

GRACE

SPECIFICATION

ROHS Compliant Parts

Customer : _____

Part Name : **Stacked Inductor**

Part Number : **KIMF-F Size**

Dongguan GRACE electronic Technology Co., LTD

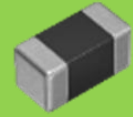
Address: Songhu Information Industrial Park.GuanminTou,Chashan Town,
Dongguan ,Guangdong ,China

Tel: 0769-22008861 **Web:** www.gracevn.com **Email:** grace@gracevn.com

Multilayer inductors —KIMF-F series

For **Signal inductors**

- **Impedance matching**



Features

- Operating temperature from -40 °C to 85°C
- Monolithic structure for high reliability
- Compact size inductor possible
- No cross coupling due to magnetic shield
- Perfect shape for mounting with no directionality
- Excellent solderability and high heat resistance For reflow soldering or wave soldering

Applications

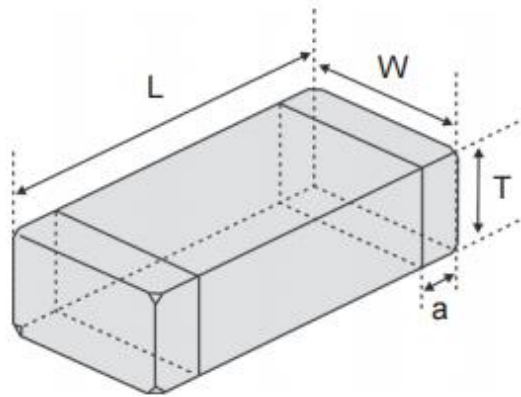
- Widely use in Communications, Video and audio equipment, Computer, Consumer Electronics, etc.

Explanation of Part Numbers

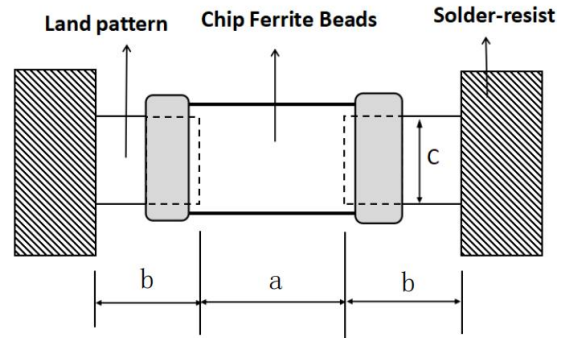
KIMF	0402	F	R10	B	S01	A	K000	T																																										
①	②	③	④	⑤	⑥	⑦	⑧	⑨																																										
<table border="1"> <tr> <th>①</th> <th>Series</th> </tr> <tr> <td colspan="2">GRACE Laminated ferrite inductance</td> </tr> </table>	①	Series	GRACE Laminated ferrite inductance		<table border="1"> <tr> <th>②</th> <th>Size</th> </tr> <tr> <td colspan="2">0402、0603、0805、1206</td> </tr> </table>	②	Size	0402、0603、0805、1206		<table border="1"> <tr> <th>③</th> <th>Series code</th> </tr> <tr> <td>F</td> <td>Distorium alone stone structure</td> </tr> </table>	③	Series code	F	Distorium alone stone structure	<table border="1"> <tr> <th>④</th> <th>Nominal inductance(μH)</th> </tr> <tr> <td>1R0</td> <td>1.0</td> </tr> <tr> <td>R10</td> <td>0.10</td> </tr> </table>	④	Nominal inductance(μH)	1R0	1.0	R10	0.10	<table border="1"> <tr> <th>⑤</th> <th>Inductance tolerance</th> </tr> <tr> <td>B</td> <td>±0.1nH</td> </tr> <tr> <td>C</td> <td>±0.2nH</td> </tr> </table>	⑤	Inductance tolerance	B	±0.1nH	C	±0.2nH	<table border="1"> <tr> <th>⑥</th> <th>Material code</th> </tr> <tr> <td colspan="2">S01</td> </tr> </table>	⑥	Material code	S01		<table border="1"> <tr> <th>⑦</th> <th>internal code</th> </tr> <tr> <td colspan="2">A</td> </tr> </table>	⑦	internal code	A		<table border="1"> <tr> <th>⑧</th> <th>Customer identification code</th> </tr> <tr> <td colspan="2">K000</td> </tr> </table>	⑧	Customer identification code	K000		<table border="1"> <tr> <th>⑨</th> <th>Packaging style</th> </tr> <tr> <td>T</td> <td>Tape</td> </tr> <tr> <td>B</td> <td>Bulk</td> </tr> </table>	⑨	Packaging style	T	Tape	B	Bulk
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■ Shape and Dimensions

1) Dimensions :



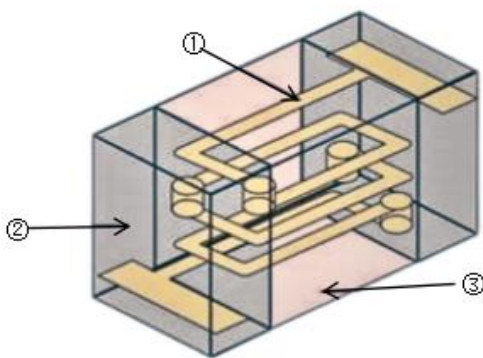
2) Recommended PCB pattern for reflow soldering:



Unit: mm

Size (EIA/JIS)	L	W	T	a	a	b	c
0402/1005	1.0±0.15	0.5±0.15	0.5±0.15	0.25±0.1	0.45	0.4	0.45
0603/1608	1.6±0.15	0.8±0.15	0.8±0.15	0.3±0.2	0.64	0.64	1.02
0805/2012	2.0(+0.3,-0.1)	1.25±0.2	0.85±0.2	0.5±0.3	0.8	0.8	1.2
			1.25±0.2				
1206/3216	3.2±0.2	1.6±0.2	0.85±0.2	0.5±0.3	1.8	1.0	1.2
			1.1±0.2				

■ Construction



No.	Name
①	Internal electrode
②	End electrode
③	Ferrite

■ Electrical Characteristics

0402 Type

Part Number	Inductance (μH)	DC Resistance(Ω)	Max. Rated Current (mA)	Min. Selfresonant Frequency(MHZ)
KIMF0402FR10□S01AK000T	0.1	0.8	25	200
KIMF0402FR12□S01AK000T	0.12	0.8	25	165
KIMF0402FR15□S01AK000T	0.15	0.9	25	140

KIMF0402FR18□S01AK000T	0.18	0.9	25	120
KIMF0402FR22□S01AK000T	0.22	1.2	25	110
KIMF0402FR27□S01AK000T	0.27	1.2	25	95
KIMF0402FR33□S01AK000T	0.33	1.25	18	85
KIMF0402FR39□S02AK000T	0.39	0.6	15	85
KIMF0402FR47□S02AK000T	0.47	0.7	15	80
KIMF0402FR56□S02AK000T	0.56	0.8	15	75
KIMF0402FR68□S02AK000T	0.68	0.9	15	70
KIMF0402FR82□S02AK000T	0.82	0.9	15	65
KIMF0402F1R0□S03AK000T	1.0	1	15	60
KIMF0402F1R2□S03AK000T	1.2	1.25	15	55
KIMF0402F1R5□S03AK000T	1.5	1.4	15	50

0603 Type

Part Number	Inductance (μ H)	DC Resistance(Ω)	Max. Rated Current (mA)	Min. Selfresonant Frequency(MHZ)
KIMF0603FR10□S01AK000T	0.1	0.5	50	240
KIMF0603FR12□S01AK000T	0.12	0.5	50	205
KIMF0603FR15□S01AK000T	0.15	0.6	50	180
KIMF0603FR18□S01AK000T	0.18	0.6	50	165
KIMF0603FR22□S01AK000T	0.22	0.8	50	150
KIMF0603FR27□S01AK000T	0.27	0.8	50	136
KIMF0603FR33□S01AK000T	0.33	0.85	35	125
KIMF0603FR39□S01AK000T	0.39	1	35	110
KIMF0603FR47□S01AK000T	0.47	1.35	35	105
KIMF0603FR56□S01AK000T	0.56	1.55	35	95
KIMF0603FR68□S01AK000T	0.68	1.7	35	90
KIMF0603FR82□S01AK000T	0.82	2.1	35	85
KIMF0603F1R0□S03AK000T	1.0	0.6	25	90
KIMF0603F1R2□S03AK000T	1.2	0.8	25	10
KIMF0603F1R5□S03AK000T	1.5	0.8	25	10

0805 Type

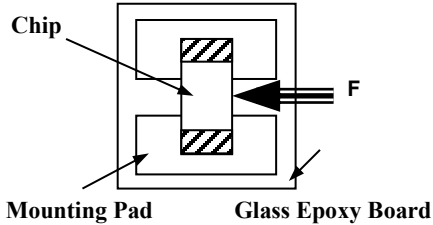
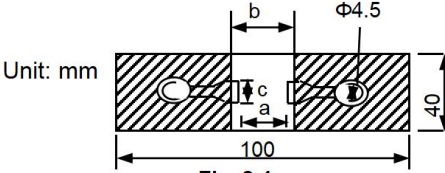
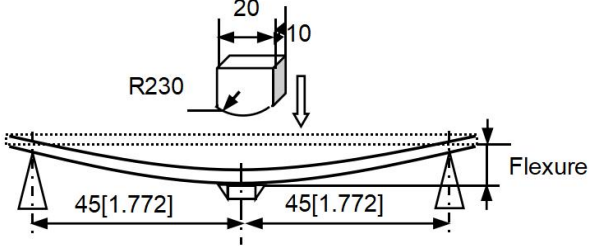
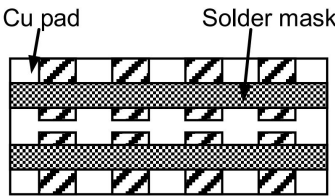
Part Number	Inductance (μ H)	DC Resistance(Ω)	Max. Rated Current (mA)	Min. Selfresonant Frequency(MHZ)
KIMF0805FR10□S01AK000T	0.1	0.3	250	235
KIMF0805FR12□S01AK000T	0.12	0.3	250	220
KIMF0805FR15□S01AK000T	0.15	0.4	250	200
KIMF0805FR18□S01AK000T	0.18	0.4	250	185
KIMF0805FR22□S01AK000T	0.22	0.5	250	170

