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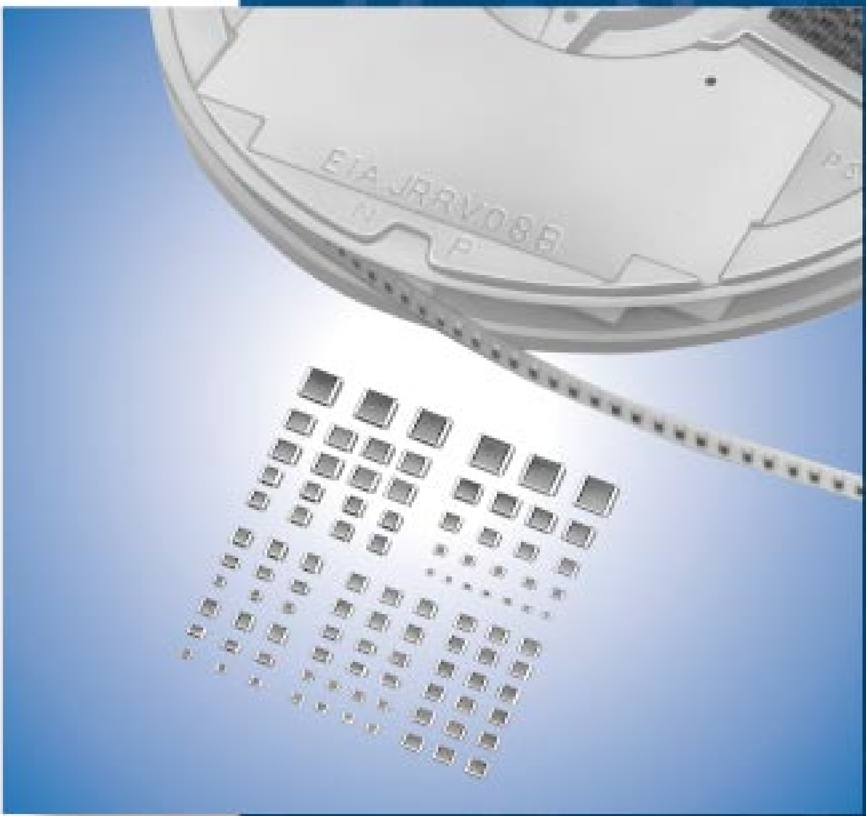
Chip Monolithic Ceramic Capacitors for Automotive



Innovator in Electronics
Murata Manufacturing Co., Ltd.

Cat.No.C03E-4

● Part Numbering

Chip Monolithic Ceramic Capacitors

(Part Number) GC M 18 8 R7 1H 102 K A37 D
❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾ ❿

❶Product ID

❷Series

Product ID	Code	Series
GC	**J**	Soft Termination Type Power-train, Safety Equipment
	M	Power-train, Safety Equipment

❸Dimension (L×W)

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

❹Dimension (T)

Code	Dimension (T)
3	0.3mm
5	0.5mm
6	0.6mm
8	0.8mm
9	0.85mm
A	1.0mm
B	1.25mm
C	1.6mm
D	2.0mm
E	2.5mm
M	1.15mm
N	1.35mm
Q	1.5mm
R	1.8mm
X	Depends on individual standards.

❺Temperature Characteristics

Temperature Characteristic Codes			Temperature Characteristics			Operating Temperature Range
Code	Public STD Code		Reference Temperature	Temperature Range	Capacitance Change or Temperature Coefficient	
5C	C0G	EIA	25°C	25 to 125°C	0±30ppm/°C	-55 to 125°C
7U	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

Murata Code	Capacitance Change from 25°C (%)					
	–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

❻Rated Voltage

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

❼Capacitance

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

Continued on the following page. ↗

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Continued from the preceding page.

❽Capacitance Tolerance

Code	Capacitance Tolerance	TC	Series	Capacitance Step	
C	±0.25pF	C0G	**GCM**	≦5pF	E12, 1pF Step *
D	±0.5pF	C0G	**GCM**	6.0 to 9.0pF	E12, 1pF Step *
J	±5%	C0G	**GCM**	≧10pF	E12 Step
		U2J	**GCM**	E12 Step	
K	±10%	X7S, X7R	**GCJ/GCM**	E6 Step	
M	±20%	X7S, X7R	**GCM**	E6 Step	

***** E24 series is also available.

❾Individual Specification Code

Expressed by three figures.

