

# for Automotive Electronics

# SPECIFICATIONS

Customer	
Product Name	Wire Wound SMD Power Inductor
Sunlord Part Number	ASWPA4035S Series
Customer Part Number	
Weight	228mg/pcs Typ.

[  New Released,  Revised]

SPEC No.: ASWPA0702210000

【This SPEC is total 17 pages including specifications and appendix.】

【ROHS, Halogen-Free and SVHC Compliant Parts】

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**【For Customer approval Only】**

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Qualification Status:  Full  Restricted  Rejected

Approved By	Verified By	Re-checked By	Checked By

Comments:

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Version Change History							
Rev.	Date	Item	Changed Contents	Change Reasons	Drawing	Check	Approval
01	/	/	/	New release	Yan Liu	Haigen He	Qintian Hou

for Automotive Electronics

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for Automotive Electronics

1 Scope

1.1 Scope of parts

This specification applies to the ASWPA4035 Series of wire wound SMD power inductor for automotive electronics based on AEC-Q200D G1.

1.2 Scope of application

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

- (1) Multimedia system.
- (2) Prohibit using in Engine Control System.

1.3 Operating and storage temperature

The part temperature (ambient + temp. rise) should not exceed 125°C under worst case operating conditions. Circuit design, component placement, PCB trace size and thickness, airflow and other cooling provisions all affect the part temperature. Part temperature should be verified in the end application.

- 1) Operating and storage temperature range (individual chip without packing):-40°C ~ +125°C (including self-heating)..
- 2) Storage temperature range (packaging conditions): -10°C~+40°C and RH 70% (Max.)

2 Product Description and Identification (Part Number)

1) Description:

ASWPA4035 Series of Wire wound SMD power inductor.

2) Product Identification (Part Number)

A	SWPA	4035	S	1R0	M	T	Y01
①	②	③	④	⑤	⑥	⑦	⑧

①Feature Code	A: for Automotive
②Product Type	SWPA: Wire wound SMD power inductor
③External Dimensions(LxWxH) [mm]	4035: 4.0x4.0x3.5
④Feature type	S:Standard Type
⑤Nominal Inductance	1R0=1.0uH,100=10uH,101=100uH
⑥Inductance Tolerance	M: ±20%,N: ±30%
⑦Packing Code	T: Tape Carrier Package
⑧Special Process code	Standard product is blank

3 Shape and Dimensions

Dimensions and recommended PCB pattern for reflow soldering, please see Fig.3-1, Fig. 3-2 and Table3-1.

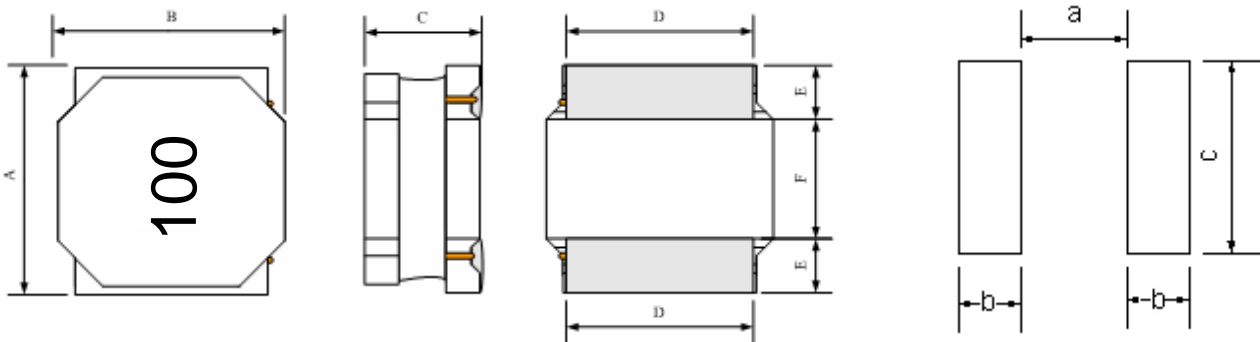


Fig.3-1

[Table 3-1] (Unit: mm)

Series	A	B	C	D	E	a	b	c
ASWPA4035S	4.0±0.2	4.0±0.2	3.5±0.2	3.20±0.1	0.95±0.1	1.9Typ.	1.1Typ.	3.7Typ.

