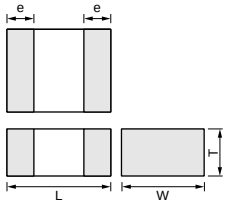
CHIP MONOLITHIC CERAMIC CAPACITOR

High-Q & High-power GRH/RPN100 Series

■ Features(GRH100 Series)

1. The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high-frequency applications (VHS-microwave band).
2. The series is ultraminiature, yet has a high-power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
3. GRH110 type is designed for both flow and reflow soldering and GRH111 type is designed for reflow soldering.
4. GRH type capacitors exhibit better solderability and lower solder leaching because of its nickel barriered terminations.



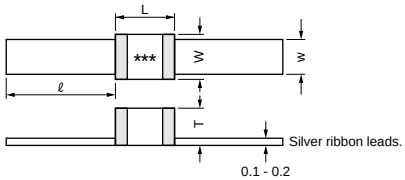
Part Number	Dimensions (mm)			
	L	W	T	e
GRH110	$1.4^{+0.6}_{-0.4}$	$1.4^{+0.6}_{-0.4}$	0.8 to 1.65	$0.25^{+0.25}_{-0.15}$
GRH111	$2.8^{+0.6}_{-0.4}$	$2.8^{+0.6}_{-0.4}$	2.0 to 2.8	$0.4^{+0.4}_{-0.3}$

■ Application

High-frequency and high-power circuits.

■ Features(RPN100 Series)

1. The dielectric is composed of low dielectric loss ceramics. This series is perfectly suited to high-frequency applications (VHS-microwave band).
2. The series is ultraminiature, yet has a high-power capacity. This is the best capacitor available for transmitter and amplifier circuits such as those in broadcasting equipment and mobile base stations.
3. RPN type capacitors withstand high temperatures because ribbon leads are attached with silver paste.
4. RPN type capacitors are easily soldered and especially well suited in applications where only a soldering iron can be used.



*** : Capacitance Code

Part Number	Dimensions (mm)				
	L	W	T max.	ℓ	w
RPN110	1.6 ±0.4	1.4 ±0.4	1.6	5.0 min.	1.3 ±0.4
RPN111	3.2 ±0.4	2.8 ±0.4	3.0	9.0 ±2.0	2.35 ±0.15

■ Application

High-frequency and high-power circuits.

Part Number	**GRH110**	**GRH111**					**RPN110**	**RPN111**				
L x W(mm)	1.40x1.40	2.80x2.80					1.60x1.40	3.20x2.80				
TC Code	C0G	C0G					C0G	C0G				
Rated Volt.(Vdc)	50	50	100	200	300	500	50	50	100	200	300	500
Capacitance and T(mm)												
0.5pF	1.20					2.40	1.60					3.00
0.6pF	1.20					2.40	1.60					3.00
0.7pF	1.20					2.40	1.60					3.00
0.8pF	1.20					2.40	1.60					3.00
0.9pF	1.20					2.40	1.60					3.00
1.0pF	1.20					2.40	1.60					3.00
1.1pF	1.20					2.40	1.60					3.00
1.2pF	1.20					2.40	1.60					3.00
1.3pF	1.20					2.40	1.60					3.00
1.4pF	1.20					2.40	1.60					3.00
1.5pF	1.20					2.40	1.60					3.00

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Part Number	GRH110	GRH111					RPN110	RPN111				
L x W(mm)	1.40x1.40	2.80x2.80					1.60x1.40	3.20x2.80				
TC Code	C0G	C0G					C0G	C0G				
Rated Volt.(Vdc)	50	50	100	200	300	500	50	50	100	200	300	500
Capacitance and T(mm)												
1.6pF	1.20					2.40	1.60					3.00
1.7pF	1.20					2.40	1.60					3.00
1.8pF	1.20					2.40	1.60					3.00
1.9pF	1.20					2.40	1.60					3.00
2.0pF	1.20					2.40	1.60					3.00
2.1pF	1.20					2.40	1.60					3.00
2.2pF	1.20					2.40	1.60					3.00
2.4pF	1.20					2.40	1.60					3.00
2.7pF	1.20					2.40	1.60					3.00
3.0pF	1.20					2.40	1.60					3.00
3.3pF	1.20					2.40	1.60					3.00
3.6pF	1.20					2.40	1.60					3.00
3.9pF	1.20					2.40	1.60					3.00
4.3pF	1.20					2.40	1.60					3.00
4.7pF	1.20					2.40	1.60					3.00
5.1pF	1.20					2.40	1.60					3.00
5.6pF	1.20					2.40	1.60					3.00
6.2pF	1.20					2.40	1.60					3.00
6.8pF	1.20					2.40	1.60					3.00
7.5pF	1.20					2.40	1.60					3.00
8.2pF	1.20					2.40	1.60					3.00
9.1pF	1.20					2.40	1.60					3.00
10.0pF	1.20					2.40	1.60					3.00
11pF	1.20					2.40	1.60					3.00
12pF	1.20					2.40	1.60					3.00
13pF	1.20					2.40	1.60					3.00
15pF	1.20					2.40	1.60					3.00
16pF	1.20					2.40	1.60					3.00
18pF	1.20					2.40	1.60					3.00
20pF	1.20					2.40	1.60					3.00
22pF	1.20					2.40	1.60					3.00
24pF	1.20					2.40	1.60					3.00
27pF	1.20					2.40	1.60					3.00
30pF	1.20					2.40	1.60					3.00
33pF	1.20					2.40	1.60					3.00
36pF	1.20					2.40	1.60					3.00
39pF	1.20					2.40	1.60					3.00
43pF	1.20					2.40	1.60					3.00
47pF	1.20					2.40	1.60					3.00
51pF	1.20					2.40	1.60					3.00
56pF	1.20					2.40	1.60					3.00
62pF	1.20					2.40	1.60					3.00
68pF	1.20					2.40	1.60					3.00
75pF	1.20					2.40	1.60					3.00
82pF	1.20					2.40	1.60					3.00
91pF	1.20					2.40	1.60					3.00
100pF	1.20					2.40	1.60					3.00
110pF					2.40						3.00	
120pF					2.40						3.00	
130pF					2.40						3.00	
150pF					2.40						3.00	
160pF					2.40						3.00	
180pF					2.40						3.00	
200pF					2.40						3.00	

