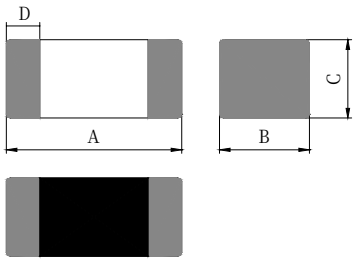
High Frequency Chip Inductor (Lead Free) HCI-Series-M

1.Features

1. Monolithic inorganic material construction.
2. Closed magnetic circuit avoids crosstalk.
3. S.M.T. type.
4. Suitable for flow and reflow soldering.
5. Shapes and dimensions follow E.I.A. spec.
6. Available in various sizes.
7. Excellent solderability and heat resistance.
8. High SRF up to 6GHz and above.
9. This component is compliant with RoHS legislation and also support lead-free soldering.

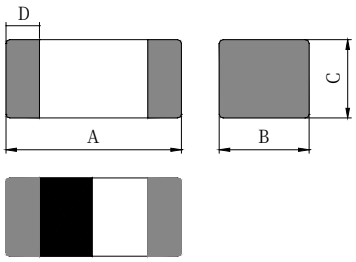
2. Dimensions

■ **1 / 4 marking**



Chip size				
Size	**A(mm)**	**B(mm)**	**C(mm)**	**D(mm)**
1005	1.0±0.1	0.5±0.1	0.5±0.1	0.25±0.1
1608	1.6±0.15	0.8±0.15	0.8±0.15	0.3±0.2

■ **1 / 8 marking**

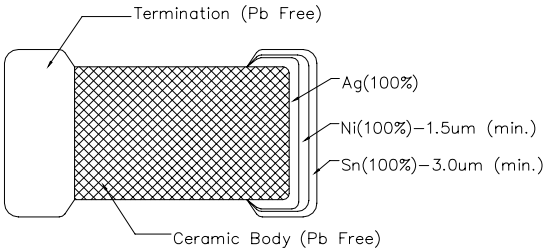


Chip size				
Size	**A(mm)**	**B(mm)**	**C(mm)**	**D(mm)**
1005	1.0±0.1	0.5±0.1	0.5±0.1	0.25±0.1

3. Part Numbering

HCI	1005	F	-	22N	J	-	M
A	B	C		D	E		F

A: Series
B: Dimension L x W
C: Material Lead Free Material
D: Inductance 22N=22 nH
E: Inductance Tolerance S=±0.3nH , J=±5% , K=±10%
F: MARKING 1/4=1N0~68N, 1/8=82N~R12



4.Specification

Part Number	Thickness (mm)	Inductance (nH)	Inductance Test Frequency (MHz)	Q@100MHz Normal Value	Q@100MHz min.	Rated Current (mA) max.	DCR (Ω) max.	SRF (MHz) min.
HCI1005F-1N0S-M	0.50±0.10	1.0	100	11	8	300	0.09	10000
HCI1005F-1N2S-M	0.50±0.10	1.2	100	11	8	300	0.09	10000

