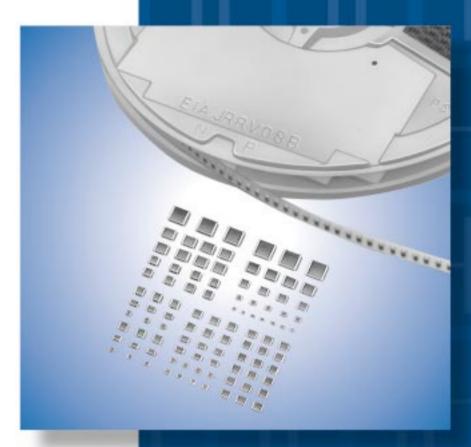


Chip Monolithic Ceramic Capacitors for Automotive





Innovator in Electronics

Murata Manufacturing Co., Ltd.

Cat.No.C03E-4

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for EU RoHS Compliant

- \cdot All the products in this catalog comply with EU RoHS.
- EU RoHS is "the European Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment".
- For more details, please refer to our website 'Murata's Approach for EU RoHS' (http://www.murata.com/info/rohs.html).



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Part Numbering

Chip Monolithic Ceramic Capacitors

| (Part Number) | GC | М | 18 | 8 | R7 | 1H | 102 | κ | A37 | D |
|---------------|----|---|----|---|----|----|-----|---|-----|---|
| | 0 | 2 | 3 | 4 | 6 | 6 | 0 | 8 | 9 | 0 |

2Series

| Product ID | Code | Series |
|------------|------|---|
| <u> </u> | J | Soft Termination Type Power-train, Safety Equipment |
| GC | м | Power-train, Safety Equipment |

3 Dimension (LXW)

| Code | Dimension (L×W) | EIA |
|------|-----------------|------|
| 03 | 0.6×0.3mm | 0201 |
| 15 | 1.0×0.5mm | 0402 |
| 18 | 1.6×0.8mm | 0603 |
| 21 | 2.0×1.25mm | 0805 |
| 31 | 3.2×1.6mm | 1206 |
| 32 | 3.2×2.5mm | 1210 |
| 43 | 4.5×3.2mm | 1812 |
| 55 | 5.7×5.0mm | 2220 |

| Dimension (T) | | | |
|---------------|----------------------------------|--|--|
| Code | Dimension (T) | | |
| 3 | 0.3mm | | |
| 5 | 0.5mm | | |
| 6 | 0.6mm | | |
| 8 | 0.8mm | | |
| 9 | 0.85mm | | |
| Α | 1.0mm | | |
| В | 1.25mm | | |
| С | 1.6mm | | |
| D | 2.0mm | | |
| E | 2.5mm | | |
| М | 1.15mm | | |
| N | 1.35mm | | |
| Q | 1.5mm | | |
| R | 1.8mm | | |
| X | Depends on individual standards. | | |

5Temperature Characteristics

| Temperature | Characteristic Co | odes | | Operating | | |
|-------------|-------------------|------|--------------------------|----------------------|--|----------------------|
| Code | Public STD (| Code | Reference Temperature | Temperature Range | Capacitance Change or Temperature Coefficient | Temperature Range |
| 5C | C0G | EIA | 25°C | 25 to 125°C | 0±30ppm/°C | -55 to 125°C |
| 70 | U2J | EIA | 25°C | 25 to 125°C | -750±120ppm/°C | -55 to 125°C |
| C7 | X7S | EIA | 25°C | -55 to 125°C | ±22% | -55 to 125°C |
| R7 | X7R | EIA | 25°C | -55 to 125°C | ±15% | -55 to 125°C |

•Capacitance Change from each temperature

| | | | Capacitance Char | nge from 25°C (%) | | |
|-------------|-------|-------|------------------|-------------------|-------|-------|
| Murata Code | –55°C | | -30 |)°C | –10°C | |
| | Max. | Min. | Max. | Min. | Max. | Min. |
| 5C | 0.58 | -0.24 | 0.40 | -0.17 | 0.25 | -0.11 |
| 7U | 8.78 | 5.04 | 6.04 | 3.47 | 3.84 | 2.21 |

6 Rated Voltage

| Code | Rated Voltage |
|------|---------------|
| 0J | DC6.3V |
| 1A | DC10V |
| 1C | DC16V |
| 1E | DC25V |
| YA | DC35V |
| 1H | DC50V |
| 2A | DC100V |
| 2E | DC250V |
| 2J | DC630V |

Capacitance

Expressed by three-digit alphanumerics. 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 |



 $\Box Continued from the preceding page.$

| Capacitance olerance | | | | | |
|------------------------|-----------------------|----------|---------|------------------|-----------------|
| Code | Capacitance Tolerance | TC | Series | Capacitance Step | |
| С | ±0.25pF | COG | GCM | ≦5pF | E12, 1pF Step * |
| D | ±0.5pF | COG | GCM | 6.0 to 9.0pF | E12, 1pF Step * |
| | ±5% | COG | GCM | ≧10pF | E12 Step |
| J | | U2J | GCM | E1 | 2 Step |
| К | ±10% | X7S, X7R | GCJ/GCM | E6 Step | |
| м | ±20% | X7S, X7R | GCM | E6 Step | |

* E24 series is also available.

Individual Specification Code

Expressed by three figures.

Package

| Code | Package |
|------|------------------------|
| L | ø180mm Embossed Taping |
| D | ø180mm Paper Taping |
| к | ø330mm Embossed Taping |
| J | ø330mm Paper Taping |
| В | Bulk |
| С | Bulk Case |
| | |



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Selection Guide of Chip Monolithic Ceramic Capacitors

| Function | Туре | Series |
|---|---|--|
| Decoupling, Smoothing | High Capacitance | GRM (X5R, X7R, Y5V etc.) 68pF-100μF |
| Decoupling, smoothing | Array (2 or 4 Elements) | GNM 10pF–2.2μF |
| Frequency Control/Tuning, Impedance Matching | Class 1 TC's | GRM (C0G) 0.1pF-0.1μF |
| impedance Matching | | GRM (U2J etc.) |
| High Speed Decoupling | Low Inductance (Reverse Geometry) | LLL 2200pF–10μF |
| 5 11 11 1 5 | Low Inductance (Multi Termination) | LLA/LLM (From 1GHz) 0.01μF–4.7μF |
| | Low ESR (50V to 500V) | ERB (1MHz to 1GHz) 0.5pF-1000pF |
| High Frequency | Low ESR, Ultra Small | GJM (500MHz to 10GHz) 0.1pF-33pF |
| | Lowest ESR | GQM (500MHz to 10GHz) 0.1pF-100pF |
| Optical Communications | Wire-Die-Bonding | GMA 100pF–0.47μF GMD 100pF–1μF |
| Medium Voltage High Frequency Snubber | 250V/630V/1kV/2kV/3.15kV Low Dissipation | GRM (COG, U2J) 10pF-10000pF |
| Medium Voltage LCD Backlight Inverter | 3.15kV Low Dissipation | GRM (C0G) 5pF–47pF |
| Medium Voltage Decoupling, Smoothing | 250V/630V/1kV High Capacitance | GRM (X7R) 220pF-1μF |
| Medium Voltage Only for Camera Flash Circuit | 350V High Capacitance | GR7 10000pF-47000pF |
| Medium Voltage | 2kV High Capacitance | GR4 100pF-10000pF |
| Only for Information Devices | Safety Standard Certified | Type GD 10pF–4700pF Type GF 10pF–4700pF |
| AC Lines Noise Demovel | Safety Standard Certified | Type GC 100pF-330pF Type GF 470pF-4700pF Type GB 10000pF-56000pF |
| AC Lines Noise Removal | AC250V which meet Japanese Law | GA2 470pF–0.1μF |
| Automotive | High Capacitance | GCM (X7R etc.) 100pF-47μF |
| (Powertrain, Safety Equipment) | Class 1 TC's | GCM (C0G etc.) 1.0pF-56000pF |
| Medium Voltage for Automotive | 250V/630V Low Dissipation | GCM (U2J) 10pF-10000pF |
| (Powertrain, Safety Equipment) | 250V/630V Soft Termination Type | GCJ (X7R) 1000pF-0.47μF |

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Applications?

Chip Monolithic Ceramic Capacitors for Automotive



for Automotive GCM Series

Features

- 1. The GCM series meet AEC-Q200 requirements.
- 2. Higher resistance of solder-leaching due to the Ni-barriered termination, applicable for reflow-soldering, and flow-soldering (GCM18/21/31 type only).
- 3. The operating temperature range of R7/C7/5C series: -55 to 125 degree C.
- 4. A wide selection of sizes is available, from miniature LxWxT:0.6x0.3x0.3mm to LxWxT: 3.2x2.5x2.5mm.
- 5. The GCM series is available in paper or embossed tape and reel packaging for automatic placement.
- 6. The GCM series is lead free product.

Applications

Automotive electronic equipment (Power-train, safety equipment)



| L → W → |
|-------------|

| Part Number | | Dime | ensions (mr | n) | | |
|-------------|-----------|------------|-------------|--------------|--------|--|
| | L | W | Т | е | g min. | |
| GCM033 | 0.6 ±0.03 | 0.3 ±0.03 | 0.3 ±0.03 | 0.1 to 0.2 | 0.2 | |
| GCM155 | 1.0 ±0.05 | 0.5 ±0.05 | 0.5 ±0.05 | 0.15 to 0.35 | 0.3 | |
| GCM188* | 1.6 ±0.1 | 0.8 ±0.1 | 0.8 ±0.1 | 0.2 to 0.5 | 0.5 | |
| GCM216 | | | 0.6 ±0.1 | | | |
| GCM219 | 2.0 ±0.15 | 1.25 ±0.15 | 0.85 ±0.1 | 0.2 to 0.7 | 0.7 | |
| GCM21B | | | 1.25 ±0.15 | | | |
| GCM319 | 2 2 10 15 | 1.6 ±0.15 | 0.85 ±0.1 | | | |
| GCM31M | 3.2 ±0.15 | | 1.15 ±0.1 | 0.3 to 0.8 | 1.5 | |
| GCM31C | 3.2 ±0.2 | 1.6 ±0.2 | 1.6 ±0.2 | | | |
| GCM32N | | | 1.35 ±0.15 | | | |
| GCM32R | 22102 | 2.5 +0.2 | 1.8 ±0.2 | 0.3 min. | 10 | |
| GCM32D | 3.2 ±0.3 | 2.5 10.2 | 2.0 ±0.2 | 0.5 11111. | 1.0 | |
| GCM32E | | | 2.5 ±0.2 | | | |

* Bulk Case: 1.6 ±0.07(L)×0.8 ±0.07(W)×0.8 ±0.07(T) The figure indicates typical specification



Capacitance Table

1

Temperature Compensating Type C0G(5C)

| 6 | ex | | Dime | | | | ber C | ode |
|--------------------------|---------------|-------------------------|-------------|------------|-------------|-----------|-------------------|-----------|
| LxW | | 1.0x0.5 | | k0.8 | | | 3.2> | |
| [mm] | (03) | (15) <0402> | (1 | 8) | (2 | 1) 055 | (3 <12 | 1) 065 |
| Rated Voltage | 25 | 50 | 100 | 50 | 100 | | 100 | |
| Capacitance [Vdc] | | | | | | | (2A) | |
| 1.0pF(1R0) | 3 | 5 | 8 | 8 | · / | () | · / | () |
| 2.0pF(2R0) | 3 | 5 | 8 | 8 | | | | |
| 3.0pF(3R0) | 3 | 5 | 8 | 8 | | | | |
| 4.0pF(4R0) | 3 | 5 | 8 | 8 | | | | |
| 5.0pF(5R0) | 3 | 5 | 8 | 8 | | | | |
| 6.0pF(6R0) | 3 | 5 | 8 | 8 | | | | |
| 7.0pF(7R0) | 3 | 5 | 8 | 8 | | | | |
| 8.0pF(8R0) | 3 | 5 | 8 | 8 | | | | |
| 9.0pF(9R0) | 3 | 5 | 8 | 8 | | | | |
| 10pF(100) | 3 | 5 | 8 | 8 | | | | |
| 12pF(120) | 3 | 5 | 8 | 8 | | | | |
| 15pF(150) | 3 | 5 | 8 | 8 | | | | |
| 18pF(180) | 3 | 5 | 8 | 8 | | | | |
| 22pF(220) | 3 | 5 | 8 | 8 | | | | |
| 27pF(270) | 3 | 5 | 8 | 8 | | | | |
| 33pF(330) | 3 | 5 | 8 | 8 | | | | |
| 39pF(390) | 3 | 5 | 8 | 8 | | | | |
| 47pF(470) | 3 | 5 | 8 | 8 | | | | |
| 56pF(560) | 3 | 5 | 8 | 8 | | | | |
| 68pF(680) | 3 | 5 | 8 | 8 | | | | |
| 82pF(820) | 3 | 5 | 8 | 8 | | | | |
| 100pF(101) | 3 | 5 | 8 | 8 | 6 | | | |
| 120pF(121) | - | 5 | 8 | 8 | 6 | | | |
| 150pF(151) | | 5 | 8 | 8 | 6 | | | |
| 180pF(181) | | 5 | 8 | 8 | 6 | | | |
| 220pF(221) | | 5 5 | 8 | 8 | 6 | | | |
| 270pF(271) 330pF(331) | | 5 | 8 8 | 8 8 | 6 6 | | | |
| 390pF(391) | | 5 | 8 | 8 | 6 | | | |
| 470pF(471) | | 5 | 8 | 8 | 6 | | | |
| 560pF(561) | | | 8 | 8 | 6 | 6 | | |
| 680pF(681) | | | 8 | 8 | 6 | 6 | | |
| 820pF(821) | | | 8 | 8 | 6 | 6 | | |
| 1000pF(102) | | ¦· | 8 | 8 | 6 | 6 | | |
| 1200pF(122) | | | 8 | 8 | 6 | 6 | | |
| 1500pF(152) | 1 | | 8 | 8 | 6 | 6 | | |
| 1800pF(182) | 1 | | | 8 | 6 | 6 | 9 | |
| 2200pF(222) | 1 | 1 | 1 | 8 | 6 | 6 | 9 | |
| 2700pF(272) | | 1 | | 8 | 6 | 6 | 9 | |
| 3300pF(332) | | | | 8 | 6 | 6 | 9 | |
| 3900pF(392) | | 1 | 1 | 8 | | 6 | 9 | |
| 4700pF(472) | | | | | | 6 | 9 | 9 |
| 5600pF(562) | | | | | | 9 | 9 | 9 |
| 6800pF(682) | | | | | | 9 | 9 | 9 |
| 8200pF(822) | | | ¦ | | | 9 | 9 | 9 |
| 10000pF(103) | | | | | | 9 | 9 | 9 |
| 12000pF(123) | | | | | | 9 | | 9 |
| 15000pF(153) | | 1 | 1 | | 1 | 9 | | 9 |
| 18000pF(183) | | | 1 1 1 | | 1 1 1 | В | | 9 |
| 22000pF(223) | | 1 1 1 | | | 1 1 1 | В | | 9 |
| 27000pF(273) | | 1 | | | | | | 9 |
| 33000pF(333) | | | | | | | | 9 |
| 39000pF(393) | | | | | | | | 9 |
| 47000pF(473) | - | | 1 | | | | | M |
| 56000pF(563) | | | | | | | | Μ |

The part numbering code is shown in () and Unit is shown in []. <>: EIA [inch] Code

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Capacitance Table

1

High Dielectric Constant Type X7R(R7)/X7S(C7)

| | | | | | | | | | | | | | | | | | | | | | 6 | i | | ex.6 | : T D | Dimer | nsion | Part | Num | per Code |
|-----------------------|------|----------------------|-----|----------------|-------------------|------|------|---------------|------|----------------------|------|------|---------------|---------------|---------------|---------------|------|---------------|---------------|---------------|---------------|---------------------|---------------|---------------|---------------|---------------|-------|------|-------------------|-----------|
| LxW | 0 | .6x0 | .3 | | 1.0 | x0.5 | | | 1 | .6x0 |).8 | | | | 2.0 |)x1.: | 25 | | | | | 3.2x | (1.6 1) | | | | | 3.2 | | |
| [mm] | | (03) 020 | | | (1 <04 | | | | | (18) 060 | | | | | | (21) | | | | | | (3) <12 | | | | | | | 2) 10> | |
| Rated Voltage | 25 | 16 | 10 | 100 | 50 | 25 | 16 | 100 | 50 | 25 | 16 | 6.3 | 100 | 50 | 35 | 25 | 16 | 10 | 6.3 | 100 | 50 | 25 | 16 | 10 | 6.3 | 100 | 50 | 25 | 16 | 10 6.3 |
| | (1E) | (1C) | (1A |) (2A) | (1H) | (1E) | (1C) | (2A) | (1H) |)(1E) | (1C) | (0J) | (2A) | (1H) | (YA) | (1E) | (1C) | (1A) | (0 J) | (2A) | (1H) | (1E) | (1C) | (1A) | (0 J) | (2A) | (1H) | (1E) | (1C)(| (1A) (0J) |
| 100pF(101) | 3 | | | i. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 150pF(151) | 3 | | | - | | | | | | | | | 1 | | | | | | | | | | | | | | | | | |
| 220pF(221) | 3 | | | 5 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 330pF(331) | 3 | | | 5 | 5 | | | 1 | | | | | 1 | | | | | | | | | | | | | 1 | | | | |
| 470pF(471) | 3 | | | 5 | 5 | | | | | | | | 1 | | | | | | | | | | | | | | | | | |
| 680pF(681) | 3 | | | 5 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1000pF(102) | 3 | | | 5 | 5 | | | 8 | 8 | | | | 1 | | | | | | | | | | | | | | | | | |
| 1500pF(152) | 3 | | _ | 5 | 5 | | | 8 | 8 | | | | | | | | | | | | | | | | | | | | | |
| 2200pF(222) | | 3 | | 5 | 5 | | | 8 | 8 | | | | | | | | | | | | | | | | | | | | | |
| 3300pF(332) | | 3 | | 5 | 5 | | | 8 | 8 | | | | 1 | | | | | | | | | | | | | | | | | |
| 4700pF(472) |] | | 3 | 5 | 5 | | | 8 | 8 | | | | 1 | | | | | | | | | | | | | | | | | |
| 6800pF(682) |] | | 3 | | 5 |] | | 8 | 8 | | | | 6 | | | | | | | | | | | | | | | | | |
| 10000pF(103) | | | 3 | | 5 | 5 | | 8 | 8 | | | | 6 | | | | | | | | | | | | | | | | | |
| 15000pF(153) | 1 | | | - | 5 | 5 | 1 | 8 | 8 | 1 | | | 6 | | | | | | | | | | | | | | | | | |
| 22000pF(223) | 1 | | | i | 5 | 5 | 1 | 8 | 8 | 1 | | | 6 | | | | | | | | | | | | | | | | | |
| 33000pF(333) | 1 | | | | | 5 | 5 | | 8 | 8 | | | 9 | 9 | | | | | | | | | | | | | | | | |
| 47000pF(473) | 1 | | | | | 5 | 5 | | 8 | 8 | 1 | | в | В | | | | | | | | | | | | 1 | | | | |
| 68000pF(683) | 1 | | | 1 | | | 5 | | 8 | 8 | 1 | | в | в | | | | | | | | | | | | | | | | |
| 0.10μF(104) | + | | | | | | 5 | 8 | 8 | 8 | 8 | [| в | В | | | | | | 9 | | | | | | | | | | |
| 0.15μF(154) | 1 | | | i - | | | | | 8 | 8 | | | | В | | В | | | | М | | | | | | | | | | |
| 0.22μF(224) | 1 | | | | | | | 1 | 8 | 8 | 1 | | 1 | в | | в | | | | М | | | | | | 1 | | | | |
| 0.33μF(334) | 1 | | | ł | | | | | | · · · | 8 | | | 9 | | в | | | | | М | | | | | | | | | |
| 0.47μF(474) | 1 | | | | | | | | | 8 | 8 | 1 | 1 | В | | 9 | | | | | М | | | | | | | | | |
| 0.68µF(684) | 1 | | | - | | | | | | | 8 | 1 | | | в | в | 9 | | | | М | | | | | | | | | |
| 1.0μF(105) | † · | | | | | | | | | 8 | 8 | † | | | в | в | 9 | | | † | М | | | | | | Ε | | | |
| 2.2μF(225) | 1 | | | i. | | | | | | | | 8 | ĺ | | | в | в | В | | | С | М | | | | D | | | | |
| 4.7μF(475) | 1 | | | | | | | 1 | | | | | 1 | | | | в | в | | | | С | С | | | | Е | D | | |
| 10μF(106) | † · | | | | | | | + | | | | | 1 1 | | | | | | в | | ١ | | С | С | | | | Е | D | |
| 22µF(226) | 1 | | | ł | | | | | | | | | | | | | | I | | | | L | | | С | 1 | | | Е | Е |
| 47μF(476) | 1 | | | | | | | 1 | | | | | | | | | | | | | | | | I | | 1 | | | | E |

