

# Chip Monolithic Ceramic Capacitors



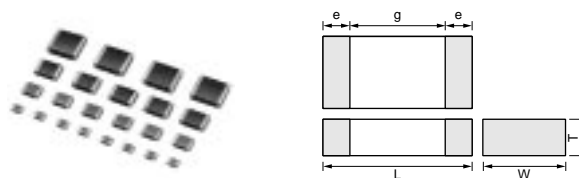
## for Smoothing

### ■ Features

1. Heat generation is low at high frequency because of low dielectric loss.
2. Compared with aluminum electrolytic capacitors, capacitance can be lower to obtain the same smoothing performance.
3. Ceramic capacitor has no polarity and ensures long life time.

### ■ Applications

- DC-DC converter
- Noise elimination LCD bias circuit  
(Use for only alumina, paper or glass epoxy board)

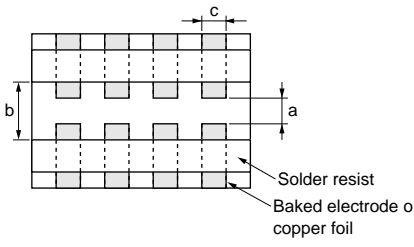


Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
<b>GJ221B</b>	2.0 ±0.1	1.25 ±0.1	1.25 ±0.1	0.2 to 0.7	0.7
<b>GJ231M</b>	3.2 ±0.15	1.6 ±0.15	1.15 ±0.1	0.3 to 0.8	1.5
<b>GJ232N</b>	3.2 ±0.3	2.5 ±0.2	1.35 ±0.15	0.3	1.0
<b>GJ232C</b>			1.6 ±0.15		
<b>GJ232R</b>			1.8 ±0.2		
<b>GJ243R</b>	4.5 ±0.4	3.2 ±0.3	1.8 ±0.2	0.3	2.0
<b>GJ243X</b>			2.2 ±0.3		

Part Number	TC	Rated Voltage (Vdc)	Capacitance (μF)	Length L (mm)	Width W (mm)	Thickness T (mm)
<b>GJ221BF50J106ZD01</b>	Y5V	6.3	10 +80.-20%	2.00	1.25	1.25
<b>GJ231MF50J226ZD01</b>	Y5V	6.3	22 +80.-20%	3.20	1.60	1.15
<b>GJ232CF50J476ZD01</b>	Y5V	6.3	47 +80.-20%	3.20	2.50	1.60
<b>GJ243RF50J107ZD11</b>	Y5V	6.3	100 +80.-20%	4.50	3.20	1.80
<b>GJ232NF51A226ZD01</b>	Y5V	10	22 +80.-20%	3.20	2.50	1.35
<b>GJ232RF51H475ZD01</b>	Y5V	50	4.7 +80.-20%	3.20	2.50	1.80
<b>GJ243XF51H106ZD12</b>	Y5V	50	10 +80.-20%	4.50	3.20	2.20
<b>GJ232RF52A105ZD01</b>	Y5V	100	1 +80.-20%	3.20	2.50	1.8

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## Specifications and Test Methods

