For Automotive Electronics

SPECIFICATIONS

Customer	
Product Name	**Wire Wound Chip Ferrite Inductor**
Sunlord Part Number	**AWL3225FP Series**
Customer Part Number	

[☒New Released, ☐Revised] **SPEC No.: AWL04220000**

【This SPEC is total 13 pages.】

【ROHS Compliant Parts】

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Qualification Status: ☐ Full ☐ Restricted ☐ Rejected

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Version Change History							
Rev.	Date	Item	Changed Contents	Change Reasons	Drawing	Check	Approval
01	/	/	New release	/	Huie Gao	Jinnan Liu	jingxin_huang

‹Content›

【Precautions】

1. Magnetic materials shall be far away from parts to avoid impacts on their electrical characteristics.
2. Parts could be damaged by external mechanical pressure or stacked heavy objects, as well as strong shaking & dropping.
3. Please do not store parts in bulk to prevent coils and parts being damaged.
4. Oversized external force to parts on PCB may lead to parts being damaged or slipped off.
5. Please do not use parts on edge or top of PCB board in your design to avoid parts being damaged during PCB is moved.
6. Please use flux contained with resin since the highly acidic (Chlorine content more than 0.2 wt%) or water-soluble one could damage the insulation film of wires, then causing short circuit of parts.
7. Please do not use the brush to clean product or its surroundings. If you use the brush to clean product or its surroundings on PCB,copper wire may be broke, causing the product open .

1. Scope

1.1 Scope of parts

This specification applies to the AWL3225FP Series of Wire Wound Chip Ferrite Inductor for automotive electronics based on AEC-Q200.

1.2 Scope of application

Product numbers recorded in this specification are limited to applications with the following modules:

(1) PoC line for automotive camera systems.

2. Product Description and Identification (Part Number)

1) Description

Wire Wound Chip Ferrite Inductor, 3225,xx uH± 20% @1MHz,xx Ω,xx mA

2) Product Identification (Part Number)

AWL	3225	F	P	□□□	□	T	F
①	②	③	④	⑤	⑥	⑦	⑧

① Type	
AWL	Wire Wound Chip Inductor for Automotive

② External Dimensions [L X W] (mm)	
3225	3.2 X2.5

③ Material Code	
F	Ferrite

④ Feature Type	
P	Large Current

⑤ Nominal Inductance (uH)	
Example	Nominal Value
470	47
2R2	2.2

⑥ Inductance Tolerance	
M	±20%

⑦ Packing	
T	Tape & Reel

⑧ HSF Products
Hazardous Substance Free Products

3. Electrical Characteristics

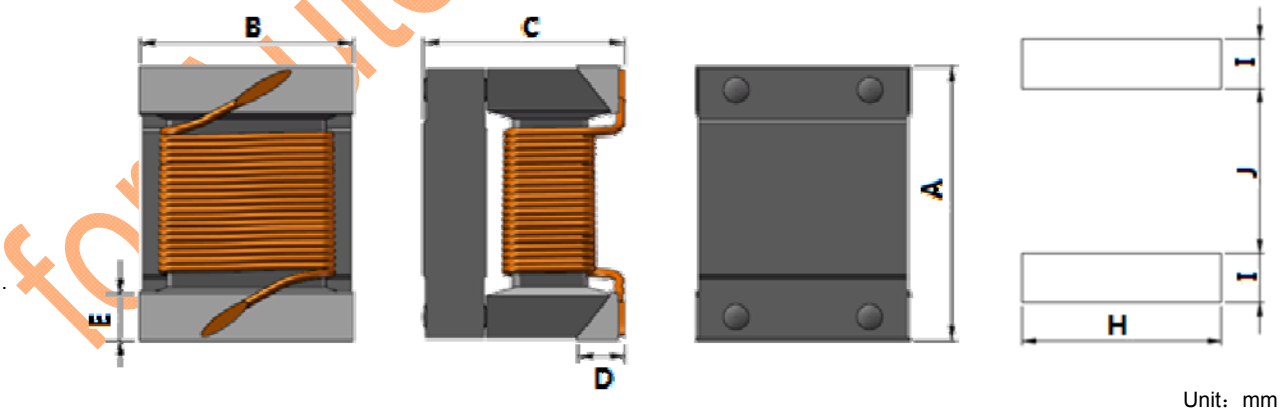
Please refer to **Item 5**.