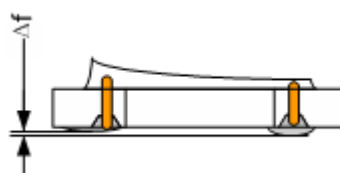


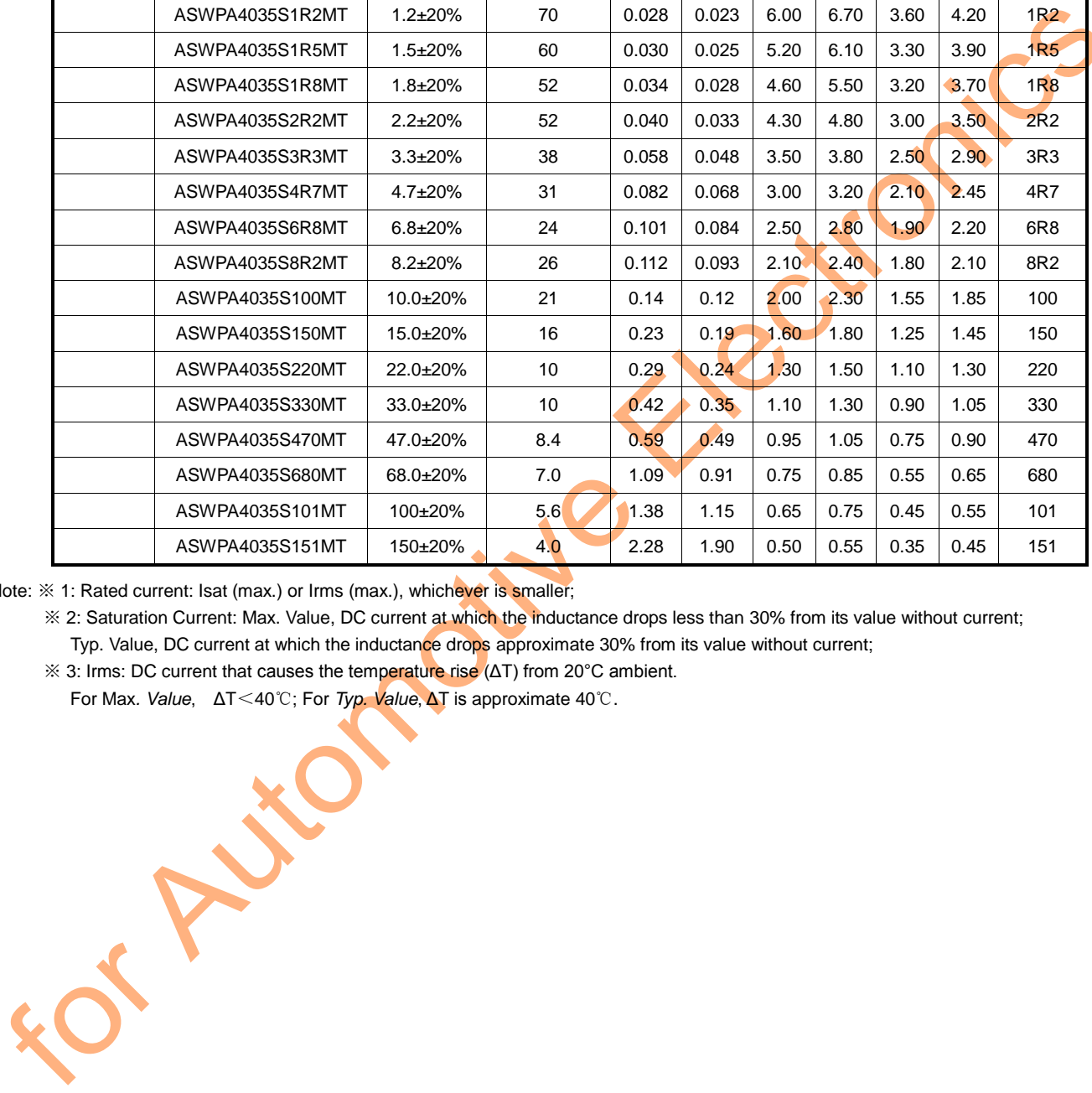
Fig.3-2

Δf: Clearance between terminal and the surface of plate must be 0.1mm max when coil is placed on a flat plate.

