muRata

Messrs.

Specification No.： JEMCG0-002637

Product Specification

Issued Date： 9 Feb. 2009

Part Description： Chip Monolithic Ceramic Capacitor

Customer Part No.：

MURATA Part No.： GRM Series (Temperature Compensating Type)

Technical Dept.

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CHIP MONOLITHIC CERAMIC CAPACITOR GRM SERIES

1.SCOPE

This product specification is applied to CHIP MONOLITHIC CERAMIC CAPACITOR used for General Electronic equipment.

2.MURATA PART NO. SYSTEM

2.1 NEW PART NO.

(EX.)	GRM	188	R7	1H	102	K	---	D
	①	②	③	④	⑤	⑥	⑦	⑧

①Type : According to 3.1

②Dimensions : According to 3.1

③Temperature Characteristics : According to 3.2

④DC Rated Voltage : According to 3.3

⑤Nominal Capacitance : According to 3.4

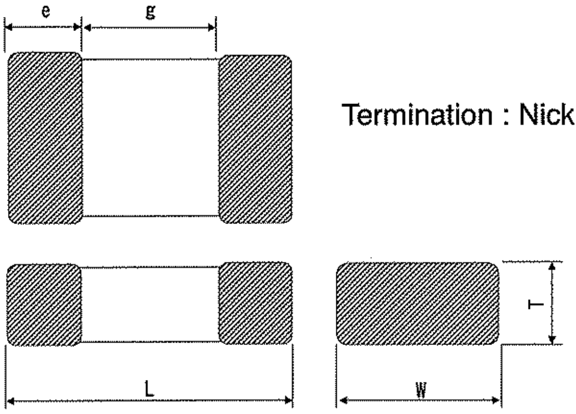
⑥Capacitance Tolerance : According to 3.5

⑦Murata's Control : Murata's Control Code

⑧Packaging Code : According to 3.6

3.TYPE

3.1 TYPE & DIMENSIONS



Termination : Nickel plated barrier layer
GRM: Tin plated

(Unit : mm)

TYPE		L	W	T	e	g
GRM033		0.6+/-0.03	0.3+/-0.03	0.3+/-0.03	0.1 ~ 0.2	0.2 min.
GRM155		1.0+/-0.05	0.5+/-0.05	0.5+/-0.05	0.15 ~ 0.35	0.3 min.
GRM18	5	1.6+/-0.1	0.8 +/-0.1	0.5+0/-0.1	0.2 ~ 0.5	0.5 min.
	8			0.8+/-0.1		
GRM21	6	2.0+/-0.1	1.25+/-0.1	0.6+/-0.1	0.2 ~ 0.7	0.7 min.
	9			0.85+/-0.1		
	A			1.0+0/-0.2		
	B			1.25+/-0.1		
GRM31	6	3.2+/-0.15	1.6 +/-0.15	0.6+/-0.1	0.3 ~ 0.8	1.5 min.
	9			0.85+/-0.1		
	M			1.15+/-0.1		
	C	3.2+/-0.2	1.6 +/-0.2	1.6+/-0.2		
GRM32	9	3.2+/-0.3	2.5 +/-0.2	0.85+/-0.1	0.3 min.	1.0 min.
	M			1.15+/-0.1		
	N			1.35+/-0.15		
	C			1.6+/-0.2		
	R			1.8+/-0.2		
	D			2.0+/-0.2		
	E			2.5+/-0.2		
GRM43	N	4.5+/-0.4	3.2 +/-0.3	1.35+/-0.15	0.3 min.	2.0 min
	C			1.6+/-0.2		
	R			1.8+/-0.2		
	D			2.0+/-0.2		
	E			2.5+/-0.2		
GRM55	N	5.7+/-0.4	5.0 +/-0.4	1.35+/-0.15	0.3 min.	2.0 min.
	C			1.6+/-0.2		
	R			1.8+/-0.2		
	D			2.0+/-0.2		
	E			2.5+/-0.2		

1.Thickness dimensions(T) : According to appendix.
2.GRM18 Series Bulk case packaging is L:1.6+/-0.07mm, W/T:0.8+/-0.07mm.
3.GRM21 Series R6 0J 335/475K is L:2.0+/-0.15mm, W/T:1.25+/-0.15mm.
4.GRM31 Series R7 1C 105/155/225K, R6 0J 475K, GRM319R61A335K are L:3.2+/-0.2mm, W:1.6+/-0.2 mm.
5.GRM31 Series R7 1E 225K, R7 2A 474/684K are L:3.2+/-0.2mm, W:1.6+/-0.2mm, T:1.15+/-0.15mm.

3.2 TEMPERATURE CHARACTERISTICS

(1)Temperature Compensating Type

Code	Temp. Range	Temp. coeff.(ppm/°C)
5C	-55 ~125°C	0 +/-30
6C		0 +/-60
6P	-55 ~ 85°C	-150 +/-60
6R		-220 +/-60
6S		-330 +/-60
6T		-470 +/-60
7U		-750 +/-120
1X	20 ~ 85°C	+350 ~ -1000

(2)High Dielectric Constant Type

Code	Cap. Change(Within%)	Temp. Range	Standard Temp.
R7	+/-15	-55 ~ 125°C	25°C
R6	+/-15	-55 ~ 85°C	
F5	+22/-82	-30 ~ 85°C	

3.3 DC RATED VOLTAGE

Code	0J	1A	1C	1E	1H	2A
DC Rated voltage	6.3V	10V	16V	25V	50V	100V

3.4 NOMINAL CAPACITANCE

Nominal Capacitance shall be expressed by three digits. The first two digits represents significant figures. The last specifies the number of zero to follow. The letter R is used as the decimal point. According to appendix.

(EX.)

Code	Capacitance
R50	0.5pF
5R0	5.0pF
220	22pF
221	220pF

3.5 CAPACITANCE TOLERANCE

Code	Type	Temperature Characteristics	Capacitance Tolerance		Capacitance Step
C	Temperature Compensating Type	ΔC to ΔX	< 10pF	+/-0.25pF	0.5,1,2,3,4,5(pF)
D				+/-0.5pF	6,7,8,9(pF)
J			≧10pF	+/-5%	E12 Step
K	High Dielectric Constant Type	R6/R7	+/-10%		E6 Step
Z		F5	+80/-20%		E3 Step

*E24 step is also available for GRM03/15,GRM18 1 to 9.1pF.

E Step

E24	1.	1.1	1.2	1.3	1.5	1.6	1.8	2	2.2	2.4	2.7	3	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
E12	1		1.2		1.5		1.8		2.2		2.7		3.3		3.9		4.7		5.6		6.8		8.2	
E6	1				1.5				2.2				3.3				4.7				6.8			
E3	1								2.2								4.7							

3.6 PACKAGING

Packaging is the following method. According to Packaging Methods.

Packaging Code	Specification	Packaging Unit
B	Bulk Packaging in a bag	1000pcs./bag (Only GRM43S,GRM55E/F:500pcs./bag)
D	ϕ178 Paper Tape Carrier Packaging	According to Capacitance Value and Tolerance
L	ϕ178 Plastic Tape Carrier Packaging	
E	ϕ178 Special Packaging	
J	ϕ 330 Paper Tape Carrier Packaging	
K	ϕ330 Plastic Tape Carrier Packaging	
F	ϕ330 Special Packaging	
C	Bulk Case Packaging	

4.SPECIFICATIONS

According to Specifications and Test Methods.

