|------------|-------------|-------------|------------|-------------|------------|------------|-------------|-------------|-------------|-------------|------------|------------|-------------|-------------|-------------|-------------|
| L x W | 1.6x0.8 | | | | | | 2.0x1.25 | | | | | | 3.2x1.6 | | | | | | |
| TC | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | X5R (R6) | | | |
| Rated Volt. | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 6.3 (0J) | |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | | | | | | |
| 0.68μF (684) | | | | | | | | | | | | 0.85 (9) | | | | | 1.15 (M) | 0.7 (7) | |
| 1.0μF (105) | | | | | | 0.5 (5) | | | | | | 0.85 (9) | | | | | 1.15 (M) | 0.7 (7) | |
| 1.5μF (155) | | | | | | | | | | | | 0.85 (9) | | | | | 1.15 (M) | 0.7 (7) | |
| 2.2μF (225) | | | | | | | | | | | | 0.85 (9) | | | | | 1.15 (M) | 0.7 (7) | |
| 4.7μF (475) | | | | | | | | | | | | | | | | | | 1.15 (M) | |
| 10μF (106) | | | | | | | | | | | | | | | | | | | 1.25 (B) |

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

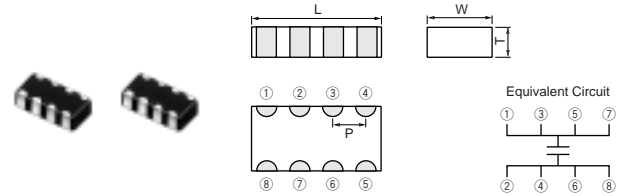
Reversed geometry Low ESL Type Low Profile

| Part Number | LLL18 | | | | LLL21 | | | | | | LLL31 | | | |
|------------------------------------------------------------------------------------------------------|-------------|------------|-------------|-----------|-------------|------------|------------|-------------|-------------|-----------|-------------|------------|------------|------------|
| L x W | 1.6x0.8 | | | | 2.0x1.25 | | | | | | 3.2x1.6 | | | |
| TC | X7R (R7) | | X7S (C7) | | X7R (R7) | | | X7S (C7) | | | X7R (R7) | | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 10 (1A) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 50 (1H) | 25 (1E) | 16 (1C) | 10 (1A) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | | | | |
| 680pF(681) | | | | | 0.5(5) | | | | | | | | | |
| 1000pF(102) | | | | | 0.5(5) | | | | | | | | | |
| 1500pF(152) | | | | | 0.5(5) | | | | | | | | | |
| 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) | 0.5(5) | | | 0.5(5) | 0.5(5) | | | | | 0.5(5) | | | |
| 15000pF(153) | 0.5(5) | 0.5(5) | | | 0.5(5) | 0.5(5) | | | | | 0.5(5) | 0.5(5) | | |
| 22000pF(223) | | 0.5(5) | | | | 0.5(5) | 0.5(5) | | | | 0.5(5) | 0.5(5) | | |
| 33000pF(333) | | 0.5(5) | | | | 0.5(5) | 0.5(5) | | | | 0.5(5) | 0.5(5) | | |
| 47000pF(473) | | 0.5(5) | | | | | 0.5(5) | | | | | 0.5(5) | 0.5(5) | |
| 68000pF(683) | | | 0.5(5) | | | | 0.5(5) | | | | | 0.5(5) | 0.5(5) | |
| 0.10μF(104) | | | 0.5(5) | | | | 0.5(5) | | | | | 0.5(5) | 0.5(5) | |
| 0.15μF(154) | | | | | | | | 0.5(5) | | | | | | 0.5(5) |
| 0.22μF(224) | | | | 0.5(5) | | | | 0.5(5) | | | | | | 0.5(5) |
| 0.33μF(334) | | | | 0.5(5) | | | | 0.5(5) | | | | | | 0.5(5) |
| 0.47μF(474) | | | | | | | | | 0.5(5) | | | | | 0.5(5) |
| 0.68μF(684) | | | | | | | | | | | | | | 0.5(5) |
| 1.0μF(105) | | | | | | | | | | 0.5(5) | | | | |

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

■ Features (Eight Terminals Low ESL Type)

1. Low ESL (100pH) , suitable to decoupling capacitor for 1GHz clock speed IC.
2. Small, large cap



■ APPLICATIONS

1. High speed micro processor
2. High frequency digital equipment.

| Part Number | Dimensions (mm) | | | |
|---------------|-----------------|-----------|----------------|-----------|
| | L | W | T | P |
| LLA185 | 1.6 ±0.1 | 0.8 ±0.1 | 0.5 +0.05/-0.1 | 0.4 ±0.1 |
| LLA215 | 2.0 ±0.1 | 1.25 ±0.1 | 0.5 +0.05/-0.1 | 0.5 ±0.05 |
| LLA219 | 2.0 ±0.1 | 1.25 ±0.1 | 0.85 ±0.1 | 0.5 ±0.05 |
| LLA315 | 3.2 ±0.15 | 1.6 ±0.15 | 0.5 +0.05/-0.1 | 0.8 ±0.1 |
| LLA319 | 3.2 ±0.15 | 1.6 ±0.15 | 0.85 ±0.1 | 0.8 ±0.1 |
| LLA31M | 3.2 ±0.15 | 1.6 ±0.15 | 1.15 ±0.1 | 0.8 ±0.1 |

Eight Terminals Low ESL Type


| Part Number | LLA18 | | LLA21 | | | | LLA31 | | | | |
|------------------------------------------------------------------------------------------------------|-------------|--|-------------|--|------------|------------|-------------|-----------|------------|------------|-----------|
| L x W | 1.6x0.8 | | 2.0x1.25 | | | | 3.2x1.6 | | | | |
| TC | X7S (C7) | | X7R (R7) | | | | X7S (C7) | | | | |
| Rated Volt. | 4 (0G) | | 25 (1E) | | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 4 (0G) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | | |
| 10000pF(103) | | | 0.85(9) | | | | | | | | |
| 15000pF(153) | | | 0.85(9) | | | | | | | | |
| 22000pF(223) | | | 0.85(9) | | | | | | | | |
| 33000pF(333) | | | 0.85(9) | | | | | | | | |
| 47000pF(473) | | | 0.85(9) | | | | | | | | |
| 68000pF(683) | | | 0.85(9) | | | | | | | | |
| 0.10µF(104) | | | 0.85(9) | | | | | | 0.85(9) | | |
| 0.15µF(154) | | | 0.85(9) | | | | | | 1.15(M) | | |
| 0.22µF(224) | | | 0.85(9) | | | | | | 0.85(9) | | |
| 0.33µF(334) | 0.5(5) | | | | 0.85(9) | | | | 0.85(9) | | |
| 0.47µF(474) | 0.5(5) | | | | 0.85(9) | | | | 0.85(9) | | |
| 0.68µF(684) | | | | | 0.85(9) | | | | 0.85(9) | | |
| 1.0µF(105) | 0.5(5) | | | | | | 0.85(9) | | | 0.85(9) | |
| 1.5µF(155) | | | | | | | 0.85(9) | | | 0.85(9) | |
| 2.2µF(225) | | | | | | | | 0.85(9) | | | 0.85(9) |
| 4.7µF(475) | | | | | | | | 0.85(9) | | | |

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

Eight Terminals Low ESL Type Low Profile

| Part Number | LLA21 | | | | | LLA31 | | |
|------------------------------------------------------------------------------------------------------|-------------|------------|------------|-------------|-------------|-------------|------------|-------------|
| L x W | 2.0x1.25 | | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | | | X7S (C7) | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 10000pF(103) | 0.5(5) | | | | | | | |
| 15000pF(153) | 0.5(5) | | | | | | | |
| 22000pF(223) | 0.5(5) | | | | | | | |
| 33000pF(333) | | 0.5(5) | | | | | | |
| 47000pF(473) | | 0.5(5) | | | | | | |
| 68000pF(683) | | 0.5(5) | | | | | | |
| 0.10µF(104) | | 0.5(5) | | | | 0.5(5) | | |
| 0.15µF(154) | | | 0.5(5) | | 0.5(5) | | 0.5(5) | |
| 0.22µF(224) | | | 0.5(5) | | 0.5(5) | | 0.5(5) | |

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| Part Number | LLA21 | | | | | LLA31 | | |
|------------------------------------------------------------------------------------------------------|-------------|------------|------------|-------------|-------------|-------------|------------|-------------|
| L x W | 2.0x1.25 | | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | | | X7S (C7) | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 10 (1A) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | |
| 0.33μF(334) | | | 0.5(5) | 0.5(5) | | | 0.5(5) | |
| 0.47μF(474) | | | | 0.5(5) | | | 0.5(5) | |
| 0.68μF(684) | | | | 0.5(5) | | | 0.5(5) | |
| 1.0μF(105) | | | | | 0.5(5) | | | 0.5(5) |
| 1.5μF(155) | | | | | 0.5(5) | | | 0.5(5) |
| 2.2μF(225) | | | | | 0.5(5) | | | 0.5(5) |

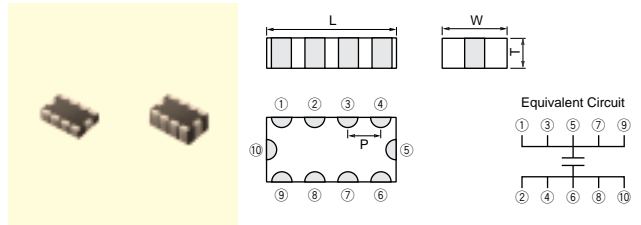
The part numbering code is shown in ().
 Dimensions are shown in mm and Rated Voltage in Vdc.

■ Features (Ten Terminals Low ESL Type)

1. Low ESL (45pH), suitable to decoupling capacitor for 2GHz clock speed IC.
2. Small, large cap

■ APPLICATIONS

1. High speed micro processor
2. High frequency digital equipment



| Part Number | Dimensions (mm) | | | |
|---------------|-----------------|-----------|----------------|-----------|
| | L | W | T | P |
| LLM215 | 2.0 ±0.1 | 1.25 ±0.1 | 0.5 +0.05/-0.1 | 0.5 ±0.05 |
| LLM219 | 2.0 ±0.1 | 1.25 ±0.1 | 0.85 ±0.1 | 0.5 ±0.05 |
| LLM315 | 3.2 ±0.15 | 1.6 ±0.15 | 0.5 +0.05/-0.1 | 0.8 ±0.1 |
| LLM31M | 3.2 ±0.15 | 1.6 ±0.15 | 1.15 ±0.1 | 0.8 ±0.1 |

Ten Terminals Low ESL Type


| Part Number | LLM21 | | | | LLM31 | | |
|------------------------------------------------------------------------------------------------------|--------------|------------|-------------|-----------|--------------|------------|-------------|
| | L x W | | | | | | |
| | 2.0x1.25 | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | X7S (C7) | | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 10000pF(103) | 0.85(9) | | | | | | |
| 15000pF(153) | 0.85(9) | | | | | | |
| 22000pF(223) | 0.85(9) | | | | | | |
| 33000pF(333) | 0.85(9) | | | | | | |
| 47000pF(473) | 0.85(9) | | | | | | |
| 68000pF(683) | | 0.85(9) | | | | | |
| 0.10μF(104) | | 0.85(9) | | | 1.15(M) | | |
| 0.15μF(154) | | 0.85(9) | | | 1.15(M) | | |
| 0.22μF(224) | | 0.85(9) | | | 1.15(M) | | |
| 0.33μF(334) | | | 0.85(9) | | 1.15(M) | | |
| 0.47μF(474) | | | 0.85(9) | | 1.15(M) | | |
| 0.68μF(684) | | | 0.85(9) | | 1.15(M) | | |
| 1.0μF(105) | | | 0.85(9) | | 1.15(M) | | |
| 1.5μF(155) | | | 0.85(9) | | | 1.15(M) | |
| 2.2μF(225) | | | | 0.85(9) | | 1.15(M) | |
| 3.3μF(335) | | | | | | | 1.15(M) |
| 4.7μF(475) | | | | | | | 1.15(M) |

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

Ten Terminals Low ESL Type Low Profile

| Part Number | LLM21 | | | | LLM31 | | |
|------------------------------------------------------------------------------------------------------|--------------|------------|-------------|-----------|--------------|------------|-------------|
| | L x W | | | | | | |
| | 2.0x1.25 | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | X7S (C7) | | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 10000pF(103) | 0.5(5) | | | | | | |
| 15000pF(153) | 0.5(5) | | | | | | |
| 22000pF(223) | 0.5(5) | | | | | | |
| 33000pF(333) | | 0.5(5) | | | | | |
| 47000pF(473) | | 0.5(5) | | | | | |
| 68000pF(683) | | 0.5(5) | | | | | |
| 0.10μF(104) | | 0.5(5) | | | 0.5(5) | | |
| 0.15μF(154) | | | 0.5(5) | | 0.5(5) | | |

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| Part Number | LLM21 | | | | LLM31 | | |
|------------------------------------------------------------------------------------------------------|-------------|------------|-------------|-------------|-------------|------------|-------------|
| L x W | 2.0x1.25 | | | | 3.2x1.6 | | |
| TC | X7R (R7) | | | X7S (C7) | X7R (R7) | | |
| Rated Volt. | 25 (1E) | 16 (1C) | 6.3 (0J) | 4 (0G) | 16 (1C) | 10 (1A) | 6.3 (0J) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | |
| 0.22μF(224) | | | 0.5(5) | | 0.5(5) | | |
| 0.33μF(334) | | | 0.5(5) | | | 0.5(5) | |
| 0.47μF(474) | | | 0.5(5) | | | 0.5(5) | |
| 0.68μF(684) | | | 0.5(5) | | | 0.5(5) | |
| 1.0μF(105) | | | | 0.5(5) | | | |
| 1.5μF(155) | | | | 0.5(5) | | | |
| 2.2μF(225) | | | | 0.5(5) | | | 0.5(5) |

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 | R6 : -55 to +85°C R7, C7 : -55 to +125°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 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 | 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°C and 75%RH max. and within 2 minutes of charging. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Dissipation Factor (D.F.) | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>C≤10μF (10V min.)</td> <td>1±0.1kHz</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td>C≤10μF (6.3V max.)</td> <td>1±0.1kHz</td> <td>0.5±0.1Vrms</td> </tr> <tr> <td>C>10μF</td> <td>120±24kHz</td> <td>0.5±0.1Vrms</td> </tr> </tbody> </table> | Capacitance | Frequency | Voltage | C≤10μF (10V min.) | 1±0.1kHz | 1.0±0.2Vrms | C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | C>10μF | 120±24kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | |
| | | | Capacitance | Frequency | Voltage | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (10V min.) | 1±0.1kHz | 1.0±0.2Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C≤10μF (6.3V max.) | 1±0.1kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C>10μF | 120±24kHz | 0.5±0.1Vrms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | <table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range (°C)</th> <th>Reference Temp.</th> <th>Cap.Change</th> </tr> </thead> <tbody> <tr> <td>R6</td> <td>-55 to +85</td> <td>25°C</td> <td>Within ±15%</td> </tr> <tr> <td>R7</td> <td>-55 to +125</td> <td>25°C</td> <td>Within ±15%</td> </tr> <tr> <td>C7</td> <td>-55 to +125</td> <td>25°C</td> <td>Within ±22%</td> </tr> </tbody> </table> | Char. | Temp. Range (°C) | Reference Temp. | Cap.Change | R6 | -55 to +85 | 25°C | Within ±15% | R7 | -55 to +125 | 25°C | Within ±15% | C7 | -55 to +125 | 25°C | Within ±22% | <p>The capacitance change should be measured after 5 min. at each specified temperature stage.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>25±2</td> </tr> <tr> <td>4</td> <td>125±3</td> </tr> <tr> <td>5</td> <td>25±2</td> </tr> </tbody> </table> <p>The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should be within the specified ranges.</p> | Step | Temperature (°C) | 1 | 25±2 | 2 | -55±3 | 3 | 25±2 | 4 | 125±3 | 5 | 25±2 |
| Char. | Temp. Range (°C) | Reference Temp. | Cap.Change | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R6 | -55 to +85 | 25°C | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R7 | -55 to +125 | 25°C | Within ±15% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C7 | -55 to +125 | 25°C | Within ±22% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Step | Temperature (°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | -55±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 125±3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 25±2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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) using a eutectic solder. Then apply 5N 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. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | D.F. | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C, or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | Resistance to Soldering Heat | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±7.5% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | D.F. | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | No failure | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | <p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 48±4 hours, then measure.</p> <ul style="list-style-type: none"> Initial measurement. <p>Perform a heat treatment at 150±9.0°C for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Continued on the following page. 

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | |
|------|-------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------|------------------------------|------------|---|------------|------------------------------|------------|------------------------------|------------|-------------|------|--------|------|--------|
| 14 | Temperature Cycle | Appearance | 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. <table border="1" style="margin: 10px 0;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. ± 3</td> <td>Room Temp.</td> <td>Max. Operating Temp. ± 3</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> </tbody> </table> | Step | 1 | 2 | 3 | 4 | Temp. (°C) | Min. Operating Temp. ± 3 | Room Temp. | Max. Operating Temp. ± 3 | Room Temp. | Time (min.) | 30±3 | 2 to 3 | 30±3 | 2 to 3 |
| | | Step | | 1 | 2 | 3 | 4 | | | | | | | | | | | |
| | | Temp. (°C) | | Min. Operating Temp. ± 3 | Room Temp. | Max. Operating Temp. ± 3 | Room Temp. | | | | | | | | | | | |
| | | Time (min.) | | 30±3 | 2 to 3 | 30±3 | 2 to 3 | | | | | | | | | | | |
| | | Capacitance Change | | Within ±7.5% *1 | | | | | | | | | | | | | | |
| D.F. | W.V.: 25V min.; 0.025 max. W.V.: 16V max.; 0.035 max. *1 | | | | | | | | | | | | | | | | | |
| I.R. | More than 10,000MΩ or 500Ω · F (Whichever is smaller) | | | | | | | | | | | | | | | | | |
| | Dielectric Strength | No failure | | | | | | | | | | | | | | | | |
| 15 | Humidity (Steady State) | Appearance | Sit the capacitor at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 48±4 hours at room temperature, then measure. | | | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±12.5% *1 | | | | | | | | | | | | | | |
| | | D.F. | | 0.05 max. *1 | | | | | | | | | | | | | | |
| | | I.R. | | More than 1,000MΩ or 50Ω · F (Whichever is smaller) | | | | | | | | | | | | | | |
| 16 | Humidity Load | Appearance | Apply the rated voltage at 40±2°C 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 | | Within ±12.5% *1 | | | | | | | | | | | | | | |
| | | D.F. | | 0.05 max. *1 | | | | | | | | | | | | | | |
| | | I.R. | | More than 500MΩ or 25Ω · F *1 (Whichever is smaller) | | | | | | | | | | | | | | |
| | | Dielectric Strength | | No failure | | | | | | | | | | | | | | |
| 17 | High Temperature Load | Appearance | Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 48±4 hours at room temperature, then measure. The charge/discharge current is less than 50mA. <p>•Initial measurement. Apply 200% (*2) of the rated DC voltage for one hour at the maximum operating temperature ±3°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement. (*1)</p> | | | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±12.5% *1 | | | | | | | | | | | | | | |
| | | D.F. | | W.V.: 25V min.; 0.04 max. W.V.: 16V max.; 0.05 max. *1 | | | | | | | | | | | | | | |
| | | I.R. | | More than 1,000MΩ or 50Ω · F *1 (Whichever is smaller) | | | | | | | | | | | | | | |
| | | Dielectric Strength | | No failure | | | | | | | | | | | | | | |

*1 : The figure Indicates typical inspection. Please refer to individual specifications.

*2 : Some of the parts are applicable in rated voltage×150%. Please refer to individual specifications.

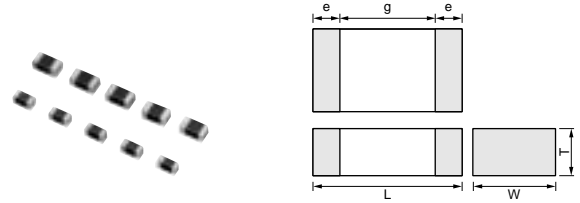
Chip Monolithic Ceramic Capacitors

High Frequency for Flow/Reflow Soldering GQM Series



■ Features

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



■ Applicatons

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 | |
|------------------------------------------------------------------------------------------------------|--------------|---------|--------------|---------|
| | 1.60x0.80 | | 2.00x1.25 | |
| L x W | COG (5C) | | COG (5C) | |
| TC | COG (5C) | | COG (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(50) | 0.80(8) | | 0.85(9) | |
| 0.75pF(75) | 0.80(8) | | 0.85(9) | |
| 1.0pF(10) | 0.80(8) | | 0.85(9) | |
| 1.1pF(11) | 0.80(8) | | 0.85(9) | |
| 1.2pF(12) | 0.80(8) | | 0.85(9) | |
| 1.3pF(13) | 0.80(8) | | 0.85(9) | |
| 1.5pF(15) | 0.80(8) | | 0.85(9) | |
| 1.6pF(16) | 0.80(8) | | 0.85(9) | |
| 1.8pF(18) | 0.80(8) | | 0.85(9) | |
| 2.0pF(20) | 0.80(8) | | 0.85(9) | |
| 2.2pF(22) | 0.80(8) | | 0.85(9) | |
| 2.4pF(24) | 0.80(8) | | 0.85(9) | |
| 2.7pF(27) | 0.80(8) | | 0.85(9) | |
| 3.0pF(30) | 0.80(8) | | 0.85(9) | |
| 3.3pF(33) | 0.80(8) | | 0.85(9) | |
| 3.6pF(36) | 0.80(8) | | 0.85(9) | |
| 3.9pF(39) | 0.80(8) | | 0.85(9) | |
| 4.0pF(40) | 0.80(8) | | 0.85(9) | |
| 4.3pF(43) | 0.80(8) | | 0.85(9) | |
| 4.7pF(47) | 0.80(8) | | 0.85(9) | |
| 5.0pF(50) | 0.80(8) | | 0.85(9) | |
| 5.1pF(51) | 0.80(8) | | 0.85(9) | |
| 5.6pF(56) | 0.80(8) | | 0.85(9) | |
| 6.0pF(60) | 0.80(8) | | 0.85(9) | |
| 6.2pF(62) | 0.80(8) | | 0.85(9) | |
| 6.8pF(68) | 0.80(8) | | 0.85(9) | |
| 7.0pF(70) | | 0.80(8) | 0.85(9) | |
| 7.5pF(75) | | 0.80(8) | 0.85(9) | |
| 8.0pF(80) | | 0.80(8) | 0.85(9) | |
| 8.2pF(82) | | 0.80(8) | 0.85(9) | |
| 9.0pF(90) | | 0.80(8) | 0.85(9) | |
| 9.1pF(91) | | 0.80(8) | 0.85(9) | |
| 10pF(100) | | 0.80(8) | 0.85(9) | |

13

Continued on the following page.

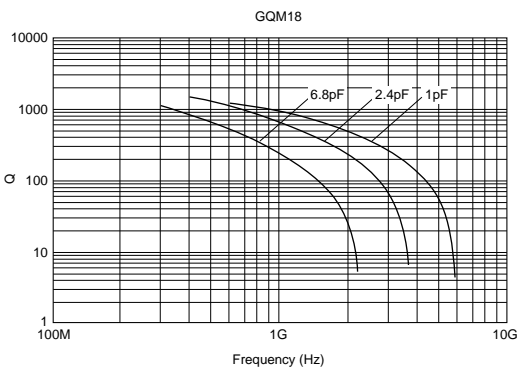


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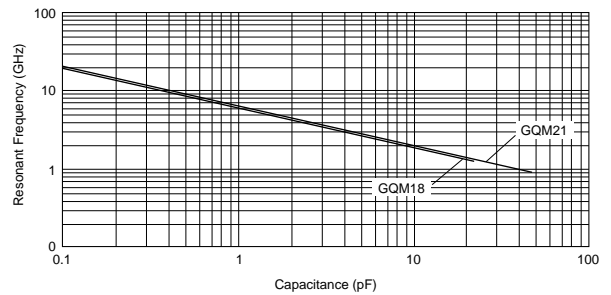
| Part Number | GQM18 | | GQM21 | |
|------------------------------------------------------------------------------------------------------|-------------|------------|-------------|------------|
| L x W | 1.60x0.80 | | 2.00x1.25 | |
| TC | COG (5C) | | COG (5C) | |
| Rated Volt. | 100 (2A) | 50 (1H) | 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) | | 0.80(8) | | 0.85(9) |
| 30pF(300) | | 0.80(8) | | 0.85(9) |
| 33pF(330) | | 0.80(8) | | 0.85(9) |
| 36pF(360) | | 0.80(8) | | 0.85(9) |
| 39pF(390) | | 0.80(8) | | 0.85(9) |
| 43pF(430) | | 0.80(8) | | 0.85(9) |
| 47pF(470) | | 0.80(8) | | 0.85(9) |
| 51pF(510) | | 0.80(8) | | 0.85(9) |
| 56pF(560) | | 0.80(8) | | 0.85(9) |
| 62pF(620) | | 0.80(8) | | 0.85(9) |
| 68pF(680) | | 0.80(8) | | 0.85(9) |
| 75pF(750) | | 0.80(8) | | 0.85(9) |
| 82pF(820) | | 0.80(8) | | 0.85(9) |
| 91pF(910) | | 0.80(8) | | 0.85(9) |
| 100pF(101) | | 0.80(8) | | 0.85(9) |

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

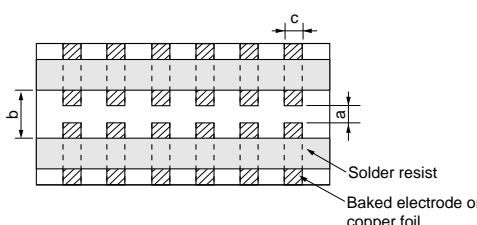
■ Q-Frequency Characteristics



■ Resonant Frequency-Capacitance



Specifications and Test Methods

| No. | Item | Specifications | Test Method | | | | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|---------|--------------|--------------------|---|-------|---|--------------------|
| 1 | Operating Temperature | -55 to 125°C | Reference Temperature : 25°C (2C, 3C, 4C : 20°C) | | | | | | | | | |
| 2 | Rated Voltage | See the previous page. | 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 | 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 (Whichever is smaller) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging. | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | The capacitance/Q should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | | |
| 8 | Q | 30pF min. : $Q \geq 1400$ 30pF max. : $Q \geq 800+20C$ C : Nominal Capacitance (pF) | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Frequency</td> <td style="width: 50%;">1±0.1MHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> </tr> </table> | Frequency | 1±0.1MHz | Voltage | 0.5 to 5Vrms | | | | | |
| | | Frequency | 1±0.1MHz | | | | | | | | | |
| Voltage | 0.5 to 5Vrms | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Step</th> <th style="width: 50%;">Temperature (°C)</th> </tr> <tr> <td>1</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>2</td> <td>-55±3</td> </tr> <tr> <td>3</td> <td>Reference Temp. ±2</td> </tr> <tr> <td>4</td> <td>125±3</td> </tr> <tr> <td>5</td> <td>Reference Temp. ±2</td> </tr> </table> | Step | Temperature (°C) | 1 | Reference Temp. ±2 | 2 | -55±3 | 3 | Reference Temp. ±2 | 4 | 125±3 | 5 | Reference Temp. ±2 |
| Step | Temperature (°C) | | | | | | | | | | | |
| 1 | Reference Temp. ±2 | | | | | | | | | | | |
| 2 | -55±3 | | | | | | | | | | | |
| 3 | Reference Temp. ±2 | | | | | | | | | | | |
| 4 | 125±3 | | | | | | | | | | | |
| 5 | Reference Temp. ±2 | | | | | | | | | | | |
| 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. 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. 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±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. *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). 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 30pF min. : $Q \geq 1400$ 30pF max. : $Q \geq 800+20C$ C : Nominal Capacitance (pF) | | | | | | | | | | |