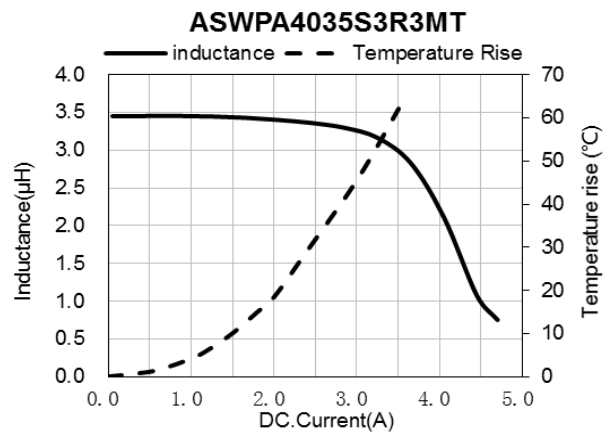
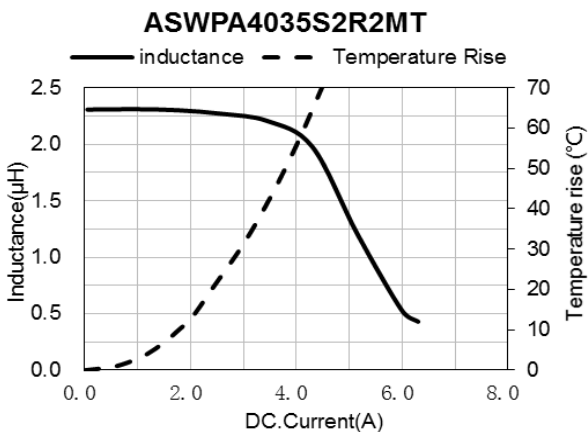
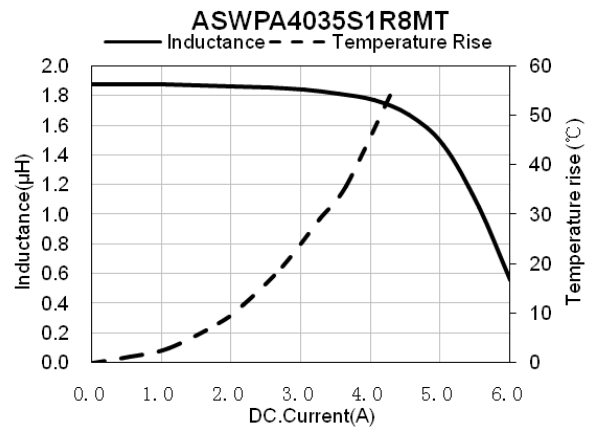
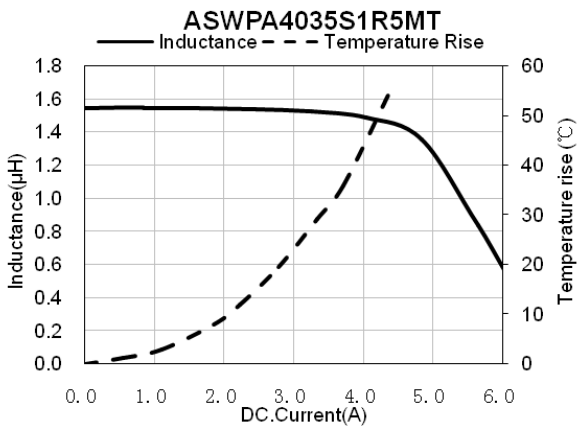
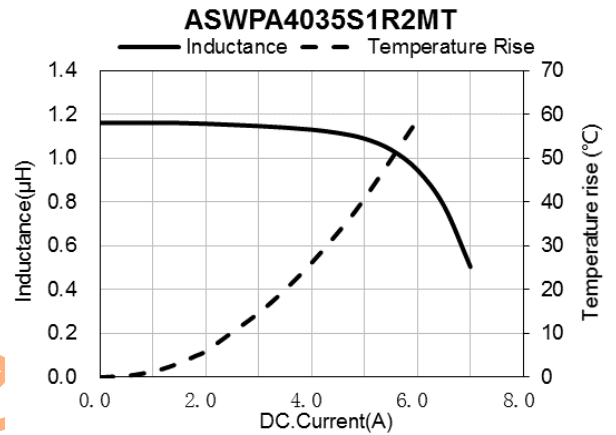
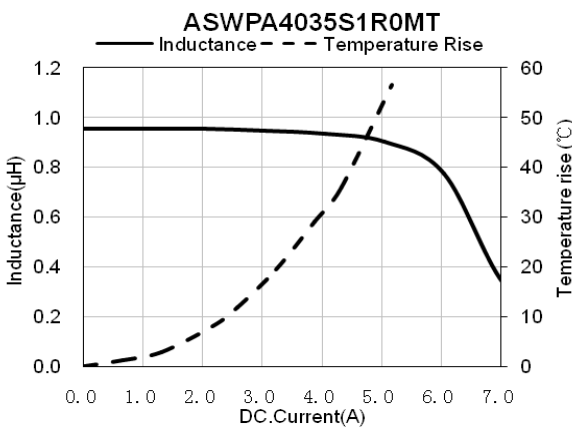
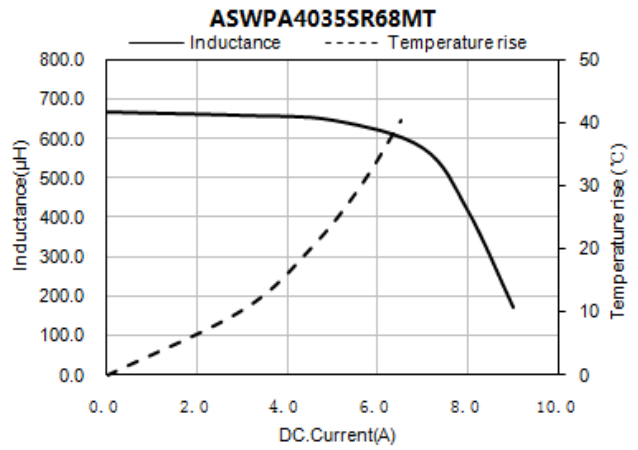
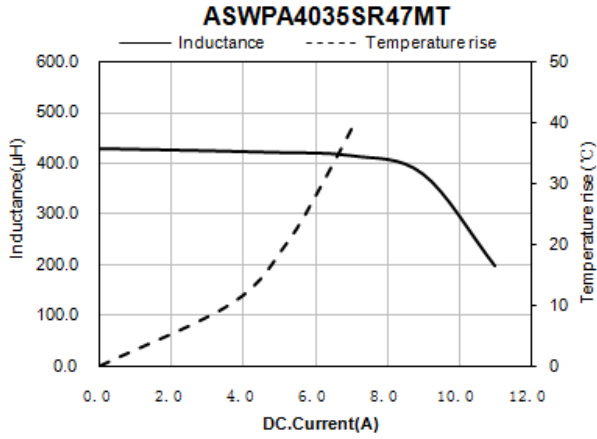
4 Electrical Characteristics

