FrelTec GmbH

Mathildenstr. 10A
82319 Starnberg
Germany

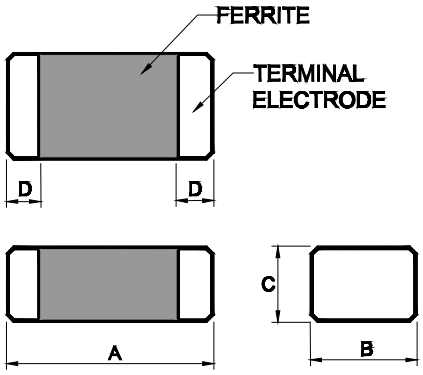
Multilayer Chip Power Inductor SMD

Part Number

191	05*	151*	S*	J*	E02	Option
Type	Size	Value	Thickness	Tolerance	Packing	
191 : SMD Multilayer Chip Power Inductor	03: 0603	The value is given in µH "N" indicates the decimal point for nH and "U" indicates the decimal point for µH. When higher than 100 µH the last digit is the multiplier	D: 0,5mm ±0,1	M : ±20%	T05: tape and reel, for 5kpcs, paper tape 0603 size D-thickness and 0805 D-thickness	C : Cost Down Version
	05: 0805	which denotes the number of zero following	A: 0,80mm ±0,15	N : ±30%	T04: tape and reel, for 4kpcs, paper tape, 0603 A-thickness	
	07 : 0806	Example:	H: 0,9mm ±0,1		E03: tape and reel, for 3kpcs, embossed plastic tape, 0805 H-thickness and Y-thickness, 0806 and 1008	
	08 : 1008	10N : 10 nH	W: 1,1mm ±0,1			
		3U3 : 3300 nH	Y: 1,25mm±0,1			
		U68 : 680 nH			* not all combination is possible	
		151 : 150 µH				

All products according to RoHS (2015/863/EU)

Dimensions:

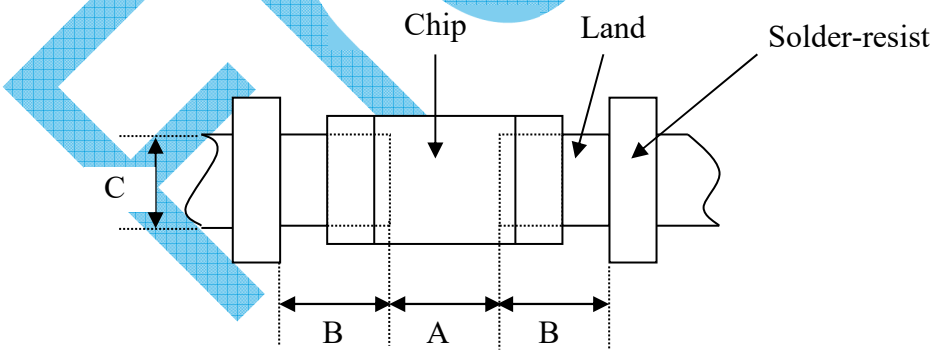


Unit: mm

Type	A	B	C	D
0603 Thickness D	1,60±0,15	0,80±0,15	D: 0,5±0,1	0,3±0,2
0603 Thickness A			A: 0,80±0,15	0,3±0,2
0805 Thickness D	2,0 (+0,3, -0,1)	1,25±0,2	D: 0,5±0,1	0,5±0,3
0805 Thickness H			H: 0,9±0,1	0,5±0,3
0805 Thickness Y			Y: 1,25±0,20	0,5±0,3
0806	2,0 (+0,3, -0,1)	1,6±0,2	H: 0,9±0,1	0,5±0,3
1008 Thickness H	2,5±0,2	2,0 +0,3, -0,1	H: 0,9±0,1	0,5±0,3
1008 Thickness W			W: 1,1±0,1	0,5±0,3

unit: mm

Recommended PCB pattern for reflow soldering:



Type	A	B	C
0603	0,6~0,8	0,60~0,8	0,6~0,8
0805	0,8~1,2	0,80~1,2	0,9~1,6
0806	0,8~1,2	0,80~1,2	1,2~2,0
1008	1,0~1,4	0,6~1,0	1,8~2,2

unit: mm

Electrical Characteristics

0603

L (µH)	Tolerance	L Test Freq. (MHz)	S.R.F Min. (MHz)	DCR (Ω)	Ir* Max. (mA)	Saturation Current (Typ.)	Saturation Current (Max.)	Thickness
0,47	±20%, ±30%*	5	105	0,19±25%	900	500	400	D
0,47		5	105	0,25±25%	800	800	600	A
1,0		1	60	0,20±25%	950	200	160	
1,5		1	50	0,25±25%	800	160	120	
2,2		1	40	0,30±25%	750	120	100	

0805

L (µH)	Tolerance	L Test Freq. (MHz)	S.R.F Min. (MHz)	DCR (Ω)	Ir* Max. (mA)	Saturation Current (Typ.)	Saturation Current (Max.)	Thickness
0,47	±20%, ±30%*	1	100	0,12±25%	1100	700	550	D
1,0		1	60	0,19±25%	800	500	400	
1,5		1	50	0,26±25%	700	350	280	
2,2		1	40	0,34±25%	600	280	220	
0,47		1	100	0,09±25%	1200	1200	950	H
1,0		1	60	0,11±25%	1000	850	700	
1,5		1	50	0,16±25%	900	700	550	
2,2		1	40	0,25±25%	800	500	400	
3,3		1	30	0,19±25%	900	250	200	
4,7		1	30	0,25±25%	800	230	180	
2,2 Cost Down Version	±20%, ±30%*	1	40	0,50±25%	500	500	400	H
2,2	±20%, ±30%*	1	40	0,33±30%	640	530	400	Y
4,7		1	25	0,50±30%	600	360	280	

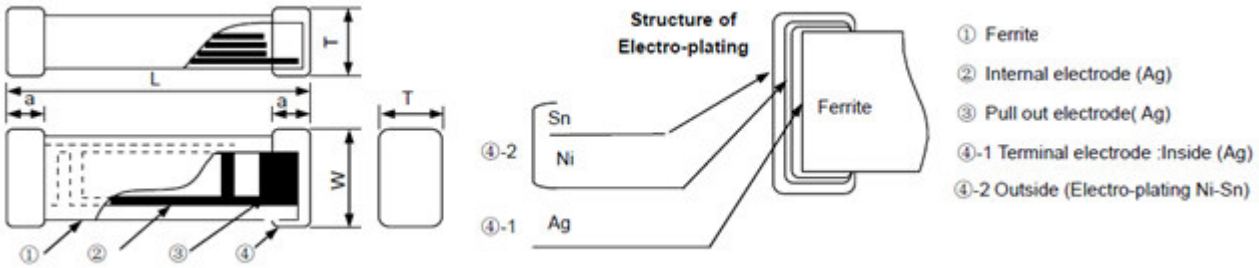
0806

L (µH)	Tolerance	L Test Freq. (MHz)	S.R.F Min. (MHz)	DCR (Ω)	Ir* Max. (mA)	Saturation Current (Typ.)	Saturation Current (Max.)	Thickness
0,47	±20%, ±30%*	1	100	0,06±25%	1600	1300	1050	H
1,0		1	70	0,09±25%	1400	900	700	
1,5		1	60	0,11±25%	1200	700	550	
2,2		1	50	0,11±25%	1200	450	350	
3,3		1	40	0,12±25%	1200	250	200	
4,7		1	30	0,14±25%	1100	180	150	

1008

L (µH)	Tolerance	L Test Freq. (MHz)	S.R.F Min. (MHz)	DCR (Ω)	Ir★ Max. (mA)	Saturation Current (Typ.)	Saturation Current (Max.)	Thickness
0,47	±20%, ±30%*	1	100	0,04±25%	1800	1350	1100	H
1,0		1	60	0,06±25%	1600	900	700	
1,5		1	50	0,07±25%	1500	700	550	
2,2		1	40	0,08±25%	1300	550	450	
3,3		1	30	0,10±25%	1200	250	200	
4,7		1	25	0,11±25%	1100	200	160	
1,0		1	70	0,09±25%	1500	1800	1500	W
2,2		1	40	0,12±25%	1000	900	700	
3,3		1	30	0,12±25%	1000	450	350	
4,7		1	25	0,14±25%	900	350	280	
10		1	15	0,30±30%	800	200	160	