1) Operating and storage temperature range (individual chip without packing): -40℃ to +125℃

2) Storage temperature range (packaging conditions): -10℃~+40℃ and RH 70% (Max.)

4. Shape and Dimensions

1) Dimensions: See the following.

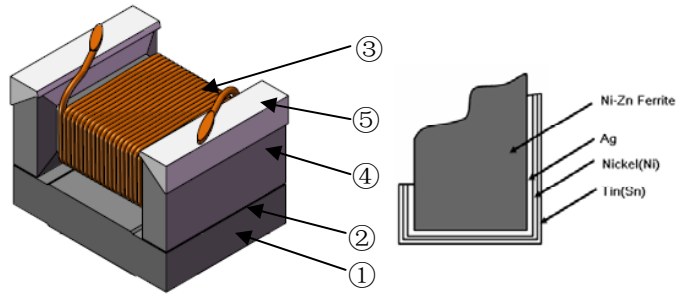


Unit：mm

A	B	C	D	E	H Typ.	I Typ.	J Typ.
3.20±0.20	2.50±0.20	2.30±0.20	0.30±0.10	0.58±0.10	2.5	0.9	2.2

2) Electrode Coplanarity:0.1mm Max.

3) Structure: See the following.



No.	Part Name	Material Name
①	Lid	Ni-Zn Ferrite
②	Epoxy	Epoxy resin
③	Wire	Polyurethane system enameled copper wire
④	Core	Ni-Zn Ferrite
⑤	Electrode structure	Ag+Ni+Sn plating