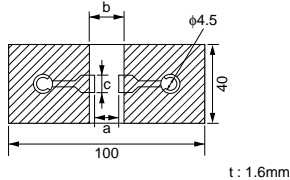
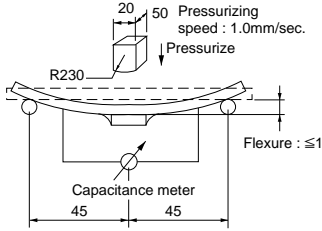
| Type | a | b | c |
|-------|-----|-----|------|
| GQM18 | 1.0 | 3.0 | 1.2 |
| GQM21 | 1.2 | 4.0 | 1.65 |

(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 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. | | | | | | | | | | | | | | |
| | |  <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GQM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GQM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> </tbody> </table> <p style="text-align: center;">(in mm)</p> <p style="text-align: center;">Fig. 2</p> | | Type | a | b | c | GQM18 | 1.0 | 3.0 | 1.2 | GQM21 | 1.2 | 4.0 | 1.65 | | |
| Type | a | b | c | | | | | | | | | | | | | | |
| GQM18 | 1.0 | 3.0 | 1.2 | | | | | | | | | | | | | | |
| GQM21 | 1.2 | 4.0 | 1.65 | | | | | | | | | | | | | | |
| | |  <p style="text-align: center;">Fig. 3</p> | | | | | | | | | | | | | | | |
| 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°C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C. | | | | | | | | | | | | | | |
| 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°C for 1 minute. Immerse the capacitor in a eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours. | | | | | | | | | | | | | | |
| | | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Appearance</td> <td>No marking defects</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±2.5% or ±0.25 pF (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td>30pF min. : Q ≥ 1400 30pF max. : Q ≥ 800+20C C : Nominal Capacitance (pF)</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </table> | | Appearance | No marking defects | Capacitance Change | Within ±2.5% or ±0.25 pF (Whichever is larger) | Q | 30pF min. : Q ≥ 1400 30pF max. : Q ≥ 800+20C C : Nominal Capacitance (pF) | I.R. | More than 10,000MΩ | Dielectric Strength | No failure | | | | |
| | | Appearance | | No marking defects | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±2.5% or ±0.25 pF (Whichever is larger) | | | | | | | | | | | | | |
| | | Q | | 30pF min. : Q ≥ 1400 30pF max. : Q ≥ 800+20C C : Nominal Capacitance (pF) | | | | | | | | | | | | | |
| I.R. | More than 10,000MΩ | | | | | | | | | | | | | | | | |
| 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 at room temperature, then measure. | | | | | | | | | | | | | | |
| | | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Appearance</td> <td>No marking defects</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±2.5% or ±0.25pF (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td>30pF min. : Q ≥ 1400 30pF max. : Q ≥ 800+20C C : Nominal Capacitance (pF)</td> </tr> <tr> <td>I.R.</td> <td>More than 10,000MΩ</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </table> | | Appearance | No marking defects | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | Q | 30pF min. : Q ≥ 1400 30pF max. : Q ≥ 800+20C C : Nominal Capacitance (pF) | I.R. | More than 10,000MΩ | Dielectric Strength | No failure | | | | |
| | | Appearance | | No marking defects | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | | | |
| | | Q | | 30pF min. : Q ≥ 1400 30pF max. : Q ≥ 800+20C C : Nominal Capacitance (pF) | | | | | | | | | | | | | |
| I.R. | More than 10,000MΩ | | | | | | | | | | | | | | | | |
| Dielectric Strength | No failure | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | <table border="1" style="margin: 0 auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 15%;">Step</th> <th style="width: 15%;">1</th> <th style="width: 15%;">2</th> <th style="width: 15%;">3</th> <th style="width: 15%;">4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</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> </tbody> </table> | Step | 1 | 2 | 3 | 4 | Temp. (°C) | 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 |
| Step | 1 | 2 | 3 | 4 | | | | | | | | | | | | | |
| Temp. (°C) | 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 | | | | | | | | | | | | | |
| 16 | Humidity Steady State | The measured and observed characteristics should satisfy the specifications in the following table. | Let the capacitor sit at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. | | | | | | | | | | | | | | |
| | | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Appearance</td> <td>No marking defects</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±5% or ±0.5pF (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td>30pF min. : Q ≥ 350 10pF and over, 30pF and below : Q ≥ 275+5C/2 10pF max. : Q ≥ 200+10C C : Nominal Capacitance (pF)</td> </tr> <tr> <td>I.R.</td> <td>More than 1,000MΩ</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </table> | | Appearance | No marking defects | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | Q | 30pF min. : Q ≥ 350 10pF and over, 30pF and below : Q ≥ 275+5C/2 10pF max. : Q ≥ 200+10C C : Nominal Capacitance (pF) | I.R. | More than 1,000MΩ | Dielectric Strength | No failure | | | | |
| | | Appearance | | No marking defects | | | | | | | | | | | | | |
| | | Capacitance Change | | Within ±5% or ±0.5pF (Whichever is larger) | | | | | | | | | | | | | |
| | | Q | | 30pF min. : Q ≥ 350 10pF and over, 30pF and below : Q ≥ 275+5C/2 10pF max. : Q ≥ 200+10C C : Nominal Capacitance (pF) | | | | | | | | | | | | | |
| I.R. | More than 1,000MΩ | | | | | | | | | | | | | | | | |
| Dielectric Strength | No failure | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |

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°C 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. : $Q \geq 200$ 30pF max. : $Q \geq 100 + 10C/3$ C : Nominal Capacitance (pF) |
| | | I.R. | | More than 500MΩ |
| | 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°C. Let sit for 24±2 hours (temperature compensating type) at room temperature, then measure. 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. : $Q \geq 350$ 10pF and over, 30pF and below : $Q \geq 275 + 5C/2$ 10pF max. : $Q \geq 200 + 10C$ C : Nominal Capacitance (pF) |
| | | I.R. | | More than 1,000MΩ |
| | Dielectric Strength | No failure | | |

Table A
(1)

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

*1 : Nominal values denote the temperature coefficient within a range of 25 to 125°C.

Chip Monolithic Ceramic Capacitors

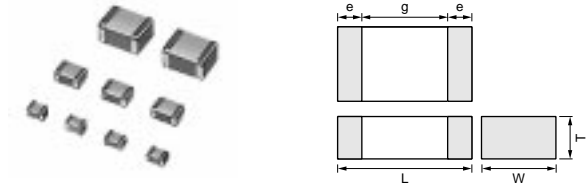


High Frequency Type ERB Series

SMD Type

■ Features (ERB 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 ERB series improve solderability and decrease solder leaching.
3. ERB18/21 series are designed for both flow and reflow soldering and ERB32 series are designed for reflow soldering.



| Part Number | Dimensions (mm) | | | | |
|---------------|-----------------|----------|--------|--------|--------|
| | L | W | T max. | e min. | g min. |
| ERB188 | 1.6±0.1 | 0.8±0.1 | 0.9 | 0.2 | 0.5 |
| ERB21B | 2.0±0.3 | 1.25±0.3 | 1.35 | 0.25 | 0.7 |
| ERB32Q | 3.2±0.3 | 2.5±0.3 | 1.7 | 0.3 | 1.0 |

■ Applications

High frequency and high-power circuits

| Part Number | ERB18 | | ERB21 | | | ERB32 | | | |
|------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|------------|
| L x W | 1.6x0.8 | | 2.0x1.25 | | | 3.2x2.5 | | | |
| TC | COG (5C) | | COG (5C) | | | COG (5C) | | | |
| Rated Volt. | 250 (2E) | 250 (2E) | 100 (2A) | 50 (1H) | 500 (2H) | 300 (YD) | 250 (2E) | 100 (2A) | 50 (1H) |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | |
| 0.50pF(R50) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 0.75pF(R75) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 1.0pF(1R0) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 1.1pF(1R1) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 1.2pF(1R2) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 1.3pF(1R3) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 1.5pF(1R5) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 1.6pF(1R6) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 1.8pF(1R8) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 2.0pF(2R0) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 2.2pF(2R2) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 2.4pF(2R4) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 2.7pF(2R7) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 3.0pF(3R0) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 3.3pF(3R3) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 3.6pF(3R6) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 3.9pF(3R9) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 4.3pF(4R3) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 4.7pF(4R7) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 5.1pF(5R1) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 5.6pF(5R6) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 6.2pF(6R2) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 6.8pF(6R8) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 7.5pF(7R5) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 8.2pF(8R2) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 9.1pF(9R1) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 10pF(100) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 11pF(110) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 12pF(120) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |
| 13pF(130) | 0.8(B) | 1.25(B) | | | 1.50(Q) | | | | |

Continued on the following page.

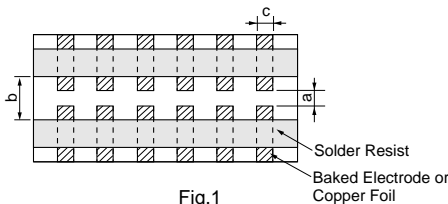
Continued from the preceding page.

| Part Number | ERB18 | | ERB21 | | | ERB32 | | | | |
|------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|------------|--|
| L x W | 1.6x0.8 | | 2.0x1.25 | | | 3.2x2.5 | | | | |
| TC | COG (5C) | | COG (5C) | | | COG (5C) | | | | |
| Rated Volt. | 250 (2E) | 250 (2E) | 100 (2A) | 50 (1H) | 500 (2H) | 300 (YD) | 250 (2E) | 100 (2A) | 50 (1H) | |
| Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code) | | | | | | | | | | |
| 15pF(150) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 16pF(160) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 18pF(180) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 20pF(200) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 22pF(220) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 24pF(240) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 27pF(270) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 30pF(300) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 33pF(330) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 36pF(360) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 39pF(390) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 43pF(430) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 47pF(470) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 51pF(510) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 56pF(560) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 62pF(620) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 68pF(680) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 75pF(750) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 82pF(820) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 91pF(910) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 100pF(101) | 0.8(8) | 1.25(B) | | | 1.50(Q) | | | | | |
| 120pF(121) | | | 1.25(B) | | 1.50(Q) | | | | | |
| 130pF(131) | | | 1.25(B) | | | 1.50(Q) | | | | |
| 150pF(151) | | | | 1.25(B) | | 1.50(Q) | | | | |
| 160pF(161) | | | | 1.25(B) | | | 1.50(Q) | | | |
| 180pF(181) | | | | | | | 1.50(Q) | | | |
| 200pF(201) | | | | | | | 1.50(Q) | | | |
| 220pF(221) | | | | | | | 1.50(Q) | | | |
| 240pF(241) | | | | | | | | 1.50(Q) | | |
| 270pF(271) | | | | | | | | 1.50(Q) | | |
| 300pF(301) | | | | | | | | 1.50(Q) | | |
| 330pF(331) | | | | | | | | 1.50(Q) | | |
| 360pF(361) | | | | | | | | 1.50(Q) | | |
| 390pF(391) | | | | | | | | 1.50(Q) | | |
| 430pF(431) | | | | | | | | 1.50(Q) | | |
| 470pF(471) | | | | | | | | 1.50(Q) | | |
| 510pF(511) | | | | | | | | | 1.50(Q) | |
| 560pF(561) | | | | | | | | | 1.50(Q) | |
| 620pF(621) | | | | | | | | | 1.50(Q) | |
| 680pF(681) | | | | | | | | | 1.50(Q) | |
| 750pF(751) | | | | | | | | | 1.50(Q) | |
| 820pF(821) | | | | | | | | | 1.50(Q) | |
| 910pF(911) | | | | | | | | | 1.50(Q) | |
| 1000pF(102) | | | | | | | | | 1.50(Q) | |

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

14

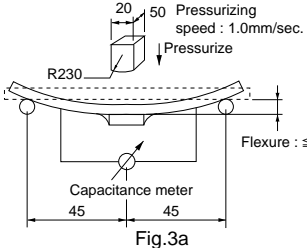
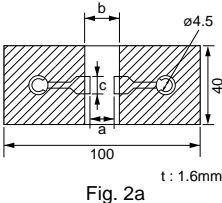
Specifications and Test Methods

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | |
|--------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------|---------|-----------|--------------|-----|-----|-----|--------------|-----|-----|------|--------------|-----|-----|-----|
| 1 | Operating Temperature Range | -55 to +125°C | Reference Temperature: 25°C | | | | | | | | | | | | | | | | |
| 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 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. (*) 300V: 250%, 500V: 200% | | | | | | | | | | | | | | | | |
| 6 | Insulation Resistance (I.R.) | 1,000,000MΩ min. (C≥470pF) 100,000MΩ min. (C>470pF) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and standard humidity and within 2 minutes of charging. | | | | | | | | | | | | | | | | |
| 7 | Capacitance | Within the specified tolerance | The capacitance/Q should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | | | | | | | | | |
| 8 | Q | $C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ C : Nominal Capacitance (pF) | <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Frequency</td> <td>1±0.1MHz</td> </tr> <tr> <td>Voltage</td> <td>1±0.2Vrms</td> </tr> </table> | Frequency | 1±0.1MHz | Voltage | 1±0.2Vrms | | | | | | | | | | | | |
| Frequency | 1±0.1MHz | | | | | | | | | | | | | | | | | | |
| Voltage | 1±0.2Vrms | | | | | | | | | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | Capacitance Change | 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. 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 | | | | | | | | | | | | | | | | | |
| | | Capacitance Drift | | Within ±0.2% or ±0.05pF (Whichever is larger) | | | | | | | | | | | | | | | |
| 10 | Adhesive Strength of Termination | No removal of the terminations or other defects should occur. | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1 using an 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. | | | | | | | | | | | | | | | | |
| | |  <p style="text-align: center;">Fig.1</p> | | | | | | | | | | | | | | | | | |
| | | | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>ERB18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>ERB21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>ERB32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> </tbody> </table> <p style="text-align: right;">(in mm) *5N (ERB188)</p> | Type | a | b | c | ERB18 | 1.0 | 3.0 | 1.2 | ERB21 | 1.2 | 4.0 | 1.65 | ERB32 | 2.2 | 5.0 | 2.9 |
| Type | a | b | c | | | | | | | | | | | | | | | | |
| ERB18 | 1.0 | 3.0 | 1.2 | | | | | | | | | | | | | | | | |
| ERB21 | 1.2 | 4.0 | 1.65 | | | | | | | | | | | | | | | | |
| ERB32 | 2.2 | 5.0 | 2.9 | | | | | | | | | | | | | | | | |

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

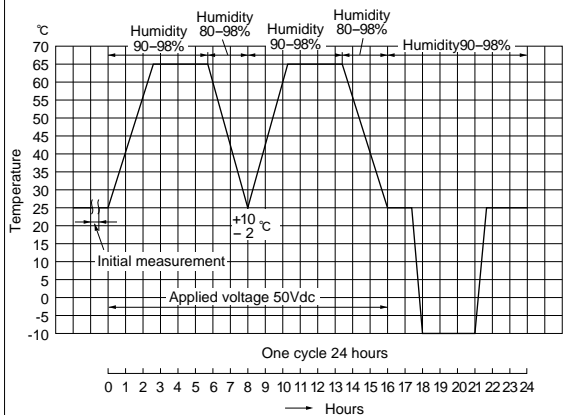
| No. | Item | Specifications | Test Method | | | | | | | | | |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------|------------|------------------|--------------------|-----------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 11 | 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 | | | | | | | | | | |
| | Q | Satisfies the initial value. $C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ C : Nominal Capacitance (pF) | | | | | | | | | | |
| 12 | Deflection | No crack or marked defect should occur. | Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a. 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 | 95% of the terminations are to be soldered evenly and continuously. | Immerse the capacitor in a solution of isopropyl alcohol and rosin (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution for 5±0.5 seconds at 245±5°C. | | | | | | | | | |
| 14 | Resistance to Soldering Heat | The measured and observed characteristics should satisfy the specifications in the following table. | Preheat according to the conditions listed in the table below. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours. | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Item</th> <th>Specifications</th> </tr> </thead> <tbody> <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>$C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> C : Nominal Capacitance (pF) | | Item | Specifications | Appearance | No marked defect | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | Q | $C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ | Dielectric Strength |
| Item | Specifications | | | | | | | | | | | |
| Appearance | No marked defect | | | | | | | | | | | |
| Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | |
| Q | $C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ | | | | | | | | | | | |
| 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 at room temperature, then measure. | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Item</th> <th>Specifications</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±5% or ±0.5pF (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td>$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$</td> </tr> <tr> <td>I.R.</td> <td>1,000MΩ min.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> C : Nominal Capacitance (pF) | | Item | Specifications | Appearance | No marked defect | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | Q | $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$ | I.R. |
| Item | Specifications | | | | | | | | | | | |
| Appearance | No marked defect | | | | | | | | | | | |
| Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | | | | | | | | | | | |
| Q | $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$ | | | | | | | | | | | |
| I.R. | 1,000MΩ min. | | | | | | | | | | | |
| Dielectric Strength | No failure | | | | | | | | | | | |
| 16 | Humidity | The measured and observed characteristics should satisfy the specifications in the following table. | Apply the 24-hour heat (-10 to +65°C) and humidity (80 to 100%) treatment shown below, 10 consecutive times. Remove, let sit for 24±2 hours at room temperature, and measure. | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Item</th> <th>Specifications</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±5% or ±0.5pF (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td>$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$</td> </tr> <tr> <td>I.R.</td> <td>1,000MΩ min.</td> </tr> </tbody> </table> C : Nominal Capacitance (pF) | | Item | Specifications | Appearance | No marked defect | Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | Q | $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$ | I.R. |
| Item | Specifications | | | | | | | | | | | |
| Appearance | No marked defect | | | | | | | | | | | |
| Capacitance Change | Within ±5% or ±0.5pF (Whichever is larger) | | | | | | | | | | | |
| Q | $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$ | | | | | | | | | | | |
| I.R. | 1,000MΩ min. | | | | | | | | | | | |

| Type | a | b | c |
|-------|-----|-----|------|
| ERB18 | 1.0 | 3.0 | 1.2 |
| ERB21 | 1.2 | 4.0 | 1.65 |
| ERB32 | 2.2 | 5.0 | 2.9 |

(in mm)

| Chip Size | Preheat Condition |
|-----------------|-----------------------------------------------------|
| 2.0x1.25mm max. | 1minute at 120 to 150°C |
| 3.2x2.5mm | Each 1 minute at 100 to 120°C and then 170 to 200°C |

| Step | 1 | 2 | 3 | 4 |
|-------------|----------------------------|------------|----------------------------|------------|
| Temp. (°C) | Min. Operating Temp. +0/-3 | Room Temp. | Max. Operating Temp. +3/-0 | Room Temp. |
| Time (min.) | 30±3 | 5 max. | 30±3 | 5 max. |



Continued on the following page. ↗

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|------------|------------------|--------------------|--------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------|------|----------------------|---------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 | High Temperature Load | <p>The measured and observed characteristics should satisfy the specifications in the following table.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 5px;"> <thead> <tr> <th style="width: 30%;">Item</th> <th style="width: 70%;">Specifications</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td>$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$</td> </tr> <tr> <td>I.R.</td> <td>1,000MΩ min.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> <p style="text-align: right; margin-right: 50px;">C : Nominal Capacitance (pF)</p> | Item | Specifications | Appearance | No marked defect | Capacitance Change | Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger) | Q | $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$ | I.R. | 1,000M Ω min. | Dielectric Strength | No failure | <p>Apply 200% (500V only 150%) of the rated voltage for 1,000\pm12 hours at 125\pm3$^{\circ}$C. Remove and let sit for 24\pm2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p> |
| Item | Specifications | | | | | | | | | | | | | | |
| Appearance | No marked defect | | | | | | | | | | | | | | |
| Capacitance Change | Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger) | | | | | | | | | | | | | | |
| Q | $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$ | | | | | | | | | | | | | | |
| I.R. | 1,000M Ω min. | | | | | | | | | | | | | | |
| Dielectric Strength | No failure | | | | | | | | | | | | | | |

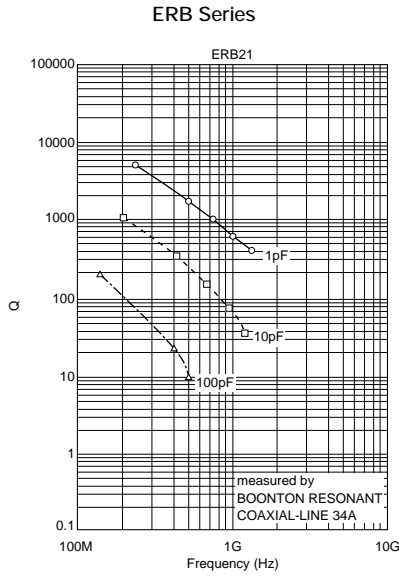
Table A-6

| Char. | Nominal Values (ppm/ $^{\circ}$ C) Note 1 | Capacitance Change from 25 $^{\circ}$ C (%) | | | | | |
|-------|-------------------------------------------|---------------------------------------------|-------|------|-------|------|-------|
| | | -55 | | -30 | | -10 | |
| | | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0 \pm 30 | 0.58 | -0.24 | 0.40 | -0.17 | 0.25 | -0.11 |

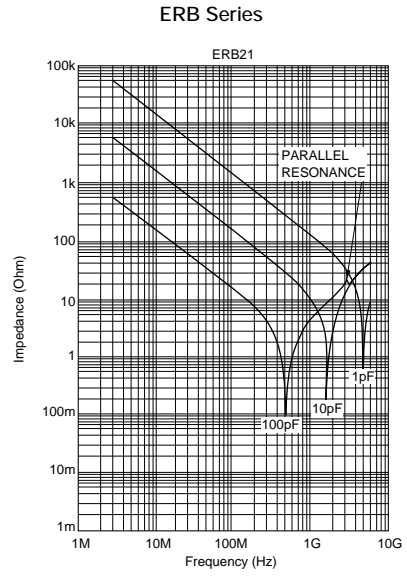
Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125 $^{\circ}$ C (for 5C)

ERB Series Data

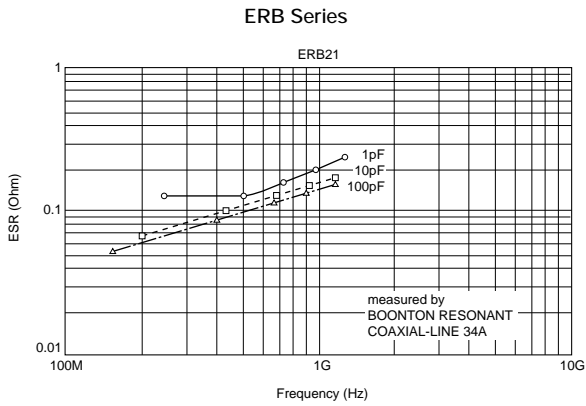
■ Q-Frequency Characteristics



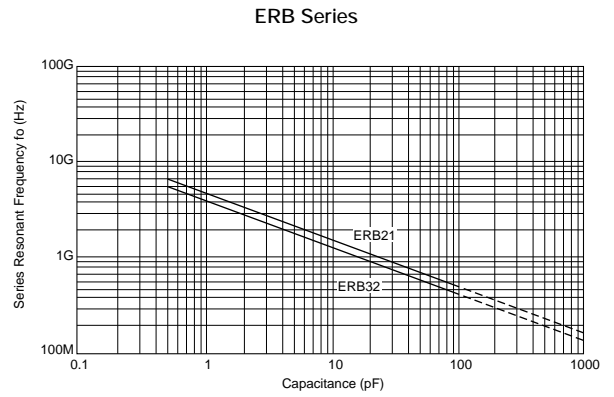
■ Impedance-Frequency Characteristics



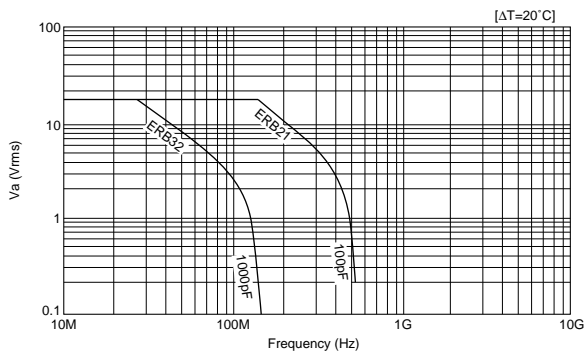
■ ESR-Frequency Characteristics



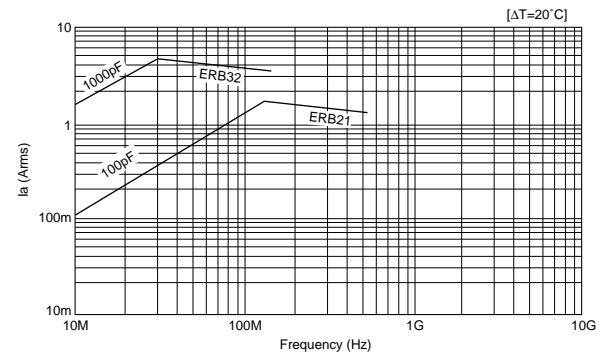
■ Resonant Frequency-Capacitance



■ Allowable Voltage-Frequency



■ Allowable Current-Frequency

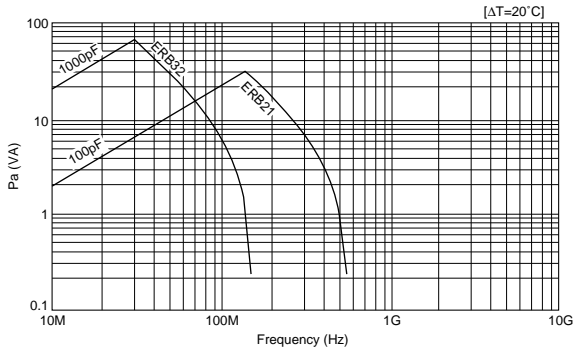


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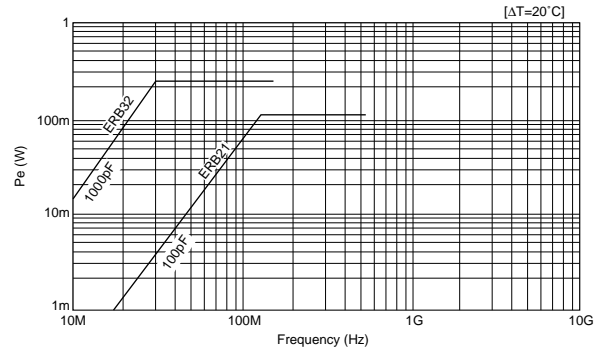
ERB Series Data

Continued from the preceding page.