Construction



Material Information

Code	Part Name	Material Name
1	Ferrite Body	Ferrite Powder
2	Inner Coils	Silver Paste
3	Pull-out Electrode (Ag)	Silver Paste
4-1	Terminal Electrode: Inside Ag	Termination Silver Composition
4-2	Electro-Plating: Ni/Sn plating	Plating Chemicals

Test and Measurement Procedures

1 Test Conditions

Unless otherwise specified, the standard atmospheric conditions for measurement/test as:

a. Ambient Temperature: 20±15℃
b. Relative Humidity: 65±20%
c. Air Pressure: 86kPa to 106kPa

If any doubt on the results, measurements/tests should be made within the following limits:

a. Ambient Temperature: 20±2°C
b. Relative Humidity: 65±5%
c. Air Pressure: 86kPa to 106kPa

2 Visual Examination

a. Inspection Equipment: 20× magnifier

3 Electrical Test

3.1 DC Resistance (DCR)

a. Refer to tabel above.
b. Test equipment (Analyzer): High Accuracy Milliohmmeter-HP4338B or equivalent.

3.2 Inductance (L)

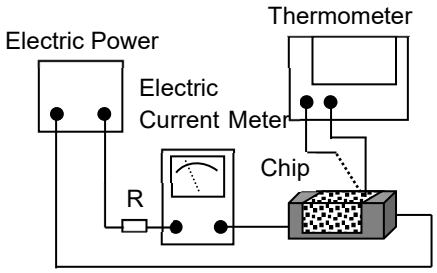
a. Refer to tabel above.
b. Test equipment: High Accuracy RF Impedance /Material Analyzer-HP4291B+HP16192A or equivalent.
c. Test signal: -20dBm or 50mV.
d. Test frequency refers to tabel above.

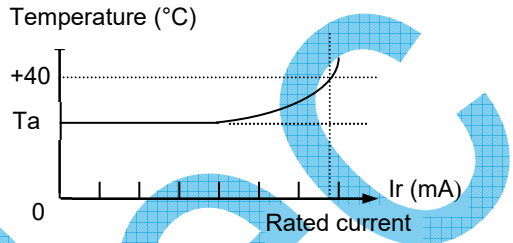
3.3 Rated Current

a. Refer to table above
b. Test equipment (see Fig below): Electric Power, Electric current meter,

Thermometer.

c. Measurement method (see Fig below):
   i. Set test current to be 0 mA.
   ii. Measure initial temperature of chip surface.
   iii. Gradually increase voltage and measure chip temperature for corresponding current.
   iv. Definition of Temperature Rise Current ($I_{DC}1$): $I_{DC}1$ is direct electric current as chip surface temperature rose just 40°C against chip initial surface temperature (Ta) (see Fig below**)**



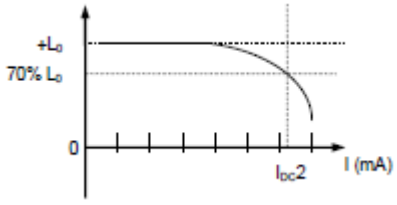


3.4 Saturation Current ($I_{DC}2$)

a. Refer to table below

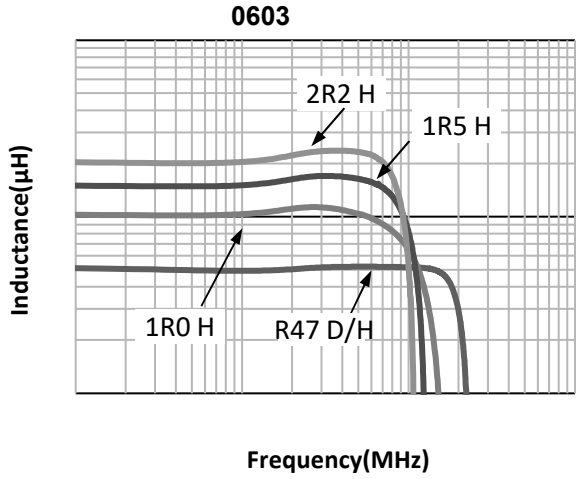
b. Test equipment: HP6632B system DC power supply, HP4291B+HP16192A+HP16200A or equivalent.

