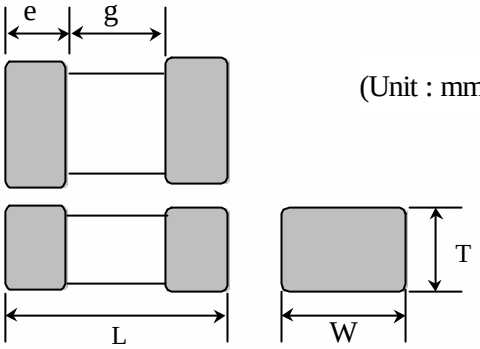
Specification No. FM7500SG2-0119

Specification Sheet

<Chip Monolithic Ceramic Capacitor>

Murata Global P/N : GRM21BF51E225ZA01L (0805,Y5V,2.2uF,25V)



(Unit : mm)

Dimensions(mm)

L	W	T	e	g
2.0+/-0.1	1.25+/-0.1	1.25+/-0.1	0.2 to 0.7	0.7 min.

Rated Value

TC code	TC	DC Rated Voltage (V)	CAP.		CAP.TOL
F5	Y5V	25	2.2	uF	+80/-20%

Packaging

Specification	Packaging unit [pcs/reel]
ϕ178 Plastic Tape Carrier Packaging	3000

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

No.	Item	Specification: Temperature Compensating Type	Specification: High Dielectric Type	Test Method
1	Operating Temperature Range	-55°C to +125°C	R6 : -55°C to +85°C R7 : -55°C to +125°C C8 : -55°C to +105°C E4 : 10°C to +85°C 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	Dimension	Within the specified dimensions.		Using calipers.
5	Dielectric Strength	No defects or abnormalities.		No failure shall be observed when 300% of the rated voltage (ΔC to 7U and 1X) or 250% of the rated voltage (R6, R7,C8,E4 and F5) is applied between the 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 25°C and 75%RH max. and within 2 minutes of charging.
7	Capacitance	Within the specified tolerance.		The capacitance/Q/D.F. shall be measured at 25°C at the frequency and voltage shown in the table.
8	Q/ Dissipation Factor (D.F.)	30pFmin.:Q≧1000 30pFmax.: Q≧400+20C C:Nominal Capacitance (pF)		

Char	25V min.	16V	10V	6.3V	4V
R6 R7 C8	0.025 max.	0.035 max.	0.035 max.	0.05max. (C<3.3μF) 0.1max. (C≧3.3μF)	
E4	0.025 max.	–	–	–	
F5	0.05 max. (C<0.1μF) 0.09 max. (C≧0.1μF)	0.07 max. (C<1.0μF) 0.09 max. (C≧1.0μF)	0.125 max.	0.15 max.	–

Char. / Item	ΔC to 7U,1X (1000pF and below)	ΔC to 7U,1X (more than 1000pF) R6,R7,C8,F5 (C≦10μF)	R6,R7,F5 (C>10μF)	E4
Frequency	1±0.1MHz	1±0.1kHz	120±24Hz	1±0.1kHz
Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.1Vrms	0.5±0.05Vrms

No.			Item	Specification	Test Method
9	Capacitance Temperature Characteristics	Capacitance Change	Within the specified tolerance. (Table A-1)		The capacitance change shall be measured after 5 min. at each specified temperature stage. (1)Temperature Compensating Type The temperature coefficient is determind using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step1 through 5 (ΔC:+25°C to +125°C , other temp. coeffs.:+25°C to +85°C) the capacitance shall be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1. The capacitance drift is caluculated by dividing the differences betweeen the maximum and minimum measured values in the step 1,3 and 5 by the cap value in step 3.
		Temperature Coefficent	Within the specified tolerance. (Table A-1)		
		Capacitance Drift	Within ±0.2% or ±0.05 pF (Whichever is larger.) *Not apply to 1X/25V		

Char.	Temp. Range	Reference Temp.	Cap. Change
R6	-55°C ~+85°C	25°C	Within ±15%
R7	-55°C ~+125°C		Within ±15%
C8	-55°C ~+105°C		Within ±22%
E4	+10°C ~+85°C		Within $^{+22}_{-56}$ %
F5	-30°C ~+85°C		Within $^{+22}_{-82}$ %

