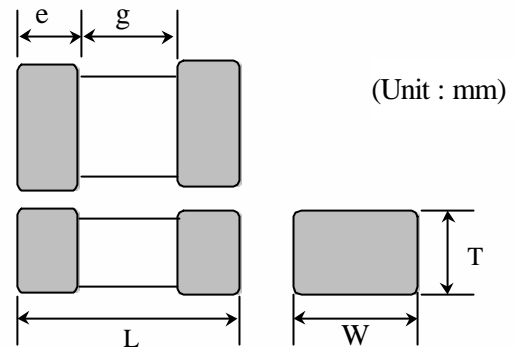


# Specification Sheet

## <Chip Monolithic Ceramic Capacitor>

Murata Global P/N : GRM32ER61C226KE20L (1210,X5R,22uF,16V)



**Dimensions(mm)**

L	W	T	e	g
3.2+/-0.3	2.5+/-0.2	2.5+/-0.2	0.3 min.	1.0 min.

**Rated Value**

TC code	TC	DC Rated Voltage (V)	CAP.	CAP.TOL
R6	X5R	16	22 uF	+/-10%

**Packaging**

Specification	Packaging unit [pcs/reel]
178 Plastic Tape Carrier Packaging	1000

**Specification**

Please refer to next page.

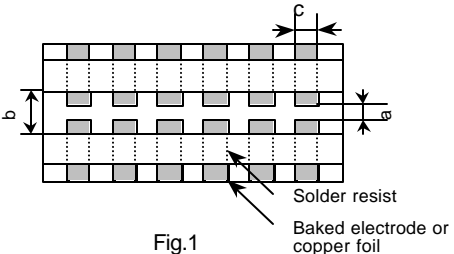
<Notice>

- (1) This specification sheet is applied for CHIP MONOLITHIC CERAMIC CAPCITOR used for General Electronics equipment for your design.
- (2) Please contact our sales representative or product engineers before using our products for the application listed below which require of our products for other applications than specified in this products.
  - (1) Aircraft equipment (2) Aerospace equipment (3) Undersea equipment (4) Medical equipment
  - (5) Transportation equipment (6) Traffic signal equipment (7) Disaster prevention / crime prevention equipment
  - (8) Application of similar complexity and/or requirements to the applications listed in the above.
- (3) Please do not use this specification sheet for quality contract.  
 If you need to exchange quality contract, please request us to provide the full product specification (including part number construction, available capacitance range, packaging and caution notes) for approval.

Product Engineering Department  
 Monolithic Ceramic Capacitor Group  
 FUKUI MURATA MFG. CO., LTD.