❿Package

Code	Package
L	ø180mm Embossed Taping
D	ø180mm Paper Taping
K	ø330mm Embossed Taping
J	ø330mm Paper Taping
B	Bulk
C	Bulk Case

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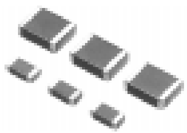
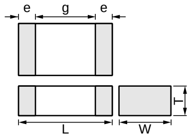
Chip Monolithic Ceramic Capacitors for Automotive

muRata

Medium Voltage for Automotive GCJ Series Soft Termination Type





Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GCJ31B	3.2 ±0.2	1.6 ±0.2	1.25 +0,-0.3	0.3 min.	1.2
GCJ31C			1.6 ±0.2		
GCJ32Q	3.2 ±0.3	2.5 ±0.2	1.5 +0,-0.3		
GCJ32D			2.0 +0,-0.3		
GCJ43Q	4.5 ±0.4	3.2 ±0.3	1.5 +0,-0.3		2.2
GCJ43D			2.0 +0,-0.3		
GCJ55D	5.7 ±0.4	5.0 ±0.4	2.0 +0,-0.3		3.2

■ 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)

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%	5.7	5.0	2.0	3.2	0.3 min.
GCJ55DR72E474KXJ1L	DC250	X7R (EIA)	0.47µF ±10%	5.7	5.0	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.

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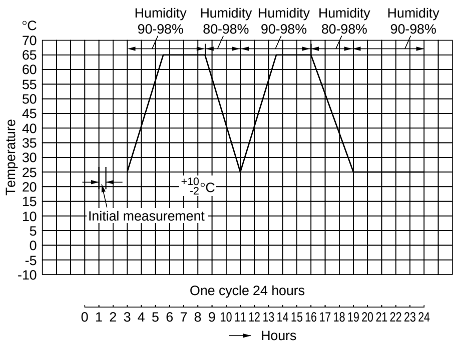
Specifications and Test Methods

<table>
<tr><th>No.</th><th colspan="2">AEC-Q200 Test Item</th><th>Specifications</th><th>AEC-Q200 Test Method</th></tr>
<tr><td>1</td><td colspan="2">Pre-and Post-Stress Electrical Test</td><td colspan="2">–</td></tr>
<tr><td rowspan="5">2</td><td colspan="2">High Temperature Exposure (Storage)</td><td>The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="5">Sit the capacitor for 1000±12 hours at 150±3°C. Let sit for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td rowspan="4"></td><td>Appearance</td><td>No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ or 100MΩ · μF
(Whichever is smaller)</td></tr>
<tr><td rowspan="5">3</td><td colspan="2">Temperature Cycle</td><td>The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="5">Fix the capacitor to the supporting jig in the same manner and under the same conditions as (19). Perform the 1000 cycles according to the 4 heat treatments listed in the following table.
Let sit for 24±2 hours at room temperature, then measure.<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>-55+0/-3</td><td>Room Temp.</td><td>125+3/-0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>15±3</td><td>1</td><td>15±3</td><td>1</td></tr></table>•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.</td></tr>
<tr><td rowspan="4"></td><td>Appearance</td><td>No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ or 100MΩ · μF
(Whichever is smaller)</td></tr>
<tr><td>4</td><td colspan="2">Destructive Physical Analysis</td><td>No defects or abnormalities</td><td>Per EIA-469</td></tr>
<tr><td rowspan="5">5</td><td colspan="2">Moisture Resistance</td><td>The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="5">Apply the 24 hour heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
Let sit for 24±2 hours at room temperature, then measure.
</td></tr>
<tr><td rowspan="4"></td><td>Appearance</td><td>No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ or 100MΩ · μF
(Whichever is smaller)</td></tr>
<tr><td rowspan="5">6</td><td colspan="2">Biased Humidity</td><td>The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="5">Apply the rated voltage and DC1.3+0.2/-0V (add 6.8kΩ 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 measure.
The charge/discharge current is less than 50mA.
•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.</td></tr>
<tr><td rowspan="4"></td><td>Appearance</td><td>No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 10MΩ · μF
(Whichever is smaller)</td></tr>
<tr><td rowspan="5">7</td><td colspan="2">Operational Life</td><td>The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="5">Apply voltage in Table for 1000±12 hours at 125±3°C. Let sit for 24±2 hours at room temperature, then measure.
The charge/discharge current is less than 50mA.<table><tr><th>Rated Voltage</th><th>Applied Voltage</th></tr><tr><td>DC250V</td><td>150% of the rated voltage</td></tr><tr><td>DC630V</td><td>120% of the rated voltage</td></tr></table>•Pretreatment
Apply test voltage for 60±5 minutes at test temperature.
Remove and let sit for 24±2 hours at room temperature.</td></tr>
<tr><td rowspan="4"></td><td>Appearance</td><td>No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±12.5%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>More than 1,000MΩ or 10MΩ · μF
(Whichever is smaller)</td></tr>
<tr><td>8</td><td colspan="2">External Visual</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>9</td><td colspan="2">Physical Dimension</td><td>Within the specified dimensions</td><td>Using calipers and micrometers</td></tr>
</table>

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Continued from the preceding page.