Appendix 1. CAPACITANCE VALUE AND TOLERANCE 50V max.
<Temperature Compensating Type>

Type	DC RATED VOLTAGE (V)	T		Temperature Characteristics and Capacitance (pF)								ϕ178 Packaging Unit (pcs./Reel)
		Code	Thickness (mm)	5C	6C	6P	6R	6S	6T	7U	1X	
GRM03	50	3	0.3+/-0.03	0.1 ~ 100	–	–	–	–	–	1 ~ 15	–	15000
	25			0.5 ~ 100	–	–	1 ~ 100	1 ~ 100	1 ~ 100	18 ~ 100	–	
GRM15	50	5	0.5+/-0.05	0.1 ~ 1000	–	3 ~ 27	3 ~ 33	3 ~ 39	3 ~ 100	0.2 ~ 180	0.2 ~ 180	10000
	25			–	–	–	–	–	–	–	220 ~ 390	
	10			–	–	–	–	–	–	1200 ~ 4700	1200 ~ 4700	
GRM18	50	8	0.8+/-0.1	0.5 ~ 3900	–	3 ~ 150	3 ~ 180	3 ~ 220	3 ~ 470	3 ~ 680 1000 ~ 10000	3 ~ 680 1000 ~ 10000	4000
	25			–	–	–	–	–	–	–	820 ~ 1500	
	10	5	0.5+0/-0.1	–	–	–	–	–	–	5600 ~ 10000	5600 ~ 10000	
		8	0.8+/-0.1	–	–	–	–	–	–	12000 ~ 22000	12000 ~ 22000	
GRM21	50	6	0.6+/-0.1	3300 ~ 4700	–	–	–	–	–	3 ~ 1200 10000 ~ 18000	3 ~ 1200 10000 ~ 18000	4000
		9	0.85+/-0.1	5600 ~ 15000	–	180 ~ 330	220 ~ 470	270 ~ 470	–	1500 ~ 2200 22000 ~ 27000	1500 ~ 2200 22000 ~ 27000	
		A	1.0+0/-0. 2	–	–	–	–	–	–	33000	33000	3000
		B	1.25+/-0.1	18000 ~ 22000	–	390 ~ 560	560 ~ 680	560 ~ 820	560 ~ 1800	2700 ~ 3300 39000 ~ 47000	2700 ~ 3300 39000 ~ 47000	3000
	10	6	0.6+/-0.1	–	–	–	–	–	–	27000 ~ 33000	27000 ~ 33000	4000
		9	0.85+/-0.1	–	–	–	–	–	–	39000 ~ 56000	39000 ~ 56000	
		B	1.25+/-0.1	–	–	–	–	–	–	68000 ~ 100000	68000 ~ 100000	3000
GRM31	50	6	0.6+/-0.1	–	–	–	–	–	–	220 ~ 1800	220 ~ 1800	4000
		9	0.85+/-0.1	12000 ~ 39000	–	680 ~ 820	820	1000	–	2200 ~ 5600 56000	2200 ~ 5600 56000	
		M	1.15+/-0.1	47000 ~ 56000	–	1000 ~ 1500	1000 ~ 1500	1200 ~ 1800	2200 ~ 3900	6800 ~ 8200 68000 ~ 100000	6800 ~ 8200 68000 ~ 100000	3000
		C	1.6+/-0.2	68000 ~ 100000	–	–	–	–	–	–	–	2000
	25	9	0.85+/-0.1	10000		–	–	–	–	–	–	3000
		C	1.6+/-0. 2	100000	–	–	–	–	–	–	–	2000
Capacitance Tolerance			(0.5 to 5.0pF) C:+/-0.25pF			(5.1 to 9.1pF) D:+/-0.5pF			(More than10pF) J:+/-5%			

1 : Inner electrode : Nickel , Palladium or Silver/Palladium

Appendix 2. CAPACITANCE VALUE AND TOLERANCE 50V max.
<High Dielectric Constant Type>

Not Apply.

Appendix 3. CAPACITANCE VALUE AND TOLERANCE (100V)

Type	DC RATED VOLTAGE (V)	T		Temperature Characteristics and Capacitance (pF)		ϕ178 Packag-ing Unit (pcs/Reel)
				Temperature Compensating Type		
		Code	Thickness (mm)	5C	1X	
GRM15	100	5	0.5+/-0.05	–	–	10000
GRM18	100	8	0.8+/-0.1	0.5 ~ 1500	0.5 ~ 390	4000
GRM21	100	6	0.6+/-0.1	100 ~ 3300	–	4000
		9	0.85+/-0.1	1 ~ 82	470 ~ 680	
		B	1.25+/-0.1	–	820 ~ 1800	3000
GRM31	100	9	0.85+/-0.1	1800 ~ 10000	–	4000
		M	1.15+/-0.1	–	2200 ~ 4700	3000
			1.15+/-0.15	–	–	
		C	1.6+/-0.2	–	–	2000
GRM32	100	N	1.35+/-0.15	–	5600 ~ 6800	2000
		C	1.6+/-0.2	–	–	
		D	2.0+/-0.2	–	–	1000
		E	2.5+/-0.2	–	–	
GRM43	100	N	1.35+/-0.15	–	8200	1000
		C	1.6+/-0.2	–	–	
		R	1.8+/-0.2	–	10000 ~ 15000	
		D	2.0+/-0.2	–	–	
		E	2.5+/-0.2	–	–	500
GRM55	100	M	1.15+/-0.1	–	18000	1000
		N	1.35+/-0.15	–	22000	
		R	1.8+/-0.2	–	27000 ~ 39000	
		D	2.0+/-0.2	–	–	
		E	2.5+/-0.2	–	–	500
Capacitance Tolerance				(1 ~ 5.0pF) C:+/-0.25pF (5.1 ~ 9.1pF) D:+/-0.5pF (More than10pF) J:+/-5%		

1 : Inner electrode : Nickel , Palladium , or Silver/Palladium.

■SPECIFICATIONS AND TEST METHODS

<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>1</td><td colspan="2">Operating Temperature Range</td><td>-55°C to +125°C</td><td>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 L8/R9 : -55°C to +150°C</td><td>Reference Temperature : 25°C</td></tr>
<tr><td>2</td><td colspan="2">Rated Voltage</td><td colspan="2">See the previous pages</td><td>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, should be maintained within the rated voltage range.</td></tr>
<tr><td>3</td><td colspan="2">Appearance</td><td colspan="2">No defects or abnormalities</td><td>Visual inspection.</td></tr>
<tr><td>4</td><td colspan="2">Dimension</td><td colspan="2">Within the specified dimensions</td><td>Using calipers or Microscope. (GRM02 size is based on Microscope)</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td colspan="2">No defects or abnormalities</td><td>No failure should 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.</td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance</td><td colspan="2">More than 10,000MΩ or 500Ω·F
(whichever is smaller)</td><td>The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max. and within 2 minutes of charging.</td></tr>
<tr><td>7</td><td colspan="2">Capacitance</td><td colspan="2">Within the specified tolerance</td><td rowspan="2">The capacitance/Q/D.F. should be measured at 25°C at the frequency and voltage shown in the table.
<table>
<tr><th>Char.
Item</th><th>ΔC
to 7U,1X
(1000pF and below)</th><th>ΔC
to 7U,1X
(more than 1000pF)
R6,R7,C8,F5
(C ≦10μF)</th><th>R6,R7,F5
(C>10μF)</th><th>E4</th></tr>
<tr><td>Frequency</td><td>1±0.1MHz</td><td>1±0.1kHz</td><td>120±24Hz</td><td>1±0.1kHz</td></tr>
<tr><td>Voltage</td><td>0.5 to 5Vrms</td><td>1±0.2Vrms</td><td>0.5±0.1Vrms</td><td>0.5±0.05Vrms</td></tr>
</table></td></tr>
<tr><td>8</td><td colspan="2">Q/
Dissipation Factor (D.F.)</td><td>30pF and over :
Q ≧ 1000

