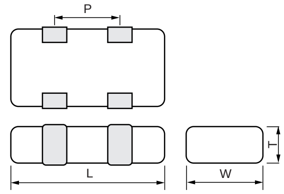
Chip Monolithic Ceramic Capacitors

Capacitor Arrays

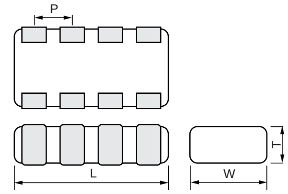
■ Features
1. High density mounting due to mounting space saving
2. Mounting cost saving

■ Applications
General electronic equipment

GNM1M2/212



GNM214/314



Part Number	Dimensions (mm)			
	L	W	T	P
GNM1M2	1.37 ±0.15	1.0 ±0.15	0.6 ±0.1	0.64 ±0.05
GNM212	2.0 ±0.15	1.25 ±0.15	0.85 ±0.1	1.0 ±0.1
GNM214			0.6 ±0.1	0.5 ±0.05
GNM314	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1 1.0 ±0.1	0.8 ±0.1

8

Temperature Compensating Type

Part Number	**GNM31**	
L x W	3.2x1.6	
TC	C0G (**5C**)	
Rated Volt.	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)		
10pF(**100**)	0.8(**4**)	0.8(**4**)
11pF(**110**)	0.8(**4**)	0.8(**4**)
12pF(**120**)	0.8(**4**)	0.8(**4**)
13pF(**130**)	0.8(**4**)	0.8(**4**)
15pF(**150**)	0.8(**4**)	0.8(**4**)
16pF(**160**)	0.8(**4**)	0.8(**4**)
18pF(**180**)	0.8(**4**)	0.8(**4**)
20pF(**200**)	0.8(**4**)	0.8(**4**)
22pF(**220**)	0.8(**4**)	0.8(**4**)
24pF(**240**)	0.8(**4**)	0.8(**4**)
27pF(**270**)	0.8(**4**)	0.8(**4**)
30pF(**300**)	0.8(**4**)	0.8(**4**)
33pF(**330**)	0.8(**4**)	0.8(**4**)
36pF(**360**)	0.8(**4**)	0.8(**4**)
39pF(**390**)	0.8(**4**)	0.8(**4**)
43pF(**430**)	0.8(**4**)	0.8(**4**)
47pF(**470**)	0.8(**4**)	0.8(**4**)
51pF(**510**)	0.8(**4**)	0.8(**4**)
56pF(**560**)	0.8(**4**)	0.8(**4**)
62pF(**620**)	0.8(**4**)	0.8(**4**)
68pF(**680**)	0.8(**4**)	0.8(**4**)
75pF(**750**)	0.8(**4**)	0.8(**4**)
82pF(**820**)	0.8(**4**)	0.8(**4**)
91pF(**910**)	0.8(**4**)	0.8(**4**)
100pF(**101**)	0.8(**4**)	0.8(**4**)
110pF(**111**)	0.8(**4**)	0.8(**4**)
120pF(**121**)	0.8(**4**)	0.8(**4**)
130pF(**131**)	0.8(**4**)	0.8(**4**)
150pF(**151**)	0.8(**4**)	0.8(**4**)
160pF(**161**)		0.8(**4**)
180pF(**181**)		0.8(**4**)

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Part Number	GNM31	
L x W	3.2x1.6	
TC	C0G (**5C**)	
Rated Volt.	100 (**2A**)	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)		
200pF(**201**)		0.8(**4**)
220pF(**221**)		0.8(**4**)
240pF(**241**)		0.8(**4**)
270pF(**271**)		0.8(**4**)
300pF(**301**)		0.8(**4**)
330pF(**331**)		0.8(**4**)
360pF(**361**)		0.8(**4**)

The part numbering code is shown in each ( ). The (4) code in T(mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

High Dielectric Constant Type GNM1 Series

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Part Number	GNM1M	
L x W	1.37x1.00	
TC	X7R (**R7**)	
Rated Volt.	16 (**1C**)	10 (**1A**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)		
22000pF(**223**)	0.6(**2**)	
47000pF(**473**)	0.6(**2**)	
0.10µF(**104**)		0.6(**2**)

The part numbering code is shown in each ( ). The (2) code in T(mm) means number of elements (two).
Dimensions are shown in mm and Rated Voltage in Vdc.