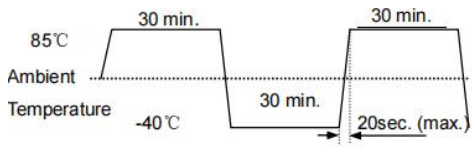
KIMF0805FR27□S01AK000T	0.27	0.5	250	150
KIMF0805FR33□S01AK000T	0.33	0.55	250	145
KIMF0805FR39□S01AK000T	0.39	0.65	200	135
KIMF0805FR47□S01AK000T	0.47	0.65	200	125
KIMF0805FR56□S01AK000T	0.56	0.75	150	115
KIMF0805FR68□S01AK000T	0.68	0.8	150	105
KIMF0805FR82□S01AK000T	0.82	1	150	100
KIMF0805F1R0□S03AK000T	1.0	0.4	50	95
KIMF0805F1R2□S03AK000T	1.2	0.5	50	85
KIMF0805F1R5□S03AK000T	1.5	0.5	50	80

1206 Type

Part Number	Inductance (μ H)	DC Resistance(Ω)	Max. Rated Current (mA)	Min. Selfresonant Frequency(MHZ)
KIMF1206FR10□S01AK000T	0.1	0.25	250	235
KIMF1206FR12□S01AK000T	0.12	0.3	250	220
KIMF1206FR15□S01AK000T	0.15	0.3	250	200
KIMF1206FR18□S01AK000T	0.18	0.4	250	185
KIMF1206FR22□S01AK000T	0.22	0.4	250	170
KIMF1206FR27□S01AK000T	0.27	0.5	250	150
KIMF1206FR33□S01AK000T	0.33	0.6	250	145
KIMF1206FR39□S01AK000T	0.39	0.5	200	135
KIMF1206FR47□S01AK000T	0.47	0.6	200	125
KIMF1206FR56□S01AK000T	0.56	0.7	150	115
KIMF1206FR68□S01AK000T	0.68	0.8	150	105
KIMF1206FR82□S01AK000T	0.82	0.9	150	100
KIMF1206F1R0□S03AK000T	1.0	0.4	100	75
KIMF1206F1R2□S03AK000T	1.2	0.5	100	65
KIMF1206F1R5□S03AK000T	1.5	0.5	50	60

Reliability Test

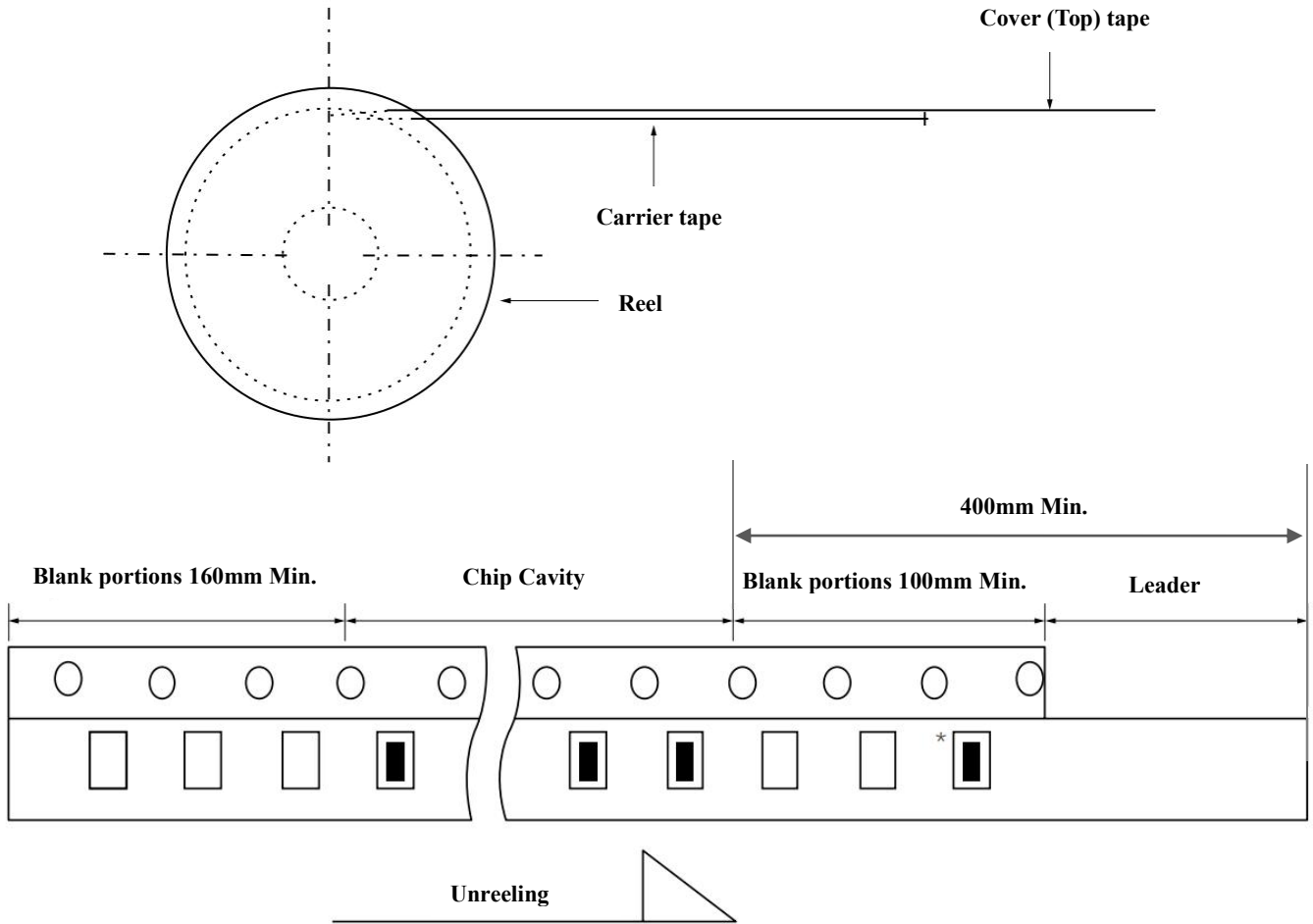
Items	Requirements	Test Methods and Remarks																																
Terminal Strength	<p>No removal or split of the termination or other defects shall occur.</p>  <p>Fig.1-1</p>	<p>Solder the inductor to the testing jig (glass epoxy board shown in the following Fig. 1-1) using eutectic solder. Then apply a force in the direction of the arrow.</p> <table border="1" data-bbox="837 432 1433 788"> <thead> <tr> <th>Size (JIS)</th> <th>Force</th> <th>Duration</th> </tr> </thead> <tbody> <tr> <td>0201/0603</td> <td>2N</td> <td rowspan="3">10 ± 1S</td> </tr> <tr> <td>0402/1005 0603/1608</td> <td>5N</td> </tr> <tr> <td>0805/2012 1206/3216</td> <td>10N</td> </tr> </tbody> </table>	Size (JIS)	Force	Duration	0201/0603	2N	10 ± 1S	0402/1005 0603/1608	5N	0805/2012 1206/3216	10N																						
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Resistance to Flexure	<p>No visible mechanical damage.</p> <p>Unit: mm</p> <table border="1" data-bbox="336 920 775 1193"> <thead> <tr> <th>Size</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>0603</td> <td>0.25</td> <td>0.8</td> <td>0.3</td> </tr> <tr> <td>1005</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>1608</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>2012</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>3216</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> </tbody> </table>  <p>Fig. 2-1</p>	Size	a	b	c	0603	0.25	0.8	0.3	1005	0.4	1.5	0.5	1608	1.0	3.0	1.2	2012	1.2	4.0	1.65	3216	2.2	5.0	2.0	<p>Solder the chip to the test jig (glass epoxy board shown in Fig.2-1) using a eutectic solder. Then apply a force in the direction shown in Fig. 2-2.</p> <table border="1" data-bbox="837 958 1433 1137"> <thead> <tr> <th>Size (JIS)</th> <th>Flexure</th> <th>Pressurizing Speed</th> <th>Duration</th> </tr> </thead> <tbody> <tr> <td>ALL</td> <td>2mm</td> <td><0.5mm/s</td> <td>30 ± 1s</td> </tr> </tbody> </table>  <p>Fig.2-2</p>	Size (JIS)	Flexure	Pressurizing Speed	Duration	ALL	2mm	<0.5mm/s	30 ± 1s
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3216	2.2	5.0	2.0																															
Size (JIS)	Flexure	Pressurizing Speed	Duration																															
ALL	2mm	<0.5mm/s	30 ± 1s																															
Vibration	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: Within ±10%. ❖ Q factor change: within ±30%  <p>Fig. 3-1</p>	<ul style="list-style-type: none"> ❖ Solder the chip to the testing jig (glass epoxy board shown in Fig.3-1) using eutectic solder. ❖ The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz. ❖ The frequency ranging from 10 to 55 Hz and returning to 10 Hz 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). 																																
Dropping	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: Within ±10%. ❖ Q factor change: within ±30% 	<ul style="list-style-type: none"> ❖ Drop chip inductor 10 times on a concrete floor from a height of 100 cm, 																																