No.	AEC-Q200 Test Item		Specifications	AEC-Q200 Test Method
10	Resistance to Solvents	Appearance	No marking defects	Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits Solvent 2: Terpene defluxer Solvent 3: 42 parts (by volume) of water 1 part (by volume) of propylene glycol monomethyl ether 1 part (by volume) of monoethanolomine
		Capacitance Change	Within the specified tolerance	
		D.F.	0.025 max.	
		I.R.	More than 10,000MΩ or 100MΩ · μF (Whichever is smaller)	
11	Mechanical Shock	Appearance	No marking defects	Three shocks in each direction should be applied along 3 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.
		Capacitance Change	Within the specified tolerance	
		D.F.	0.025 max.	
		I.R.	More than 10,000MΩ or 500MΩ · μF (Whichever is smaller)	
12	Vibration	Appearance	No defects or abnormalities	Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (19). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 2000Hz. The 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).
		Capacitance Change	Within the specified tolerance	
		D.F.	0.025 max.	
		I.R.	More than 10,000MΩ or 500MΩ · μF (Whichever is smaller)	
13	Resistance to Soldering Heat		The measured and observed characteristics should satisfy the specifications in the following table.	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. •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	
		Capacitance Change	Within ±10%	
		D.F.	0.025 max.	
		I.R.	More than 10,000MΩ or 100MΩ · μF (Whichever is smaller)	
14	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 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. Step: 1 / 2 Temp. (°C): -55+0/-3 / 125+3/-0 Time (min.): 15±3 / 15±3 •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	
		Capacitance Change	Within ±10%	
		D.F.	0.025 max.	
		I.R.	More than 10,000MΩ or 100MΩ · μF (Whichever is smaller)	
15	ESD	Appearance	No marking defects	Per AEC-Q200-002
		Capacitance Change	Within the specified tolerance	
		D.F.	0.025 max.	
		I.R.	More than 10,000MΩ or 100MΩ · μF (Whichever is smaller)	
16	Solderability		95% of the terminations is to be soldered evenly and continuously.	(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. (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.

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<table>
<tr><th>No.</th><th colspan="2">AEC-Q200 Test Item</th><th>Specifications</th><th>AEC-Q200 Test Method</th></tr>
<tr><td rowspan="5">17</td><td rowspan="5">Electrical Characteri-zation</td><td>Appearance</td><td>No defects or abnormalities</td><td>Visual inspection.</td></tr>
<tr><td>Capacitance Change</td><td>Within the specified tolerance</td><td rowspan="2">The capacitance/Q should be measured at 25°C at the frequency and voltage shown in the table.
<table>
<tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr>
<tr><td>C<1000pF</td><td>1±0.2MHz</td><td>AC0.5 to 5V(r.m.s.)</td></tr>
<tr><td>C≧1000pF</td><td>1±0.2kHz</td><td>AC1±0.2V(r.m.s.)</td></tr>
</table></td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>25°C
More than 10,000MΩ or 100MΩ · μF
(Whichever is smaller)

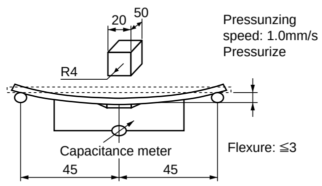
Max. Operating Temperature···125°C
More than 1,000MΩ or 10MΩ · μF
(Whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 125°C and within 2 minutes of charging.</td></tr>
<tr><td>Dielectric Strength</td><td>No failure</td><td>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.
<table>
<tr><th>Rated Voltage</th><th>Test Voltage</th></tr>
<tr><td>DC250V</td><td>200% of the rated voltage</td></tr>
<tr><td>DC630V</td><td>150% of the rated voltage</td></tr>
</table></td></tr>
<tr><td rowspan="3">18</td><td rowspan="3">Board Flex</td><td>Appearance</td><td>No marking defects</td><td rowspan="3">Solder the capacitor on the test jig (glass epoxy board) shown in 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 the soldering is uniform and free of defects such as heat shock.
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>**GCJ31**</td><td>2.0</td><td>4.4</td><td>1.7</td></tr>
<tr><td>**GCJ32**</td><td>2.0</td><td>4.4</td><td>2.6</td></tr>
<tr><td>**GCJ43**</td><td>3.0</td><td>6.0</td><td>3.3</td></tr>
<tr><td>**GCJ55**</td><td>4.2</td><td>7.2</td><td>5.1</td></tr>
</table>
(in mm)


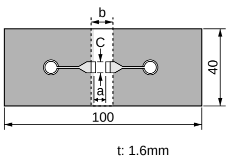
Fig. 2</td></tr>
<tr><td>Capacitance Change</td><td>Within ±12.5%</td></tr>
<tr><td></td><td>