□ : S=±0.3nH, J=±5% , K=±10%

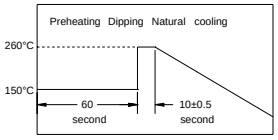
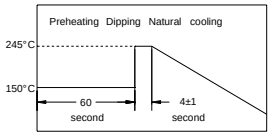
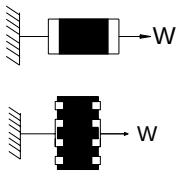
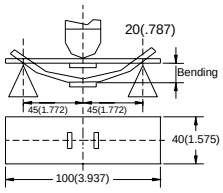
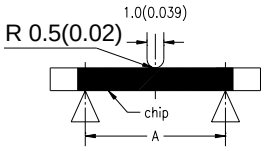
Part Number	Thickness (mm)	Inductance (nH)	Inductance Test Frequency (MHz)	Q@100MHz Normal Value	Q@100MHz min.	Rated Current (mA) max.	DCR (Ω) max.	SRF (MHz) min.
HCI1005F-1N5S-M	0.50±0.10	1.5	100	11	8	300	0.12	6000
HCI1005F-1N8S-M	0.50±0.10	1.8	100	11	8	300	0.12	6000
HCI1005F-2N2S-M	0.50±0.10	2.2	100	10	8	300	0.14	6000
HCI1005F-2N7S-M	0.50±0.10	2.7	100	10	8	300	0.14	6000
HCI1005F-3N3□-M	0.50±0.10	3.3	100	10	8	300	0.16	6000
HCI1005F-3N9□-M	0.50±0.10	3.9	100	10	8	300	0.19	4000
HCI1005F-4N7□-M	0.50±0.10	4.7	100	10	8	300	0.21	4000
HCI1005F-5N6□-M	0.50±0.10	5.6	100	10	8	300	0.23	4000
HCI1005F-6N8□-M	0.50±0.10	6.8	100	10	8	300	0.25	3900
HCI1005F-8N2□-M	0.50±0.10	8.2	100	10	8	300	0.28	3600
HCI1005F-10N□-M	0.50±0.10	10	100	10	8	300	0.31	3200
HCI1005F-12N□-M	0.50±0.10	12	100	11	8	300	0.40	2700
HCI1005F-15N□-M	0.50±0.10	15	100	11	8	300	0.50	2300
HCI1005F-18N□-M	0.50±0.10	18	100	11	8	300	0.55	2100
HCI1005F-22N□-M	0.50±0.10	22	100	11	8	300	0.60	1900
HCI1005F-27N□-M	0.50±0.10	27	100	11	8	300	0.70	1600
HCI1005F-33N□-M	0.50±0.10	33	100	11	8	300	0.80	1300
HCI1005F-39N□-M	0.50±0.10	39	100	11	8	200	1.00	1200
HCI1005F-47N□-M	0.50±0.10	47	100	11	8	200	1.20	1000
HCI1005F-56N□-M	0.50±0.10	56	100	11	8	200	1.30	750
HCI1005F-68N□-M	0.50±0.10	68	100	11	8	180	2.00	750
HCI1005F-82N□-M	0.50±0.10	82	100	10	8	150	2.20	600
HCI1005F-R10□-M	0.50±0.10	100	100	10	8	150	2.50	600
HCI1005F-R12□-M	0.50±0.10	120	100	10	8	150	2.70	600
HCI1608F-1N0S-M	0.80±0.15	1.0	100	14	8	300	0.05	10000
HCI1608F-1N2S-M	0.80±0.15	1.2	100	14	8	300	0.05	10000
HCI1608F-1N5S-M	0.80±0.15	1.5	100	14	8	300	0.10	6000
HCI1608F-1N8S-M	0.80±0.15	1.8	100	10	8	300	0.10	6000
HCI1608F-2N2S-M	0.80±0.15	2.2	100	12	8	300	0.10	6000
HCI1608F-2N7S-M	0.80±0.15	2.7	100	13	10	300	0.10	6000
HCI1608F-3N3□-M	0.80±0.15	3.3	100	14	10	300	0.12	6000
HCI1608F-3N9□-M	0.80±0.15	3.9	100	13	10	300	0.14	6000
HCI1608F-4N7□-M	0.80±0.15	4.7	100	13	10	300	0.16	4000
HCI1608F-5N6□-M	0.80±0.15	5.6	100	14	10	300	0.18	4000
HCI1608F-6N8□-M	0.80±0.15	6.8	100	14	10	300	0.22	4000

