Chip Monolithic Ceramic Capacitors

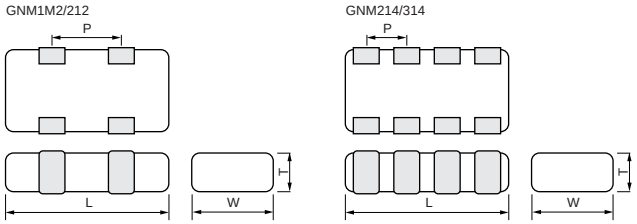
Capacitor Arrays

■ Features

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

■ Applications

General electronic equipment



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	0.8 ±0.1
			1.0 ±0.1	

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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

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**)	
0.10∝F(**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**)
0.10∝F(**104**)				1.0(**4**)			0.8(**4**)
0.15∝F(**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.

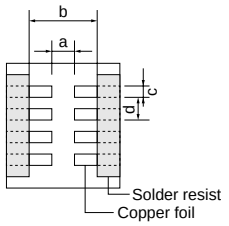
Specifications and Test Methods

No.	Item	Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
1	Operating Temperature Range	5C : −55℃ to +125℃	R7 : −55℃ to +125℃ F5 : −30℃ to +85℃	
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, should 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 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.
6	Insulation Resistance	More than 10,000MΩ or 500Ω • F (Whichever is smaller)		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.
7	Capacitance	Within the specified tolerance		The capacitance/Q/D.F. should be measured at 25℃ at the frequency and voltage shown in the table.
8	Q/Dissipation Factor (D.F.)	30pF min. : Q≧1000 30pF max. : Q≧400+20C 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. / —	Item \ Char. / 5C / R7, F5 Frequency / 1±0.1MHz / 1±0.1kHz Voltage / 0.5 to 5Vr.m.s. / 1.0±0.2Vr.m.s.
9	Capacitance Temperature Characteristics — Capacitance Change	Within the specified tolerance (Table A)	Char. / Temp. Range / Reference Temp. / Cap. Change R7 / −55 to +125℃ / 25℃ / Within±15% F5 / −30 to +85℃ / 25℃ / Within $^{+22}_{-82}$%	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.
	Capacitance Temperature Characteristics — Temperature Coefficient	Within the specified tolerance (Table A)		
	Capacitance Temperature Characteristics — Capacitance Drift	Within ±0.2% or ±0.05 pF (Whichever is larger)		

Step	Temperature (℃)
1	25±2
2	−55±3 (for 5C/ R7), −30±3 (for F5)
3	25±2
4	125±3 (for 5C/R7), 85±3 (F5)
5	25±2

(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.

No.	Item	Specifications	Test Method
10	Adhesive Strength of Termination	No removal of the terminations or other defect should occur.	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.



Type	a	b	c	d
GNM1M	0.5	—	0.32	0.32
GNM21	0.4	1.6	0.25	0.5
GNM31	0.8	2.5	0.4	0.8

(in mm)

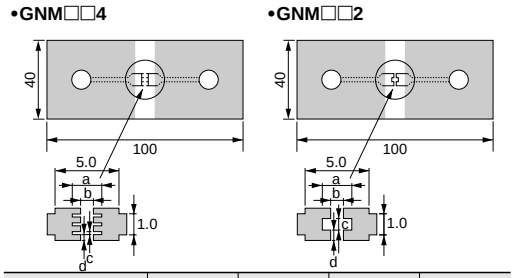
Fig. 1

Continued on the following page.

Specifications and Test Methods

Continued from the preceding page.

No.	Item		Specifications: Temperature Compensating Type	Specifications: High Dielectric Type	Test Method
11	Vibration Resistance	Appearance	No defects or abnormalities		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).
		Capacitance	Within the specified tolerance		
		Q/D.F.	30pF min. : Q≧1000 30pF max. : Q≧400+20C 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. / –	
12	Deflection		No cracking or marking defects should occur.		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.
13	Solderability of Termination		75% of the terminations are 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℃ for 10 to 30 seconds. After preheating, immerse in eutectic solder solution for 2±0.5 seconds at 230±5℃.
14	Resistance to Soldering Heat		The measured and observed characteristics should satisfy the specifications in the following table.		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.
		Appearance	No marking defects		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	R7 : Within ±7.5% F5 : Within ±20%	
		Q/D.F.	30pF min. : Q≧1000 30pF max. : Q≧400+20C 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 10,000MΩ or 500Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		
15	Temperature Cycle		The measured and observed characteristics should satisfy the specifications in the following table.		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 Step / 1 / 2 / 3 / 4 Temp. (℃) / Min. Operating Temp. $^{+3}_{-0}$ / Room Temp. / Max. Operating Temp. $^{+3}_{-0}$ / Room Temp. Time (min.) / 30±3 / 2 to 3 / 30±3 / 2 to 3 • 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.
		Appearance	No marking defects		
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	R7 : Within ±7.5% F5 : Within ±20%	
		Q/D.F.	30pF min. : Q≧1000 30pF max. : Q≧400+20C 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 10,000MΩ or 500Ω • F (Whichever is smaller)		
		Dielectric Strength	No failure		



Type	a	b	c	d
GNM1M	2.0±0.05	0.5±0.05	0.32±0.05	0.32±0.05
GNM21	2.0±0.05	0.7±0.05	0.3±0.05	0.2±0.05
GNM31	2.5±0.05	0.8±0.05	0.4±0.05	0.4±0.05

(in mm)

Fig. 2

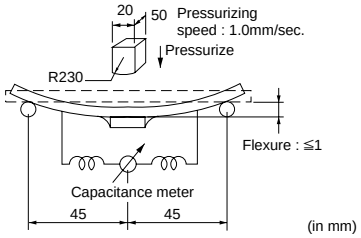


Fig. 3

t=0.8mm (GNM21), 1.6mm (GNM31)

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Specifications and Test Methods

Continued from the preceding page.

<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="7">16</td><td rowspan="7">Humidity Steady State</td><td colspan="3">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="7">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.</td></tr>
<tr><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF (Whichever is larger)</td><td>R7 : Within ±12.5%
F5 : Within ±30%</td></tr>
<tr><td>Q/D.F.</td><td>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)</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 1,000MΩ or 50Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
<tr><td rowspan="7">17</td><td rowspan="7">Humidity Load</td><td colspan="3">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="7">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.</td></tr>
<tr><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5% or ±0.75pF (Whichever is larger)</td><td>R7 : Within ±12.5%
F5 : Within ±30%</td></tr>
<tr><td>Q/D.F.</td><td>30pF and over : Q≧200
30pF and below :
Q≧100+10C/3
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 500MΩ or 25Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
<tr><td rowspan="7">18</td><td rowspan="7">High Temperature Load</td><td colspan="3">The measured and observed characteristics should satisfy the specifications in the following table.</td><td rowspan="7">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.</td></tr>
<tr><td>Appearance</td><td colspan="2">No marking defects</td></tr>
<tr><td>Capacitance Change</td><td>Within ±3% or ±0.3pF (Whichever is larger)</td><td>R7 : Within ±12.5%
F5 : Within ±30%</td></tr>
<tr><td>Q/D.F.</td><td>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)</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 1,000MΩ or 50Ω • F (Whichever is smaller)</td></tr>
<tr><td>Dielectric Strength</td><td colspan="2">No failure</td></tr>
</table>

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℃.