High Dielectric Constant Type GNM2 Series

Part Number	GNM21
L x W	2.0x1.25
TC	X7R (**R7**)
Rated Volt.	50 (**1H**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)	
1000pF(**102**)	0.6(**4**)
10000pF(**103**)	0.6(**4**)

The part numbering code is shown in each ( ). The (4) code in T(mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

High Dielectric Constant Type GNM3 Series

Part Number	GNM31						
L x W	3.2x1.6						
TC	X7R (**R7**)				Y5V (**F5**)		
Rated Volt.	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	100 (**2A**)	50 (**1H**)	16 (**1C**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)							
220pF(**221**)	0.8(**4**)						

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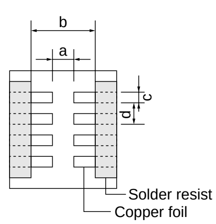
Part Number	GNM31						
L x W	3.2x1.6						
TC	X7R (**R7**)				Y5V (**F5**)		
Rated Volt.	100 (**2A**)	50 (**1H**)	25 (**1E**)	16 (**1C**)	100 (**2A**)	50 (**1H**)	16 (**1C**)
Capacitance (Capacitance part numbering code) and T (mm) Dimension (T Dimension part numbering code)							
270pF(**271**)	0.8(**4**)						
330pF(**331**)	0.8(**4**)						
390pF(**391**)	0.8(**4**)	0.8(**4**)					
470pF(**471**)	0.8(**4**)	0.8(**4**)					
560pF(**561**)	0.8(**4**)	0.8(**4**)					
680pF(**681**)	0.8(**4**)	0.8(**4**)					
820pF(**821**)	0.8(**4**)	0.8(**4**)					
1000pF(**102**)	0.8(**4**)	0.8(**4**)					
1200pF(**122**)	0.8(**4**)	0.8(**4**)					
1500pF(**152**)	0.8(**4**)	0.8(**4**)					
1800pF(**182**)	0.8(**4**)	0.8(**4**)					
2200pF(**222**)	0.8(**4**)	0.8(**4**)			0.8(**4**)		
2700pF(**272**)	0.8(**4**)	0.8(**4**)					
3300pF(**332**)	0.8(**4**)	0.8(**4**)			0.8(**4**)		
3900pF(**392**)	0.8(**4**)	0.8(**4**)					
4700pF(**472**)	0.8(**4**)	0.8(**4**)			0.8(**4**)		
5600pF(**562**)		0.8(**4**)					
6800pF(**682**)		0.8(**4**)					
8200pF(**822**)		0.8(**4**)					
10000pF(**103**)		0.8(**4**)					
12000pF(**123**)		0.8(**4**)					
15000pF(**153**)		0.8(**4**)					
18000pF(**183**)			0.8(**4**)				
22000pF(**223**)				0.8(**4**)		0.8(**4**)	
27000pF(**273**)				0.8(**4**)			
33000pF(**333**)				0.8(**4**)		0.8(**4**)	
39000pF(**393**)				0.8(**4**)			
47000pF(**473**)				1.0(**4**)		0.8(**4**)	
68000pF(**683**)				1.0(**4**)			0.8(**4**)
0.10µF(**104**)				1.0(**4**)			0.8(**4**)
0.15µF(**154**)							0.8(**4**)

The part numbering code is shown in each ( ). The (4) code in T(mm) means number of elements (four).
Dimensions are shown in mm and Rated Voltage in Vdc.