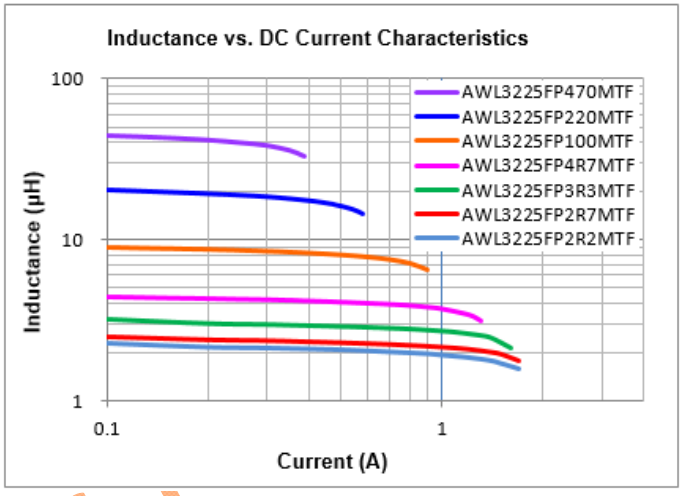
5. Electrical Characteristics

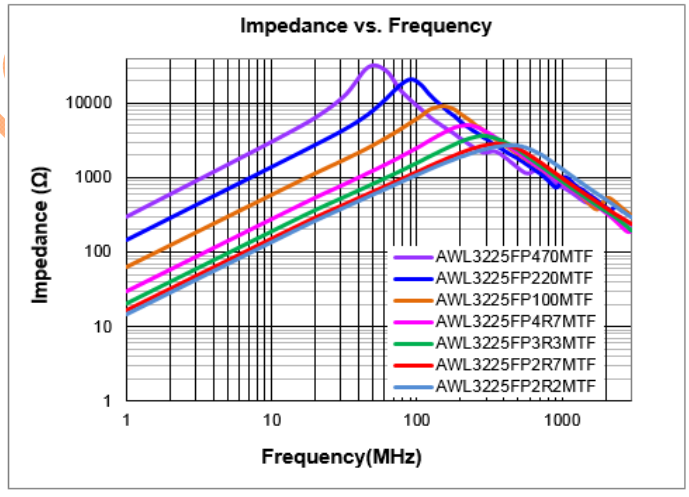
I. AWL3225FP Series

Part Number	Inductance(uH) @1MHz,1V	DCR (Ω) Max.	SRF (MHz) Min.	Isat (mA) Max.	Irms (mA) Max.
AWL3225FP2R2MTF	2.2±20%	0.19	200	1000	1000
AWL3225FP2R7MTF	2.7±20%	0.22	200	975	975
AWL3225FP3R3MTF	3.3±20%	0.24	150	950	950
AWL3225FP4R7MTF	4.7±20%	0.28	100	850	850
AWL3225FP100MTF	10±20%	0.40	100	500	700
AWL3225FP220MTF	22±20%	0.62	50	400	550
AWL3225FP470MTF	47±20%	0.90	30	300	500

Note: ※ 1: Rated current: Isat (max.) or Irms (max.), whichever is smaller;

II. Typical Electrical Characteristic





6. Test and Measurement Procedures

6.1 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: 86 KPa to 106 KPa

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

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

6.2 Visual Examination

a. Inspection Equipment: 10X magnifier

6.3 Electrical Test

6.3.1 DC Resistance (DCR)

a. Refer to **Item 5**.
b. Test equipment: HIOKI3540 or equivalent.

6.3.2 Inductance (L)

a. Refer to **Item 5**.
b. Test equipment: Agilent4287A+Agilent16197A or equivalent.
c. Test signal: -13dBm or 10mA
d. Test frequency refers to **Item 5**.

6.3.3 Saturation Current (Isat)

a. Refer to **Item 5**.
b. Test equipment: Agilent4287A+Agilent16197A or equivalent.
c. Definition of saturation current (Isat): DC current at which the inductance drops approximate 30% from its value without current.

6.3.4 Temperature rise current (Irms)

a. Refer to **Item 5**.
b. Test equipment (see **Fig.6.3.4-1**): Electric Power, Electric current meter, Thermometer.
c. Measurement method (see **Fig. 6.3.4-1**):
   1. Set test current to be 0 mA.
   2. Measure initial temperature of chip surface.
   3. Gradually increase voltage and measure chip temperature for corresponding curre
d. Definition of Rated Current (Ir): Ir is direct electric current as chip surface temperature rose just 40℃ against chip initial surface temperature (Ta) (see **Fig. 6.3.4-2**).

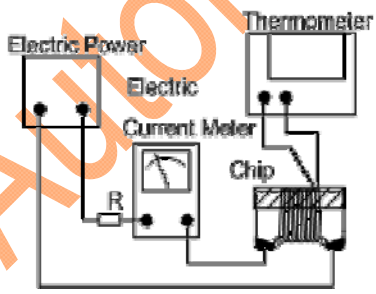


Fig. 6.3.4-1

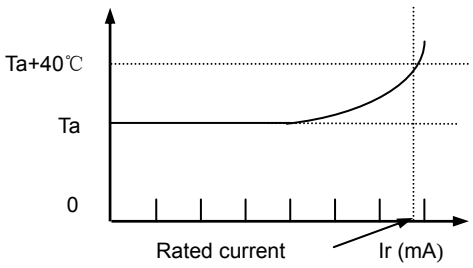
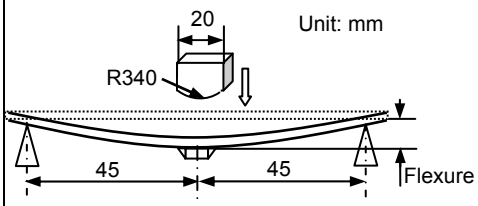
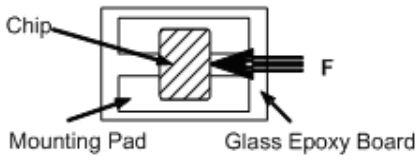


