

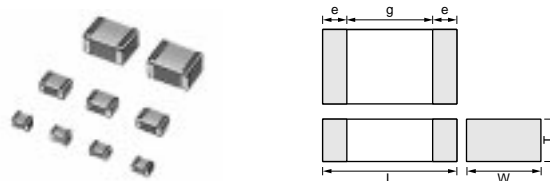
CHIP MONOLITHIC CERAMIC CAPACITOR



High-frequency GRH/RPN700 Series

■ Features(GRH700 Series)

1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
2. Nickel barriered terminations of GRH type improve solderability and decrease solder leaching.
3. GRH706/GRH708 type is designed for both flow and reflow soldering and GRH710 type is designed for reflow soldering.



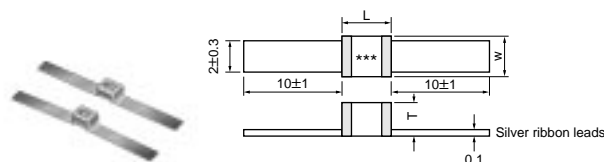
Part Number	Dimensions (mm)				
	L	W	T max.	e	g min.
GRH706	1.25 ^{+0.5} _{-0.3}	1.0 ^{+0.5} _{-0.3}	1.2	0.15 min.	0.3
GRH708	2.0 ^{+0.5} _{-0.3}	1.25 ^{+0.5} _{-0.3}	1.45	0.2 max.	0.5
GRH710	3.2 ^{+0.6} _{-0.4}	2.5 ^{+0.5} _{-0.3}	1.9	0.3 max.	0.5

■ Application

High-frequency and high-power circuits.

■ Features(RPN700 Series)

1. Negligible inductance is achieved by its monolithic structure so the series can be used at frequencies above 1GHz.
2. RPN type capacitors withstand at high temperatures because ribbon leads are attached with silver paste.
3. RPN type capacitors are easily soldered and are especially well suited in applications where only a soldering iron can be used.



*** : Capacitance Code


Part Number	Dimensions (mm)		
	L max.	W max.	T max.
RPN710	4.0	3.0	2.3

■ Application


High-frequency and high-power circuits.


Part Number	GRH706			GRH708			GRH710			RPN710		
L x W(mm)	1.25x1.00			2.00x1.25			3.20x2.50			4.00x3.00		
TC Code	COG			COG			COG			COG		
Rated Volt.(Vdc)	50	100	200	50	100	200	50	100	200	50	100	200
Capacitance and T(mm)												
0.5pF			1.20			1.45			1.90			2.30
0.6pF			1.20			1.45			1.90			2.30
0.7pF			1.20			1.45			1.90			2.30
0.8pF			1.20			1.45			1.90			2.30
0.9pF			1.20			1.45			1.90			2.30
1.0pF			1.20			1.45			1.90			2.30
1.1pF			1.20			1.45			1.90			2.30
1.2pF			1.20			1.45			1.90			2.30
1.3pF			1.20			1.45			1.90			2.30
1.4pF			1.20			1.45			1.90			2.30
1.5pF			1.20			1.45			1.90			2.30
1.6pF			1.20			1.45			1.90			2.30
1.7pF			1.20			1.45			1.90			2.30
1.8pF			1.20			1.45			1.90			2.30
1.9pF			1.20			1.45			1.90			2.30
2.0pF			1.20			1.45			1.90			2.30
2.1pF			1.20			1.45			1.90			2.30
2.2pF			1.20			1.45			1.90			2.30
2.4pF			1.20			1.45			1.90			2.30
2.7pF			1.20			1.45			1.90			2.30