# SPECIFICATIONS AND TEST METHODS

P 1

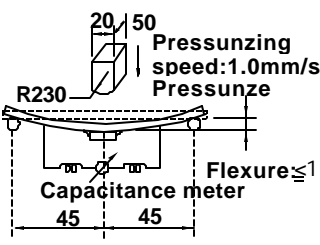
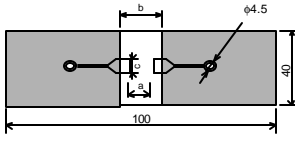
No	Item	Specification	Test Method																					
1	Operating Temperature Range	R6: -55°C to +85°C R7/ C7 : -55°C to +125°C F5: -30°C to +85°C C8: -55°C to +105°C																						
2	Rated Voltage	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied 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 terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																					
6	Insulation Resistance	50Ω·F min.	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25 °C and 75%RH max. and within 1 minutes of charging.																					
7	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at 25 °C at the frequency and voltage shown in the table.																					
8	Dissipation Factor (D.F.)	R6 / R7 / C7/ C8 : 0.1 max. F5: 0.2 max.	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Voltage</th> </tr> </thead> <tbody> <tr> <td><math>C_{\leq} 10\mu F</math> (10V min.)</td> <td>1± 0.1kHz</td> <td>* 1.0 ± 0.2 Vrms</td> </tr> <tr> <td><math>C_{\leq} 10\mu F</math> (6.3V max.)</td> <td>1± 0.1kHz</td> <td>0.5± 0.1 Vrms</td> </tr> <tr> <td>C &gt; 10μF</td> <td>120± 24Hz</td> <td>0.5± 0.1 Vrms</td> </tr> </tbody> </table> <p>* Measuring Voltage : 0.5 ± 0.1Vrms GRM155R61A124~224KE19 GRM185R61A105KE26 GRM188R61A225KE19 GRM219R61A475KE19</p>	Capacitance	Frequency	Voltage	$C_{\leq} 10\mu F$ (10V min.)	1± 0.1kHz	* 1.0 ± 0.2 Vrms	$C_{\leq} 10\mu F$ (6.3V max.)	1± 0.1kHz	0.5± 0.1 Vrms	C > 10μF	120± 24Hz	0.5± 0.1 Vrms									
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<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Reference Temp.</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>R6</td> <td>-55°C to +85°C</td> <td>25°C</td> <td>Within ±15%</td> </tr> <tr> <td>R7</td> <td>-55°C to +125°C</td> <td>25°C</td> <td>Within ±15%</td> </tr> <tr> <td>F5</td> <td>-30°C to +85°C</td> <td>25°C</td> <td>Within +22/-82%</td> </tr> <tr> <td>C7</td> <td>-55°C to +125°C</td> <td>25°C</td> <td>Within ±22%</td> </tr> <tr> <td>C8</td> <td>-55°C to +105°C</td> <td>25°C</td> <td>Within ±22%</td> </tr> </tbody> </table>	Char.	Temp. Range	Reference Temp.	Cap. Change	R6	-55°C to +85°C	25°C	Within ±15%	R7	-55°C to +125°C	25°C	Within ±15%	F5	-30°C to +85°C	25°C	Within +22/-82%	C7	-55°C to +125°C	25°C	Within ±22%	C8	-55°C to +105°C	25°C	Within ±22%
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C8	-55°C to +105°C	25°C	Within ±22%																					
9	Capacitance Temperature Characteristics		The capacitance change shall be measured after 5 min. at each specified temperature stage. The ranges of capacitance change compared with the 25 °C value over the temperature ranges shown in the table shall be within the specified ranges. Measuring Voltage : GRM43 R6 0J/1A 336/476 : 1.0+/-0.2Vrms																					
10	Adhesive Strength of Termination	No removal of the terminations or other defects shall occur.   <p style="text-align: center;">Fig.1</p>	Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply *10N force in parallel with the test jig for 10±1 sec. The soldering 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. *5N (GR□15, GRM18)/2N (GR□03)																					
11	Vibration	Appearance	No defects or abnormalities.																					
		Capacitance	Within the specified tolerance.																					
		D.F	R6/R7/C7/C8 : 0.1 max. F5: 0.2 max.																					
			Solder the capacitor to the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor shall 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, 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).																					

Type	a	b	c
GR□03	0.3	0.9	0.3
GR□15	0.4	1.5	0.5
GRM18	1.0	3.0	1.2
GRM21	1.2	4.0	1.65
GRM31	2.2	5.0	2.0
GRM32	2.2	5.0	2.9
GRM43	3.5	7.0	3.7
GRM55	4.5	8.0	5.6

(in mm)

# SPECIFICATIONS AND TEST METHODS

P 2

No	Item	Specification	Test Method																																				
12	Deflection	No cracking or marking defects shall occur.  	Solder the capacitor to the test jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig.3. The soldering 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.  <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>GR□03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GR□15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table> <p style="text-align: center;">(in:mm)</p>	Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
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GRM55	4.5	8.0	5.6																																				
																																							