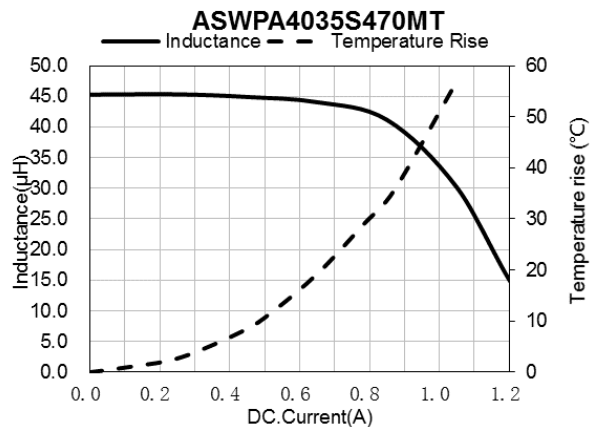
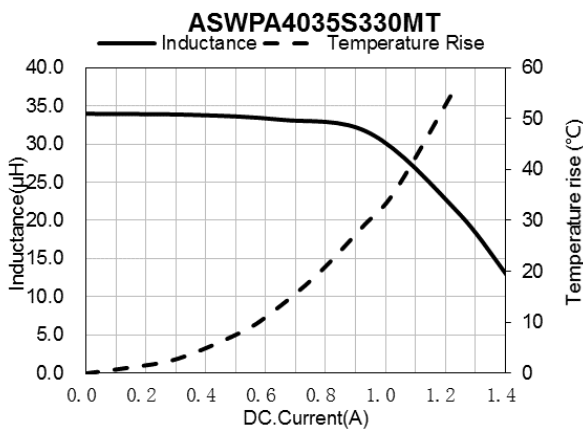
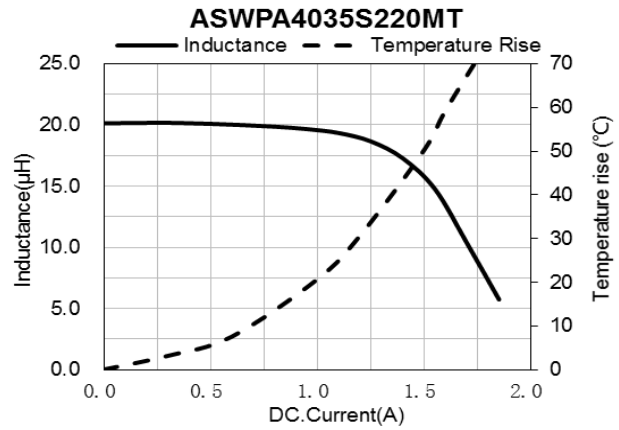
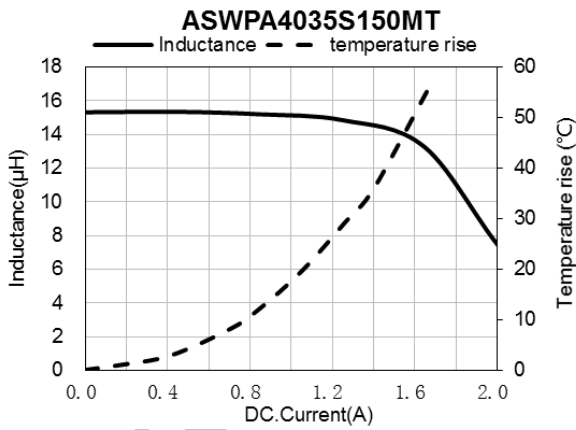
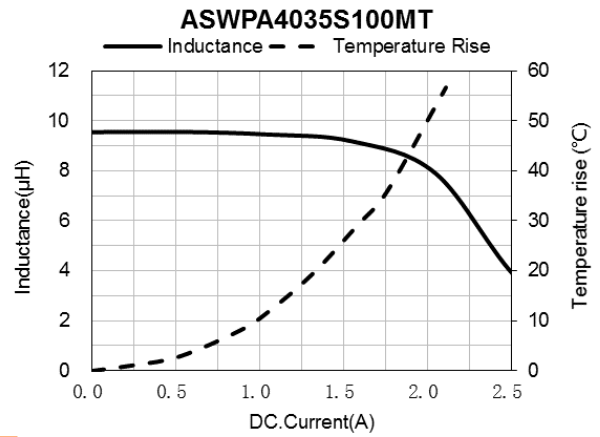
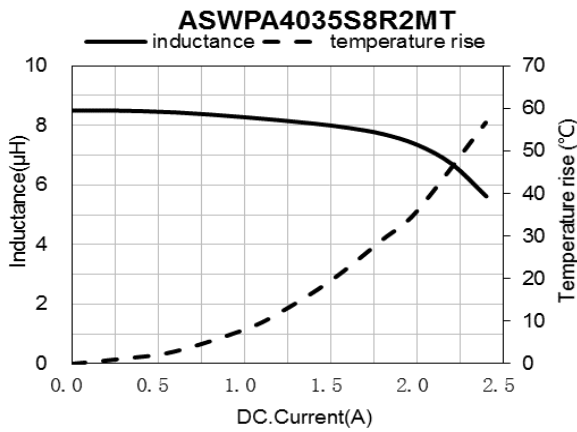
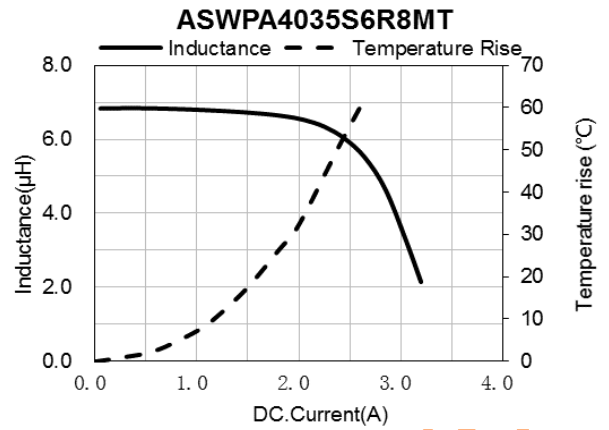
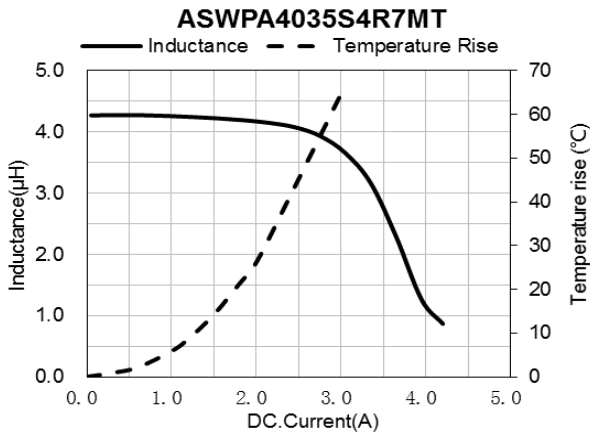
Customer P/N	Part Number	Inductance 0.1MHz/1V	Min. Self-resonant frequency	DC Resistance		Saturation Current		Heat Rating Current		Marking
				Max.	Typ.	Max.	Typ.	Max.	Typ.	
	Units	µH	MHz	Ω	Ω	A	A	A	A	
	Symbol	L	SRF	DCR		Isat		Irms		-
	ASWPA4035SR47MT	0.47±20%	176	0.010	0.008	7.80	9.80	5.20	5.90	R47
	ASWPA4035SR68MT	0.68±20%	132	0.013	0.010	6.80	7.80	4.56	5.10	R68
	ASWPA4035S1R0MT	1.0±20%	121	0.024	0.020	6.30	6.90	3.85	4.50	1R0
	ASWPA4035S1R2MT	1.2±20%	70	0.028	0.023	6.00	6.70	3.60	4.20	1R2
	ASWPA4035S1R5MT	1.5±20%	60	0.030	0.025	5.20	6.10	3.30	3.90	1R5
	ASWPA4035S1R8MT	1.8±20%	52	0.034	0.028	4.60	5.50	3.20	3.70	1R8
	ASWPA4035S2R2MT	2.2±20%	52	0.040	0.033	4.30	4.80	3.00	3.50	2R2
	ASWPA4035S3R3MT	3.3±20%	38	0.058	0.048	3.50	3.80	2.50	2.90	3R3
	ASWPA4035S4R7MT	4.7±20%	31	0.082	0.068	3.00	3.20	2.10	2.45	4R7
	ASWPA4035S6R8MT	6.8±20%	24	0.101	0.084	2.50	2.80	1.90	2.20	6R8
	ASWPA4035S8R2MT	8.2±20%	26	0.112	0.093	2.10	2.40	1.80	2.10	8R2
	ASWPA4035S100MT	10.0±20%	21	0.14	0.12	2.00	2.30	1.55	1.85	100
	ASWPA4035S150MT	15.0±20%	16	0.23	0.19	1.60	1.80	1.25	1.45	150
	ASWPA4035S220MT	22.0±20%	10	0.29	0.24	1.30	1.50	1.10	1.30	220
	ASWPA4035S330MT	33.0±20%	10	0.42	0.35	1.10	1.30	0.90	1.05	330
	ASWPA4035S470MT	47.0±20%	8.4	0.59	0.49	0.95	1.05	0.75	0.90	470
	ASWPA4035S680MT	68.0±20%	7.0	1.09	0.91	0.75	0.85	0.55	0.65	680
	ASWPA4035S101MT	100±20%	5.6	1.38	1.15	0.65	0.75	0.45	0.55	101
	ASWPA4035S151MT	150±20%	4.0	2.28	1.90	0.50	0.55	0.35	0.45	151