Temperature Characteristic	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: within $\pm 10\%$ 	<ul style="list-style-type: none"> ❖ Temperature range: $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$. ❖ Reference temperature: $+20^{\circ}\text{C}$
Solderability	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Wetting shall exceed 95% coverage. 	<ul style="list-style-type: none"> ❖ Solder temperature: $240 \pm 5^{\circ}\text{C}$. ❖ Duration: 3 sec. ❖ Solder: Sn/3.0Ag/0.5Cu. ❖ Flux: 25% Resin and 75% ethanol in weight.
Resistance to Soldering Heat	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Wetting shall exceed 95% coverage. ❖ Inductance change: within $\pm 10\%$. ❖ Q factor change: within $\pm 30\%$ 	<ul style="list-style-type: none"> ❖ Solder temperature: $260 \pm 5^{\circ}\text{C}$. ❖ Duration: 5 sec. ❖ Solder: Sn/3.0Ag/0.5Cu. ❖ Flux: 25% Resin and 75% ethanol in weight. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Thermal Shock	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: within $\pm 10\%$. ❖ Q factor change: within $\pm 30\%$  <p>The diagram shows a thermal shock test profile. The y-axis is labeled 'Temperature' and has markers for 'Ambient', '85°C', and '-40°C'. The x-axis represents time. The profile consists of three temperature levels: 85°C, Ambient, and -40°C. Each level is held for 30 minutes. The transitions between 85°C and Ambient, and between Ambient and -40°C, are marked with '30 min.' and a double-headed arrow indicating a 20-second maximum transition time. The transition from -40°C back to Ambient is also marked with '30 min.' and a double-headed arrow indicating a 20-second maximum transition time.</p>	<ul style="list-style-type: none"> ❖ Temperature, Time: -40°C for 30 ± 3 min \rightarrow 85°C for 30 ± 3 min. ❖ Transforming interval: 20sec. Max. ❖ Tested cycle: 100 cycles. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Resistance to Low Temperature	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: within $\pm 10\%$. ❖ Q factor change: within $\pm 30\%$ 	<ul style="list-style-type: none"> ❖ Temperature: $-40 \pm 2^{\circ}\text{C}$. ❖ Duration: 1000 ± 24 hours. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Resistance to High Temperature	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: within $\pm 10\%$. ❖ Q factor change: Within $\pm 30\%$. 	<ul style="list-style-type: none"> ❖ Temperature: $85 \pm 2^{\circ}\text{C}$. ❖ Duration: 1000 ± 24 hours. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Damp Heat (Steady States)	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: within $\pm 10\%$. ❖ Q factor change: Within $\pm 30\%$. 	<ul style="list-style-type: none"> ❖ Temperature: $60 \pm 2^{\circ}\text{C}$ ❖ Humidity: 90% to 95% RH. ❖ Duration: 1000 ± 24 hours. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Loading Under Damp Heat	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: within $\pm 10\%$ for inductance $\leq 12\mu\text{H}$, Within $\pm 15\%$ for inductance $\geq 15\mu\text{H}$. ❖ Q factor change: Within $\pm 30\%$. 	<ul style="list-style-type: none"> ❖ Temperature: $60 \pm 2^{\circ}\text{C}$ ❖ Duration: 1000 ± 24 hours. ❖ Applied current: Max. Permissive Operating Current. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.

<p>Loading at High Temperature (Life Test)</p>	<ul style="list-style-type: none"> ❖ No visible mechanical damage. ❖ Inductance change: within $\pm 10\%$ for inductance $\leq 12\mu\text{H}$, Within $\pm 15\%$ for inductance $\geq 15\mu\text{H}$. ❖ Q factor change: Within $\pm 30\%$. 	<ul style="list-style-type: none"> ❖ Temperature: $85\pm 2^\circ\text{C}$. ❖ Duration: 1000+24 hours. ❖ Applied current: Max. Permissive Operating Current. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
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■ Packaging

(1) Figure

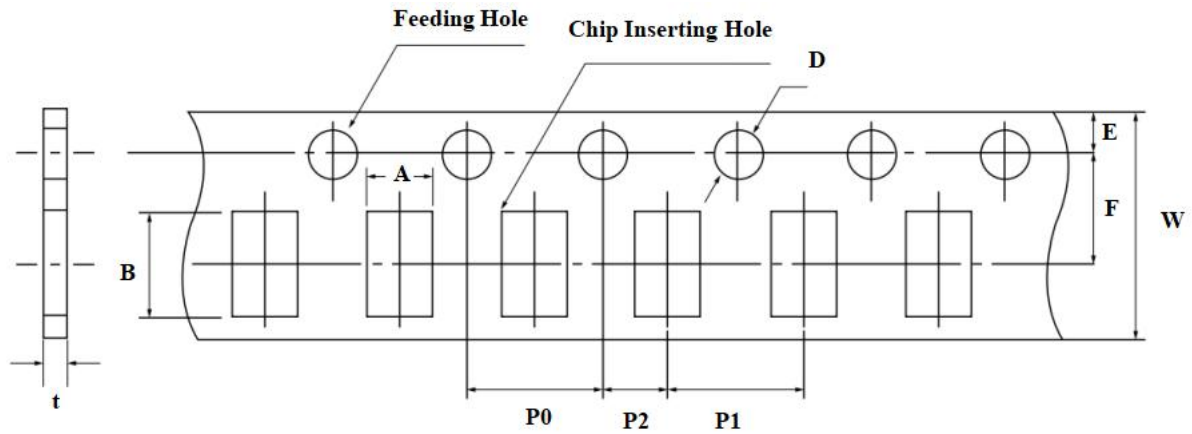


(2) Quantity

Size(JIS)	Taping Type	Reel	Inner Box	Outer Box
0402/1005	Paper	10K	10K×10=100K	100K×6=600K
0603/1608	Paper	4K	4K×10=40K	40K×6=240K
0805/2012	Paper	4K	4K×10=40K	40K×6=240K
1206/3216	Paper	3K	3K×10=30K	30K×6=180K

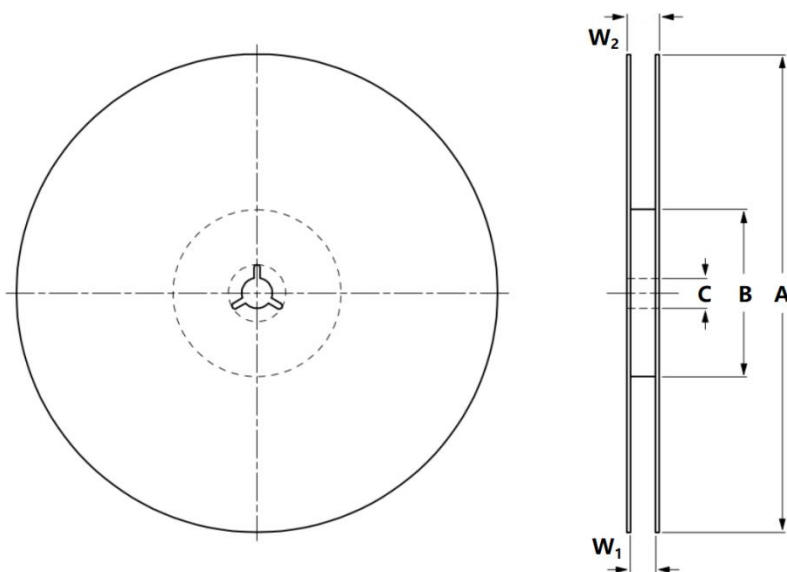
(3) Tape Size

❖ Cardboard(Paper) tape



Size (EIA)	A	B	W	F	E	P1	P2	P0	D	t
0402/1005	0.65	1.15	8.0 ± 0.3	3.5 ± 0.05	1.75 ± 0.10	2.0 ± 0.05	1.8 ± 0.05	4.0 ± 0.10	$\Phi 1.5$ $+0.1/0$	0.80
0603/1608	1.8	4.0	8.0 ± 0.3	3.5 ± 0.05	1.75 ± 0.10	2.0 ± 0.05	1.8 ± 0.05	4.0 ± 0.10	$\Phi 1.5$ $+0.1/0$	1.10
0805/2012	2.30	4.0	8.0 ± 0.3	3.5 ± 0.05	1.75 ± 0.10	2.0 ± 0.05	1.8 ± 0.05	4.0 ± 0.05	$\Phi 1.5$ $+0.1/0$	1.10
1206/3216	2.30	4.0	8.0 ± 0.3	3.5 ± 0.05	1.75 ± 0.10	2.0 ± 0.05	1.8 ± 0.05	4.0 ± 0.05	$\Phi 1.5$ $+0.1/0$	1.10

(4) Reel Size

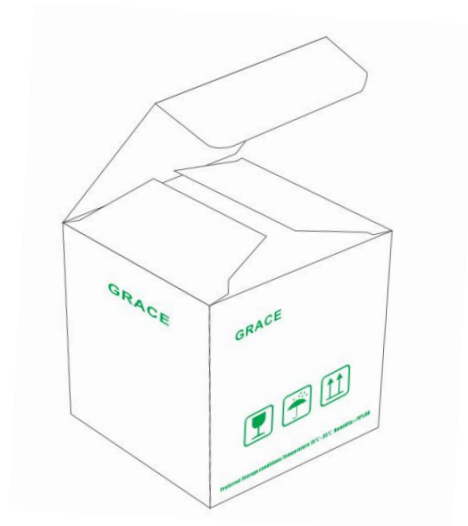
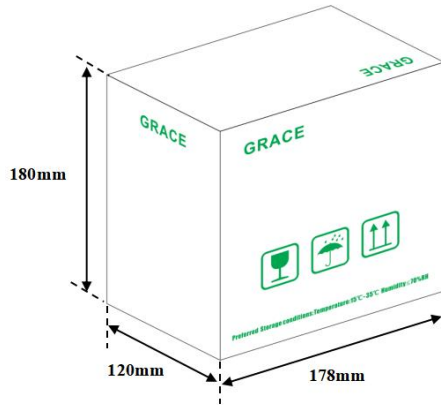


Type	Symbol	Dimensions(mm)
All	A	178 ± 2
	B	58 ± 2
	C	13.5 ± 0.2
	W1	4.5 ± 0.5
	W2	7.5 ± 1

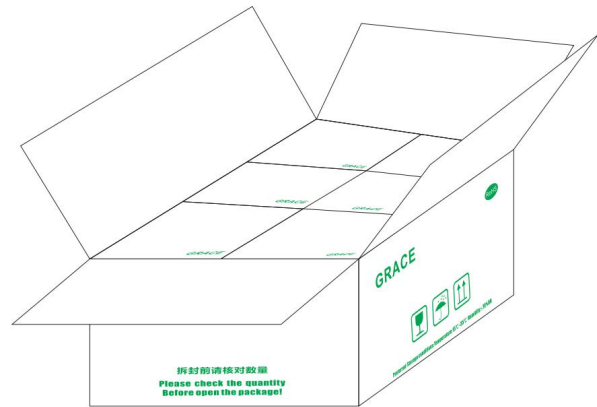
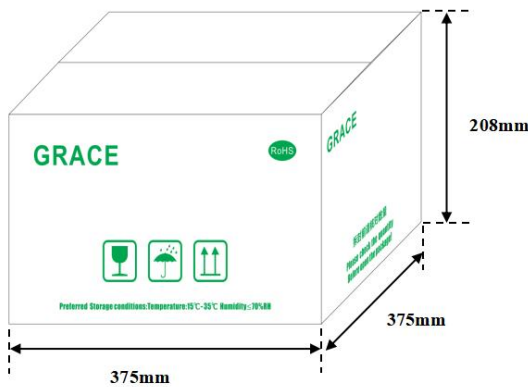
(5) BOX package

Double packaging with the paper type of inner box and outer box.

❖ Inner Box :



❖ Outer Box :



※ Box size specifications for reference.