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Part Number	GRH706			GRH708			GRH710			RPN710		
L x W(mm)	1.25x1.00			2.00x1.25			3.20x2.50			4.00x3.00		
TC Code	C0G			C0G			C0G			C0G		
Rated Volt.(Vdc)	50	100	200	50	100	200	50	100	200	50	100	200
Capacitance and T(mm)												
3.0pF			1.20			1.45			1.90			2.30
3.3pF			1.20			1.45			1.90			2.30
3.6pF			1.20			1.45			1.90			2.30
3.9pF			1.20			1.45			1.90			2.30
4.3pF			1.20			1.45			1.90			2.30
4.7pF			1.20			1.45			1.90			2.30
5.1pF			1.20			1.45			1.90			2.30
5.6pF			1.20			1.45			1.90			2.30
6.2pF			1.20			1.45			1.90			2.30
6.8pF			1.20			1.45			1.90			2.30
7.5pF			1.20			1.45			1.90			2.30
8.2pF			1.20			1.45			1.90			2.30
9.1pF			1.20			1.45			1.90			2.30
10pF			1.20			1.45			1.90			2.30
11pF			1.20			1.45			1.90			2.30
12pF			1.20			1.45			1.90			2.30
13pF			1.20			1.45			1.90			2.30
15pF		1.20				1.45			1.90			2.30
16pF		1.20				1.45			1.90			2.30
18pF		1.20				1.45			1.90			2.30
20pF		1.20				1.45			1.90			2.30
22pF		1.20				1.45			1.90			2.30
24pF	1.20					1.45			1.90			2.30
27pF	1.20					1.45			1.90			2.30
30pF	1.20					1.45			1.90			2.30
33pF	1.20					1.45			1.90			2.30
36pF	1.20					1.45			1.90			2.30
39pF	1.20					1.45			1.90			2.30
43pF	1.20					1.45			1.90			2.30
47pF	1.20					1.45			1.90			2.30
51pF	1.20					1.45			1.90			2.30
56pF					1.45				1.90			2.30
62pF					1.45				1.90			2.30
68pF					1.45				1.90			2.30
75pF					1.45				1.90			2.30
82pF					1.45				1.90			2.30
91pF					1.45				1.90			2.30
100pF				1.45					1.90			2.30
110pF				1.45					1.90			2.30
120pF				1.45					1.90			2.30
130pF				1.45					1.90			2.30
150pF				1.45					1.90			2.30
160pF				1.45					1.90			2.30
180pF								1.90			2.30	
200pF								1.90			2.30	
220pF								1.90			2.30	
240pF								1.90			2.30	
270pF								1.90			2.30	
300pF								1.90			2.30	
330pF								1.90			2.30	
360pF								1.90			2.30	
390pF								1.90			2.30	
430pF								1.90			2.30	
470pF								1.90			2.30	

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Part Number	GRH706			GRH708			GRH710			RPN710		
L x W(mm)	1.25x1.00			2.00x1.25			3.20x2.50			4.00x3.00		
TC Code	C0G			C0G			C0G			C0G		
Rated Volt.(Vdc)	50	100	200	50	100	200	50	100	200	50	100	200
Capacitance and T(mm)												
510pF								1.90			2.30	
560pF							1.90			2.30		
620pF							1.90			2.30		
680pF							1.90			2.30		
750pF							1.90			2.30		
820pF							1.90			2.30		
910pF							1.90			2.30		
1000pF							1.90			2.30		

Specifications and Test Methods

No.	Item	Specification	Test Method									
1	Operating Temperature Range	-55°C to +125°C										
2	Rated Voltage	See the previous pages.	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, shall be maintained within the rated voltage range.									
3	Appearance	No defects or abnormalities.	Visual inspection.									
4	Dimensions	Within the specified dimension.	Using calipers.									
5	Dielectric Strength	No defects or abnormalities.	No failure shall be observed when 300% 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.)	10,000MΩ min.	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and standard humidity and within 2 minutes of charging.									
7	Capacitance	Within the specified tolerance.	The capacitance/Q shall be measured at 25°C at the frequency and voltage shown in the table.									
8	Q	$C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ C : Nominal Capacitance (pF)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Item</th> <th style="width: 30%;">Char.</th> <th style="width: 40%;">COG (1,000pF and below)</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td></td> <td>1±0.1MHz</td> </tr> <tr> <td>Voltage</td> <td></td> <td>0.5 to 5Vr.m.s.</td> </tr> </tbody> </table>	Item	Char.	COG (1,000pF and below)	Frequency		1±0.1MHz	Voltage		0.5 to 5Vr.m.s.
			Item	Char.	COG (1,000pF and below)							
Frequency		1±0.1MHz										
Voltage		0.5 to 5Vr.m.s.										
9	Capacitance Temperature Characteristics	Capacitance Variation Rate	Within the specified tolerance. (Table A-6)									
		Temperature Coefficient	Within the specified tolerance. (Table A-6)									
		Capacitance Drift	Within ±0.2% or ±0.05pF (Whichever is larger) 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.									
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. *5N (GRH 706)									
		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 5N.									
		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.									