■ 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 | 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 | Embossed Tape | Paper Tape | Embossed Tape | | | |
| Ultra Miniaturized | GRM02 | 0.4 | 0.2 | 0.2 | 20,000 | - | - | - | - | - | |
| | 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 | |
| | | | | 0.6 | 4,000 | - | 10,000 | - | 10,000 | 1,000 | |
| | GRM21 | 2.0 | 1.25 | 0.85/1.0 | 4,000 | - | 10,000 | - | - | 1,000 | |
| | | | | 1.25 | - | 3,000 | - | 10,000 | 5,000 ²⁾ | 1,000 | |
| | GRM31 | 3.2 | 1.6 | 0.6/0.85 | 4,000 | - | 10,000 | - | - | 1,000 | |
| | | | | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 | |
| | | | 1.6 | - | 2,000 | - | 6,000 | - | 1,000 | | |
| For Reflow | GRM15X | 1.0 | 0.5 | 0.25 | 10,000 | - | 50,000 | - | - | 1,000 | |
| | GRM155 | 1.0 | 0.5 | 0.5 | 10,000 | - | 50,000 | - | 50,000 | 1,000 | |
| | GRM32 | 3.2 | 2.5 | 0.85 | - | 4,000 | - | 10,000 | - | - | 1,000 |
| | | | | 1.15 | - | 3,000 | - | 10,000 | - | - | 1,000 |
| | | | | 1.35 | - | 2,000 | - | 8,000 | - | - | 1,000 |
| | | | | 1.6 | - | 2,000 | - | 6,000 | - | - | 1,000 |
| | GRM43 | 4.5 | 3.2 | 1.8/2.0 | - | 1,000 | - | 4,000 | - | - | 1,000 |
| | | | | 2.5 | - | 1,000 | - | 5,000 | - | - | 1,000 |
| | | | | 1.35/1.6 | - | 1,000 | - | 4,000 | - | - | 1,000 |
| | | | | 1.8/2.0 | - | 500 | - | 2,000 | - | - | 1,000 |
| | GRM55 | 5.7 | 5.0 | 2.8 | - | 500 | - | 1,500 | - | - | 1,000 |
| | | | | 1.15 | - | 1,000 | - | 5,000 | - | - | 1,000 |
| 1.35/1.6 | | | | - | 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 | |
| | GJM15 | 1.0 | 0.5 | 0.5 | 10,000 | - | 50,000 | - | 50,000 | 1,000 | |
| High Frequency | QQM18 | 1.6 | 0.8 | 0.8 | 4,000 | - | 10,000 | - | - | 1,000 | |
| | QQM21 | 2.0 | 1.25 | 0.85 | 4,000 | - | 10,000 | - | - | 1,000 | |
| | ERB18 | 1.6 | 0.8 | 0.9 max. | 4,000 | - | 10,000 | - | - | 1,000 | |
| | ERB21 | 2.0 | 1.25 | 1.35 max. | - | 3,000 | - | 10,000 | - | 1,000 | |
| | ERB32 | 3.2 | 2.5 | 1.7 max. | - | 2,000 | - | 8,000 | - | 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 ¹⁾ | |
| | GMA08 | 0.8 | 0.8 | 0.5 | - | - | - | - | - | 400 ¹⁾ | |
| 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 | 0.5 | - | 4,000 | - | 10,000 | - | 1,000 | |
| | LLL21 | 1.25 | 2.0 | 0.5/0.6 | - | 4,000 | - | 10,000 | - | 1,000 | |
| | | | | 0.85 | - | 3,000 | - | 10,000 | - | 1,000 | |
| | LLL31 | 1.6 | 3.2 | 0.5/0.7 | - | 4,000 | - | 10,000 | - | 1,000 | |
| | | | | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 | |
| | LLA18 | 1.6 | 0.8 | 0.5 | - | 4,000 | - | 10,000 | - | 1,000 | |
| | LLA21 | 2.0 | 1.25 | 0.5 | - | 4,000 | - | 10,000 | - | 1,000 | |
| | | | | 0.85 | - | 3,000 | - | 10,000 | - | 1,000 | |
| | LLA31 | 3.2 | 1.6 | 0.5 | - | 4,000 | - | 10,000 | - | 1,000 | |
| | | | | 0.85 | - | 3,000 | - | 10,000 | - | 1,000 | |
| | | | | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 | |
| | LLM21 | 2.0 | 1.25 | 0.5 | - | 4,000 | - | 10,000 | - | 1,000 | |
| 0.85 | | | | - | 3,000 | - | 10,000 | - | 1,000 | | |
| LLM31 | 3.2 | 1.6 | 0.5 | - | 4,000 | - | 10,000 | - | 1,000 | | |
| | | | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 | | |

1) Tray 2) 10µF, 1.0µF, 3.3/4.7µF of 6.3V R6 rated are not available by bulk case.

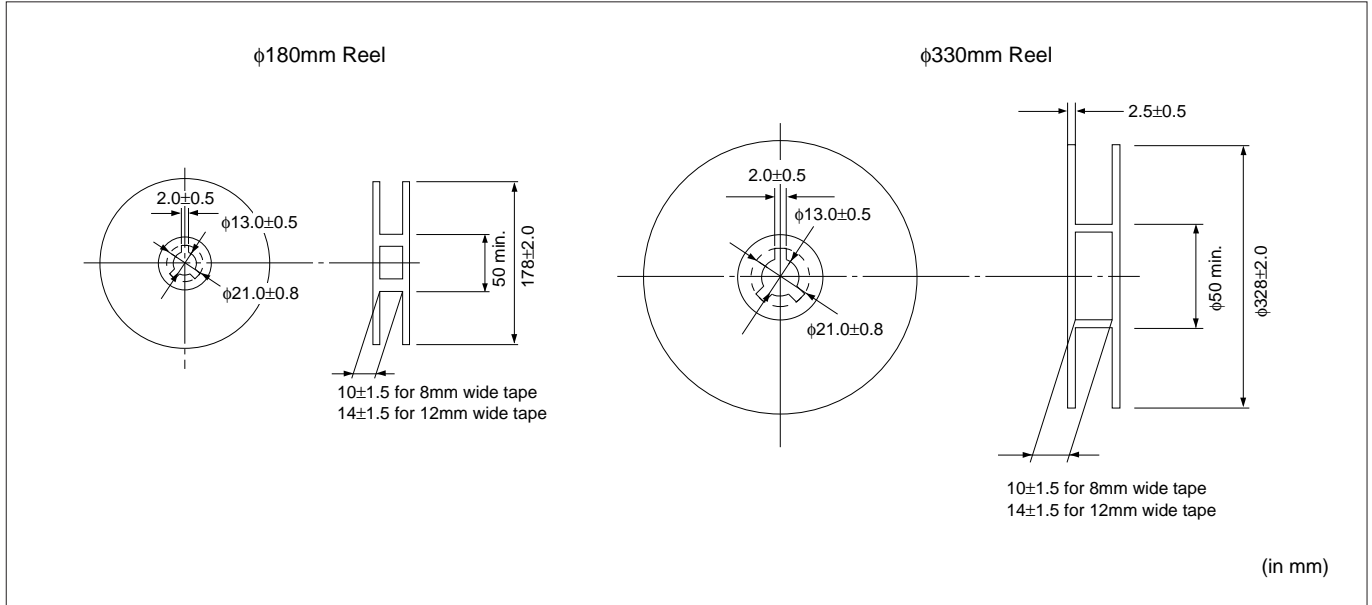
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Package

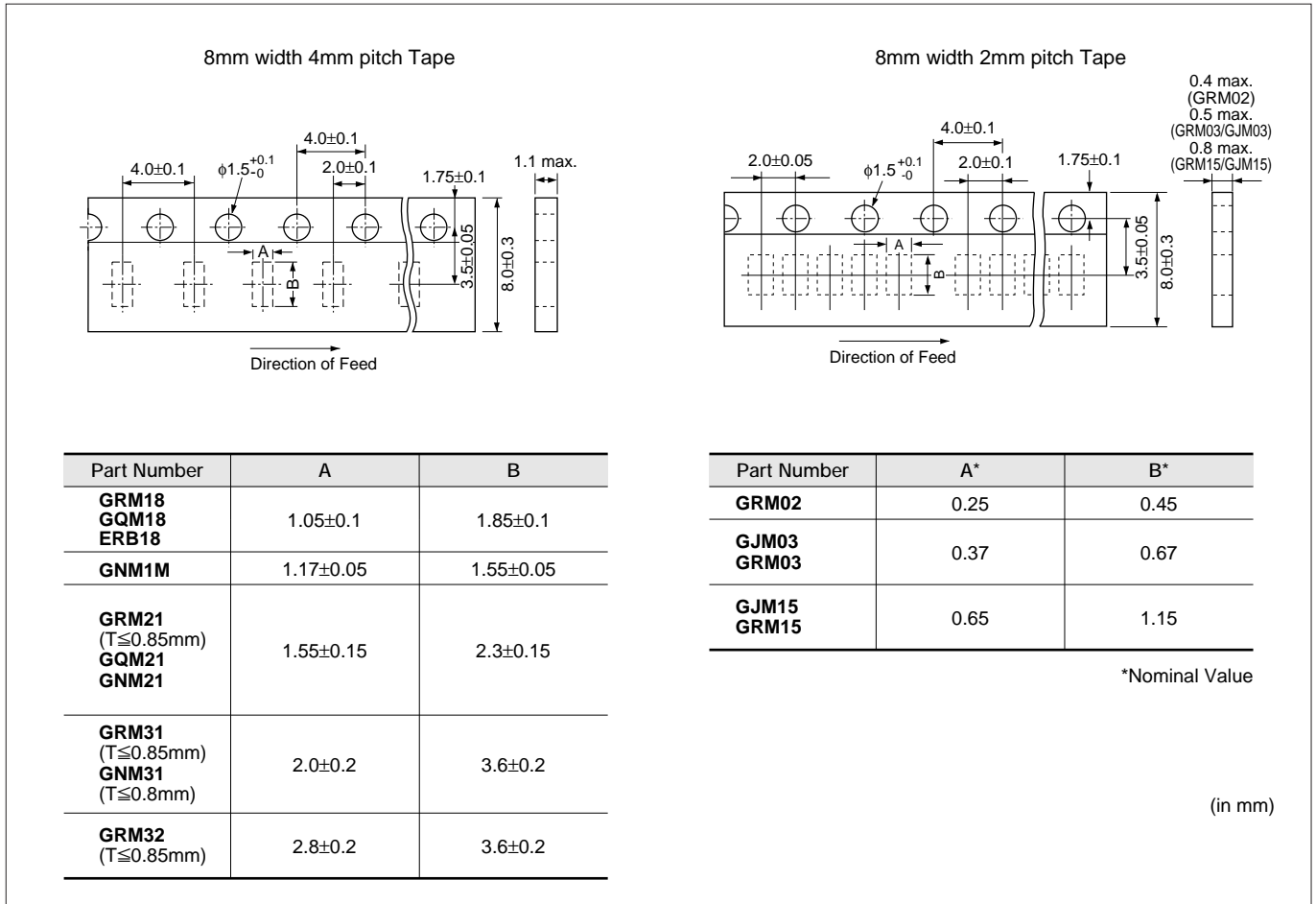
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■ Tape Carrier Packaging

(1) Dimensions of Reel



(2) Dimensions of Paper Tape

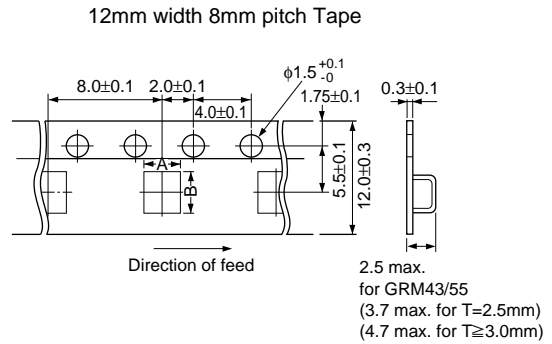
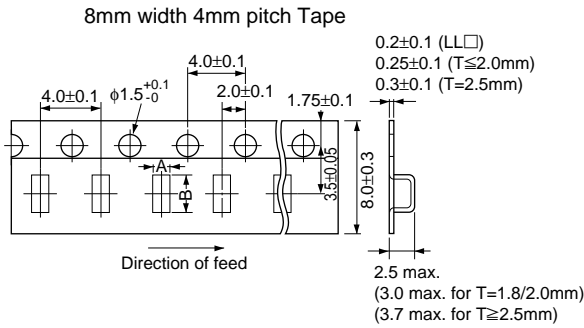


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Package

Continued from the preceding page.

(3) Dimensions of Embossed Tape



| Part Number | A | B |
|------------------------------------------------------------------------------------------------|----------|----------|
| LLL18, LLA18 | 1.05±0.1 | 1.85±0.1 |
| GRM21, ERB21 (T≥1.0mm) LLL21 LLA21, LLM21 | 1.45±0.2 | 2.25±0.2 |
| GRM31 (T≥1.15mm) LLL31 LLA31, LLM31 GJM31 (T≥1.0mm) | 1.9±0.2 | 3.5±0.2 |
| GRM32, ERB32 (T≥1.15mm) | 2.8±0.2 | 3.5±0.2 |

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

*Nominal Value

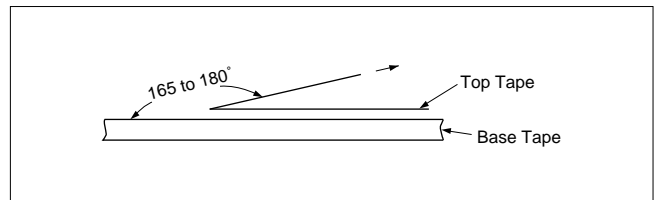
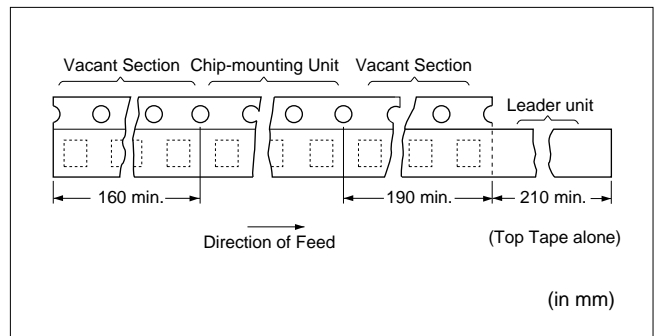
*Nominal Value

(in mm)

(4) Taping Method

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

*GRM02
GRM03 } : 0.05 to 0.5N
GJM03 }



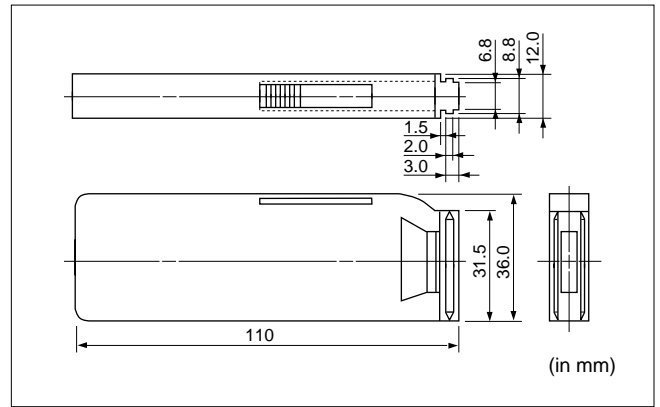
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Package

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.

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. 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 depanelization)

(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.

Do not use chips from a case which has been dropped.

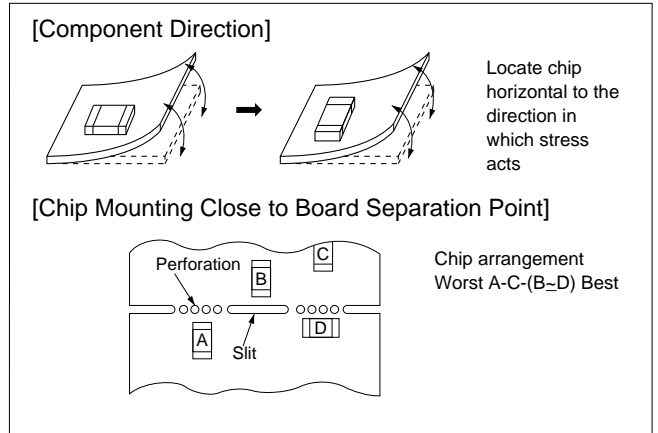
FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCTS IS USED.

Caution

■ Soldering and Mounting

1. Mounting Position

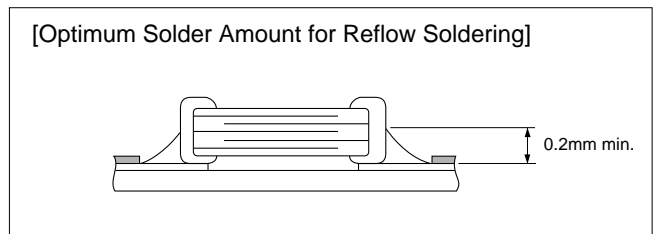
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.



(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)

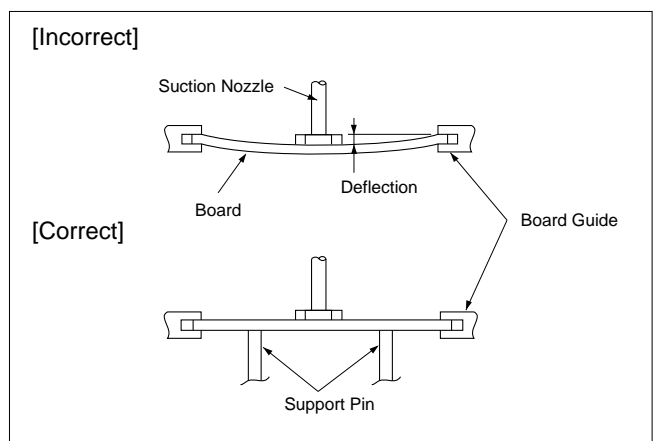
2. Solder Paste Printing

- 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.



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)



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.
- Solderability of Tin plating termination chip might be deteriorated when low temperature soldering profile where peak solder temperature is below the Tin melting point is used. Please confirm the solderability of Tin plating termination chip before use.
- 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 |
|-------------------------------------------------------------------------|-----------------------------------|
| GRM02/03/15/18/21/31 GJM03/15 LLL18/21/31 ERB18/21 GQM18/21 | $\Delta T \leq 190^\circ\text{C}$ |
| GRM32/43/55 LLA18/21/31 LLM21/31 GNM ERB32 | $\Delta T \leq 130^\circ\text{C}$ |

Recommended Conditions

| | Pb-Sn Solder | | Lead Free Solder |
|------------------|-----------------|--------------|-----------------------|
| | Infrared Reflow | Vapor Reflow | |
| Peak Temperature | 230-250°C | 230-240°C | 240-260°C |
| Atmosphere | Air | Air | Air or N ₂ |

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

Inverting the PCB

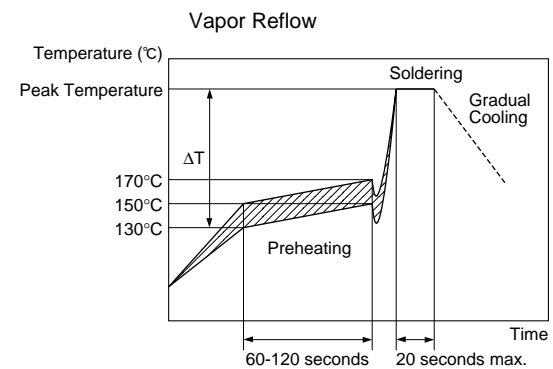
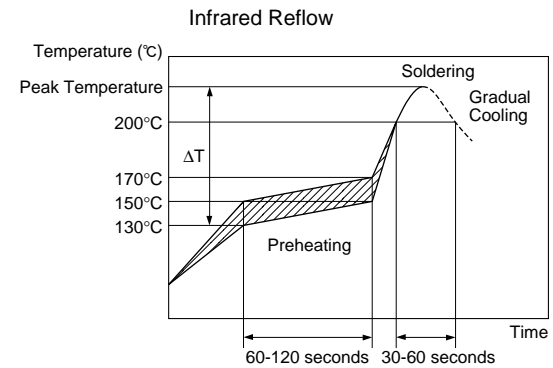
Make sure not to impose an abnormal mechanical shock on the PCB.

5. Leaded Component Insertion

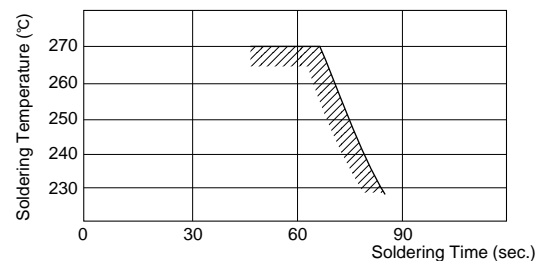
If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break.

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

[Standard Conditions for Reflow Soldering]



[Allowable Soldering Temperature and Time]



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

Continued on the following page. ☞



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 2.

Table 2

| Part Number | Temperature Differential |
|-------------|-----------------------------------|
| GRM18/21/31 | $\Delta T \leq 150^\circ\text{C}$ |
| LLL21/31 | |
| ERB18/21 | |
| GQM18/21 | |

Recommended Conditions

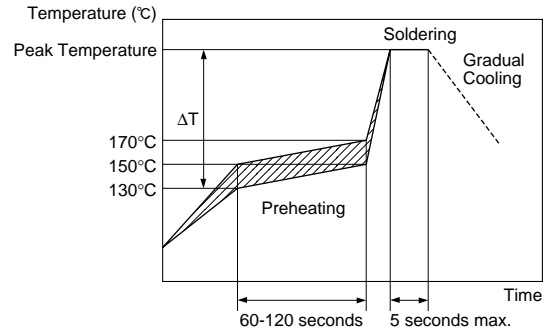
| | Pb-Sn Solder | Lead Free Solder |
|------------------|--------------|------------------|
| Peak Temperature | 240-250°C | 250-260°C |
| Atmosphere | Air | N ₂ |

Pb-Sn Solder: Sn-37Pb

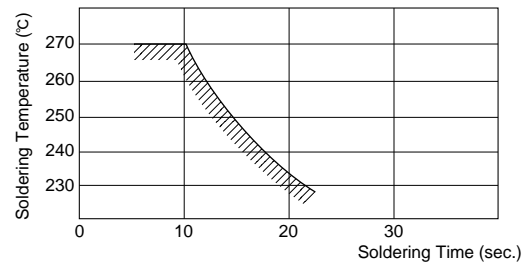
Lead Free Solder: Sn-3.0Ag-0.5Cu

- Optimum Solder Amount for Flow Soldering

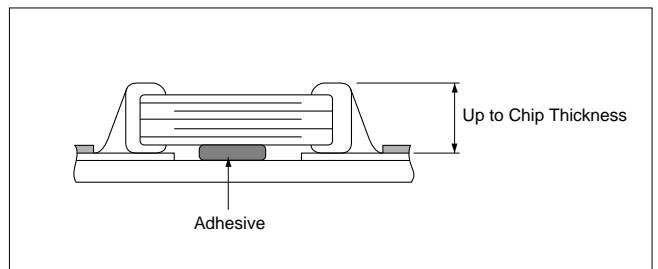
[Standard Conditions for Flow Soldering]



[Allowable Soldering Temperature and Time]



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



Continued on the following page. ↗

⚠ Caution

☐ Continued from the preceding page.

7. Correction with a Soldering Iron

(1) For Chip Type Capacitors

- 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

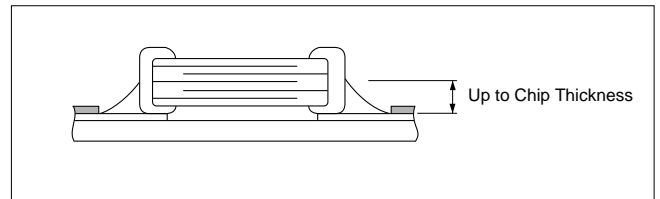
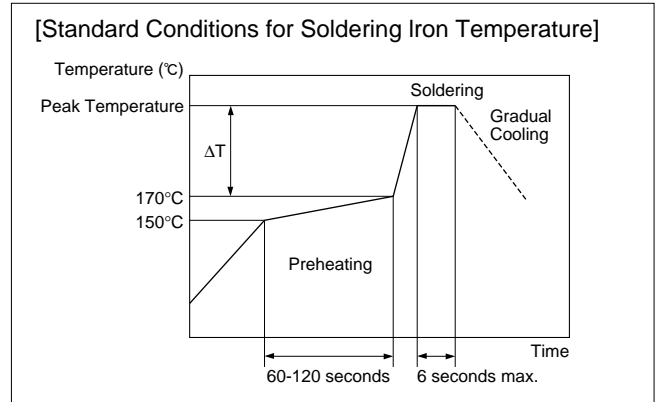
| Part Number | Temperature Differential | Peak Temperature | Atmosphere |
|----------------------------------------------------------------|-----------------------------------|-----------------------------------------------|------------|
| GRM15/18/21/31 GJM15 LLL18/21/31 GQM18/21 ERB18/21 | $\Delta T \leq 190^\circ\text{C}$ | 300°C max. 3 seconds max. / termination | Air |
| GRM32/43/55 GNM LLA18/21/31 LLM21/31 ERB32 | $\Delta T \leq 130^\circ\text{C}$ | 270°C max. 3 seconds max. / termination | Air |

*Applicable for both Pb-Sn and Lead Free Solder.

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

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



(2) 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.

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-Sn (80/20) 300 to 320 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:
20 micro m (0.0008 inch), 25 micro m (0.001 inch) diameter
- Bonding
 - (1) Thermocompression, ultrasonic ball bonding.
 - (2) Required stage temperature : 200 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

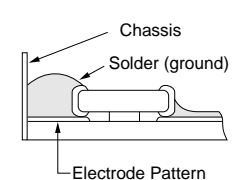
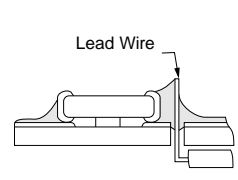
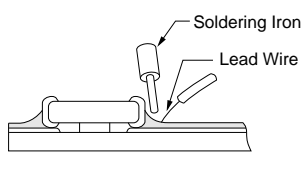
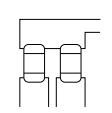
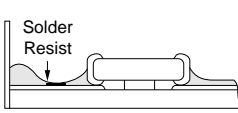
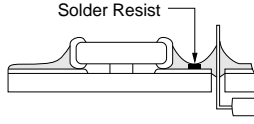
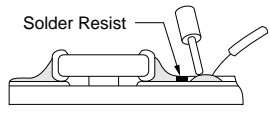
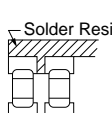
(1) Notice for Pattern Forms


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

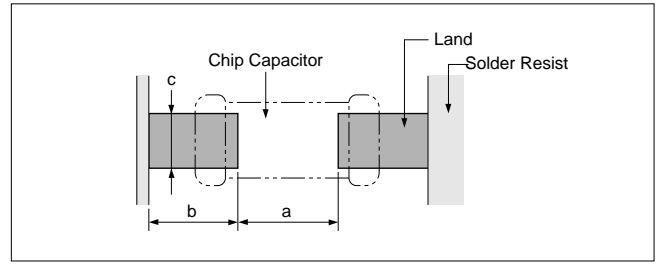


Table 1 Flow Soldering Method

| Part Number | Dimensions | Dimensions (L×W) | a | b | c |
|----------------|------------|------------------|---------|---------|---------|
| GRM18 GQM18 | | 1.6×0.8 | 0.6–1.0 | 0.8–0.9 | 0.6–0.8 |
| GRM21 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 |
| ERB18 | | 1.6×0.8 | 0.6–1.0 | 0.8–0.9 | 0.6–0.8 |
| ERB21 | | 2.0×1.25 | 1.0–1.2 | 0.9–1.0 | 0.8–1.1 |

(in mm)

Table 2 Reflow Soldering Method

| Part Number | Dimensions | Dimensions (L×W) | a | b | c |
|----------------|------------|------------------|----------|-----------|----------|
| GRM02 | | 0.4×0.2 | 0.16–0.2 | 0.12–0.18 | 0.2–0.23 |
| GRM03 GJM03 | | 0.6×0.3 | 0.2–0.3 | 0.2–0.35 | 0.2–0.4 |
| GRM15 GJM15 | | 1.0×0.5 | 0.3–0.5 | 0.35–0.45 | 0.4–0.6 |
| GRM18 GQM18 | | 1.6×0.8 | 0.6–0.8 | 0.6–0.7 | 0.6–0.8 |
| GRM21 GQM21 | | 2.0×1.25 | 1.0–1.2 | 0.6–0.7 | 0.8–1.1 |
| GRM31 | | 3.2×1.6 | 2.2–2.4 | 0.8–0.9 | 1.0–1.4 |
| GRM32 | | 3.2×2.5 | 2.0–2.4 | 1.0–1.2 | 1.8–2.3 |
| GRM43 | | 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 |
| ERB18 | | 1.6×0.8 | 0.6–0.8 | 0.6–0.7 | 0.6–0.8 |
| ERB21 | | 2.0×1.25 | 1.0–1.2 | 0.6–0.7 | 0.8–1.1 |
| ERB32 | | 3.2×2.5 | 2.0–2.4 | 1.0–1.2 | 1.8–2.3 |

(in mm)

Continued on the following page.