The part numbering code is shown in () and Unit is shown in []. <>: EIA [inch] Code

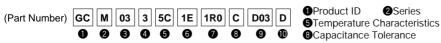


1

Temperature Compensating Type

| L x W [mm] | | 0.6x0.3(03)<0201> | 1.0x0.5(15)<0402> | | 8)<0603> |
|----------------------|---------------------|----------------------------|----------------------------|--------------------|--------------------|
| Rated Volt. [Vdc] |] | 25(1E) | 50(1H) | 100(2A) | 50(1H) |
| ТС | | | C00 | G(5C) | |
| Capacitance | Tolerance | | Part N | lumber | 1 |
| 1.0pF(1R0) | ±0.25pF(C) | GCM0335C1E1R0CD03D | GCM1555C1H1R0CZ13D | GCM1885C2A1R0CZ13D | GCM1885C1H1R0CZ13D |
| 2.0pF(2R0) | ±0.25pF(C) | GCM0335C1E2R0CD03D | GCM1555C1H2R0CZ13D | GCM1885C2A2R0CZ13D | GCM1885C1H2R0CZ13D |
| 3.0pF(3R0) | ±0.25pF(C) | GCM0335C1E3R0CD03D | GCM1555C1H3R0CZ13D | GCM1885C2A3R0CZ13D | GCM1885C1H3R0CZ13D |
| 4.0pF(4R0) | ±0.25pF(C) | GCM0335C1E4R0CD03D | GCM1555C1H4R0CZ13D | GCM1885C2A4R0CZ13D | GCM1885C1H4R0CZ13D |
| 5.0pF(5R0) | ±0.25pF(C) | GCM0335C1E5R0CD03D | GCM1555C1H5R0CZ13D | GCM1885C2A5R0CZ13D | GCM1885C1H5R0CZ13D |
| 6.0pF(6R0) | ±0.5pF(D) | GCM0335C1E6R0DD03D | GCM1555C1H6R0DZ13D | GCM1885C2A6R0DZ13D | GCM1885C1H6R0DZ13D |
| 7.0pF(7R0) | ±0.5pF(D) | GCM0335C1E7R0DD03D | GCM1555C1H7R0DZ13D | GCM1885C2A7R0DZ13D | GCM1885C1H7R0DZ13D |
| 8.0pF(8R0) | ±0.5pF(D) | GCM0335C1E8R0DD03D | GCM1555C1H8R0DZ13D | GCM1885C2A8R0DZ13D | GCM1885C1H8R0DZ13D |
| 9.0pF(9R0) | ±0.5pF(D) | GCM0335C1E9R0DD03D | GCM1555C1H9R0DZ13D | GCM1885C2A9R0DZ13D | GCM1885C1H9R0DZ13D |
| 10pF(100) | ±5%(J) | GCM0335C1E100JD03D | GCM1555C1H100JZ13D | GCM1885C2A100JA16D | GCM1885C1H100JA16D |
| 12pF(120) | ±5%(J) | GCM0335C1E120JD03D | GCM1555C1H120JZ13D | GCM1885C2A120JA16D | GCM1885C1H120JA16D |
| 15pF(150) | ±5%(J) | GCM0335C1E150JD03D | GCM1555C1H150JZ13D | GCM1885C2A150JA16D | GCM1885C1H150JA16D |
| 18pF(180) | ±5%(J) | GCM0335C1E180JD03D | GCM1555C1H180JZ13D | GCM1885C2A180JA16D | GCM1885C1H180JA16D |
| 22pF(220) | ±5%(J) | GCM0335C1E220JD03D | GCM1555C1H220JZ13D | GCM1885C2A220JA16D | GCM1885C1H220JA16D |
| 27pF(270) | ±5%(J) | GCM0335C1E270JD03D | GCM1555C1H270JZ13D | GCM1885C2A270JA16D | GCM1885C1H270JA16D |
| 33pF(330) | ±5%(J) | GCM0335C1E330JD03D | GCM1555C1H330JZ13D | GCM1885C2A330JA16D | GCM1885C1H330JA16D |
| 39pF(390) | ±5%(J) | GCM0335C1E390JD03D | GCM1555C1H390JZ13D | GCM1885C2A390JA16D | GCM1885C1H390JA16D |
| 47pF(470) | ±5%(J) | GCM0335C1E470JD03D | GCM1555C1H470JZ13D | GCM1885C2A470JA16D | GCM1885C1H470JA16D |
| 56pF(560) | ±5%(J) | GCM0335C1E560JD03D | GCM1555C1H560JZ13D | GCM1885C2A560JA16D | GCM1885C1H560JA16D |
| 68pF(680) | ±5%(J) | GCM0335C1E680JD03D | GCM1555C1H680JZ13D | GCM1885C2A680JA16D | GCM1885C1H680JA16D |
| 82pF(820) | ±5%(J) | GCM0335C1E820JD03D | GCM1555C1H820JZ13D | GCM1885C2A820JA16D | GCM1885C1H820JA16D |
| 100pF(101) | ±5%(J) | GCM0335C1E101JD03D | GCM1555C1H101JZ13D | GCM1885C2A101JA16D | GCM1885C1H101JA16D |
| 120pF(121) | ±5%(J) | | GCM1555C1H121JA16D | GCM1885C2A121JA16D | GCM1885C1H121JA16D |
| 150pF(151) | ±5%(J) | | GCM1555C1H151JA16D | GCM1885C2A151JA16D | GCM1885C1H151JA16D |
| 180pF(181) | ±5%(J) | | GCM1555C1H181JA16D | GCM1885C2A181JA16D | GCM1885C1H181JA16D |
| 220pF(221) | ±5%(J) | | GCM1555C1H221JA16D | GCM1885C2A221JA16D | GCM1885C1H221JA16D |
| 270pF(271) | ±5%(J) | | GCM1555C1H271JA16D | GCM1885C2A271JA16D | GCM1885C1H271JA16D |
| 330pF(331) | ±5%(J) | | GCM1555C1H331JA16D | GCM1885C2A331JA16D | GCM1885C1H331JA16D |
| 390pF(391) | ±5%(J) | | GCM1555C1H391JA16D | GCM1885C2A391JA16D | GCM1885C1H391JA16D |
| 470pF(471) | ±5%(J) | | GCM1555C1H471JA16D | GCM1885C2A471JA16D | GCM1885C1H471JA16D |
| 560pF(561) | ±5%(J) | | | GCM1885C2A561JA16D | GCM1885C1H561JA16D |
| 680pF(681) | ±5%(J) | | | GCM1885C2A681JA16D | GCM1885C1H681JA16D |
| 820pF(821) | ±5%(J) | | | GCM1885C2A821JA16D | GCM1885C1H821JA16D |
| 1000pF(102) | ±5%(J) | | | GCM1885C2A102JA16D | GCM1885C1H102JA16D |
| 1200pF(122) | ±5%(J) | | | GCM1885C2A122JA16D | GCM1885C1H122JA16D |
| 1500pF(152) | ±5%(J) | | | GCM1885C2A152JA16D | GCM1885C1H152JA16D |
| 1800pF(182) | ±5%(J) | | | | GCM1885C1H182JA16D |
| 2200pF(222) | ±5%(J) | | | | GCM1885C1H222JA16D |
| 2700pF(272) | ±5%(J) | | | | GCM1885C1H272JA16D |
| 3300pF(332) | ±5%(J) | | | | GCM1885C1H332JA16D |
| 3900pF(392) | ±5%(J) | | | | GCM1885C1H392JA16D |

The part numbering code is shown in () and Unit is shown in []. <>: EIA [inch] Code



Packaging Code in Part Number is a code shows STD 180mm Reel Taping.



2 Series

3Dimension (LXW) 6 Rated Voltage Individual Specification Code

Dimension (T) Dension (1)CapacitancePackage

Temperature Compensating Type

| L x W [mm] | | 2.0x1.25(2 | 21)<0805> | 3.2x1.6(3 | 1)<1206> |
|-----------------------|-----------------|--------------------|--------------------|--------------------|--------------------|
| Rated Volt. [Vdc |] | 100(2A) | 50(1H) | 100(2A) | 50(1H) |
| тс | | | COG | G(5C) | |
| Capacitance | Tolerance | | Part N | umber | |
| 100pF(101) | ±5%(J) | GCM2165C2A101JA16D | | | |
| 120pF(121) | ±5%(J) | GCM2165C2A121JA16D | | | |
| 150pF(151) | ±5%(J) | GCM2165C2A151JA16D | | | |
| 180pF(181) | ±5%(J) | GCM2165C2A181JA16D | | | |
| 220pF(221) | ±5%(J) | GCM2165C2A221JA16D | | | |
| 270pF(271) | ±5%(J) | GCM2165C2A271JA16D | | | |
| 330pF(331) | ±5%(J) | GCM2165C2A331JA16D | | | |
| 390pF(391) | ±5%(J) | GCM2165C2A391JA16D | | | |
| 470pF(471) | ±5%(J) | GCM2165C2A471JA16D | | | |
| 560pF(561) | ±5%(J) | GCM2165C2A561JA16D | GCM2165C1H561JA16D | | |
| 680pF(681) | ±5%(J) | GCM2165C2A681JA16D | GCM2165C1H681JA16D | | |
| 820pF(821) | ±5%(J) | GCM2165C2A821JA16D | GCM2165C1H821JA16D | | |
| 1000pF(102) | ±5%(J) | GCM2165C2A102JA16D | GCM2165C1H102JA16D | | |
| 1200pF(122) | ±5%(J) | GCM2165C2A122JA16D | GCM2165C1H122JA16D | | |
| 1500pF(152) | ±5%(J) | GCM2165C2A152JA16D | GCM2165C1H152JA16D | | |
| 1800pF(182) | ±5%(J) | GCM2165C2A182JA16D | GCM2165C1H182JA16D | GCM3195C2A182JA16D | |
| 2200pF(222) | ±5%(J) | GCM2165C2A222JA16D | GCM2165C1H222JA16D | GCM3195C2A222JA16D | |
| 2700pF(272) | ±5%(J) | GCM2165C2A272JA16D | GCM2165C1H272JA16D | GCM3195C2A272JA16D | |
| 3300pF(332) | ±5%(J) | GCM2165C2A332JA16D | GCM2165C1H332JA16D | GCM3195C2A332JA16D | |
| 3900pF(392) | ±5%(J) | | GCM2165C1H392JA16D | GCM3195C2A392JA16D | |
| 4700pF(472) | ±5%(J) | | GCM2165C1H472JA16D | GCM3195C2A472JA16D | GCM3195C1H472JA16D |
| 5600pF(562) | ±5%(J) | | GCM2195C1H562JA16D | GCM3195C2A562JA16D | GCM3195C1H562JA16D |
| 6800pF(682) | ±5%(J) | | GCM2195C1H682JA16D | GCM3195C2A682JA16D | GCM3195C1H682JA16E |
| 8200pF(822) | ±5%(J) | | GCM2195C1H822JA16D | GCM3195C2A822JA16D | GCM3195C1H822JA16E |
| 10000pF(103) | ±5%(J) | | GCM2195C1H103JA16D | GCM3195C2A103JA16D | GCM3195C1H103JA16D |
| 12000pF(123) | ±5%(J) | | GCM2195C1H123JA16D | | GCM3195C1H123JA16D |
| 15000pF(153) | ±5%(J) | | GCM2195C1H153JA16D | | GCM3195C1H153JA16D |
| 18000pF(183) | ±5%(J) | | GCM21B5C1H183JA16L | | GCM3195C1H183JA16E |
| 22000pF(223) | ±5%(J) | | GCM21B5C1H223JA16L | | GCM3195C1H223JA16E |
| 27000pF(273) | ±5%(J) | | | | GCM3195C1H273JA16E |
| 33000pF(333) | ±5%(J) | | | | GCM3195C1H333JA16E |
| 39000pF(393) | ±5%(J) | | | | GCM3195C1H393JA16E |
| 47000pF(473) | ±5%(J) | | | | GCM31M5C1H473JA16I |
| 56000pF(563) | ±5%(J) | | | | GCM31M5C1H563JA16I |

The part numbering code is shown in () and Unit is shown in []. $\hfill <>:$ EIA [inch] Code



1

High Dielectric Constant Type

| L x W [mm] | | | 0.6x0.3(03)<0201> | | | | | | |
|-----------------------|------------------|--------------------|----------------------------|--------------------|--|--|--|--|--|
| Rated Volt. [Vdc |] | 25(1E) | 16(1C) | 10(1A) | | | | | |
| TC | | X7R (R7) | | | | | | | |
| Capacitance | Tolerance | | Part Number | | | | | | |
| 100pF(101) | ±10%(K) | GCM033R71E101KA03D | | | | | | | |
| 150pF(151) | ±10%(K) | GCM033R71E151KA03D | | | | | | | |
| 220pF(221) | ±10%(K) | GCM033R71E221KA03D | | | | | | | |
| 330pF(331) | ±10%(K) | GCM033R71E331KA03D | | | | | | | |
| 470pF(471) | ±10%(K) | GCM033R71E471KA03D | | | | | | | |
| 680pF(681) | ±10%(K) | GCM033R71E681KA03D | | | | | | | |
| 1000pF(102) | ±10%(K) | GCM033R71E102KA03D | | | | | | | |
| 1500pF(152) | ±10%(K) | GCM033R71E152KA03D | | | | | | | |
| 2200pF(222) | ±10%(K) | | GCM033R71C222KA55D | | | | | | |
| 3300pF(332) | ±10%(K) | | GCM033R71C332KA55D | | | | | | |
| 4700pF(472) | ±10%(K) | | | GCM033R71A472KA03D | | | | | |
| 6800pF(682) | ±10%(K) | | | GCM033R71A682KA03D | | | | | |
| 10000pF(103) | ±10%(K) | | | GCM033R71A103KA03D | | | | | |

| L x W [mm] | | | 1.0x0.5(1 | 5)<0402> | | | | | |
|-----------------------|------------------|--------------------|--------------------|--------------------|--------------------|--|--|--|--|
| Rated Volt. [Vdc |] | 100(2A) | 50(1H) | 25(1E) | 16(1C) | | | | |
| TC | | X7R(R7) | | | | | | | |
| Capacitance | Tolerance | | Part N | umber | | | | | |
| 220pF(221) | ±10%(K) | GCM155R72A221KA37D | GCM155R71H221KA37D | | | | | | |
| 330pF(331) | ±10%(K) | GCM155R72A331KA37D | GCM155R71H331KA37D | | | | | | |
| 470pF(471) | ±10%(K) | GCM155R72A471KA37D | GCM155R71H471KA37D | | | | | | |
| 680pF(681) | ±10%(K) | GCM155R72A681KA37D | GCM155R71H681KA37D | | | | | | |
| 1000pF(102) | ±10%(K) | GCM155R72A102KA37D | GCM155R71H102KA37D | | | | | | |
| 1500pF(152) | ±10%(K) | GCM155R72A152KA37D | GCM155R71H152KA37D | | | | | | |
| 2200pF(222) | ±10%(K) | GCM155R72A222KA37D | GCM155R71H222KA37D | | | | | | |
| 3300pF(332) | ±10%(K) | GCM155R72A332KA37D | GCM155R71H332KA37D | | | | | | |
| 4700pF(472) | ±10%(K) | GCM155R72A472KA37D | GCM155R71H472KA37D | | | | | | |
| 6800pF(682) | ±10%(K) | | GCM155R71H682KA55D | | | | | | |
| 10000pF(103) | ±10%(K) | | GCM155R71H103KA55D | GCM155R71E103KA37D | | | | | |
| 15000pF(153) | ±10%(K) | | GCM155R71H153KA55D | GCM155R71E153KA55D | | | | | |
| 22000pF(223) | ±10%(K) | | GCM155R71H223KA55D | GCM155R71E223KA55D | | | | | |
| 33000pF(333) | ±10%(K) | | | GCM155R71E333KA55D | GCM155R71C333KA37D | | | | |
| 47000pF(473) | ±10%(K) | | | GCM155R71E473KA55D | GCM155R71C473KA37D | | | | |
| 68000pF(683) | ±10%(K) | | | | GCM155R71C683KA55D | | | | |
| 0.10μF(104) | ±10%(K) | | | | GCM155R71C104KA55D | | | | |

The part numbering code is shown in () and Unit is shown in []. <>: EIA [inch] Code



Product ID
Series
Temperature Characteristics
Capacitance Tolerance

Dimension (L×W)Rated VoltageIndividual Specification Code

Dimension (T)CapacitancePackage

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.