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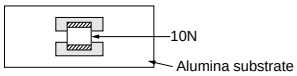
Part Number	GRH110	GRH111					RPN110	RPN111				
L x W(mm)	1.40x1.40	2.80x2.80					1.60x1.40	3.20x2.80				
TC Code	C0G	C0G					C0G	C0G				
Rated Volt.(Vdc)	50	50	100	200	300	500	50	50	100	200	300	500
Capacitance and T(mm)												
220pF				2.40						3.00		
240pF				2.40						3.00		
270pF				2.40						3.00		
300pF				2.40						3.00		
330pF				2.40						3.00		
360pF				2.40						3.00		
390pF				2.40						3.00		
430pF				2.40						3.00		
470pF				2.40						3.00		
510pF			2.40						3.00			
560pF			2.40						3.00			
620pF			2.40						3.00			
680pF			2.40						3.00			
750pF		2.40						3.00				
820pF		2.40						3.00				
910pF		2.40						3.00				
1000pF		2.40						3.00				

Specifications and Test Methods

No.	Item		Specification	Test Method
1	Operating Temperature Range		−55℃ to +125℃	
2	Rated Voltage		See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P}, whichever is larger, shall be maintained within the rated voltage range.
3	Appearance		No defects or abnormalities.	Visual inspection.
4	Dimensions		Within the specified dimension.	Using calipers.
5	Dielectric Strength		No defects or abnormalities.	No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.
6	Insulation Resistance (I.R.)	25℃	C≦ 470pF :1,000,000MΩ min. 470pF<C≦1,000pF : 100,000MΩ min.	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25℃ and 125℃ standard humidity and within 2 minutes of charging.
		125℃	C≦ 470pF : 100,000MΩ min. 470pF<C≦1,000pF : 10,000MΩ min.	
7	Capacitance		Within the specified tolerance.	The capacitance/Q shall be measured at 25℃ at the frequency and voltage shown in the table. Item / Char. | C0G (1,000pF and below) Frequency | 1±0.1MHz Voltage | 0.5 to 5Vr.m.s.
8	Q		C≦ 220pF : Q≧10,000 220pF<C≦ 470pF : Q≧ 5,000 470pF<C≦1,000pF : Q≧ 3,000 C : Nominal Capacitance (pF)	
9	Capacitance Temperature Characteristics	Capacitance Variation Rate	Within the specified tolerance. (Table A-7)	The temperature coefficient is determined using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5, the capacitance shall 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 the step 1, 3 and 5 by the cap. value in step 3. The capacitance change shall be measured after 5 min. at each specified temperature stage. Step | Temperature(℃) 1 | 25±2 2 | −55±3 3 | 25±2 4 | 125±3 5 | 25±2
		Temperature Coefficient	Within the specified tolerance. (Table A-7)	
		Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger)	
10	Terminal Strength	Adhesive Strength of Termination (for chip type)	No removal of the terminations or other defects shall occur.	Solder the capacitor to the test jig (alumina substrate) shown in Fig.1 using solder containing 2.5% silver. The soldering shall be done either with an iron or in furnace and be conducted with care so the soldering is uniform and free of defects such as heat shock. Then apply a 10N force in the direction of the arrow.  Fig.1
		Tensile Strength (for micro-strip type)	Capacitor shall not be broken or damaged.	The capacitor body is fixed and a load is applied gradually in the axial direction until its value reaches 10N (5N for RPN110).
		Bending Strength of lead wire terminal (for micro-strip type)	Lead wire shall not be cut or broken.	Position the main body of the capacitor so the lead wire terminal is perpendicular, and load 2.5N to the lead wire terminal. Bend the main body by 90 degrees, bend back to original position, bend 90 degrees in the reverse direction, and then bend back to original position.