30pF and below :
Q ≧ 400+20C

C:Nominal Capacitance (pF)</td><td>[R6,R7,C8,L8]
W.V.:100V : 0.025max.(C < 0. 068μF)
: 0.05max.(C≧ 0.068μF)
W.V.:25/50V :0.025max.
W.V.:16/10V :0.035max.
W.V.:6.3V/4V :0.05max. (C < 3.3μF)
:0.1max.(C ≧ 3.3μF)
[R9]W.V.:50V: 0.05max.
[E4] W.V.:25Vmin :0.025max.
[F5] W.V.:25Vmin.
:0.05max. (C < 0.1μF) :0.09max. (C ≧ 0.1μF)
W.V.:16/10V:0.125max. W.V.:6.3V:0.15max.</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Capacitance Temperature Character-istics</td><td>Capacitance Change</td><td>Within the specified tolerance.
(Table A -1)</td><td>
<table>
<tr><th>Char.</th><th>Temp. Range</th><th>Reference Temp.</th><th>Cap. Change</th></tr>
<tr><td>R6</td><td>-55°C to +85°C</td><td rowspan="8">25°C</td><td>Within ±15%</td></tr>
<tr><td>R7</td><td>-55°C to +125°C</td><td>Within ±15%</td></tr>
<tr><td>C8</td><td>-55°C to +105°C</td><td>Within ±22%</td></tr>
<tr><td rowspan="2">L8</td><td>-55°C to +125°C</td><td>Within ±15%</td></tr>
<tr><td>+125°C to+150°C</td><td>Within+15/-40%</td></tr>
<tr><td>R9</td><td>-55°C to+150°C</td><td>Within ±15%</td></tr>
<tr><td>E4</td><td>+10°C to +85°C</td><td>Within+22/-56%</td></tr>
<tr><td>F5</td><td>-30°C to +85°C</td><td>Within+22/-82%</td></tr>
</table></td><td rowspan="3">The capacitance change should 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 should 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.
<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(forΔC to 7U/1X/R6/R7/C8/L8/R9)
-30±3(for F5), 10±3(for E4)</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>150±3(for R9),125±3(for ΔC/R7),
105±3(for C8),85±3(for other TC)</td></tr>
<tr><td>5</td><td>25±2</td></tr>
</table>
(2) High Dielectric Constant Type
The ranges of capacitance change compared with the 25°C value over the temperature ranges shown in the table should 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 24±2 hours at room temperature.
Perform the initial measurement.</td></tr>
<tr><td>Temperature Coefficent</td><td>Within the specified tolerance.
(Table A -1)</td><td rowspan="2"></td></tr>
<tr><td>Capacitance Drift</td><td>Within ±0.2% or ±0.05 pF
(Whichever is larger.)
*Not apply to 1X/25V</td></tr>
<tr><td>10</td><td colspan="2">Adhesive Strength of Termination</td><td colspan="2">No removal of the terminations or other defect should occur.

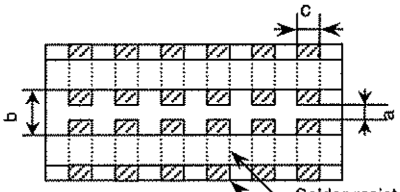



Fig.1</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig.1 using a eutectic solder. Then apply *10N force in parallel with the test jig for 10±1sec.
The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock
*5N (GR□15, GRM18)
2N (GR□03),1N(GR□02)
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>GR□02</td><td>0.2</td><td>0.56</td><td>0.23</td></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>
</table>

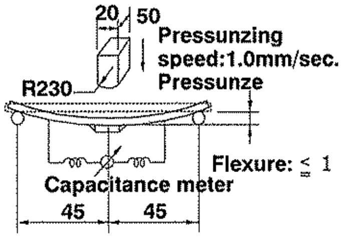
<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specification</th><th rowspan="2">Test Method</th></tr>
<tr><th>Temperature Compensating Type</th><th>High Dielectric Type</th></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td colspan="2">No defects or abnormalities</td><td rowspan="3">Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as(10). 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 3 mutually perpendicular directions(total of 6 hours).</td></tr>
<tr><td>Capacitance</td><td colspan="2">Within the specified tolerance</td></tr>
<tr><td>Q/D.F.</td><td>30pF and over:Q≧1000
30pF and below:
Q≧400+20C
C:Nominal
Capacitance (pF)</td><td>[R6,R7,C8,L8]
W.V.:100V : 0.025max. (C < 0. 068μF)
: 0.05max.(C≧ 0.068μF)
W.V.:25/50V :0.025max.
W.V.:16/10V :0.035max.
W.V.:6.3V/4V :0.05max. (C < 3.3μF)
:0.1max.(C≧3.3μF)
[R9]W.V.:50V: 0.05max.
[E4] W.V.:25Vmin. :0.025max
[F5] W.V.:25Vmin.
:0.05max. (C < 0.1μF) :0.09max.(C≧0.1μF)
W.V.:16/10V:0.125max. W.V.:6.3V:0.15max.</td></tr>
<tr><td>12</td><td colspan="2">Deflection</td><td colspan="2">No crack or marked defect should occur


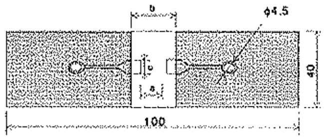
Fig.3</td><td>Solder the capacitor on the test jig (glass epoxy board) shown in Fig.2 using a eutectic solder. Then apply a force in the direction shown in Fig 3 for 5±1sec. The soldering should be done by the reflow method and should be conducted with care so that the soldering is uniform and free of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


Fig.2
t : 1.6mm
(GR□02/03,GR□15:0.8mm)
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GR□02</td><td>0.2</td><td>0.56</td><td>0.23</td></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 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.</td></tr>
<tr><td rowspan="6">14</td><td rowspan="6">Resistance to Soldering Heat</td><td></td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table</td><td rowspan="6">Preheat the capacitor at *120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder solution* 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.
*Not apply to GRM02

· 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.

*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>Appearance</td><td colspan="2">No defects or abnormalities</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</td><td>R6,R7,C8,L8,R9:Within ±7.5%
E4,F5:Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>30pF and over:Q≧1000
30pF and below:
Q≧ 400+20C
C:Nominal
Capacitance (pF)</td><td>[R6,R7,C8,L8]
W.V.:100V : 0.025max.(C < 0. 068μF)
: 0.05max. (C≧ 0.068μF)
W.V.:25/50V :0.025max.
W.V.:16/10V :0.035max.
W.V.:6.3V/4V :0.05max.(C < 3.3μF)
:0.1max.(C≧ 3.3μF)
[R9]W.V.:50V: 0.05max.
[E4] W.V.:25Vmin :0.025max
[F5] W.V.:25Vmin
:0.05max. (C < 0.1μF) :0.09max. (C≧ 0.1μF)
W.V.:16/10V:0.125max. W.V.:6.3V:0.15max.</td></tr>
<tr><td>I.R.</td><td colspan="2">More than 10,000MΩor 500Ω·F(Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No defects</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 rowspan="6">15</td><td rowspan="6">Temperature Cycle</td><td></td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table</td><td rowspan="6">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
<table>
<tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></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 set at room temperature for 24±2 hours. Perform the initial measurement</td></tr>
<tr><td>Appearance</td><td colspan="2">No defects or abnormalities</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</td><td>R6,R7,C8,L8,R9:Within ±7.5%
E4,F5:Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>30pF and over:Q≧1000
30pF and below:
Q≧400+20C
C:Nominal Capacitance (pF)</td><td>[R6,R7,C8,L8]
W.V.:100V : 0.025max. (C < 0. 068μF)
: 0.05max.(C≧ 0.068μF)
W.V.:25/50V :0.025max.
W.V.:16/10V :0.035max.
W.V.:6.3V/4V :0.05max. (C < 3.3μF)
:0.1max. (C≧ 3.3μF)
[R9]W.V.:50V: 0.05max.
[E4] W.V.:25Vmin. :0.025max
[F5] W.V.:25Vmin.
:0.05max. (C < 0.1μF) :0.09max.(C≧ 0.1μF)
W.V.:16/10V:0.125max. W.V.:6.3V:0.15max.</td></tr>
<tr><td>I.R.</td><td colspan="2">More than 10,000MΩor 500Ω·F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No defects</td></tr>
<tr><td rowspan="6">16</td><td rowspan="6">Humidity Steady State</td><td></td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table</td><td rowspan="6">Set the capacitor at 40±2°C and in 90 to 95% humiduty for 500±12 hours.
Remove and set for 24±2 hours at room temperature, then measure.</td></tr>
<tr><td>Appearance</td><td colspan="2">No defects or abnormalities</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF
(Whichever is larger)</td><td>R6,R7,C8,L8,R9:Within ±12.5%
E4,F5:Within ±30%</td></tr>
<tr><td>Q/D.F.</td><td>30pF and over:Q≧350
10pF and over,
30pF and below:
$Q \geqq 275 + \frac{5}{2} C$
10pF and below:
Q≧200+10C
C:Nominal Capacitance(pF)</td><td>[R6,R7,C8,L8]
W.V.:100V : 0.05max. (C < 0.068μF)
: 0.075max. (C≧ 0.068μF)
W.V.:25/50V :0.05max.
W.V.:16/10V :0.05max.
W.V.:6.3V/4V:0.075max. (C <3.3μF)
:0.125max. (C≧ 3.3μF)
[R9]W.V.:50V: 0.075max.
[E4] W.V.:25Vmin.:0.05max.
[F5] W.V.:25Vmin.
:0.075max. (C< 0.1μF) :0.125max. (C≧ 0.1μF)
W.V.:16/10V:0.15max. W.V.:6.3V:0.2max.</td></tr>
<tr><td>I.R.</td><td colspan="2">More than 1,000MΩor 50Ω·F(Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No defects</td></tr>
<tr><td rowspan="6">17</td><td rowspan="6">Humidity Load</td><td></td><td colspan="2">The measured and observed characteristics should satisfy the specifications in the following table</td><td rowspan="6">Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours.
Remove and set for 24±2 hours at room temprature, then measure.
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 set for 24±2 hours at room temperature.
Perform initial measurement.</td></tr>
<tr><td>Appearance</td><td colspan="2">No defects or abnormalities</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5% or ±0.75pF
(Whichever is larger)</td><td>R6,R7,C8,L8,R9:Within ±12.5%
E4:Within ±30%
F5:Within ±30% (W.V.>10V)
F5:Within +30/-40% (W.V.≦10V)</td></tr>
<tr><td>Q/D.F.</td><td>30pF and over:Q≧200
30pF and below:
$Q \geqq 100 + \frac{10}{3} C$
C:Nominal Capacitance(pF)</td><td>[R6,R7,C8,L8]
W.V.:100V : 0.05max. (C < 0.068μF)
: 0.075max. (C≧ 0.068μF)
W.V.:25/50V :0.05max.
W.V.:16/10V :0.05max.
W.V.:6.3V/4V:0.075max. (C <3.3μF)
:0.125max. (C≧ 3.3μF)
[R9]W.V.:50V: 0.075max.
[E4] W.V.:25Vmin.:0.05max.
[F5] W.V.:25Vmin.
:0.075max. (C< 0.1μF) :0.125max. (C≧ 0.1μF)
W.V.:16/10V:0.15max. W.V.:6.3V:0.2max.</td></tr>
<tr><td>I.R.</td><td colspan="2">More than 500MΩor 25Ω·F(Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No defects</td></tr>
</table>