High Dielectric Constant Type

| L x W [mm] | | | 1.6x0.8(1 | 8)<0603> | | | | | |
|-----------------------|------------------|--------------------|-----------------------------------|--------------------|--------------------|--|--|--|--|
| Rated Volt. [Vdc |] | 100(2A) | 50(1H) | 25(1E) | 16(1C) | | | | |
| тс | | | X7R(R7)/X7S(C7) | | | | | | |
| Capacitance | Tolerance | | Part N | umber | | | | | |
| 1000pF(102) | ±10%(K) | GCM188R72A102KA37D | GCM188R71H102KA37D | | | | | | |
| 1500pF(152) | ±10%(K) | GCM188R72A152KA37D | GCM188R71H152KA37D | | | | | | |
| 2200pF(222) | ±10%(K) | GCM188R72A222KA37D | GCM188R71H222KA37D | | | | | | |
| 3300pF(332) | ±10%(K) | GCM188R72A332KA37D | GCM188R71H332KA37D | | | | | | |
| 4700pF(472) | ±10%(K) | GCM188R72A472KA37D | GCM188R71H472KA37D | | | | | | |
| 6800pF(682) | ±10%(K) | GCM188R72A682KA37D | GCM188R71H682KA37D | | | | | | |
| 10000pF(103) | ±10%(K) | GCM188R72A103KA37D | GCM188R71H103KA37D | | | | | | |
| 15000pF(153) | ±10%(K) | GCM188R72A153KA37D | GCM188R71H153KA37D | | | | | | |
| 22000pF(223) | ±10%(K) | GCM188R72A223KA37D | GCM188R71H223KA37D | | | | | | |
| 33000pF(333) | ±10%(K) | | GCM188R71H333KA55D | GCM188R71E333KA37D | | | | | |
| 47000pF(473) | ±10%(K) | | GCM188R71H473KA55D | GCM188R71E473KA37D | | | | | |
| 68000pF(683) | ±10%(K) | | GCM188R71H683KA57D | GCM188R71E683KA57D | | | | | |
| 0.10μF(104) | ±10%(K) | GCM188R72A104KA64D | GCM188R71H104KA57D | GCM188R71E104KA57D | GCM188R71C104KA37D | | | | |
| 0.15μF(154) | ±10%(K) | | GCM188R71H154KA64D | GCM188R71E154KA37D | | | | | |
| 0.22μF(224) | ±10%(K) | | GCM188R71H224KA64D | GCM188R71E224KA55D | | | | | |
| 0.33μF(334) | ±10%(K) | | | | GCM188R71C334KA37D | | | | |
| 0.47μF(474) | ±10%(K) | | | GCM188R71E474KA64D | GCM188R71C474KA55D | | | | |
| 1.0μF(105) | ±10%(K) | | | GCM188R71E105KA64D | GCM188R71C105KA64D | | | | |

| L x W [mm] | | 1.6x0.8(18)<0603> | | | |
|---------------------|------------------|----------------------------|--|--|--|
| Rated Volt. [Vdc] |] | 6.3(0J) | | | |
| TC | | X7R(R7) | | | |
| Capacitance | Tolerance | Part Number | | | |
| 2.2μF(225) | ±10%(K) | GCM188R70J225KE22D | | | |

The part numbering code is shown in () and Unit is shown in []. <>: EIA [inch] Code

1

High Dielectric Constant Type

| L x W [mm] | | | 2.0x1.25(| 21)<0805> | | | | | | |
|-----------------------|------------------|--------------------|--------------------|--------------------|--------------------|--|--|--|--|--|
| Rated Volt. [Vdc |] | 100(2A) | 50(1H) | 35(YA) | 25(1E) | | | | | |
| TC | | | X7R(R7) | | | | | | | |
| Capacitance | Tolerance | | Part Number | | | | | | | |
| 6800pF(682) | ±10%(K) | GCM216R72A682KA37D | | | | | | | | |
| 10000pF(103) | ±10%(K) | GCM216R72A103KA37D | | | | | | | | |
| 15000pF(153) | ±10%(K) | GCM216R72A153KA37D | | | | | | | | |
| 22000pF(223) | ±10%(K) | GCM216R72A223KA37D | | | | | | | | |
| 33000pF(333) | ±10%(K) | GCM219R72A333KA37D | GCM219R71H333KA37D | | | | | | | |
| 47000pF(473) | ±10%(K) | GCM21BR72A473KA37L | GCM21BR71H473KA37L | | | | | | | |
| 68000pF(683) | ±10%(K) | GCM21BR72A683KA37L | GCM21BR71H683KA37L | | | | | | | |
| 0.10μF(104) | ±10%(K) | GCM21BR72A104KA37L | GCM21BR71H104KA37L | | | | | | | |
| 0.15μF(154) | ±10%(K) | | GCM21BR71H154KA37L | | GCM21BR71E154KA37L | | | | | |
| 0.22μF(224) | ±10%(K) | | GCM21BR71H224KA37L | | GCM21BR71E224KA37L | | | | | |
| 0.33μF(334) | ±10%(K) | | GCM219R71H334KA55D | | GCM21BR71E334KA37L | | | | | |
| 0.47µF(474) | ±10%(K) | | GCM21BR71H474KA55L | | GCM219R71E474KA55D | | | | | |
| 0.68µF(684) | ±10%(K) | | | GCM21BR7YA684KA55L | GCM21BR71E684KA55L | | | | | |
| 1.0μF(105) | ±10%(K) | | | GCM21BR7YA105KA55L | GCM21BR71E105KA56L | | | | | |
| 2.2μF(225) | ±10%(K) | | | | GCM21BR71E225KA73L | | | | | |

| L x W [mm] | | 2.0x1.25(21)<0805> | | | | | | |
|--------------------------------------|------------------|-----------------------------------|--|--------------------|--|--|--|--|
| Rated Volt. [Vdc |] | 16(1C) | 16(1C) 10(1A) 6.3(0J) | | | | | |
| TC | | X7R(R7)/X7S(C7) | | | | | | |
| Capacitance | Tolerance | Part N | lumber | | | | | |
| 0.68µF(684) | ±10%(K) | GCM219R71C684KA37D | | | | | | |
| 1.0μF(105) | ±10%(K) | GCM219R71C105KA37D | | | | | | |
| 2.2μF(225) | ±10%(K) | GCM21BR71C225KA64L | GCM21BR71A225KA37L | | | | | |
| 4.7μF(475) ±10%(K) | | GCM21BR71C475KA73L | GCM21BC71A475KA73L | | | | | |
| 10μF(106) | ±10%(K) | | | GCM21BR70J106KE22L | | | | |

| L x W [mm] | | | 3.2x1.6 (31)<1206> | | | | | | | |
|----------------------|------------------|--------------------|----------------------------|--------------------|--------------------|--|--|--|--|--|
| Rated Volt. [Vdc |] | 100(2A) | 50(1H) | 25(1E) | 16(1C) | | | | | |
| TC | | X7R(R7) | | | | | | | | |
| Capacitance | Tolerance | Part Number | | | | | | | | |
| 0.10μF(104) | ±10%(K) | GCM319R72A104KA37D | | | | | | | | |
| 0.15μF(154) | ±10%(K) | GCM31MR72A154KA37L | | | | | | | | |
| 0.22μF(224) | ±10%(K) | GCM31MR72A224KA37L | | | | | | | | |
| 0.33μF(334) | ±10%(K) | | GCM31MR71H334KA37L | | | | | | | |
| 0.47µF(474) | ±10%(K) | | GCM31MR71H474KA37L | | | | | | | |
| 0.68μF(684) | ±10%(K) | | GCM31MR71H684KA55L | | | | | | | |
| 1.0μF(105) | ±10%(K) | | GCM31MR71H105KA55L | | | | | | | |
| 2.2μF(225) | ±10%(K) | | GCM31CR71H225KA55L | GCM31MR71E225KA57L | | | | | | |
| 4.7μF(475) | ±10%(K) | | | GCM31CR71E475KA55L | GCM31CR71C475KA37L | | | | | |
| 10μF(106) | ±10%(K) | | | | GCM31CR71C106KA64L | | | | | |

| L x W [mm] | | 3.2x1.6(31)<1206> | | | |
|--------------------|------------------|----------------------------------|--------------------|--|--|
| Rated Volt. [Vdc |] | 10(1A) 6.3(0J) | | | |
| TC | | X7R | X7R(R7) | | |
| Capacitance | Tolerance | Part Number | | | |
| 10μF(106) | ±10%(K) | GCM31CR71A106KA64L | | | |
| 22μF(226) | ±20%(M) | | GCM31CR70J226ME23L | | |

The part numbering code is shown in () and Unit is shown in []. <>: EIA [inch] Code

 Product ID
Series
Temperature Characteristics
Capacitance Tolerance

Dimension (L×W)Rated VoltageIndividual Specification Code

Dimension (T)CapacitancePackage

Packaging Code in Part Number is a code shows STD 180mm Reel Taping.



High Dielectric Constant Type

| L x W [mm] | | 3.2x2.5(32)<1210> | | | | | | |
|-------------------------------------|---------------------|----------------------------|--------------------|--------------------|--------------------|--|--|--|
| Rated Volt. [Vdc |] | 100(2A) | 16(1C) | | | | | |
| тс | rc X7R(R7) | | | | | | | |
| Capacitance | Tolerance | Part Number | | | | | | |
| 1.0μF(105) | ±10%(K) | | GCM32ER71H105KA37L | | | | | |
| 2.2μF(225) | ±10%(K) | GCM32DR72A225KA64L | | | | | | |
| 4.7μF(475) | ±10%(K) | | GCM32ER71H475KA55L | GCM32DR71E475KA55L | | | | |
| 10μF(106) ±10%(K) | | | | GCM32ER71E106KA57L | GCM32DR71C106KA37L | | | |
| 22μF(226) | ±20%(M) | | | | GCM32ER71C226ME19L | | | |

| L x W [mm] | | 3.2x2.5(32)<1210> | | | |
|--------------------|------------------|----------------------------------|--------------------|--|--|
| Rated Volt. [Vdc |] | 10(1A) 6.3(0J) | | | |
| TC | | X7R | X7R(R7) | | |
| Capacitance | Tolerance | Part Number | | | |
| 22μF(226) | ±20%(M) | GCM32ER71A226ME12L | | | |
| 47μF(476) | ±20%(M) | | GCM32ER70J476ME19L | | |

The part numbering code is shown in () and Unit is shown in []. <>: EIA [inch] Code



1

| ۱o. | AEC-Q20 | 00 | Specifi | cations | AEC-Q200 Test Method | | | | |
|-----|----------------------------------|---|--|---|---|--|--|--|--|
| v0. | Test Iter | m | Temperature Compensating Type | High Dielectric Type | ALC-0200 Test Method | | | | |
| 1 | Pre-and Post- Electrical Test | | | | - - | | | | |
| | High Temper Exposure (St | | The measured and observed ch specifications in the following tal | | | | | | |
| | Ар | pearance | No marking defects | | | | | | |
| 2 | | pacitance ange | Within ±2.5% or ±0.25pF (Whichever is larger) | Within ±10.0% | Sit the capacitor for 1000 ± 12 hours at $150\pm3^{\circ}$ C. Let sit for $24\pm$ | | | | |
| | Q | /D.F. | 30pFmin.: Q≥1000 30pFmax.: Q≥400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.03 max. W.V.: 16V: 0.05 max. | hours at room temperature, then measure. | | | | |
| | I.F | २. | More than 10,000M Ω or 500 Ω - (Whichever is smaller) | F *1 | | | | | |
| | Temperature Cycle | 9 | The measured and observed ch specifications in the following tal | • | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (18). Perform the 1000 cycles | | | | |
| | Ар | pearance | No marking defects | | according to the four heat treatments listed in the following table Let sit for 24±2 hours at room temperature, then measure | | | | |
| 3 | | pacitance ange | Within $\pm 2.5\%$ or $\pm 0.25pF$ (Whichever is larger) | Within ±10.0% | Step 1 2 3 4 Temp. (°C) -55+0/-3 Room Temp. 125+3/-0 (ΔC/R7/C7) Room Temp. | | | | |
| 3 | Q | Q/D.F. 30pFmin.: Q≥1 30pFmax.: Q≥4 C: Nominal Cap | | *1 W.V.: 25Vmin.: 0.03 max. W.V.: 16V: 0.05 max. | Time (min.) 15±3 1 15±3 1 | | | | |
| | 1.F | ર. | More than 10,000M Ω or 500 Ω · (Whichever is smaller) | *1 | 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. | | | | |
| 4 | Destructive Physical Ana | alysis | No defects or abnormalities | | Per EIA-469 | | | | |
| | Moisture Resistance | e The measured and observed characteristics should satisfy the specifications in the following table. | | • | Apply the 24-hour heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times. | | | | |
| | Ар | pearance | No marking defects | | Let sit for 24±2 hours at room temperature, then measure. | | | | |
| | | pacitance ange | Within ±3.0% or ±0.30pF (Whichever is larger) | Within ±12.5% | - Humidity Humidity Humidity Humidity Humidity °C 90-98% 80-98% 90-98% 80-98% 90-98% 70 | | | | |
| 5 | Q | Q/D.F. 30pFmin.: Q≥350 10pF and over, 30pF Q≥275+2 10pFmax.: Q≥200 C: Nominal Capaci | | *1 W.V.: 25Vmin.: 0.03 max. W.V.: 16V: 0.05 max. | | | | | |
| | 1.F | ٦. | More than 10,000M Ω or 500 Ω \cdot (Whichever is smaller) | *1 F | 15 10 10 10 10 10 10 10 10 10 10 | | | | |
| | Biased Humi | idity | The measured and observed ch specifications in the following tal | | | | | | |
| | Ар | pearance | No marking defects | | 1 | | | | |
| 6 | | pacitance ange | Within ±3.0% or ±0.30pF (Whichever is larger) | Within ±12.5% | Apply the rated voltage and 1.3+0.2/-0Vdc (add 6.8k Ω resisto at 85±3°C and 80 to 85% humidity for 1000±12 hours. Remove and let sit for 24±2 hours at room temperature, then | | | | |
| - | Q | /D.F. | 30pF and over: Q≥200 30pF and below: Q≥100+ $\frac{10}{3}$ C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.035 max. W.V.: 16V: 0.05 max. | measure. The charge/discharge current is less than 50mA. | | | | |
| | I.F | २. | More than 1,000M Ω or 50 $\Omega \cdot$ F *1 (Whichever is smaller) | | | | | | |

*1: The figure indicates typical specification. Please refer to individual specifications.





1

Continued from the preceding page.

| No. | AEC-Q200 Test Item | | Specifi | cations | AEC-Q200 Test Method | | | |
|-------------|---------------------------|--|---|--|---|--|--|--|
| NO . | Test | Item | Temperature Compensating Type | High Dielectric Type | - AEC-Q200 Test Method | | | |
| | Operatior | nal Life | The measured and observed ch specifications in the following ta | | | | | |
| | | Appearance | No marking defects | | Apply 200% of the rated voltage for 1000 ± 12 hours at | | | |
| | | Capacitance Change | Within ±3.0% or ±0.30pF (Whichever is larger) | Within ±12.5% | 125±3°C. Let sit for 24±2 hours at room temperature, then measure. *2 The charge/discharge current is less than 50mA. | | | |
| 7 | Q/D.F. | | 30pFmin.: Q≥350 10pF and over, 30pF and below: Q≥275+ $\frac{5}{2}$ C 10pFmax.: Q≥200+10C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.035 max. W.V.: 16V: 0.05 max. | 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. *2 | | | |
| | | I.R. | More than 1,000M Ω or 50 $\Omega \cdot F$ (Whichever is smaller) | *1 | | | | |
| 8 | External | Visual | No defects or abnormalities | | Visual inspection | | | |
| 9 | Physical [| Dimension | Within the specified dimensions | | Using calipers | | | |
| | | Appearance | No marking defects | | Per MIL-STD-202 Method 215 | | | |
| | | Capacitance Change | | | Solvent 1: 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits | | | |
| 10 | Resistance to Solvents | to Solvents Q/D.F. 30pFmax.: Q≧400+20C W.V.: 25Vmi | | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | Solvent 2: Terpene defluxer Solvent 3: 42 parts (by volume) of water 1 part (by volume) of propylene glycol | | | |
| | | I.R. | More than 10,000M\Omega or 500 $\Omega \cdot$ (Whichever is smaller) | F *1 | monomethyl ether 1 part (by volume) of monoethanolamine | | | |
| | | Appearance | No marking defects | | | | | |
| | | Capacitance Change | Within the specified tolerance | | Three shocks in each direction should be applied along 3 | | | |
| 11 | Mechanical Shock | Q/D.F. | 30pFmin.: Q≧1000 30pFmax.: Q≧400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | mutually perpendicular axes of the test specimen (18 shocks). The specified test pulse should be Half-sine and should have a duration: 0.5ms, peak value: 1500g and velocity change: 4.7m/s | | | |
| | | I.R. | More than 10,000M Ω or 500 Ω \cdot (Whichever is smaller) | F *1 | | | | |
| | | Appearance | No defects or abnormalities | | Solder the capacitor to the test jig (glass epoxy board) in the | | | |
| | | Capacitance Change | Within the specified tolerance | | same manner and under the same conditions as (19). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied | | | |
| 12 | Vibration | Q/D.F. | 30pFmin.: Q≧1000 30pFmax.: Q≧400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | uniformly between the approximate limits of 10 and 2000Hz. The frequency range, from 10 to 2000Hz and return to 10Hz, should be traversed in approximately 20 minutes. This motion should be | | | |
| | | I.R. | More than 10,000M Ω or 500 Ω · (Whichever is smaller) | F *1 | applied for 12 items in each 3 mutually perpendicular directions (total of 36 times). | | | |
| | Resistand Soldering | | The measured and observed ch specifications in the following ta | 3 | | | | |
| | | Appearance | No marking defects | | Immerse the capacitor in a eutectic solder solution at $260\pm5^{\circ}$ C fo 10±1 seconds. Let sit at room temperature for 24±2 hours, ther | | | |
| 13 | | Capacitance Change | Within the specified tolerance | | measure. | | | |
| 13 | | Q/D.F. | 30pFmin.: Q≧1000 30pFmax.: Q≧400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | Initial measurement for high dielectric constant type Perform a heat treatment at 150⁺⁰/₋₁o°C for one hour and then lesit for 24±2 hours at room temperature. Perform the initial measurement. | | | |
| | | I.R. | More than 10,000M Ω or 500 Ω · (Whichever is smaller) | F *1 | | | | |

*1: The figure indicates typical specification. Please refer to individual specifications.

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



Continued from the preceding page

| No. | AEC-Q200 Test Item | | Specifi | cations | AEC-Q200 Test Method | | | |
|-----|---------------------------|---------------------------|---|---|--|--|--|--|
| NO. | Test | Item | Temperature Compensating Type | High Dielectric Type | AEC-0200 Test Method | | | |
| | Thermal \$ | Shock | The measured and observed ch specifications in the following ta | | Fix the capacitor to the supporting jig in the same manner and under the same conditions as (18). Perform the 300 cycles | | | |
| | | Appearance | No marking defects | | according to the two heat treatments listed in the following tabl (Maximum transfer time is 20 seconds). Let sit for 24±2 hours a | | | |
| | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | Within ±10.0% | room temperature, then measure. | | | |
| 14 | | Q/D.F. | 30pF min.: Q≧1000 30pF max.: Q≧400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | Temp. (°C) -55+0/-3 125+3/-0 (5C, C7, R7) Time (min.) 15±3 15±3 | | | |
| | | I.R. | More than 10,000M Ω or 500 Ω · (Whichever is smaller) | F *1 | Initial measurement for high dielectric constant type Perform a heat treatment at 150⁺⁰/₋₀°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 the specified tolerance | | | | | |
| 15 | ESD | 20=E min + 0>1000 | | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | Per AEC-Q200-002 | | | |
| | | I.R. | More than 10,000M Ω or 500 Ω · (Whichever is smaller) | F *1 | Per AEC-Q200-002 (a) Preheat at 155°C for 4 hours. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 5+0/-0.5 seconds at 235±5°C. (b) Should be placed into steam aging for 8 hours±15 minutes. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 5+0/-0.5 seconds at 235±5°C. | | | |
| 16 | 6 Solderability | | 95% of the terminations is to be continuously. | soldered evenly and | capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 5+0/-0.5 seconds at 235±5°C. (b) Should be placed into steam aging for 8 hours±15 minutes. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for | | | |
| | | A | No defects or abnormalities | | ±5 seconds at 260±5°C. Visual inspection. | | | |
| | | Appearance Capacitance | | | The capacitance/Q/D.F. should be measured at 25°C at the | | | |
| | | Change | Within the specified tolerance | | frequency and voltage shown in the table. (1) Temperature Compensating Type | | | |
| 17 | Electrical Characteri- | Q/D.F. | 30pF min.: Q≧1000 30pF max.: Q≧400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25V min.: 0.025 max. W.V.: 16V: 0.035 max | $\begin{tabular}{ c c c c c } \hline Capacitance & Frequency & Voltage \\ \hline C \leq 1000 pF & 1\pm 0.1 MHz & 0.5 to 5 Vrms \\ \hline C > 1000 pF & 1\pm 0.1 kHz & 1\pm 0.2 Vrms \\ \hline (2) High Dielectric Type & \\ \hline Capacitance & Frequency & Voltage \\ \hline C \leq 10 \mu F & 1\pm 0.1 kHz & 1\pm 0.2 Vrms \\ \hline C > 10 \mu F & 120\pm 24 Hz & 0.5\pm 0.1 Vrms \\ \hline \end{tabular}$ | | | |
| ., | zation | I.R. | 25°C More than 100,000MΩ or 1,000Ω · F (Whichever is smaller) Max. Operating Temperature…125°C More than 10,000MΩ or 100Ω · F (Whichever is smaller) | *1 25°C More than $10,000M\Omega$ or $500\Omega \cdot F$ (Whichever is smaller) Max. Operating Temperature125°C More than $1,000M\Omega$ or $10\Omega \cdot F$ (Whichever is smaller) | The insulation resistance should be measured with a DC voltag not exceeding the rated voltage at 25°C and 125°C and within minutes of charging. | | | |
| | | Dielectric Strength | (Whichever is smaller) (Whichever is smaller) No failure (Whichever is smaller) | | No failure should be observed when 250% of the rated voltage i applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. | | | |

*1: The figure indicates typical specification. Please refer to individual specifications.