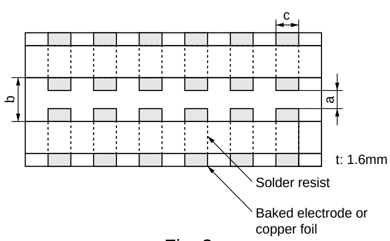
Fig. 1</td></tr>
<tr><td rowspan="4">19</td><td rowspan="4">Terminal Strength</td><td>Appearance</td><td>No marking defects</td><td rowspan="4">Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 3 using a eutectic solder. Then apply 18N force in parallel with the test jig for 60 seconds.
The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>**GCJ31**</td><td>2.2</td><td>5.0</td><td>2.0</td></tr>
<tr><td>**GCJ32**</td><td>2.2</td><td>5.0</td><td>2.9</td></tr>
<tr><td>**GCJ43**</td><td>3.5</td><td>7.0</td><td>3.7</td></tr>
<tr><td>**GCJ55**</td><td>4.5</td><td>8.0</td><td>5.6</td></tr>
</table>
(in mm)


Fig. 3</td></tr>
<tr><td>Capacitance Change</td><td>Within the specified tolerance</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ or 100MΩ · μF
(Whichever is smaller)</td></tr>
</table>

Continued on the following page.

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Specifications and Test Methods

Continued from the preceding page.

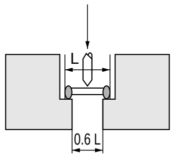
<table>
<tr><th>No.</th><th colspan="2">AEC-Q200
Test Item</th><th>Specifications</th><th>AEC-Q200 Test Method</th></tr>
<tr><td>20</td><td colspan="2">Beam Load Test</td><td>The chip endure following force.
Chip thickness < 1.25mm rank: 15N
Chip thickness ≧ 1.25mm rank: 54.5N</td><td>Place the capacitor in the beam load fixture as Fig. 4.
Apply a force.


Fig. 4
Speed supplied the Stress Load: 2.5mm / s</td></tr>
<tr><td>21</td><td>Capacitance Temperature Character-istics</td><td>Capacitance Change</td><td>Within ±15%</td><td>The capacitance change should be measured after 5 minutes at each specified temperature stage.
<table>
<tr><th>Step</th><th>Temperature (°C)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>-55±3</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>125±3</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table>
The ranges of capacitance change compared with the above 25°C value over the temperature ranges shown in the table should be within the specified ranges.
•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.
Perform the initial measurement.</td></tr>
</table>

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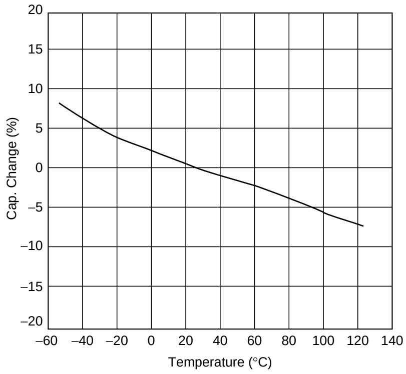
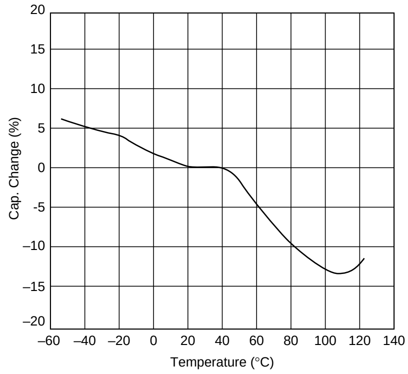
Medium Voltage Data (Typical Example)

■ Capacitance - Temperature Characteristics

U2J Characteristics

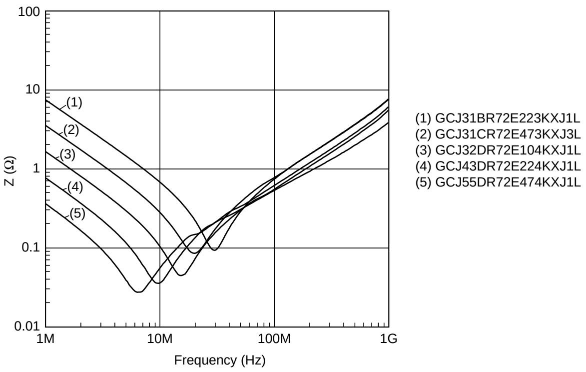


X7R Characteristics

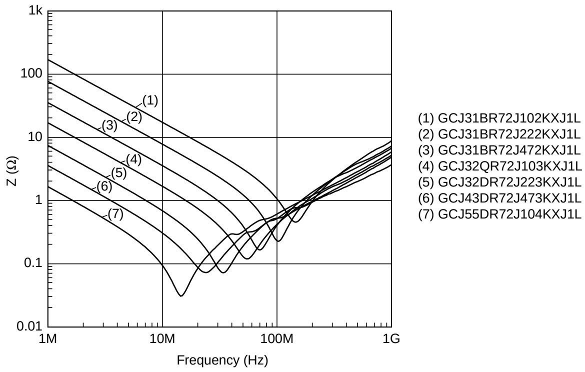


■ Impedance - Frequency Characteristics

X7R Characteristics DC250V



X7R Characteristics DC630V



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Package

Taping is standard packaging method.