Step	Temperature(°C)
1	25±2
2	-55±3(for ΔC to 7U/1X/R6/R7/C8) -30±3(for F5), 10±3(for E4)
3	25±2
4	125±3(for ΔC/R7),105±3(for C8) 85±3(for other TC)
5	25±2

(2) High Dielectric Constant Type
The ranges of capacitance change compared with the above 25°C value over the temperature ranges shown in the table shall be within the specified ranges.
· Initial measurement for high dielectric constant type.
Perform a heat treatment at 150+0/-10°C for one hour and then set for 48±4 hours at room temperature.
Perform the initial measurement.

No.	Item	Specification	Test Method
10	Adhesive Strength of Termination	No removal of the terminations or other defect shall occur.	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±1sec. 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 gree of defects such as heat shock *5N (GR□15, GRM18) 2N (GR□03)

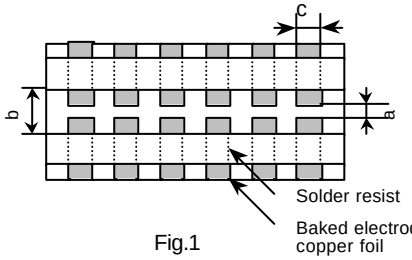


Fig.1

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)

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specification</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td>11</td><td>Vibration Resistance</td><td>Appearance</td><td colspan="2">No defects or abnormalities.</td><td rowspan="4">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).</td></tr>
<tr><td></td><td></td><td>Capacitance</td><td colspan="2">Within the specified tolerance.</td></tr>
<tr><td></td><td></td><td>Q/D.F.</td><td colspan="2">30pFmin.:Q≧1000
30pFmax.:
Q≧400+20C

C:Nominal Capacitance (pF)

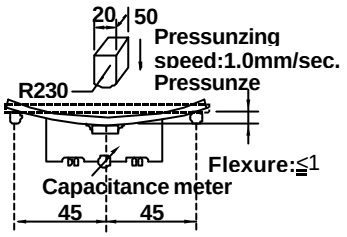
<table>
<tr><th>Char</th><th>25V min.</th><th>16V</th><th>10V</th><th>6.3V</th><th>4V</th></tr>
<tr><td>R6
R7
C8</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td><td colspan="2">0.05 max. (C<3.3μF)
0.1max. (C≧3.3μF)</td></tr>
<tr><td>E4</td><td>0.025 max.</td><td>–</td><td>–</td><td colspan="2">–</td></tr>
<tr><td>F5</td><td>0.05 max. (C<0.1μF)
0.09 max. (C≧0.1μF)</td><td>0.07 max. (C<1.0μF)
0.09 max. (C≧1.0μF)</td><td>0.125 max.</td><td>0.15 max.</td><td>–</td></tr>
</table></td></tr>
<tr><td>12</td><td colspan="2">Deflection</td><td colspan="2">No cracking or marking defects shall occur.
 

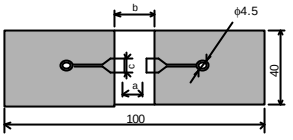
Fig.3</td><td>Solder the capacitor on the test jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig 3 for 5±1sec. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.
 

Fig.2 t : 1.6mm
(GR□03,GR□15:0.8mm)
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<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>
</table>(in mm)</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td colspan="2">75% of the terminations is to be soldered evenly and continuously.</td><td>Immerse the capacitor in a solution of ethanol(JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight propotion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating , immerse in eutectic solder solution for 2±0.5 seconds at 230±5°C .</td></tr>
<tr><td>14</td><td colspan="2">Resistance to Soldering Heat</td><td colspan="2">The measured and observed characteristics shall satisfy the specifications in the following table.</td><td>Preheat the capacitor at *120 to 150°C for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5°C for 10±0.5 seconds. Let sit at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), then measure.