13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously.	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120 °C for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for $2 \pm 0.5$ seconds at $230 \pm 5^\circ\text{C}$ .																																				
14	Resistance to Soldering Heat	Appearance	No marking defects.																																				
		Capacitance Change	R6/R7/C7/C8 : Within $\pm 7.5\%$ F5: Within $\pm 20\%$																																				
		D.F.	R6/R7/C7/C8 : 0.1 max. F5: 0.2 max.																																				
		I.R.	50Ω·F min.																																				
	Dielectric Strength	No failure	Preheat the capacitor at 120 to 150 °C for 1 minute. Immerse the capacitor in a eutectic solder solution at $270 \pm 5^\circ\text{C}$ for $10 \pm 0.5$ seconds. Let sit at room temperature for $48 \pm 4$ hours, then measure. · Initial measurement Perform a heat treatment at $150 \pm 10^\circ\text{C}$ for one hour and then let sit for $48 \pm 4$ hours at room temperature. Perform the initial measurement.																																				
15	Temperature Sudden Change	Appearance	No marking defects.																																				
		Capacitance Change	R6/R7/C7/C8 : Within $\pm 7.5\%$ F5: Within $\pm 20\%$																																				
		D.F.	R6/R7/C7/C8 : 0.1 max. F5 : 0.2 max.																																				
		I.R.	50Ω·F min.																																				
		Dielectric Strength	No failure																																				
		Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for $48 \pm 4$ hours at room temperature, then measure.																																					
		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp.(°C)</td> <td>Min. Operating Temp. <math>\pm 3</math></td> <td>Room Temp.</td> <td>Max. Operating Temp. <math>\pm 3</math></td> <td>Room Temp.</td> </tr> <tr> <td>Time(min.)</td> <td>30±3</td> <td>2 to 3</td> <td>30±3</td> <td>2 to 3</td> </tr> </tbody> </table>	Step	1	2	3	4	Temp.(°C)	Min. Operating Temp. $\pm 3$	Room Temp.	Max. Operating Temp. $\pm 3$	Room Temp.	Time(min.)	30±3	2 to 3	30±3	2 to 3																						
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		· Initial measurement Perform a heat treatment at $150 \pm 10^\circ\text{C}$ for one hour and then let sit for $48 \pm 4$ hours at room temperature. Perform the initial measurement.																																					
16	High Temperature High Humidity (Steady)	Appearance	No marking defects.																																				
		Capacitance Change	R6/R7/C7/C8 : Within $\pm 12.5\%$ F5: Within $\pm 30\%$																																				
		D.F.	R6/R7/C7/C8 : 0.2max. F5: 0.4max.																																				
		I.R.	12.5Ω·F min.																																				
		Dielectric Strength	No failure																																				
		Apply the rated voltage at $40 \pm 2^\circ\text{C}$ and 90 to 95% humidity for $500 \pm 12$ hours. The charge/discharge current is less than 50mA.																																					
		· Initial measurement Perform a heat treatment at $150 \pm 10^\circ\text{C}$ for one hour and then let sit for $48 \pm 4$ hours at room temperature. Perform the initial measurement.																																					
		· Measurement after test Perform a heat treatment at $150 \pm 10^\circ\text{C}$ for one hour and then let sit for $48 \pm 4$ hours at room temperature, then measure																																					
17	Durability	Appearance	No marking defects.																																				
		Capacitance Change	R6/R7/C7/C8 : Within $\pm 12.5\%$ F5: Within $\pm 30\%$																																				
		D.F.	R6/R7/C7/C8 : 0.2max. F5: 0.4max.																																				
		I.R.	25Ω·F min.																																				
		Dielectric Strength	No failure																																				
		Apply 150% of the rated voltage for $1000 \pm 12$ hours at the maximum operating temperature $\pm 3^\circ\text{C}$ . The charge/ discharge current is less than 50mA.																																					
		· Initial measurement Perform a heat treatment at $150 \pm 10^\circ\text{C}$ for one hour and then let sit for $48 \pm 4$ hours at room temperature. Perform the initial measurement.																																					
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