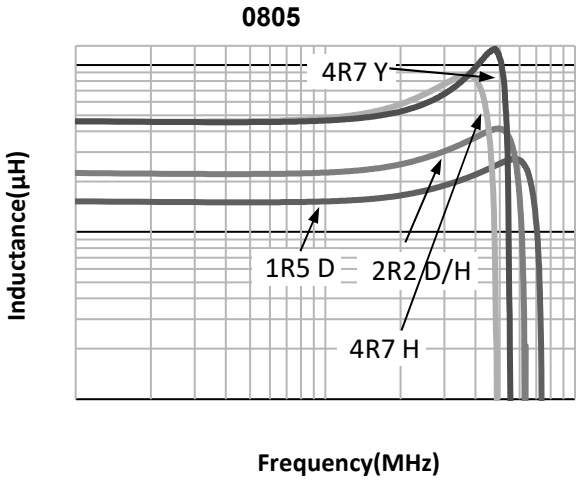
c. Measurement method:
   i. Measurement conditions of initial inductance L: Measuring Frequency: 1MHz. Test Current: 1mA.
   ii. Raising the voltage of the DC power supply, measure the inductance at the various current.
   The rated current is the value of DC current at which the inductance will be 30% down compared with the initial inductance value.
   Note: In the period of raising voltage, voltage cannot be reduced.
   iii. Definition of Saturation Current ($I_{DC}2$): $I_{DC}2$ is the value of DC current as inductance L (μH) decreased just 30% against initial value (see Fig below).

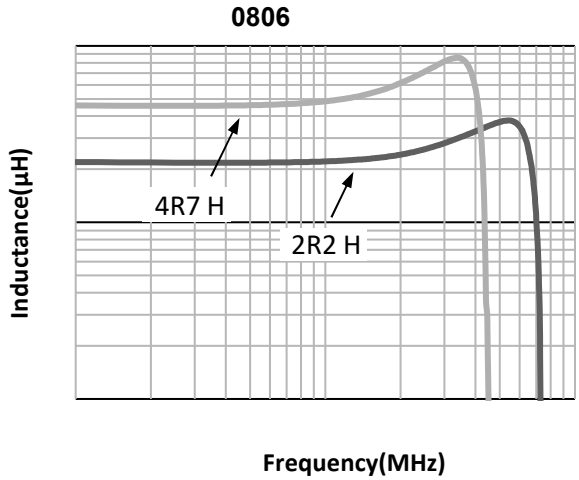


3.5 Self-Resonant Frequency (SRF)
   a. Refer to table above.
   b. Test equipment: High Accuracy RF Impedance /Material Analyzer- HP4291B+HP16192A or equivalent.
   c. Test signal: -20dBm or 50 mV.

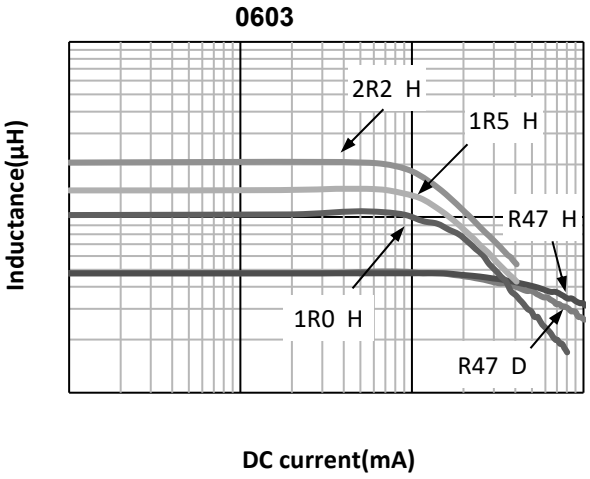
Inductance vs. Frequency Characteristics