· Initial measurement for high dielectric constant type
Perform a heat treatment at 150 $^{+0}_{-10}$ °C for one hour and then let sit for 48±4 hours at room temperature.
Perform the initial measurement.

*Preheating for GRM32/43/55
<table>
<tr><th>Step</th><th>Temperature</th><th>Time</th></tr>
<tr><td>1</td><td>100°C to 120°C</td><td>1 min.</td></tr>
<tr><td>2</td><td>170°C to 200°C</td><td>1 min.</td></tr>
</table></td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects.</td><td></td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R6,R7,C8:Within ±7.5%
E4,F5:Within ±20%</td><td></td></tr>
<tr><td></td><td>Q/D.F.</td><td colspan="2">30pFmin.:Q≧1000
30pFmax.:
Q≧400+20C

C:Nominal Capacitance (pF)

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<tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th><th>6.3V</th><th>4V</th></tr>
<tr><td>R6
R7
C8</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td><td colspan="2">0.05 max. (C<3.3μF)
0.1max. (C≧3.3μF)</td></tr>
<tr><td>E4</td><td>0.025 max.</td><td>–</td><td>–</td><td colspan="2">–</td></tr>
<tr><td>F5</td><td>0.05 max. (C<0.1μF)
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<tr><td></td><td>I.R.</td><td colspan="2">More than 10,000MΩor 500Ω · F(Whichever is smaller)</td><td></td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td><td></td></tr>
</table>

SPECIFICATIONS AND TEST METHODS

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Item</th><th colspan="2">Specification</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td>15</td><td>Temperature Cycle</td><td colspan="2">The measured and observed characteristics shall 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 (10). Perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure
<table><tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><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></table>· Initial measurement for high dielectric constant type
Perform a heat treatment at 150 $^{+0}_{-10}$°C for one hour and then let sit for 48±4 hours at room temperature.
Perform the initial measurement</td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects.</td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R6,R7,C8:Within ±7.5%
E4,F5:Within ±20%</td></tr>
<tr><td></td><td>Q/D.F.</td><td>30pFmin.:Q≧1000
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Q≧400+20C
C:Nominal Capacitance (pF)</td><td><table><tr><td>Char</td><td>25V min.</td><td>16V</td><td>10V</td><td>6.3V</td><td>4V</td></tr><tr><td>R6
R7
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0.09 max. (C≧0.1μF)</td><td>0.07 max. (C<1.0μF)
0.09 max. (C≧1.0μF)</td><td>0.125 max.</td><td>0.15 max.</td><td>–</td></tr></table></td></tr>
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<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
<tr><td>16</td><td>Humidity Steady State</td><td colspan="2">The measured and observed characteristics shall satisfy the specifications in the following table.</td><td rowspan="5">Sit the capacitor at 40±2°C and 90 to 95% humiduty for 500±12 hours.
Remove and let sit for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.</td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects.</td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±5% or ±0.5pF (Whichever is larger)</td><td>R6,R7,C8:Within ±12.5%
E4,F5:Within ±30%</td></tr>
<tr><td></td><td>Q/D.F.</td><td>30pF and over:Q≧350
10pF and over, 30pF and below:
Q≧275+ $\frac{5}{2}$ C
10pF and below:
Q≧200+10C
C:Nominal Capacitance(pF)</td><td><table><tr><td>Char.</td><td>25V min.</td><td>16V</td><td>10V</td><td>6.3V</td><td>4V</td></tr><tr><td>R6
R7
C8</td><td>0.05 max.</td><td>0.05 max.</td><td>0.05 max.</td><td>0.075max. (C<3.3μF)
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0.125 max. (C≧1.0μF)</td><td>0.15 max.</td><td>0.2 max.</td><td>–</td></tr></table></td></tr>
<tr><td></td><td>I.R.</td><td colspan="2">More than 1,000MΩor 50Ω·F(Whichever is smaller)</td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
<tr><td>17</td><td>Humidity Load</td><td colspan="2">The measured and observed characteristics shall satisfy the specifications in the following table.</td><td rowspan="5">Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours.
Remove and let sit for 24±2 hours(temperature compensating type) or 48±4 hours (high dielectric constant type) at room temprature, then muasure.
The charge/discharge current is less than 50mA.