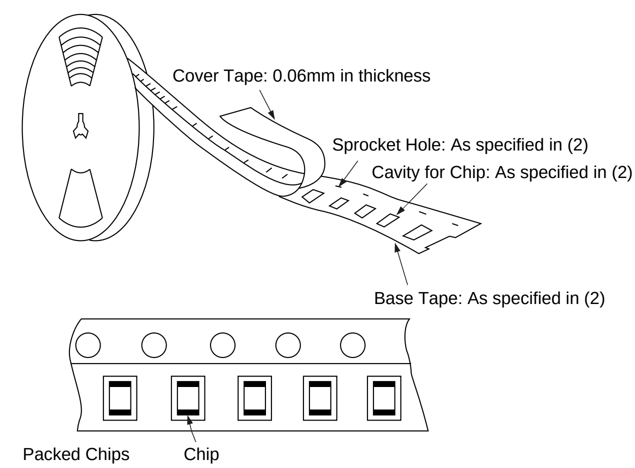
■ Minimum Quantity Guide

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

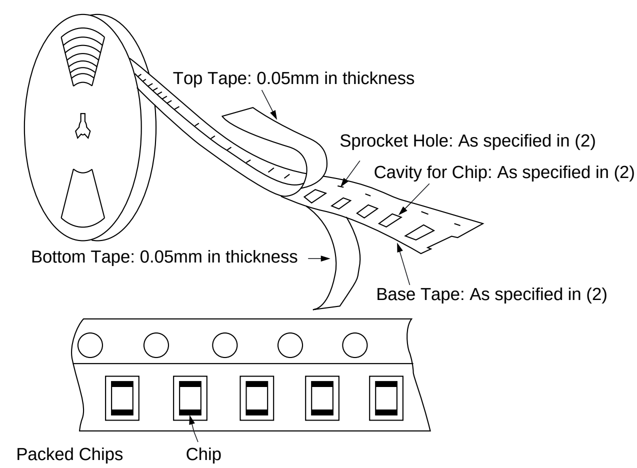
■ Tape Carrier Packaging

(1) Appearance of Taping

① Embossed Tape



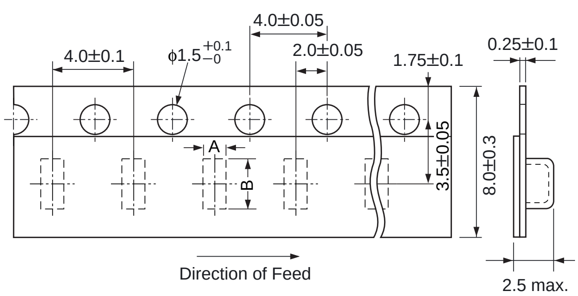
② Paper Tape



(2) Dimensions of Tape

① Embossed Tape

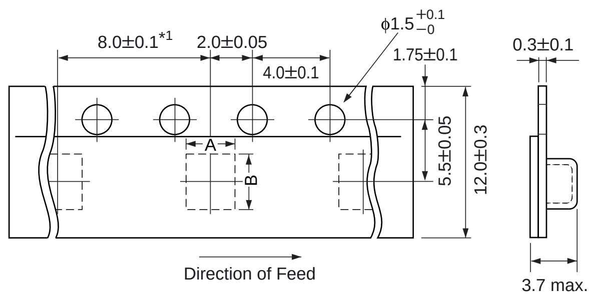
8mm width 4mm pitch Tape



Part Number	A*	B*
GCM21 (T≧1.25mm)	1.45	2.25
GCJ31/GCM31 (T≧1.25mm)	2.0	3.6
GCJ32 (T≧1.25mm)	2.9	3.6

*Nominal Value

12mm width 8mm/4mm pitch Tape



Part Number	A*	B*
GCJ43	3.6	4.9
GCJ55	5.4	6.1

*Nominal Value

(in mm)

Continued on the following page.

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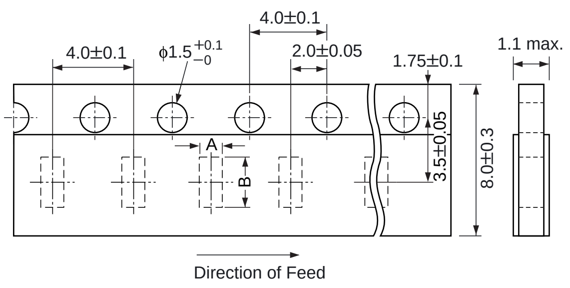
Package

Continued from the preceding page.