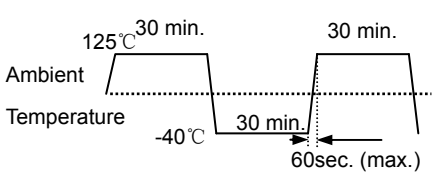
Fig. 6.3.4-2

6.3.5 Self-resonant frequency(SRF)

a. Refer to **Item 5**.
b. Test equipment: Agilent E4991A+16197or equivalent

7. Reliability Test

Items	Requirements	Test Method(According to AEC-Q200)
7.1 Board Flex	① No visible mechanical damage. 	① Solder the chip to the test jig (glass epoxy board) using a eutectic solder. Then apply a force in the direction shown as left. ② Flexure: 2mm. ③ Pressurizing speed: 1mm/sec. ④ Keep time: 60(+5) sec. ⑤ FR4 1.6mm±0.2mm
7.2 Terminal Strength	① No removal or split of the termination or other defects shall occur. 	① Solder the inductor to the testing jig (glass epoxy board,) using eutectic solder. Then apply a force in the direction of the arrow. ② 17.7N force. ③ Keep time: 60±1s ④ Speed: 1.0 mm/s.
7.3 Mechanical Shock	① No visible mechanical damage ② Inductance change: Within ±20% ③ DCR :Satisfy electrical characteristic	① Half sinusoid, the peak acceleration: 100g. ② Pulse width: 6 ms. ③ This motion shall be applied for 6 times in each 6 mutually directions (total of 36 times).
7.4 High Frequency Vibration	① No visible mechanical damage ② Inductance change: Within ±20% ③ DCR :Satisfy electrical characteristic	10~2000~10Hz, the vibration acceleration is 5g, the vibration cycle (10~2000~10Hz time) is 20min, according to X, Y, Z three directions, each direction vibration 12 cycle 4h. A total of 36 cycles, 12h.
7.5 Solderability	①Wetting shall be exceeded 95% coverage except the solder joints	Method 1:① pretreatment:155℃,4h ② 245℃,5(-0.5,+0)s ③ Solder:Sn/3.0Ag/0.5Cu ④ Flux: 25% resin and 75% ethanol in weight. Method 2:① Steam aging:8h ② 245℃,5(-0.5,+0)s ③ Solder:Sn/3.0Ag/0.5Cu ④ Flux: 25% resin and 75% ethanol in weight. Method 3:① Steam aging:8h ② 260℃,30(-0.5,+0.5)s ③ Solder:Sn/3.0Ag/0.5Cu ④ Flux: 25% resin and 75% ethanol in weight.
7.6 Resistance to Soldering Heat	① No visible mechanical damage ② Inductance change: Within ±20% ③ DCR :Satisfy electrical characteristic	① 260±5℃/10±1s, ② depth: 1.5mm, ③ Rate: 25mm/s ± 6mm/s ④ Solder:Sn/3.0Ag/0.5Cu
7.7 Flammability (External Flame)	① t1 or t2:≤10s. ② t1 plus t2 for the 5 specimens:≤50s. ③ t2+t3 for each specimen:≤30s. ④ no afterflame or afterglow of any specimen up to the holding clamp. ⑤ no cotton indicator ignited by flaming particles or drops.	MIL-STD-202 Method 115、UL94
7.8 Resistance to High Temperature	① No visible mechanical damage ② Inductance change: Within ±20% ③ DCR :Satisfy electrical characteristic	① Temperature: 125±2℃ ② Duration: 1000^{+24}hours. ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.

Items	Requirements	Test Method(According to AEC-Q200)
7.9 Resistance to low temperature	① No mechanical damage. ② Inductance change: within ±20%. ③ DCR :Satisfy electrical characteristic	① Temperature: -40±2℃ ② Duration: 1000^{+24} hours. ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
7.10 Biased Humidity	① No visible mechanical damage ② Inductance change: Within ±20% ③ DCR :Satisfy electrical characteristic	① Temperature: 85±2℃, Humidity : 85%RH; ② Duration: 1000^{+24}hours. ③ No load required ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
7.11 Temperature Characteristics	① No visible mechanical damage ② Inductance change: Within ±20%	① Temperature range: -40℃~+125℃. ② Reference tempera ture: +25℃.
7.12 Operational Life	① No visible mechanical damage ② Inductance change: Within ±20% ③ DCR :Satisfy electrical characteristic	① Temperature: 125±2℃. ② Duration: 1000^{+24} hours. ③ Applied current: Rated current. ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
7.13 Thermal Shock	① No visible mechanical damage ② Inductance change: Within ±20% ③ DCR :Satisfy electrical characteristic 	① Temperature, time: -40℃for 30±3 min →125℃ for 30±3min. ② Transforming interval: 60 sec (max.). ③ Tested cycle: 1000 cycles. ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
7.14 ESD Test	① No visible mechanical damage ② Inductance change:Within ±20% ③ DCR :Satisfy electrical characteristic	HBM ESD discharge waveform,8KV,each 1 time of +/- polarity
7.15 Resistance to Solvents	After test, the samples no fell off, fade, dim, transposition and others phenomenon.	MIL-STD-202 Method 215