Notice

Continued from the preceding page.

● GNM, LLA Series for reflow soldering method

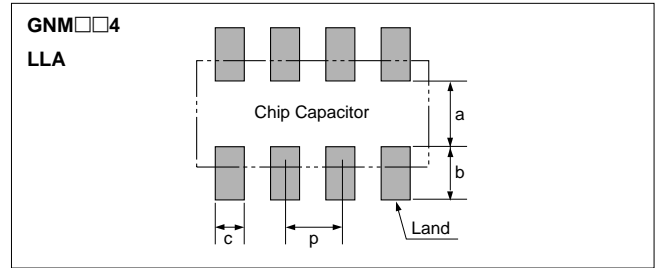
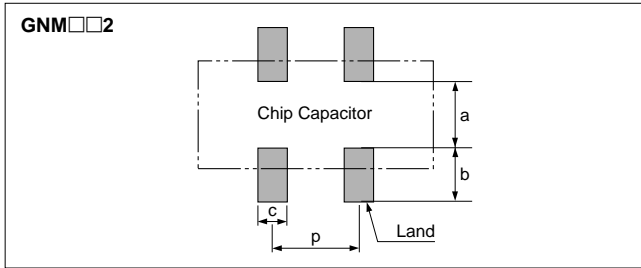


Table 3 GNM, LLA Series for Reflow Soldering Land Dimensions

| Part Number | Dimensions (mm) | | | | | |
|---------------|-----------------|------|--------------|--------------|--------------|----------|
| | L | W | a | b | c | p |
| GNM1M2 | 1.37 | 1.0 | 0.45 to 0.5 | 0.5 to 0.55 | 0.3 to 0.35 | 0.64±0.1 |
| GNM212 | 2.0 | 1.25 | 0.6 to 0.7 | 0.5 to 0.7 | 0.4 to 0.5 | 1.0±0.1 |
| GNM214 | 2.0 | 1.25 | 0.6 to 0.7 | 0.5 to 0.7 | 0.25 to 0.35 | 0.5±0.05 |
| GNM314 | 3.2 | 1.6 | 0.8 to 1.0 | 0.7 to 0.9 | 0.3 to 0.4 | 0.8±0.05 |
| LLA18 | 1.6 | 0.8 | 0.45 to 0.55 | 0.25 to 0.35 | 0.15 to 0.25 | 0.4 |
| LLA21 | 2.0 | 1.25 | 0.7 to 0.8 | 0.4 to 0.6 | 0.2 to 0.3 | 0.5 |
| LLA31 | 3.2 | 1.6 | 0.8 to 1.0 | 0.7 to 0.9 | 0.3 to 0.4 | 0.8 |

● LLM Series for reflow soldering method

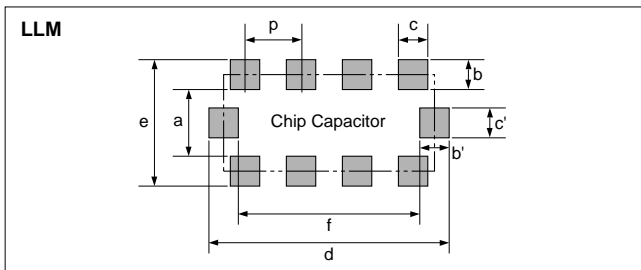


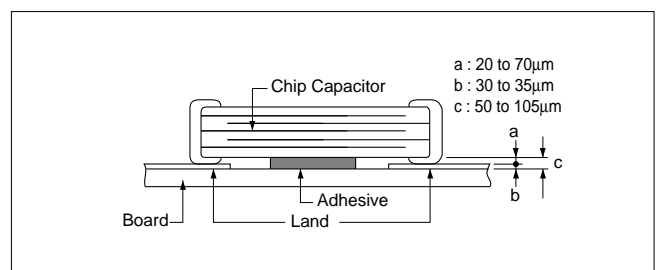
Table 4 LLM Series for Reflow Soldering Land Dimensions

| Part Number | Dimensions (mm) | | | | | | |
|--------------|-----------------|--------------|-------|------------|------------|------------|-----|
| | a | b, b' | c, c' | d | e | f | p |
| LLM21 | 0.6 to 0.8 | (0.3 to 0.5) | 0.3 | 2.0 to 2.6 | 1.3 to 1.8 | 1.4 to 1.6 | 0.5 |
| LLM31 | 1.0 | (0.3 to 0.5) | 0.4 | 3.2 to 3.6 | 1.6 to 2.0 | 2.6 | 0.8 |

$$b=(c-e)/2, b'=(d-f)/2$$

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°C)
- Adhesive Coverage*



| Part Number | Adhesive Coverage* |
|----------------------------|--------------------|
| GRM18, GQM18 | 0.05mg min. |
| GRM21, LLL21, GQM21 | 0.1mg min. |
| GRM31, LLL31 | 0.15mg min. |

*Nominal Value

Continued on the following page. ↗

Notice

☐ Continued from the preceding page.

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.

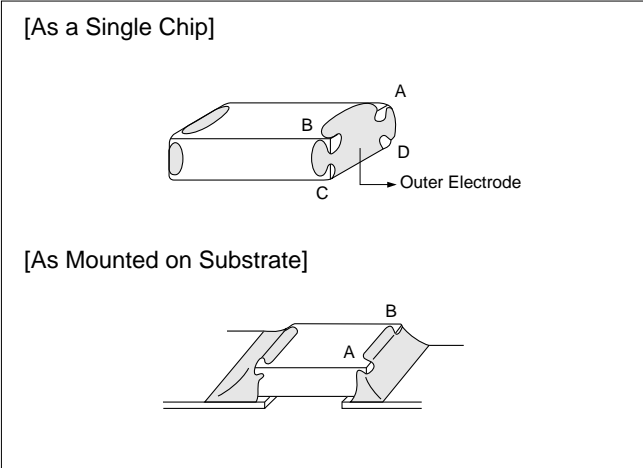
4. Flux Application

- 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.



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

Others

1. Resin Coating
 When selecting resin materials, select those with low contraction.
2. Circuit Design
 These capacitors on 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 here in 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°C 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°C)

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

(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.

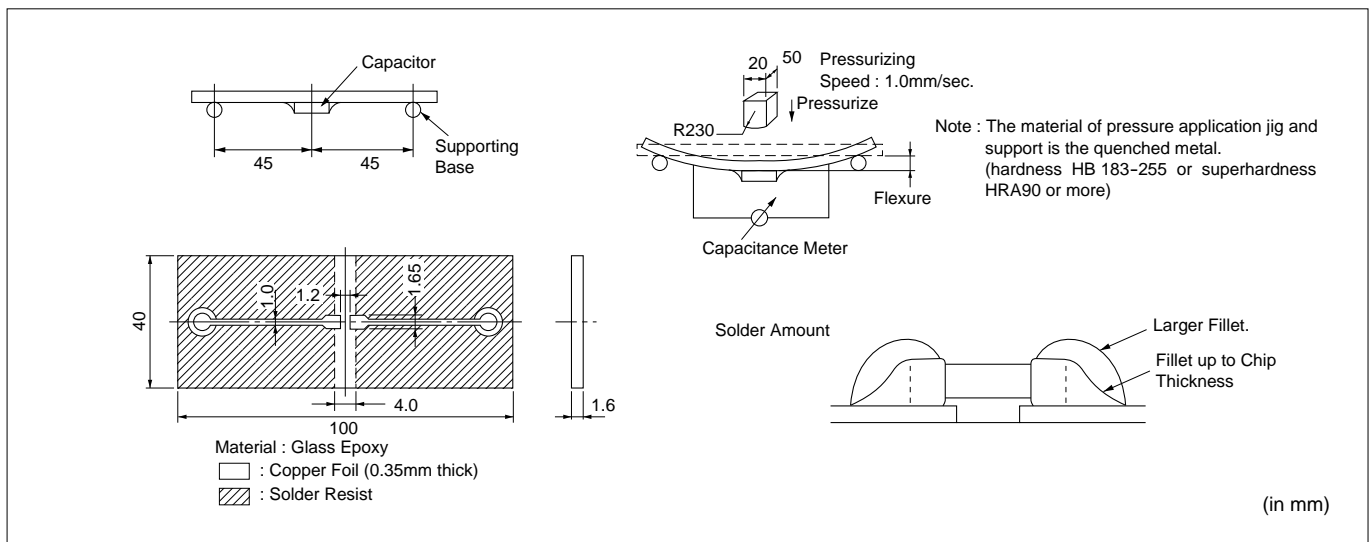
Table 1

| Sample | Initial State | Prepared at Room Temperature | | Prepared at High Temperature for 100 Hours at 85°C | Prepared at High Humidity for 100 Hours at 90 to 95% RH and 40°C |
|---------------------------------|---------------|------------------------------|-----------|----------------------------------------------------|------------------------------------------------------------------|
| | | 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 5C/R7/F5 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

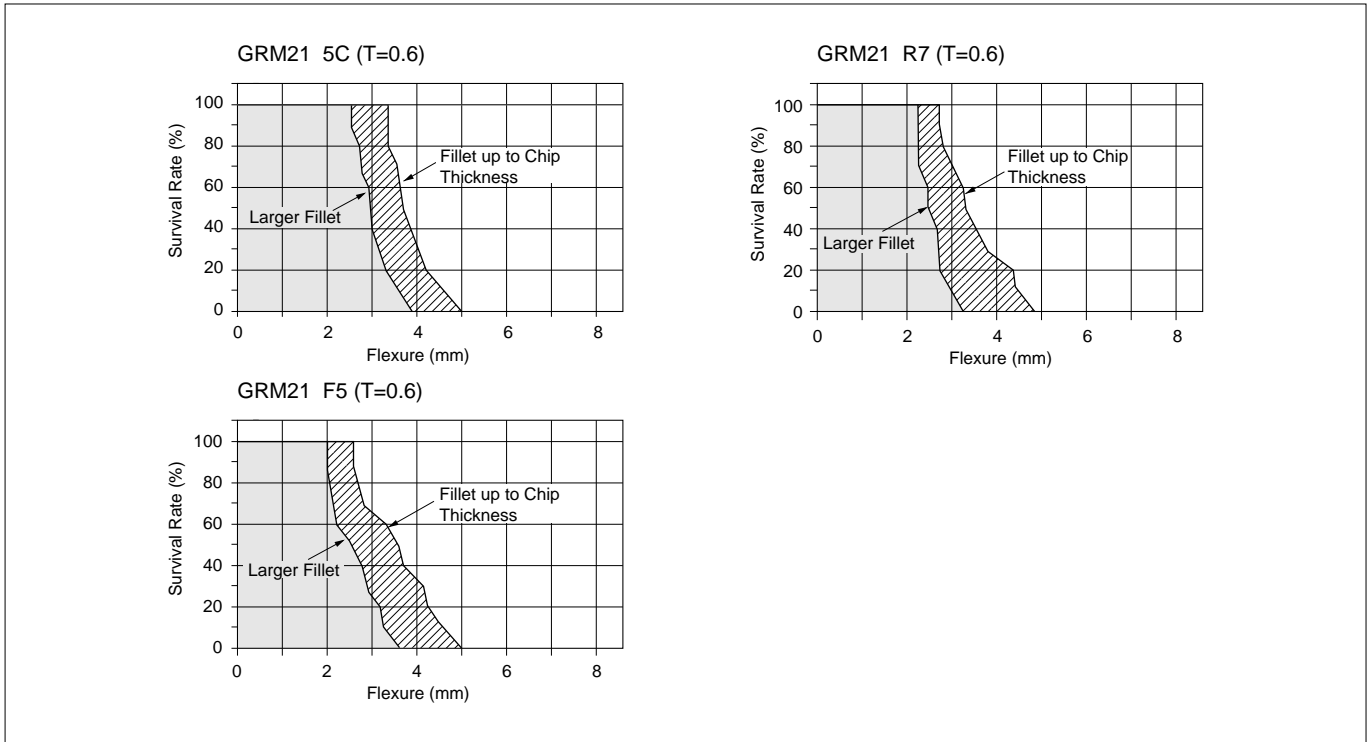
| Characteristics | Change in Capacitance |
|-----------------|---------------------------------------------------------------|
| 5C | Within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever is greater |
| R7 | Within $\pm 12.5\%$ |
| F5 | Within $\pm 20\%$ |

Continued on the following page. ↗

Reference Data

Continued from the preceding page.

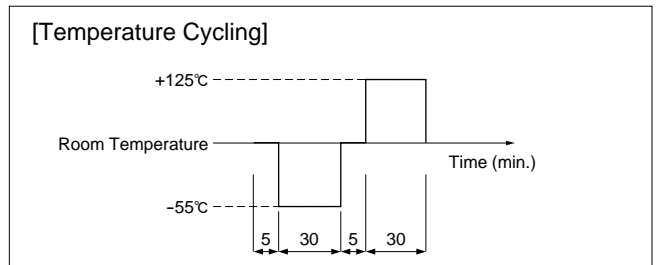
(4) Results



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.



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

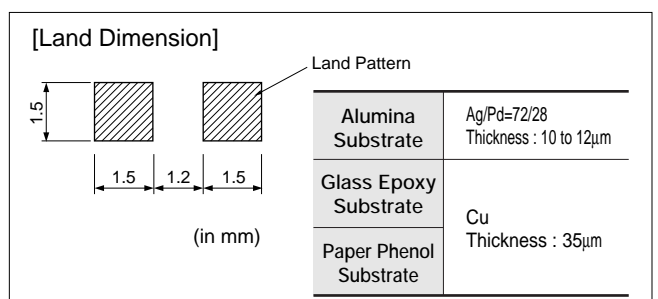
Alumina (Thickness : 0.64mm)

Glass epoxy (Thickness : 1.64mm)

Paper phenol (Thickness : 1.64mm)

| [Solder Amount] | | Alumina | Glass Epoxy or Paper Phenol |
|-------------------|---|---------------------|-----------------------------|
| Solder Amount | ① | | |
| | ② | | |
| | ③ | | |
| Solder to be used | | 6X4 Eutectic solder | |

③ Land Dimension



Continued on the following page.

Reference Data

Continued from the preceding page.

(2) Test Samples

GRM21 5C/R7/F5 Characteristics T=0.6mm

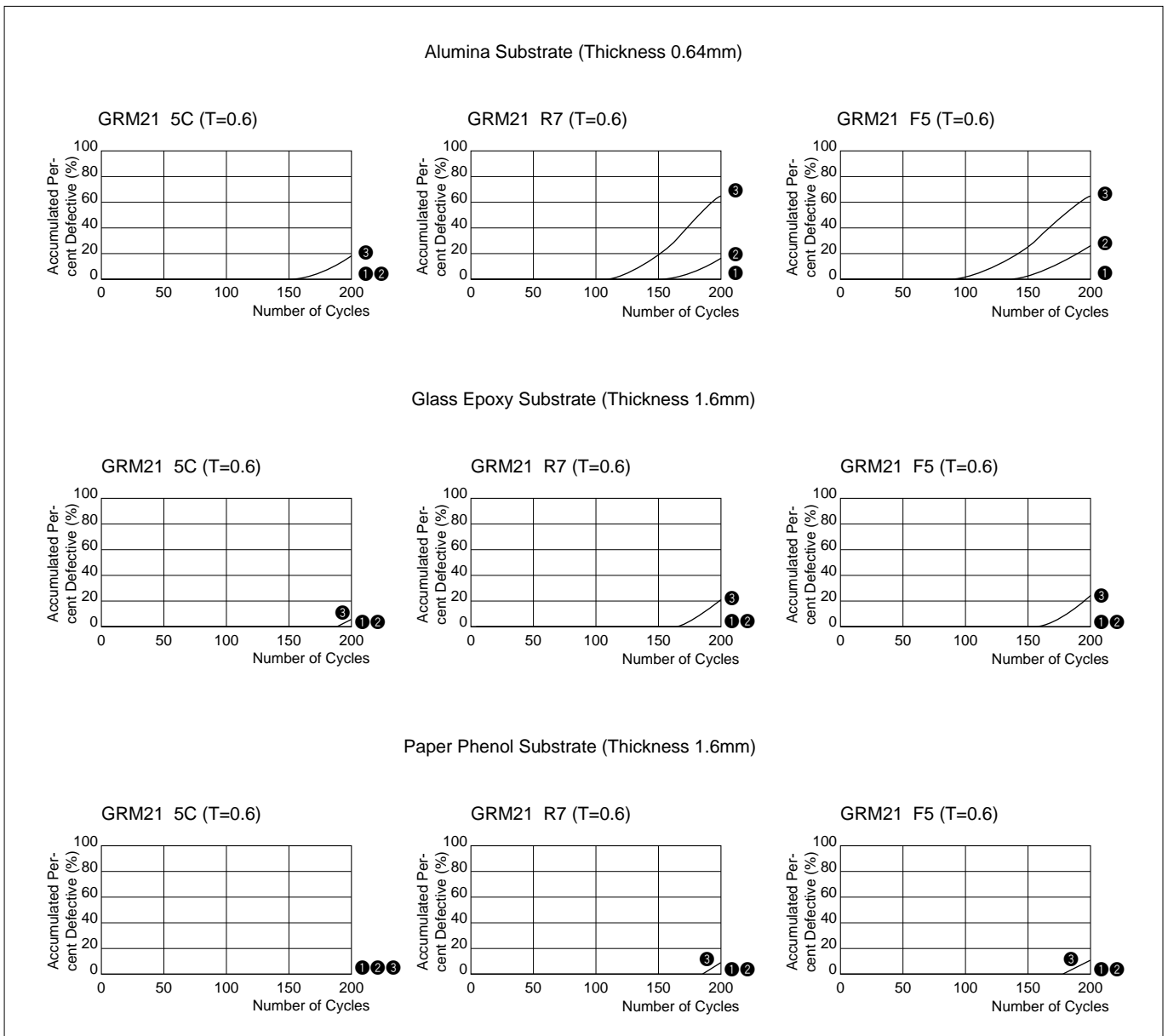
(3) Acceptance Criteria

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 |
|-----------------|------------------------------------------------------------------|
| 5C | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is greater |
| R7 | Within $\pm 7.5\%$ |
| F5 | Within $\pm 20\%$ |

(4) Results



Continued on the following page. ↗

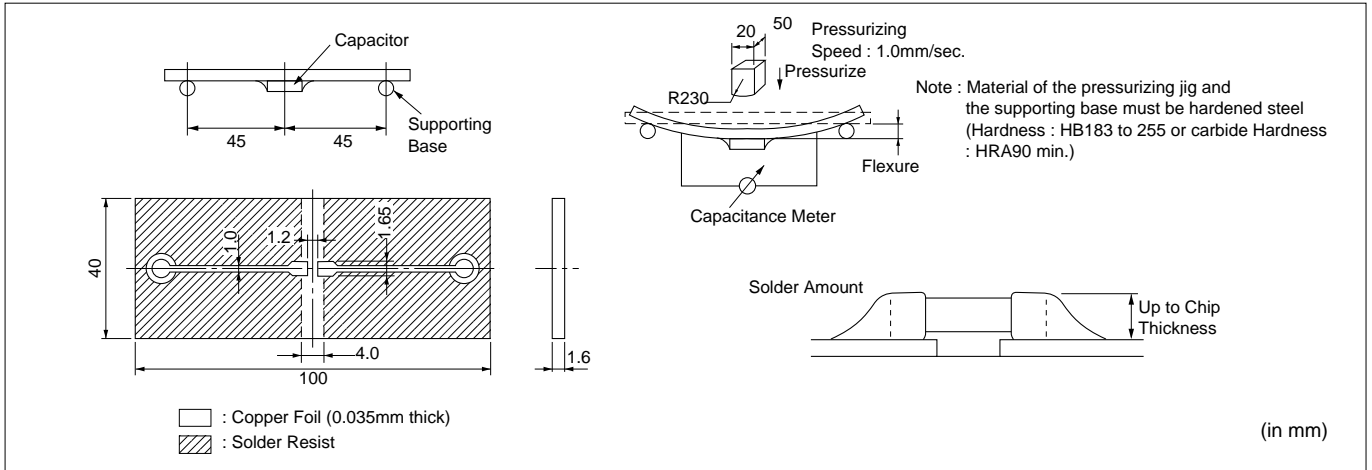
Reference Data

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 5C/R7/F5 Characteristics T=0.6mm typical

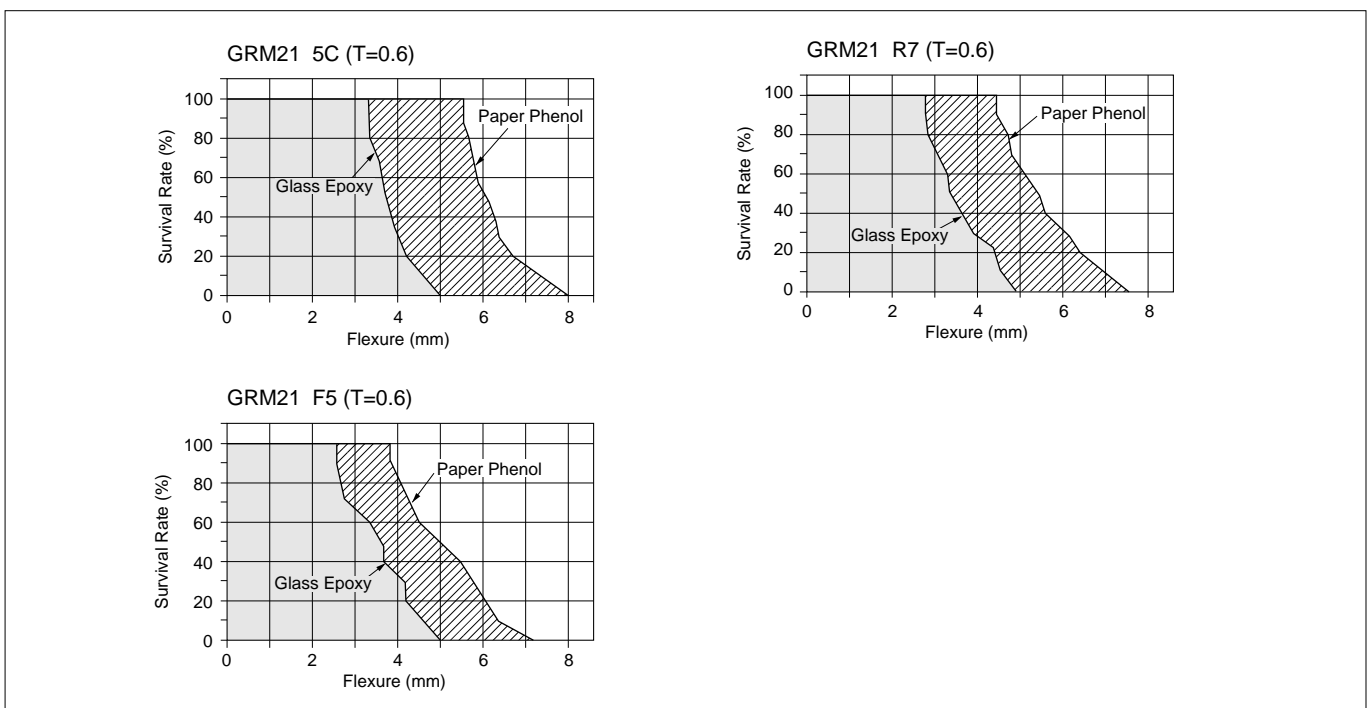
(3) Acceptance Criteria

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

Table 4

| Characteristics | Change in Capacitance |
|-----------------|---------------------------------------------------------------|
| 5C | Within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever is greater |
| R7 | Within $\pm 12.5\%$ |
| F5 | Within $\pm 20\%$ |

(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 5C/R7/F5 Characteristics
 GRM31 5C/R7/F5 Characteristics

(3) Acceptance Criteria

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

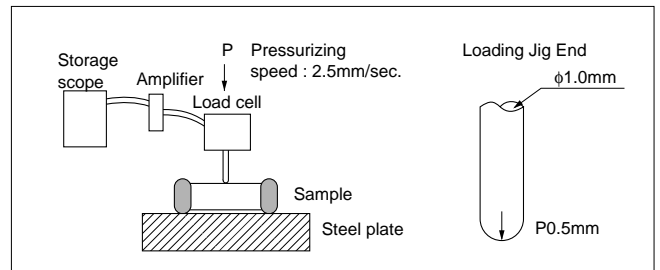
(4) Explanation

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 :

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

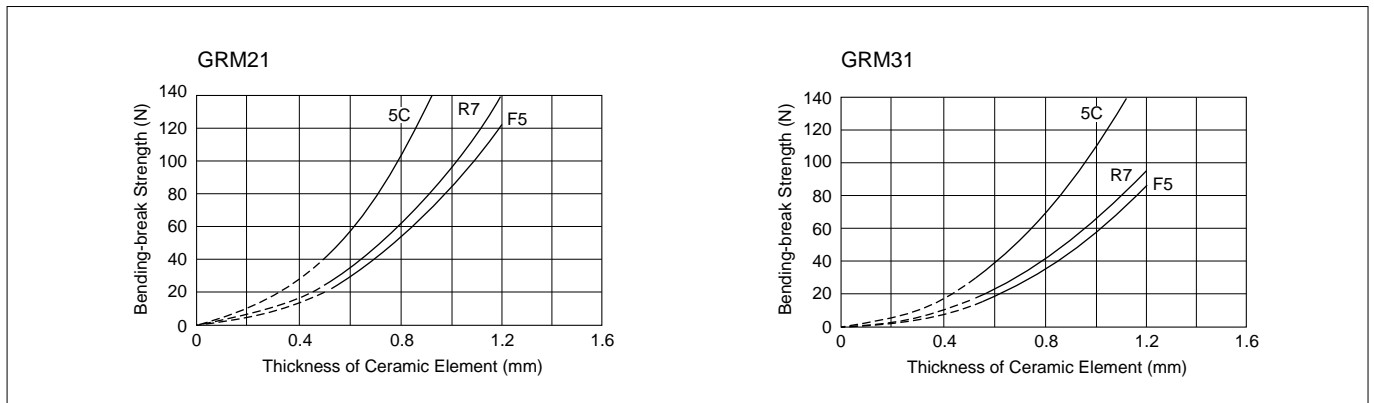
- W : Width of ceramic element (mm)
- T : Thickness of element (mm)
- L : Distance between fulcrums (mm)
- γ : Bending stress (N/mm²)



| Chip Size | L | W | γ | | |
|--------------|-----|-----|--------------------|--------------------|--------------------|
| | | | 5C Characteristics | R7 Characteristics | F5 Characteristics |
| GRM21 | 1.5 | 1.2 | 300 | 180 | 160 |
| GRM31 | 2.7 | 1.5 | | | |

(in mm)

(5) Results



6. Thermal Shock

(1) Test method

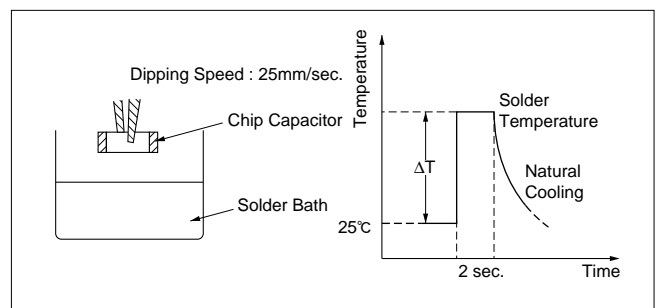
After applying flux (an ethanol solution of 25% rosin), dip the chip in a solder bath (6X4 eutectic solder) in accordance with the following conditions :

(2) Test samples

GRM21 5C/R7/F5 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.