□：S=±0.3nH, J=±5% , K=±10%

Part Number	Thickness (mm)	Inductance (nH)	Inductance Test Frequency (MHz)	Q@100MHz Normal Value	Q@100MHz min.	Rated Current (mA) max.	DCR (Ω) max.	SRF (MHz) min.
HCI1608F-8N2□-M	0.80±0.15	8.2	100	14	10	300	0.24	3500
HCI1608F-10N□-M	0.80±0.15	10	100	14	12	300	0.26	3400
HCI1608F-12N□-M	0.80±0.15	12	100	14	12	300	0.28	2600
HCI1608F-15N□-M	0.80±0.15	15	100	15	12	300	0.32	2300
HCI1608F-18N□-M	0.80±0.15	18	100	15	12	300	0.35	2000
HCI1608F-22N□-M	0.80±0.15	22	100	16	12	300	0.40	1600
HCI1608F-27N□-M	0.80±0.15	27	100	16	12	300	0.45	1400
HCI1608F-33N□-M	0.80±0.15	33	100	17	12	300	0.55	1200
HCI1608F-39N□-M	0.80±0.15	39	100	18	12	300	0.60	1100
HCI1608F-47N□-M	0.80±0.15	47	100	17	12	300	0.70	900
HCI1608F-56N□-M	0.80±0.15	56	100	17	12	300	0.75	900
HCI1608F-68N□-M	0.80±0.15	68	100	18	12	300	0.85	700
HCI1608F-82N□-M	0.80±0.15	82	100	18	12	300	0.95	600
HCI1608F-R10□-M	0.80±0.15	100	100	18	12	300	1.00	600
HCI1608F-R12□-M	0.80±0.15	120	50	16	8	300	1.20	500
HCI1608F-R15□-M	0.80±0.15	150	50	13	8	300	1.20	500
HCI1608F-R18□-M	0.80±0.15	180	50	13	8	300	1.30	400
HCI1608F-R22□-M	0.80±0.15	220	50	12	8	300	1.50	400
HCI1608F-R27□-M	0.80±0.15	270	50	14	8	150	1.90	300

□：S=±0.3nH, J=±5% , K=±10%

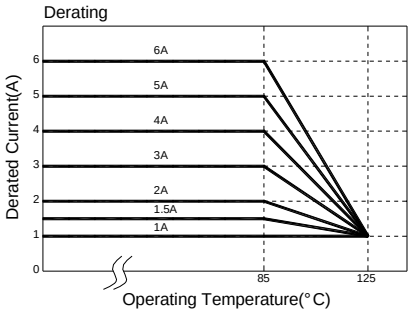
5. Reliability and Test Condition

Item	Performance										Test Condition
Series No.	FCB	FCM	HCB	HPB	HFB	FCA	FCI	FHI	FCH	HCI	--
Operating Temperature	-55~+125℃ (Including self-temperature rise)						-40~+85℃ (Including self-temperaturerise)				--
Storage Temperature	-55~+125℃						-40~+85℃				--
Impedance (Z)	Refer to standard electrical characteristics list										HP4291A, HP4287A+16092A
Inductance (Ls)											
Q Factor											
DC Resistance											HP4338B
Rated Current											**
Temperature Rise Test	30℃ max. (ΔT)										1. Applied the allowed DC current. 2. Temperature measured by digital surface thermometer.
Solder heat Resistance	Appearance: No significant abnormality. Impedance change: Within ± 30%.						No mechanical damage. Remaining terminal electrode:70% min.				Preheat: 150℃,60sec. Solder: Sn-Ag3.0-Cu0.5 Solder tamperature: 260±5℃ Flux for lead free: rosin Dip time: 10±0.5sec. 
Solderability	More than 90% of the terminal electrode should be covered with solder. 										Preheat: 150℃,60sec. Solder: Sn-Ag3.0-Cu0.5 Solder tamperature: 245±5℃ Flux for lead free: rosin Dip time: 4±1sec.
Terminal strength	The terminal electrode and the dielectric must not be damaged by the forces applied on the right conditions. 										For FCB FCM HCB HPB HFB FCI FHI FCH HCI: Size / Force (Kfg) / Time(sec) 1005 0.2 1608 0.5 2012 0.6 3216 1.0 >25 3225 1.0 4516 1.0 4532 1.5 5750 2.0 For FCA: Size / Force (Kfg) / Time(sec) 3216 0.5 >25
Flexture strength	The terminal electrode and the dielectric must not be damaged by the forces applied on the right conditions. 										Solder a chip on a test substrate, bend the substrate by 2mm (0.079in)and return.
Bending Strength	The ferrite should not be damaged by Forces applied on the right condition. 										Size / mm(inches) / P-Kgf 1608 0.80(0.033) 0.3 2012 1.40(0.055) 1.0 FCA3216 2.00(0.079) 1.5 3216 3225 2.00(0.079) 2.5 4516 4532 5750 2.70(0.106) 2.5
Random Vibration Test	Appearance: Cracking, shipping and any other defects harmful to the characteristics should not be allowed. Impedance: within±30%										Frequency: 10-55-10Hz for 1 min. Amplitude: 1.52mm Directions and times: X, Y, Z directions for 2 hours. A period of 2 hours in each of 3 mutually perpendicular directions (Total 6 hours).