■SPECIFICATIONS AND TEST METHODS

No.	Item		Specification		Test Method
			Temperature Compensating Type	High Dielectric Type	
18	High Temperature Load		The measured and observed characteristics should satisfy the specifications in the following table		Apply 200% of the rated voltage at the maximun operating temperature ±3°C for 1000±12 hours . Set for 24±2 hours 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 at the maximun operating temperature ±3°C for one hour. Remove and set for 24±2 hours at room temperature.Perform initial measurement.
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	R6,R7,C8,L8,R9:Within ±12.5% E4:Within ±30% F5:Within±30% (Cap<1.0 ≧µF) F5:Within +30/-40% (Cap ≧ 1.0µF)	
		Q/D.F.	30pF and over:Q ≧ 350 10pF and over, 30pF and below: $Q \geqq 275+\frac{5}{2}C$ 10pF and below: Q ≧ 200+10C C:Nominal Capacitance(pF)	[R6,R7,C8,L8] W.V.:100V : 0.05max. (C < 0.068µF) : 0.075max. (C ≧ 0.068µF) W.V.:25/50V :0.05max. W.V.:16/10V :0.05max. W.V.:6.3V/4V:0.075max. (C < 3.3µF) :0.125max. (C ≧ 3.3µF) [R9]W.V.:50V: 0.075max. [E4] W.V.:25Vmin.:0.05max. [F5] W.V.:25Vmin. :0.075max. (C< 0.1µF) :0.125max.(C ≧ 0.1µF) W.V.:16/10V:0.15max. W.V.:6.3V:0.2max.	
		I.R.	More than 1,000MΩor 50Ω·F(Whichever is smaller)		
		Dielectric Strength	No defects		

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 (forΔC)/85°C (for other TC).

PACKAGING
GRM/F Type

There are three type of packaging for chip monolithic ceramic capacitor.
Please specify the packaging code.

1.Bulk Packaging(Packaging Code=B):In a bag.
Minimum Quantity : 1000(pcs./bag) , Only GR□43S, GR□55E/F : 500(pcs./bag)

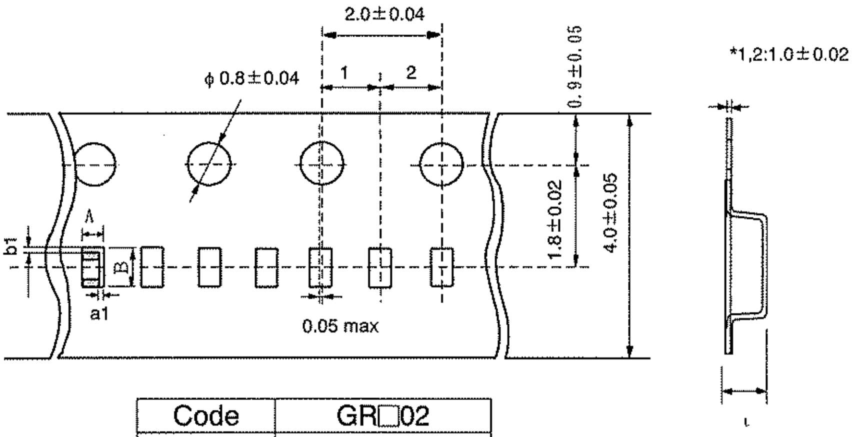
2.Tape Carrier Packaging(Packaging Code:D/E/F/L/J/K)

2.1 Minimum Quantity(pcs./reel)

Type		φ178 reel		φ330 reel	
		Paper Tape	Plastic Tape	Paper Tape	Plastic Tape
		Code:D/E	Code:L	Code:F/J	Code:K
GR□02		20000	40000		
GR□03		15000		50000	
GR□15		10000		50000	
GR□18		4000		10000	
GR□21	5/6/9	4000		10000	
	A/B		3000		10000
GR□31	6/9	4000		10000	
	M/X		3000		10000
	C		2000		6000
GR□32	5/6/9	4000		10000	
	A/M		3000		10000
	N		2000		8000
	C		2000		6000
	R/D/E		1000		4000
GR□43	M		1000		5000
	N/C/R		1000		4000
	D		1000		4000
	E		500		2000
	S		500		1500
GR□55	M		1000		5000
	N/C/R		1000		4000
	D		1000		4000
	E		500		
	F/X		300		1500

2.2 Dimensions of Tape

(1)GR□02 (Code:L)



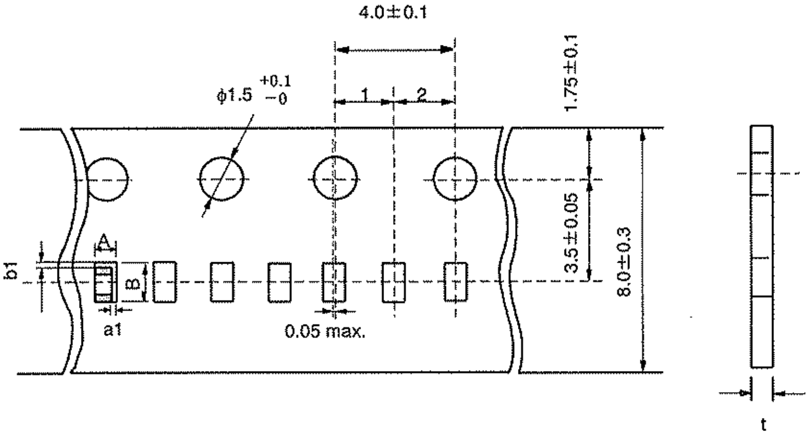
Code	GR□02
A *3	0.23
B *3	0.43
t	0.5 max.