Specifications

Specifications and Test Methods

Continued from the preceding page

No

18 F

19

20

| | AEC-Q200 Test Item | Q200 | Specifi | cations | AEC-Q200 Test Method | | | | |
|---|-----------------------|-----------------------|---|--|--|-----------------------------|---|---------------------------|--|
| • | Test | Item | Temperature Compensating Type | High Dielectric Type | | ALC-0200 N | estimethou | | |
| | | Appearance | No marking defects | | Solder the capacito | or on the test ji | g (glass epoxy | board) shown in | |
| | | Capacitance Change | Within $\pm 5.0\%$ or ± 0.5 pF (Whichever is larger) | Within ±10.0% | Fig. 1 using a euter shown in Fig. 2 for reflow method and | 5±1sec. The s | oldering should | be done by the | |
| | | Q/D.F. | 30pF min.: Q≧1000 30pF max.: Q≧400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | soldering is uniform | n and free of d | efects such as | heat shock. | |
| | | | | | GCM03 GCM15 GCM18 | 0.3 0.5 0.6 | 0.9 1.5 2.2 | 0.3 0.6 0.9 | |
| | Board Flex | | | | GCM21 GCM31 GCM32 | 0.8 2.0 2.0 | 3.0 4.4 4.4 | 1.3 1.7 2.6 | |
| | | I.R. | *1 More than $10,000M\Omega$ or $500\Omega \cdot F$ (Whichever is smaller) | | R4 | | Pressunzing speed: 1.0mm/se Pressurize | (in mm) ec | |
| | | | | t: 1.6mm (GCM03/15: 0.8mm) Fig. 1 | Ca | | Flexure: ≦2 (High Dielectric | Туре) | |
| | | | | | 45 | 5 _ ₄ ⁴⁵ Fig. | Flexure: ≦3 (Temperature Compensating 7 | Гуре) | |
| | | Appearance | No marking defects | | Solder the capacito | | | | |
| | | Capacitance Change | Within the specified tolerance | | Fig. 3 using a eute with the test jig for The soldering shou | 60sec. | | | |
| | | Q/D.F. | 30pF min.: Q≧1000 30pF max.: Q≧400+20C C: Nominal Capacitance (pF) | *1 W.V.: 25Vmin.: 0.025 max. W.V.: 16V: 0.035 max. | reflow method and soldering is uniforn *2N (GCM03/15) | | | | |
| | | | | | Type GCM03 GCM15 GCM18 | a 0.3 0.4 1.0 | b 0.9 1.5 | c 0.3 0.5 1.2 | |
| , | Terminal Strength | | | | GCM18 GCM21 GCM31 GCM32 | 1.0 1.2 2.2 2.2 | 3.0 4.0 5.0 5.0 | 1.2 1.65 2.0 2.9 | |
| | | I.R. | More than 10,000M Ω or 500 Ω \cdot (Whichever is smaller) | *1 F | c (in mm) | | | | |
| | | | | | Solder resist Baked electrode or | | | | |
| | | | | | | | | | |
| | | | | | Fig. 3 | | | | |
| | | | | | Place the capacitor in the beam load fixture as Fig. 4. Apply a force. < Chip Length: 2.5mm max. > | | | | |
| | | | | | | ļ | | | |
| | | | The chip endure following force. < Chip L dimension: 2.5mm r | | [| | Iron Board | | |
|) | Beam Loa | ad Test | Chip thickness > 0.5mm ra Chip thickness ≦ 0.5mm ra < Chip L dimension: 3.2mm r | nk: 8N | Speed supplied the | | 0.5mm / sec. | | |
| | | | Chip thickness < 1.25mm r Chip thickness ≥ 1.25mm r Chip thickness ≥ 1.25mm r | ank: 15N | | | | | |
| | | | | | Speed supplied the | e Stress Load: | 2.5mm / sec. | | |
| | | | | | | Fig. 4 | | | |
| : | The figure i | indicates ty | pical specification. Please refer t | o individual specifications. | • | | | | |

*1: The figure indicates typical specification. Please refer to individual specifications.



Continued from the preceding page.

| No. | AEC- | Q200 | Specifi | cations | | AEC-O200 Test Method | | |
|-----|---------------------------|----------------------------|---|--|---|---|--|--|
| NO. | Test | Item | Temperature Compensating Type | emperature Compensating Type High Dielectric Type | | AEC-0200 Test Method | | |
| | | Capacitance Change | Within the specified tolerance (Table A) | C7: Within ±22% (-55°C to +125°C) R7: Within ±15% (-55°C to +125°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 | | | |
| | | Temperature Coefficient | Within the specified tolerance (Table A) | / | temperat | In step 3 as a reference. When cycling the ture sequentially from step1 through 5 (Δ C: +25°C to other temp. coeffs.: +25°C to +85°C) the capacitance | | |
| | Capacitance | | | | coefficien capacitan between 1, 3 and | e within the specified tolerance for the temperature nt and capacitance change as shown in Table A. The nce drift is calculated by dividing the differences the maximum and minimum measured values in steps 5 by the capacitance value in step 3. | | |
| 21 | Temperature Character- | | | | Step 1 | Temperature (°C) 25+2 | | |
| | istics | | | | 2 | -55±2 | | |
| | 15005 | | Within ±0.2% or ±0.05 pF | | 3 | 25±2 | | |
| | | Capacitance | (Whichever is larger) | | 4 | 125±2 | | |
| | | Drift | * Do not apply to 1X/25V | | 5 | 25±2 | | |
| | | | | | The rang 25°C val should b · Initial m Perform a set for 24 | electric Constant Type ges of capacitance change compared with the above ue over the temperature ranges shown in the table e within the specified ranges. neasurement for high dielectric constant type. a heat treatment at 150+0/-10°C for one hour and then 4±2 hours at room temperature. the initial measurement. | | |

*1: The figure indicates typical specification. Please refer to individual specifications.

Table A

18

| | | | (| Capacitance Chai | nge from 25°C (% |) | | |
|-------|-------------------------------|------|-------|------------------|------------------|------|-------|--|
| Char. | Nominal Values (ppm/°C) Note1 | -5 | 55 | -3 | 30 | -10 | | |
| | | Max. | Min. | Max. | Min. | Max. | Min. | |
| 5C | 0±30 | 0.58 | -0.24 | 0.40 | -0.17 | 0.25 | -0.11 | |

Note 1: Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for 5C).



Package

1

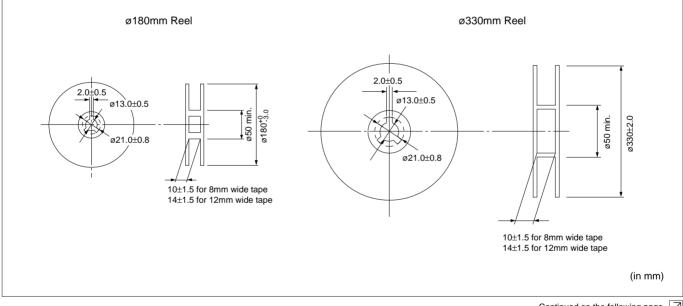
Minimum Quantity Guide

| | Dim | onciono | (mm) | | | Quantit | ty (pcs.) | | |
|-------------|-----------------|---------|---------------------------------|------------------------------------|---------------------------------|------------------------------------|--------------------------------|-------------------------------|----------|
| Part Number | Dimensions (mm) | | | ø180n | nm reel | ø330m | nm reel | Dull Care | Dull Dee |
| Part Number | L W T | | Paper Tape Packaging Code: D | Embossed Tape Packaging Code: L | Paper Tape Packaging Code: J | Embossed Tape Packaging Code: K | Bulk Case Packaging Code: C | Bulk Bag Packaging Code: B | |
| GCM03 | 0.6 | 0.3 | 0.3 | 15,000 | - | 50,000 | - | - | 1,000 |
| GCM15 | 1.0 | 0.5 | 0.5 | 10,000 | - | 50,000 | - | 50,000 | 1,000 |
| GCM18 | 1.6 | 0.8 | 0.8 | 4,000 | - | 10,000 | - | 15,000 ¹⁾ | 1,000 |
| | | | 0.6 | 4,000 | - | 10,000 | - | 10,000 | 1,000 |
| GCM21 | 2.0 | 1.25 | 0.85 | 4,000 | - | 10,000 | - | - | 1,000 |
| | | | 1.25 | - | 3,000 | - | 10,000 | 5,000 ¹⁾ | 1,000 |
| | | | 0.85 | 4,000 | - | 10,000 | - | - | 1,000 |
| GCM31 | 3.2 | 1.6 | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 |
| | | | 1.6 | - | 2,000 | - | 6,000 | - | 1,000 |
| | | | 1.15 | - | 3,000 | - | 10,000 | - | 1,000 |
| GCM32 | 22 | 2.5 | 1.35 | - | 2,000 | - | 8,000 | - | 1,000 |
| GUNISZ | 3.2 | 2.5 | 1.6 | - | 2,000 | - | 6,000 | - | 1,000 |
| | | | 1.8/2.0/2.5 | - | 1,000 | - | 4,000 | - | 1,000 |

1) There are parts number without bulk case.

■ Tape Carrier Packaging

1. Dimensions of Reel



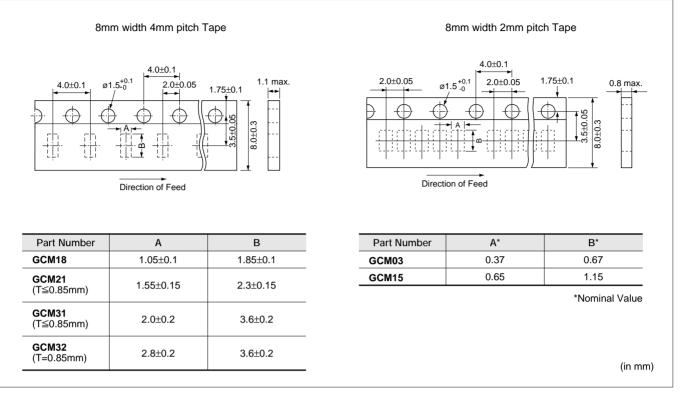
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Package

Continued from the preceding page.

2. Dimensions of Paper Tape



3. Dimensions of Embossed Tape

| 8mm w | idth 4mm pitch Tape | | |
|------------------------------------|--|---|--------|
| ₩ ₩ + | 0.1 2.0±0.1 1.75±0.1 4.4 4.4 4.4 4.4 4.4 4.4 4.4 4.4 4.4 4 | 1 0.2±0.1 1 0.2±0.1 1 0.2±0.1 2.5 max. (3.0 max. T=1.8mm/2. | |
| | | (0.0 max. 1=1.0mm/2 | Umm) |
| Part Number | А | B | |
| Part Number GCM21 (T=1.25mm) | A 1.45±0.2 | | |
| GCM21 | | B | |
| GCM21 (T=1.25mm) GCM31 | 1.45±0.2 | B 2.25±0.2 | - - |

Continued on the following page.



Package

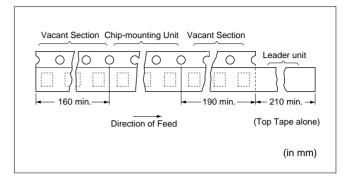
1

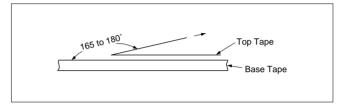
- 4. Taping Method
 - Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
 - (2) Part of the leader and part of the empty tape should be attached to the end of the tape as follows.
 - (3) The top tape and base tape are not attached at the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

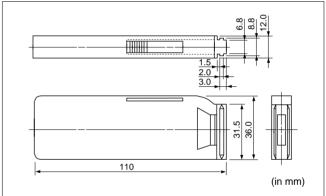
*GCM03: 0.05 to 0.5N

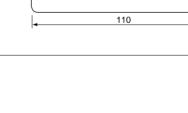
Dimensions of Bulk Case Packaging

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











△Caution (Storage and Operation Condition)

■ Storage and Operation condition

- 1. The performance of chip monolithic ceramic capacitors may be affected by the storage conditions.
 - 1-1. Store capacitors in the following conditions: Temperature of +5°C to +40°C and a Relative Humidity of 20% to 70%.
 - (1) Sunlight, dust, rapid temperature changes, corrosive gas atmosphere or high temperature and humidity conditions during storage may affect the solderability and the packaging performance. Please use product within six months of receipt.
 - (2) Please confirm solderability before using after six months. Store the capacitors without opening the original bag. Even if the storage period is short, do not exceed the specified atmospheric conditions.
- 1-2. Corrosive gas can react with the termination (external) electrodes or lead wires of capacitors, and result in poor solderability. Do not store the capacitors in an atmosphere consisting of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.).
- 1-3. Due to moisture condensation caused by rapid humidity changes, or the photochemical change caused by direct sunlight on the terminal electrodes and/or the resin/epoxy coatings, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or in high humidity conditions.



1

Rating

- 1. Temperature Dependent Characteristics
- 1. The electrical characteristics of the capacitor can change with temperature.
 - 1-1. For capacitors having larger temperature dependency, the capacitance may change with

temperature changes.

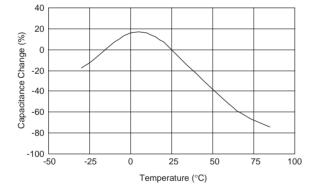
The following actions are recommended in order to insure suitable capacitance values.

(1) Select a suitable capacitance for the operating temperature range.

Typical Temperature Characteristics Char. R6(X5R)

20 15 Capacitance Change (%) 10 5 0 -5 -10 -15 -20 -50 -25 25 100 -75 0 50 75 Temperature (°C)

Typical Temperature Characteristics Char. F5(Y5V)

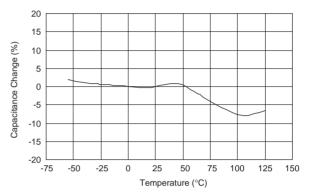


- 2. Measurement of Capacitance
- 1. Measure capacitance with the voltage and the frequency specified in the product specifications.
 - 1-1. The output voltage of the measuring equipment may decrease when capacitance is high occasionally.
 Please confirm whether a prescribed measured voltage is impressed to the capacitor.
 - 1-2. The capacitance values of high dielectric constant type capacitors change depending on the AC voltage applied. Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.

(2) The capacitance may change within the rated temperature.

When you use a high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. And check capacitors using your actual appliances at the intended environment and operating conditions.

Typical Temperature Characteristics Char. R7(X7R)





Continued from the preceding page.

3. Applied Voltage

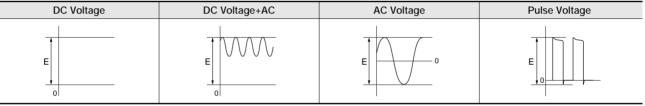
1

- 1. Do not apply a voltage to the capacitor that exceeds the rated voltage as called-out in the specifications.
 - 1-1. Applied voltage between the terminals of a capacitor shall be less than or equal to the rated voltage.
 - (1) When AC voltage is superimposed on DC voltage, the zero-to-peak voltage shall not exceed the

rated DC voltage. When AC voltage or pulse voltage is applied, the peak-to-peak voltage shall not exceed the rated DC voltage.

(2) Abnormal voltages (surge voltage, static electricity, pulse voltage, etc.) shall not exceed the rated DC voltage.

Typical Voltage Applied to the DC Capacitor



(E: Maximum possible applied voltage.)

1-2. Influence of overvoltage

Overvoltage that is applied to the capacitor may result in an electrical short circuit caused by the breakdown of the internal dielectric layers . The time duration until breakdown depends on the applied voltage and the ambient temperature.

4. Applied Voltage and Self-heating Temperature

- 1. When the capacitor is used in a high-frequency voltage, pulse voltage, application, be sure to take into account self-heating may be caused by resistant factors of the capacitor.
 - 1-1. The load should be contained to the level such that when measuring at atmospheric temperature of 25°C, the product's self-heating remains below 20°C and surface temperature of the capacitor in the actual circuit remains within the maximum operating temperature.

Continued on the following page.

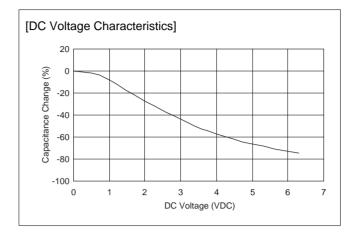


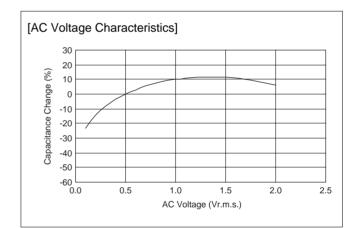
Continued from the preceding page.

- 5. DC Voltage and AC Voltage Characteristic
- The capacitance value of a high dielectric constant type capacitor changes depending on the DC voltage applied. Please consider the DC voltage characteristics when a capacitor is selected for use in a DC circuit.
 - 1-1. The capacitance of ceramic capacitors may change sharply depending on the applied voltage. (See figure)

Please confirm the following in order to secure the capacitance.

- Whether the capacitance change caused by the applied voltage is within the range allowed or not.
- (2) In the DC voltage characteristics, the rate of capacitance change becomes larger as voltage increases. Even if the applied voltage is below the rated voltage. When a high dielectric constant type capacitor is in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. And check capacitors using your actual appliances at the intended environment and operating conditions.
- The capacitance values of high dielectric constant type capacitors change depending on the AC voltage applied.
 Please consider the AC voltage characteristics when selecting a capacitor to be used in a AC circuit.