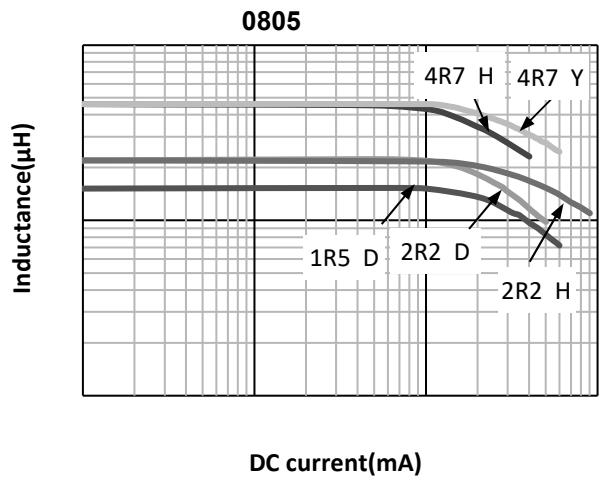


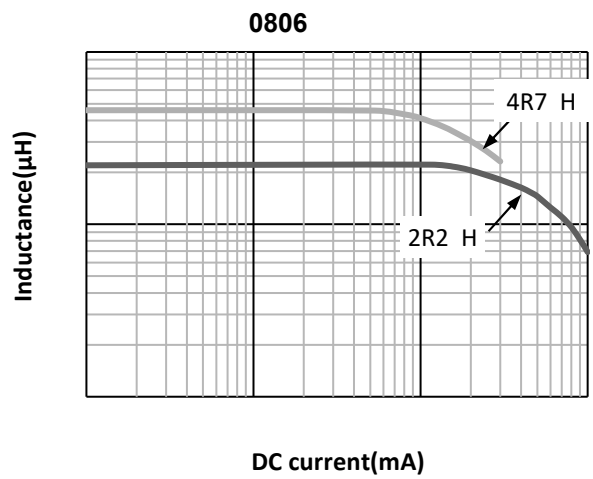


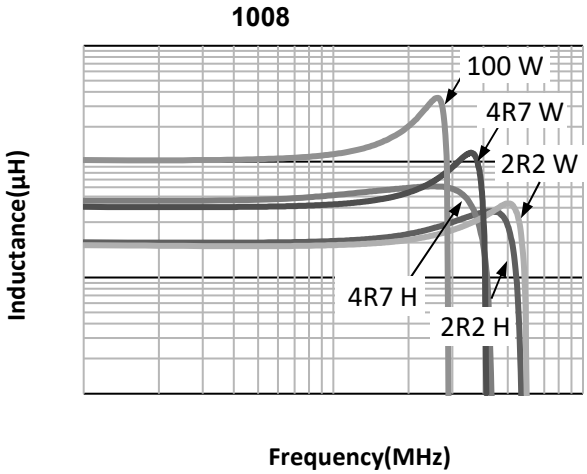


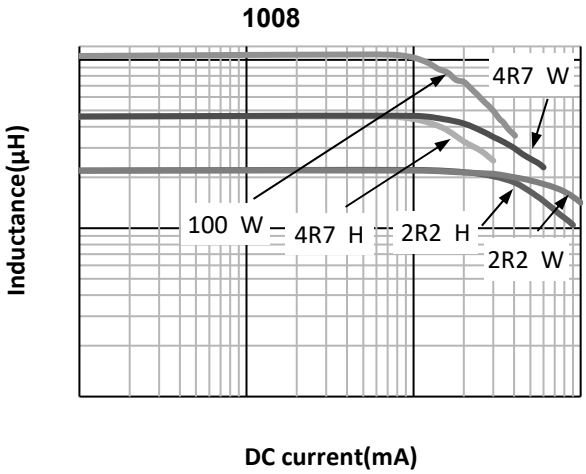
Inductance vs. DC Current Characteristics