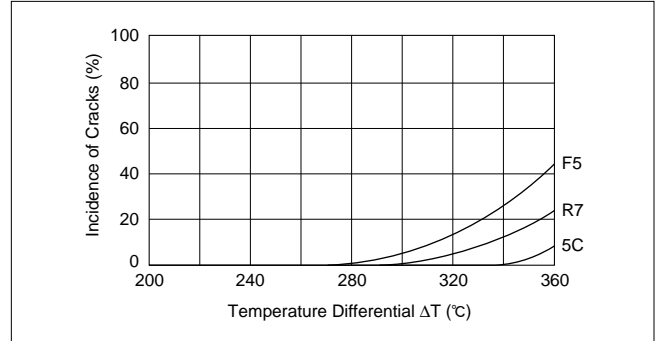


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Reference Data

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.

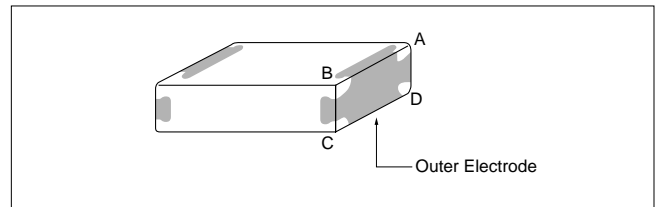
④ Flux to be used : An ethanol solution of 25% rosin.

(2) Test samples

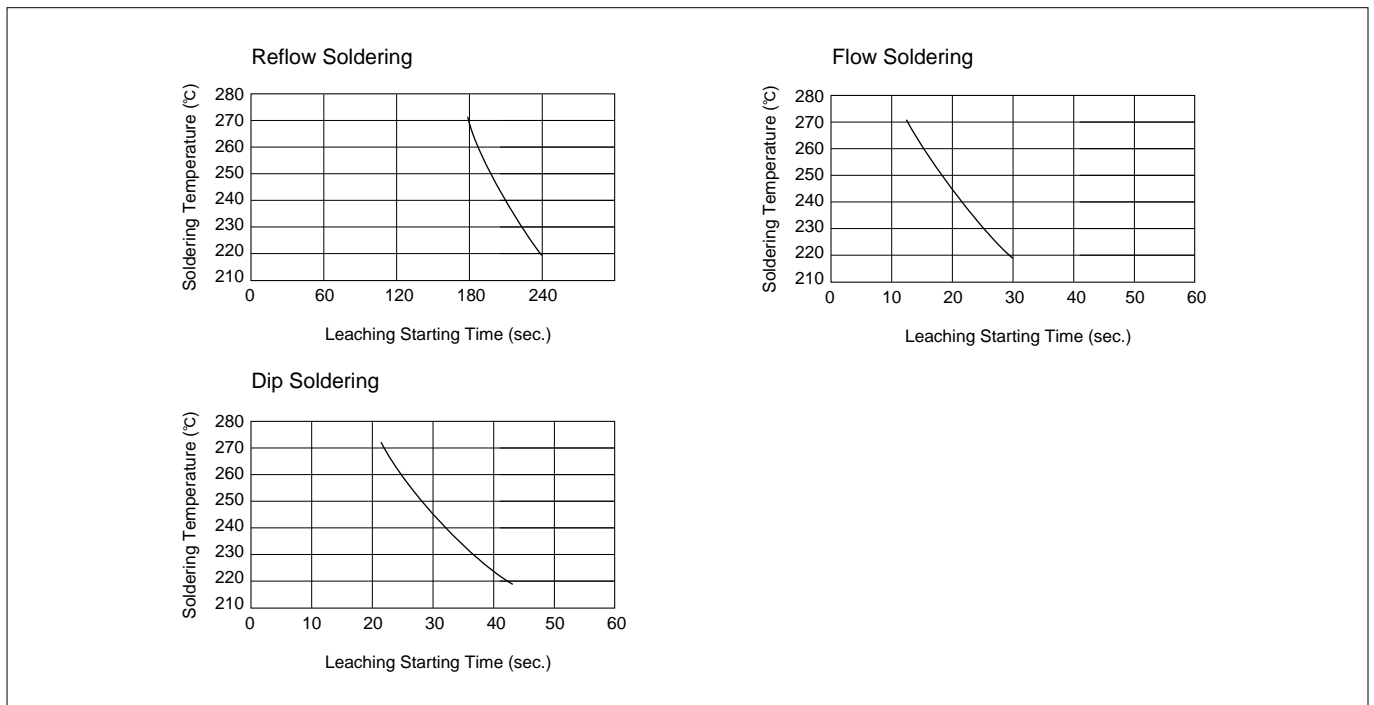
GRM21 : For flow/reflow soldering T=0.6mm

(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



Continued on the following page.

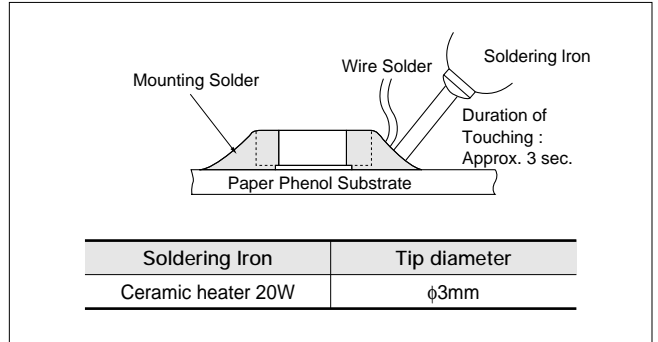
Reference Data

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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.)



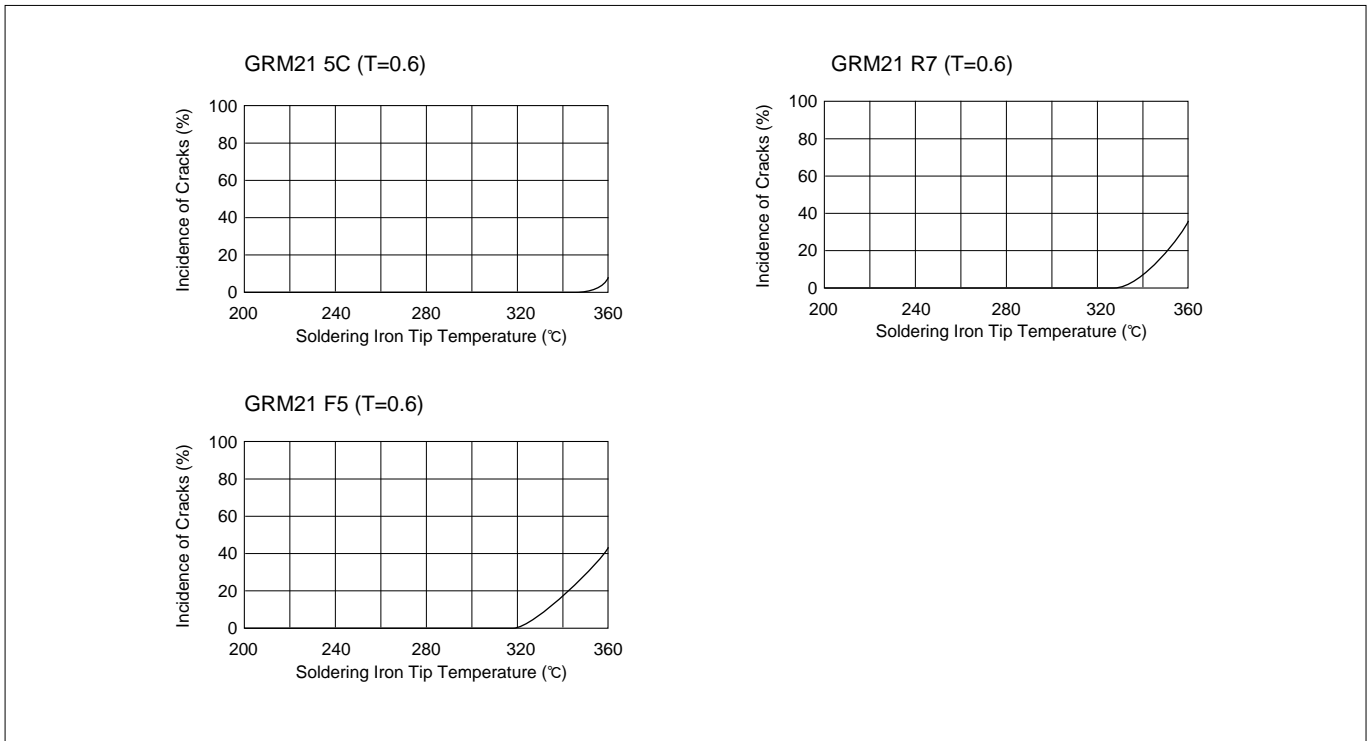
(2) Test Samples

GRM21 5C/R7/F5 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



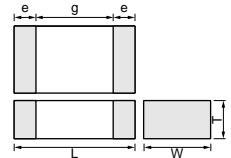
Chip Monolithic Ceramic Capacitors



Medium Voltage Low Dissipation Factor

■ 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 GRM21/31 type with flow or reflow soldering, and other types with reflow soldering only.
5. Low-loss and suitable for high frequency circuits



| Part Number | Dimensions (mm) | | | | |
|-------------|-----------------|-----------|---------------|--------|--------|
| | L | W | T | e min. | g min. |
| GRM21A | 2.0 ±0.2 | 1.25 ±0.2 | 1.0 +0, -0.3 | 0.3 | 0.7 |
| GRM31A | 3.2 ±0.2 | 1.6 ±0.2 | 1.25 +0, -0.3 | | 1.5* |
| GRM31B | | | 1.0 +0, -0.3 | | |
| GRM32A | 3.2 ±0.2 | 2.5 ±0.2 | 1.25 +0, -0.3 | | |
| GRM32B | | | 1.0 +0, -0.3 | | |
| GRM42A | 4.5 ±0.3 | 2.0 ±0.2 | 2.0 ±0.3 | | 2.9 |
| GRM42D | | | 1.0 +0, -0.3 | | |

* GRM31A7U3D, GRM32A7U3D, GRM32B7U3D : 1.8mm min.

■ 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.

SL/U2J Characteristics

| 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) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM21A7U2E101JW31D | DC250 | U2J (EIA) | 100 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E151JW31D | DC250 | U2J (EIA) | 150 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E221JW31D | DC250 | U2J (EIA) | 220 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E331JW31D | DC250 | U2J (EIA) | 330 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E471JW31D | DC250 | U2J (EIA) | 470 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E681JW31D | DC250 | U2J (EIA) | 680 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E102JW31D | DC250 | U2J (EIA) | 1000 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E152JW31D | DC250 | U2J (EIA) | 1500 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM21A7U2E222JW31D | DC250 | U2J (EIA) | 2200 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GRM31A7U2E332JW31D | DC250 | U2J (EIA) | 3300 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2E472JW31D | DC250 | U2J (EIA) | 4700 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31B7U2E682JW31L | DC250 | U2J (EIA) | 6800 ±5% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| GRM31B7U2E103JW31L | DC250 | U2J (EIA) | 10000 ±5% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| GRM31A7U2J100JW31D | DC630 | U2J (EIA) | 10 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J150JW31D | DC630 | U2J (EIA) | 15 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J220JW31D | DC630 | U2J (EIA) | 22 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J330JW31D | DC630 | U2J (EIA) | 33 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J470JW31D | DC630 | U2J (EIA) | 47 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J680JW31D | DC630 | U2J (EIA) | 68 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J101JW31D | DC630 | U2J (EIA) | 100 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J151JW31D | DC630 | U2J (EIA) | 150 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J221JW31D | DC630 | U2J (EIA) | 220 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J331JW31D | DC630 | U2J (EIA) | 330 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J471JW31D | DC630 | U2J (EIA) | 470 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U2J681JW31D | DC630 | U2J (EIA) | 680 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |

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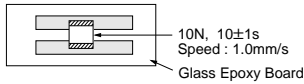
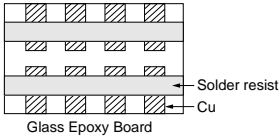
| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM31A7U2J102JW31D | DC630 | U2J (EIA) | 1000 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM32A7U2J152JW31D | DC630 | U2J (EIA) | 1500 ±5% | 3.2 | 2.5 | 1.0 | 1.5 | 0.3 min. |
| GRM32A7U2J222JW31D | DC630 | U2J (EIA) | 2200 ±5% | 3.2 | 2.5 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A100JW31D | DC1000 | U2J (EIA) | 10 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A150JW31D | DC1000 | U2J (EIA) | 15 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A220JW31D | DC1000 | U2J (EIA) | 22 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A330JW31D | DC1000 | U2J (EIA) | 33 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A470JW31D | DC1000 | U2J (EIA) | 47 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A680JW31D | DC1000 | U2J (EIA) | 68 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A101JW31D | DC1000 | U2J (EIA) | 100 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A151JW31D | DC1000 | U2J (EIA) | 150 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A221JW31D | DC1000 | U2J (EIA) | 220 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31A7U3A331JW31D | DC1000 | U2J (EIA) | 330 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GRM31B7U3A471JW31L | DC1000 | U2J (EIA) | 470 ±5% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| GRM31A7U3D100JW31D | DC2000 | U2J (EIA) | 10 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D120JW31D | DC2000 | U2J (EIA) | 12 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D150JW31D | DC2000 | U2J (EIA) | 15 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D180JW31D | DC2000 | U2J (EIA) | 18 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D220JW31D | DC2000 | U2J (EIA) | 22 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D270JW31D | DC2000 | U2J (EIA) | 27 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D330JW31D | DC2000 | U2J (EIA) | 33 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D390JW31D | DC2000 | U2J (EIA) | 39 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D470JW31D | DC2000 | U2J (EIA) | 47 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D560JW31D | DC2000 | U2J (EIA) | 56 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM31A7U3D680JW31D | DC2000 | U2J (EIA) | 68 ±5% | 3.2 | 1.6 | 1.0 | 1.8 | 0.3 min. |
| GRM32A7U3D820JW31D | DC2000 | U2J (EIA) | 82 ±5% | 3.2 | 2.5 | 1.0 | 1.8 | 0.3 min. |
| GRM32A7U3D101JW31D | DC2000 | U2J (EIA) | 100 ±5% | 3.2 | 2.5 | 1.0 | 1.8 | 0.3 min. |
| GRM32A7U3D121JW31D | DC2000 | U2J (EIA) | 120 ±5% | 3.2 | 2.5 | 1.0 | 1.8 | 0.3 min. |
| GRM32A7U3D151JW31D | DC2000 | U2J (EIA) | 150 ±5% | 3.2 | 2.5 | 1.0 | 1.8 | 0.3 min. |
| GRM32B7U3D181JW31L | DC2000 | U2J (EIA) | 180 ±5% | 3.2 | 2.5 | 1.25 | 1.8 | 0.3 min. |
| GRM32B7U3D221JW31L | DC2000 | U2J (EIA) | 220 ±5% | 3.2 | 2.5 | 1.25 | 1.8 | 0.3 min. |
| GRM42D1X3F100JY02L | DC3150 | SL (JIS) | 10 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| GRM42D1X3F120JY02L | DC3150 | SL (JIS) | 12 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| GRM42D1X3F150JY02L | DC3150 | SL (JIS) | 15 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| GRM42D1X3F180JY02L | DC3150 | SL (JIS) | 18 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| GRM42D1X3F220JY02L | DC3150 | SL (JIS) | 22 ±5% | 4.5 | 2.0 | 2.0 | 2.9 | 0.3 min. |
| GRM42A7U3F270JW31L | DC3150 | U2J (EIA) | 27 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A7U3F330JW31L | DC3150 | U2J (EIA) | 33 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A7U3F390JW31L | DC3150 | U2J (EIA) | 39 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A7U3F470JW31L | DC3150 | U2J (EIA) | 47 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A7U3F560JW31L | DC3150 | U2J (EIA) | 56 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A7U3F680JW31L | DC3150 | U2J (EIA) | 68 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A7U3F820JW31L | DC3150 | U2J (EIA) | 82 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A7U3F101JW31L | DC3150 | U2J (EIA) | 100 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |

Application Specific Products, C0G Characteristics

| 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) |
|--------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM42A5C3F050DW01L | DC3150 | C0G (EIA) | 5.0 ±0.5pF | 4.5 | 2.0 | 1.0 | 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. |
| GRM42A5C3F270JW01L | DC3150 | C0G (EIA) | 27 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A5C3F330JW01L | DC3150 | C0G (EIA) | 33 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A5C3F390JW01L | DC3150 | C0G (EIA) | 39 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |
| GRM42A5C3F470JW01L | DC3150 | C0G (EIA) | 47 ±5% | 4.5 | 2.0 | 1.0 | 2.9 | 0.3 min. |

Please contact us in case that the C0G char. DC3150V items are considered to use for the application which is not LCD back lighting inverters circuit.

Specifications and Test Methods

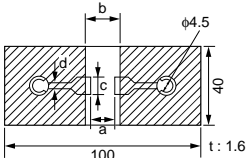
| No. | Item | Specifications | Test Method | | | | | | | | | | | | |
|---------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|---------|---------------------------|----------|---------------------------|--------------|---------------------------|------------------|------------------------|---|--------------------------|
| 1 | Operating Temperature Range | -55 to +125°C | | | | | | | | | | | | | |
| 2 | Appearance | No defects or abnormalities | Visual inspection | | | | | | | | | | | | |
| 3 | Dimensions | Within the specified dimension | Using calipers | | | | | | | | | | | | |
| 4 | Dielectric Strength | No defects or abnormalities | <p>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.</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Test voltage</th> </tr> </thead> <tbody> <tr> <td>DC250V</td> <td>200% of the rated voltage</td> </tr> <tr> <td>DC630V</td> <td>150% of the rated voltage</td> </tr> <tr> <td>DC1kV, DC2kV</td> <td>120% of the rated voltage</td> </tr> <tr> <td>DC3.15kV</td> <td>DC4095V</td> </tr> </tbody> </table> | Rated voltage | Test voltage | DC250V | 200% of the rated voltage | DC630V | 150% of the rated voltage | DC1kV, DC2kV | 120% of the rated voltage | DC3.15kV | DC4095V | | |
| Rated voltage | Test voltage | | | | | | | | | | | | | | |
| DC250V | 200% of the rated voltage | | | | | | | | | | | | | | |
| DC630V | 150% of the rated voltage | | | | | | | | | | | | | | |
| DC1kV, DC2kV | 120% of the rated voltage | | | | | | | | | | | | | | |
| DC3.15kV | DC4095V | | | | | | | | | | | | | | |
| 5 | Insulation Resistance (I.R.) | More than 10,000MΩ | The insulation resistance should be measured with DC500±50V (DC250±25V in case of rated voltage : DC250V) and within 60±5 sec. of charging. | | | | | | | | | | | | |
| 6 | Capacitance | Within the specified tolerance | The capacitance/Q should be measured at 20°C at the frequency and voltage shown as follows. | | | | | | | | | | | | |
| 7 | Q | C0G/U2J char. : 1,000 min. SL char. : 400+20C ^{*1} min. | <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td>C<1,000pF</td> <td>1±0.2MHz</td> <td>AC0.5 to 5V(r.m.s.)</td> </tr> <tr> <td>C≥1,000pF</td> <td>1±0.2kHz</td> <td>AC1±0.2V(r.m.s.)</td> </tr> </tbody> </table> | Capacitance | Frequency | Voltage | C<1,000pF | 1±0.2MHz | AC0.5 to 5V(r.m.s.) | C≥1,000pF | 1±0.2kHz | AC1±0.2V(r.m.s.) | | | |
| Capacitance | Frequency | Voltage | | | | | | | | | | | | | |
| C<1,000pF | 1±0.2MHz | AC0.5 to 5V(r.m.s.) | | | | | | | | | | | | | |
| C≥1,000pF | 1±0.2kHz | AC1±0.2V(r.m.s.) | | | | | | | | | | | | | |
| 8 | Capacitance Temperature Characteristics | Temp. Coefficient C0G char. : 0±30ppm/°C (Temp. Range : +25 to +125°C) 0+30, -72ppm/°C (Temp. Range : -55 to +25°C) U2J char. : -750±120 ppm/°C (Temp. Range : +25 to +125°C) -750+120, -347 ppm/°C (Temp. Range : -55 to +25°C) SL char. : +350 to -1000 ppm/°C (Temp. Range : +20 to +85°C) | <p>The temperature coefficient is determined using the capacitance measured in step 3 as a reference.</p> <p>When cycling the temperature sequentially from step 1 through 5 (SL char. : +20 to +85°C) the capacitance should be within the specified tolerance for the temperature coefficient.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25±2 (20±2 for SL char.)</td> </tr> <tr> <td>2</td> <td>Min. Operating Temp.±3</td> </tr> <tr> <td>3</td> <td>25±2 (20±2 for SL char.)</td> </tr> <tr> <td>4</td> <td>Max. Operating Temp.±2</td> </tr> <tr> <td>5</td> <td>25±2 (20±2 for SL char.)</td> </tr> </tbody> </table> | Step | Temperature (°C) | 1 | 25±2 (20±2 for SL char.) | 2 | Min. Operating Temp.±3 | 3 | 25±2 (20±2 for SL char.) | 4 | Max. Operating Temp.±2 | 5 | 25±2 (20±2 for SL char.) |
| Step | Temperature (°C) | | | | | | | | | | | | | | |
| 1 | 25±2 (20±2 for SL char.) | | | | | | | | | | | | | | |
| 2 | Min. Operating Temp.±3 | | | | | | | | | | | | | | |
| 3 | 25±2 (20±2 for SL char.) | | | | | | | | | | | | | | |
| 4 | Max. Operating Temp.±2 | | | | | | | | | | | | | | |
| 5 | 25±2 (20±2 for SL char.) | | | | | | | | | | | | | | |
| 9 | Adhesive Strength of Termination | No removal of the terminations or other defect should occur. | <p>Solder the capacitor to the testing jig (glass epoxy board) shown in Fig. 1 using a eutectic solder.</p> <p>Then apply 10N force in the direction of the arrow.</p> <p>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.</p>  <p>Fig. 1</p> | | | | | | | | | | | | |
| 10 | Appearance | No defects or abnormalities | <p>Solder the capacitor to the test jig (glass epoxy board).</p> <p>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.).</p>  | | | | | | | | | | | | |
| | Capacitance | Within the specified tolerance | | | | | | | | | | | | | |
| | Q | C0G/U2J char. : 1,000 min. SL char. : 400+20C ^{*1} min. | | | | | | | | | | | | | |

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

Continued on the following page. ↗

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | | | | | | | | |
|----------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------|--|--|--|---|---|---|---|----------|-----|-----|------|-----|---------|-----|-----|-----|---------|-----|-----|-----|---------|
| 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. | | | | | | | | | | | | | | | | | | | | | | | |
| | |  <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <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> </thead> <tbody> <tr> <td>2.0×1.25</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> <td rowspan="4" style="text-align: center; vertical-align: middle;">1.0</td> </tr> <tr> <td>3.2×1.6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>3.2×2.5</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>4.5×2.0</td> <td>3.5</td> <td>7.0</td> <td>2.4</td> </tr> </tbody> </table> <p style="text-align: center;">Fig. 2</p> | | L×W (mm) | Dimension (mm) | | | | a | b | c | d | 2.0×1.25 | 1.2 | 4.0 | 1.65 | 1.0 | 3.2×1.6 | 2.2 | 5.0 | 2.0 | 3.2×2.5 | 2.2 | 5.0 | 2.9 | 4.5×2.0 |
| L×W (mm) | Dimension (mm) | | | | | | | | | | | | | | | | | | | | | | | | | |
| | a | b | c | d | | | | | | | | | | | | | | | | | | | | | | |
| 2.0×1.25 | 1.2 | 4.0 | 1.65 | 1.0 | | | | | | | | | | | | | | | | | | | | | | |
| 3.2×1.6 | 2.2 | 5.0 | 2.0 | | | | | | | | | | | | | | | | | | | | | | | |
| 3.2×2.5 | 2.2 | 5.0 | 2.9 | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5×2.0 | 3.5 | 7.0 | 2.4 | | | | | | | | | | | | | | | | | | | | | | | |
| 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 solder solution for 2±0.5 sec. Immersing speed : 25±2.5mm/s Temp. of solder : 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | Resistance to Soldering Heat | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±2.5% | | | | | | | | | | | | | | | | | | | | | | | |
| | | Q | C0G/U2J char. : 1,000 min. SL char. : 400+20C*2 min. | | | | | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 10,000MΩ | | | | | | | | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | Temperature Cycle | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±2.5% | | | | | | | | | | | | | | | | | | | | | | | |
| | | Q | C0G char. : 1,000 min. U2J char. : 500 min. SL char. : 400+20C*2 min. | | | | | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 10,000MΩ | | | | | | | | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | Humidity (Steady State) | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±5.0% | | | | | | | | | | | | | | | | | | | | | | | |
| | | Q | C0G/U2J char. : 350 min. SL char. : 275+5/2C*2 min. | | | | | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 1,000MΩ | | | | | | | | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | Life | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±3.0% | | | | | | | | | | | | | | | | | | | | | | | |
| | | Q | C0G/U2J char. : 350 min. SL char. : 275+5/2C*2 min. | | | | | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 1,000MΩ | | | | | | | | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | | | | | | | |

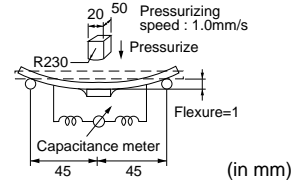


Fig. 3

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

| Step | Temperature (°C) | 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 |

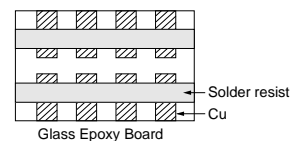


Fig. 4

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

Chip Monolithic Ceramic Capacitors



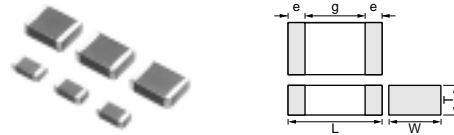
Medium Voltage High Capacitance for General-Use

■ Features

1. A new monolithic structure for small, high capacitance capable of operating at high voltage levels.
2. Sn-plated external electrodes realizes 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 | | | |
| GRM21B | | | 1.25 ±0.2 | 0.3 min. | 1.2 | |
| GRM31B | 3.2 ±0.2 | 1.6 ±0.2 | 1.25 +0,-0.3 | | | |
| 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 | | | |
| GRM43D | | | 2.0 +0,-0.3 | | | |
| GRM55D | 5.7 ±0.4 | 5.0 ±0.4 | 2.0 +0,-0.3 | | | 3.2 |

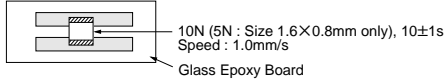
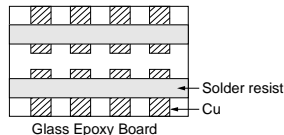
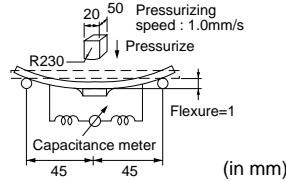
| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|--------------|---------------|--------------|------------------|-----------------------|------------------|
| 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. |
| GRM31BR72E683KW01L | DC250 | X7R (EIA) | 68000pF ±10% | 3.2 | 1.6 | 1.25 | 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. |

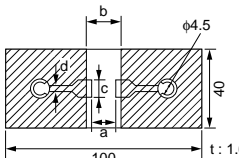
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| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|-------------------|--------------------|--------------|---------------|--------------|------------------|-----------------------|------------------|
| GRM31BR72J222KW01L | DC630 | X7R (EIA) | 2200pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| 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 | 3.2 | 0.3 min. |