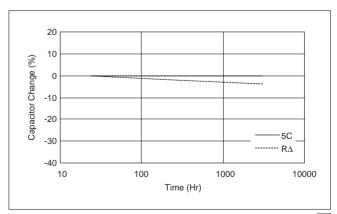




6. Capacitance Aging

 The high dielectric constant type capacitors have the characteristic in which the capacitance value decreases with passage of time.

When you use a high dielectric constant type capacitors in a circuit that needs a tight (narrow) capacitance tolerance. Example: a time constant circuit., please carefully consider the characteristics of these capacitors, such as their aging, voltage, and temperature characteristics. And check capacitors using your actual appliances at the intended environment and operating conditions.

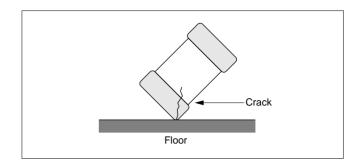


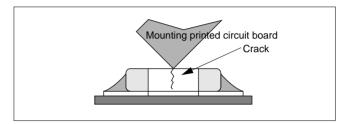
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- 7. Vibration and Shock
- The capacitors mechanical actress (vibration and shock) shall be specified for the use environment.
 Please confirm the kind of vibration and/or shock, its condition, and any generation of resonance.
 Please mount the capacitor so as not to generate resonance, and do not allow any impact on the terminals.
- Mechanical shock due to falling may cause damage or a crack in the dielectric material of the capacitor.
 Do not use a fallen capacitor because the quality and reliability may be deteriorated.
- 3. When printed circuit boards are piled up or handled, the corners of another printed circuit board should not be allowed to hit the capacitor in order to avoid a crack or other damage to the capacitor.







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Caution (Soldering and Mounting)

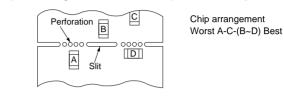
■ Soldering and Mounting

- 1. Mounting Position
- 1. Confirm the best mounting position and direction that minimizes the stress imposed on the capacitor during flexing or bending the printed circuit board.
 - 1-1. Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

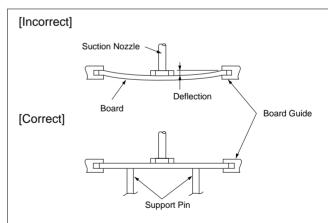
[Component Direction]

Locate chip horizontal to the direction in which stress acts

[Chip Mounting Close to Board Separation Point]



- 2. Information before Mounting
- 1. Do not re-use capacitors that were removed from the equipment.
- 2. Confirm capacitance characteristics under actual applied voltage.
- 3. Confirm the mechanical stress under actual process and equipment use.
- 4. Confirm the rated capacitance, rated voltage and other electrical characteristics before assembly.
- 5. Prior to use, confirm the Solderability for the capacitors that were in long-term storage.
- 6. Prior to measuring capacitance, carry out a heat treatment for capacitors that were in long-term storage.
- 7. The use of Sn-Zn based solder will deteriorate the reliability of the MLCC.
 Please contact our sales representative or product engineers on the use of Sn-Zn based solder in advance.
- 3. Maintenance of the Mounting (pick and place) Machine
- 1. Make sure that the following excessive forces are not applied to the capacitors.
 - 1-1. In mounting the capacitors on the printed circuit board, any bending force against them shall be kept to a minimum to prevent them from any bending damage or cracking. Please take into account the following precautions and recommendations for use in your process.
 - (1) Adjust the lowest position of the pickup nozzle so as not to bend the printed circuit board.
 - (2) Adjust the nozzle pressure within a static load of 1N to 3N during mounting.
- 2. Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes greater force upon the chip during mounting, causing cracked chips. Also 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.



Continued on the following page. \square



Caution (Soldering and Mounting)

Continued from the preceding page.

4-1. Reflow Soldering

- 1. When sudden heat is applied to the components, the mechanical strength of the components will decrease because a sudden temperature change causes deformation inside the components. In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board. Preheating conditions are shown in table 1. It is required to keep the temperature differential between the solder and the components surface (Δ T) as small as possible.
- Solderability of Tin plating termination chips might be deteriorated when a low temperature soldering profile where the peak solder temperature is below the melting point of Tin is used. Please confirm the Solderability of Tin plated termination chips before use.
- When components are immersed in solvent after mounting, be sure to maintain the temperature difference (ΔT) between the component and the solvent within the range shown in the table 1.

Table 1

| Part Number | Temperature Differential | |
|-------------------|--------------------------|--|
| GRM03/15/18/21/31 | ∆T≦190°C | |
| GCM32 | ∆T≦130°C | |

Recommended Conditions

| | Pb-Sn S | Lead Free Solder | |
|------------------|-----------------|------------------|------------------|
| | Infrared Reflow | Vapor Reflow | Leau Fiee Solder |
| Peak Temperature | 230 to 250°C | 230 to 240°C | 240 to 260°C |
| Atmosphere | Air | Air | Air or N2 |

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

4. Optimum Solder Amount for Reflow Soldering

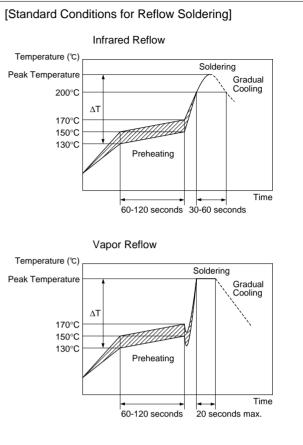
4-1. Overly thick application of solder paste results in a excessive solder fillet height.

This makes the chip more susceptible to mechanical and thermal stress on the board and may cause the chips to crack.

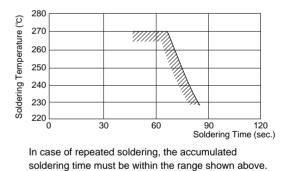
- 4-2. Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.
- 4-3. Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm* min.

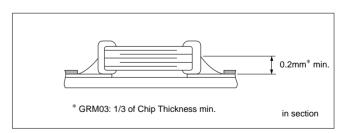
Inverting the PCB

Make sure not to impose any abnormal mechanical shocks to the PCB.



[Allowable Reflow Soldering Temperature and Time]







Caution (Soldering and Mounting)

Continued from the preceding page.

4-2. Flow Soldering

 When sudden heat is applied to the components, the mechanical strength of the components will decrease because a sudden temperature change causes deformation inside the components. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board.

Preheating conditions are shown in table 2. It is required to keep temperature differential between the solder and the components surface (Δ T) as small as possible.

- 2. Excessively long soldering time or high soldering temperature can result 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 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 table 2.
- 4. Do not apply flow soldering to chips not listed in table 2.

Table 2

| Part Number | Temperature Differential |
|-------------|--------------------------|
| GCM18/21/31 | Δ T ≦150°C |

Recommended Conditions

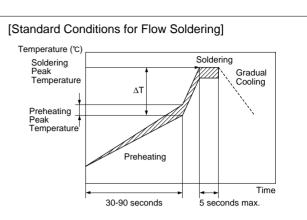
| | Pb-Sn Solder | Lead Free Solder |
|-----------------------------|--------------|------------------|
| Preheating Peak Temperature | 90 to 110°C | 100 to 120°C |
| Soldering Peak Temperature | 240 to 250°C | 250 to 260°C |
| Atmosphere | Air | N2 |

Pb-Sn Solder: Sn-37Pb

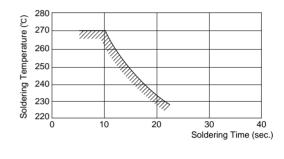
Lead Free Solder: Sn-3.0Ag-0.5Cu

5. Optimum Solder Amount for Flow Soldering

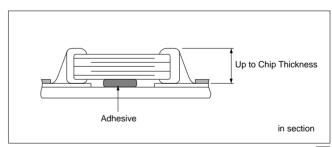
5-1. The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessive, the risk of cracking is higher during board bending or any other stressful condition.



[Allowable Flow Soldering Temperature and Time]



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





☐ ▲ Caution (Soldering and Mounting)

Continued from the preceding page.

4-3. Correction with a Soldering Iron

- 1. When sudden heat is applied to the components when using a soldering iron, the mechanical strength of the components will decrease because the extreme temperature change can cause deformations inside the components. In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board. Preheating conditions, (The "Temperature of the Soldering Iron Tip", "Preheating Temperature", "Temperature Differential" between the iron tip and the components and the PCB), should be within the conditions of table 3. It is required to keep the temperature differential between the soldering iron and the component surfaces (Δ T) as small as possible.
- 2. After soldering, do not allow the component/PCB to rapidly cool down.
- 3. The operating time for the re-working should be as short as possible. When re-working time is too long, it may cause solder leaching, and that will cause a reduction in the adhesive strength of the terminations.
- 4. Optimum Solder amount when re-working with a Soldering Iron
 - 4-1. In case of sizes smaller than 0603, (GCM03/15/18), the top of the solder fillet should be lower than 2/3's of the thickness of the component or 0.5mm whichever is smaller. In case of 0805 and larger sizes, (GCM21/31/32), the top of the solder fillet should be lower than 2/3's of the thickness of the component. If the solder amount is excessive, the risk of cracking is higher during board bending or under any other stressful condition.
 - 4-2. A soldering iron with a tip of ø3mm or smaller should be used. It is also necessary to keep the soldering iron from touching the components during the re-work.
 - 4-3. Solder wire with Ø0.5mm or smaller is required for soldering.

4-4. 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.

5. Washing

Excessive ultrasonic oscillation during cleaning can cause the PCBs to resonate, resulting in cracked chips or broken solder joints. Take note not to vibrate PCBs.

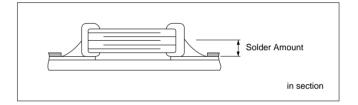
Table 3

| Part Number | Temperature of Soldering Iron Tip | Preheating Temperature | Temperature Differential (∆T) | Atmosphere |
|-------------------|---|---------------------------|-------------------------------------|------------|
| GCM03/15/18/21/31 | 350°C max. | 150°C min. | ∆T≦190°C | Air |
| GCM32 | 280°C max. | 150°C min. | ∆T≦130°C | Air |

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

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu





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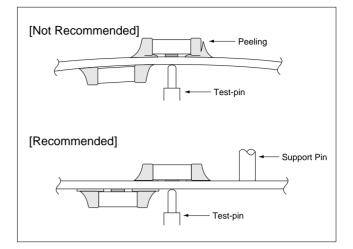
Caution (Soldering and Mounting)

Continued from the preceding page.

- 6. Electrical Test on Printed Circuit Board
- Confirm position of the support pin or specific jig, when inspecting the electrical performance of a capacitor after mounting on the printed circuit board.
 - 1-1. Avoid bending printed circuit board by the pressure of a test pin, etc.The 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.

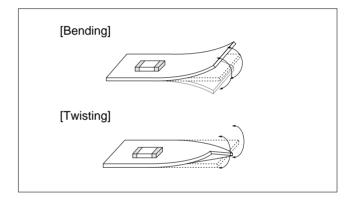
1-2. Avoid vibration of the board by shock when a test pin contacts a printed circuit board.



7. Printed Circuit Board Cropping

- 1. After mounting a capacitor on a printed circuit board, do not apply any stress to the capacitor that is caused by bending or twisting the board.
 - 1-1. In cropping the board, the stress as shown right may cause the capacitor to crack.

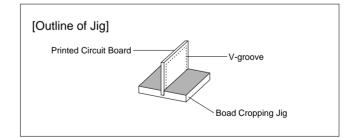
Try not to apply this type of stress to a capacitor.

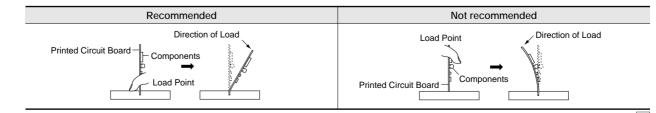


- 2. Check of the cropping method for the printed circuit board in advance.
 - 2-1. Printed circuit board cropping shall be carried out by using a jig or an apparatus to prevent the mechanical stress which can occur to the board.
 - (1) Example of a suitable jig

Recommended example: the board should be pushed as close to the near the cropping jig as possible and from the back side of board in order to minimize the compressive stress applied to capacitor.

Not recommended example* when the board is pushed at a point far from the cropping jig and from the front side of board as below, the capacitor may form a crack caused by the tensile stress applied to capacitor.







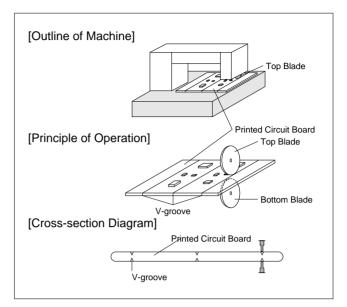
ACaution (Soldering and Mounting)

Continued from the preceding page.

(2) Example of a suitable machine

An outline of a printed circuit board cropping machine is shown as follows. Along the lines with the V-grooves on printed circuit board, the top and bottom blades are aligned to one another when cropping the board.

The misalignment of the position between top and bottom blades may cause the capacitor to crack.



| Recommended | Not Recommended | | | |
|--------------|---|--------------|-------------------------|--|
| Recommended | Top-bottom Misalignment Left-right Misalignment | | Front-rear Misalignment | |
| Top Blade | Top Blade | Top Blade | Top Blade | |
| Bottom Blade | Bottom Blade | Bottom Blade | Bottom Blade | |



Caution (Others)

Others

- 1. Under Operation of Equipment
 - 1-1. Do not touch a capacitor directly with bare hands during operation in order to avoid the danger of a electric shock.
 - 1-2. Do not allow the terminals of a capacitor to come in contact with any conductive objects (short-circuit). Do not expose a capacitor to a conductive liquid, inducing any acid or alkali solutions.
 - 1-3. Confirm the environment in which the equipment will operation is under the specified conditions.Do not use the equipment under the following environment.
 - (1) Being spattered with water or oil.
 - (2) Being exposed to direct sunlight.
 - (3) Being exposed to Ozone, ultraviolet rays or radiation.
 - (4) Being exposed to toxic gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas, etc.)
 - (5) Any vibrations or mechanical shocks exceeding the specified limits.
 - (6) Moisture condensing environments.
 - 1-4. Use damp proof countermeasures if using under any conditions that can cause condensation.
- 2. Others
 - 2-1. In an Emergency
 - If the equipment should generate smoke, fire or smell, immediately turn off or unplug the equipment.

If the equipment is not turned off or unplugged, the hazards may be worsened by supplying continuous power.

- (2) In this type of situation, do not allow face and hands to come in contact with the capacitor or burns may be caused by the capacitors high temperature.
- 2-2. Disposal of Waste

When capacitors are disposed, they must be burned or buried by the industrial waste vender with the appropriate licenses.

2-3. Circuit Design

GRM, GCM, GMA/D, LLL/A/M, ERB, GQM, GJM, GNM Series capacitors in this catalog are not safety certified products.

2-4. Remarks

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

The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions.

Select optimum conditions for operation as they determine the reliability of the product after assembly. The data herein are given in typical values, not guaranteed ratings.



Notice (Rating)

Rating

- 1. Operating Temperature
 - 1. The operating temperature limit depends on the capacitor.
 - 1-1. Do not apply temperatures exceeding the upper operating temperature.
 - It is necessary to select a capacitor with a suitable rated temperature which will cover the operating temperature range.
 - Also it is necessary to consider the temperature distribution in equipment and the seasonal temperature variable factor.
 - 1-2. Consider the self-heating of the capacitor The surface temperature of the capacitor shall be the upper operating temperature or less when including the self-heating factors.
- 2. Atmosphere Surroundings (gaseous and liquid)
- 1. Restriction on the operating environment of capacitors.
 - 1-1. The capacitor, when used in the above, unsuitable, operating environments may deteriorate due to the corrosion of the terminations and the penetration of moisture into the capacitor.

- 1-2. The same phenomenon as the above may occur when the electrodes or terminals of the capacitor are subject to moisture condensation.
- 1-3. The deterioration of characteristics and insulation resistance due to the oxidization or corrosion of terminal electrodes may result in breakdown when the capacitor is exposed to corrosive or volatile gases or solvents for long periods of time.
- 3. Piezo-electric Phenomenon
 - When using high dielectric constant type capacitors in AC or pulse circuits, the capacitor itself vibrates at specific frequencies and noise may be generated. Moreover, when the mechanical vibration or shock is added to capacitor, noise may occur.



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Notice (Soldering and Mounting)

1

■ Soldering and Mounting

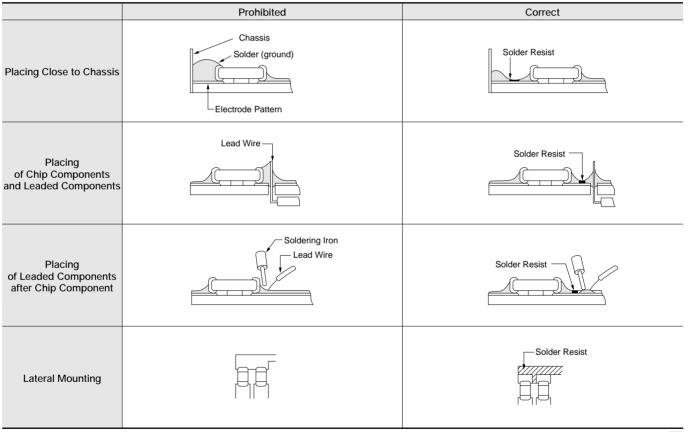
1. PCB Design

- 1. Notice for Pattern Forms
 - 1-1. 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.

1-2. It is possible for the chip to crack by the expansion and shrinkage of a metal board. Please contact us if you want to use our ceramic capacitors on a metal board such as Aluminum.

Pattern Forms



Continued on the following page. \square



Notice (Soldering and Mounting)

Continued from the preceding page.

- 2. Land Dimensions
 - 2-1. Chip capacitor can be cracked due to the stress of PCB bending / etc if the land area is larger than needed and has an excess amount of solder.
 Please refer to the land dimensions in table 1 for flow soldering, table 2 for reflow soldering.
 Please confirm the suitable land dimension by evaluating of the actual SET / PCB.

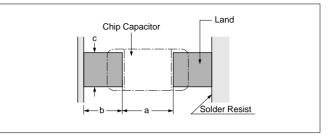


Table 1 Flow Soldering Method

| Dimensions Part Number | Chip (L×W) | а | b | с |
|---------------------------|------------|------------|------------|------------|
| GCM18 | 1.6×0.8 | 0.6 to 1.0 | 0.8 to 0.9 | 0.6 to 0.8 |
| GCM21 | 2.0×1.25 | 1.0 to 1.2 | 0.9 to 1.0 | 0.8 to 1.1 |
| GCM31 | 3.2×1.6 | 2.2 to 2.6 | 1.0 to 1.1 | 1.0 to 1.4 |

Table 2 Reflow Soldering Method

| Dimensions Part Number | Chip (L×W) | а | b | с | |
|---------------------------|------------|------------|--------------|------------|--|
| GCM03 | 0.6×0.3 | 0.2 to 0.3 | 0.2 to 0.35 | 0.2 to 0.4 | |
| GCM15 | 1.0×0.5 | 0.3 to 0.5 | 0.35 to 0.45 | 0.4 to 0.6 | |
| GCM18 | 1.6×0.8 | 0.6 to 0.8 | 0.6 to 0.7 | 0.6 to 0.8 | |
| GCM21 | 2.0×1.25 | 1.0 to 1.2 | 0.6 to 0.7 | 0.8 to 1.1 | |
| GCM31 | 3.2×1.6 | 2.2 to 2.4 | 0.8 to 0.9 | 1.0 to 1.4 | |
| GCM32 | 3.2×2.5 | 2.0 to 2.4 | 1.0 to 1.2 | 1.8 to 2.3 | |

(in mm)

(in mm)

2. Adhesive Application

 Thin or insufficient adhesive can cause the chips to loosen or become disconnected during flow soldering. The amount of adhesive must be more than dimension c, shown in the drawing at right, to obtain the correct bonding strength.