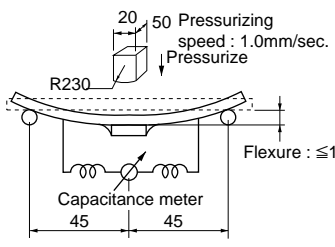
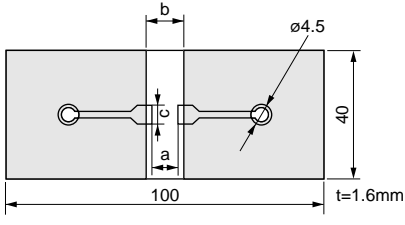
No.	Item	Specification	Test Method																								
1	Operating Temperature Range	F5 : -30°C to 85°C																									
2	Rated Voltage	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, shall be maintained within the rated voltage range.																								
3	Appearance	No defects or abnormalities.	Visual inspection.																								
4	Dimensions	Within the specified dimension.	Using calipers.																								
5	Dielectric Strength	No defects or abnormalities.	No failure shall be observed when 250% of the rated voltage is applied between the both terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																								
6	Insulation Resistance	More than 10,000MΩ or 500Ω · F. (Whichever is smaller)	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 minutes* of charging. *5minutes for $c > 47\mu F$ .																								
7	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at 25°C at the frequency and voltage shown in the table.																								
8	Dissipation Factor (D.F.)	0.07 max. (50/100V) 0.09 max. (10/16/25V) 0.15 max. (6.3V)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td><math>C \leq 10\mu F</math></td> <td><math>1 \pm 0.1kHz</math></td> <td><math>1 \pm 0.2V_{rms}</math></td> </tr> <tr> <td><math>C &gt; 10\mu F</math></td> <td><math>120 \pm 24Hz</math></td> <td><math>0.5 \pm 0.1V_{rms}</math></td> </tr> </tbody> </table>	Capacitance	Frequency	Voltage	$C \leq 10\mu F$	$1 \pm 0.1kHz$	$1 \pm 0.2V_{rms}$	$C > 10\mu F$	$120 \pm 24Hz$	$0.5 \pm 0.1V_{rms}$															
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9	Capacitance Temperature Characteristics	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change Rate</th> </tr> </thead> <tbody> <tr> <td>F5</td> <td>-30 to +85°C</td> <td>25°C</td> <td>Within <math>\pm \frac{22}{82}\%</math></td> </tr> </tbody> </table>	Char.	Temp. Range	Reference Temp.	Cap. Change Rate	F5	-30 to +85°C	25°C	Within $\pm \frac{22}{82}\%$	The capacitance change shall be measured after 5 min. at each specified temperature stage. The ranges of capacitance change compared to 25°C with the temperature ranges shown in the table shall be within the specified ranges.																
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10	Adhesive Strength of Termination	<p>No removal of the terminations or other defects shall occur.</p>  <p style="text-align: center;">Fig.1</p>	<p>Solder the capacitor on the testing jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply 5N force in parallel with the test jig for <math>10 \pm 1</math> sec. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defect such as heat shock.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GJ218</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GJ221</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GJ231</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GJ232</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GJ243</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> </tbody> </table> <p style="text-align: right;">(in mm)</p>	Type	a	b	c	GJ218	1.0	3.0	1.2	GJ221	1.2	4.0	1.65	GJ231	2.2	5.0	2.0	GJ232	2.2	5.0	2.9	GJ243	3.5	7.0	3.7
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11	Vibration Resistance	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No defects or abnormalities.</td> </tr> <tr> <td>Capacitance Change</td> <td>Within the specified tolerance.</td> </tr> <tr> <td>D.F.</td> <td>50, 100V    10, 16, 25V    6.3V 0.07 max.    0.09 max.    0.15 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Frequency	Appearance	No defects or abnormalities.	Capacitance Change	Within the specified tolerance.	D.F.	50, 100V    10, 16, 25V    6.3V 0.07 max.    0.09 max.    0.15 max.	Dielectric Strength	No failure	<p>Solder the capacitor on the testing jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor shall be subjected to simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).</p>														
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Continued on the following page.

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# Specifications and Test Methods

Continued from the preceding page.