*3 Nominal value

2.2 Dimensions of Tape

(in : mm)

(2)GR□02(Code:D)/03/15

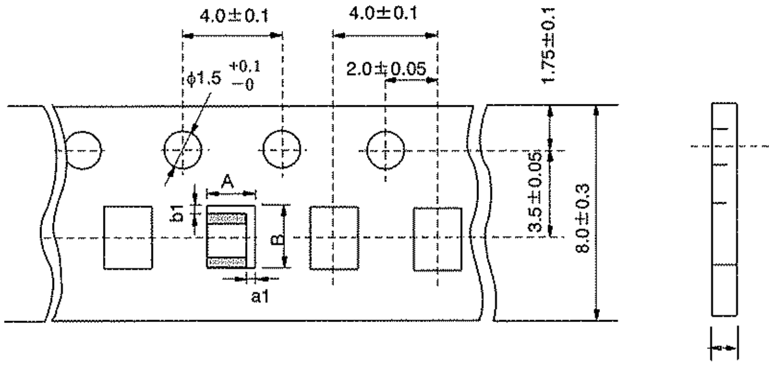


*1,2:2.0±0.05

Code	GR□02	GR□03	GR□15
A *3	0.25	0.37	0.65
B *3	0.45	0.67	1.15
a1,b1 *3			0.15
t	0.4 max.	0.5 max.	0.8 max.

*3 Nominal value

(3) GR□18/21/31/32 T:0.85 max.



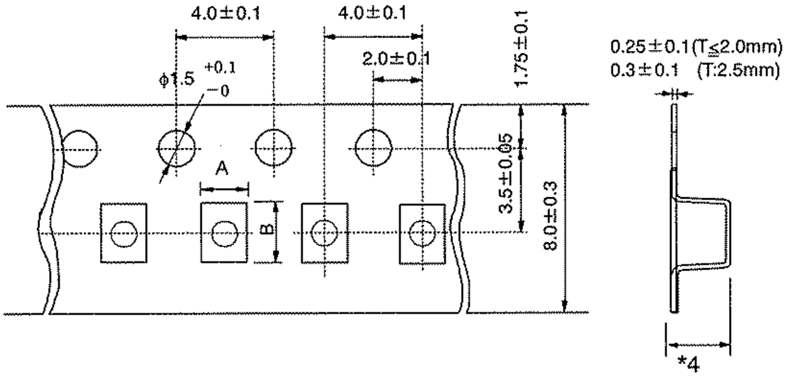
0.8 max (T=0.5mm)

1.1 max (T=0.85mm)

Code	GR□18	GR□21	GR□31	GR□32
A	1.05±0.1	1.55±0.15	2.0±0.2	2.8±0.2
B	1.85±0.1	2.3±0.15	3.6±0.2	3.6±0.2
a1,b1	0.25±0.2	0.4±0.2	0.4±0.2	0.4+0.3/-0.2

PACKAGING
GRM/F Type

(4) GR□21/31/32 T:1.0 min.

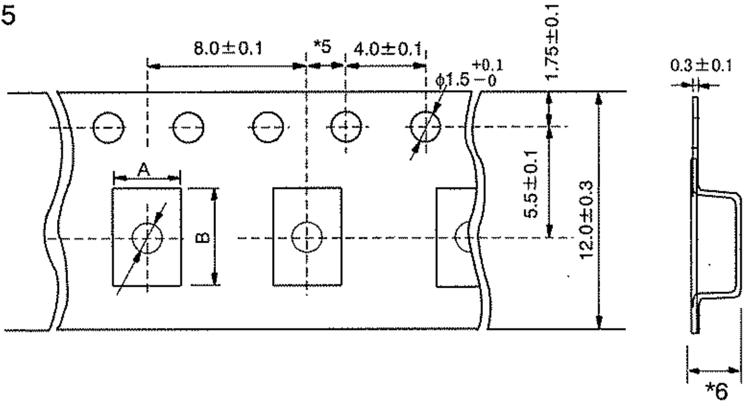


*4

1.7 max. (T ≦ 1.25mm)
2.5 max. (T:1.35/1.6mm)
3.0 max. (T:1.8/2.0mm)
3.7 max. (T ≧2.5mm)

Code	GR□21	GR□31	GR□32
A	1.45±0.2	1.9±0.2	2.8±0.2
B	2.25±0.2	3.5±0.2	3.5±0.2

(5) GR□43/55



*5 : 2.0±0.1

*6

2.5 max. (T≦1.8mm)
3.7 max. (T = 2.0/2.5mm)
4.7 max. (T≧2.8mm)

Code	GR□43	GR□55
A *7	3.6	5.2
B *7	4.9	6.1

*7Nominal value

PACKAGING
GRM/F Type

Fig.1 Package Chips

(in : mm)

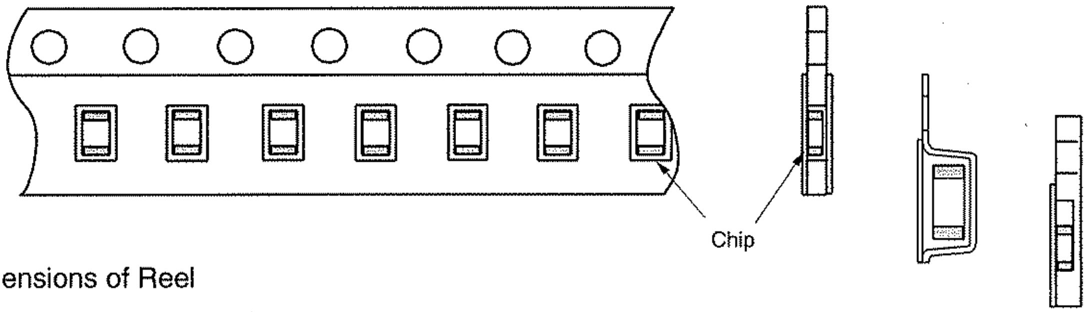
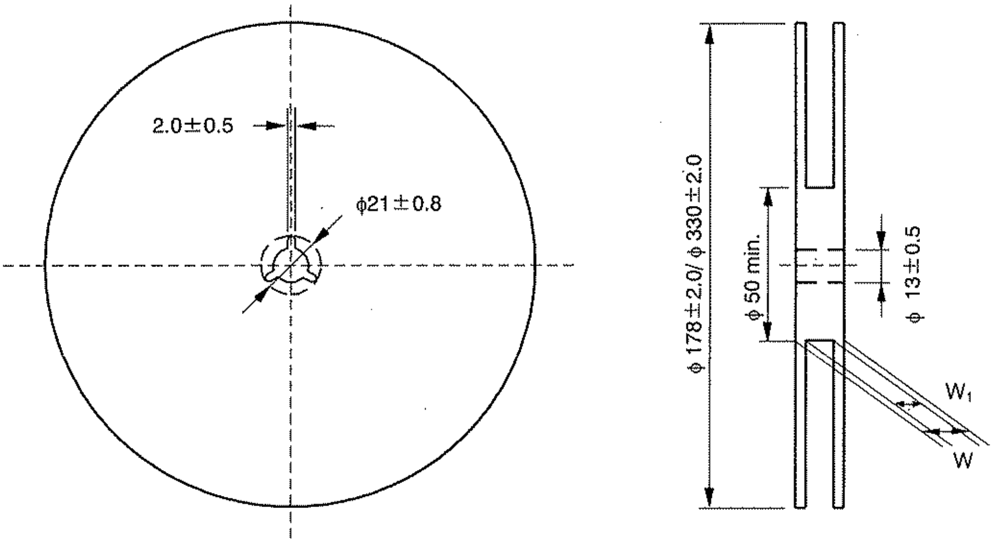
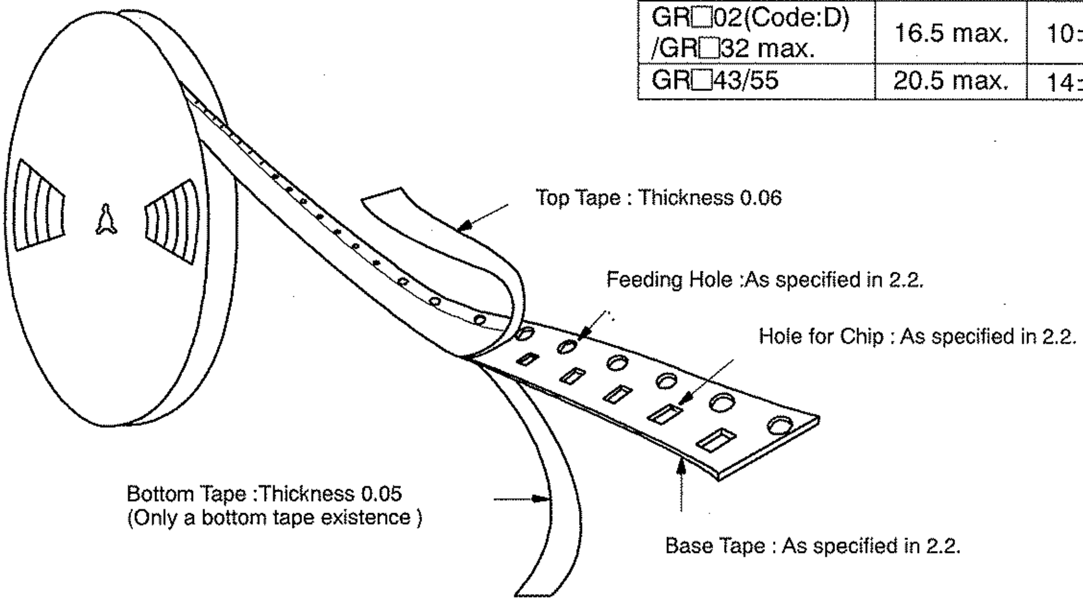