8. Packaging and Storage

8.1 Packaging

There is one type of packaging for the chip inductors. Please specify the packing code when ordering.

Tape Carrier Packaging:

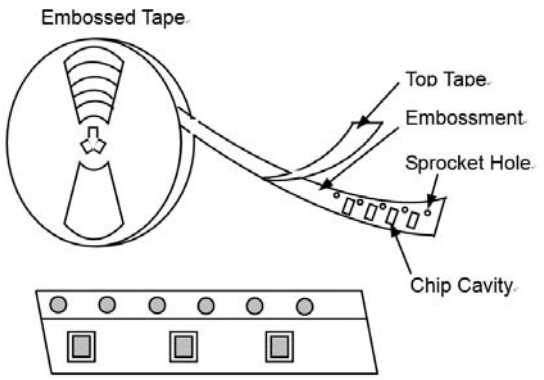
Packaging code: T

a. Tape carrier packaging are specified in attached figure **Fig.8.1-1~5**

b. Tape carrier packaging quantity please see the following table:

Type	3225	
Tape	Embossed Tape	
Quantity	Standard	2K

(1) Taping Drawings (Unit: mm)



Remark: The sprocket holes are to the right as the tape is pulled toward the user.

(2) Taping Dimensions (Unit: mm)

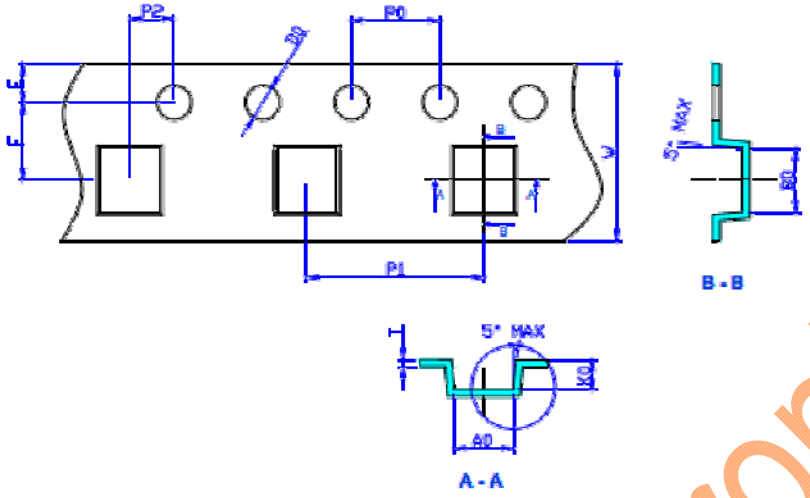


Fig. 8.1-2

Items	A0	B0	P0	P1	W	K0
Dimension	2.90±0.10	3.60±0.10	4.00±0.10	8.00±0.10	12.00±0.20	2.60±0.10
Items	P2	E	F	D0	10P0	T
Dimension	2.00±0.10	1.75±0.10	5.50±0.10	1.50+0.1/-0	40.00±0.20	0.30±0.05