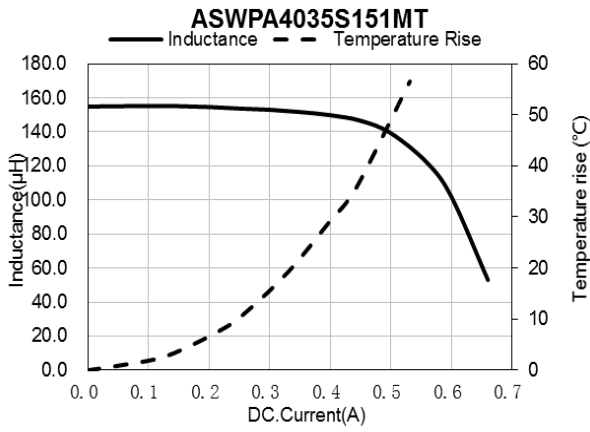
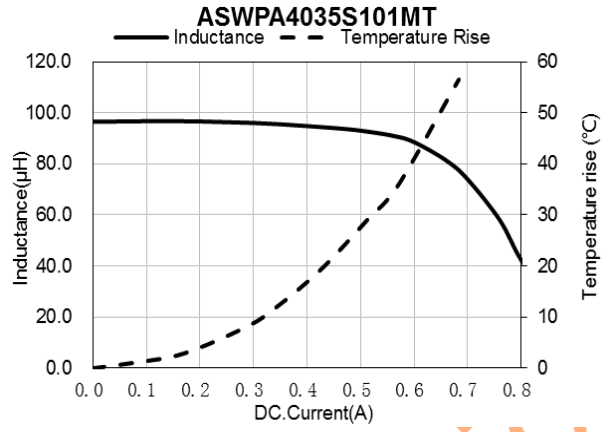
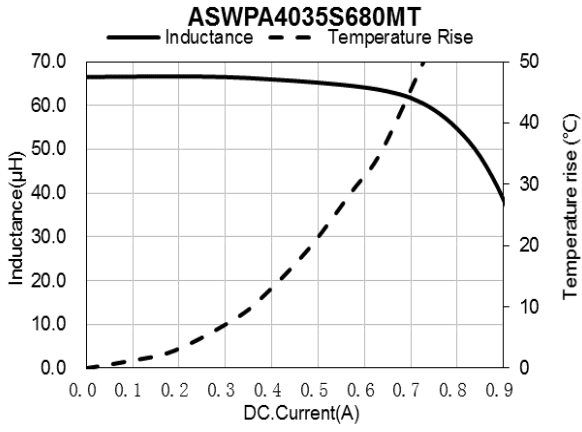
Note: ※ 1: Rated current: Isat (max.) or Irms (max.), whichever is smaller;  
 ※ 2: Saturation Current: Max. Value, DC current at which the inductance drops less than 30% from its value without current;  
 Typ. Value, DC current at which the inductance drops approximate 30% from its value without current;  
 ※ 3: Irms: DC current that causes the temperature rise (ΔT) from 20°C ambient.  
 For Max. Value, ΔT < 40°C; For Typ. Value, ΔT is approximate 40°C.