Fig.2 Dimensions of Reel



	W	W_1
GR□02(Code:L)	8.0 max	5±1.5
GR□02(Code:D) /GR□32 max.	16.5 max.	10±1.5
GR□43/55	20.5 max.	14±1.5

Fig.3 Taping Diagram


Top Tape : Thickness 0.06

Feeding Hole :As specified in 2.2.

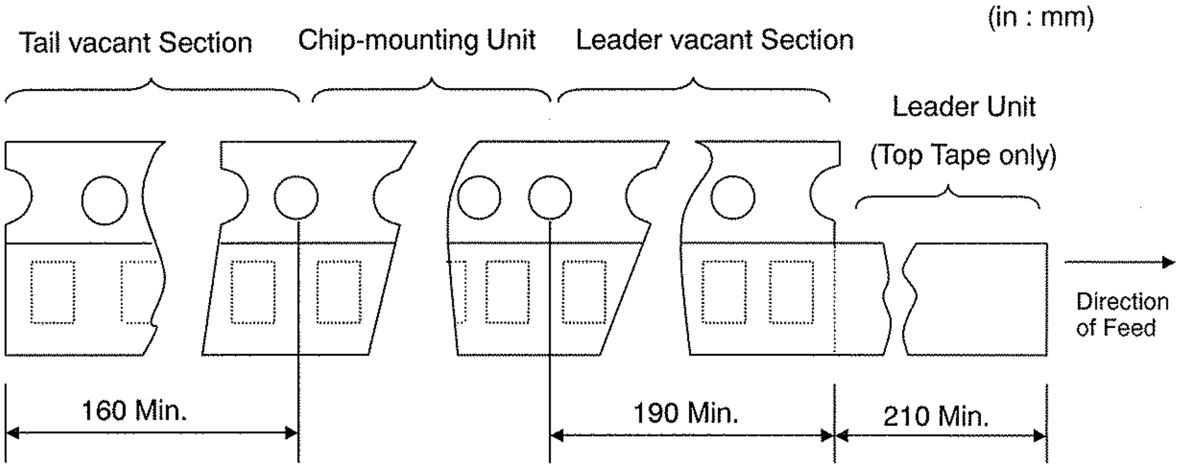
Hole for Chip : As specified in 2.2.

Bottom Tape :Thickness 0.05
(Only a bottom tape existence)

Base Tape : As specified in 2.2.

2.3 Tapes for capacitors are wound clockwise shown in Fig.3.
(The sprocket holes are to the right as the tape is pulled toward the user.)

2.4 Part of the leader and part of the vacant section are attached as follows.



2.5 Accumulate pitch : 10 of sprocket holes pitch = 40±0.3mm

2.6 Chip in the tape is enclosed by top tape and bottom tape as shown in Fig.1.

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

2.8 There are no jointing for top tape and bottom tape.

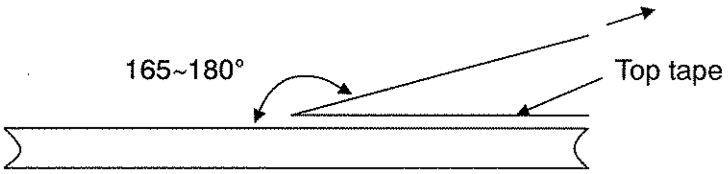
2.9 There are no fuzz in the cavity.

2.10 Break down force of top tape : 5N min.
Break down force of bottom tape : 5N min. (Only a bottom tape existence)

2.11 Reel is made by resin and appeaser and dimension is shown in Fig 2. There are possibly to change the material and dimension due to some impairment.

2.12 Peeling off force : 0.1 to 0.6N[*8] in the direction as shown below.

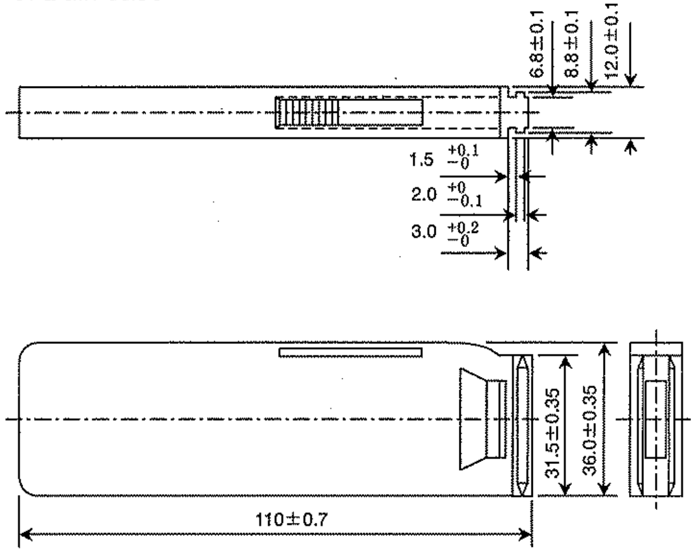
*8□GR□02,03:0.05N~0.5N



2.13 Label that show the customer parts number, our parts number, our company name, inspection number and quantity, will be put in outside of reel.

3.Bulk Case Packaging (Packaging Code=C)

Fig.4 Dimensions of Bulk case



3.1 Minimum Quantity(pcs./case)

GR□15		50000
GR□18		15000
GR□21	6	10000
	B	5000

3.2 Case is made by resin of transparence or semitransparency, and appeaser and dimension is shown in Fig.4.

There are possibility to change the material and dimension due to some impairment.

3.3 Case must be marked in Customer 's part number, MURATA part number, MURATA name, Inspection number and quantity(pcs).

⚠CAUTION

◆Limitation of use

Please contact our sales representatives or product engineers before using our products for the applications listed below which require of our products for other applications than specified in this product.

①Aircraft equipment ②Aerospace equipment ③Undersea equipment ④Power plant control equipment
⑤Medical equipment ⑥Transportation equipment(vehicles,trains,ships,etc.) ⑦Traffic signal equipment
⑧Disaster prevention / crime prevention equipment ⑨Data-processing equipment
⑩Application of similar complexity and/or requirements to the applications listed in the above

⚠CAUTION

◆Storage and Operating Conditions

1.Chip monolithic ceramic capacitors(chips) can experience degradation of termination solderability when subjected to high temperature or humidity, or if exposed to sulfur or chlorine gases. Storage environment must be at an ambient temperatureof 5-40 °C. and an ambient humidity of 20-70%RH. Use chip within 6 months. If 6 months or more have elapsed, check solderability before use. (Reference Data 1/ Solderability) Insulation Resistance should be deteriorated on specific condition of high humidity or incorrosion gas such as hydrogen sulfide, sulfurous acid gas,cholorine. Those condition are not suitable for use.

2.Use of Sn-Zn based solder will deteriorate reliability of MLCC. Please contact murata factory for the use of Sn-Zn based solder in advance.