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Specifications and Test Methods

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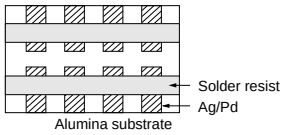
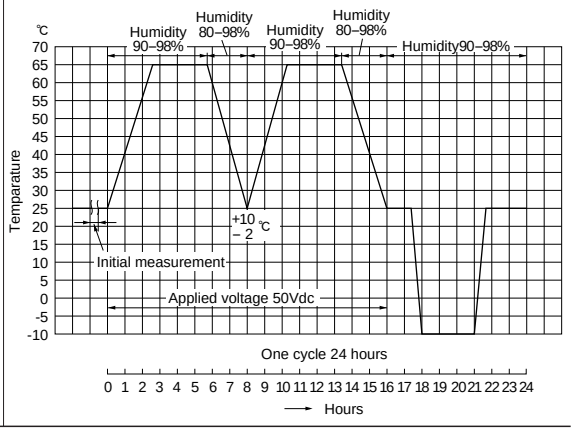
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specification</th><th>Test Method</th></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Vibration Resistance</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="3">Solder the capacitor to the test jig (alumina substrate) shown in Fig.2 using solder containing 2.5% silver. The soldering shall be done either with an iron or using the reflow method and shall be conducted with care so the soldering is uniform and free of defects such as heat shock.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).
 

Fig. 2</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance.</td></tr>
<tr><td>Q</td><td>Satisfies the initial value.
C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000
C : Nominal Capacitance (pF)</td></tr>
<tr><td>12</td><td colspan="2">Solderability of Termination</td><td>95% 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 proportion). Preheat at 80 to 120℃ for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5℃. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal.</td></tr>
<tr><td>13</td><td colspan="2">Resistance to Soldering Heat</td><td>The measured and observed characteristics shall satisfy the specifications in the following table.
<table><tr><th>Item</th><th>Specification</th></tr><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr><tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr><tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr><tr><td>Dielectric Strength</td><td>No failure</td></tr></table>C : Nominal Capacitance (pF)</td><td>Preheat the capacitor at 80 to 100℃ for 2 minutes and then at 150 to 200℃ for 5 minutes.
Immerse in solder containing 2.5% silver for 3±0.5 seconds at 270±5℃. Set at room temperature for 24±2 hours, then measure. The dipping depth for microstrip type capacitors is up to 2mm from the root of the terminal.</td></tr>
<tr><td>14</td><td colspan="2">Temperature Cycle</td><td>The measured and observed characteristics shall satisfy the specifications in the following table.
<table><tr><th>Item</th><th>Specification</th></tr><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td>Within ±1% or ±0.25pF (Whichever is larger)</td></tr><tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr><tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr><tr><td>Dielectric Strength</td><td>No failure</td></tr></table>C : Nominal Capacitance (pF)</td><td>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (11). Perform the five cycles according to the four heat treatments listed in the following table. Then, repeat twice the successive cycles of immersion, each cycle consisting of immersion in a fresh water at 65 $^{+5}_{0}$℃ for 15 minutes and immersion in a saturated uqueous solution of salt at 0±3℃ for 15 minutes.
The cpapcitor is promptly washed with running water, dried with a dry cloth, and allowed to sit at room temperature for 24±2 hours.
<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp.(℃)</td><td>−55 $^{+0}_{-3}$</td><td>RoomTemp.</td><td>125 $^{+3}_{-0}$</td><td>RoomTemp.</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></td></tr>
<tr><td>15</td><td colspan="2">Humidity</td><td>The measured and observed characteristics shall satisfy the specifications in the following table.
<table><tr><th>Item</th><th>Specification</th></tr><tr><td>Appearance</td><td>No marked defect</td></tr><tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF (Whichever is larger)</td></tr><tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr><tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr></table>C : Nominal Capacitance (pF)</td><td>Apply the 24-hour heat (−10 to +65℃) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Remove, set for 24±2 hours at room temperature, and measure.
 
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Specifications and Test Methods

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<table>
<tr><th>No.</th><th>Item</th><th>Specification</th><th>Test Method</th></tr>
<tr><td>16</td><td>High Temperature Load</td><td>The measured and observed characteristics shall satisfy the specifications in the following table.
<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Appearance</td><td>No marked defect</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF (Whichever is larger)</td></tr>
<tr><td>Q</td><td>C≦ 220pF : Q≧10,000
220pF<C≦ 470pF : Q≧ 5,000
470pF<C≦1,000pF : Q≧ 3,000</td></tr>
<tr><td>I.R.</td><td>More than 30% of the initial specification value at 25℃.</td></tr>
</table>
C : Nominal Capacitance (pF)</td><td>Apply 150% of the rated voltage for 2,000±12 hours at 125±3℃.
Remove and set for 24±2 hours at room temperature, then measure.
The charge/discharge current is less than 50mA.</td></tr>
</table>

Table A

Char.	Temp. Coeff. (ppm/℃) Note 1	Capacitance Change from 25℃ Value (%)					
		−55℃		−30℃		−10℃	
		Max.	Min.	Max.	Min.	Max.	Min.
C0G	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℃.