Appendix :Typical Electrical Characteristics:







for Automotive Electronic



5 Test and Measurement Procedures

5.1 Test Conditions

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

- a. Ambient Temperature:  $20 \pm 15^{\circ}\text{C}$
- b. Relative Humidity:  $65 \pm 20\%$
- c. Air Pressure: 86kPa to 106kPa

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

- a. Ambient Temperature:  $20 \pm 2^{\circ}\text{C}$
- b. Relative Humidity:  $65 \pm 5\%$
- c. Air Pressure: 86kPa to 106kPa

5.2 Visual Examination

Inspection Equipment: Visual.

5.3 Electrical Test

5.3.1 Inductance (L)

- a. Refer to **Item 4**. Test equipment: WK3260B LCR meter or equivalent.
- b. Test Frequency and Voltage: refers to **Item 4**.

5.3.2 Direct Current Resistance (DCR)

- a. Refer to **Item 4**.
- b. Test equipment: HIOKI 3540 or equivalent.

5.3.3 Saturation Current (Isat)

- a. Refer to **Item 4**.
- b. Test equipment: WK3260B LCR meter or equivalent.

5.3.4 Temperature rise current (Irms)

- a. Refer to **Item 4**.
- b. Test equipment (see **Fig. 5.3.4-1, Fig. 5.3.4-2**): Electric Power, Electric current meter, Thermometer.
- c. Measurement method
  1. Set test current to be 0 mA.
  2. Measure initial temperature of choke surface.
  3. Gradually increase current and measure choke temperature for corresponding current.
  4. Definition of Temperature rise current: DC current that causes the temperature rise ( $\Delta T$ ) from ambient temperature.

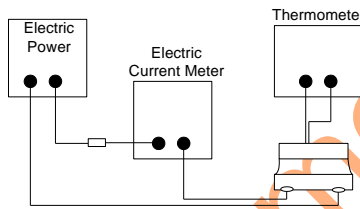


Fig. 5.3.4-1

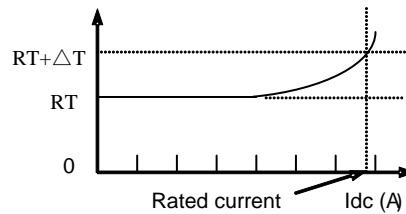
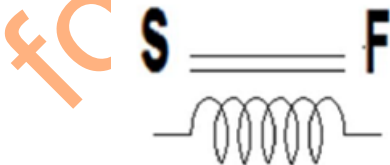


Fig. 5.3.4-2

5.3.5 Self-resonant frequency (SRF)

- a. Refer to **Item 4**.
- b. Test equipment: Agilent E4991A+16197 or equivalent

Schematic Diagram



6 Structure

1) The structure of ASWPA4035 product, please refer to Fig.6-1 and Table 6-1.

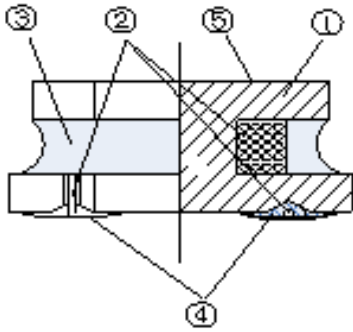


Fig. 6-1

[Table 6-1]

No.	Components	Material
①	Ferrite Core	NiZn Ferrite
②	Wire	Polyurethane system enameled copper wire
③	Magnetic Glue	Epoxy resin and magnetic powder
④	Electrodes	Ag/Ni/Sn+Cu +Sn Alloy
⑤	Marking	Laser Marking

7 Product Marking

Please refer to Fig. 7-1.

The content of marking please refers to Item 4.

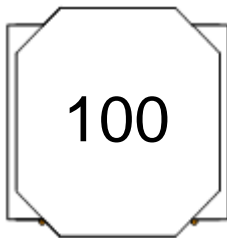


Fig. 7-1

8 Reliability Test

No.	Test Item	Test Method(According to AEC-Q200)	Requirements
1	Terminal Strength	Reflow 2 times, 17.7N(Requirement from AEC-Q200),X,Ydirect, 60(+1)s.	No removal or split of the termination or other defects shall occur
2	Resistance to Flexure	Reflow 2 times,2mm,60(+5)s.	No visible mechanical damage
3	Temp. Characteristics	-40°C/15(+3)min → +25°C/15(+3)min → +125°C/15(+3)min.	Inductance change should be within ±20% of reference value measuring at 25°C
4	Solderability	Method 1: ①pretreatment:155°C,4h ②235°C,5(-0.5,+0)s. ③Solder:Sn/3.0Ag/0.5Cu.	Wetting shall be exceeded 95% coverage
		Method 2: ①Steam aging:8h. ②235°C,5(-0.5,+0)s. ③Solder:Sn/3.0Ag/0.5Cu.	Wetting shall be exceeded 95% coverage
		Method 3: ①Steam aging:8h. ②260°C,7(-0.5,+0.5)s. ③Solder:Sn/3.0Ag/0.5Cu.	No more than 5% of the solderable termination exhibits exposed underlying, nonwetable base metal or metallization layers or portions of the ceramic substrate after exposure to molten solder
5	Resistance to Soldering Heat	Reflow:Max. 260°C/10s,3 times.	(1) No visible mechanical damage (2) Inductance change: Within ±10%
6	High Frequency Vibration	10~2000Hz,5g,20min/Cycle,4hours in each 3 mutually perpendicular directions (total of 12hours)	(1) No visible mechanical damage (2) Inductance change: Within ±10%