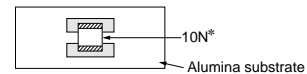
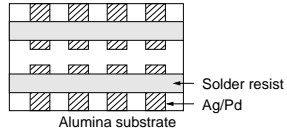
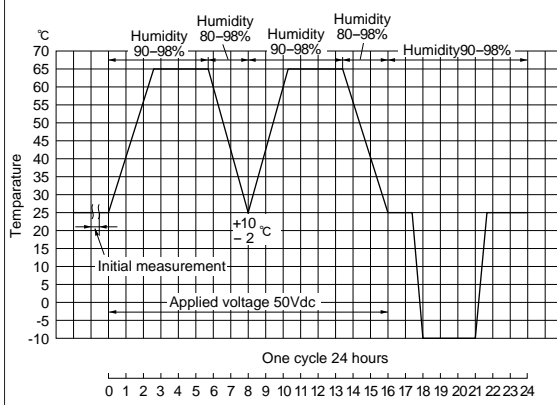


Fig.1

Continued on the following page.

Specifications and Test Methods


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No.	Item	Specification	Test Method																											
11	Appearance	No defects or abnormalities.	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).																											
	Capacitance	Within the specified tolerance.																												
	Vibration Resistance	Satisfies the initial value. $C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ C : Nominal Capacitance (pF)	 <p>Fig.2</p>																											
12	Solderability of Termination	75% of the terminations is 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°C for 10 to 30 seconds. After preheating immerse in solder containing 2.5% silver for 5±0.5 seconds at 230±5°C. The dipping depth for microstrip type capacitors is up to 1 mm from the root of the terminal.																											
13	Resistance to Soldering Heat	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1" style="width: 100%; margin-top: 5px;"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <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> $C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$ </td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> C : Nominal Capacitance (pF)	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	Q	$C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$	Dielectric Strength	No failure	Preheat according to the conditions listed in the table below. Immerse in solder containing 2.5% silver for 3±0.5 seconds at 270±5°C. 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. <table border="1" style="width: 100%; margin-top: 5px;"> <thead> <tr> <th>Chip Size</th> <th>Preheat Condition</th> </tr> </thead> <tbody> <tr> <td>2.0X1.25mm max.</td> <td>1minute at 120 to 150°C</td> </tr> <tr> <td>3.2X2.5mm</td> <td>Each 1 minute at 100 to 120°C and then 170 to 200°C</td> </tr> </tbody> </table>	Chip Size	Preheat Condition	2.0X1.25mm max.	1minute at 120 to 150°C	3.2X2.5mm	Each 1 minute at 100 to 120°C and then 170 to 200°C											
		Item	Specification																											
Appearance	No marked defect																													
Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)																													
Q	$C \leq 220\text{pF} : Q \geq 10,000$ $220\text{pF} < C \leq 470\text{pF} : Q \geq 5,000$ $470\text{pF} < C \leq 1,000\text{pF} : Q \geq 3,000$																													
Dielectric Strength	No failure																													
Chip Size	Preheat Condition																													
2.0X1.25mm max.	1minute at 120 to 150°C																													
3.2X2.5mm	Each 1 minute at 100 to 120°C and then 170 to 200°C																													
	Temperature Cycle	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1" style="width: 100%; margin-top: 5px;"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <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> $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$ </td> </tr> <tr> <td>I.R.</td> <td>1,000MΩ min.</td> </tr> <tr> <td>Dielectric Strength</td> <td>No failure</td> </tr> </tbody> </table> C : Nominal Capacitance (pF)	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	Q	$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$	I.R.	1,000MΩ min.	Dielectric Strength	No failure	Preheat according to the conditions listed in the table below. 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. Let sit for 24±2 hours at room temperature, then measure. <table border="1" style="width: 100%; margin-top: 5px;"> <thead> <tr> <th>Step</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Temp.(°C)</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> </tbody> </table>	Step	1	2	3	4	Temp.(°C)	-55 ⁺⁰ ₋₃	RoomTemp.	125 ⁺³ ₋₀	RoomTemp.	Time(min.)	30±3	2 to 3	30±3	2 to 3
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)																													
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I.R.	1,000MΩ min.																													
Dielectric Strength	No failure																													
Step	1	2	3	4																										
Temp.(°C)	-55 ⁺⁰ ₋₃	RoomTemp.	125 ⁺³ ₋₀	RoomTemp.																										
Time(min.)	30±3	2 to 3	30±3	2 to 3																										
15	Humidity	The measured and observed characteristics shall satisfy the specifications in the following table. <table border="1" style="width: 100%; margin-top: 5px;"> <thead> <tr> <th>Item</th> <th>Specification</th> </tr> </thead> <tbody> <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> $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$ </td> </tr> <tr> <td>I.R.</td> <td>1,000MΩ min.</td> </tr> </tbody> </table> C : Nominal Capacitance (pF)	Item	Specification	Appearance	No marked defect	Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)	Q	$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$	I.R.	1,000MΩ min.	Apply the 24-hour heat (-10 to +65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Remove, set for 24±2 hours at room temperature, and measure. <div style="text-align: center;">  <p>One cycle 24 hours</p> </div>																	
Item	Specification																													
Appearance	No marked defect																													
Capacitance Change	Within ±5% or ±0.5pF (Whichever is larger)																													
Q	$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{5}{2} C$ $C < 10\text{pF} : Q \geq 200 + 10C$																													
I.R.	1,000MΩ min.																													