Specifications and Test Methods

| No. | Item | Specifications | Test Method |
|-----|-----------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Operating Temperature Range | -55 to +125°C | - |
| 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.) | $C \geq 0.01\mu\text{F}$: More than 100MΩ • μF $C < 0.01\mu\text{F}$: 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°C at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.) |
| 7 | Dissipation Factor (D.F.) | 0.025 max. | •Pretreatment Perform a heat treatment at 150±5°C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| 8 | Capacitance Temperature Characteristics | Cap. Change Within ±15% (Temp. Range : -55 to +125°C) | The range of capacitance change compared with the 25°C value within -55 to +125°C should be within the specified range. •Pretreatment Perform a heat treatment at 150±5°C 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. 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. <div style="text-align: center;">  <p>10N (5N : Size 1.6×0.8mm only), 10±1s Speed : 1.0mm/s Glass Epoxy Board</p> </div> <p>Fig. 1</p> |
| 10 | 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.). <div style="text-align: center;">  <p>Solder resist Cu Glass Epoxy Board</p> </div> |
| | Capacitance | Within the specified tolerance | |
| | D.F. | 0.025 max. | |
| 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. <div style="text-align: center;">  <p>20 50 Pressurizing speed : 1.0mm/s Pressurize R230 Flexure=1 Capacitance meter 45 45 (in mm)</p> </div> <p>Fig. 3</p> |



$\phi 4.5$
t: 1.6
100

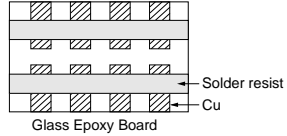
| L×W (mm) | Dimension (mm) | | | |
|----------|----------------|-----|------|-----|
| | a | b | c | d |
| 1.6×0.8 | 1.0 | 3.0 | 1.2 | 1.0 |
| 2.0×1.25 | 1.2 | 4.0 | 1.65 | |
| 3.2×1.6 | 2.2 | 5.0 | 2.0 | |
| 3.2×2.5 | 2.2 | 5.0 | 2.9 | |
| 4.5×3.2 | 3.5 | 7.0 | 3.7 | |
| 5.7×5.0 | 4.5 | 8.0 | 5.6 |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

Fig. 2

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

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). Immerse in solder solution for 2±0.5 sec. Immersing speed : 25±2.5mm/s Temp. of solder : 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder | | | | | | | | | | | | | | | |
| 13 | Resistance to Soldering Heat | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±10% | | | | | | | | | | | | | | | |
| | | D.F. | 0.025 max. | | | | | | | | | | | | | | | |
| | | I.R. | C≥0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Preheat the capacitor at 120 to 150°C* for 1 min. Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at *room condition for 24±2 hrs., then measure. •Immersing speed : 25±2.5mm/s •Pretreatment Perform a heat treatment at 150 ± ₁ 8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. *Preheating for more than 3.2X2.5mm | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | |
| Step | Temperature | Time | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | |
| 14 | Temperature Cycle | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±7.5% | | | | | | | | | | | | | | | |
| | | D.F. | 0.025 max. | | | | | | | | | | | | | | | |
| | | I.R. | C≥0.01μF : More than 100MΩ • μF C<0.01μF : More than 10,000MΩ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder. Perform the 5 cycles according to the 4 heat treatments listed in the following table. Let sit for 24±2 hrs. at *room condition, then measure. | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <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> </tbody> </table> | Step | Temperature (°C) | 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 |
| Step | Temperature (°C) | 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 | | | | | | | | | | | | | | | | |
| | | | •Pretreatment Perform a heat treatment at 150 ± ₁ 8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. | | | | | | | | | | | | | | | |
| | | |  <p style="text-align: center;">Glass Epoxy Board</p> | | | | | | | | | | | | | | | |
| | | | Fig. 4 | | | | | | | | | | | | | | | |
| 15 | Humidity (Steady State) | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±15% | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | |
| | | I.R. | C≥0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500 ± ₂ 8 hrs. Remove and let sit for 24±2 hrs. at *room condition, then measure. •Pretreatment Perform a heat treatment at 150 ± ₁ 8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. | | | | | | | | | | | | | | | |
| 16 | Life | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±15% (rated voltage : DC250V, DC630V) Within ±20% (rated voltage : DC1kV) | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | |
| | | I.R. | C≥0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | 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 ± ₄ 8 hrs. at maximum operating temperature ±3°C. Remove and let sit for 24 ±2 hrs. at *room condition, then measure. The charge/discharge current is less than 50mA. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at *room condition. | | | | | | | | | | | | | | | |
| 17 | Humidity Loading (Application : DC250V, DC630V item) | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±15% | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | |
| | | I.R. | C≥0.01μF : More than 10MΩ • μF C<0.01μF : More than 1,000MΩ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Apply the rated voltage at 40±2°C and relative humidity of 90 to 95% for 500 ± ₂ 8 hrs. Remove and let sit for 24±2 hrs. at *room condition, then measure. •Pretreatment Apply test voltage for 60±5 min. at test temperature. Remove and let sit for 24±2 hrs. at *room condition. | | | | | | | | | | | | | | | |

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

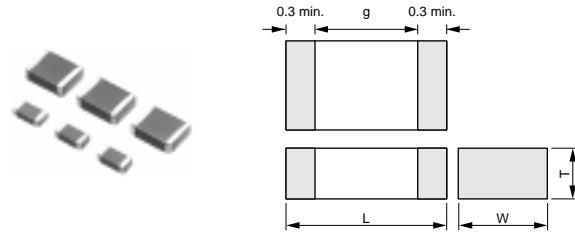
Chip Monolithic Ceramic Capacitors



Only for Information Devices/Tip & Ring

■ Features

1. These items are designed specifically for telecommunication 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.



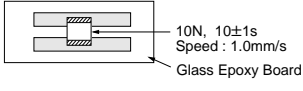
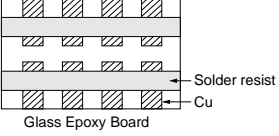
| Part Number | Dimensions (mm) | | | |
|-------------|-----------------|----------|--------------|--------|
| | L | W | T | g min. |
| GR442Q | 4.5 ±0.3 | 2.0 ±0.2 | 1.5 +0, -0.3 | 2.5 |
| GR443D | 4.5 ±0.4 | 3.2 ±0.3 | 2.0 +0, -0.3 | |
| GR443Q | | | 1.5 +0, -0.3 | |

■ 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

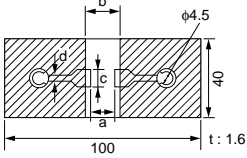
| No. | Item | Specifications | Test Method | | | | | | | | |
|---------------|-----------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|------|-------|---------------------------|-----------|-----------------|-----------|
| 1 | Operating Temperature Range | -55 to +125°C | — | | | | | | | | |
| 2 | Appearance | No defects or abnormalities | Visual inspection | | | | | | | | |
| 3 | Dimensions | Within the specified dimensions | Using calipers | | | | | | | | |
| 4 | Dielectric Strength | No defects or abnormalities | <p>No failure should be observed when voltage in table is applied between the terminations, provided the charge/discharge current is less than 50mA.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated voltage</th> <th>Test Voltage</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">DC2kV</td> <td style="text-align: center;">120% of the rated voltage</td> <td style="text-align: center;">60±1 sec.</td> </tr> <tr> <td style="text-align: center;">AC1500V(r.m.s.)</td> <td style="text-align: center;">60±1 sec.</td> </tr> </tbody> </table> | Rated voltage | Test Voltage | Time | DC2kV | 120% of the rated voltage | 60±1 sec. | AC1500V(r.m.s.) | 60±1 sec. |
| Rated voltage | Test Voltage | Time | | | | | | | | | |
| DC2kV | 120% of the rated voltage | 60±1 sec. | | | | | | | | | |
| | AC1500V(r.m.s.) | 60±1 sec. | | | | | | | | | |
| 5 | Pulse Voltage | No self healing break downs or flash-overs have taken place in the capacitor. | <p>10 impulse of alternating polarity is subjected. (5 impulse for each polarity) The interval between impulse is 60 sec. Applied Voltage : 2.5kV zero to peak</p> | | | | | | | | |
| 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°C at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.) | | | | | | | | |
| 8 | Dissipation Factor (D.F.) | 0.025 max. | <p>•Pretreatment Perform a heat treatment at 150 ± 0 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition.</p> | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | Cap. Change within ±15% (Temp. Range : -55 to +125°C) | <p>The range of capacitance change compared with the 25°C value within the specified range. •Pretreatment Perform a heat treatment at 150 ± 0 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition.</p> | | | | | | | | |
| 10 | Adhesive Strength of Termination | No removal of the terminations or other defect should occur. | <p>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.</p> <div style="text-align: center;">  <p>10N, 10±1s Speed : 1.0mm/s Glass Epoxy Board</p> </div> <p style="text-align: center;">Fig. 1</p> | | | | | | | | |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | |
| | | D.F. | 0.025 max. | | | | | | | | |
| | | | <p>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.).</p> <div style="text-align: center;">  <p>Solder resist Cu Glass Epoxy Board</p> </div> | | | | | | | | |

* "Room condition" Temperature : 15 to 35°C, 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 | | | | | | | | | | | | | | | | |
|----------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------|--|--|--|---|---|---|---|---|---------|-----|-----|-----|-----|---------|
| 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. 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. | | | | | | | | | | | | | | | | |
| | |  <table border="1" data-bbox="367 481 877 593"> <thead> <tr> <th rowspan="2">L×W (mm)</th> <th colspan="4">Dimension (mm)</th> <th rowspan="2">d</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>4.5×2.0</td> <td>3.5</td> <td>7.0</td> <td>2.4</td> <td rowspan="2">1.0</td> </tr> <tr> <td>4.5×3.2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> </tbody> </table> <p style="text-align: center;">Fig. 2</p> | | L×W (mm) | Dimension (mm) | | | | d | a | b | c | d | 4.5×2.0 | 3.5 | 7.0 | 2.4 | 1.0 | 4.5×3.2 |
| L×W (mm) | Dimension (mm) | | | | d | | | | | | | | | | | | | | |
| | 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 | | | | | | | | | | | | | | | | |
| 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). Immerse in solder solution for 2±0.5 sec. Immersing speed : 25±2.5mm/s Temp. of solder : 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder | | | | | | | | | | | | | | | | |
| | | | Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at *room condition for 24±2 hrs., then measure. Immersing speed : 25±2.5mm/s •Pretreatment Perform a heat treatment at 150±18°C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. | | | | | | | | | | | | | | | | |
| 14 | Resistance to Soldering Heat | Appearance | No marking defects | | | | | | | | | | | | | | | | |
| | | 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 | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±15% | | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | | |
| | | I.R. | More than 3,000MΩ | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | |
| 16 | Humidity (Steady State) | Appearance | No marking defects | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±15% | | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | | |
| | | I.R. | More than 1,000MΩ | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | |

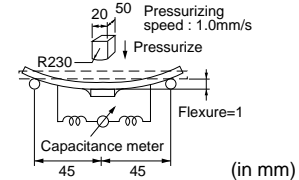


Fig. 3

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

| Step | Temperature (°C) | 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 |

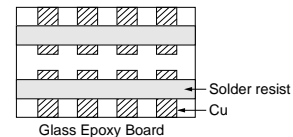


Fig. 4

* "Room condition" Temperature : 15 to 35°C, 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 | Appearance | No marking defects | Apply 110% of the rated voltage for 1,000 ^{±48} hrs. at maximum operating temperature ±3°C. Remove and let sit for 24 ±2 hrs. at *room condition, then measure. The charge/discharge current is less than 50mA. •Pretreatment Apply test voltage for 60±5 min. at test temperature. 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 | |

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

Chip Monolithic Ceramic Capacitors



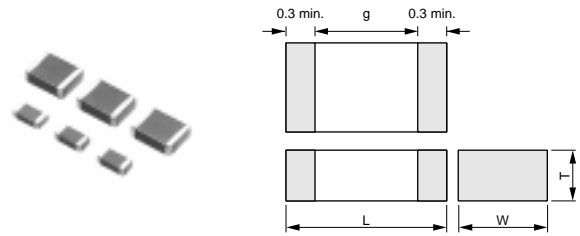
Only for Camera Flash Circuit

■ Features

1. Suitable for the trigger of the flash circuit, because real capacitance is stable during operating voltage.
2. The thin type fit for thinner camera.
3. Sn-plated external electrodes realizes good solderability.
4. For flow and reflow soldering

■ Applications

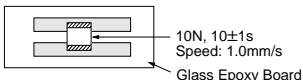
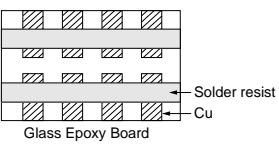
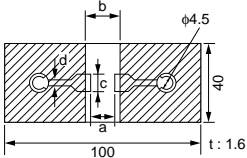
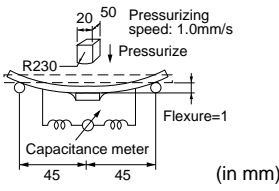
For strobe circuit



| Part Number | Dimensions (mm) | | | |
|---------------|-----------------|----------|---------------|--------|
| | L | W | T | g min. |
| GR731A | 3.2 ±0.2 | 1.6 ±0.2 | 1.0 +0, -0.3 | 1.2 |
| GR731B | | | 1.25 +0, -0.3 | |
| GR731C | | | 1.6 ±0.2 | |

| 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) |
|---------------------------|-------------------|--------------------|------------------|---------------|--------------|------------------|-----------------------|------------------|
| GR731AW0BB103KW01D | DC350 | - | 10000 ±10% | 3.2 | 1.6 | 1.0 | 1.2 | 0.3 min. |
| GR731AW0BB153KW01D | DC350 | - | 15000 ±10% | 3.2 | 1.6 | 1.0 | 1.2 | 0.3 min. |
| GR731BW0BB223KW01L | DC350 | - | 22000 ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GR731BW0BB333KW01L | DC350 | - | 33000 ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GR731CW0BB473KW03L | DC350 | - | 47000 ±10% | 3.2 | 1.6 | 1.6 | 1.2 | 0.3 min. |

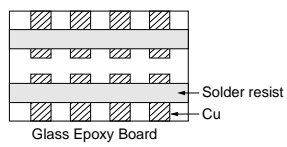
Specifications and Test Methods

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | |
|---------|-----------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------|--|--|--|---|---|---|---|---------|-----|-----|-----|-----|
| 1 | Operating Temperature Range | -55 to +125°C | — | | | | | | | | | | | | | | |
| 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 DC500V 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 C < 0.01μF: More than 10,000MΩ | The insulation resistance should be measured with DC250±50V and within 60±5 sec. of charging. | | | | | | | | | | | | | | |
| 6 | Capacitance | Within the specified tolerance | The capacitance/D.F. should be measured at 25°C at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.) •Pretreatment | | | | | | | | | | | | | | |
| 7 | Dissipation Factor (D.F.) | 0.025 max. | Perform a heat treatment at 150 ± 0.5 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. | | | | | | | | | | | | | | |
| 8 | Capacitance Temperature Characteristics | Cap. Change Within ±10% (Apply DC350V bias) Within ±2.5% (No DC bias) | The range of capacitance change compared with the 25°C value within -55 to +125°C should be within the specified range. •Pretreatment Perform a heat treatment at 150 ± 0.5 °C 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. 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.  | | | | | | | | | | | | | | |
| 10 | Vibration Resistance | Appearance | No defects or abnormalities | | | | | | | | | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | | | | | | | | | |
| | | D.F. | 0.025 max. | | | | | | | | | | | | | | |
| | | | 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.).  | | | | | | | | | | | | | | |
| 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.  <table border="1" data-bbox="375 1747 877 1825"> <thead> <tr> <th rowspan="2">LxW (mm)</th> <th colspan="4">Dimension (mm)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>3.2x1.6</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> <td>1.0</td> </tr> </tbody> </table> | LxW (mm) | Dimension (mm) | | | | a | b | c | d | 3.2x1.6 | 2.2 | 5.0 | 2.0 | 1.0 |
| | | LxW (mm) | | | Dimension (mm) | | | | | | | | | | | | |
| a | b | | c | d | | | | | | | | | | | | | |
| 3.2x1.6 | 2.2 | 5.0 | 2.0 | 1.0 | | | | | | | | | | | | | |
| | | |  | | | | | | | | | | | | | | |
| 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 solder solution for 2±0.5 sec. Immersing speed: 25±2.5mm/s Temp. of solder : 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder | | | | | | | | | | | | | | |

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

Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | |
|------|----------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------------------------|-------------|---|------------------------------|------------|---|----------------------------|--------|---|------------------------------|------------|---|------------|--------|
| 13 | Resistance to Soldering Heat | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within $\pm 10\%$ | | | | | | | | | | | | | | | |
| | | D.F. | 0.025 max. | | | | | | | | | | | | | | | |
| | | I.R. | $C \geq 0.01\mu\text{F}$: More than $100\text{M}\Omega \cdot \mu\text{F}$ $C < 0.01\mu\text{F}$: More than $10,000\text{M}\Omega$ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Preheat the capacitor at 120 to 150°C^* for 1 min. Immerse the capacitor in solder solution at $260 \pm 5^\circ\text{C}$ for 10 ± 1 sec. Let sit at *room condition for 24 ± 2 hrs., then measure. •Immersing speed : $25 \pm 2.5\text{mm/s}$ •Pretreatment Perform a heat treatment at $150 \pm 1.8^\circ\text{C}$ for 60 ± 5 min. and then let sit for 24 ± 2 hrs. at *room condition. *Preheating for more than $3.2 \times 2.5\text{mm}$ <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | |
| Step | Temperature | Time | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | |
| 14 | Temperature Cycle | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within $\pm 7.5\%$ | | | | | | | | | | | | | | | |
| | | D.F. | 0.025 max. | | | | | | | | | | | | | | | |
| | | I.R. | $C \geq 0.01\mu\text{F}$: More than $100\text{M}\Omega \cdot \mu\text{F}$ $C < 0.01\mu\text{F}$: More than $10,000\text{M}\Omega$ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder. Perform the 5 cycles according to the 4 heat treatments listed in the following table. Let sit for 24 ± 2 hrs. at *room condition, then measure. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature ($^\circ\text{C}$)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <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> </tbody> </table> •Pretreatment Perform a heat treatment at $150 \pm 1.8^\circ\text{C}$ for 60 ± 5 min. and then let sit for 24 ± 2 hrs. at *room condition. | Step | Temperature ($^\circ\text{C}$) | 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 |
| Step | Temperature ($^\circ\text{C}$) | 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 | | | | | | | | | | | | | | | | |
| | | |  <p>Fig. 4</p> | | | | | | | | | | | | | | | |
| 15 | Humidity (Steady State) | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within $\pm 15\%$ | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | |
| | | I.R. | $C \geq 0.01\mu\text{F}$: More than $10\text{M}\Omega \cdot \mu\text{F}$ $C < 0.01\mu\text{F}$: More than $1,000\text{M}\Omega$ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Let the capacitor sit at $40 \pm 2^\circ\text{C}$ and relative humidity of 90 to 95% for 500 ± 24 hrs. Remove and let sit for 24 ± 2 hrs. at *room condition, then measure. •Pretreatment Perform a heat treatment at $150 \pm 1.8^\circ\text{C}$ for 60 ± 5 min. and then let sit for 24 ± 2 hrs. at *room condition. | | | | | | | | | | | | | | | |
| 16 | Life | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within $\pm 15\%$ | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | |
| | | I.R. | $C \geq 0.01\mu\text{F}$: More than $10\text{M}\Omega \cdot \mu\text{F}$ $C < 0.01\mu\text{F}$: More than $1,000\text{M}\Omega$ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Apply DC350V for $1,000 \pm 48$ hrs. at maximum operating temperature $\pm 3^\circ\text{C}$. Remove and let sit for 24 ± 2 hrs. at *room condition, then measure. The charge/discharge current is less than 50mA. •Pretreatment Apply test voltage for 60 ± 5 min. at test temperature. Remove and let sit for 24 ± 2 hrs. at *room condition. | | | | | | | | | | | | | | | |
| 17 | Humidity Loading | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within $\pm 15\%$ | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | |
| | | I.R. | $C \geq 0.01\mu\text{F}$: More than $10\text{M}\Omega \cdot \mu\text{F}$ $C < 0.01\mu\text{F}$: More than $1,000\text{M}\Omega$ | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | |
| | | | Apply the rated voltage at $40 \pm 2^\circ\text{C}$ and relative humidity of 90 to 95% for 500 ± 24 hrs. Remove and let sit for 24 ± 2 hrs. at *room condition, then measure. •Pretreatment Apply test voltage for 60 ± 5 min. at test temperature. Remove and let sit for 24 ± 2 hrs. at *room condition. | | | | | | | | | | | | | | | |

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

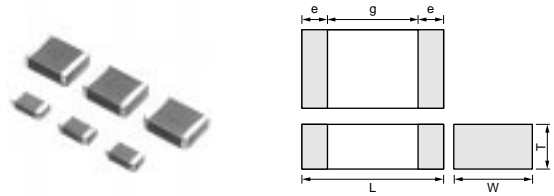
Chip Monolithic Ceramic Capacitors



AC250V(r.m.s.) 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 0.1uF for connecting lines and 470 to 4700pF 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 | | 3.2 |

■ Applications

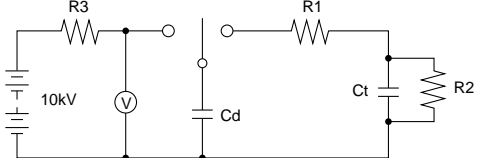
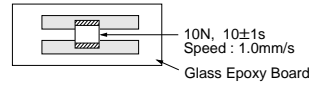
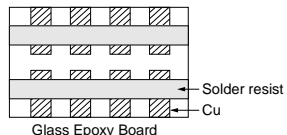
Noise suppression filters for switching power supplies, telephones, facsimiles, modems.

■ 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 | 3.2 | 0.3 min. |

Specifications and Test Methods

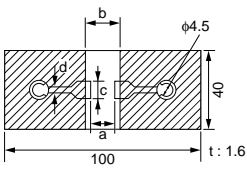
| No. | Item | Specifications | Test Method | | | | | | |
|---------------------|--------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------|------------|----------------|------------|-----------------|
| 1 | Operating Temperature Range | -55 to +125°C | — | | | | | | |
| 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. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Nominal Capacitance</th> <th>Test voltage</th> </tr> </thead> <tbody> <tr> <td>C≥10,000pF</td> <td>AC575V(r.m.s.)</td> </tr> <tr> <td>C<10,000pF</td> <td>AC1500V(r.m.s.)</td> </tr> </tbody> </table> | Nominal Capacitance | Test voltage | C≥10,000pF | AC575V(r.m.s.) | C<10,000pF | AC1500V(r.m.s.) |
| Nominal Capacitance | Test voltage | | | | | | | | |
| C≥10,000pF | AC575V(r.m.s.) | | | | | | | | |
| 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°C at a frequency of 1±0.2kHz and a voltage of AC1±0.2V(r.m.s.) | | | | | | |
| 7 | Dissipation Factor (D.F.) | 0.025 max. | •Pretreatment Perform a heat treatment at 150±1.8°C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. | | | | | | |
| 8 | Capacitance Temperature Characteristics | Cap. Change Within ±15% (Temp. Range : -55 to +125°C) | The range of capacitance change compared with the 25°C value within -55 to +125°C should be within the specified range. •Pretreatment Perform a heat treatment at 150±1.8°C 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.  Ct : Capacitor under test Cd : 0.001μF 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.  Fig. 1 10N, 10±1s Speed : 1.0mm/s Glass Epoxy Board | | | | | | |
| 11 | Vibration Resistance | Appearance | No defects or abnormalities | | | | | | |
| | | Capacitance | Within the specified tolerance | | | | | | |
| | | D.F. | 0.025 max. | | | | | | |
| | | | 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.).  Solder resist Cu Glass Epoxy Board | | | | | | |

* "Room condition" Temperature : 15 to 35°C, 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 | | | | | | | | | | | | | | | | | | | |
|----------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------|--|--|--|---|---|---|---|---------|-----|-----|-----|-----|---------|-----|-----|-----|---------|
| 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. 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. | | | | | | | | | | | | | | | | | | | |
| | |  <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <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> </thead> <tbody> <tr> <td>4.5×2.0</td> <td>3.5</td> <td>7.0</td> <td>2.4</td> <td rowspan="3" style="text-align: center; vertical-align: middle;">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> </tbody> </table> <p style="text-align: center;">Fig. 2</p> | | 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 | 5.7×5.0 |
| 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 | | | | | | | | | | | | | | | | | | | |
| 5.7×5.0 | 4.5 | 8.0 | 5.6 | | | | | | | | | | | | | | | | | | | |
| 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). Immerse in solder solution for 2±0.5 sec. Immersing speed : 25±2.5mm/s Temp. of solder : 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder | | | | | | | | | | | | | | | | | | | |
| 14 | Humidity Insulation | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±15% | | | | | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 1,000MΩ | | | | | | | | | | | | | | | | | | | |
| 15 | Resistance to Soldering Heat | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±10% | | | | | | | | | | | | | | | | | | | |
| | | D.F. | 0.025 max. | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 2,000MΩ | | | | | | | | | | | | | | | | | | | |
| 16 | Temperature Cycle | Appearance | No marking defects | | | | | | | | | | | | | | | | | | | |
| | | Capacitance Change | Within ±15% | | | | | | | | | | | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | | | | | | | | | | | |
| | | I.R. | More than 2,000MΩ | | | | | | | | | | | | | | | | | | | |
| 16 | Temperature Cycle | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | | | |

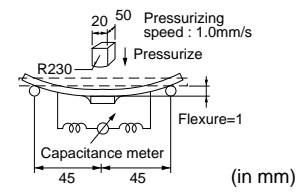


Fig. 3

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

| Step | Temperature (°C) | 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 |

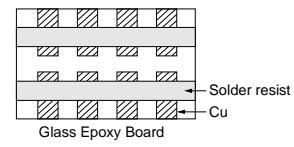


Fig. 4

* "Room condition" Temperature : 15 to 35°C, 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 | | | | | | | | | |
| | | Capacitance Change | Within $\pm 15\%$ | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | |
| | | I.R. | More than 1,000M Ω | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | |
| | | | Let the capacitor sit at $40\pm 2^\circ\text{C}$ and relative humidity of 90 to 95% for 500 ± 24 hrs. Remove and let sit for 24 ± 2 hrs. at *room condition, then measure. •Pretreatment Perform a heat treatment at $150\pm 18^\circ\text{C}$ for 60 ± 5 min. and then let sit for 24 ± 2 hrs. at *room condition. | | | | | | | | | |
| 18 | Life | Appearance | No marking defects | | | | | | | | | |
| | | Capacitance Change | Within $\pm 20\%$ | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | |
| | | I.R. | More than 1,000M Ω | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | |
| | | | Apply voltage and time as Table at $85\pm 2^\circ\text{C}$. Remove and let sit for 24 ± 2 hrs. at *room condition, then measure. The charge / discharge current is less than 50mA. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Nominal Capacitance</th> <th>Test Time</th> <th>Test voltage</th> </tr> </thead> <tbody> <tr> <td>$C \geq 10,000\text{pF}$</td> <td>$1,000\pm 48$ hrs.</td> <td>AC300V(r.m.s.)</td> </tr> <tr> <td>$C < 10,000\text{pF}$</td> <td>$1,500\pm 48$ hrs.</td> <td>AC500V(r.m.s.) *</td> </tr> </tbody> </table> * Except that once each hour the voltage is increased to AC1,000V (r.m.s.) for 0.1 sec. •Pretreatment Apply test voltage for 60 ± 5 min. at test temperature. Remove and let sit for 24 ± 2 hrs. at *room condition. | Nominal Capacitance | Test Time | Test voltage | $C \geq 10,000\text{pF}$ | $1,000\pm 48$ hrs. | AC300V(r.m.s.) | $C < 10,000\text{pF}$ | $1,500\pm 48$ hrs. | AC500V(r.m.s.) * |
| Nominal Capacitance | Test Time | Test voltage | | | | | | | | | | |
| $C \geq 10,000\text{pF}$ | $1,000\pm 48$ hrs. | AC300V(r.m.s.) | | | | | | | | | | |
| $C < 10,000\text{pF}$ | $1,500\pm 48$ hrs. | AC500V(r.m.s.) * | | | | | | | | | | |
| 19 | Humidity Loading | Appearance | No marking defects | | | | | | | | | |
| | | Capacitance Change | Within $\pm 15\%$ | | | | | | | | | |
| | | D.F. | 0.05 max. | | | | | | | | | |
| | | I.R. | More than 1,000M Ω | | | | | | | | | |
| | | Dielectric Strength | In accordance with item No.4 | | | | | | | | | |
| | | | Apply the rated voltage at $40\pm 2^\circ\text{C}$ and relative humidity of 90 to 95% for 500 ± 24 hrs. Remove and let sit for 24 ± 2 hrs. at *room condition, then measure. •Pretreatment Apply test voltage for 60 ± 5 min. at test temperature. Remove and let sit for 24 ± 2 hrs. at *room condition. | | | | | | | | | |