Item	Performance	Test Condition
Loading at High Temperature	Appearance: no damage. Impedance: within±30%of initial value. Inductance: within±10%of initial value. Q: within±30%of initial value. (FCI FHI FCH) Q: within±20%of initial value. (HCI)	Temperature: 125±5℃(bead),85±5℃(inductor) Applied current: rated current. Duration: 1008±12hrs. Measured at room temperature after placing for 2 to 3hrs.
Humidity		Humidity: 90~95%RH. Temperature: 40±2℃. Temperature: 60±2℃.(HCI) Duration: 1008±12hrs. Measured at room temperature after placing for 2 to 3hrs.
Thermal shock	Appearance: no damage. Impedance: within±30%of initial value. Inductance: within±10%of initial value. Q: within±30%of initial value. (FCI FHI FCH) Q: within±20%of initial value. (HCI) For Bead： Phase / Temperature(℃) / Time(min.) 1 / -55±2℃ / 30±3 2 / +125±5℃ / 30±3 Measured: 5 times For Inductor： Phase / Temperature(℃) / Time(min.) 1 / -40±2℃ / 30±3 2 / +85±5℃ / 30±3 Measured: 100 times	For FCB FCM HCB HPB HFB FCA： Condition for 1 cycle Step1: -55±2℃ 30±3 min. Step2: +125±5℃ 30±3 min. Number of cycles: 5 For FCI FHI FCH HCI： Condition for 1 cycle Step1: -40±2℃ 30±3 min. Step2: +85±5℃ 30±3 min. Number of cycles: 100 Measured at room temperature after placing for 2 to 3 hrs.
Low temperature storage test		Temperature: -55±2℃. Duration: 1008±12hrs. Measured at room temperature after placing for 2 to 3hrs.
Drop	a: No mechanical damage b: Impedance change: ±30%	Drop 10 times on a concrete floor from a height of 75cm

****Derating Curve**

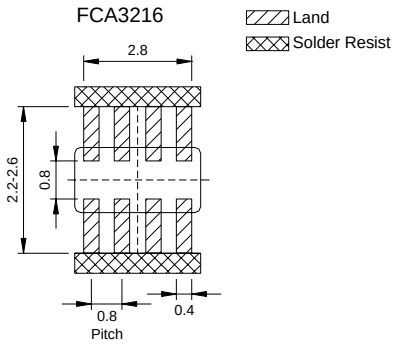
For the ferrite chip bead which withstanding current over 1.5A, as the operating temperature over 85℃, the derating current information is necessary to consider with. For the detail derating of current, please refer to the Derated Current vs. Operating Temperature curve.

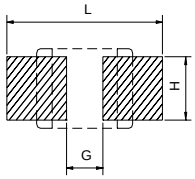


6.Soldering and Mounting

6-1. Recommended PC Board Pattern

Chip Size						Land Patterns For Reflow Soldering		
Series	**Type**	**A(mm)**	**B(mm)**	**C(mm)**	**D(mm)**	**L(mm)**	**G(mm)**	**H(mm)**
FCB	1005	1.0±0.10	0.50±0.10	0.50±0.10	0.25±0.10	2.10	0.50	0.55
FCM	1608	1.6±0.15	0.80±0.15	0.80±0.15	0.30±0.20	2.60	0.60	0.80
HCB	2012	2.0±0.20	1.25±0.20	0.85±0.20	0.50±0.30	3.00	1.00	1.00
HPB		2.0±0.20	1.25±0.20	1.25±0.20	0.50±0.30			
HFB	2520	2.5±0.20	2.00±0.20	1.60±0.20	0.50±0.30	3.90	1.50	1.50
FCI	3216	3.2±0.20	1.60±0.20	1.10±0.20	0.50±0.30	4.40	2.20	1.40
FHI	3225	3.2±0.20	2.50±0.20	1.30±0.20	0.50±0.30	4.40	2.20	3.40
FCH	4516	4.5±0.20	1.60±0.20	1.60±0.20	0.50±0.30	5.70	2.70	1.40
HCI	4532	4.5±0.20	3.20±0.20	1.50±0.20	0.50±0.30	5.90	2.57	4.22
UHI	5750	5.7±0.20	5.00±0.30	1.80±0.20	0.50±0.30	8.00	4.00	5.80