(3) Leader and blank portion

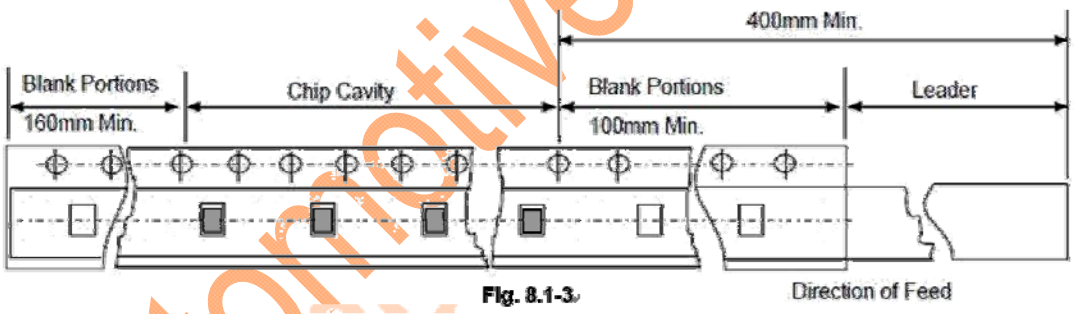


Fig. 8.1-3

(4) Reel Dimensions (Unit: mm)

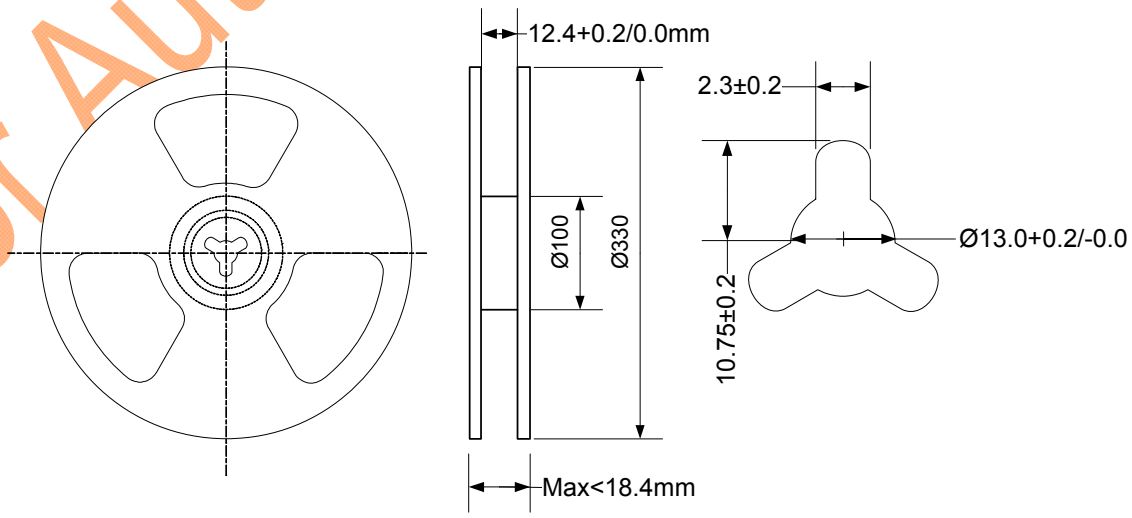


Fig. 8.1-4

(5) Peeling off force: 15gf to 70gf in the direction show below.

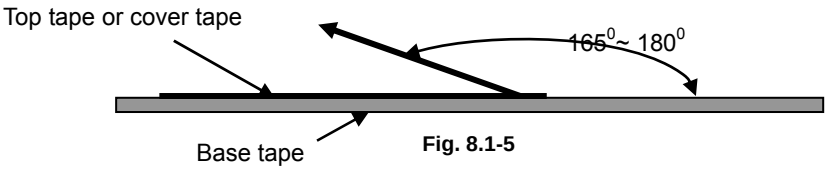


Fig. 8.1-5

8.2 Storage

a. The solderability of the external electrode may be deteriorated if packages are stored where they are exposed to high humidity. Package must be stored at 40℃ or less and 70% RH or less.
b. 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)
c. Packaging material may be deformed if package are stored where they are exposed to heat of direct sunlight.
d. Minimum packages, such as polyvinyl heat-seal packages shall not be opened until they are used. If opened, use the reels as soon as possible.
e. Solderability shall be guaranteed for 12 months from the date of delivery on condition that they are stored at the environment specified in specification. For those parts, which passed more than 12 months shall be checked solder-ability before use.