Specifications and Test Methods

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specifications</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>5C : −55℃ to +125℃</td><td>R7 : −55℃ to +125℃
F5 : −30℃ to +85℃</td><td></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</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 (5C) or 250% of the rated voltage (R7, 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℃ 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℃ at the frequency and voltage shown in the table.
<table>
<tr><th>Item \ Char.</th><th>5C</th><th>R7, F5</th></tr>
<tr><td>Frequency</td><td>1±0.1MHz</td><td>1±0.1kHz</td></tr>
<tr><td>Voltage</td><td>0.5 to 5Vr.m.s.</td><td>1.0±0.2Vr.m.s.</td></tr>
</table></td></tr>
<tr><td>8</td><td colspan="2">Q/Dissipation Factor (D.F.)</td><td>30pF min. : Q≧1000
30pF max. : Q≧400+20C

C : Nominal Capacitance (pF)</td><td>
<table>
<tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr>
<tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr>
<tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>−</td></tr>
</table></td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Capacitance Temperature Characteristics</td><td>Capacitance Change</td><td>Within the specified tolerance (Table A)</td><td>
<table>
<tr><th>Char.</th><th>Temp. Range</th><th>Reference Temp.</th><th>Cap. Change</th></tr>
<tr><td>R7</td><td>−55 to +125℃</td><td rowspan="2">25℃</td><td>Within±15%</td></tr>
<tr><td>F5</td><td>−30 to +85℃</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 determined using the capacitance measured in step 3 as a reference.
When cycling the temperature sequentially from step1 through 5, the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.
The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in steps 1, 3 and 5 by the capacitance value in step 3.
<table>
<tr><th>Step</th><th>Temperature (℃)</th></tr>
<tr><td>1</td><td>25±2</td></tr>
<tr><td>2</td><td>−55±3 (for 5C/ R7), −30±3 (for F5)</td></tr>
<tr><td>3</td><td>25±2</td></tr>
<tr><td>4</td><td>125±3 (for 5C/R7), 85±3 (F5)</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 above 25℃ value over the temperature ranges shown in the table should be within the specified ranges.</td></tr>
<tr><td>Temperature Coefficient</td><td>Within the specified tolerance (Table A)</td><td rowspan="2"></td></tr>
<tr><td>Capacitance Drift</td><td>Within ±0.2% or ±0.05 pF
(Whichever is larger)</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.

</td><td>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1 using a eutectic solder. Then apply 5N force in parallel with the test jig for 10±1 sec.
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.
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>GNM1M</td><td>0.5</td><td>−</td><td>0.32</td><td>0.32</td></tr>
<tr><td>GNM21</td><td>0.4</td><td>1.6</td><td>0.25</td><td>0.5</td></tr>
<tr><td>GNM31</td><td>0.8</td><td>2.5</td><td>0.4</td><td>0.8</td></tr>
</table>
(in mm)
Fig. 1</td></tr>
</table>

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Specifications and Test Methods

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<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Item</th><th colspan="2">Specifications</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 to 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 of 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 min. : Q≧1000
30pF max. : Q≧400+20C

C : Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>–</td></tr></table></td></tr>
<tr><td rowspan="2">12</td><td rowspan="2" colspan="2">Deflection</td><td colspan="2">No cracking or marking defects should occur.</td><td rowspan="2">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±1 sec. 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.

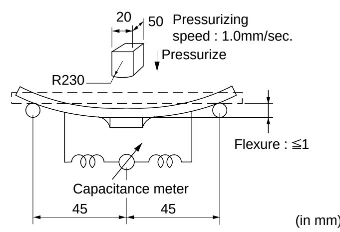
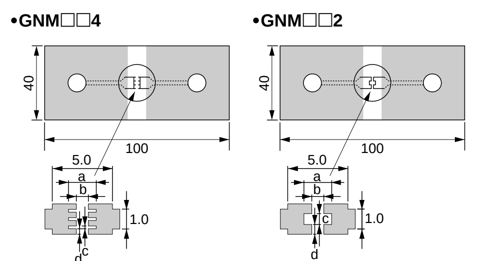