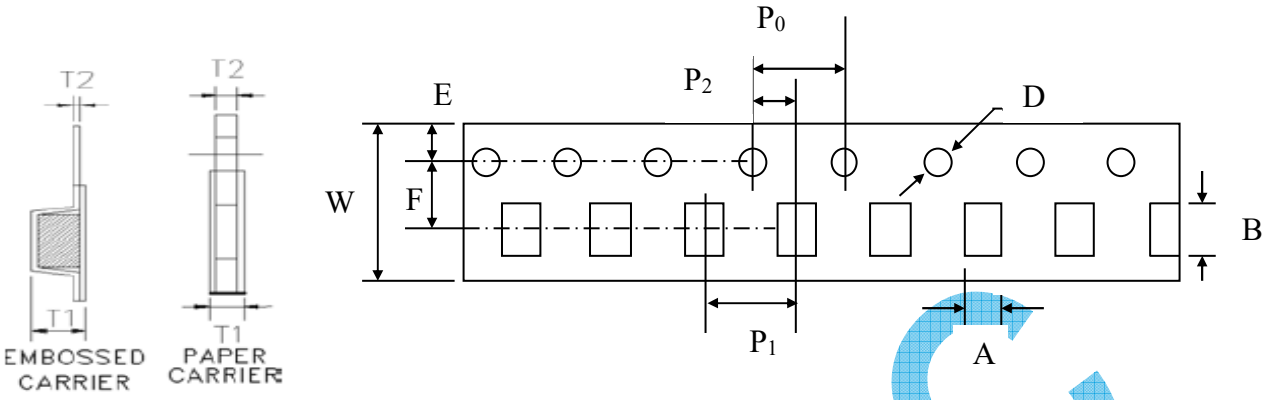




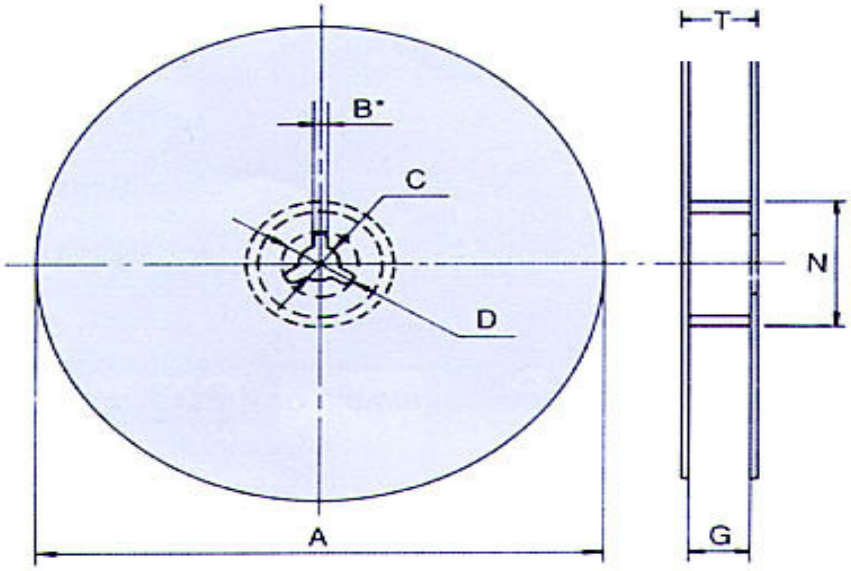




Tape Dimensions



Packing	Size	A	B	W	F	E	P_1	P_2	P_0	D	T_1 (Max)	$T_{2\,(Max)}$
Paper Tape (T)	0603 D-thickness	1,0±0,2	1,8±0,2	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	0,8	
	0603 H-thickness	1,0±0,2	1,8±0,2	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	1,1	
	0805 D-thickness	1,6±0,1	2,3±0,1	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	0,8	
Embossed Tape (E)	0805 H-thickness	1,55±0,1	2,30±0,1	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	1,45	0,3
	1206 Y-thickness	1,55±0,1	2,30±0,1	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	1,75	0,3
	1206 H-thickness	1,90±0,1	2,30±0,1	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	1,45	0,3
	1206 H-thickness	2,30±0,1	2,80±0,1	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	1,45	0,3
	1206 W-thickness	2,30±0,1	2,80±0,1	8,0±0,3	3,5±0,05	1,75±0,1	4,0±0,1	2,0±0,05	4,0±0,1	1,50+0,1/-0	1,75	0,3



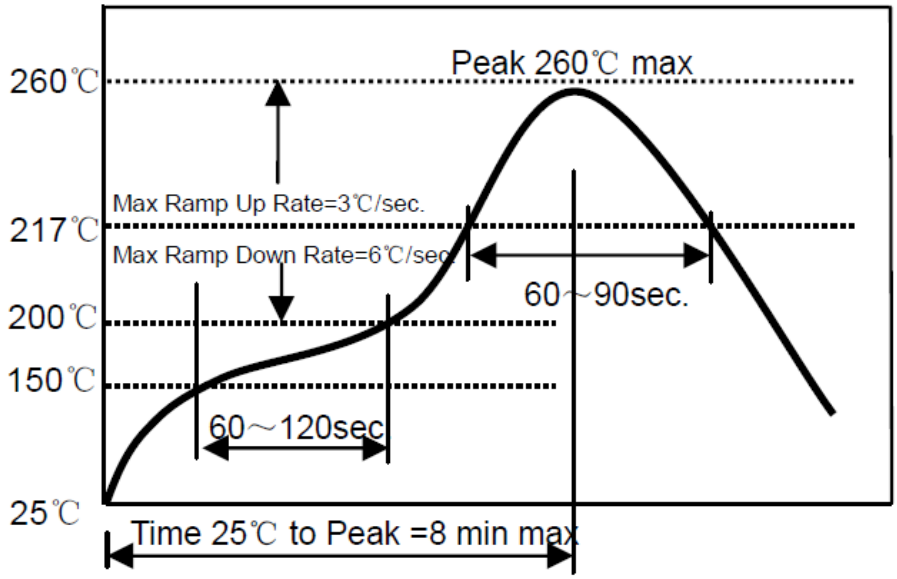
Symbol	Reel Type / Tape	A	N	C	B	T (max)	G
Dimension	7" reel	178±2,0	58,0±2,0	13,5±0,2	2,45±0,2	14,4	8,4+1,5/-0,0