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Specifications and Test Methods

 Continued from the preceding page.

No.	Item	Specification	Test Method										
16	High Temperature Load	<p>The measured and observed characteristics shall satisfy the specifications in the following table.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 5px;"> <thead> <tr style="background-color: #eee;"> <th style="width: 30%;">Item</th> <th style="width: 70%;">Specification</th> </tr> </thead> <tbody> <tr> <td>Appearance</td> <td>No marked defect</td> </tr> <tr> <td>Capacitance Change</td> <td>Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)</td> </tr> <tr> <td>Q</td> <td> $C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$ </td> </tr> <tr> <td>I.R.</td> <td>1,000MΩ min.</td> </tr> </tbody> </table> <p style="text-align: center; margin-top: 0;">C : Nominal Capacitance (pF)</p>	Item	Specification	Appearance	No marked defect	Capacitance Change	Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)	Q	$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$	I.R.	1,000M Ω min.	<p>Apply 200% of the rated voltage for 1,000\pm12 hours at 125\pm3$^{\circ}$C. Remove and set for 24\pm2 hours at room temperature, then measure.</p> <p>The charge/discharge current is less than 50mA.</p>
Item	Specification												
Appearance	No marked defect												
Capacitance Change	Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)												
Q	$C \geq 30\text{pF} : Q \geq 350$ $10\text{pF} \leq C < 30\text{pF} : Q \geq 275 + \frac{C}{10}$ $C < 10\text{pF} : Q \geq 200 + 10C$												
I.R.	1,000M Ω min.												

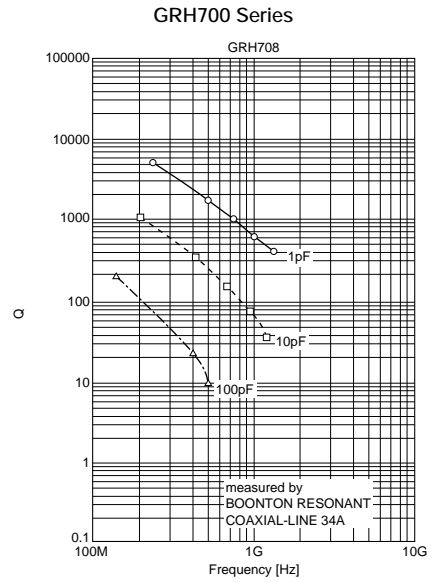
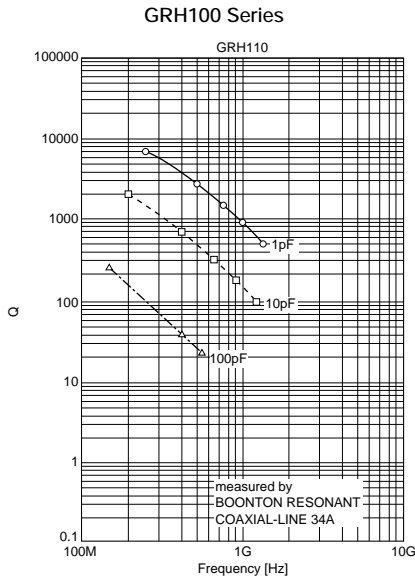
Table A

