

# GRM Series Specifications and Test Methods (2)

No.	Item	Specifications	Test Method																																																												
1	Operating Temperature Range	B1, B3, F1: -25 to +85°C R1, R7, C7, D7, E7: -55 to +125°C C6, R6: -55 to +85°C F5: -30 to +85°C C8, D8: -55 to +105°C,	Reference temperature: 25°C (B1, B3, R1, F1: 20°C)																																																												
2	Rated Voltage	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{D-P}$ , whichever is larger, should be maintained within the rated voltage range.																																																												
3	Appearance	No defects or abnormalities	Visual inspection																																																												
4	Dimensions	Within the specified dimensions	Using calipers																																																												
5	Dielectric Strength	No defects or abnormalities	No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																																																												
6	Insulation Resistance	More than 50Ω · F	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at reference temperature and 75%RH max. and within 1 minutes of charging, provided the charge/discharge current is less than 50mA.																																																												
7	Capacitance	Within the specified tolerance  *Table 1 <table border="1"> <thead> <tr> <th>Part No.</th> <th>Code</th> <th>Value</th> <th>Tolerance</th> </tr> </thead> <tbody> <tr> <td>GRM155</td> <td>B3/R6</td> <td>1A</td> <td>124 to 105</td> </tr> <tr> <td>GRM185</td> <td>B3/R6</td> <td>1C/1A</td> <td>105</td> </tr> <tr> <td>GRM185</td> <td>C8/D7</td> <td>1A</td> <td>105</td> </tr> <tr> <td>GRM188</td> <td>B3/R6</td> <td>1C/1A</td> <td>225</td> </tr> <tr> <td>GRM188</td> <td>R7/C8</td> <td>1A</td> <td>225</td> </tr> <tr> <td>GRM188</td> <td>B3/R6</td> <td>1A</td> <td>335</td> </tr> <tr> <td>GRM219</td> <td>B3/R6</td> <td>1C/1A</td> <td>475, 106</td> </tr> <tr> <td>GRM219</td> <td>C8</td> <td>1A</td> <td>475</td> </tr> <tr> <td>GRM21B</td> <td>B3/R6</td> <td>1C/1A</td> <td>106</td> </tr> <tr> <td>GRM21B</td> <td>R7/C8</td> <td>1A</td> <td>106</td> </tr> <tr> <td>GRM319</td> <td>B3/R6</td> <td>1C/1A</td> <td>106</td> </tr> </tbody> </table>	Part No.	Code	Value	Tolerance	GRM155	B3/R6	1A	124 to 105	GRM185	B3/R6	1C/1A	105	GRM185	C8/D7	1A	105	GRM188	B3/R6	1C/1A	225	GRM188	R7/C8	1A	225	GRM188	B3/R6	1A	335	GRM219	B3/R6	1C/1A	475, 106	GRM219	C8	1A	475	GRM21B	B3/R6	1C/1A	106	GRM21B	R7/C8	1A	106	GRM319	B3/R6	1C/1A	106	The capacitance/D.F. should be measured at reference temperature at the frequency and voltage shown in the table. <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td><math>C \leq 10\mu\text{F}</math> (10V min.)*1</td> <td>1±0.1kHz</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td><math>C \leq 10\mu\text{F}</math> (6.3V max.)</td> <td>1±0.1kHz</td> <td>0.5±0.1Vrms</td> </tr> <tr> <td><math>C &gt; 10\mu\text{F}</math></td> <td>120±24Hz</td> <td>0.5±0.1Vrms</td> </tr> </tbody> </table> <p>*1 However the voltage is 0.5±0.1Vrms about Table 1 items on the left side.</p>	Capacitance	Frequency	Voltage	$C \leq 10\mu\text{F}$ (10V min.)*1	1±0.1kHz	1.0±0.2Vrms	$C \leq 10\mu\text{F}$ (6.3V max.)	1±0.1kHz	0.5±0.1Vrms	$C > 10\mu\text{F}$	120±24Hz	0.5±0.1Vrms