9. Warning and Attentions

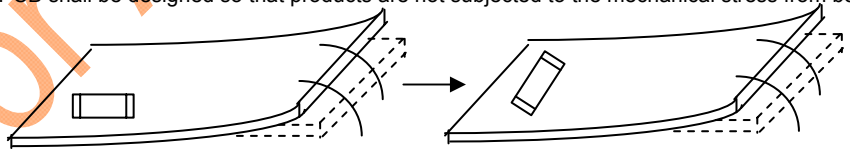
9.1 Precautions on Use

a. Always wear static control bands to protect against ESD.
b. Any devices used (soldering iron, measuring instruments) should be properly grounded.
c. Use non-magnetic tweezers when handing the chips.
d. Pre-heating when soldering, and refer to the recommended condition specified in specification.
e. Don't apply current in excess of the rated current value. It may cause damage to components due to over-current.
f. Keep clear of anything that may generate magnetic fields such as speakers, coils.
g. When soldering, the electrical characteristics may be varied due to hot energy and mechanical stress.
h. When coating products with resin, the relatively high resin curing stress may change the electrical characteristics. For exterior coating, select resin carefully so that electrical and mechanical performance of the product is not affected. Before using, please evaluate reliability with the product mounted in your application set.
i. When mount chips with adhesive in preliminary assembly, do appropriate check before the soldering stage, i.e., the size of land pattern, type of adhesive, amount applied, hardening of the adhesive on proper usage and amounts of adhesive to use.
j. Mounting density: Add special attention to radiating heat of products when mounting other components nearby. The excessive heat by other products may cause deterioration at joint of this product with substrate.
k. Since some products are constructed like an open magnetic circuit, narrow spacing between components may cause magnetic coupling.
l. Please do not give the product any excessive mechanical shocks in transportation.
m. Please do not touch wires by sharp terminals such as tweezers to avoid causing any damage to wires.
n. Please do not add any shock and power to the soldered product to avoid causing any damage to chip body.
o. Please do not touch the electrodes by naked hand as the solderability of the external electrodes may deteriorate by grease or oil on the skin.

9.2 PCB Bending Design

The following shall be considered when designing and laying out PCB's.

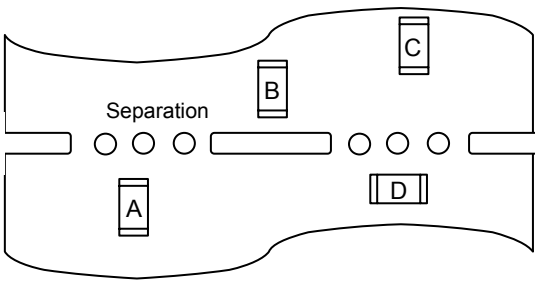
a. PCB shall be designed so that products are not subjected to the mechanical stress from board warp or deflection.



(Poor example) (Good example)

Products shall be located in the sideways direction to the mechanical stress.

b. Products location on PCB separation.



Product shall be located carefully because they may be subjected to the mechanical stress in order of A>C=B>D.

c. When splitting the PCB board, or insert (remove) connector, or fasten thread after mounting components, care is required so as not to give any stress of deflection or twisting to the board. Because mechanical force may cause deterioration of the bonding strength of electrode and solder, even crack of product body. Board separation should not be done manually, but by using appropriate devices.

9.3 Recommended PCB Design for SMT Land-Patterns

When chips are mounted on a PCB, the amount of solder used (size of fillet) and the size of PCB Land-Patterns can directly affect chip performance (such as Q). And they can also cause other soldering question (such as offset and side lap). Therefore, the following items must be carefully considered in the design of solder land patterns.

a. Please use the PCB pad and solder paste we recommend, and contact us in advance if they need to be changed.
b. Please use flux contained with resin since the highly acidic (Chlorine content more than 0.2 wt%) or water-soluble one could damage the insulation film of wires, then causing short circuit of parts.
c. The amount of solder applied can affect the ability of chips to withstand mechanical stresses which may lead to breaking or cracking. Therefore, when designing land-patterns it is necessary to consider the appropriate size and configuration of the solder pads which in turn determines the amount of solder necessary to form the fillets.
d. When more than one part is jointly soldered onto the same land or pad, the pad must be designed that each component's soldering point is separated by solder-resist.

Recommended land dimensions please refer to product specification.