② Paper Tape

8mm width 4mm pitch Tape

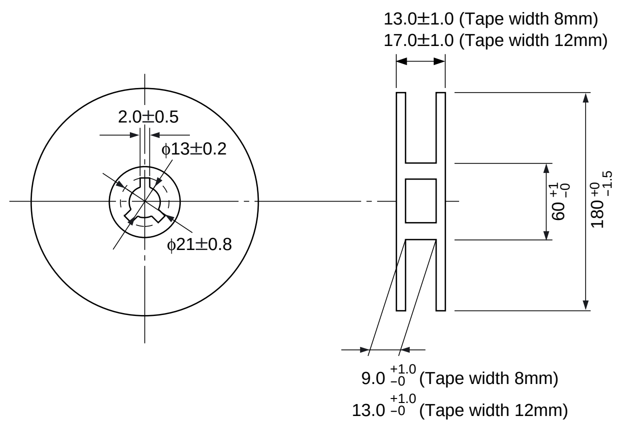


Part Number	A*	B*
GCM21 (T=1.0mm)	1.45	2.25
GCM31 (T=1.0mm)	2.0	3.6
GCM32 (T=1.0mm)	2.9	3.6

*Nominal Value

(in mm)

(3) Dimensions of Reel



(in mm)

(4) Taping Method

① Tapes for capacitors are wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.

② Part of the leader and part of the empty tape should be attached to the end of the tape as shown at right.

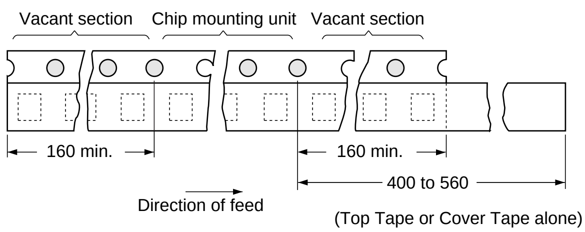
③ The top tape or cover tape and base tape are not attached at the end of the tape for a minimum of 5 pitches.

④ Missing capacitors number within 0.1% of the number per reel or 1 pc, whichever is greater, and are not continuous.

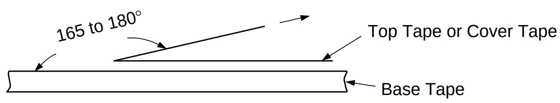
⑤ The top tape or cover tape and bottom tape should not protrude beyond the edges of the tape and should not cover sprocket holes.

⑥ Cumulative tolerance of sprocket holes, 10 pitches: ±0.3mm.

⑦ Peeling off force: 0.1 to 0.6N in the direction shown at right.



(in mm)



⚠Caution

■ Storage and Operating Conditions

Operating and storage environment

Do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. And avoid exposure to moisture. Before cleaning, bonding or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed 5 to 40 degrees centigrade and 20 to 70%.

Use capacitors within 6 months 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.

■ 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.

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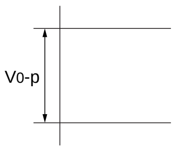
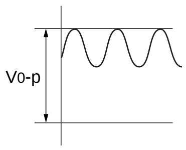
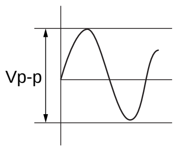
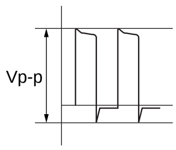
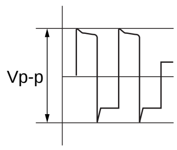
⚠Caution

■ 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					

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

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⚠Caution

Continued from the preceding page.

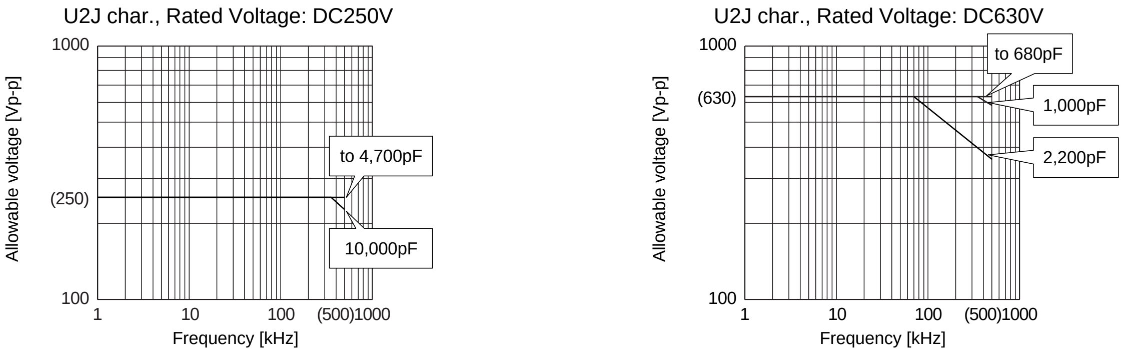
(2) In case of U2J char.

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

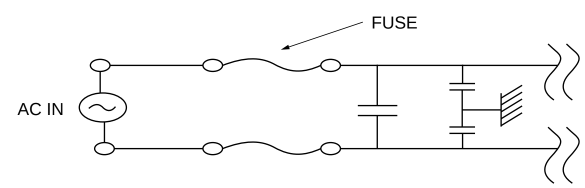
The temperature of the surface
of capacitor: 125˚C or less (including self-heating)



The sine-wave frequency VS allowable voltage

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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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.