7	Mechanical Shock	Half sine shock pulse, 100g, 6ms, 6 shocks in each 3 mutually perpendicular directions (total of 18 shocks).	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
8	ESD Test	HBM ESD discharge waveform, 8KV, each 1 time of +/- polarity.	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
9	Thermal Shock	Reflow 2 times, $-40/(30\pm 3\text{min})$ , $+125/(30\pm 3\text{min})$ , transforming interval: 20s(Max.), 1000 cycles.	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
10	Resistance to Low Temperature	Reflow 2 times, $-40\pm 2^\circ\text{C}$ , 1000(+24) hours	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
11	Resistance to High Temperature	Reflow 2 times, $125\pm 2^\circ\text{C}$ , 1000(+24) hours	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
12	Moisture Resistance	Reflow 2 times, ① $25^\circ\text{C} \rightarrow 65^\circ\text{C}$ , 90%~100%RH, 2.5h ② $65^\circ\text{C}$ , 90%~100%RH, 3h ③ $65^\circ\text{C} \rightarrow 25^\circ\text{C}$ , 80%~100%RH, 2.5h ④ $25^\circ\text{C} \rightarrow 65^\circ\text{C}$ , 90%~100%RH, 2.5h ⑤ $65^\circ\text{C}$ , 90%~100%RH, 3h ⑥ $65^\circ\text{C} \rightarrow 25^\circ\text{C}$ , 80%~100%RH, 2.5h, ⑦ $25^\circ\text{C}$ , 90%~100%RH, 8h, 24 hours of 1 cycle (total of 240 hours)	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
13	Biased Humidity	Reflow 2 times, $85^\circ\text{C}$ , 85%RH, 1000h	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
14	Operational Life	Reflow 2 times, $85\pm 2^\circ\text{C}$ , 1000(+24) hours, rated current	(1) No visible mechanical damage (2) Inductance change: Within $\pm 10\%$
15	Flammability	Refer to UL94.	① $t_1$ or $t_2 \leq 10\text{s}$ ; ② $t_1$ plus $t_2$ for the 5 specimens: $\leq 50\text{s}$ ; ③ $t_2+t_3$ for each specimen: $\leq 30\text{s}$ ; ④ No after-flame or after-glow of any specimen up to the holding clamp ⑤ No cotton indicator ignited by flaming particles or drops

9 Packaging, Storage and Transportation

9.1 Tape and Reel Packaging Dimensions

9.1.1 Taping Dimensions (Unit: mm)

Please refer to Fig. 9.1.1 and Table 9.1.1.

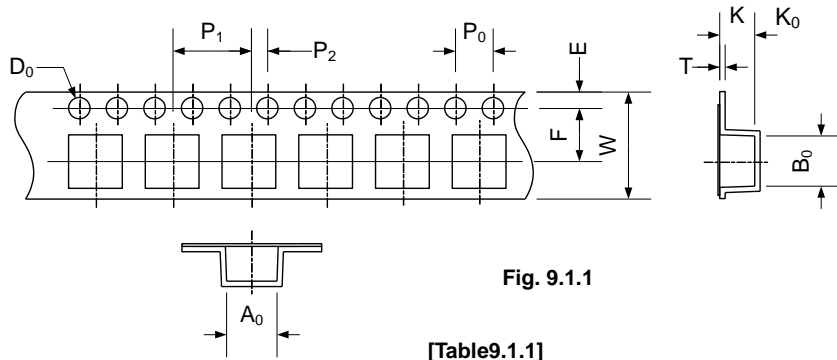


Fig. 9.1.1

[Table9.1.1]

Series	$A_0$	$B_0$	$W$	$E$	$F$	$P_0$	$P_1$	$P_2$	$D_0$	$T$	$K_0$
ASWPA4035S	$4.3 \pm 0.1$	$4.3 \pm 0.1$	$12.0 \pm 0.3$	$1.75 \pm 0.1$	$5.5 \pm 0.1$	$4.0 \pm 0.1$	$8.0 \pm 0.1$	$2.0 \pm 0.1$	$1.5 + 0.1 / - 0.0$	$0.40 \pm 0.05$	$3.7 \pm 0.1$

9.1.2 Direction of rolling

Please refer to Fig. 9.1.2

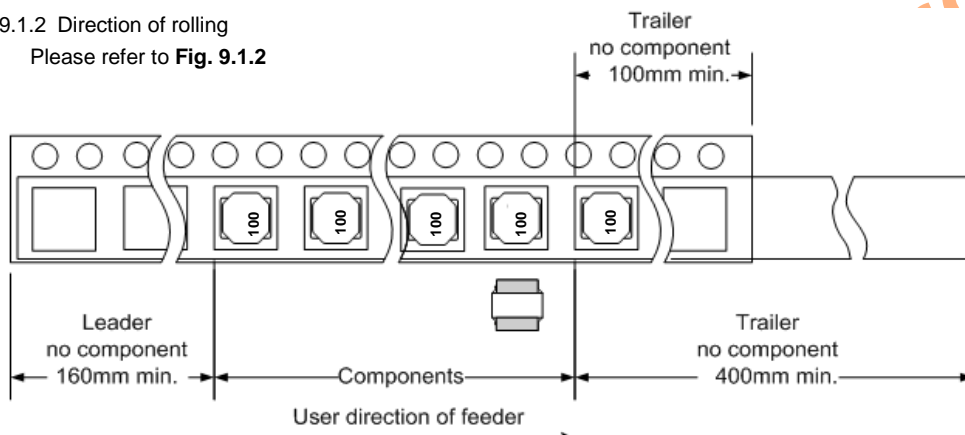


Fig. 9.1.2

9.1.3 Reel Dimensions (Unit: mm)

Please refer to Fig. 9.1.3.