in mm

Stock period
The performance of these products, including the solderability, is guaranteed for 12 month, provided that they remain packed as they were when delivered and stored at a temperature of maximum 40°C (min -10°C) and a relative humidity less than 70%RH
The solderability of the external electrode may be deteriorated if packages are stored where they are exposed to dust of harmful gas (e.g. HCl, sulfurous gas of H_2S).
Packaging material may be deformed if package are stored where they are exposed to heat of direct sunlight.

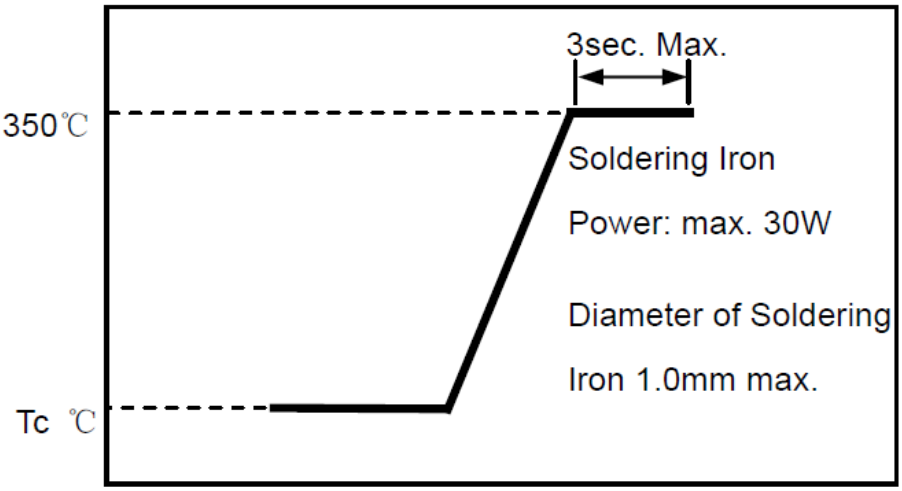
Operating and storage temperature range
(Individual chip without packing): -40°C ~ +125°C (Including Self-heating)

Lead Free Reflow Soldering Profile



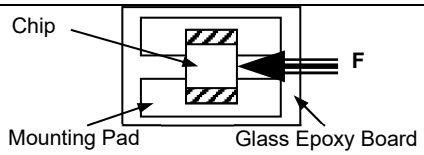
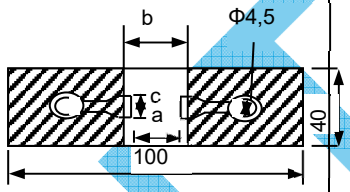
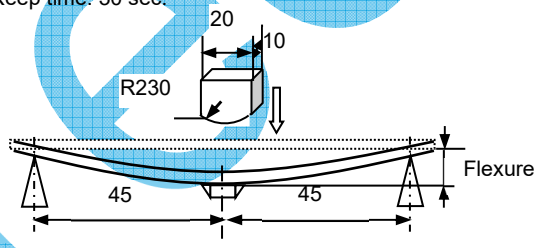
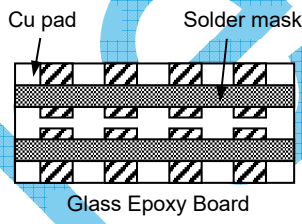
- 1~2 °C/sec. Ramp
- Pre-heating: 150~200°C/60~120 sec.
- Allowed time above 217°C: 60~90sec
- Peak temperature: 260°C for max 10s
- Solder paste: Sn/3,0Ag/0,5Cu
- Max.2 times for re-flowing