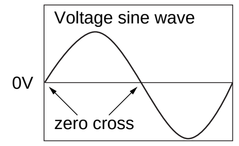
If the distorted sine wave or overload exceeding the specified voltage value is applied, a defect may be caused.

(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.

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■ Solder and Mounting

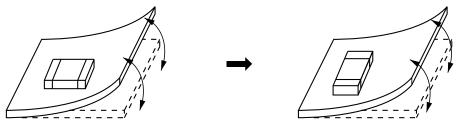
1. Vibration and Impact
   Do not expose a capacitor to excessive shock or vibration during use.

2. Circuit Board Material
   In case that 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

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

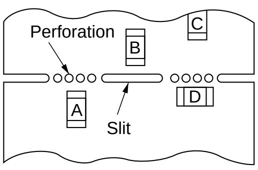
[Component Direction]



Locate chip horizontal to the direction in which stress acts.

<Examples to be avoided> <Examples of improvements>

[Chip Mounting Close to Board Separation Point]



Chip arrangement
Worst A>C>B~D Best

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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
G□□21/31	ΔT≦190℃
G□□32/43/55	ΔT≦130℃

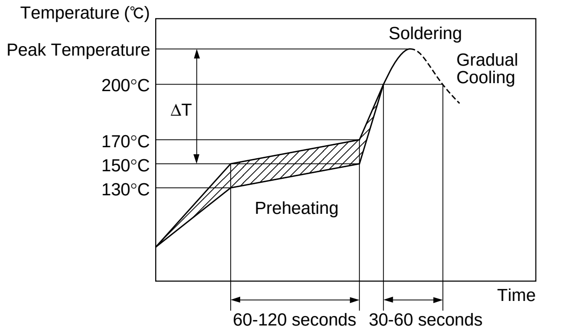
Recommended Conditions

	Pb-Sn Solder		Lead Free Solder
	Infrared Reflow	Vapor Reflow	
Peak Temperature	230-250°C	230-240°C	240-260°C
Atmosphere	Air	Air	Air or N_2

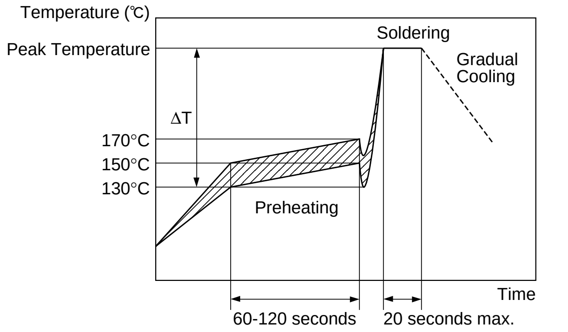
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Reflow Soldering]

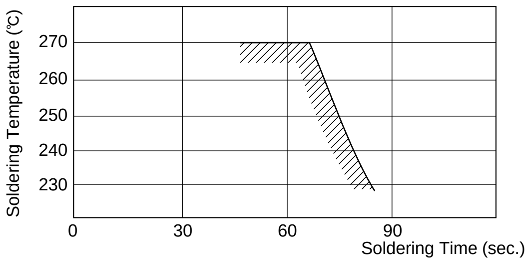
Infrared Reflow



Vapor Reflow



[Allowable Soldering Temperature and Time]

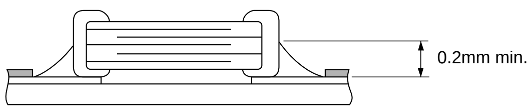


In case of repeated soldering, the accumulated soldering time must be within the range shown above.

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.

[Optimum Solder Amount for Reflow Soldering]



in section

Inverting the PCB

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

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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

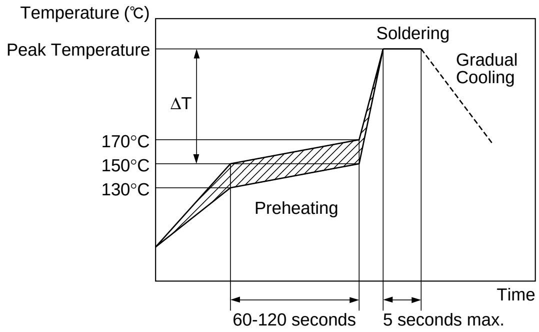
Part Number	Temperature Differential
G□□21/31	ΔT≦150℃

Recommended Conditions

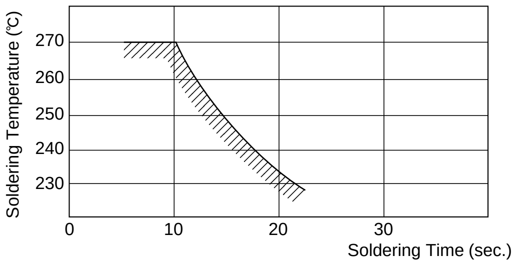
	Pb-Sn Solder	Lead Free Solder
Peak Temperature	240-250°C	250-260°C
Atmosphere	Air	N_2

Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Flow Soldering]

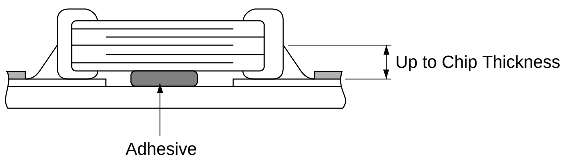


[Allowable Soldering Temperature and Time]



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

- Optimum Solder Amount for Flow Soldering
  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.