The chip's electrode thickness and land thickness must also be taken into consideration.

- Low viscosity adhesive can cause chips to slip after mounting. The adhesive must have a viscosity of 5000Pa • s (500ps) min. (at 25°C).
- 3. Adhesive Coverage

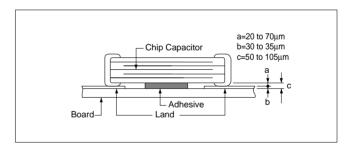
| Part Number | Adhesive Coverage* |
|-------------|--------------------|
| GCM18 | 0.05mg min. |
| GCM21 | 0.1mg min. |
| GCM31 | 0.15mg min. |

*Nominal Value

3. Adhesive Curing

 Insufficient curing of the adhesive can cause chips to disconnect during flow soldering and causes deterioration in the insulation resistance between the outer electrodes due to moisture absorption.

Control curing temperature and time in order to prevent insufficient hardening.





Notice (Soldering and Mounting)

1

Continued from the preceding page.

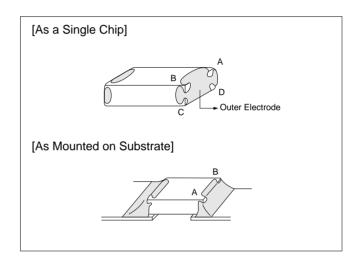
4. Flux Application

- An excessive amount of flux generates a large quantity of flux gas, which can cause a deterioration of Solderability. So apply flux thinly and evenly throughout. (A foaming system is generally used for flow soldering).
- 2. Flux containing too a high percentage of halide may cause corrosion of the outer electrodes unless there is sufficient cleaning. Use flux with a halide content of 0.1% max.

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 right) and 25% of the length A-B shown below as mounted on substrate.

- 3. Do not use strong acidic flux.
- Do not use water-soluble flux.
 (*Water-soluble flux can be defined as non rosin type flux including wash-type flux and non-wash-type flux.)



6. Washing

- 1. Please evaluate a capacitor by actual cleaning equipment and condition surely for confirming the quality and select the applicable solvent.
- 2. Unsuitable cleaning solvent may leave residual flux, other foreign substances, causing deterioration of electrical characteristics and the reliability of the capacitors.

7. Coating

1. A crack may be caused in the capacitor due to the stress of the thermal contraction of the resin during curing process.

The stress is affected by the amount of resin and curing contraction.

Select a resin with small curing contraction.

The difference in the thermal expansion coefficient between a coating resin or a molding resin and capacitor may cause the destruction and deterioration of the capacitor such as a crack or peeling, and lead to the deterioration of insulation resistance or dielectric breakdown.

- 3. Select the proper cleaning conditions.
 - 3-1. Improper cleaning conditions (excessive or insufficient) may result in the deterioration of the performance of the capacitors.

Select a resin for which the thermal expansion coefficient is as close to that of capacitor as possible.

A silicone resin can be used as an under-coating to buffer against the stress.

- Select a resin that is less hygroscopic.
 Using hygroscopic resins under high humidity conditions
 - may cause the deterioration of the insulation resistance of a capacitor.

An epoxy resin can be used as a less hygroscopic resin.



Notice (Others)

1

Others

- 1. Transportation
 - 1. The performance of a capacitor may be affected by the conditions during transportation.
 - 1-1. The capacitors shall be protected against excessive temperature, humidity and mechanical force during transportation.
 - (1) Climatic condition
 - low air temperature: -40°C
 - change of temperature air/air: -25°C/+25°C
 - low air pressure: 30 kPa
 - change of air pressure: 6 kPa/min.
 - (2) Mechanical condition
 - Transportation shall be done in such a way that the boxes are not deformed and forces are not directly passed on to the inner packaging.

- 1-2. Do not apply excessive vibration, shock, and pressure to the capacitor.
 - When excessive mechanical shock or pressure is applied to a capacitor, chipping or cracking may occur in the ceramic body of the capacitor.
 - (2) When a sharp edge of an air driver, a soldering iron, tweezers, a chassis, etc. impacts strongly on the surface of capacitor, the capacitor may crack and short-circuit.
- 1-3. Do not use a capacitor to which excessive shock was applied by dropping, etc. The capacitor dropped accidentally during processing may be damaged.



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• This PDF catalog is downloaded from the website of Murata Manufacturing co., Itd. Therefore, it's specifications are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications.

Chip Monolithic Ceramic Capacitors for Automotive

muRata

Medium Voltage for Automotive GCM Series Low Dissipation Factor

Capacitance

Features

- 1. The GCM series meet AEC-Q200 requirements.
- 2. Low-loss and suitable for high frequency circuits
- 3. Murata's original internal electrode structure realizes high flash-over voltage.
- 4. A new monolithic structure for small, surfacemountable devices capable of operating at high voltage levels.
- 5. Sn-plated external electrodes realize good solderability.
- 6. Use the GCM21/31 type with flow or reflow soldering, and other types with reflow soldering only.

Rated Voltage

TC Code

Applications

Ideal for use on high frequency pulse circuits such as snubber circuits for DC-DC converters.



Length L Width W Thickness T

| - | | | L | w | |
|-------------|------------------|-----------|--------------|--------|--------|
| Part Number | | Dim | ensions (mm |) | |
| Fait Number | L | W | Т | e min. | g min. |
| GCM21A | 20402 | 1.25 ±0.2 | 1.0 +0,-0.3 | | 0.7 |
| GCM21B | 2.0 ±0.2 | | 1.25 ±0.2 | | |
| GCM31A | 3.2 +0.2 | 1.6 ±0.2 | 1.0 +0,-0.3 | 0.3 | |
| GCM31B | J.∠ <u>1</u> 0.∠ | 1.0 ±0.2 | 1.25 +0,-0.3 | | |
| GCM32A | 3.2 ±0.2 | 2.5 ±0.2 | 1.0 +0,-0.3 | | |

Electrode g

Electrode e

| Part Number | (V) | (Standard) | (pF) | (mm) | (mm) | (mm) | min. (mm) | (mm) |
|--------------------|-------|--------------|---|------|------|---------|--------------|----------|
| GCM21A7U2E101JX01D | DC250 | U2J (EIA) | 100 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E121JX01D | DC250 | U2J (EIA) | 120 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E151JX01D | DC250 | U2J (EIA) | 150 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E181JX01D | DC250 | U2J (EIA) | 180 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E221JX01D | DC250 | U2J (EIA) | 220 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E271JX01D | DC250 | U2J (EIA) | 270 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E331JX01D | DC250 | U2J (EIA) | 330 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E391JX01D | DC250 | U2J (EIA) | 390 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E471JX01D | DC250 | U2J (EIA) | 470 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E561JX01D | DC250 | U2J (EIA) | 560 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E681JX01D | DC250 | U2J (EIA) | 680 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E821JX01D | DC250 | U2J (EIA) | 820 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E102JX01D | DC250 | U2J (EIA) | 1000 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E122JX01D | DC250 | U2J (EIA) | 1200 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E152JX01D | DC250 | U2J (EIA) | 1500 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E182JX01D | DC250 | U2J (EIA) | 1800 ±5% | 2.0 | 1.25 | 1.0 | 0.7 | 0.3 min. |
| GCM21A7U2E222JX01D | DC250 | 50 U2J (EIA) | 2200 ±5% 2.0 2700 ±5% 2.0 | 2.0 | | 1.0 | 0.7 | 0.3 min. |
| GCM21B7U2E272JX03L | DC250 | U2J (EIA) | | 2.0 | | 0.7 | 0.3 min. | |
| GCM31A7U2E272JX01D | DC250 | 0 U2J (EIA) | 2700 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM21B7U2E332JX03L | DC250 | U2J (EIA) | 3300 ±5% | 2.0 | 1.25 | 1.25 | 0.7 | 0.3 min. |
| GCM31A7U2E332JX01D | DC250 | U2J (EIA) | 3300 ±5% | 3.2 | 1.6 | 1.6 1.0 | 1.5 | 0.3 min. |
| GCM21B7U2E392JX03L | DC250 | U2J (EIA) | 3900 ±5% | 2.0 | 1.25 | 1.25 | 0.7 | 0.3 min. |
| GCM31A7U2E392JX01D | DC250 | U2J (EIA) | 3900 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM21B7U2E472JX03L | DC250 | U2J (EIA) | 4700 ±5% | 2.0 | 1.25 | 1.25 | 0.7 | 0.3 min. |
| GCM31A7U2E472JX01D | DC250 | U2J (EIA) | 4700 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM21B7U2E562JX03L | DC250 | U2J (EIA) | 5600 ±5% | 2.0 | 1.25 | 1.25 | 0.7 | 0.3 min. |
| GCM31A7U2E562JX01D | DC250 | U2J (EIA) | 5600 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31B7U2E682JX01L | DC250 | U2J (EIA) | 6800 ±5% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| GCM31B7U2E822JX01L | DC250 | U2J (EIA) | 8200 ±5% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| GCM31B7U2E103JX01L | DC250 | U2J (EIA) | 10000 ±5% | 3.2 | 1.6 | 1.25 | 1.5 | 0.3 min. |
| GCM31A7U2J100JX01D | DC630 | U2J (EIA) | 10 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J120JX01D | DC630 | U2J (EIA) | 12 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J150JX01D | DC630 | U2J (EIA) | 15 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |



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Continued from the preceding page.

| Part Number | Rated Voltage (V) | TC Code (Standard) | Capacitance (pF) | Length L (mm) | Width W (mm) | Thickness T (mm) | Electrode g min. (mm) | Electrode e (mm) |
|--------------------|----------------------|-----------------------|---------------------|------------------|-----------------|---------------------|-----------------------------|---------------------|
| GCM31A7U2J180JX01D | DC630 | U2J (EIA) | 18 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J220JX01D | DC630 | U2J (EIA) | 22 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J270JX01D | DC630 | U2J (EIA) | 27 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J330JX01D | DC630 | U2J (EIA) | 33 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J390JX01D | DC630 | U2J (EIA) | 39 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J470JX01D | DC630 | U2J (EIA) | 47 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J560JX01D | DC630 | U2J (EIA) | 56 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J680JX01D | DC630 | U2J (EIA) | 68 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J820JX01D | DC630 | U2J (EIA) | 82 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J101JX01D | DC630 | U2J (EIA) | 100 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J121JX01D | DC630 | U2J (EIA) | 120 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J151JX01D | DC630 | U2J (EIA) | 150 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J181JX01D | DC630 | U2J (EIA) | 180 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J221JX01D | DC630 | U2J (EIA) | 220 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J271JX01D | DC630 | U2J (EIA) | 270 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J331JX01D | DC630 | U2J (EIA) | 330 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J391JX01D | DC630 | U2J (EIA) | 390 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J471JX01D | DC630 | U2J (EIA) | 470 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J561JX01D | DC630 | U2J (EIA) | 560 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J681JX01D | DC630 | U2J (EIA) | 680 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J821JX01D | DC630 | U2J (EIA) | 820 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM31A7U2J102JX01D | DC630 | U2J (EIA) | 1000 ±5% | 3.2 | 1.6 | 1.0 | 1.5 | 0.3 min. |
| GCM32A7U2J122JX01D | DC630 | U2J (EIA) | 1200 ±5% | 3.2 | 2.5 | 1.0 | 1.5 | 0.3 min. |
| GCM32A7U2J152JX01D | DC630 | U2J (EIA) | 1500 ±5% | 3.2 | 2.5 | 1.0 | 1.5 | 0.3 min. |
| GCM32A7U2J182JX01D | DC630 | U2J (EIA) | 1800 ±5% | 3.2 | 2.5 | 1.0 | 1.5 | 0.3 min. |
| GCM32A7U2J222JX01D | DC630 | U2J (EIA) | 2200 ±5% | 3.2 | 2.5 | 1.0 | 1.5 | 0.3 min. |



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2

Specifications and Test Methods

| No. | AEC-C Test I | | Specifications | AE | C-Q200 Test Method | |
|-----|-----------------------------|-----------------------|---|--|--|--|
| 1 | Pre-and Po Electrical To | | | _ | | |
| | High Temp Exposure | | The measured and observed characteristics should satisfy the specifications in the following table. | | | |
| | | Appearance | No marking defects | | | |
| 2 | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | Sit the capacitor for 10 hours at room tempera | 100 ± 12 hours at $150\pm3^{\circ}$ C. Let sit for 24 ± 2 ature, then measure. | |
| | | Q | Q≧1000 | _ | | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega\cdot\mu F$ (Whichever is smaller) | | | |
| | Temperatu Cycle | ıre | The measured and observed characteristics should satisfy the specifications in the following table. | Fix the capacitor to the | e supporting jig in the same manner and | |
| | _ | Appearance | No marking defects | | tions as (19). Perform the 1000 cycles tt reatments listed in the following table. | |
| 3 | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | , ° | at room temperature, then measure. | |
| | _ | Q | Q≧1000 | Temp. (°C) -55+0/- | 3 Room Temp. 125+3/-0 Room Temp. | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega \cdot \mu F$ (Whichever is smaller) | Time (min.) 15±3 | 1 15±3 1 | |
| 4 | Destructiv Physical A | | No defects or abnormalities | Per EIA-469 | | |
| | Moisture Resistance | е | The measured and observed characteristics should satisfy the specifications in the following table. | treatment shown below | t (25 to 65°C) and humidity (80 to 98%) w, 10 consecutive times. | |
| | | Appearance | No marking defects | Let sit for 24±2 hours a | at room temperature, then measure. | |
| | | Capacitance Change | Within ±3.0% or ±0.3pF (Whichever is larger) | | umidity Humidity Humidity Humidity 0-98% 80-98% 90-98% 80-98% 90-98% 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | |
| | | Q | Q≧350 | | /++++/++/+++++++ | |
| 5 | | I.R. | More than 10,000M Ω or 500M $\Omega \cdot \mu F$ (Whichever is smaller) | 45 97 98 98 92 15 10 10 10 10 10 10 10 10 10 10 | | |
| | Biased Hu | midity | The measured and observed characteristics should satisfy the specifications in the following table. | | | |
| | | Appearance | No marking defects | | e and DC1.3+0.2/-0V (add 6.8k Ω | |
| 6 | | Capacitance Change | Within ±3.0% or ±0.3pF (Whichever is larger) | | d 80 to 85% humidity for 1000±12 hours. 24±2 hours at room temperature, then | |
| | _ | Q | Q≥200 | The charge/discharge | current is less than 50mA. | |
| | | I.R. | More than 1,000M Ω or 50M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | | | |
| | Operation | al Life | The measured and observed characteristics should satisfy the specifications in the following table. | Apply voltage as Table | e for 1000±12 hours at 125±3°C. Let sit | |
| | | Appearance | No marking defects | | n temperature, then measure. | |
| 7 | | Capacitance Change | Within ±3.0% or ±0.3pF (Whichever is larger) | Rated Voltage DC250V | Applied Voltage 150% of the rated voltage | |
| | | Q | Q≧350 | DC630V 120% of the rated voltage The charge/discharge current is less than 50mA. | | |
| | | I.R. | More than 1,000M Ω or 50M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | | | |
| 8 | External V | isual | No defects or abnormalities | Visual inspection | | |
| 9 | Physical D | imension | Within the specified dimensions | Using calipers and mic | crometers | |



Specifications and Test Methods

Continued from the preceding page

| No. | | | Specifications | AEC-Q200 Test Method | | | |
|-----|---------------------------|--|---|---|--|--|--|
| | Test | Item Appearance | No marking defects | Per MIL-STD-202 Method 215 | | | |
| | Resistance to Solvents | Capacitance Change | Within the specified tolerance | Solvent 1: 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits | | | |
| 10 | | Q | Q≥1000 | Solvent 2: Terpene defluxer Solvent 3: 42 parts (by volume) of water | | | |
| | | I.R. | More than 10,000M\Omega or 500M\Omega $\cdot\mu\text{F}$ (Whichever is smaller) | 1 part (by volume) of propylene glycol monomethyl ether 1 part (by volume) of monoethanolomine | | | |
| | | Appearance | No marking defects | | | | |
| 11 | Mechanical | Capacitance Change | Within the specified tolerance | Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks). | | | |
| | Shock | Q | Q≥1000 | The specified test pulse should be Half-sine and should have a - duration: 0.5ms, peak value: 1500g and velocity change: 4.7m/s. | | | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | duralion. c.onio, pour value. rooog and velocity onalige. 4.717. | | | |
| | | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board) in the | | | |
| | | Capacitance Change | Within the specified tolerance | same manner and under the same conditions as (19). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied | | | |
| 12 | Vibration | Q | Q≥1000 | uniformly between the approximate limits of 10 and 2000Hz. The | | | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | frequency range, from 10 to 2000Hz and return to 10Hz, should be traversed in approximately 20 minutes. This motion should be applied for 12 items in each 3 mutually perpendicular directions (total of 36 times). | | | |
| | | | The measured and observed characteristics should satisfy the specifications in the following table. | | | | |
| | | Appearance | No marking defects | Immoreo the expectator in a suitestic colder solution at 2001 500 for | | | |
| 13 | Capacitance Change | | Within the specified tolerance | Immerse the capacitor in a eutectic solder solution at 260±5°C for 10±1 seconds. Let sit at room temperature for 24±2 hours, then measure. | | | |
| | | Q | | Q≥1000 | | | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | | | | |
| | Thermal S | Shock | 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 (19). Perform the 300 cycles | | | |
| | | Appearance | No marking defects | according to the two heat treatments listed in the following table (Maximum transfer time is 20 seconds). Let sit for 24±2 hours at room temperature, then measure. | | | |
| 14 | | Capacitance Change | Within ±2.5% or ±0.25pF (Whichever is larger) | | | | |
| | | Q | Q≥1000 | Step 1 2 Temp. (°C) -55+0/-3 125+3/-0 | | | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | Time (min.) 15±3 15±3 | | | |
| | | Appearance | No marking defects | | | | |
| 15 | FSD | Capacitance Change | Within the specified tolerance | – – Per AEC-Q200-002 | | | |
| | LUD | Q | Q≧1000 | | | | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | | | | |
| | | | | (a) Preheat at 155°C for 4 hours. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 5+0/-0.5 seconds at 235±5°C. | | | |
| 16 | 6 Solderabi | Iderability 95% of the terminations is to be soldered evenly and continuously. | | (b) Should be placed into steam aging for 8 hours±15 minutes. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 5+0/-0.5 seconds at 235±5°C. | | | |
| | | | | (c) Should be placed into steam aging for 8 hours±15 minutes. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 120 ±5 seconds at 260±5°C. | | | |



2

Specifications and Test Methods

 $\fbox{}$ Continued from the preceding page.

| | | - | | | | | | | | | | |
|----------|--|------------------------|--|---|--|--|--|--|--|--|--|---|
| lo. | | | Specifications | AEC-Q200 Test Method | | | | | | | | |
| | | Appearance | No defects or abnormalities | Visual inspection. | | | | | | | | |
| | | Capacitance Change | Within the specified tolerance | The capacitance/Q should be measured at 25°C at the frequency and voltage shown in the table. | | | | | | | | |
| | Electrical Characteri- zation Board Flex | Q | Q≥1000 | Capacitance Frequency Voltage C<1000pF | | | | | | | | |
| 17 Chara | racteri- | I.R. | 25°C More than 100,000MΩ or 1,000MΩ \cdot μF (Whichever is smaller) Max. Operating Temperature125°C More than 10,000MΩ or 100MΩ \cdot μF (Whichever is smaller) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 125°C and within 2 minutes of charging. | | | | | | | | |
| | ectrical laracteri- tion I. E S A C C C S A C C C C C C C C C C C C C | Dielectric Strength | No failure | No failure should be observed when voltage in Table is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. Rated Voltage Test Voltage DC250V 200% of the rated voltage DC630V 150% of the rated voltage | | | | | | | | |
| | | Appearance | No marking defects | Solder the capacitor on the test jig (glass epoxy board) shown in | | | | | | | | |
| | | Capacitance Change | Within ±5.0% or ±0.5pF (Whichever is larger) | Fig. 1 using a eutectic solder. Then apply a force in the direction shown in Fig. 2 for 5 ± 1 seconds. The soldering should be done by the reflow method and should be conducted with care so that | | | | | | | | |
| 18 | | | t: 1.6mm Fig. 1 | $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | | | | | | | | |
| | | Appearance | No marking defects | Solder the capacitor to the test jig (glass epoxy board) shown in | | | | | | | | |
| | | Capacitance Change | Within the specified tolerance | Fig. 3 using a eutectic solder. Then apply 18N force in parallel with the test jig for 60 seconds. | | | | | | | | |
| | - | Q | Q≧1000 | The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free | | | | | | | | |
| | | | | | | | | | | | | of defects such as heat shock. Type a b c GCM21 1.2 4.0 1.65 GCM31 2.2 5.0 2.0 GCM32 2.2 5.0 2.9 (in mm) |
| | | I.R. | More than 10,000M Ω or 500M Ω · μ F (Whichever is smaller) | Solder resist Baked electrode or copper foil Fig. 3 | | | | | | | | |
| | | | | 1 I I I I I I I I I I I I I I I I I I I | | | | | | | | |



Specifications and Test Methods

Continued from the preceding page.