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GRM155	B3/R6	1A	124 to 105																																																												
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8	Dissipation Factor (D.F.)	B1, B3, R6*2, R7*3, C7, C8, D8*2: 0.1 max. F1, F5: 0.2 max.																																																													
9	Capacitance Temperature Characteristics	No bias B1, B3 : Within ±10% (-25 to +85°C) F1 : Within +30/-80% (-25 to +85°C) R6 : Within ±15% (-55 to +85°C) R1, R7 : Within ±15% (-55 to +125°C) F5 : Within +22/-82% (-30 to +85°C) C6 : Within ±22% (-55 to +85°C) C7 : Within ±22% (-55 to +125°C) C8 : Within ±22% (-55 to +105°C) D7 : Within +22/-33% (-55 to +125°C) E7 : Within +22/-56% (-55 to +125°C) D8 : Within +22/-33% (-55 to +105°C)	The capacitance change should be measured after 5 min. at each specified temp. stage. The ranges of capacitance change compared with the reference temperature value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.  *GRM43 B1/R6 0J/1A 336/476 only: 1.0±0.2Vrms																																																												
		50% of the Rated Voltage B1: Within +10/-30% R1: Within +15/-40% F1: Within +30/-95%	<table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Applying Voltage (V)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">1</td> <td>25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5) 20±2 (for B1, B3, F1, R1)</td> <td rowspan="8">No bias</td> </tr> <tr> <td>-55±3 (for R1, R6, R7, C6, C7, C8, D7, D8, E7) -30±3 (for F5) -25±3 (for B1, B3, F1)</td> </tr> <tr> <td rowspan="2">3</td> <td>25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5) 20±2 (for B1, B3, F1, R1)</td> </tr> <tr> <td>125±3 (for R1, R7, C7, D7, E7) 105±3 (for C8, D8) 85±3 (for B1, B3, F1, F5, R6, C6)</td> </tr> <tr> <td>5</td> <td>20±2 (for B1, F1, R1)</td> <td rowspan="4">50% of the rated voltage</td> </tr> <tr> <td>6</td> <td>-55±3 (for R1) -25±3 (for B1, F1)</td> </tr> <tr> <td>7</td> <td>20±2 (for B1, F1, R1)</td> </tr> <tr> <td>8</td> <td>125±3 (for R1) 85±3 (for B1, F1)</td> </tr> </tbody> </table> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150 +0/-10°C for one hour and then set for 24±2 hours at room temperature. Perform the initial measurement.</p>	Step	Temperature (°C)	Applying Voltage (V)	1	25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5) 20±2 (for B1, B3, F1, R1)	No bias	-55±3 (for R1, R6, R7, C6, C7, C8, D7, D8, E7) -30±3 (for F5) -25±3 (for B1, B3, F1)	3	25±2 (for R6, R7, C6, C7, C8, D7, D8, E7, F5) 20±2 (for B1, B3, F1, R1)	125±3 (for R1, R7, C7, D7, E7) 105±3 (for C8, D8) 85±3 (for B1, B3, F1, F5, R6, C6)	5	20±2 (for B1, F1, R1)	50% of the rated voltage	6	-55±3 (for R1) -25±3 (for B1, F1)	7	20±2 (for B1, F1, R1)	8	125±3 (for R1) 85±3 (for B1, F1)																																									
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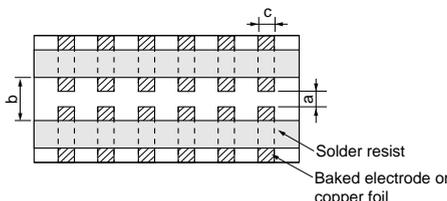
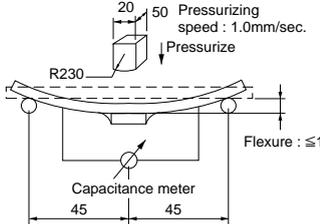
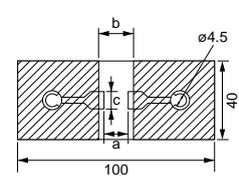
\*2: GRM31CR60J107, GRM31CD80G107: 0.15 max.