Storage environment

(1) Recommendation for temperature/humidity

- ❖ Even taping and packaging materials are designed to endure a long-term storage, they should be stored with a temperature of $-10\sim 40^{\circ}\text{C}$ and an RH of $0\sim 70\%$ otherwise, too high temperatures or humidity may deteriorate the quality of the chip rapidly.
- ❖ Packaging material may be deformed if packages are stored where they are exposed to heat of direct sunlight.
- ❖ As oxidization is accelerated when relative humidity is above $70\%\text{RH}$, the lower the humidity is, the better the solderability is.
- ❖ As the temperature difference may cause dew condensation during the storage of the chip, it is a must to maintain a temperature control environment.

(2) Shelf Life

- ❖ An allowable storage period should be within 12 months from the outgoing date of delivery in consideration of solderability.
- ❖ As for chips in storage over 12 months, please check solderability before use.

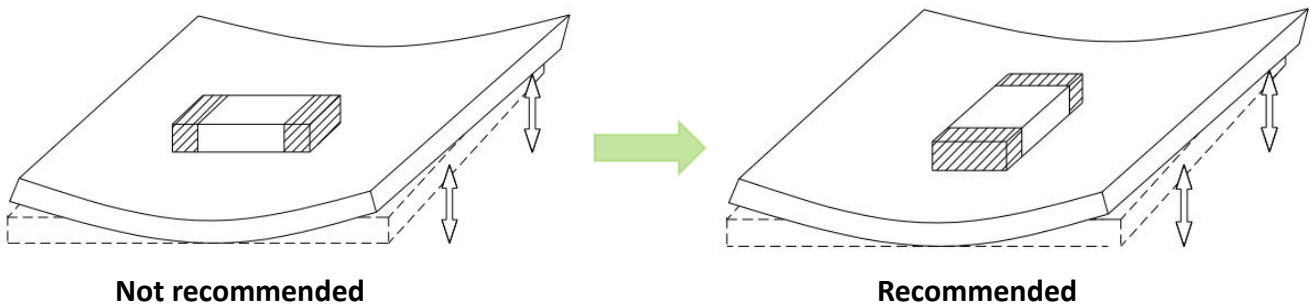
(3) Caution for corrosive environment

As corrosive gases may deteriorate the solderability of chip outer termination, it is a must to store chip in an environment without gases. chip that is exposed to corrosive gases may cause its quality issues due to the corrosion of plating layers and the penetration of moisture.

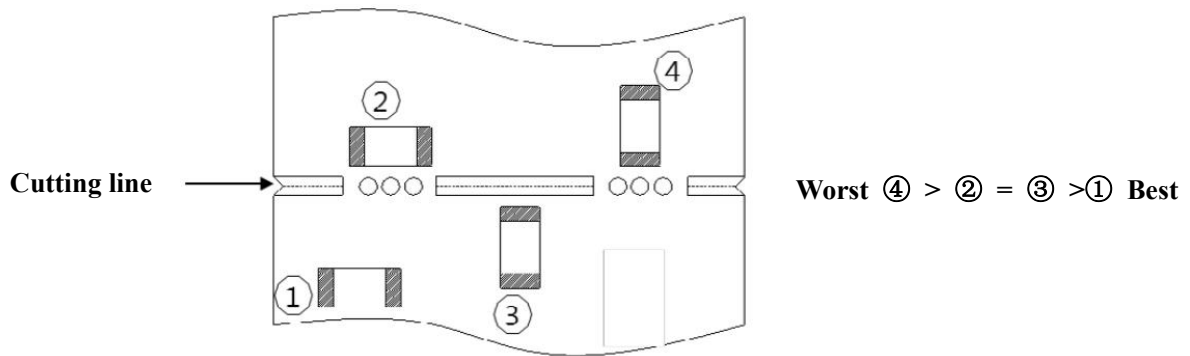
■ Process of Mounting and Soldering

(1) Mounting

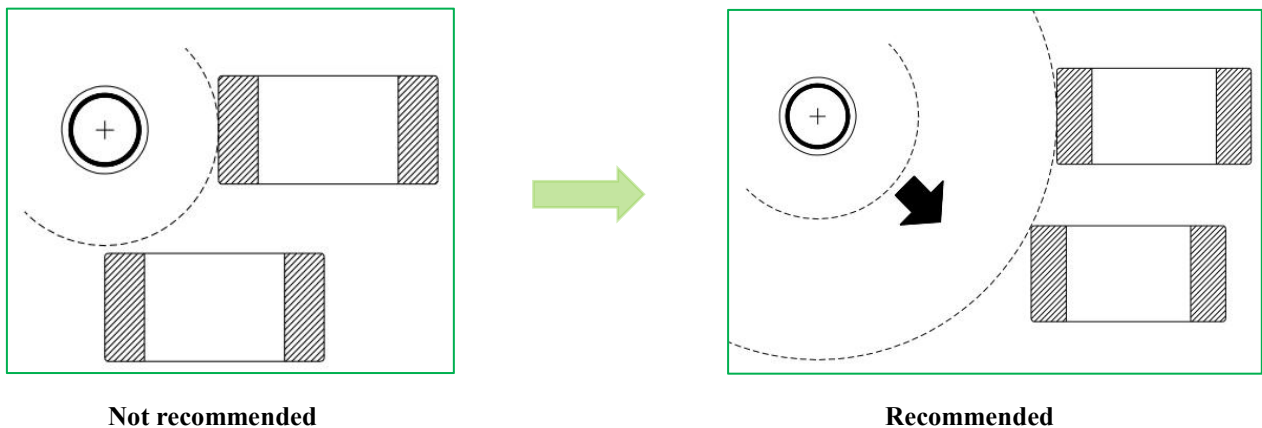
- ❖ It is recommended to locate the major axis of chip in parallel to the direction in which the stress is applied.



- ❖ Please take the following measures to effectively reduce the stress generated from the cutting of PCB. Select the mounting location shown below, since the mechanical stress is affected by a location and a direction of chip mounted near the cutting line.

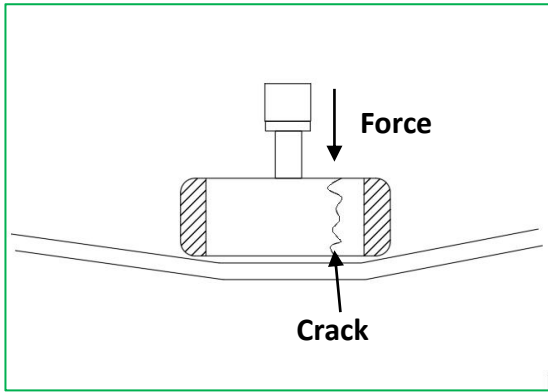


- ❖ If the chip is mounted near a screw hole, the board deflection may be occurred by screw torque. Mount the chip as far from the screw holes as possible.

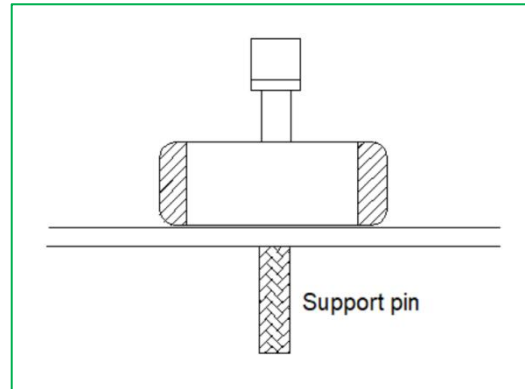


- ❖ Substrate fixes up back surface of substrate with support pin in impact of suction nozzle to wely deflection to the

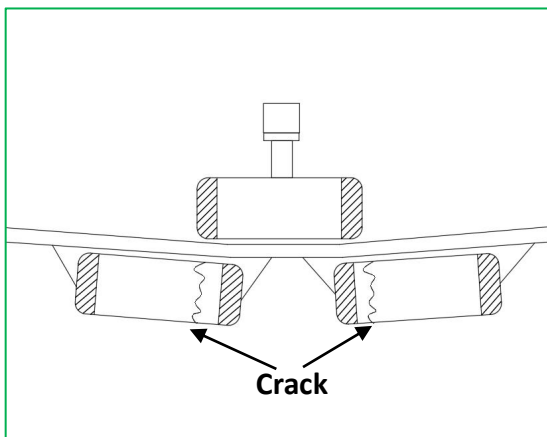
❖ utmost, and substrate hold deflection, please. A representative example is shown in the following.



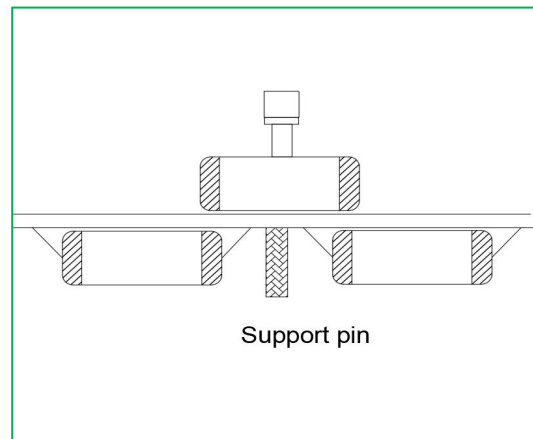
Cases to avoid



Recommended Case



Cases to avoid



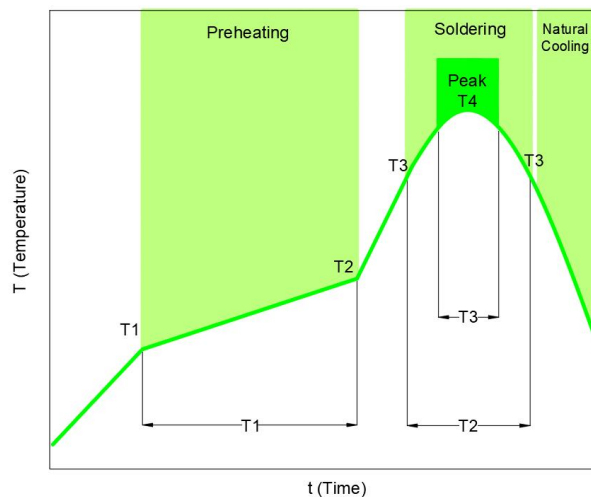
Recommended Case

※ Dust accumulated in a suction nozzle and suction mechanism can impede a smooth movement of the nozzle. This may cause cracks in the chip due to the excessive force during mounting. If the mounting claw is worn out, it may cause cracks in the chip due to the uneven force during positioning. A regular inspection such as maintenance, monitor and replacement for the suction nozzle and mounting claw should be conducted.

(2) Reflow soldering

The reflow soldering temperature conditions are composed of temperature curves of Preheating, Temp. rise, Heating, Peak and Gradual cooling. Large temperature difference inside the chip caused by rapid heat application to the chip may lead to excessive thermal stresses, contributing to the thermal cracks. The Preheating temperature requires controlling with great care so that tombstone phenomenon may be prevented.