PC board should be designed so that products are not sufficient under mechanical stress as warping the board.
Products shall be positioned in the sideway direction against the mechanical stress to prevent failure.

6-2. Soldering

Mildly activated rosin fluxes are preferred. The minimum amount of solder can lead to damage from the stresses caused by the difference in coefficients of expansion between solder, chip and substrate. The terminations are suitable for all wave and re-flow soldering systems. If hand soldering cannot be avoided, the preferred technique is the utilization of hot air soldering tools.

6-2.1 Lead Free Solder re-flow:
Recommended temperature profiles for lead free re-flow soldering in Figure 1.

6-2.2 Solder Wave:
Wave soldering is perhaps the most rigorous of surface mount soldering processes due to the steep rise in temperature seen by the circuit when immersed in the molten solder wave , Due to the risk of thermal damage to products, wave soldering of large size products is discouraged. Recommended temperature profile for wave soldering is shown in Figure 2.

6-2.3 Soldering Iron(Figure 3):
Products attachment with a soldering iron is discouraged due to the inherent process control limitations. In the event that a soldering iron must be employed the following precautions are recommended.

Note： · Preheat circuit and products to 150℃ · Never contact the ceramic with the iron tip · Use a 20 watt soldering iron with tip diameter of 1.0mm
· 350℃ tip temperature for Ferrite chip bead (max) · 1.0mm tip diameter (max) · Limit soldering time to 3 sec.

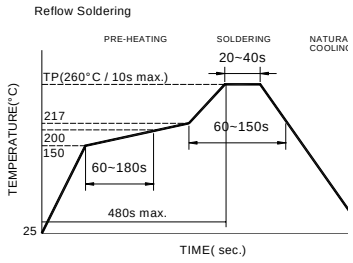


Figure 1. Re-flow Soldering(Lead Free)

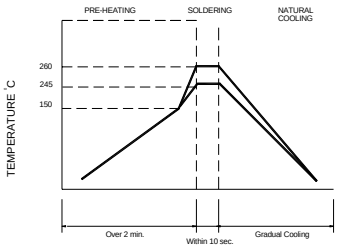


Figure 2. Wave Soldering

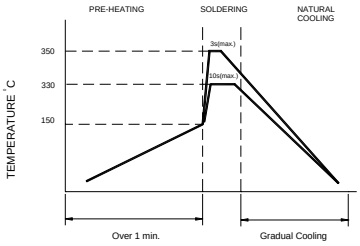
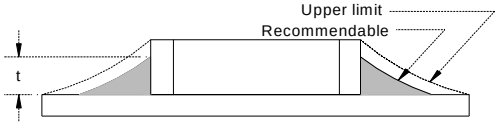


Figure 3. Hand Soldering

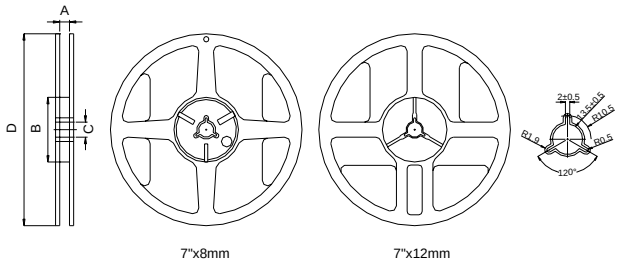
6-2.4 Solder Volume:

Accordingly increasing the solder volume, the mechanical stress to product is also increased. Exceeding solder volume may cause the failure of mechanical or electrical performance. Solder shall be used not to be exceed as shown in right side:



7.Packaging Information

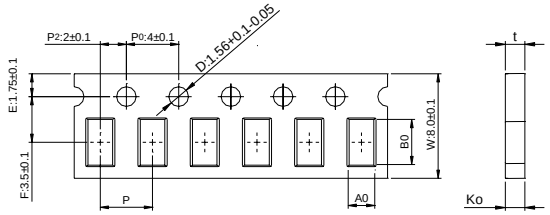
7-1. Reel Dimension



Type	A(mm)	B(mm)	C(mm)	D(mm)
7"x8mm	9.0±0.5	60±2	13.5±0.5	178±2
7"x12mm	13.5±0.5	60±2	13.5±0.5	178±2

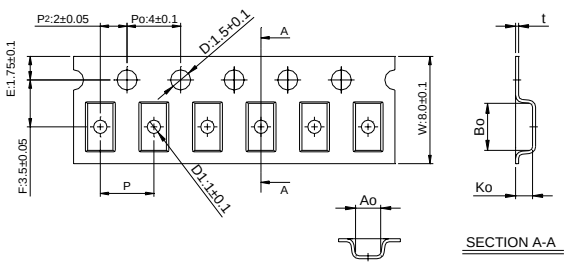
7-2.1 Tape Dimension / 8mm

■Material of taping is paper



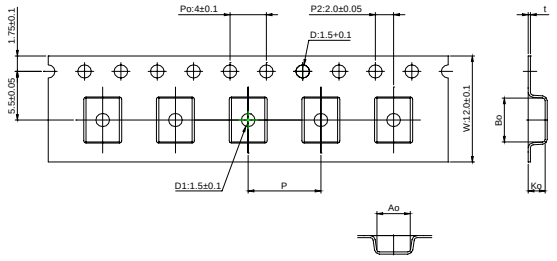
Series	Size	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	t(mm)	D1(mm)
FCB.FCM.HCB	100505	1.12±0.03	0.62±0.03	0.60±0.03	2.0±0.10	0.60±0.03	none
HPB.HFB.FCI	160808	1.85±0.05	1.05±0.05	0.95±0.05	4.0±0.10	0.95±0.05	none
FHI.FCH.HCI	201209	2.30±0.05	1.50±0.05	0.95±0.05	4.0±0.10	0.95±0.05	none

■Material of taping is plastic



Series	Size	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	t(mm)	D1(mm)
FCB,FCM	160808	1.95±0.10	1.05±0.10	1.05±0.10	4.0±0.10	0.23±0.05	none
HCB,HPB	201209	2.25±0.10	1.42±0.10	1.04±0.10	4.0±0.10	0.22±0.05	1.0±0.10
HFB.FCI	201212	2.35±0.10	1.50±0.10	1.45±0.10	4.0±0.10	0.22±0.05	1.0±0.10
FHI.FCH	321611	3.50±0.10	1.88±0.10	1.27±0.10	4.0±0.10	0.22±0.05	1.0±0.10
HCI	322513	3.42±0.10	2.77±0.10	1.55±0.10	4.0±0.10	0.22±0.05	1.0±0.10
FCA	321609	3.40±0.10	1.77±0.10	1.04±0.10	4.0±0.10	0.22±0.05	1.0±0.10

7-2.2 Tape Dimension / 12mm

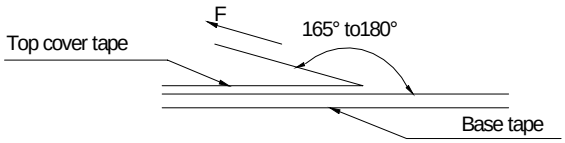


Series	Size	Bo(mm)	Ao(mm)	Ko(mm)	P(mm)	t(mm)	D1(mm)
FCB,	451616	4.95±0.1	1.93±0.1	1.93±0.1	4.0±0.1	0.24±0.05	1.5±0.1
HCB.FCM	453215	4.95±0.1	3.66±0.1	1.85±0.1	8.0±0.1	0.24±0.05	1.5±0.1
FCI	575018	6.10±0.1	5.40±0.1	2.00±0.1	8.0±0.1	0.30±0.05	1.5±0.1