\*3: GRM31CR71E106: 0.125 max.

Continued on the following page. 

# GRM Series Specifications and Test Methods (2)

Continued from the preceding page.

No.	Item	Specifications	Test Method																																								
10	Adhesive Strength of Termination	<p>No removal of the terminations or other defects should occur.</p>  <p>Fig. 1a</p>	<p>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1sec.</p> <p>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <p>*1N: GRM02, 2N: GRM03, 5N: GRM15/GRM18</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr><td>GRM02</td><td>0.2</td><td>0.56</td><td>0.23</td></tr> <tr><td>GRM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr> <tr><td>GRM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr> <tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr> <tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr> <tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr> <tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr> <tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr> <tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr> </tbody> </table>	Type	a	b	c	GRM02	0.2	0.56	0.23	GRM03	0.3	0.9	0.3	GRM15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
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11	Vibration	<table border="1"> <tr> <td>Appearance</td> <td>No defects or abnormalities</td> </tr> <tr> <td>Capacitance</td> <td>Within the specified tolerance</td> </tr> <tr> <td>D.F.</td> <td>B1, B3, R1, R6*2, R7*3, C7, C8, E7, D7, D8*2: 0.1 max. C6: 0.125 max. F1, F5: 0.2 max.</td> </tr> </table>	Appearance	No defects or abnormalities	Capacitance	Within the specified tolerance	D.F.	B1, B3, R1, R6*2, R7*3, C7, C8, E7, D7, D8*2: 0.1 max. C6: 0.125 max. F1, F5: 0.2 max.	<p>Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10).</p> <p>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).</p>																																		
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12	Deflection	<p>No cracking or marking defects should occur.</p>  <p>Fig.3a</p>	<p>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5±1 sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p>  <p>Fig. 2a</p> <p>(GRM02/03/15: t: 0.8mm)</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr><td>GRM02</td><td>0.2</td><td>0.56</td><td>0.23</td></tr> <tr><td>GRM03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr> <tr><td>GRM15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr> <tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr> <tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr> <tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr> <tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr> <tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr> <tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GRM02	0.2	0.56	0.23	GRM03	0.3	0.9	0.3	GRM15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
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13	Solderability of Termination	<p>75% of the terminations is to be soldered evenly and continuously.</p>	<p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion) . Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5°C or Sn-3.0Ag-0.5Cu solder solution for 2±0.5 seconds at 245±5°C.</p>																																								

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Continued on the following page. ↗

## GRM Series Specifications and Test Methods (2)

Continued from the preceding page.

No.	Item	Specifications	Test Method															
14	Resistance to Soldering Heat	Appearance Capacitance Change D.F. I.R. Dielectric Strength	<p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder or Sn-3.0Ag-0.5Cu solder solution at 270±5°C for 10±0.5 seconds. Set at room temperature for 24±2 hours, then measure.</p> <p>*Do not apply to GRM02.</p> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.</p> <p>*Preheating for GRM32/43/55</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>100 to 120°C</td> <td>1 min.</td> </tr> <tr> <td>2</td> <td>170 to 200°C</td> <td>1 min.</td> </tr> </tbody> </table>	Step	Temperature	Time	1	100 to 120°C	1 min.	2	170 to 200°C	1 min.						
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	1	100 to 120°C		1 min.														
	2	170 to 200°C		1 min.														
	15	Temperature Sudden Change		Appearance Capacitance Change D.F. I.R. Dielectric Strength	<p>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table. Set for 24±2 hours at room temperature, then measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp. (°C)</td> <td>Min. Operating Temp. +0/−3</td> <td>Room Temp.</td> <td>Max. Operating Temp. +3/−0</td> <td>Room Temp.</td> </tr> <tr> <td>Time (min.)</td> <td>30±3</td> <td>2 to 3</td> <td>30±3</td> <td>2 to 3</td> </tr> </tbody> </table> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 24±2 hours. Perform the initial measurement.</p>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. +0/−3	Room Temp.	Max. Operating Temp. +3/−0	Room Temp.	Time (min.)	30±3	2 to 3
Step		1	2	3		4												
Temp. (°C)		Min. Operating Temp. +0/−3	Room Temp.	Max. Operating Temp. +3/−0		Room Temp.												
Time (min.)		30±3	2 to 3	30±3		2 to 3												
16		High Temperature High Humidity (Steady)	Appearance Capacitance Change D.F. I.R.	<p>Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge/discharge current is less than 50mA.</p> <p>•Initial measurement Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> <p>•Measurement after test Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</p>														
	17	Durability	<p>Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3°C. Let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.</p> <p>•Initial measurement Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.</p> <p>•Measurement after test Perform a heat treatment at 150+0/−10°C for one hour and then let sit for 24±2 hours at room temperature, then measure.</p>															
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\*3: GRM31CR71E106: 0.125 max.

\*4: GRM153R60G105, GRM188R60J106: Within ±12.5%