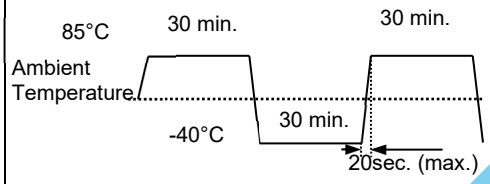
Iron Soldering Profile



- Iron soldering power: Max.30W.
- Pre-heating: 150°C / 60sec.
- Soldering Tip temperature: 350°C Max.
- Soldering time: 3sec Max.
- Solder paste: Sn/3,0Ag/0,5Cu.
- Max.1 times for iron soldering.
- Take care not to apply the tip of the soldering iron to the terminal electrodes.

Reliability Test

<table>
<tr><th>Items</th><th>Requirements</th><th>Test Methods and Remarks</th></tr>
<tr><td>Terminal Strength</td><td>No removal or split of the termination or other defects shall occur.
 
</td><td>① Solder the inductor to the testing jig (glass epoxy board shown in Fig) using leadfree solder. Then apply a 10N force in the direction of the arrow.
② Keep time: 10±1s.
③ Speed: 1,0mm/s.</td></tr>
<tr><td>Resistance to Flexure</td><td>No visible mechanical damage.
<table>
<tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr>
<tr><td>0603</td><td>1,0</td><td>3,0</td><td>1,2</td></tr>
<tr><td>0805</td><td>1,2</td><td>4,0</td><td>1,62</td></tr>
<tr><td>0806</td><td>1,2</td><td>4,0</td><td>1,65</td></tr>
<tr><td>1008</td><td>1,3</td><td>3,0</td><td>1,8</td></tr>
</table>
Unit: mm

</td><td>① Solder the inductor to the test jig (glass epoxy board shown) Using a leadfree solder. Then apply a force in the direction shown.
② Flexure: 2mm.
③ Pressurizing Speed: 0,5mm/sec.
④ Keep time: 30 sec.
 
</td></tr>
<tr><td>Vibration</td><td>① No visible mechanical damage.
② Inductance change: Within ±20%
 
</td><td>① Solder the inductor to the testing jig (glass epoxy board shown) using leadfree solder.
② The inductor 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.
③ The frequency range from 10 to 55 Hz and return 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).</td></tr>
<tr><td>Dropping</td><td>① No visible mechanical damage.
② Inductance change: Within ±20%.</td><td>Drop chip inductor 10 times on a concrete floor from a height of 100 cm.</td></tr>
<tr><td>Temperature</td><td>Inductance change should be within ±20% of initial value measuring at 20°C.</td><td>Temperature range: -40°C~ +85°C
Reference temperature: +20℃</td></tr>
<tr><td>Solderability</td><td>① No visible mechanical damage.
② Wetting shall exceed 95% coverage.</td><td>① Solder temperature: 240±2°C
② Duration: 3sec.
③ Solder: Sn/3,0Ag/0,5Cu.
④ Flux: 25% Resin and 75% ethanol in weight.</td></tr>
</table>

Resistance to Soldering Heat	① No visible mechanical damage. ② Wetting shall exceed 95% coverage. ③ Inductance change: Within ±20%.	① Solder temperature: 260±3°C. ② Duration: 5sec. ③ Solder: Sn/3,0Ag/0,5Cu. ④ Flux: 25% Resin and 75% ethanol in weight. ⑤ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Thermal Shock	① No mechanical damage. ② Inductance change: Within ±20%. 	① Temperature, Time: -40°C for 30±3 min→ 85°C for 30±3min. ② Transforming interval: 20 sec.(max.). ③ Tested cycle: 100 cycles. ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Resistance to Low Temperature	① No mechanical damage. ② Inductance change: Within ±20%.	① Temperature: -40±2°C ② Duration: 1000^{+24} hours. ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Resistance to High Temperature	① No mechanical damage. ② Inductance change: Within ±20%.	① Temperature: 85±2°C ② Duration: 1000^{+24} hours. ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Damp Heat (Steady States)	① No visible mechanical damage. ② Inductance change: Within ±20%.	① Temperature: 60±2°C ② Humidity: 90% to 95% RH. ③ Duration: 1000^{+24} hours. ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.

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