3.Do not use under the condition that causes condensation.
Use dampproof countermeasure if using under the condition that causes condensation.

⚠CAUTION

◆Handling

1.Inspection

- Thrusting force of the test probe can flex the PCB, resulting in cracked chips or open solder joints. Provide support pins on the back side of the PCB to prevent warping or flexing.

2.Board Separation (or Depane-lization)

- Board flexing at the time of separation causes cracked chips or broken solder.
- Severity of stresses imposed on the chip at the time of board break is in the order of: Pushback<Slitter<V Slot<Perforator.
- Board separation must be performed using special jigs, not with hands.

3.Reel and bulk case

- In the handling of reel and case, please pay attention not to drop it. Please do not use chip of the case which dropped.

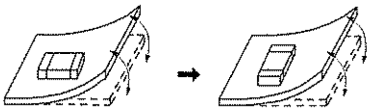
⚠CAUTION

◆Soldering and Mounting

1.Mounting Position

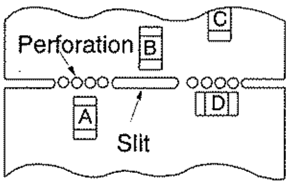
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

[Component direction]



Locate chip horizontal to the direction in which stress acts

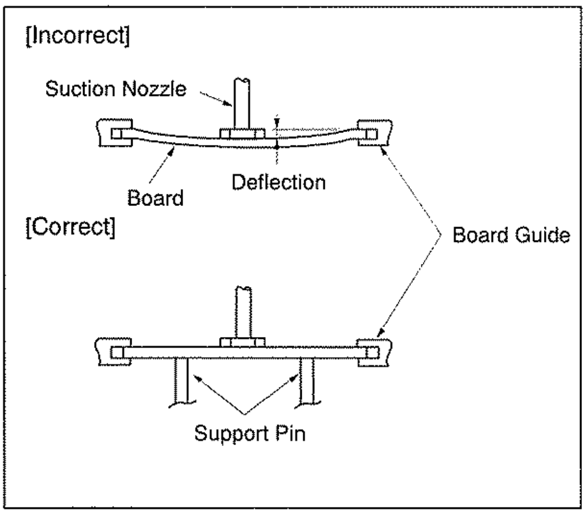
[Chip Mounting Close to Board Separation Point]



Chip arrangement
Worst A-C-(B,D) Best

2.Chip Placing

- An excessively low bottom dead point of the suction nozzle imposes great force on the chip during mounting, causing cracked chips. So adjust the suction nozzle's bottom dead point by correcting warp in the board.
  Normally, the suction nozzle's bottom dead point must be set on the upper surface of the board. Nozzle pressure for chip mounting must be a 1 to 3N static load.
- Dirt particles and dust accumulated between the suction nozzle and the cylinder inner wall prevent the nozzle from moving smoothly. This imposes great force on the chip during mounting, causing cracked chips. And the locating claw, when worn out, imposes uneven forces on the chip when positioning, causing cracked chips. The suction nozzle and the locating claw must be maintained, checked and replaced periodically.



3.Caution for Soldering

(1)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
GR□02/03/15 GR□18/21/31	Δ T ≦ 190°C
GR□32/43/55	Δ T ≦ 130°C

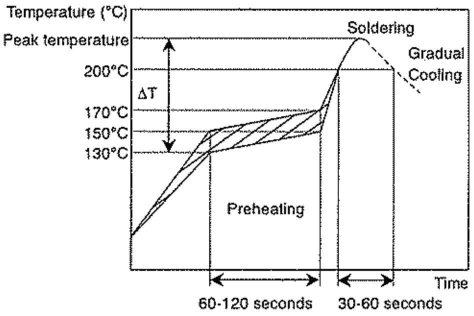
Recommended Conditions

	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

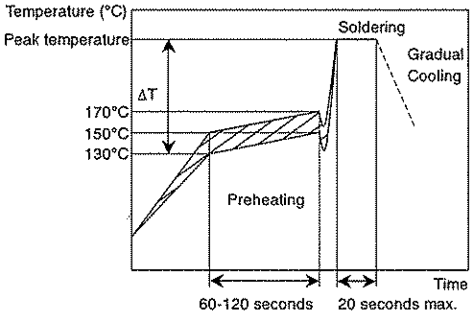
Pb-Sn Solder: Sn-37Pb
Lead Free Solder: Sn-3.0Ag-0.5Cu

[Standard Conditions for Reflow Soldering]

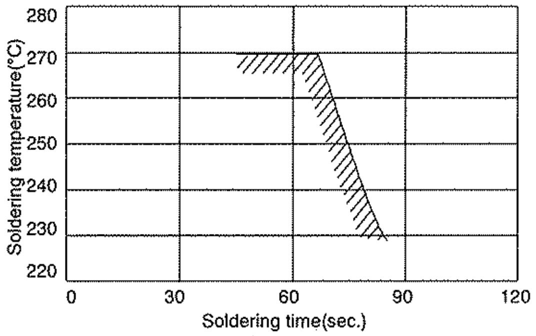
Infrared Reflow



Vapor Reflow



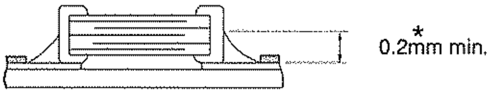
[Allowable Soldering Temperature and Time]



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]



*GRM02/03 : 1/3 of Chip Thickness min.

Inverting the PCB

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

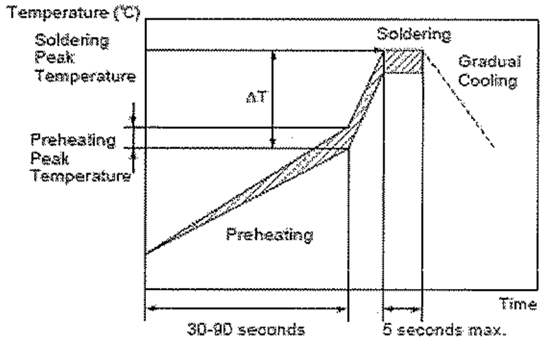
(2)Leaded Component Insertion

If the PCB is flexed when leaded components (such as transformers and ICs) are being mounted, chips may crack and solder joints may break.
Before mounting leaded components, support the PCB using backup pins or special jigs prevent warping.

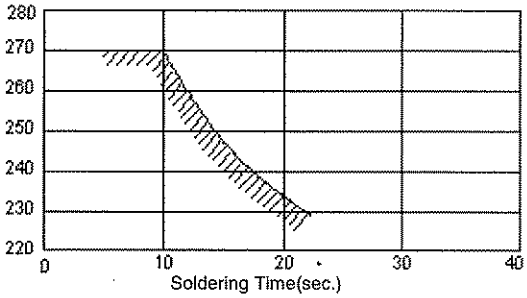
(3)Flow Soldering

- 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 of 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.

[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.

Table 2

Part Number	Temperature Differential
GR□18/21/31	Δ T ≦ 150°C

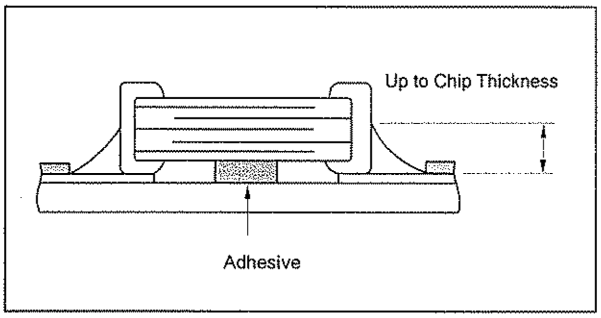
Recommended Conditions

	Pb-Sn Solder	Lead Free Solder
Preheating Peak Temperature	90-110°C	100-120°C
Soldering 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

- 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.



(4)Correction with a Soldering Iron

- When the sudden heat is given to the components by soldering iron, 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 3. It is required to keep temperature differential between the soldering and the components surface (ΔT) as small as possible. After soldering, it is not allowed to cool it down rapidly.