Char.	Temperature Coefficient (ppm/ $^{\circ}$ C) Note 1	Capacitance Change from 25 $^{\circ}$ C Value (%)					
		-55 $^{\circ}$ C		-30 $^{\circ}$ C		-10 $^{\circ}$ C	
		Max.	Min.	Max.	Min.	Max.	Min.
COG	0 \pm 30	0.58	-0.24	0.40	-0.17	0.25	-0.11

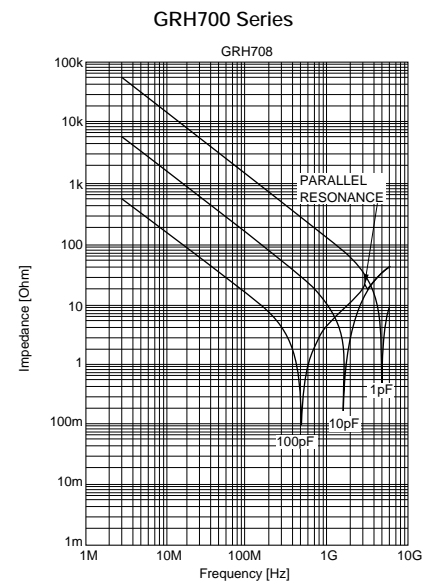
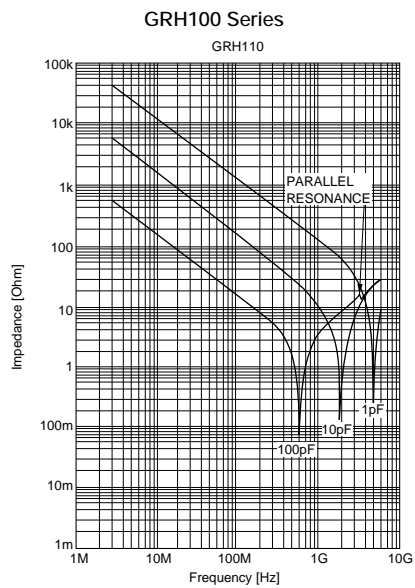
Note 1 : Nominal values denote the temperature coefficient within a range of 25 to 125 $^{\circ}$ C.

GRH/RPN Series Data

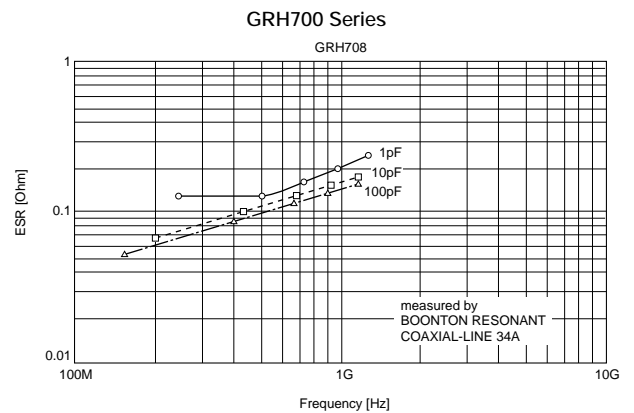
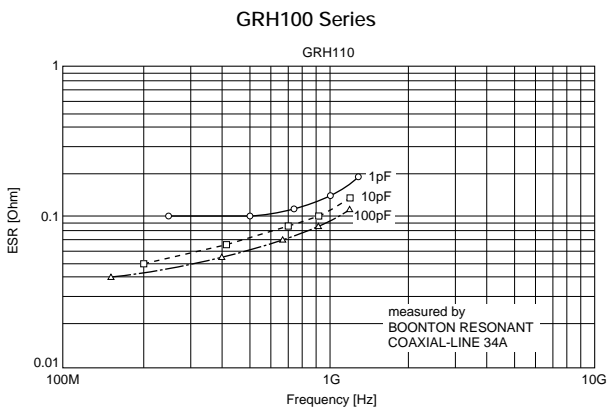
■ Q-Frequency Characteristics