No.	Item	Specification	Test Method																											
12	Deflection	<p>No cracks or marking defects shall occur.</p>  <p style="text-align: center;">Fig.3</p>	<p>Solder the capacitor to the test jig (glass epoxy boards) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig.3 for 5±1 sec. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p style="text-align: center;">Fig.2</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td><b>GJ218</b></td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td><b>GJ221</b></td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td><b>GJ231</b></td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td><b>GJ232</b></td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td><b>GJ243</b></td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> </tbody> </table> <p style="text-align: right;">(in mm)</p>	Type	a	b	c	<b>GJ218</b>	1.0	3.0	1.2	<b>GJ221</b>	1.2	4.0	1.65	<b>GJ231</b>	2.2	5.0	2.0	<b>GJ232</b>	2.2	5.0	2.9	<b>GJ243</b>	3.5	7.0	3.7			
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13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor first ethanol (JIS-K-8101) a solution of rosin (JIS-K-5902) (25% rosin in weight proportion), then in an eutectic solder solution for 2±0.5 seconds at 230±5°C after pre-heating in the following table. then set it for 48±4 hours at room temperature and measure.																											
14	Resistance to Soldering Heat	<p>The measured values shall satisfy the values in the following table.</p> <table border="1" style="width: 100%;"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±20%</td> </tr> <tr> <td>I. R.</td> <td>More than 10,000MΩ or 500Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>50, 100V    10, 16, 25V    6.3V 0.07 max.    0.09 max.    0.15 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ±20%	I. R.	More than 10,000MΩ or 500Ω · F (Whichever is smaller)	D.F.	50, 100V    10, 16, 25V    6.3V 0.07 max.    0.09 max.    0.15 max.	Dielectric Strength	No failure	<p>The capacitor shall be set for 48±4 hours at room temperature after one hour heat of treatment at 150<sup>+0</sup><sub>-10</sub> °C. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds after preheating in the following table. Then set it for 48T4 hours at room temperature and measure.</p>															
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16	Humidity Steady State	<p>No marking defects.</p> <table border="1" style="width: 100%;"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within ±30%</td> </tr> <tr> <td>I. R.</td> <td>More than 1,000MΩ or 50Ω · F (Whichever is smaller)</td> </tr> <tr> <td>D.F.</td> <td>50, 100V    10, 16, 25V    6.3V 0.1 max.    0.125 max.    0.2 max.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ±30%	I. R.	More than 1,000MΩ or 50Ω · F (Whichever is smaller)	D.F.	50, 100V    10, 16, 25V    6.3V 0.1 max.    0.125 max.    0.2 max.	Dielectric Strength	No failure	Set the capacitor for 500±12 hours at 40±2°C and 90 to 95% humidity. Take it out and set it for 48T4 hours at room temperature, then measure.															
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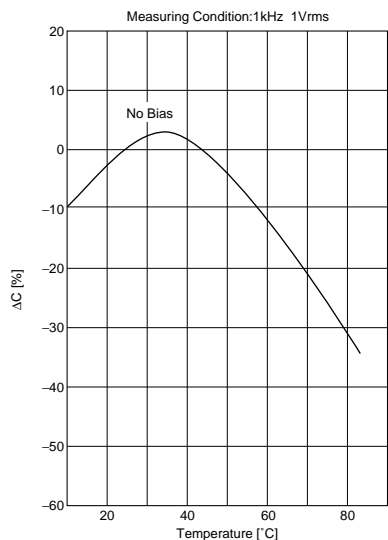
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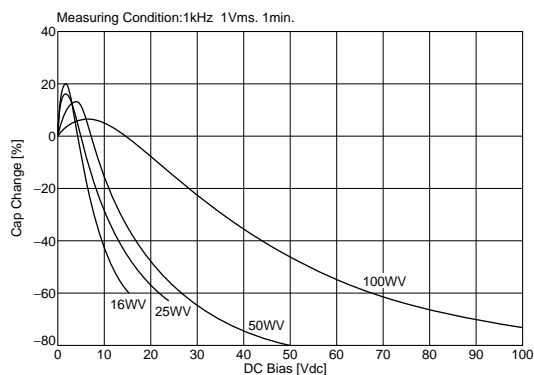
No.	Item	Specification	Test Method	
18	High Temperature Load	No marked defect.		The voltage treatment shall be given to the capacitor, in which a DC voltage of 200%* the rated voltage is applied for one hour at the maximum operating temperature $\pm 3^{\circ}\text{C}$ then it shall be set for $48\pm 4$ hours at room temperature and the measurement shall be conducted. Then apply the above mentioned voltage continuously for $1000\pm 12$ hours at the same temperature, remove it from the bath, and set it for $48\pm 4$ hours at room temperature, then measure. The charge/discharge current is less than 50mA.  *150% for $C > 10\mu\text{F}$
		Item	Specification	
		Appearance	No marked defect	
		Capacitance Change	Within $\pm 30\%$	
		I. R.	More than $1,000\text{M}\Omega$ or $50\Omega \cdot \text{F}$ (Whichever is smaller)	
		D.F.	50, 100V    10, 16, 25V    6.3V 0.1 max.    0.125 max.    0.2 max.	
		Dielectric Strength	No failure	