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

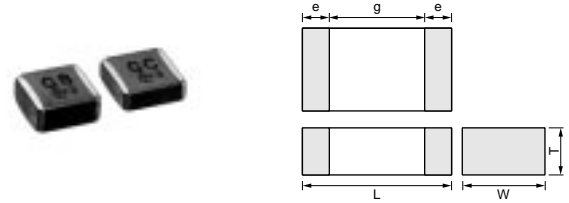
Chip Monolithic Ceramic Capacitors



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



| 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 |

■ Applications

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

■ 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. |

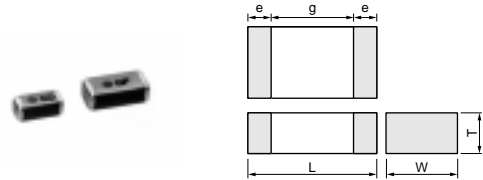
Chip Monolithic Ceramic Capacitors



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.



| 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

■ 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

■ 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



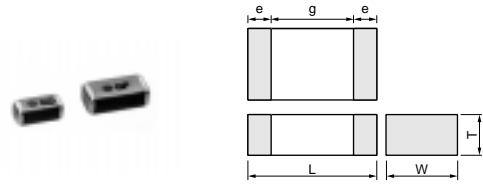
Safety Standard Recognized Type GF (IEC60384-14 Class Y2, X1/Y2)

■ 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 | 2.8 ±0.3 | 1.5 +0, -0.3 | | | |
| GA355D | 5.7 ±0.4 | 5.0 ±0.4 | 2.0 +0, -0.3 | | 4.0 |
| GA355Q | | | 1.5 +0, -0.3 | | |

* GA342D1X : 2.0±0.3

■ Standard Recognition

| | Standard No. | Class | Status of Recognition | | Rated Voltage |
|-------|--------------|--------|-----------------------|---------------------------|-----------------|
| | | | Type GF | | |
| | | | Size : 4.5x2.0mm | Size : 5.7x2.8mm 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 |
|--------------------|--------------------------|-----------------------------------------------|
| 4.5x2.0mm | — | ⊙ |
| 5.7x2.8mm 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. |
| GA355DR7GF472KW01L | AC250 (r.m.s.) | X7R (EIA) | 4700 ±10% | 5.7 | 5.0 | 2.0 | 4.0 | 0.3 min. |

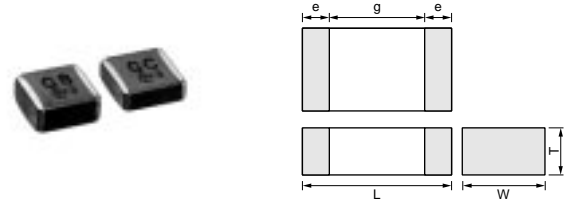
Chip Monolithic Ceramic Capacitors



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



| 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 | | |

■ Applications

Ideal for use as X capacitor for various switching power supplies

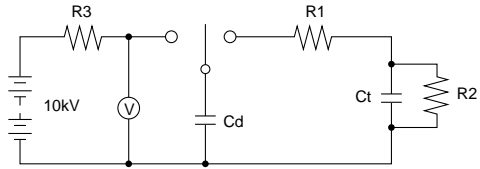
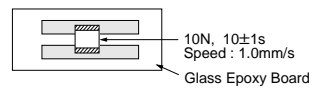
■ Standard Recognition

| | 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

| No. | Item | Specifications | Test Method | | | | | | | | |
|---------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----|--------------|---------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Operating Temperature Range | -55 to +125°C | - | | | | | | | | |
| 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. <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Test Voltage</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Type GB</td> <td style="text-align: center;">DC1075V</td> </tr> <tr> <td style="text-align: center;">Type GC/GD/GF</td> <td style="text-align: center;">AC1500V(r.m.s.)</td> </tr> </tbody> </table> | Test Voltage | | Type GB | DC1075V | Type GC/GD/GF | AC1500V(r.m.s.) | | |
| Test Voltage | | | | | | | | | | | |
| Type GB | DC1075V | | | | | | | | | | |
| Type GC/GD/GF | AC1500V(r.m.s.) | | | | | | | | | | |
| 5 | Pulse Voltage (Application: Type GD/GF) | No self healing break downs or flash-overs have taken place in the capacitor. | 10 impulse of alternating polarity is subjected. (5 impulse for each polarity) The interval between impulse is 60 sec. 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/Q/D.F. should be measured at 20°C at a frequency of 1±0.2kHz (SL char. : 1±0.2MHz) and a voltage of AC1±0.2V(r.m.s.). | | | | | | | | |
| 8 | Dissipation Factor (D.F.) Q | <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Char.</th> <th style="text-align: center;">Specification</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">X7R</td> <td style="text-align: center;">D.F. ≤ 0.025</td> </tr> <tr> <td style="text-align: center;">SL</td> <td style="text-align: center;">Q ≥ 400+20C*² (C < 30pF) Q ≥ 1000 (C ≥ 30pF)</td> </tr> </tbody> </table> | Char. | Specification | X7R | D.F. ≤ 0.025 | SL | Q ≥ 400+20C* ² (C < 30pF) Q ≥ 1000 (C ≥ 30pF) | •Pretreatment for X7R char. Perform a heat treatment at 150 ± 10°C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. | | |
| Char. | Specification | | | | | | | | | | |
| X7R | D.F. ≤ 0.025 | | | | | | | | | | |
| SL | Q ≥ 400+20C* ² (C < 30pF) Q ≥ 1000 (C ≥ 30pF) | | | | | | | | | | |
| 9 | Capacitance Temperature Characteristics | <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Char.</th> <th style="text-align: center;">Capacitance Change</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">X7R</td> <td style="text-align: center;">Within ±15%</td> </tr> </tbody> </table> Temperature characteristic guarantee is -55 to +125°C <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Char.</th> <th style="text-align: center;">Temperature Coefficient</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">SL</td> <td style="text-align: center;">+350 to -1000ppm/°C</td> </tr> </tbody> </table> Temperature characteristic guarantee is +20 to +85°C | Char. | Capacitance Change | X7R | Within ±15% | Char. | Temperature Coefficient | SL | +350 to -1000ppm/°C | The range of capacitance change compared with the 25°C (SL char. : 20°C) value within -55 to +125°C should be within the specified range. •Pretreatment for X7R char. Perform a heat treatment at 150 ± 10°C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. |
| Char. | Capacitance Change | | | | | | | | | | |
| X7R | Within ±15% | | | | | | | | | | |
| Char. | Temperature Coefficient | | | | | | | | | | |
| SL | +350 to -1000ppm/°C | | | | | | | | | | |
| 10 | 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. <div style="text-align: center;">  <p style="margin: 5px 0;">Ct : Capacitor under test Cd : 0.001μF R1 : 1,000Ω R2 : 100MΩ R3 : Surge resistance</p> </div> | | | | | | | | |
| | I.R. | More than 1,000MΩ | | | | | | | | | |
| | Dielectric Strength | In accordance with item No.4 | | | | | | | | | |
| 11 | 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. 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. <div style="text-align: center;">  <p style="margin: 5px 0;">10N, 10±1s Speed : 1.0mm/s Glass Epoxy Board</p> </div> <p style="text-align: center;">Fig. 1</p> | | | | | | | | |

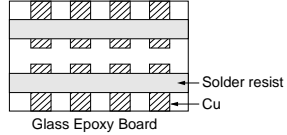
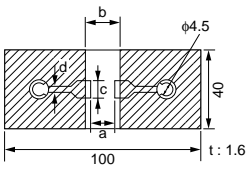
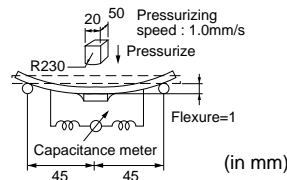
*1 "Room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

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

Continued on the following page.

GA3 Series Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|------|-------------|--------------|-----------------------------------------------|---|--------------|--------|---|---------|-----|-----|-----|-----|---------|-----|-----|-----|---------|-----|-----|-----|---------|
| 12 | 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 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | Vibration Resistance | D.F. |  | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Q | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | 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. | | | | | | | | | | | | | | | | | | | | | | | | |
| | |  <table border="1" data-bbox="367 884 877 1030"> <thead> <tr> <th>LxW (mm)</th> <th colspan="4">Dimension (mm)</th> </tr> <tr> <th></th> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>4.5x2.0</td> <td>3.5</td> <td>7.0</td> <td>2.4</td> <td rowspan="4">1.0</td> </tr> <tr> <td>4.5x3.2</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>5.7x2.8</td> <td>4.5</td> <td>8.0</td> <td>3.2</td> </tr> <tr> <td>5.7x5.0</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> | | LxW (mm) | Dimension (mm) | | | | | a | b | c | d | 4.5x2.0 | 3.5 | 7.0 | 2.4 | 1.0 | 4.5x3.2 | 3.5 | 7.0 | 3.7 | 5.7x2.8 | 4.5 | 8.0 | 3.2 | 5.7x5.0 |
| LxW (mm) | Dimension (mm) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | a | b | c | d | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5x2.0 | 3.5 | 7.0 | 2.4 | 1.0 | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5x3.2 | 3.5 | 7.0 | 3.7 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.7x2.8 | 4.5 | 8.0 | 3.2 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.7x5.0 | 4.5 | 8.0 | 5.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | Solderability of Termination | 75% of the terminations are to be soldered evenly and continuously. |  | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1" data-bbox="933 1456 1452 1534"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | |
| Step | Temperature | Time | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | Resistance to Soldering Heat | Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in solder solution for 2±0.5 sec. Immersing speed : 25±2.5mm/s Temp. of solder : 245±5°C Lead Free Solder (Sn-3.0Ag-0.5Cu) 235±5°C H60A or H63A Eutectic Solder | Preheat the capacitor as table. Immerse the capacitor in solder solution at 260±5°C for 10±1 sec. Let sit at *room condition for 24±2 hrs., then measure. •Immersing speed : 25±2.5mm/s •Pretreatment for X7R char. Perform a heat treatment at 150±10°C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. *Preheating | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 75% of the terminations are to be soldered evenly and continuously. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | Appearance | No marking defects | <table border="1" data-bbox="351 1288 702 1388"> <thead> <tr> <th>Char.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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> </tbody> </table> | Char. | Capacitance Change | X7R | Within ±10% | SL | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | | | | | | | | |
| | | Char. | | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | Within ±10% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SL | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | Capacitance Change | More than 1,000MΩ | <table border="1" data-bbox="351 1467 702 1534"> <thead> <tr> <th>Char.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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> </tbody> </table> | Char. | Capacitance Change | X7R | Within ±10% | SL | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | | | | | | | | |
| | | Char. | | Capacitance Change | | | | | | | | | | | | | | | | | | | | | | | |
| X7R | Within ±10% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SL | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | I.R. | In accordance with item No.4 | <table border="1" data-bbox="933 1456 1452 1534"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | |
| | | Step | | Temperature | Time | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | Dielectric Strength | More than 1,000MΩ | <table border="1" data-bbox="933 1456 1452 1534"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | |
| | | Step | | Temperature | Time | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | Dielectric Strength | In accordance with item No.4 | <table border="1" data-bbox="933 1456 1452 1534"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table> | Step | Temperature | Time | 1 | 100 to 120°C | 1 min. | 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | |
| | | Step | | Temperature | Time | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 100 to 120°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 170 to 200°C | 1 min. | | | | | | | | | | | | | | | | | | | | | | | | | |

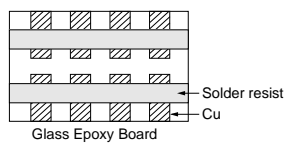
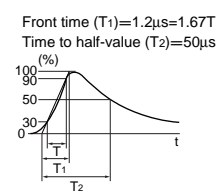
*1 "Room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

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

Continued on the following page. 

GA3 Series Specifications and Test Methods

Continued from the preceding page.

| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|-------------|--------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------|-----------|------------|--------|---|-------------------------|------|---|------------|--------|
| 16 | Temperature Cycle | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Char.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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> </tbody> </table> | Char. | Capacitance Change | X7R | Within ±15% | SL | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | |
| | | | Char. | Capacitance Change | | | | | | | | | | | | | | |
| | | X7R | Within ±15% | | | | | | | | | | | | | | | |
| | | SL | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | | | | | | | | | | | | |
| D.F. Q | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Char.</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>D.F. ≤0.05</td> </tr> <tr> <td>SL</td> <td>Q ≥ 400 + 20C*2 (C < 30pF) Q ≥ 1000 (C ≥ 30pF)</td> </tr> </tbody> </table> | Char. | Specification | X7R | D.F. ≤0.05 | SL | Q ≥ 400 + 20C*2 (C < 30pF) Q ≥ 1000 (C ≥ 30pF) | | | | | | | | | | | |
| | Char. | Specification | | | | | | | | | | | | | | | | |
| X7R | D.F. ≤0.05 | | | | | | | | | | | | | | | | | |
| SL | Q ≥ 400 + 20C*2 (C < 30pF) Q ≥ 1000 (C ≥ 30pF) | | | | | | | | | | | | | | | | | |
| I.R. | More than 3,000MΩ | | | | | | | | | | | | | | | | | |
| Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | |
| | | | Fix the capacitor to the supporting jig (glass epoxy board) shown in Fig. 4 using a eutectic solder. Perform the 5 cycles according to the 4 heat treatments listed in the following table. Let sit for 24±2 hrs. at *room condition, then measure. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 15%;">Step</th> <th style="width: 55%;">Temperature (°C)</th> <th style="width: 30%;">Time (min.)</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>•Pretreatment for X7R char. Perform a heat treatment at 150 ± 1.8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition.</p> <div style="text-align: center;">  <p style="font-size: small;">Solder resist Cu Glass Epoxy Board</p> </div> <p style="text-align: center;">Fig. 4</p> | Step | Temperature (°C) | 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 |
| Step | Temperature (°C) | 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 | | | | | | | | | | | | | | | | |
| 17 | Humidity (Steady State) | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Char.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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> </tbody> </table> | Char. | Capacitance Change | X7R | Within ±15% | SL | Within ±5.0% or ±0.5pF (Whichever is larger) | | | | | | | | | |
| | | | Char. | Capacitance Change | | | | | | | | | | | | | | |
| | | X7R | Within ±15% | | | | | | | | | | | | | | | |
| | | SL | Within ±5.0% or ±0.5pF (Whichever is larger) | | | | | | | | | | | | | | | |
| D.F. Q | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Char.</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>D.F. ≤0.05</td> </tr> <tr> <td>SL</td> <td>Q ≥ 275 + 5/2C*2 (C < 30pF) Q ≥ 350 (C ≥ 30pF)</td> </tr> </tbody> </table> | Char. | Specification | X7R | D.F. ≤0.05 | SL | Q ≥ 275 + 5/2C*2 (C < 30pF) Q ≥ 350 (C ≥ 30pF) | | | | | | | | | | | |
| | Char. | Specification | | | | | | | | | | | | | | | | |
| X7R | D.F. ≤0.05 | | | | | | | | | | | | | | | | | |
| SL | Q ≥ 275 + 5/2C*2 (C < 30pF) Q ≥ 350 (C ≥ 30pF) | | | | | | | | | | | | | | | | | |
| I.R. | More than 3,000MΩ | | | | | | | | | | | | | | | | | |
| Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | |
| | | | Before this test, the test shown in the following is performed. -Item 11 Adhesive Strength of Termination (apply force is 5N) -Item 13 Deflection Let the capacitor sit at 40±2°C and relative humidity of 90 to 95% for 500 ± 24 hrs. Remove and let sit for 24±2 hrs. at *room condition, then measure. •Pretreatment for X7R char. Perform a heat treatment at 150 ± 1.8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition. | | | | | | | | | | | | | | | |
| 18 | Life | Appearance | No marking defects | | | | | | | | | | | | | | | |
| | | Capacitance Change | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Char.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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> </tbody> </table> | Char. | Capacitance Change | X7R | Within ±20% | SL | Within ±3.0% or ±0.3pF (Whichever is larger) | | | | | | | | | |
| | | | Char. | Capacitance Change | | | | | | | | | | | | | | |
| | | X7R | Within ±20% | | | | | | | | | | | | | | | |
| | | SL | Within ±3.0% or ±0.3pF (Whichever is larger) | | | | | | | | | | | | | | | |
| D.F. Q | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Char.</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>D.F. ≤0.05</td> </tr> <tr> <td>SL</td> <td>Q ≥ 275 + 5/2C*2 (C < 30pF) Q ≥ 350 (C ≥ 30pF)</td> </tr> </tbody> </table> | Char. | Specification | X7R | D.F. ≤0.05 | SL | Q ≥ 275 + 5/2C*2 (C < 30pF) Q ≥ 350 (C ≥ 30pF) | | | | | | | | | | | |
| | Char. | Specification | | | | | | | | | | | | | | | | |
| X7R | D.F. ≤0.05 | | | | | | | | | | | | | | | | | |
| SL | Q ≥ 275 + 5/2C*2 (C < 30pF) Q ≥ 350 (C ≥ 30pF) | | | | | | | | | | | | | | | | | |
| I.R. | More than 3,000MΩ | | | | | | | | | | | | | | | | | |
| Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | |
| | | | Before this test, the test shown in the following is performed. -Item 11 Adhesive Strength of Termination (apply force is 5N) -Item 13 Deflection Impulse Voltage 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. <div style="text-align: right; margin-top: 10px;">  <p style="font-size: x-small;">Front time (T1) = 1.2μs = 1.67T Time to half-value (T2) = 50μs</p> </div> <p>Apply voltage as Table for 1,000 hrs. at 125 ± 2 °C, relative humidity 50% max.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 15%;">Type</th> <th>Applied Voltage</th> </tr> </thead> <tbody> <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</td> <td rowspan="2">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> <tr> <td>GF</td> </tr> </tbody> </table> <p>Let sit for 24±2 hrs. at *room condition, then measure. •Pretreatment for X7R char. Perform a heat treatment at 150 ± 1.8 °C for 60±5 min. and then let sit for 24±2 hrs. at *room condition.</p> | Type | Applied Voltage | GB | AC312.5V(r.m.s.), except that once each hour the voltage is increased to AC1,000V(r.m.s.) for 0.1 sec. | GC | AC425V(r.m.s.), except that once each hour the voltage is increased to AC1,000V(r.m.s.) for 0.1 sec. | GF | | | | | | | | |
| Type | Applied Voltage | | | | | | | | | | | | | | | | | |
| GB | AC312.5V(r.m.s.), except that once each hour the voltage is increased to AC1,000V(r.m.s.) for 0.1 sec. | | | | | | | | | | | | | | | | | |
| GC | AC425V(r.m.s.), except that once each hour the voltage is increased to AC1,000V(r.m.s.) for 0.1 sec. | | | | | | | | | | | | | | | | | |
| GF | | | | | | | | | | | | | | | | | | |

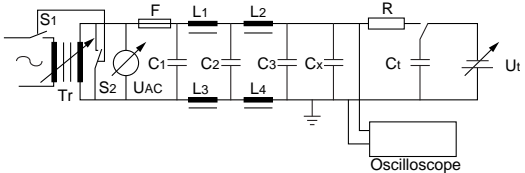
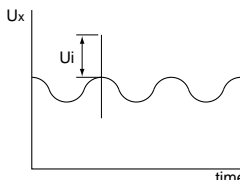
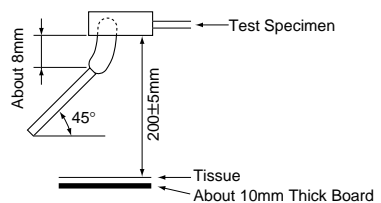
*1 "Room condition" Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmospheric pressure : 86 to 106kPa

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

Continued on the following page.

GA3 Series Specifications and Test Methods

Continued from the preceding page.

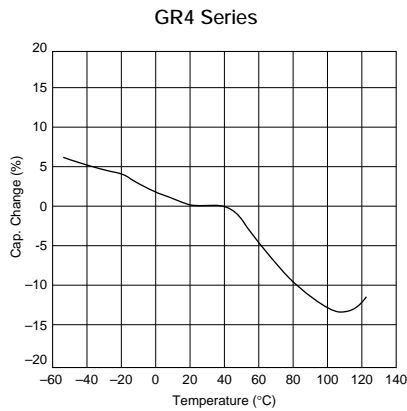
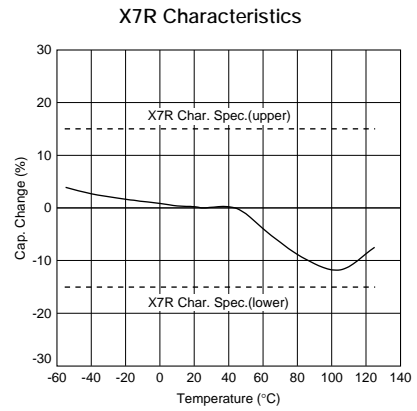
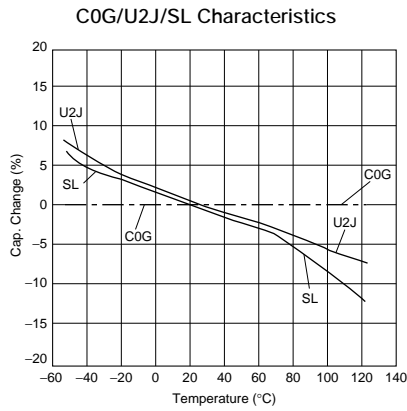
| No. | Item | Specifications | Test Method | | | | | | | | | | | | | | | | | | |
|-----------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------|-----------------------------------------------|--|---------------------------------|------------------------|---------------------------|--------------------|---------------------|--------------------|--|----------------------------|------|----|--------|-------|--------|-----|
| 19 | Appearance | No marking defects | Before this test, the test shown in the following is performed. -Item 11 Adhesive Strength of Termination (apply force is 5N) -Item 13 Deflection Apply the rated voltage at $40\pm 2^{\circ}\text{C}$ and relative humidity of 90 to 95% for $500\pm 2^{\circ}\text{hrs}$. Remove and let sit for 24 ± 2 hrs. at *1room condition, then measure. •Pretreatment for X7R char. Perform a heat treatment at $150\pm 1^{\circ}\text{C}$ for 60 ± 5 min. and then let sit for 24 ± 2 hrs. at *1room condition. | | | | | | | | | | | | | | | | | | |
| | Capacitance Change | Char. | | Capacitance Change | | | | | | | | | | | | | | | | | |
| | | X7R | | Within $\pm 15\%$ | | | | | | | | | | | | | | | | | |
| | D.F. Q | SL | | Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$ (Whichever is larger) | | | | | | | | | | | | | | | | | |
| | | Char. | | Specification | | | | | | | | | | | | | | | | | |
| X7R | D.F. ≤ 0.05 | | | | | | | | | | | | | | | | | | | | |
| SL | $Q \geq 275 + 5/2C^{*2}$ (C < 30pF) $Q \geq 350$ (C $\geq 30\text{pF}$) | | | | | | | | | | | | | | | | | | | | |
| I.R. | More than 3,000M Ω | | | | | | | | | | | | | | | | | | | | |
| Dielectric Strength | In accordance with item No.4 | | | | | | | | | | | | | | | | | | | | |
| 20 | Active Flammability | The cheese-cloth should not be on fire. | The capacitor should be individually wrapped in at least one but not more than two complete layers of cheese-cloth. The capacitor should be subjected to 20 discharges. The interval between successive discharges should be 5 sec. The UAC should be maintained for 2 min. after the last discharge.  <table border="0"> <tr> <td>C1,2 : $1\mu\text{F}\pm 10\%$</td> <td>C3 : $0.033\mu\text{F}\pm 5\%$ 10kV</td> </tr> <tr> <td>L1 to 4 : 1.5mH$\pm 20\%$ 16A Rod core choke</td> <td></td> </tr> <tr> <td>Ct : $3\mu\text{F}\pm 5\%$ 10kV</td> <td>R : $100\Omega\pm 2\%$</td> </tr> <tr> <td>Cx : Capacitor under test</td> <td>UAC : $U_R\pm 5\%$</td> </tr> <tr> <td>F : Fuse, Rated 16A</td> <td>UR : Rated Voltage</td> </tr> <tr> <td></td> <td>Ut : Voltage applied to Ct</td> </tr> </table>  <table border="1"> <thead> <tr> <th>Type</th> <th>Ui</th> </tr> </thead> <tbody> <tr> <td>GB, GD</td> <td>2.5kV</td> </tr> <tr> <td>GC, GF</td> <td>5kV</td> </tr> </tbody> </table> | C1,2 : $1\mu\text{F}\pm 10\%$ | C3 : $0.033\mu\text{F}\pm 5\%$ 10kV | L1 to 4 : 1.5mH $\pm 20\%$ 16A Rod core choke | | Ct : $3\mu\text{F}\pm 5\%$ 10kV | R : $100\Omega\pm 2\%$ | Cx : Capacitor under test | UAC : $U_R\pm 5\%$ | F : Fuse, Rated 16A | UR : Rated Voltage | | Ut : Voltage applied to Ct | Type | Ui | GB, GD | 2.5kV | GC, GF | 5kV |
| | | | | C1,2 : $1\mu\text{F}\pm 10\%$ | C3 : $0.033\mu\text{F}\pm 5\%$ 10kV | | | | | | | | | | | | | | | | |
| L1 to 4 : 1.5mH $\pm 20\%$ 16A Rod core choke | | | | | | | | | | | | | | | | | | | | | |
| Ct : $3\mu\text{F}\pm 5\%$ 10kV | R : $100\Omega\pm 2\%$ | | | | | | | | | | | | | | | | | | | | |
| Cx : Capacitor under test | UAC : $U_R\pm 5\%$ | | | | | | | | | | | | | | | | | | | | |
| F : Fuse, Rated 16A | UR : Rated Voltage | | | | | | | | | | | | | | | | | | | | |
| | Ut : Voltage applied to Ct | | | | | | | | | | | | | | | | | | | | |
| Type | Ui | | | | | | | | | | | | | | | | | | | | |
| GB, GD | 2.5kV | | | | | | | | | | | | | | | | | | | | |
| GC, GF | 5kV | | | | | | | | | | | | | | | | | | | | |
| 21 | Passive Flammability | The burning time should not exceed 30 sec. The tissue paper should not ignite. | The capacitor under test should be held in the flame in the position which best promotes burning. Each specimen should only be exposed once to the flame. Time of exposure to flame: 30 sec. Length of flame : $12\pm 1\text{mm}$ Gas burner : Length 35mm min. : Inside Dia. $0.5\pm 0.1\text{mm}$: Outside Dia. 0.9mm max. Gas : Butane gas Purity 95% min.  | | | | | | | | | | | | | | | | | | |

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

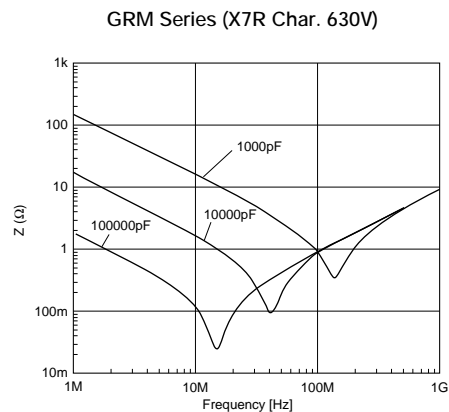
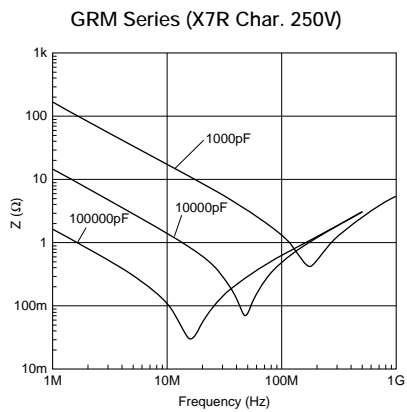
*2 "C" expresses nominal capacitance value (pF).

GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

■ Capacitance-Temperature Characteristics



■ Impedance-Frequency Characteristics



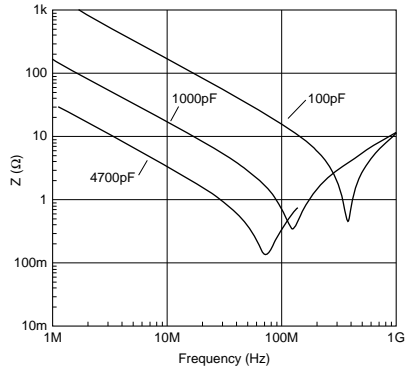
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GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

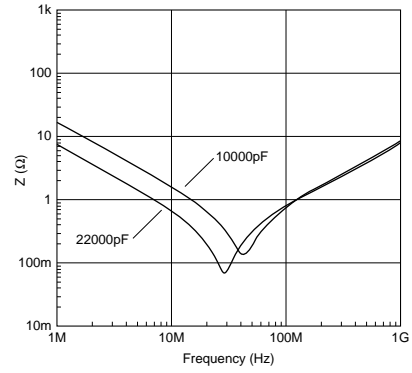
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Impedance-Frequency Characteristics

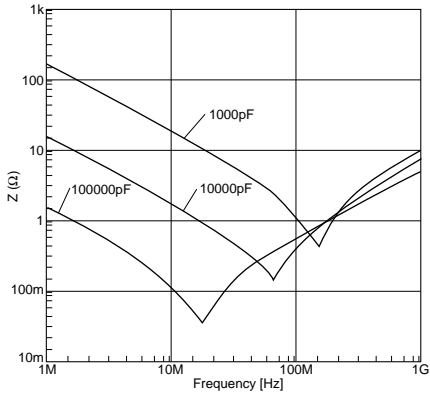
GR4 Series



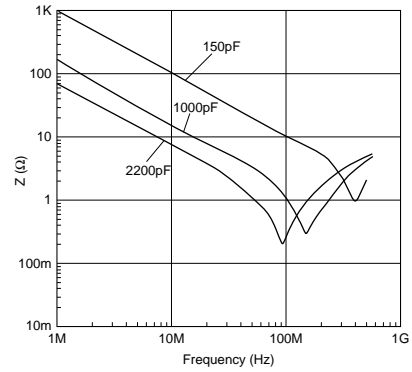
GR7 Series



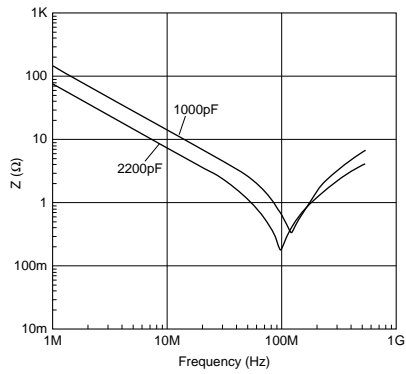
GA2 Series



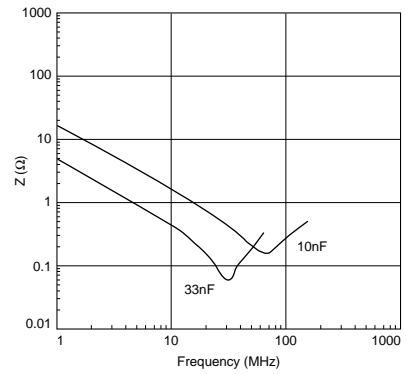
GA3 Series (Type GD)



GA3 Series (Type GF)

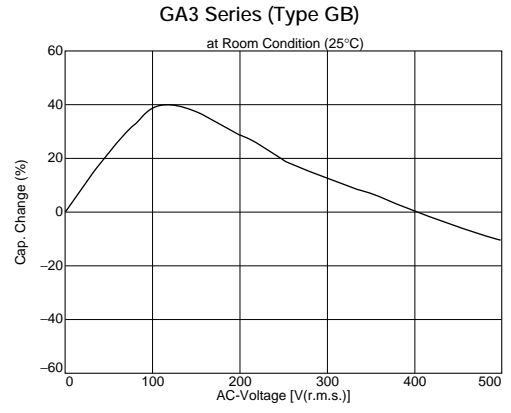
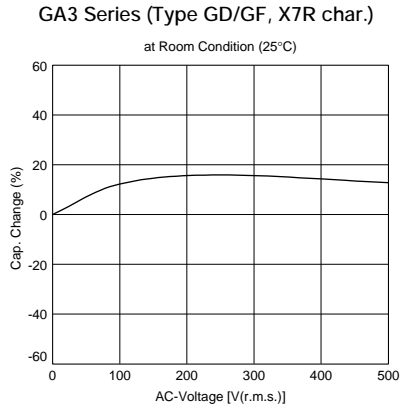


GA3 Series (Type GB)



GRM/GR4/GR7/GA2/GA3 Series Data (Typical Example)

■ Capacitance-AC Voltage Characteristics



Package

Taping is standard packaging method.

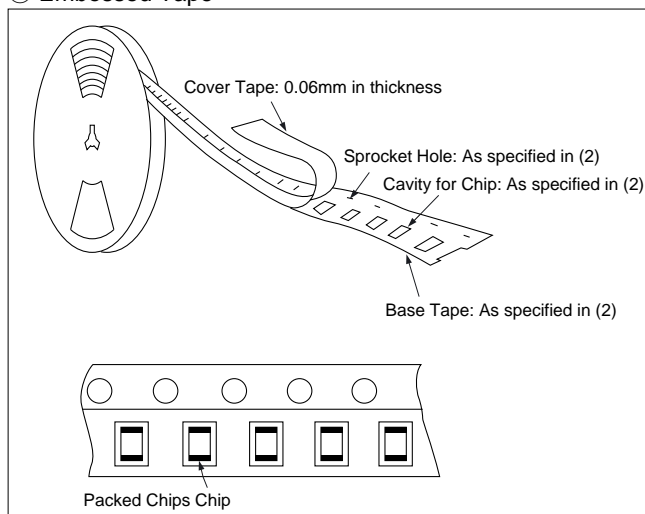
■ Minimum Quantity Guide

| Part Number | | Dimensions (mm) | | | Quantity (pcs.) | |
|-------------------------|-------------|-----------------|------|------|-----------------|---------------|
| | | | | | φ180mm reel | |
| | | L | W | T | Paper Tape | Embossed 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/GR731 | 3.2 | 1.6 | 1.0 | 4,000 | - |
| | | | | 1.25 | - | 3,000 |
| | | | | 1.6 | - | 2,000 |
| | GRM32 | 3.2 | 2.5 | 1.0 | 4,000 | - |
| | | | | 1.25 | - | 3,000 |
| | | | | 1.5 | - | 2,000 |
| | | | | 2.0 | - | 1,000 |
| | GRM42/GR442 | 4.5 | 2.0 | 1.0 | - | 3,000 |
| | | | | 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 | 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 |
| | GA355 | 5.7 | 5.0 | 1.5 | - | 1,000 |
| | | | | 2.0 | - | 1,000 |
| | | | 2.7 | - | 500 | |

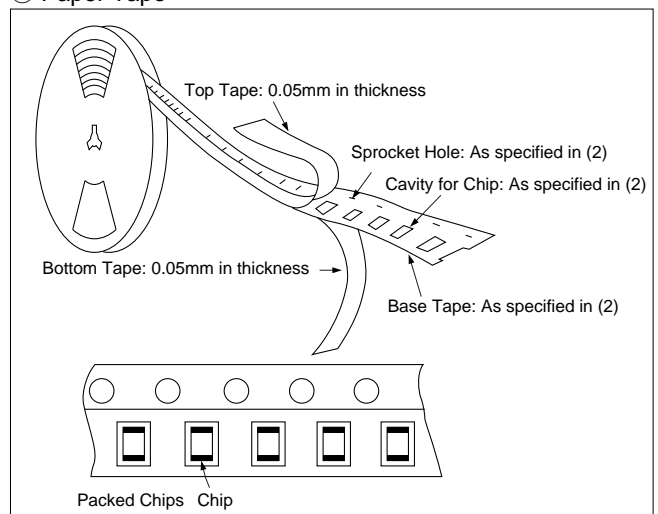
■ Tape Carrier Packaging

(1) Appearance of Taping

① Embossed Tape



② Paper Tape



Continued on the following page.

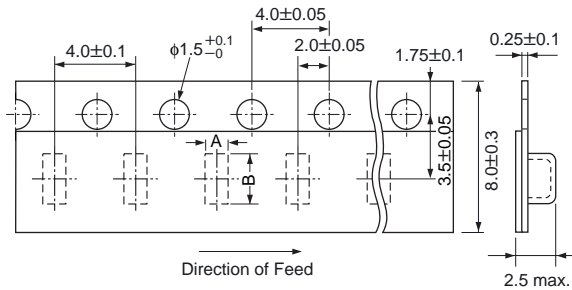
Package

Continued from the preceding page.

(2) Dimensions of Tape

① Embossed Tape

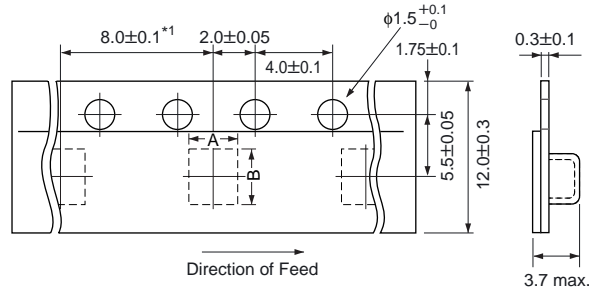
8mm width 4mm pitch Tape



| Part Number | A* | B* |
|----------------------------------|------|------|
| GRM21 (T≥1.25mm) | 1.45 | 2.25 |
| GRM31/GR731 (T≥1.25mm) | 2.0 | 3.6 |
| GRM32 (T≥1.25mm) | 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 |
| GA352 | 3.2 | 6.1 |
| GRM55/GA255/GA355 | 5.4 | 6.1 |

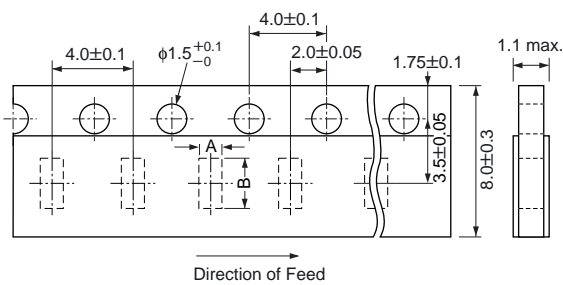
*1 4.0±0.1mm in case of GRM42/GR442/GA242/GA342

*Nominal Value

(in mm)

② Paper Tape

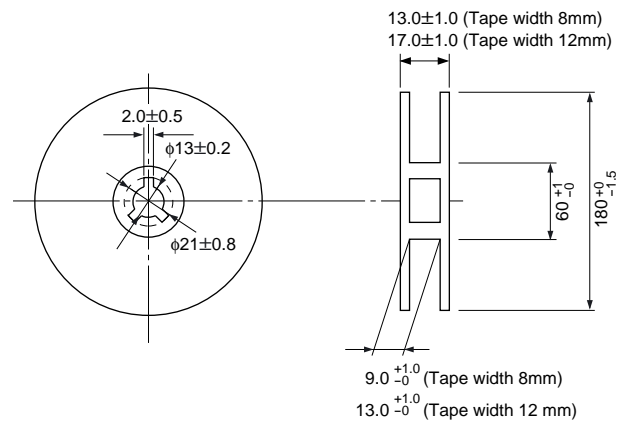
8mm width 4mm pitch Tape



| Part Number | A* | B* |
|---------------------------------|------|------|
| GRM18 | 1.05 | 1.85 |
| GRM21 (T=1.0mm) | 1.45 | 2.25 |
| GRM31/GR731 (T=1.0mm) | 2.0 | 3.6 |
| GRM32 (T=1.0mm) | 2.9 | 3.6 |

*Nominal value
(in mm)

(3) Dimensions of Reel



(in mm)

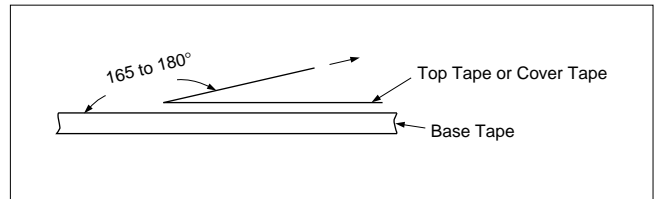
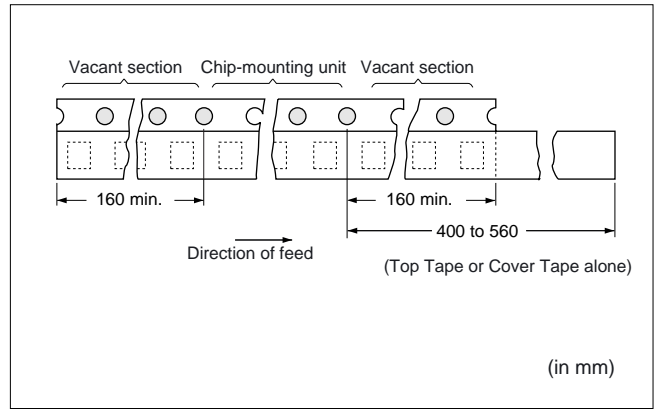
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Package

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 : $\pm 0.3\text{mm}$.
- ⑦ Peeling off force : 0.1 to 0.6N in the direction shown at right.





■ 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 V_{p-p} value of the applied voltage or the V_{o-p} which contains DC bias within the rated voltage range.

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

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

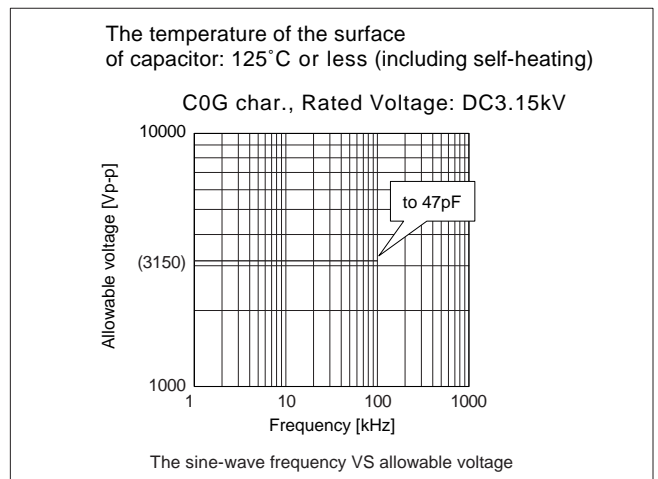
2. Operating Temperature and Self-generated Heat

(1) In case of X7R 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 $\phi 0.1\text{mm}$ in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

(2) In case of C0G 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 100kHz. 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.)



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(3) In case of U2J char.

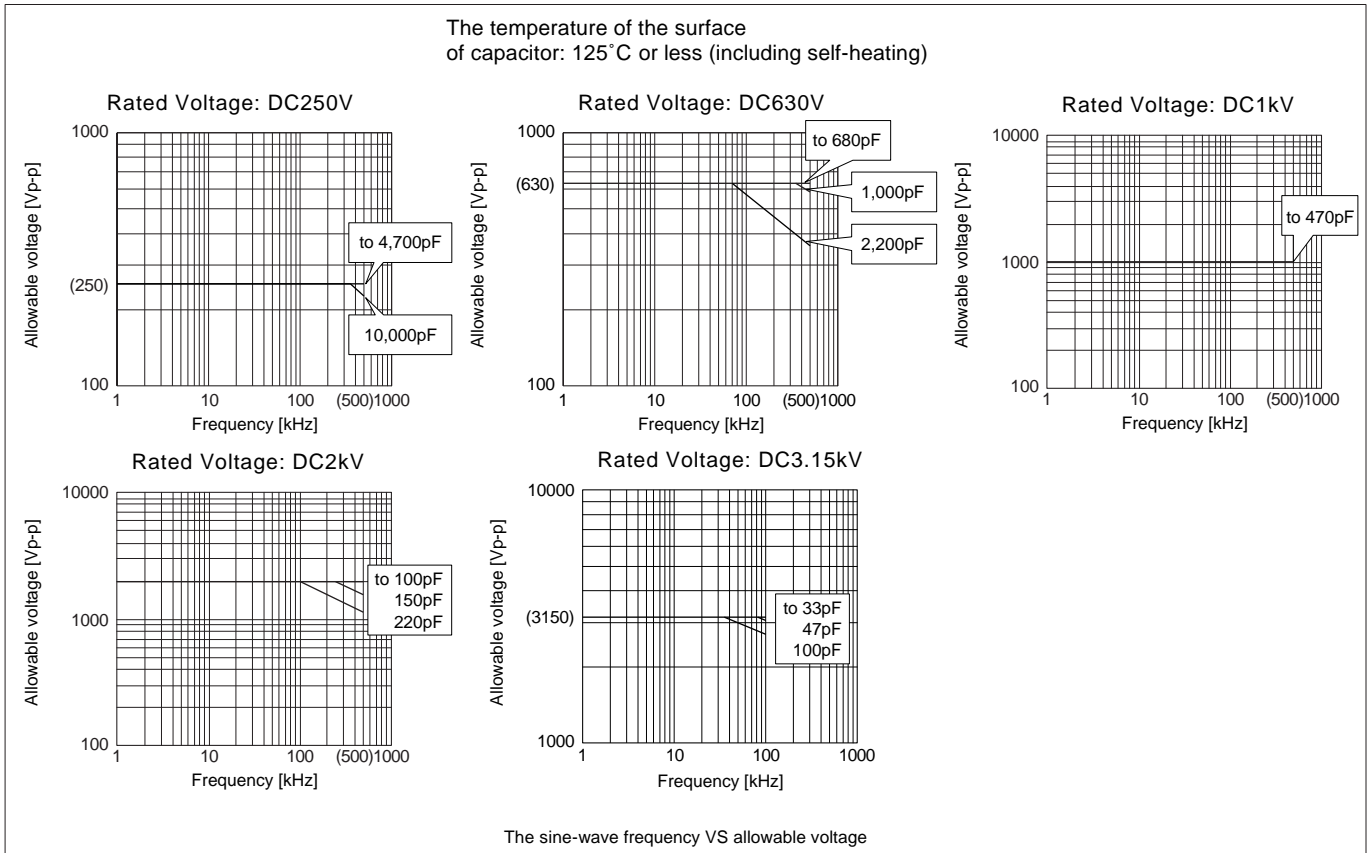
Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range.

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 below.

In case of non-sine wave which includes 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.)

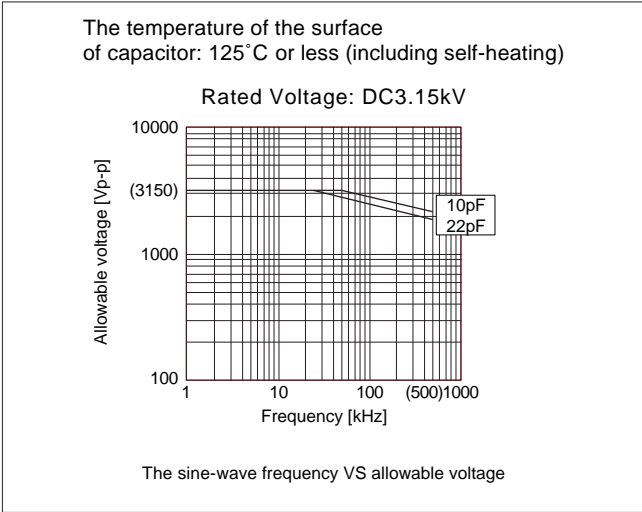


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Caution

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(4) 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.)



3. Test condition for AC withstanding Voltage

(1) Test Equipment

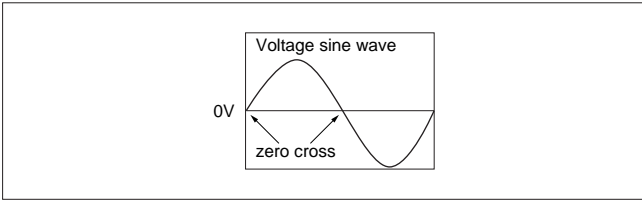
Tests for AC withstanding voltage should be made with equipment capable of creating a wave similar to a 50/60 Hz sine wave. If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

(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 -



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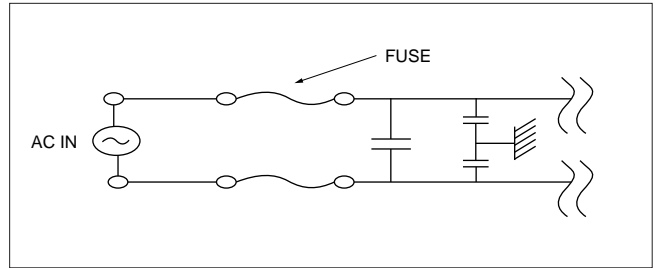
Caution

☐ 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)

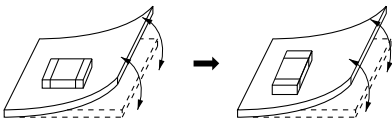
1. Vibration and Impact

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

3. Land Layout for Cropping PC Board

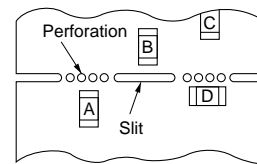
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[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

4. Soldering

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. The smaller the temperatures difference (ΔT) between the solder and component surface is, the smaller the influence on the chip is. When components are immersed in solvent after mounting, please set the slow cooling process to keep the temperature difference within 100°C.

| Chip Size | 3.2×1.6mm and under | 3.2×2.5mm and over |
|----------------------------------------|-----------------------------------|-----------------------------------|
| Soldering Method | | |
| Reflow Method or Soldering Iron Method | $\Delta T \leq 190^\circ\text{C}$ | $\Delta T \leq 130^\circ\text{C}$ |
| Flow Method or Dip Soldering Method | $\Delta T \leq 150^\circ\text{C}$ | — |

5. Soldering Iron

When soldering chips with a soldering iron, it should be performed in following conditions.

And pre-heating shown in clause 4.

| Item | Conditions | |
|-------------------------|------------------------------------------------------------------|--------------------------------|
| Chip Size | $\leq 2.0 \times 1.25\text{mm}$ | $\geq 3.2 \times 1.6\text{mm}$ |
| Temperature of Iron tip | 300°C max. | 270°C max. |
| Soldering Iron Wattage | 20W max. | |
| Diameter of Iron tip | $\phi 3.0\text{mm}$ max. | |
| Soldering Time | 3 sec. max. | |
| Caution | Do not allow the iron tip to directly touch the ceramic element. | |

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.

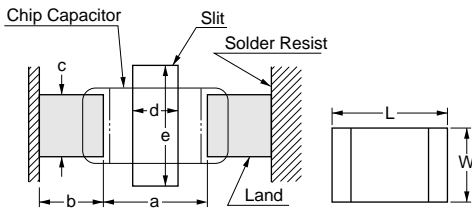
Notice

■ Notice (Soldering and Mounting)

1. 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 |

Flow soldering : 3.2×1.6 or less available.

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)

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 | | | |

Continued on the following page.

Notice

☐ Continued from the preceding page.

2. Mounting of Chips

● Thickness of adhesives applied

Keep thickness of adhesives applied (50-105 μ m or more) to reinforce the adhesive contact considering the thickness of the termination or capacitor (20-70 μ m) and the land pattern (30-35 μ m).

● 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.

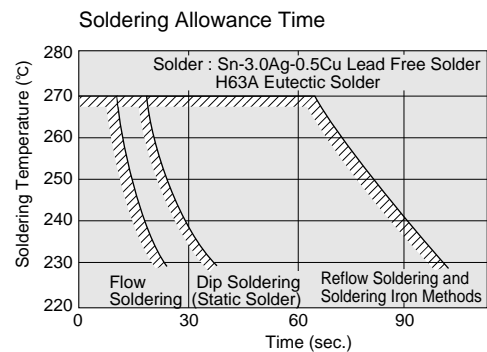
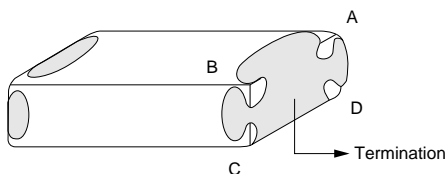
3. Soldering

(1) Limit of losing effective area of the terminations and conditions needed for soldering.

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.

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



(2) Flux

- Please use it after confirming there is no problem in the reliability of the product beforehand with a intended equipment. The residue of flux might cause the decrease in nonconductivity and the corrosion of an external electrode, etc.

(3) Solder Amount

① Flow soldering and iron soldering

Use as little solder as possible, and confirm that the solder is securely placed.

Continued on the following page. ☐

☐ 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.

4. Cleaning

Please confirm there is no problem in the reliability of the product beforehand when cleaning it with a intended equipment.

The residue after it cleaning it might cause the decrease in the surface resistance of the chip and the corrosion of the electrode part, etc. As a result might cause reliability to deteriorate. Please confirm there is no problem with a intended equipment in the ultrasonic cleansing beforehand.

5. Resin Coating

Please use it after confirming there is no influence on the product with a intended equipment beforehand when the resin coating and molding.

The chip crack might be caused at the cool and heat cycle by bias of the amount of spreading of the resin and spreading thickness.

The resin for the coating and molding must use the thing that as the stress when stiffening is small, and the hygroscopic is as low as possible.

■ Rating

1. 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 any char. except X7R

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

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

2. Performance check by equipment

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

Generally speaking, CLASS 2 (X7R char.) ceramic capacitors have voltage dependence characteristics and temperature dependence characteristics in capacitance. So, the capacitance value may change depending on the operating condition in a equipment. Therefore, be sure to confirm the apparatus performance of receiving influence in a capacitance value change of a capacitor, such as leakage current and noise suppression characteristic.

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

ISO 9001 Certifications

■ Qualified Standards

The products listed here have been produced by ISO 9001 certified factory.

| Plant |
|--------------------------------------------|
| Fukui Murata Mfg. Co., Ltd. |
| Izumo Murata Mfg. Co., Ltd. |
| Okayama Murata Mfg. Co., Ltd. |
| Murata Electronics Singapore (Pte.) Ltd. |
| Murata Amazonia Industria E Comercio Ltda. |
| Suzhou Murata Electronics Co., Ltd. |
| Beijing Murata Electronics Co., Ltd. |

△Note:

1. Export Control

〈For customers outside Japan〉

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

〈For customers in Japan〉

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

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

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

3. Product specifications in this catalog are as of July 2005. 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.