Fig. 3
t=0.8mm (GNM21), 1.6mm (GNM31)</td></tr>
<tr><td colspan="2"><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>GNM1M</td><td>2.0±0.05</td><td>0.5±0.05</td><td>0.32±0.05</td><td>0.32±0.05</td></tr><tr><td>GNM21</td><td>2.0±0.05</td><td>0.7±0.05</td><td>0.3±0.05</td><td>0.2±0.05</td></tr><tr><td>GNM31</td><td>2.5±0.05</td><td>0.8±0.05</td><td>0.4±0.05</td><td>0.4±0.05</td></tr></table>(in mm)
Fig. 2</td></tr>
<tr><td>13</td><td colspan="2">Solderability of Termination</td><td colspan="2">75% of the terminations are 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 proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃.</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℃ for 1 minute. Immerse the capacitor in a eutectic solder solution at 270±5℃ 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$^{+0}_{-10}$℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R7 : Within ±7.5%
F5 : Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>30pF min. : Q≧1000
30pF max. : Q≧400+20C

C : Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>–</td></tr></table></td></tr>
<tr><td>I.R.</td><td colspan="2">More than 10,000MΩ or 500Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No failure</td></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 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><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (℃)</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$^{+0}_{-10}$℃ for one hour and then let sit for 48±4 hours at room temperature. Perform the initial measurement.</td></tr>
<tr><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td><td>R7 : Within ±7.5%
F5 : Within ±20%</td></tr>
<tr><td>Q/D.F.</td><td>30pF min. : Q≧1000
30pF max. : Q≧400+20C

C : Nominal Capacitance (pF)</td><td><table><tr><th>Char.</th><th>25V min.</th><th>16V</th><th>10V</th></tr><tr><td>R7</td><td>0.025 max.</td><td>0.035 max.</td><td>0.035 max.</td></tr><tr><td>F5</td><td>0.05 max.</td><td>0.07 max.</td><td>–</td></tr></table></td></tr>
<tr><td>I.R.</td><td colspan="2">More than 10,000MΩ or 500Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
</table>

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Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
16	Humidity Steady State		The measured and observed characteristics should satisfy the specifications in the following table.		Let the capacitor sit at 40±2℃ 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 temperature, then measure.
		Appearance	No marking defects		
		Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	R7 : Within ±12.5% F5 : Within ±30%	
		Q/D.F.	30pF and over : Q≧350 10pF and over, 30pF and below : Q≧275+5C/2 10pF and below : Q≧200+10C C : Nominal Capacitance (pF)	Char. / 25V min. / 16V / 10V R7 / 0.025 max. / 0.035 max. / 0.035 max. F5 / 0.05 max. / 0.07 max. / –	
		I.R.	More than 1,000MΩ or 50Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		
17	Humidity Load		The measured and observed characteristics should satisfy the specifications in the following table.		Apply the rated voltage at 40±2℃ 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 temperature, then measure. The charge/discharge current is less than 50mA.
		Appearance	No marking defects		
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)	R7 : Within ±12.5% F5 : Within ±30%	
		Q/D.F.	30pF and over : Q≧200 30pF and below : Q≧100+10C/3 C : Nominal Capacitance (pF)	Char. / 25V min. / 16V / 10V R7 / 0.025 max. / 0.035 max. / 0.035 max. F5 / 0.05 max. / 0.07 max. / –	
		I.R.	More than 500MΩ or 25Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		
18	High Temperature Load		The measured and observed characteristics should satisfy the specifications in the following table.		Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ±3℃. 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 maximum operating temperature ±3℃. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.
		Appearance	No marking defects		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)	R7 : Within ±12.5% F5 : Within ±30%	
		Q/D.F.	30pF and over : Q≧350 10pF and over, 30pF and below : Q≧275+5C/2 10pF and below : Q≧200+10C C : Nominal Capacitance (pF)	Char. / 25V min. / 16V / 10V R7 / 0.025 max. / 0.035 max. / 0.035 max. F5 / 0.05 max. / 0.07 max. / –	
		I.R.	More than 1,000MΩ or 50Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		

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Table A

Char.	Nominal Values (ppm/℃) Note 1	Capacitance Change from 25℃ (%)					
		−55		−30		−10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0±30	0.58	−0.24	0.40	−0.17	0.25	−0.11

Note 1 : Nominal values denote the temperature coefficient within a range of 25℃ to 125℃.