2

| No. | AEC-0 Test | | Specifications | Apply a force. < Chip L dimension: 2.5mm max. > | | | |
|-----|----------------------------|---|---|---|---|--|--|
| 20 | Beam Loa | ad Test | The chip endure following force. < Chip L dimension: 2.5mm max. > Chip thickness > 0.5mm rank: 20N Chip thickness ≤ 0.5mm rank: 8N < Chip L dimension: 3.2mm min. > Chip thickness < 1.25mm rank: 15N Chip thickness ≥ 1.25mm rank: 54.5N | < Chip L dimension: 3.2mm min. > | | | |
| 21 | Capacitance Temperature | Capacitance Change pacitance nperature | citance erature change -750±120, -347 ppm/°C (Temp. Range: -55 to +25°C) | | temperature sequentially from step1 through 5 the capacitance should be within the specified tolerance for the temperature coefficient. The capacitance drift is calculated by dividing the differences between the maximum and minimum measured | | |
| | istics | racter- | | values in steps 1, 3 and 5 by the capacitance value in step 3. Step Temperature (°C) 1 25±2 2 -55±3 3 25±2 4 125±3 5 25±2 | | | |

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Chip Monolithic Ceramic Capacitors for Automotive

muRata

Medium Voltage for Automotive GCJ Series Soft Termination Type

Features

- 1. The GCJ series meet AEC-Q200 requirements.
- 2. Improve the endurance against Board Bending Stress.
- 3. Reduce the board bending stress by the conductive polymer termination.
- 4. Use the GCJ31 type with flow or reflow soldering, and other types with reflow soldering only.

Applications

Automotive electronic equipment (Power-train, safety equipment)



| | \checkmark | | | | | |
|-------------|--------------|----------|--------------|----------|--------|--|
| Part Number | | Dir | nensions (mm | l) | | |
| Part Number | L | W | Т | е | g min. | |
| GCJ31B | 3.2 ±0.2 | 1 (10 0 | 1.25 +0,-0.3 | | 1.2 | |
| GCJ31C | 3.2 ±0.2 | 1.6 ±0.2 | 1.6 ±0.2 | | | |
| GCJ32Q | 3.2 ±0.3 | 25102 | 1.5 +0,-0.3 | | | |
| GCJ32D | 3.2 ±0.3 | 2.5 ±0.2 | 2.0 +0,-0.3 | 0.3 min. | 1 | |
| GCJ43Q | 4.5 ±0.4 | 3.2 ±0.3 | 1.5 +0,-0.3 | | 2.2 | |
| GCJ43D | 4.3 ±0.4 | 3.2 ±0.3 | 2.0 +0,-0.3 | | 2.2 | |
| GCJ55D | 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) |
|--------------------|----------------------|-----------------------|--------------|------------------|-----------------|---------------------|-----------------------------|---------------------|
| GCJ31BR72E153KXJ1L | DC250 | X7R (EIA) | 15000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GCJ31BR72E223KXJ1L | DC250 | X7R (EIA) | 22000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GCJ31CR72E333KXJ3L | DC250 | X7R (EIA) | 33000pF ±10% | 3.2 | 1.6 | 1.6 | 1.2 | 0.3 min. |
| GCJ31CR72E473KXJ3L | DC250 | X7R (EIA) | 47000pF ±10% | 3.2 | 1.6 | 1.6 | 1.2 | 0.3 min. |
| GCJ32QR72E683KXJ1L | DC250 | X7R (EIA) | 68000pF ±10% | 3.2 | 2.5 | 1.5 | 1.2 | 0.3 min. |
| GCJ32DR72E104KXJ1L | DC250 | X7R (EIA) | 0.10μF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| GCJ43QR72E154KXJ1L | DC250 | X7R (EIA) | 0.15μF ±10% | 4.5 | 3.2 | 1.5 | 2.2 | 0.3 min. |
| GCJ43DR72E224KXJ1L | DC250 | X7R (EIA) | 0.22µF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| GCJ55DR72E334KXJ1L | DC250 | X7R (EIA) | 0.33µF ±10% | • | 5.0 | 2.0 | 3.2 | 0.3 min. |
| GCJ55DR72E474KXJ1L | DC250 | X7R (EIA) | 0.47µF ±10% | | 2.0 | 3.2 | 0.3 min. | |
| GCJ31BR72J102KXJ1L | DC630 | X7R (EIA) | 1000pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GCJ31BR72J152KXJ1L | DC630 | X7R (EIA) | 1500pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GCJ31BR72J222KXJ1L | DC630 | X7R (EIA) | 2200pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GCJ31BR72J332KXJ1L | DC630 | X7R (EIA) | 3300pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GCJ31BR72J472KXJ1L | DC630 | X7R (EIA) | 4700pF ±10% | 3.2 | 1.6 | 1.25 | 1.2 | 0.3 min. |
| GCJ32QR72J682KXJ1L | DC630 | X7R (EIA) | 6800pF ±10% | 3.2 | 2.5 | 1.5 | 1.2 | 0.3 min. |
| GCJ32QR72J103KXJ1L | DC630 | X7R (EIA) | 10000pF ±10% | 3.2 | 2.5 | 1.5 | 1.2 | 0.3 min. |
| GCJ32DR72J153KXJ1L | DC630 | X7R (EIA) | 15000pF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| GCJ32DR72J223KXJ1L | DC630 | X7R (EIA) | 22000pF ±10% | 3.2 | 2.5 | 2.0 | 1.2 | 0.3 min. |
| GCJ43DR72J333KXJ1L | DC630 | X7R (EIA) | 33000pF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| GCJ43DR72J473KXJ1L | DC630 | X7R (EIA) | 47000pF ±10% | 4.5 | 3.2 | 2.0 | 2.2 | 0.3 min. |
| GCJ55DR72J104KXJ1L | DC630 | X7R (EIA) | 0.10μF ±10% | 5.7 | 5.0 | 2.0 | 3.2 | 0.3 min. |

Specifications and Test Methods

| No. | o. AEC-Q200 Test Item | | Specifications | AEC-Q200 Test Method | |
|-----|----------------------------|-----------------------|---|---|--|
| 1 | Pre-and Po Electrical T | | | _ | |
| | High Tem Exposure | | The measured and observed characteristics should satisfy the specifications in the following table. | | |
| | | Appearance | No marking defects | | |
| 2 | | Capacitance Change | Within ±10% | Sit the capacitor for 1000±12 hours at 150±3°C. Let sit for 24±2 hours at room temperature, then measure. | |
| | | D.F. | 0.05 max. | | |
| | | I.R. | More than 10,000M Ω or 100M $\Omega\cdot\mu F$ (Whichever is smaller) | | |
| | Temperat Cycle | ure | 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 (19). Perform the 1000 cycles | |
| | | Appearance | No marking defects | according to the 4 heat treatments listed in the following table. Let sit for 24 ± 2 hours at room temperature, then measure. | |
| 3 | | Capacitance Change | Within ±10% | Step 1 2 3 4 Temp. (°C) -55+0/-3 Room Temp. 125+3/-0 Room Temp. | |
| | | D.F. | 0.05 max. | Time (min.) 15±3 1 15±3 1 | |
| | | I.R. | More than 10,000M Ω or 100M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | Pretreatment Perform the heat treatment at 150+0/-10°C for 60±5 minutes and then let sit for 24±2 hours at room temperature. | |
| 4 | Destructiv Physical A | | No defects or abnormalities | Per EIA-469 | |
| | Moisture Resistanc | e | The measured and observed characteristics should satisfy the specifications in the following table. | Apply the 24 hour heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times. | |
| | - | Appearance | No marking defects | Let sit for 24±2 hours at room temperature, then measure. | |
| | | Capacitance Change | Within ±12.5% | Humidity Humidity | |
| | | D.F. | 0.05 max. | | |
| 5 | | I.R. | More than 10,000M Ω or 100M $\Omega\cdot\mu F$ (Whichever is smaller) | 45 45 45 45 45 45 45 45 45 45 | |
| | Biased Hu | umidity | The measured and observed characteristics should satisfy the specifications in the following table. | Apply the rated voltage and DC1.3+0.2/-0V (add $6.8k\Omega$ | |
| | | Appearance | No marking defects | resistor) at 85±3°C and 80 to 85% humidity for 1000±12 hours. Remove and let sit for 24±2 hours at room temperature, then | |
| 6 | | Capacitance Change | Within ±12.5% | measure. The charge/discharge current is less than 50mA. | |
| | | D.F. | 0.05 max. | •Pretreatment Perform the heat treatment at 150+0/-10°C for 60±5 minutes | |
| | | I.R. | More than 1,000M Ω or 10M $\Omega \cdot \mu F$ (Whichever is smaller) | and then let sit for 24±2 hours at room temperature. | |
| | Operational Life | | The measured and observed characteristics should satisfy the specifications in the following table. | Apply voltage in Table for 1000±12 hours at 125±3°C. Let sit for 24±2 hours at room temperature, then measure. | |
| | | Appearance | No marking defects | The charge/discharge current is less than 50mA. | |
| 7 | | Capacitance Change | Within ±12.5% | Rated Voltage Applied Voltage DC250V 150% of the rated voltage DC630V 120% of the rated voltage | |
| | | D.F. | 0.05 max. | •Pretreatment | |
| | I.R. | | More than 1,000M Ω or $10M\Omega\cdot\mu F$ (Whichever is smaller) | Apply test voltage for 60±5 minutes at test temperature. Remove and let sit for 24±2 hours at room temperature. | |
| 8 | External V | /isual | No defects or abnormalities | Visual inspection | |
| 9 | Physical D | imension | Within the specified dimensions | Using calipers and micrometers | |



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Specifications and Test Methods

Continued from the preceding page.

| No. | | Q200 Item | Specifications | AEC-Q200 Test Method | | | |
|-----|------------------------|--|---|--|--|--|--|
| | | Appearance | No marking defects | Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol | | | |
| 10 | Resistance | Capacitance Change | Within the specified tolerance | 3 parts (by volume) of mineral spirits Solvent 2: Terpene defluxer | | | |
| 10 | to Solvents | D.F. | 0.025 max. | Solvent 3: 42 parts (by volume) of water | | | |
| | | I.R. | More than 10,000M Ω or 100M $\Omega\cdot\mu F$ (Whichever is smaller) | 1 part (by volume) of propylene glycol monomethyl ether 1 part (by volume) of monoethanolomine | | | |
| | | Appearance | No marking defects | | | | |
| 11 | Mechanical | Capacitance Change | Within the specified tolerance | Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks). | | | |
| ••• | Shock | D.F. | 0.025 max. | The specified test pulse should be Half-sine and should have a duration: 0.5ms, peak value: 1500g and velocity change: 4.7m/s | | | |
| | | I.R. | More than 10,000M Ω or 500M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | dutation. c.ons, peak value. roong and velocity onlange. 4. miles | | | |
| | | Appearance | No defects or abnormalities | Solder the capacitor to the test jig (glass epoxy board) in the | | | |
| | | Capacitance Change | Within the specified tolerance | same manner and under the same conditions as (19). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied | | | |
| 12 | Vibration | D.F. | 0.025 max. | uniformly between the approximate limits of 10 and 2000Hz. The | | | |
| | | I.R. | More than 10,000M\Omega or 500M $\Omega \cdot \mu F$ (Whichever is smaller) | frequency range, from 10 to 2000Hz and return to 10Hz, should be traversed in approximately 20 minutes. This motion should be applied for 12 items in each 3 mutually perpendicular directions (total of 36 times). | | | |
| | Resistand Soldering | | The measured and observed characteristics should satisfy the specifications in the following table. | | | | |
| 13 | | Appearance | No marking defects | Immerse the capacitor in a eutectic solder solution at $260\pm5^{\circ}$ 10±1 seconds. Let sit at room temperature for 24±2 hours, | | | |
| | | Capacitance Change | Within ±10% | ePretreatment | | | |
| | | D.F. | 0.025 max. | Perform the heat treatment at $150+0/-10^{\circ}C$ for 60 ± 5 minu and then let sit for 24 ± 2 hours at room temperature. | | | |
| | | I.R. | More than 10,000M Ω or 100M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | | | | |
| | Thermal Shock | | 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 (19). Perform the 300 cycles | | | |
| | | Appearance | No marking defects | according to the two heat treatments listed in the following table (Maximum transfer time is 20 seconds). Let sit for 24±2 hours a | | | |
| 14 | | Capacitance Change | Within ±10% | room temperature, then measure. Step 1 2 | | | |
| | | D.F. | 0.025 max. | Temp. (°C) -55+0/-3 125+3/-0 Time (min.) 15±3 15±3 | | | |
| | | I.R. | More than 10,000M Ω or 100M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | Pretreatment Perform the heat treatment at 150+0/-10°C for 60±5 minutes and then let sit for 24±2 hours at room temperature. | | | |
| | | Appearance | No marking defects | | | | |
| | 505 | Capacitance Change | Within the specified tolerance | | | | |
| 15 | ESD | D.F. | 0.025 max. | – Per AEC-Q200-002 | | | |
| | | I.R. | More than 10,000M Ω or 100M $\Omega\cdot\mu\text{F}$ (Whichever is smaller) | | | | |
| | | | | (a) Preheat at 155°C for 4 hours. After preheating, immerse th capacitor in a solution of ethanol (JIS-K-8101) and rosin (JI K-5902) (25% rosin in weight proportion). Immerse in eutec solder solution for 5+0/-0.5 seconds at 235±5°C. | | | |
| 16 | Solderabi | solderability 95% of the terminations is to be soldered evenly and continuously. | | (b) Should be placed into steam aging for 8 hours±15 minutes. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 5+0/-0.5 seconds at 235±5°C. (c) Should be placed into steam aging for 8 hours±15 minutes. After preheating, immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Immerse in eutectic solder solution for 120 ±5 seconds at 260±5°C. | | | |
| | | | | | | | |



Specifications and Test Methods

Continued from the preceding page.

| No. | | ·Q200 Item | Specifications | AEC-Q200 Test Method | |
|-----|-------------------------------------|------------------------|---|---|---|
| | | Appearance | No defects or abnormalities | Visual inspection. | |
| | | Capacitance Change | Within the specified tolerance | The capacitance/Q should be measured at 25°C at the frequency and voltage shown in the table. | |
| | | D.F. | 0.025 max. | Capacitance Frequency Voltage C<1000pF | |
| 17 | Electrical Characteri- zation | I.R. | 25°C More than 10,000MΩ or 100MΩ \cdot μF (Whichever is smaller) Max. Operating Temperature125°C More than 1,000MΩ or 10MΩ \cdot μF (Whichever is smaller) | The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 125°C and within 2 minutes of charging. | |
| | | Dielectric Strength | No failure | No failure should be observed when voltage in Table is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA. Rated Voltage Test Voltage DC250V 200% of the rated voltage DC630V 150% of the rated voltage | |
| | | Appearance | No marking defects | Solder the capacitor on the test jig (glass epoxy board) shown in | |
| | | Capacitance Change | Within ±12.5% | Fig. 1 using a eutectic solder. Then apply a force in the direction shown in Fig. 2 for 5±1 seconds. The soldering should be done by the reflow method and should be conducted with care so that | |
| 18 | Board Flex | d | | t 1.6mm Fig. 1 | the soldering is uniform and free of defects such as heat shock. $\begin{array}{r rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$ |
| | | Appearance | No marking defects | Solder the capacitor to the test jig (glass epoxy board) shown in | |
| | | Capacitance Change | Within the specified tolerance | Fig. 3 using a eutectic solder. Then apply 18N force in parallel with the test jig for 60 seconds. The soldering should be done by the reflow method and should | |
| | | D.F. | 0.025 max. | be conducted with care so that the soldering is uniform and free of defects such as heat shock. | |
| 19 | Terminal Strength | | | Type a b c GCJ31 2.2 5.0 2.0 GCJ32 2.2 5.0 2.9 GCJ43 3.5 7.0 3.7 GCJ55 4.5 8.0 5.6 | |
| ., | | I.R. | More than 10,000M Ω or 100M $\Omega \cdot \mu F$ (Whichever is smaller) | (in mm) | |



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 10.5.20

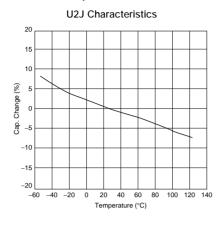
Specifications and Test Methods

| No. | AEC- Test | | Specifications | AEC-Q200 Test Method | | | | | | | |
|-----|---|--------|---|--|--|------------------|---|-------|--|--|--|
| 20 | 0 Beam Load Test The chip endure following force. Chip thickness < 1.25mm rank: 15N Chip thickness ≧ 1.25mm rank: 54.5N | | ad Test Chip thickness < 1.25mm rank: 15N | | Place the capacitor in the beam load fixture as Fig. 4. Apply a force. | | | | | | |
| | | | Speed supplied the Stress Load: 2.5mm / s | | | | | | | | |
| | | | | The capacitance change should be measured after 5 minutes at each specified temperature stage. | | | | | | | |
| | | | | | Step | Temperature (°C) | | | | | |
| | | | | 1 | 25±2 | | | | | | |
| | | | Canacitance | | | | 2 | -55±3 | | | |
| | Capacitance | | | | | | | | | | |
| | Temperature | | | | 4 | 125±3 | | | | | |
| 21 | Character- | Change | Within ±15% | 5 | 25±2 | | | | | | |
| | istics | change | | 25°C value should be •Pretreatn Perform t and then | s of capacitance change compared with the above e over the temperature ranges shown in the table within the specified ranges. nent he heat treatment at 150+0/-10°C for 60±5 minutes let sit for 24±2 hours at room temperature. he initial measurement. | | | | | | |

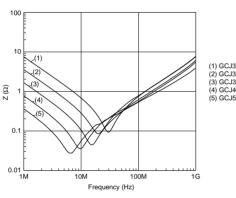
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Medium Voltage Data (Typical Example)

■ Capacitance - Temperature Characteristics

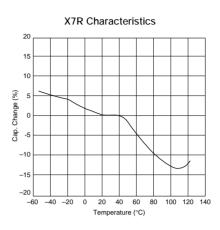


■ Impedance - Frequency Characteristics

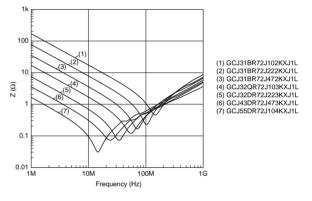


X7R Characteristics DC250V

(1) GCJ31BR72E223KXJ1L (2) GCJ31CR72E473KXJ3L (3) GCJ32DR72E104KXJ1L (4) GCJ43DR72E224KXJ1L (5) GCJ55DR72E474KXJ1L



X7R Characteristics DC630V



Package

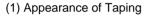
Taping is standard packaging method.