Table 3

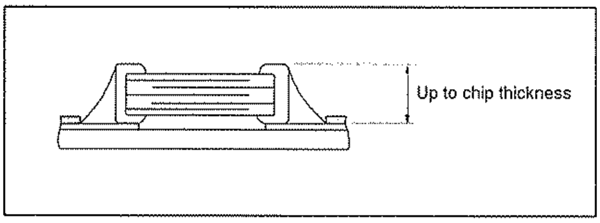
Part Number	Temperature Differential	Peak Temperature	Atmosphere
GR□03/15 GR□18/21/31	Δ T ≦ 190°C	300°C max. 3 seconds max. /termination	Air
GR□32/43/55	Δ T ≦130°C	270°C max. 3 seconds max /termination	Air

*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 Corrections Are Made Using a Soldering Iron

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.

Soldering iron ϕ3mm or smaller should be required. And it is necessary to keep a distance between the soldering iron and the components without direct touch.Thread solder with ϕ0.5mm or smaller is required for soldering.



4.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 products is used.

NOTICE

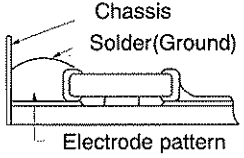
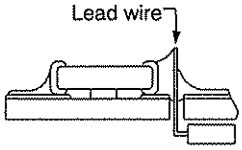
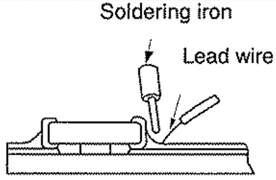
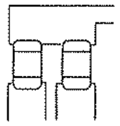
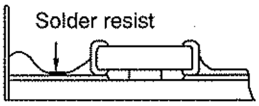
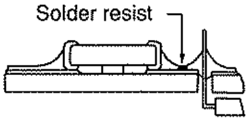
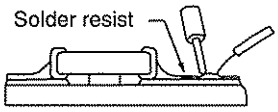
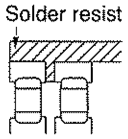
◆Soldering and Mounting

1.PCB Design

(1)Notice for Pattern Forms

- ●Unlike leaded components, chip components are susceptible to flexing stresses since they are mounted directly on the substrate.
  They are also more sensitive to mechanical and thermal stresses than leaded components.
  Excess solder fillet height can multiply these stresses and cause chip cracking. When designing substrates, take land patterns and dimensions into consideration to eliminate the possibility of excess solder fillet height.
- ●It has a possibility to happen the chip crack by the expansion and shrinkage of metal board. Please contact us if you want to use the ceramic capacitor on metal board such as Aluminum.

Pattern Forms

	Placing Close to Chassis	Placing of Chip Components and Leaded Components	Placing of Leaded Components after Chip Component	Lateral Mounting
prohibited				
Correct				

(2)Land Dimensions

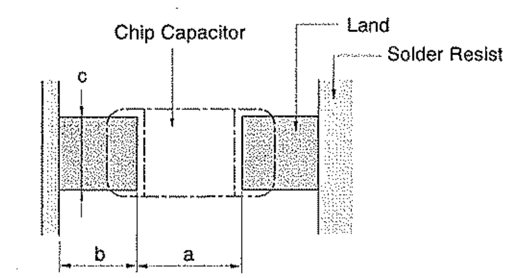


Table 1 Flow Soldering Method

Dimensions Part Number	Dimensions(L X W)	a	b	c
GR□18	1.6 X 0.8	0.6-1.0	0.8-0.9	0.6-0.8
GR□21	2.0 X 1.25	1.0-1.2	0.9-1.0	0.8-1.1
GR□31	3.2 X 1.6	2.2-2.6	1.0-1.1	1.0-1.4

(in : mm)

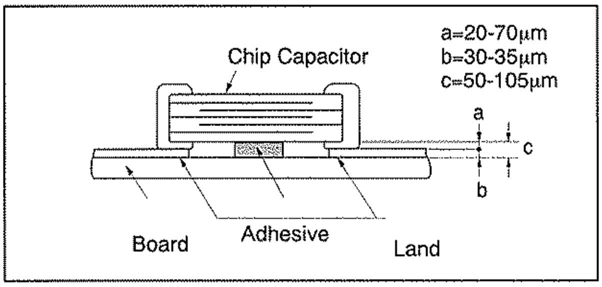
Table 2 Reflow Soldering Method

Dimensions Part Number	Dimensions(L X W)	a	b	c
GR□02	0.4 X 0.2	0.16-0.2	0.12-0.18	0.2-0.23
GR□03	0.6 X 0.3	0.2-0.3	0.2-0.35	0.2-0.4
GR□15	1.0 X 0.5	0.3-0.5	0.35-0.45	0.4-0.6
GR□18	1.6 X 0.8	0.6-0.8	0.6-0.7	0.6-0.8
GR□21	2.0 X 1.25	1.0-1.2	0.6-0.7	0.8-1.1
GR□31	3.2 X 1.6	2.2-2.4	0.8-0.9	1.0-1.4
GR□32	3.2 X 2.5	2.0-2.4	1.0-1.2	1.8-2.3
GR□43	4.5 X 3.2	3.0-3.5	1.2-1.4	2.3-3.0
GR□55	5.7 X 5.0	4.0-4.6	1.4-1.6	3.5-4.8

(in : mm)

2.Adhesive Application

- Thin or insufficient adhesive causes chips to loosen or become disconnected when flow soldered. The amount of adhesive must be more than dimension c shown in the drawing below to obtain enough bonding strength.
  The chip's electrode thickness and land thickness must be taken into consideration.
- Low viscosity adhesive causes chips to slip after mounting. Adhesive must have a viscosity of 5000pa-s(500ps)min. (at 25°C)



3.Adhesive Curing

Insufficient curing of the adhesive causes chips to disconnect during flow soldering and causes deteriorated insulation resistance between outer electrodes due to moisture absorption.
Control curing temperature and time in order to prevent insufficient hardening.

Inverting the PCB

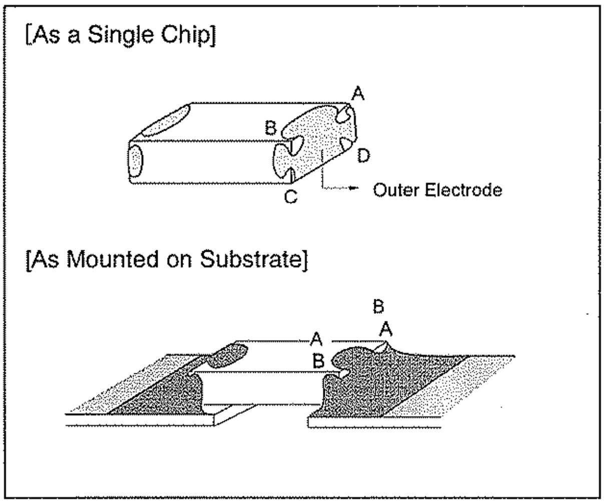
Make sure not to impose an abnormal mechanical shock on the PCB.

4.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 a percentage of halide may cause corrosion of the outer electrodes unless sufficiently cleaning. Use flux with a halide content of 0.2% max.
  But do not use strong acidic flux.
  Do not use water-soluble flux*.
  (*Water-soluble flux can be defined as non resin type flux including wash-type flux and non-wash-type flux.)

5.Flow Soldering

- Set temperature and time to ensure that leaching of the outer electrode does not exceed 25% of the chip end area as a single chip(full length of the edge A-B-C-D shown below) and 25% of the length A-B shown below as mounted on substrate.



◆Others

1.Resin Coating

When selecting resin materials, select those with low contraction.

2.Circuit Design

These capacitors on this catalog are not safety recognized products.

3.Remarks

The above notices are for standard applications and conditions. Contact us when the products are used in special mounting conditions. Select optimum conditions for operation as they determine the reliability of the product after assembly.

⚠NOTE

1.Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.

2.Your are requested not to use our product deviating from this product specification.

3.Please return one copy of these specifications upon your acceptance.
If the copy is not returned by a day mentioned in a cover the specifications will be deemed to have been accepted.

4.We consider it not appropriate to include any terms and conditions with regard to the business transaction in the product specifications, drawings or other technical documents. Therefore, if your technical documents as above include such terms and conditions such as warranty clause, product liability clause, or intellectual property infringement liability clause, they will be deemed to be invalid.