Follow the recommended soldering conditions to avoid degradation of performance .



Item	Specification	
	For eutectic mixture solder	For lead-free solder
Preheating temperature	160 ~ 180 °C	150 ~ 180 °C
Solder melting temperature	200 °C	230 °C
Maximum temperature	240° C max.	260 °C max.
Preheating time	100s max.	120s max.
Time to reach higher than the solder melting temperature	30s max.	40s max.
number of possible reflow cycles	2 max.	2 max.

- ※ Pre-heating is necessary for all constituents including the PCB to prevent the mechanical damages on the chip .
The temperature difference between the PCB and the component surface must be kept to the minimum.
- Allowable temperature difference $\Delta T \cong 150 \text{ }^\circ\text{C}$
 - Use non-activated flux. (Max. Cl content less than 0.1%)

(3) Soldering Iron

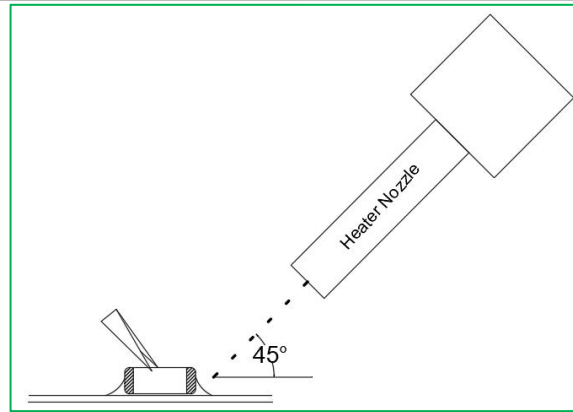
Manual soldering can pose a great risk on creating thermal cracks in the chip. The high temperature soldering iron tip may come into a direct contact with the ceramic body of the chip due to the carelessness of an operator. Therefore, the soldering iron must be handled carefully, and close attention must be paid to the selection of the soldering iron tip and to temperature control of the tip.

Iron soldering power	Soldering time	Soldering Temp.	Number of times	Pre-heating
20W max.	3s max.	300±10°C max.	Within each terminal once(Within total of twice)	① $\Delta T \leq 130$ ② $\geq 60\text{S}$

- ※ Keep the contact time between the outer termination of the chip and the soldering iron as short as possible.
Long soldering time may cause problems such as adhesion deterioration by the leaching phenomenon of the outer termination.
- Control ΔT in the solder iron and preheating temperature;
 - Caution - Iron tip should not contact with ceramic body directly;
 - Do not cool down the chip and PCB rapidly after soldering;
 - Lead-free solder: Sn-3.0Ag-0.5Cu.

(4) Spot heater

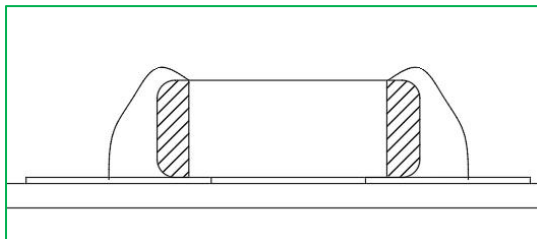
Compared to local heating with a soldering iron, hot air heating by a spot heater heats the overall component and board, therefore, it tends to lessen the thermal shock. In the case of a high density mounted board, a spot heater can also prevent concerns of the soldering iron making direct contact with the component.



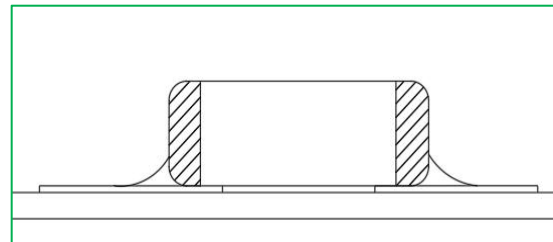
Distance	Hot Air Application angle	Hot Air Temperature Nozzle Outlet	Application Time
≥ 5mm	45°C	≤ 400°C	≤ 10s

※ If the distance from the hot air outlet of the spot heater to the component is too close, cracks may occur due to thermal shock. To prevent this problem, Follow the conditions set in the table above to prevent this problem.

(5) Recommended Amount of Solder



Excessive amount



Insufficient amount

※ Notes:

- a. Too much solder amount will increase the risk of PCB bending or cause other damages.
- b. Too little solder amount will result in the chip breaking loose from the PCB due to the inadequate adhesive strength.
- c. Check if the solder has been applied properly and ensure the solder fillet has a proper shape.

(6) Cleaning

❖ In general, cleaning is unnecessary if rosin flux is used.

When acidic flux is used strongly, chlorine in the flux may dissolve into some types of cleaning fluids, thereby affecting the performance of the chip.

This means that the cleansing solution must be carefully selected and should always be new.

❖ Cautions for cleaning

- a. Soldering flux residue may remain on the PC board if cleaned with an inappropriate solvent. This may deteriorate the performance of Varistors, especially insulation resistance.
- b. The chip or solder joint may be cracked with the vibration of PCB, if ultrasonic vibration is too strong during cleaning. Therefore, test should be done for the cleaning equipment and its process before the cleaning in order to avoid damages on the chip, you can refer to the following conditions for cleaning

Ultrasound output	Ultrasound frequency	Cleaning time
20W/liter or less	40kHz or less	5minutes or less

**Limitation**

Please contact us with usage environment information such as voltage, current, temperature, or other special conditions before using our products for the applications listed below. The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require especially high reliability, or whose failure, malfunction or trouble might directly cause damage to society, person, or property. Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below.

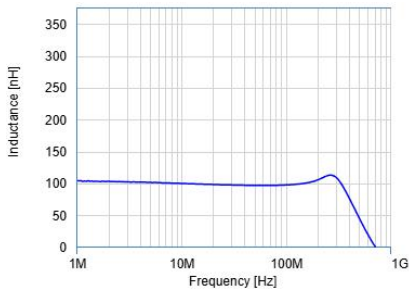
If you have any questions regarding this 'Limitation', you should first contact our sales personnel or application engineers.

- ❖ **Aerospace/Aviation equipment 1wheeler, 2wheeler and 3wheeler vehicle**
- ❖ **Automotive of Transportation equipment**
- ❖ **Military equipment**
- ❖ **Atomic energy-related equipment**
- ❖ **Undersea equipment**
- ❖ **Medical equipment**
- ❖ **Disaster prevention/crime prevention equipment**
- ❖ **Power plant control equipment**
- ❖ **Traffic signal equipment**
- ❖ **Data-processing equipment**
- ❖ **Electric heating apparatus, burning equipment**
- ❖ **Safety equipment**
- ❖ **Any other applications with the same as or similar complexity or reliability to the applications**