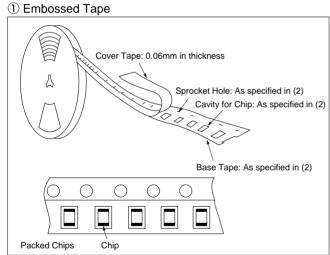
Minimum Quantity Guide

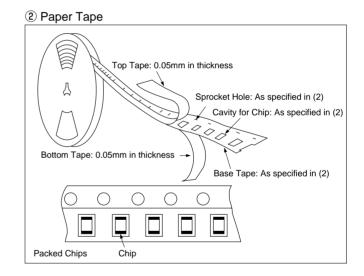
| | | Dimensions (mm) | | | Quantity (pcs.) | | |
|----------------|-------------|-----------------|------|------|-----------------|---------------|--|
| Part Number | | Dimensions (mm) | | | ø180mm Reel | | |
| | | L | W | Т | Paper Tape | Embossed Tape | |
| | GCM21 | 2.0 | 1.25 | 1.0 | 4,000 | - | |
| | GCWZT | 2.0 | 1.25 | 1.25 | - | 3,000 | |
| | GCJ31/GCM31 | 3.2 | 1.6 | 1.0 | 4,000 | - | |
| | | | | 1.25 | - | 3,000 | |
| | | | | 1.6 | - | 2,000 | |
| Medium Voltage | | 3.2 | 2.5 | 1.0 | 4,000 | - | |
| | GCJ32/GCM32 | | | 1.5 | - | 2,000 | |
| | | | | 2.0 | - | 1,000 | |
| | GCJ43 | 4.5 | 3.2 | 1.5 | - | 1,000 | |
| | 66343 | | | 2.0 | - | 1,000 | |
| | GCJ55 | 5.7 | 5.0 | 2.0 | - | 1,000 | |

muRata

■ Tape Carrier Packaging

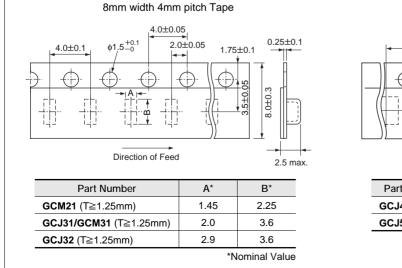


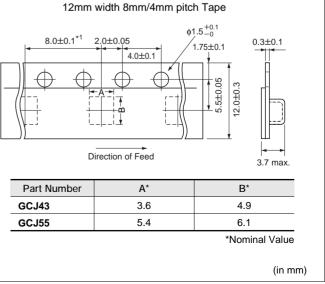




(2) Dimensions of Tape

① Embossed Tape



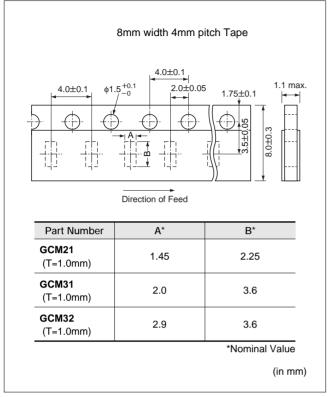




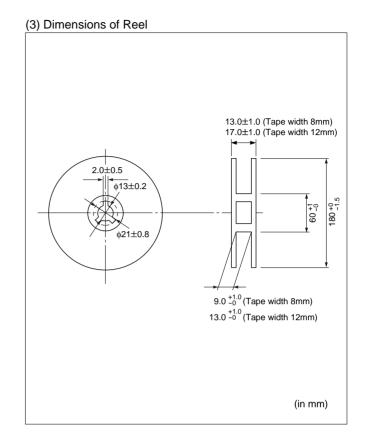
Package

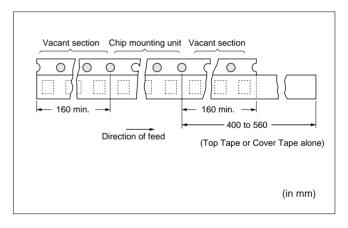
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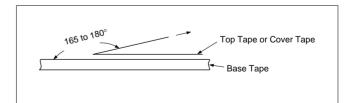
2 Paper Tape



- (4) Taping Method
 - ① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
 - ② Part of the leader and part of the empty tape should be attached to the end of the tape as 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 should not protrude beyond the edges of the tape and should not cover sprocket holes.
 - Cumulative tolerance of sprocket holes, 10 pitches: ±0.3mm.
 - 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%.

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

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



Caution

Rating

1. Operating Voltage

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

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

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

| Voltage | DC Voltage | DC+AC Voltage | AC Voltage | Pulse Voltage (1) | Pulse Voltage (2) |
|---------------------------|------------|---------------|------------|-------------------|-------------------|
| Positional Measurement | V0-p | Vo-p | Vp-p | Vp-p | Vp-p |

 Operating Temperature, Self-generated Heat, and Load Reduction at High-frequency Voltage Condition 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 highfrequency voltage, pulse voltage, it may self-generate heat due to dielectric loss.

(1) In case of X7R char.

Applied voltage should be the load such as selfgenerated heat is within 20°C <u>on the condition of</u> <u>atmosphere temperature 25°C</u>. When measuring, use a thermocouple of small thermal capacity -K of ø0.1mm in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)



Continued from the preceding page.

(2) In case of U2J char.

Due to the low self-heating characteristics of lowdissipation capacitors, the allowable electric power of these capacitors is generally much higher than that of X7R characteristic capacitors.

When a high frequency voltage which cause 20°C self heating to the capacitor is applied, it will exceed capacitor's allowable electric power.

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 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.)

<Capacitor Selection Tool>

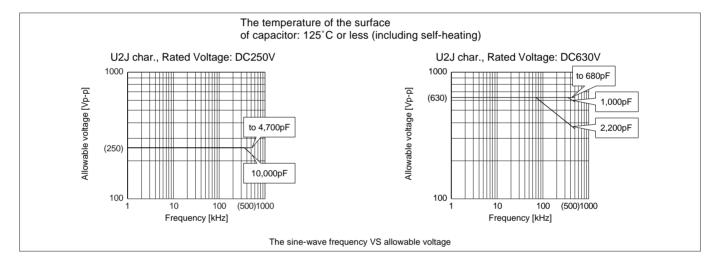
We are also offering free software the "capacitor selection tool: Murata Medium Voltage Capacitors Selection Tool by Voltage Form (*)" which will assist you in selecting a suitable capacitor.

The software can be downloaded from Murata's Internet Web site.

(http://www.murata.com/designlib/mmcsv_e.html) By inputting capacitance values and applied voltage waveform of the specific capacitor series, this software will calculate the capacitor's power consumption and list suitable capacitors. (non-sine wave is also available).

* Subject series are below.

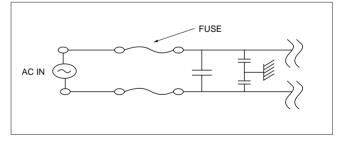
· Temperature Characteristics U2J



3. 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.





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 10.5.20

Caution

Continued from the preceding page.

4. 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.

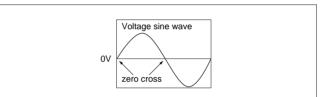
(2) Voltage Applied Method

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 -

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.





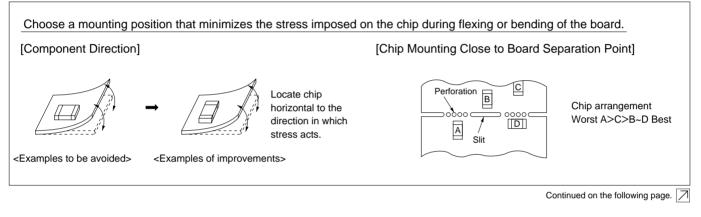
<u>A</u>Caution

Solder and Mounting

- Vibration and Impact Do not expose a capacitor to excessive shock or vibration during use.
- 2. Circuit Board Material

In case that ceramic chip capacitor is soldered on the metal board, such as Aluminum board, the stress of heat expansion and contraction might cause the crack of ceramic capacitor, due to the difference of thermal expansion coefficient between metal board and ceramic chip.

3. Land Layout for Cropping PC Board





Continued from the preceding page.

- 4. Reflow Soldering
- When the sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 1. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
- 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 Table 1.

Table 1

| Part Number | Temperature Differential | |
|-------------|--------------------------|--|
| G21/31 | ∆T≦190℃ | |
| G32/43/55 | ∆T≦130℃ | |

Recommended Conditions

| | Pb-Sn S | Lead Free Solder | |
|------------------|-----------------|------------------|------------------|
| | Infrared Reflow | Vapor Reflow | Lead Free Solder |
| Peak Temperature | 230-250°C | 230-240°C | 240-260°C |
| Atmosphere | Air | Air | Air or N2 |

Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

Optimum Solder Amount for Reflow Soldering

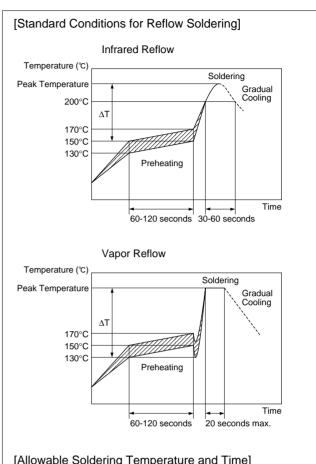
• Overly thick application of solder paste results in excessive fillet height solder.

This makes the chip more susceptible to mechanical and thermal stress on the board and may cause cracked chips.

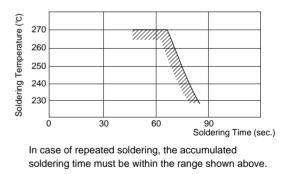
- Too little solder paste results in a lack of adhesive strength on the outer electrode, which may result in chips breaking loose from the PCB.
- Make sure the solder has been applied smoothly to the end surface to a height of 0.2mm min.

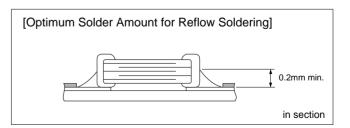
Inverting the PCB

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



[Allowable Soldering Temperature and Time]







Caution

Continued from the preceding page.

- 5. Flow Soldering
- When the sudden heat is given to the components, the mechanical strength of the components should go down because remarkable temperature change causes deformity of components inside. And an excessively long soldering time or high soldering temperature results in leaching by the outer electrodes, causing poor adhesion or a reduction in capacitance value due to loss of contact between electrodes and end termination.
- In order to prevent mechanical damage in the components, preheating should be required for both of the components and the PCB board. Preheating conditions are shown in Table 2. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible.
- 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 | |
|-------------|--------------------------|--|
| G□□21/31 | ∆T≦150℃ | |

Recommended Conditions

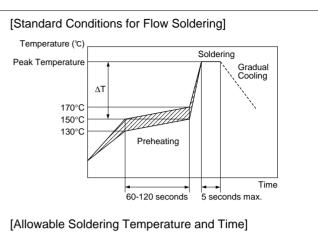
| | Pb-Sn Solder | Lead Free Solder |
|------------------|--------------|------------------|
| Peak Temperature | 240-250°C | 250-260°C |
| Atmosphere | Air | N2 |

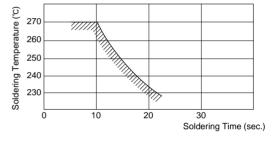
Pb-Sn Solder: Sn-37Pb

Lead Free Solder: Sn-3.0Ag-0.5Cu

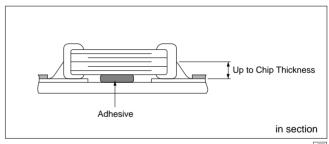
Optimum Solder Amount for Flow Soldering

The top of the solder fillet should be lower than the thickness of components. If the solder amount is excessively big, the risk of cracking is higher during board bending or under any other stressful conditions.





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





Continued from the preceding page.

6. Correction with a Soldering Iron

 When sudden heat is applied to the components by use of a soldering iron, the mechanical strength of the components will go down because the extreme temperature change causes deformations inside the components.

In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board.

Preheating conditions, (The "Temperature of the Soldering Iron tip", "Preheating Temperature",

"Temperature Differential" between iron tip and the

Table 3

| Part Number | Temperature of Soldering Iron tip | Preheating Temperature | | Atmosphere |
|-------------|---|---------------------------|---------|------------|
| G21/31 | 350°C max. | 150°C min. | ∆T≦190℃ | air |
| G32/43/55 | 280°C max. | 150°C min. | ∆T≦130℃ | 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 re-working Using a Soldering Iron

In case of larger sizes than $G\square\square 21$, the top of the solder fillet should be lower than 2/3's of the thickness of the component.

If the solder amount is excessive, the risk of cracking is higher during board bending or under any other stressful conditions.

A Soldering iron ø3mm or smaller should be used. It is also necessary to keep the soldering iron from touching the components during the re-work. Solder wire with ø0.5mm or smaller is required for soldering.

7. Washing

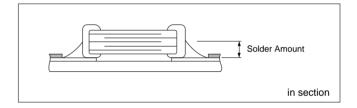
Excessive output of ultrasonic oscillation during cleaning causes PCBs to resonate, resulting in cracked chips or broken solder. Take note not to vibrate PCBs.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND FUMING WHEN THE PRODUCT IS USED. components and the PCB), should be within the conditions of table 3.

It is required to keep the temperature differential between the soldering Iron and the components surface (Δ T) as small as possible.

After soldering, do not allow the component/PCB to cool down rapidly.

The operating time for the re-working should be as short as possible. When re-working time is too long, it may cause solder leaching, and that will cause a reduction of the adhesive strength of the terminations.



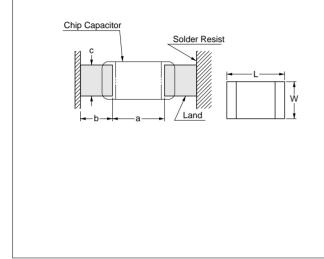


Notice

■ Notice (Soldering and Mounting)

 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)



Flow Soldering

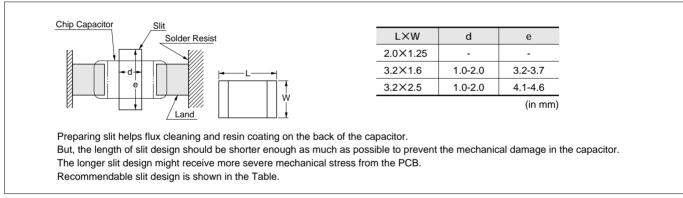
| Tiow Soldening | | | | |
|----------------|---------|---------|---------|--|
| L×W | а | b | с | |
| 2.0×1.25 | 1.0-1.2 | 0.9-1.0 | 0.8-1.1 | |
| 3.2×1.6 | 2.2-2.6 | 1.0-1.1 | 1.0-1.4 | |
| | | | | |

Flow soldering : 3.2×1.6 or less available.

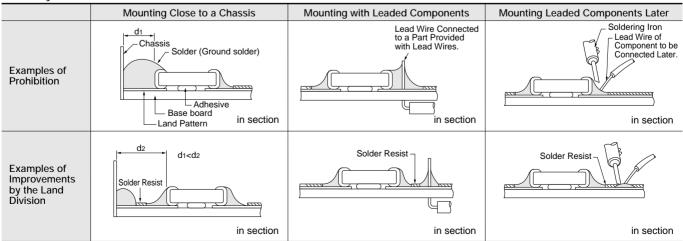
Reflow Soldering

| | 0 | | |
|----------|---------|---------|---------|
| L×W | а | b | С |
| 2.0×1.25 | 1.0-1.2 | 0.6-0.7 | 0.8-1.1 |
| 3.2×1.6 | 2.2-2.4 | 0.8-0.9 | 1.0-1.4 |
| 3.2×2.5 | 2.0-2.4 | 1.0-1.2 | 1.8-2.3 |
| 4.5×3.2 | 2.8-3.4 | 1.2-1.4 | 2.3-3.0 |
| 5.7×5.0 | 4.0-4.6 | 1.4-1.6 | 3.5-4.8 |
| | | | (in mm) |

Dimensions of Slit (Example)



Land Layout to Prevent Excessive Solder





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Notice

Continued from the preceding page.

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

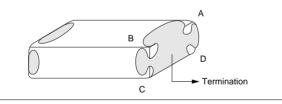
prevent unexpected trouble. An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. Please set the suction nozzle's bottom dead point on the upper surface of the board.

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.



(2) 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 percentage of halide may cause corrosion of the outer electrodes unless sufficient cleaning. Use flux with a halide content of 0.2% max.
- Do not use strong acidic flux.
- Do not use water-soluble flux*.
- (*Water-soluble flux can be defined as non rosin type flux including wash-type flux and non-wash-type flux.)

(3) Solder

The use of Sn-Zn based solder will deteriorate the reliability of the MLCC.

Please contact our sales representative or product engineers on the use of Sn-Zn based solder in advance.



Notice

Continued from the preceding page.

4. Cleaning

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

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

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.

A cracked chip might be caused at the cooling/heating cycle by the amount of resin spreading and/or bias thickness.

The resin for coating and molding must be selected as the stress is small when stiffening and the hygroscopic is 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 U2J char.

Capacitance might change a little depending on the surrounding temperature or an applied voltage. Please contact us if you intend to use this product in a strict time constant circuit. 2. Performance check by equipment

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

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.



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 - ③ Undersea equipment
 - (5) Medical equipment
 - (6) Transportation equipment (vehicles, trains, ships, etc.) (7) Traffic signal equipment
 - 9 Data-processing equipment
- (8) Disaster prevention / crime prevention equipment
 - 1 Application of similar complexity and/or reliability requirements to the applications listed above
- 3. Product specifications in this catalog are as of March 2010. 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
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