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⚠Caution

Continued from the preceding page.

6. Correction with a Soldering Iron

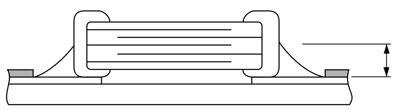
● When sudden heat is applied to the components by use of a soldering iron, the mechanical strength of the components will go down because the extreme temperature change causes deformations inside the components.
In order to prevent mechanical damage to the components, preheating is required for both the components and the PCB board.
Preheating conditions, (The "Temperature of the Soldering Iron tip", "Preheating Temperature", "Temperature Differential" between iron tip and the 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 (ΔT) 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.

Table 3

Part Number	Temperature of Soldering Iron tip	Preheating Temperature	Temperature Differential (ΔT)	Atmosphere
G□□21/31	350°C max.	150°C min.	ΔT≦190℃	air
G□□32/43/55	280°C max.	150°C min.	ΔT≦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□□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.

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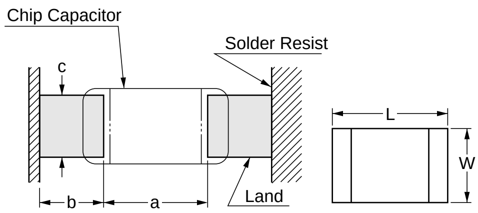
■ Notice (Soldering and Mounting)

1. Construction of Board Pattern

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

Construction and Dimensions of Pattern (Example)



Flow Soldering

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

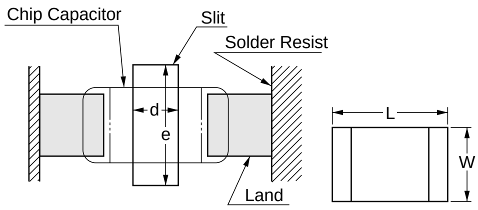
Flow soldering : 3.2×1.6 or less available.

Reflow Soldering

L×W	a	b	c
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)

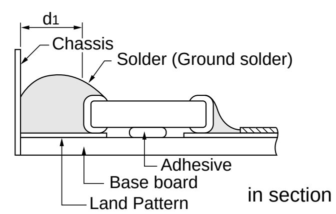
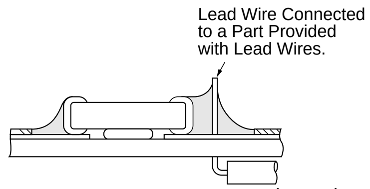
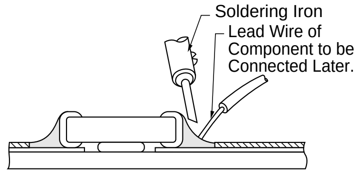
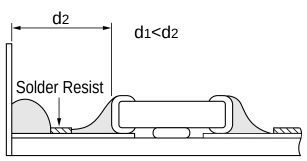
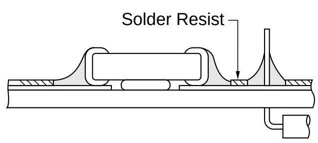
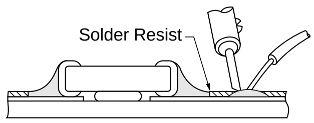


L×W	d	e
2.0×1.25	-	-
3.2×1.6	1.0-2.0	3.2-3.7
3.2×2.5	1.0-2.0	4.1-4.6

(in mm)

Preparing slit helps flux cleaning and resin coating on the back of the capacitor.
But, the length of slit design should be shorter enough as much as possible to prevent the mechanical damage in the capacitor.
The longer slit design might receive more severe mechanical stress from the PCB.
Recommendable slit design is shown in the Table.

Land Layout to Prevent Excessive Solder

	Mounting Close to a Chassis	Mounting with Leaded Components	Mounting Leaded Components Later
Examples of Prohibition	 in section	 in section	 in section
Examples of Improvements by the Land Division	 in section	 in section	 in section

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Notice

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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).

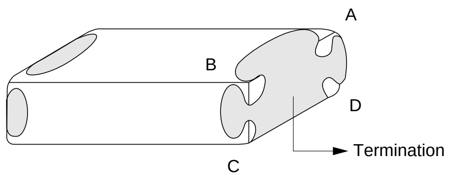
- Mechanical shock of the chip placer

  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.

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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.