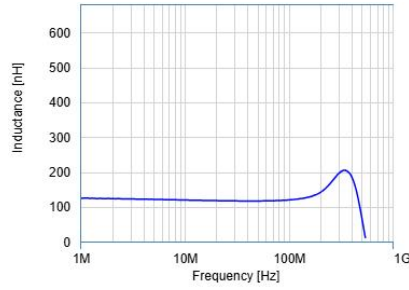
Typical Characteristic Curve

Inductance-Frequency

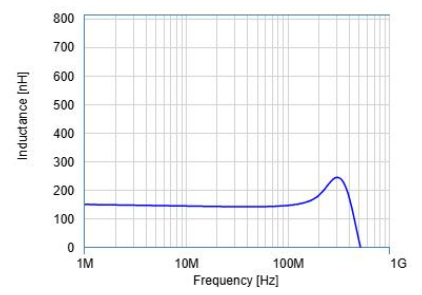
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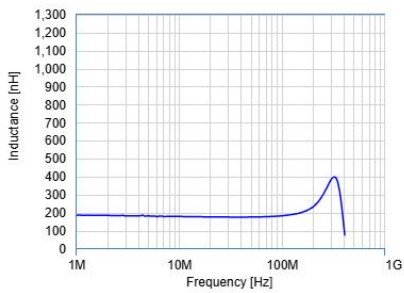
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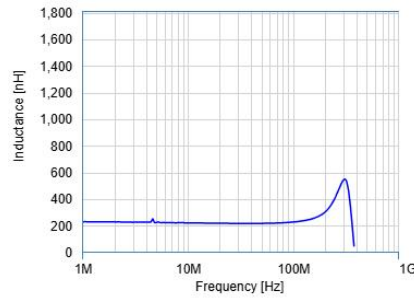
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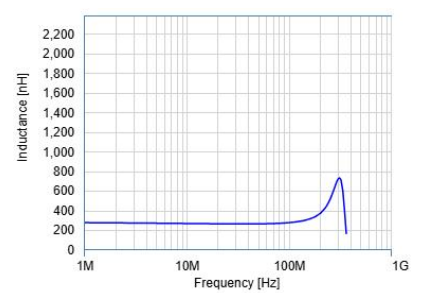
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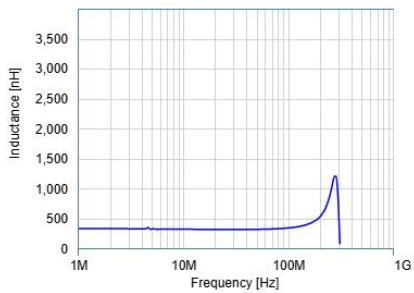
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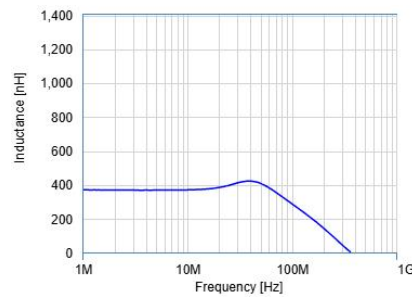
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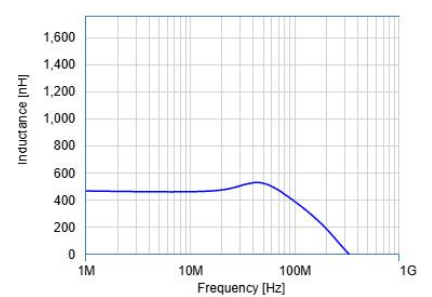
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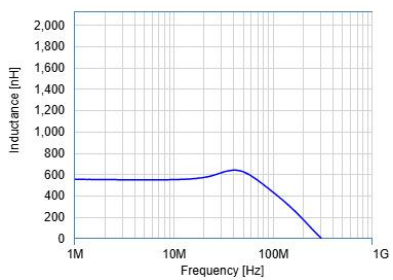
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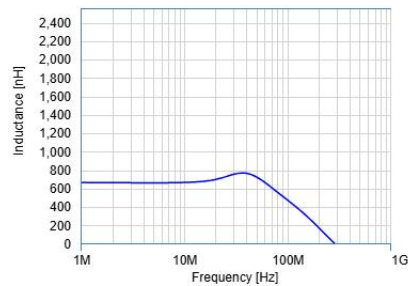
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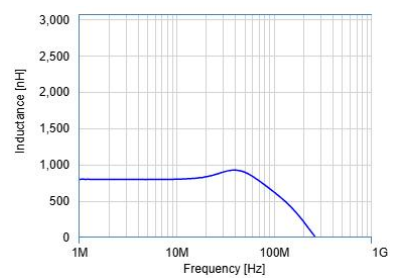
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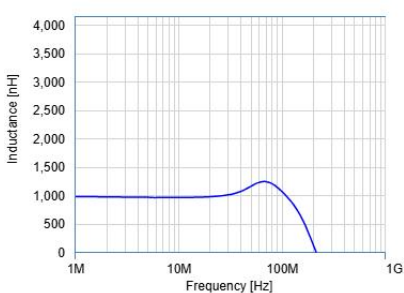
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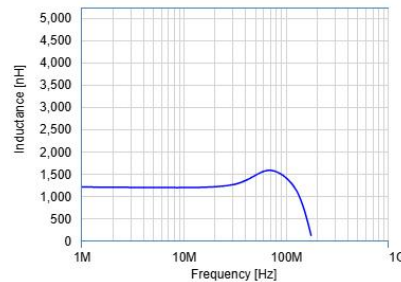
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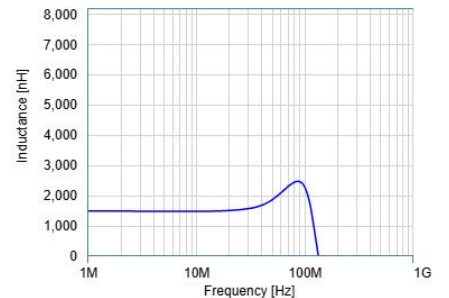
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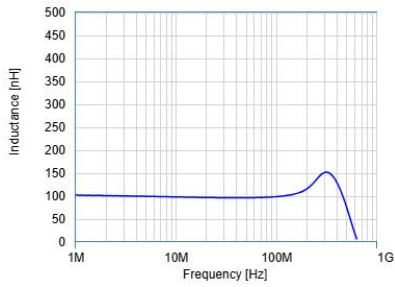
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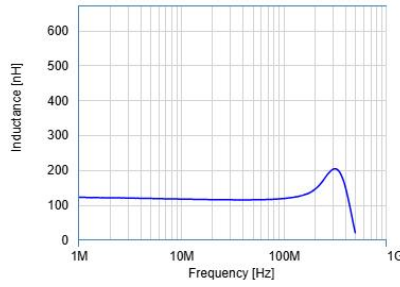
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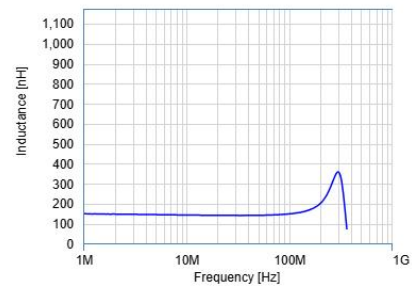
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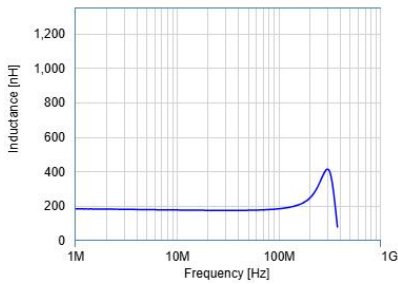
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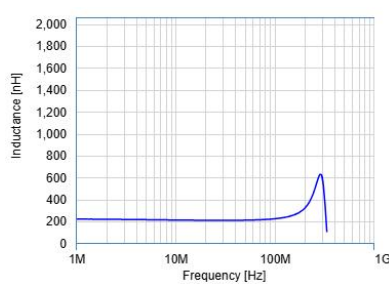
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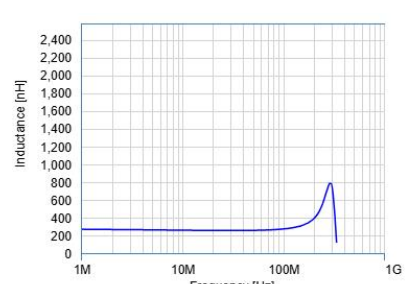
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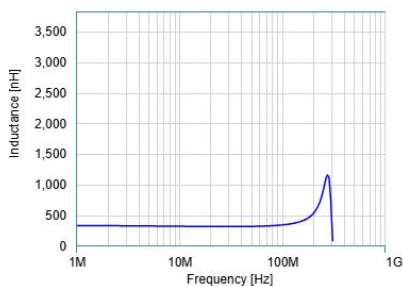
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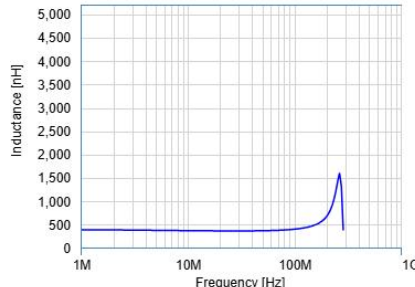
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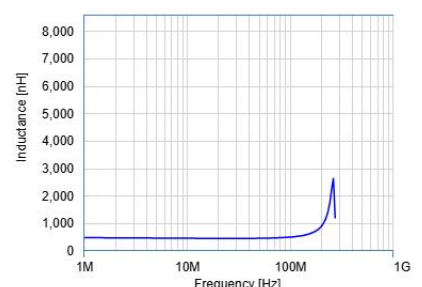
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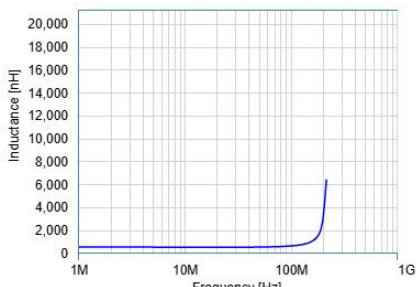
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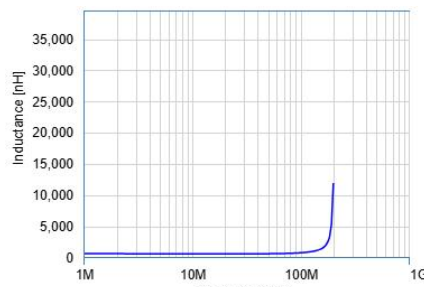
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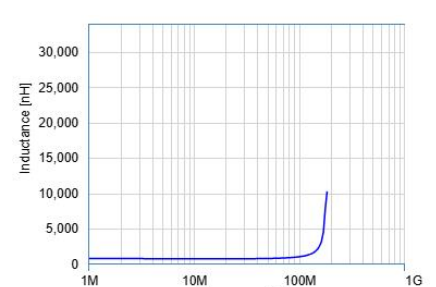
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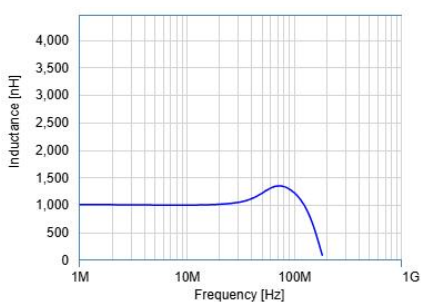
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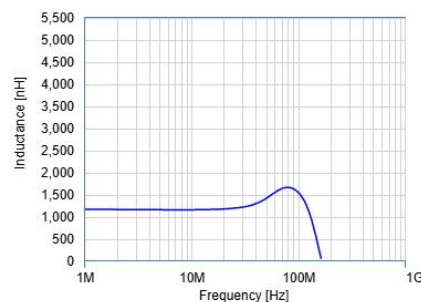
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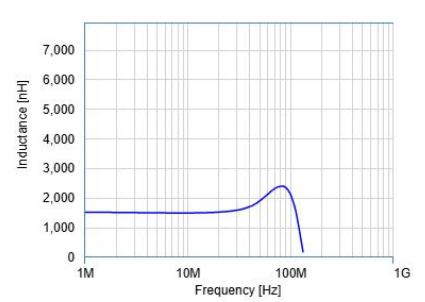
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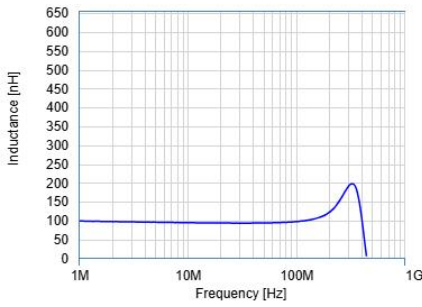