·Initial measurement for F5/16Vmax.
Apply the rated DC voltage for 1 hour at 40±2°C .
Remove and let sit for 48±4 hours at room temperature.
Perform initial measurement.</td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects.</td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±7.5% or ±0.75pF (Whichever is larger)</td><td>R6,R7,C8:Within ±12.5%
E4:Within ±30%
F5:Within ±30% (W.V.>10V)
F5:Within +30/-40% (W.V.≦10V)</td></tr>
<tr><td></td><td>Q/D.F.</td><td>30pF and over:Q≧200
30pF and below:
Q≧100 + $\frac{10}{3}$ C
C:Nominal Capacitance(pF)</td><td><table><tr><td>Char.</td><td>25V min.</td><td>16V</td><td>10V</td><td>6.3V</td><td>4V</td></tr><tr><td>R6
R7
C8</td><td>0.05 max.</td><td>0.05 max.</td><td>0.05 max.</td><td>0.075max. (C<3.3μF)
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0.125 max. (C≧0.1μF)</td><td>0.1 max. (C<1.0μF)
0.125 max. (C≧1.0μF)</td><td>0.15 max.</td><td>0.2 max.</td><td>–</td></tr></table></td></tr>
<tr><td></td><td>I.R.</td><td colspan="2">More than 500MΩor 25Ω·F(Whichever is smaller)</td></tr>
<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
</table>

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specification</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td>18</td><td colspan="2">High Temperature Load</td><td colspan="2">The measured and observed characteristics shall satisfy the specifications in the following table.</td><td rowspan="5">Apply 200% of the rated voltage for 1000±12 hours at the maximun operating temperature ±3°C . Let sit for 24±2 hours(temperature compensating type) or 48±4 hours(high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA.

·Initial measurement for high dielectric constant type.
Apply 200% of the rated DC voltage for one hour at the maximun operating temperature ±3°C . Remove and let sit for 48±4 hours at room temperature.Perform initial measurement.</td></tr>
<tr><td></td><td>Appearance</td><td colspan="2">No marking defects.</td></tr>
<tr><td></td><td>Capacitance Change</td><td>Within ±3% or ±0.3pF (Whichever is larger)</td><td>R6,R7,C8:Within ±12.5%
E4:Within ±30%
F5:Within±30% (Cap<1.0≧μF)
F5:Within +30/-40% (Cap≧1.0μF)</td></tr>
<tr><td></td><td>Q/D.F.</td><td>30pF and over:Q≧350
10pF and over,
30pF and below:
Q≧275+ 5/2 C

10pF and below:
Q≧200+10C
C:Nominal Capacitance(pF)</td><td>
<table>
<tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th><th>6.3V</th><th>4V</th></tr>
<tr><td>R6
R7
C8</td><td>0.05 max.</td><td>0.05 max.</td><td>0.05 max.</td><td colspan="2">0.075max. (C<3.3μF)
0.125max. (C≧3.3μF)</td></tr>
<tr><td>E4</td><td>0.05 max.</td><td>–</td><td>–</td><td colspan="2">–</td></tr>
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<tr><td></td><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
</table>

Table A-1

Char.	Nominal Values (ppm/°C) Note 1	Capacitance Change from 25 °C (%)					
		-55		-30		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
6C	0± 60	0.87	-0.48	0.59	-0.33	0.38	-0.21
6P	-150± 60	2.33	0.72	1.61	0.50	1.02	0.32
6R	-220± 60	3.02	1.28	2.08	0.88	1.32	0.56
6S	-330± 60	4.09	2.16	2.81	1.49	1.79	0.95
6T	-470± 60	5.46	3.28	3.75	2.26	2.39	1.44
7U	-750±120	8.78	5.04	6.04	3.47	3.84	2.21
1X	+350~-1000	—	—	—	—	—	—

Note 1:Nominal values denote the temperature coefficient within a range of 25 °C to 125°C (for△C)/85°C (for other TC).