■ Impedance-Frequency Characteristics



■ ESR-Frequency Characteristics



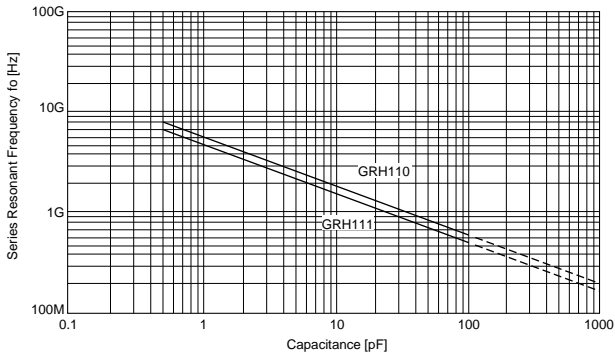
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GRH/RPN Series Data

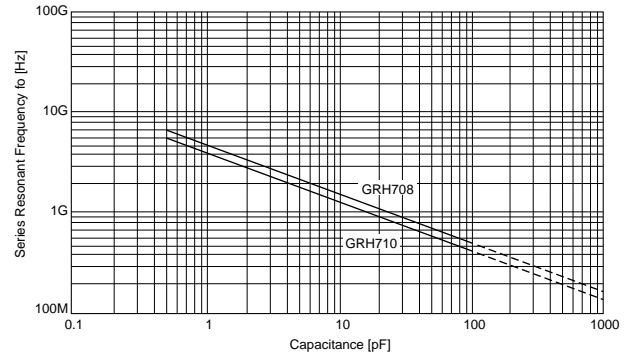
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Resonant Frequency-Capcitrance

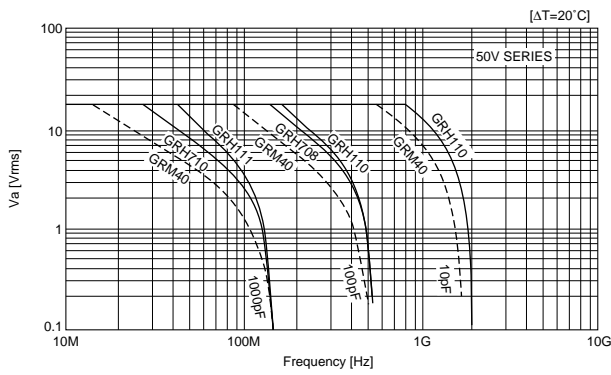
GRH100 Series



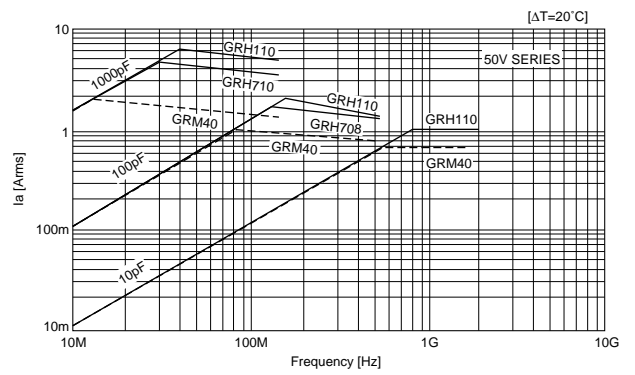
GRH700 Series



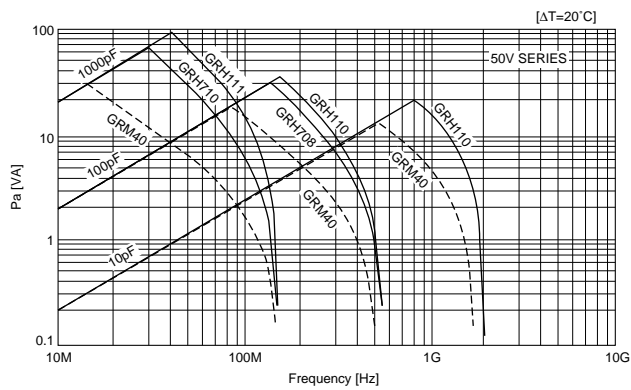
Allowable Voltage-Frequency



Allowable Current-Frequency



Allowable Apparent Power-Frequency



Allowable Effective Power-Frequency