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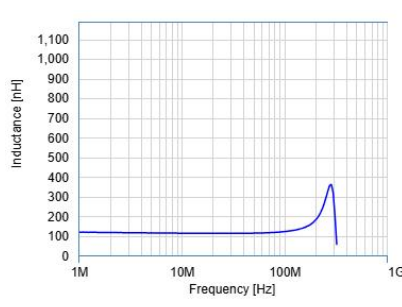
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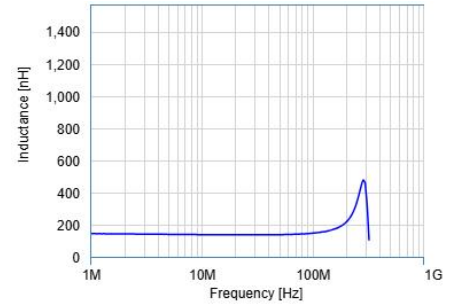
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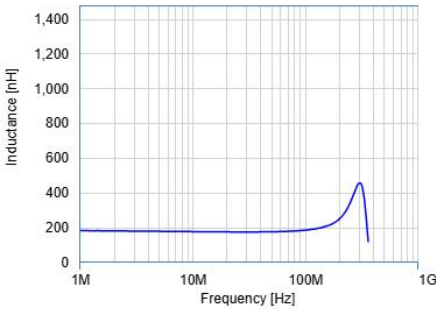
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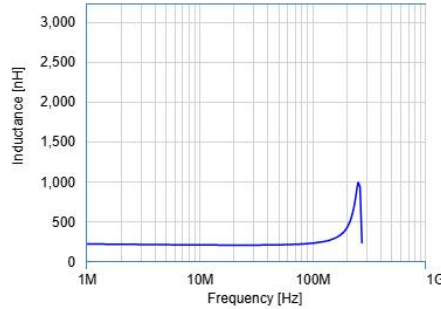
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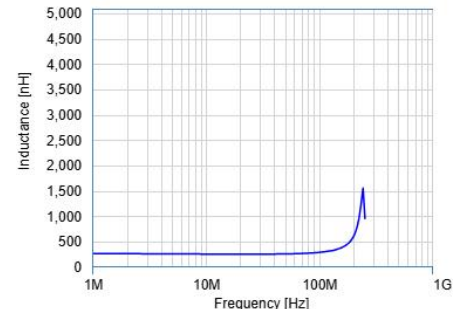
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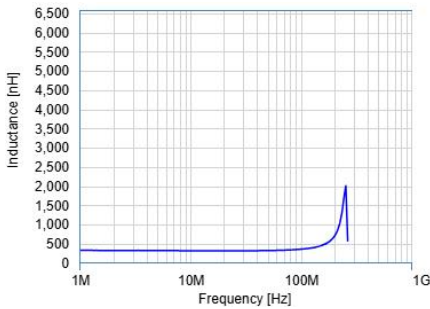
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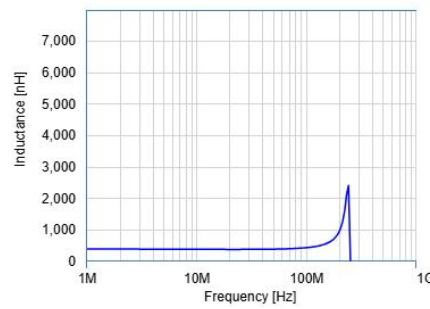
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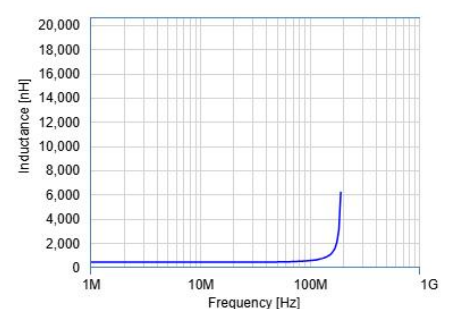
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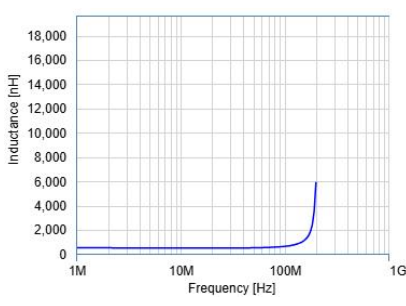
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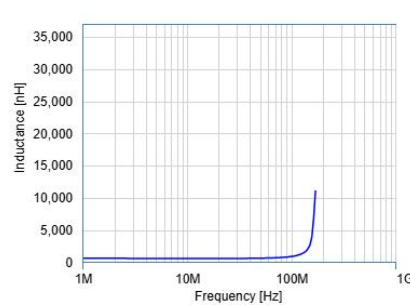
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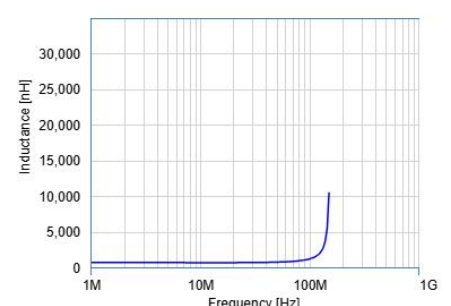
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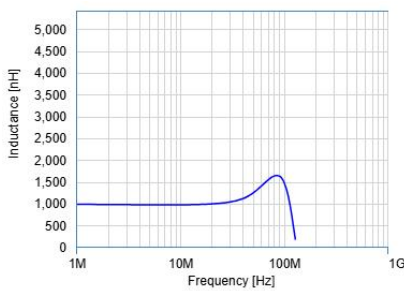
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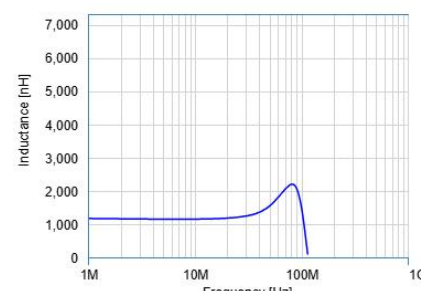
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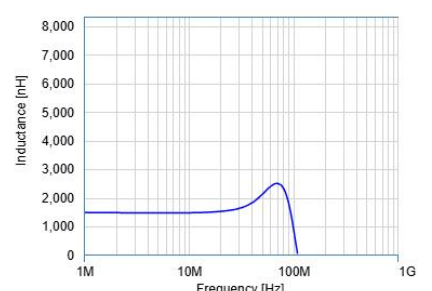
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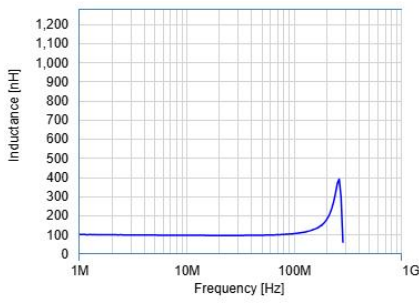
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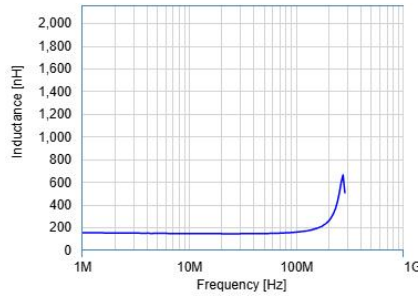
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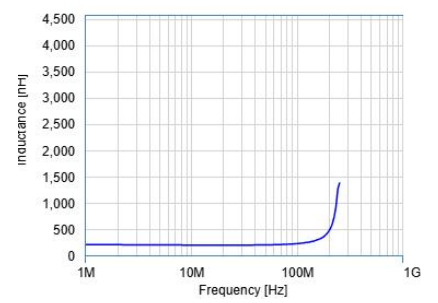
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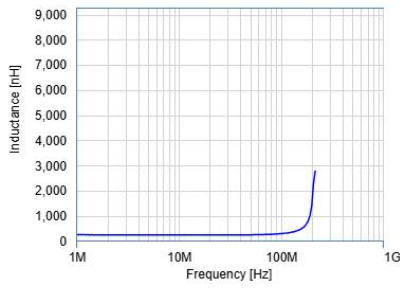
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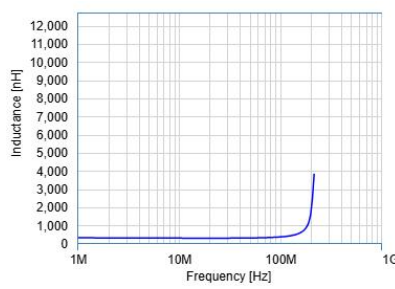
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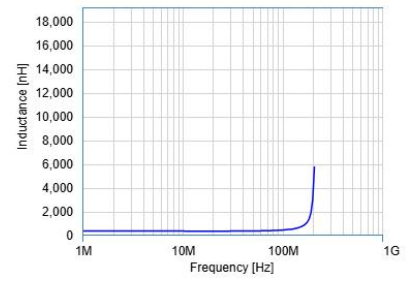
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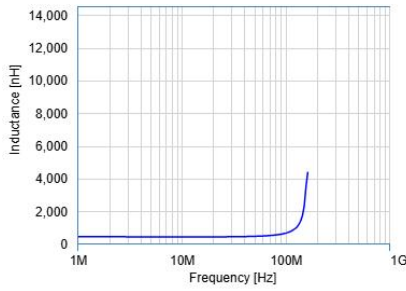
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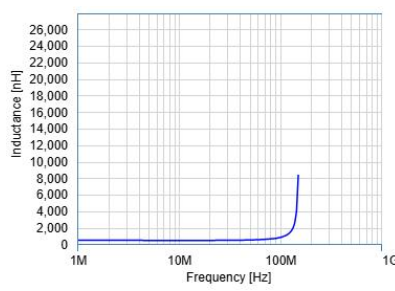
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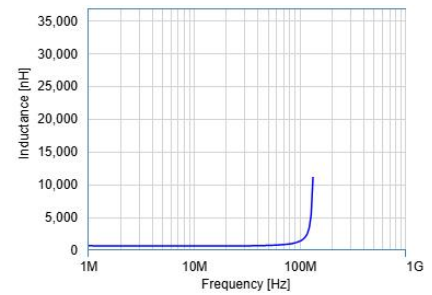
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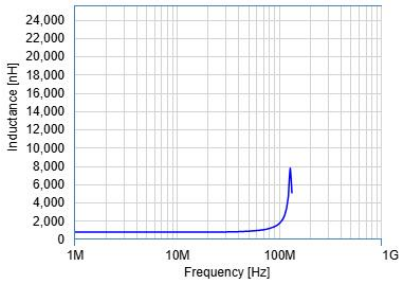
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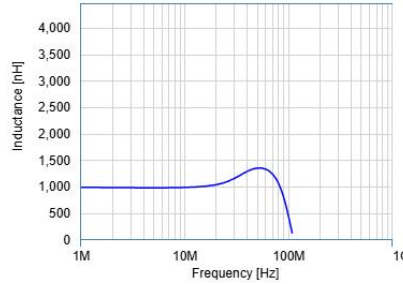
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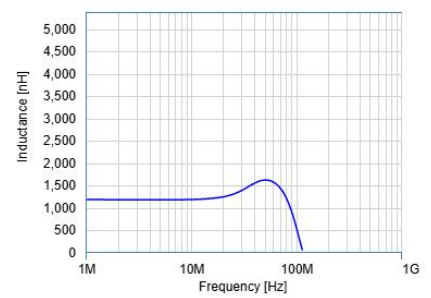
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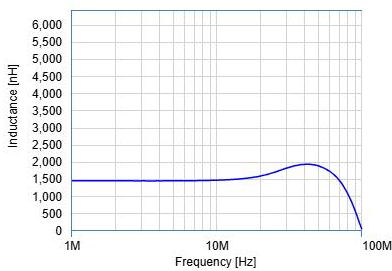
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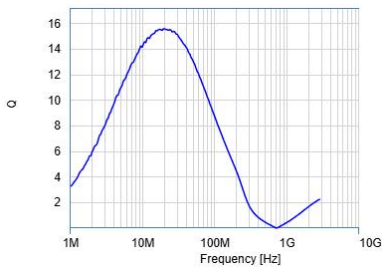
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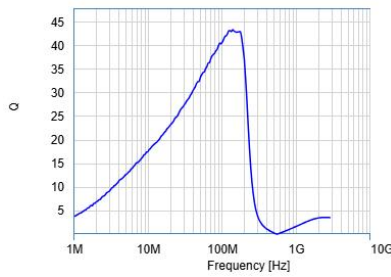
Typical Characteristic Curve