7-3. Packaging Quantity

Chip Size	575018	453215	451616	322513	321611	201212	201209	160808	100505
Chip / Reel	1000	1000	2000	2500	3000	2000	4000	4000	10000
Inner box	4000	4000	8000	12500	15000	10000	20000	20000	50000
Middle box	20000	20000	40000	62500	75000	50000	100000	100000	250000
Carton	40000	40000	80000	125000	150000	100000	200000	200000	500000
Bulk (Bags)	7000	12000	20000	30000	50000	100000	150000	200000	300000

7-4. Tearing Off Force



The force for tearing off cover tape is 15 to 60 grams in the arrow direction under the following conditions.

Room Temp. (℃)	Room Humidity (%)	Room atm (hPa)	Tearing Speed mm/min
5~35	45~85	860~1060	300

Application Notice

· Storage Conditions

To maintain the solderability of terminal electrodes:

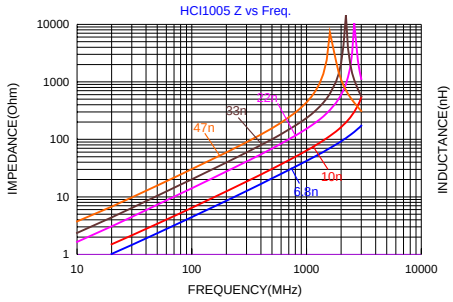
1. Temperature and humidity conditions: -10~ 40℃ and 30~70% RH.
2. Recommended products should be used within 6 months from the time of delivery.
3. The packaging material should be kept where no chlorine or sulfur exists in the air.

· Transportation

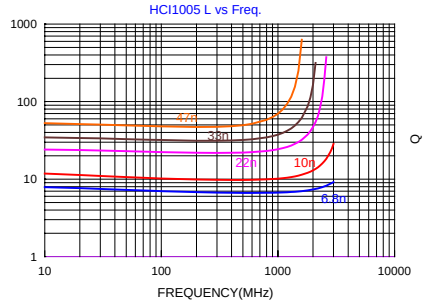
1.Products should be handled with care to avoid damage or contamination from perspiration and skin oils.
2. The use of tweezers or vacuum pick up is strongly recommended for individual components.
3. Bulk handling should ensure that abrasion and mechanical shock are minimized.

Impedance Frequency Characteristics(Typical)

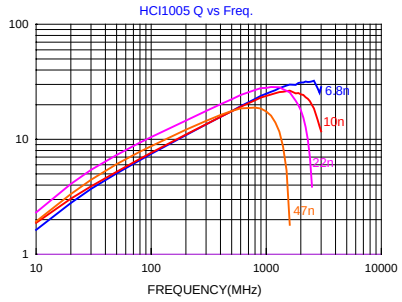
Impedance v.s. Frequency Characteristics



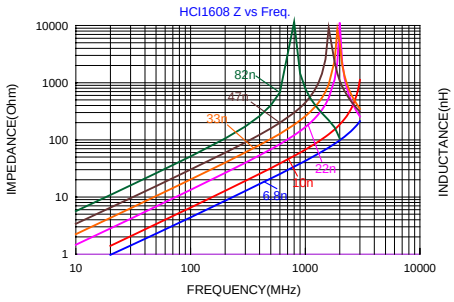
Inductance v.s. Frequency Characteristics



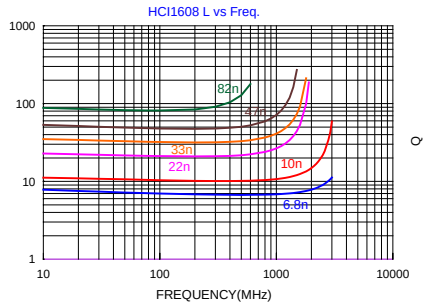
Q v.s. Frequency Characteristics



Impedance v.s. Frequency Characteristics



Inductance v.s. Frequency Characteristics



Q v.s. Frequency Characteristics