## Characteristics Data

### Capacitance-Temperature Characteristics

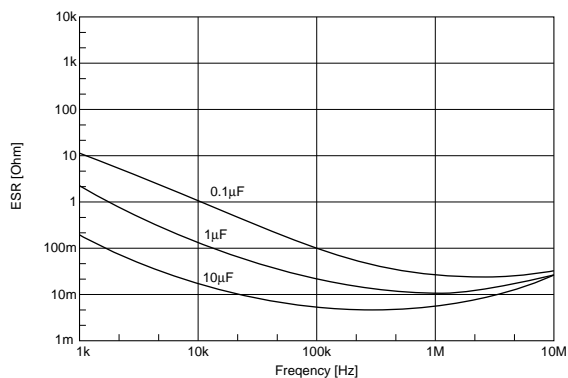


### Capacitance-DC Voltage Characteristics

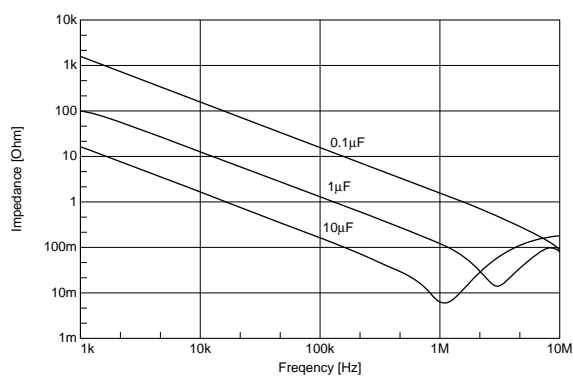


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### Capacitance-AC Voltage Characteristics



### Impedance-Frequency Characteristics

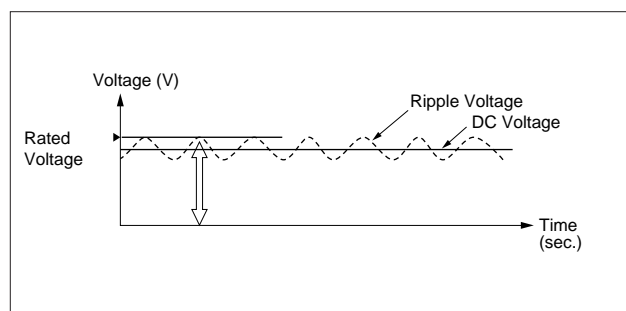


## Reference Data

### ■ Allowable Ripple Current

Ripple current should be less than "Allowable ripple current value" shown in the following table.

And temperature rise of the chip surface ( $\Delta T$ ) should be below 20°C. When AC and DC voltage are superimposed, keep the peak value of the voltage within the rated voltage.



### Allowable ripple current value

Series	Rated Voltage	Allowable ripple current value (r.m.s.)		
		100kHz ≤ f < 300kHz	300kHz ≤ f < 500kHz	500kHz ≤ f < 1MHz
GJ221	4V / 6.3V	1.4Ar.m.s.	1.5Ar.m.s.	1.6Ar.m.s.
GJ231		1.5Ar.m.s.	1.6Ar.m.s.	1.6Ar.m.s.
GJ232		1.7Ar.m.s.	1.8Ar.m.s.	2.0Ar.m.s.
GJ243		1.4Ar.m.s.	1.3Ar.m.s.	1.2Ar.m.s.
GJ218	10V	1.4Ar.m.s.	1.5Ar.m.s.	1.6Ar.m.s.
GJ231		1.5Ar.m.s.	1.6Ar.m.s.	1.6Ar.m.s.
GJ232		1.7Ar.m.s.	1.8Ar.m.s.	2.0Ar.m.s.
GJ243		1.4Ar.m.s.	1.3Ar.m.s.	1.2Ar.m.s.
GJ231	16V	1.5Ar.m.s.	1.6Ar.m.s.	1.6Ar.m.s.
GJ232		1.7Ar.m.s.	1.8Ar.m.s.	2.0Ar.m.s.
GJ232	25V / 35V / 50V	2.0Ar.m.s.	2.2Ar.m.s.	2.2Ar.m.s.
GJ243		2.0Ar.m.s.	2.2Ar.m.s.	2.2Ar.m.s.
GJ232	100V	1.6Ar.m.s.	1.7Ar.m.s.	1.8Ar.m.s.