Q-Frequency

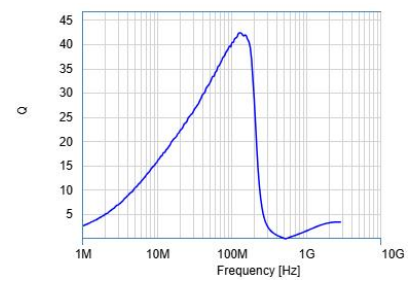
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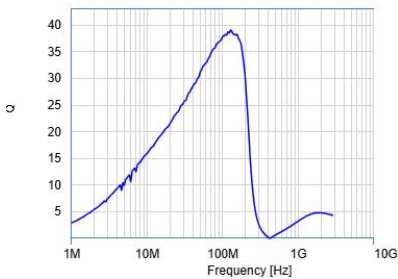
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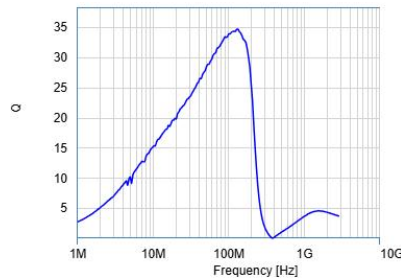
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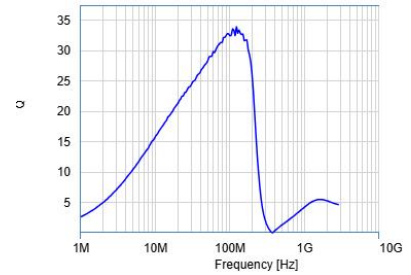
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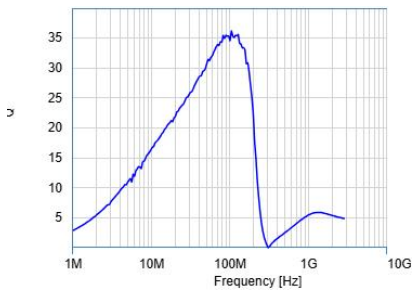
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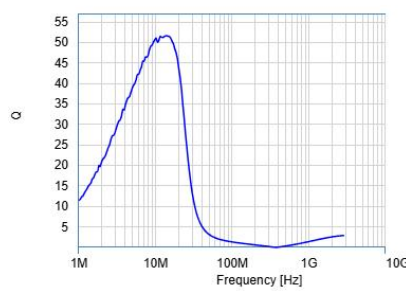
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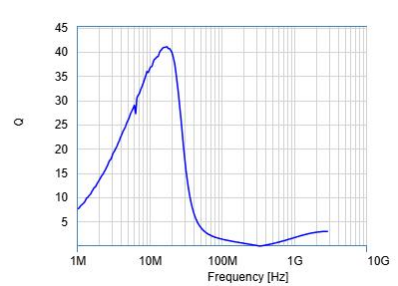
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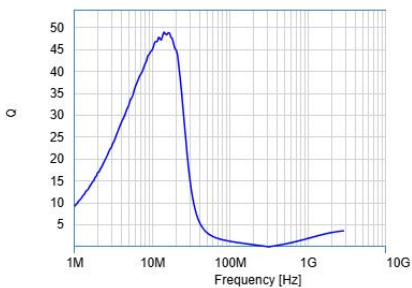
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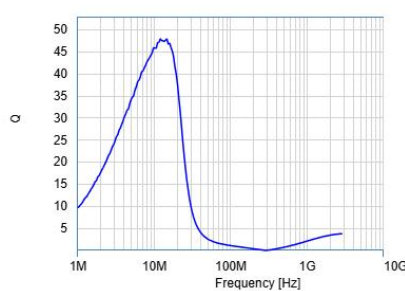
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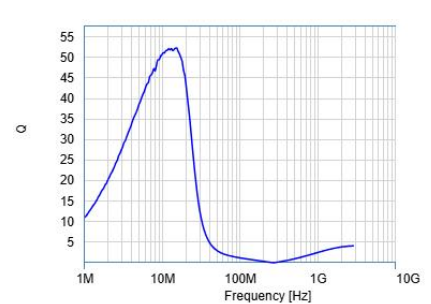
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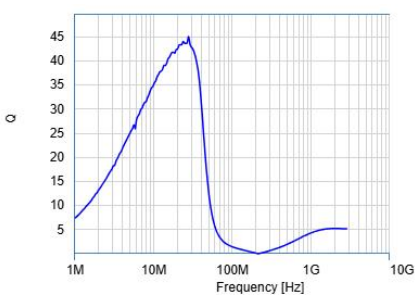
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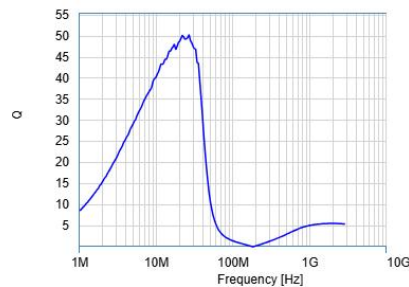
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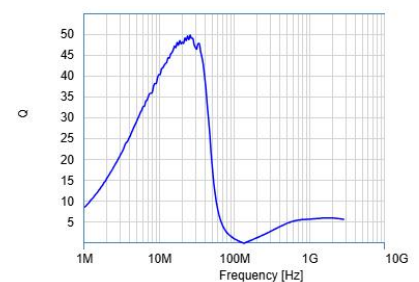
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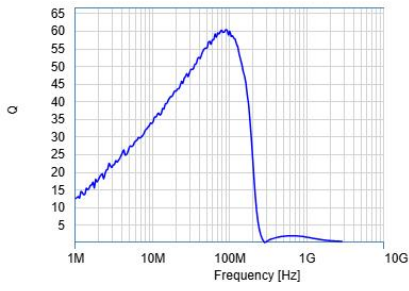
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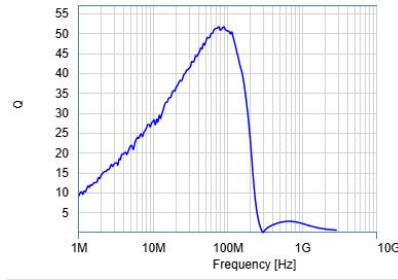
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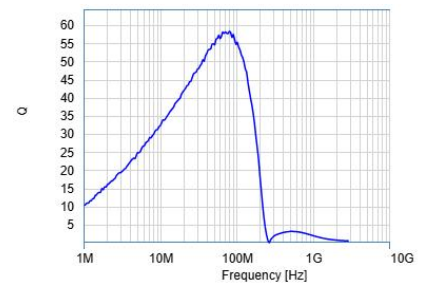
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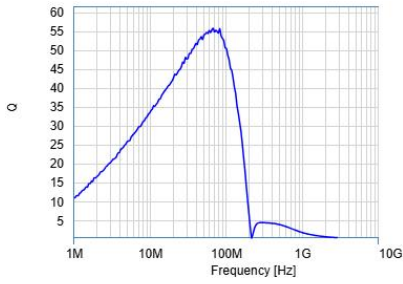
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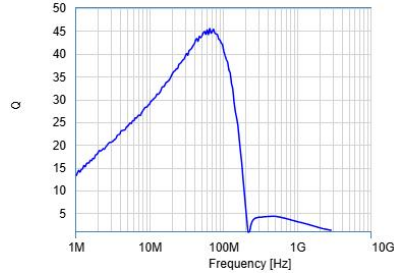
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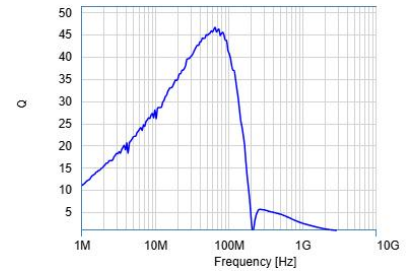
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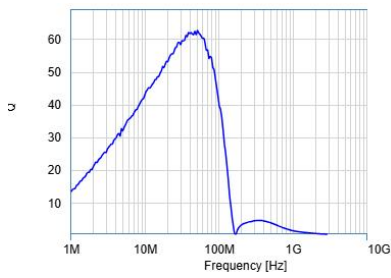
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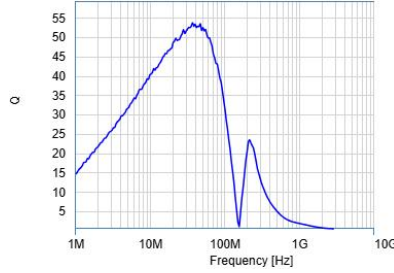
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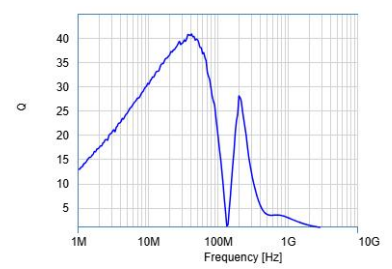
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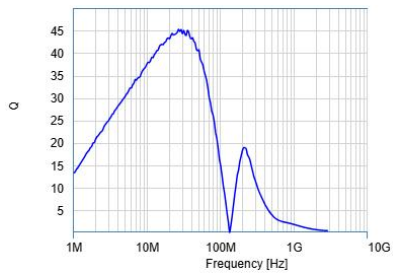
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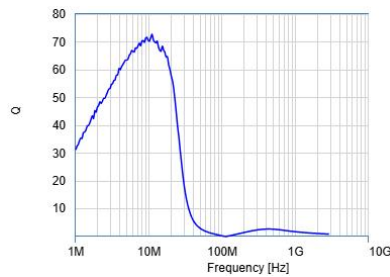
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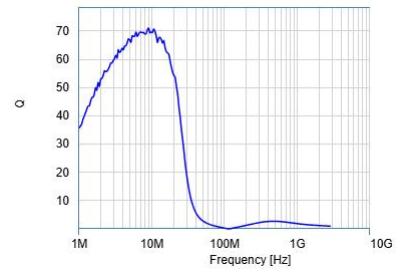
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