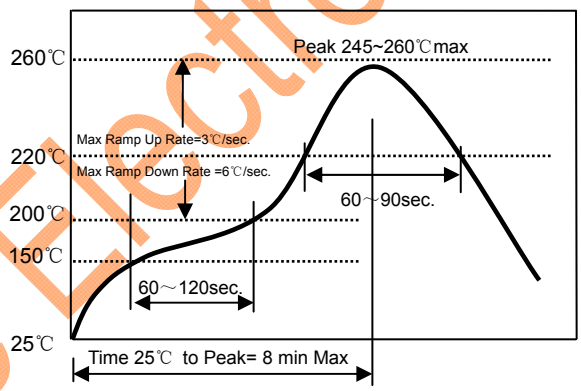
10. Recommended Soldering Technologies

This product is only for reflow soldering and iron soldering.

10.1 Re-flowing Profile

△ Preheat condition: 150~200℃/60~120sec.
△ Allowed time above 220℃: 60~90sec.
△ Peak temp: 245~260℃
△ Max time at Peak temp: 10sec.
△ Solder paste: Sn/3.0Ag/0.5Cu
△ Allowed Reflow time: 3 times max.

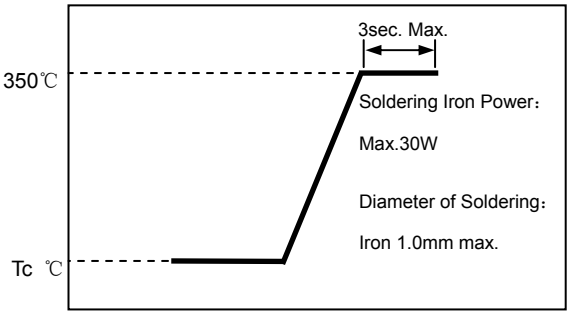
[Note: The reflow profile in the above table is only for qualification and is not meant to specify board assembly profiles. Actual board assembly profiles must be based on the customer's specific board design, solder paste and process, and should not exceed the parameters as the Reflow profile shows.]



10.2 Iron Soldering Profile

△ Iron soldering power: 30W Max.
△ Preheat condition: 150℃/60sec.
△ Soldering tip temperature: 350℃ Max.
△ Soldering time: 3sec. Max.
△ Solder paste: Sn/3.0Ag/0.5Cu
△ Iron Soldering time: 1 time max.

[Note: Take care not to apply the tip of the soldering iron to the terminal electrodes.]



11. Solder Volume

a. Accordingly increasing the solder volume, the mechanical stress to chip is also increased.Exceeding solder volume may cause the failure of mechanical or electrical performance.
b. Before soldering, please ensure that the solder should not adhere to the wire part of chip.
c. Please pay particular attention to whether there is flux remaining on surface of the wire part of chip after subjected to reflow soldering since this may causing short circuit of parts.

12. Cleaning

Products shall be cleaned on the following conditions:

a. Cleaning temperature shall be limited to 60℃ Max. (40℃ Max. for fluoride and alcohol type cleaner.)
b. Ultrasonic cleaning shall comply with the following conditions, avoiding the resonance phenomenon at the mounted products and PCB.
   Power: 20W/l Max.
   Frequency: 28 KHz to 40 KHz
   Time: 5 minutes Max
c. Cleaner
   i. Alternative cleaner

- Isopropyl alcohol (IPA)
- HCFC-225

ii. Aqueous agent

- Surface Active Agent Type (Clean through-750H)
- Hydrocarbon Type (Techno Cleaner-335)
- Higher Alcohol Type (Pine Alpha ST-100S)
- Alkali saponifier Type (※ Aqua Cleaner 240)

※ Alkali saponification shall be diluted to 20% volume with de-ionized water.

※ Please contact our technical service department before using other cleaner.

d. There shall be no residual flux and residual cleaner after cleaning. In the case of using aqueous agent, product shall be dried completely after rinse with de-ionized water in order to remove the cleaner.

e. Some products may become slightly whitened. However, product performance or usage is not affected.

f. Please take care of winding part while cleaning.

g. After cleaning, parts could be subjected to the next reflow soldering till the solvent remaining on surface of parts being volatilized.