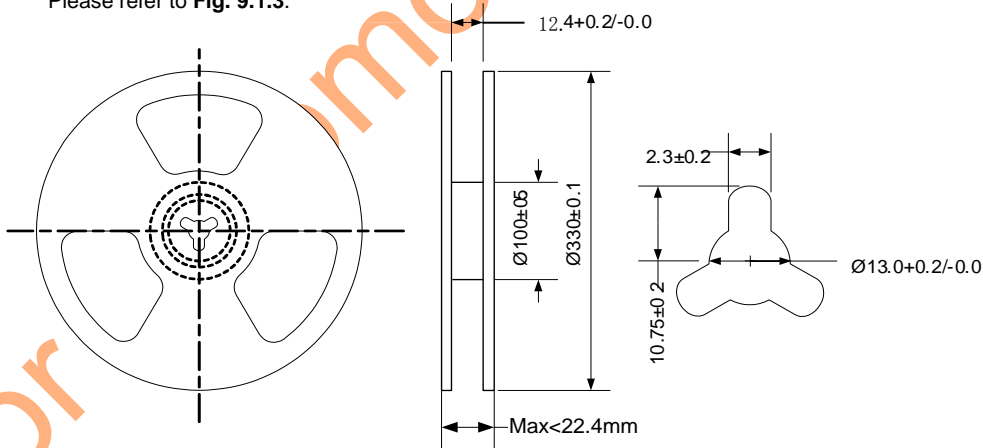


Fig.9.1.3

- 9.1.4 Top tape strength  
Peel-off strength: 10~130gf.  
Peel-off angle: 165°~180° refers to Fig.9.1.4.  
Peel-off speed: 300mm/min.

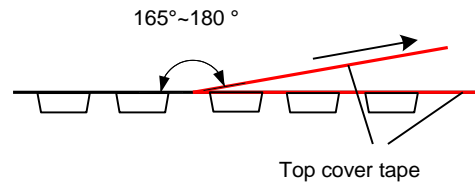


Fig. 9.1.4

- 9.1.5 The number of components  
A tape & reel package contains 2000 inductors.
- 9.1.6 The allowable number of empty chip cavities  
Maximum two (2) chip cavities missing product may exist in a reel but they may not be consecutive two cavities.

9.2 Packing Documents and Marking

9.2.1 Packing Documents

Packing documents include the following:

- 1) Packaging list
- 2) Certificate of compliance (COC)

9.2.2 Packing QTY.

- 1) Inner Box: 1 reel in each box.
- 2) Outer Box: 2 or 4 inner boxes in each outer case.
- 3) 2 or 4 reels in each outer case.

9.2.3 Marking

1) Marking label information on reels includes (see Fig.9.2.3-1~2):

Fig.9.2.3-2a: Shipping labels

- a). P/O No.
- b). Customer Part No.
- c). Sunlord Part No.
- a). Quantity..
- b). Lot No.
- a). Date code
- b). Inspection stamp
- c). MFG address as 'Made In China'.

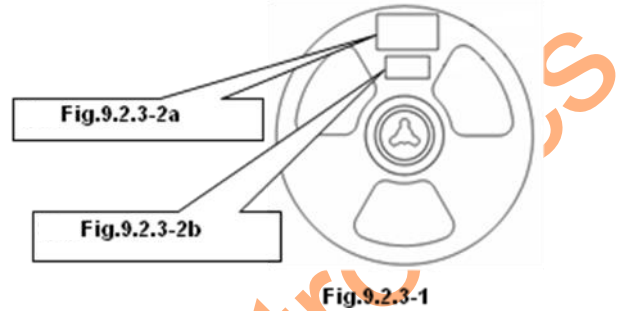


Fig.9.2.3-1

[Table 9.2.3-1]

Packaging type	A(mm)	B(mm)	C(mm)
Inner box	340	30	340

Fig.9.2.3-2b: Production label

- a). P/O No.
- b). Quantity..
- c). Lot No.
- d). Inspe No
- e). Inspection stamp
- f). MFG address as 'Made In China'.
- g). sequence number

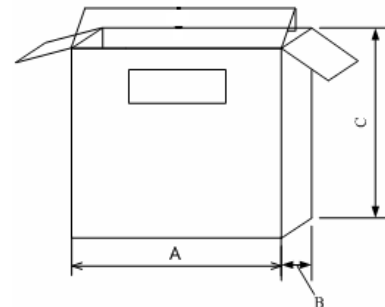


Fig.9.2.3-3

[Table 9.2.3-2]

Packaging type	L(mm)	W(mm)	H(mm)
TYP1	380	380	250
TYP2	380	380	190

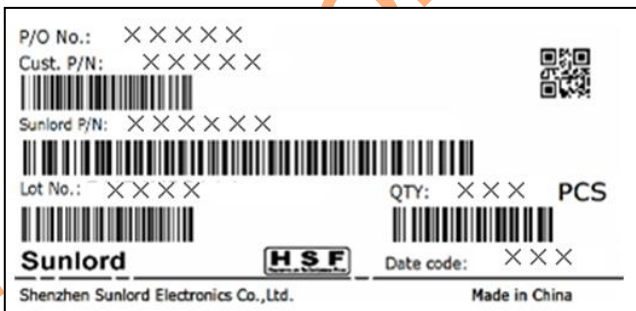


Fig.9.2.3-2a

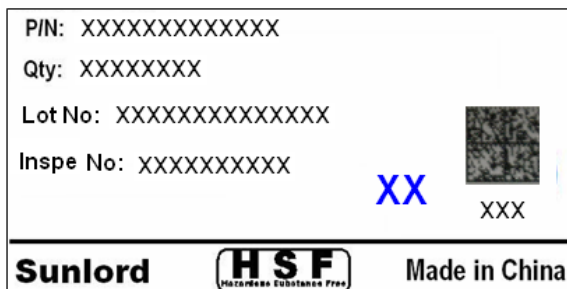


Fig.9.2.3-2b

- 2) Marking label information on inner box
  - a). Inner box please refers to **Fig.9.2.3-3** and **Table 9.2.3-1**.
  - b). Marking Label on inner box  
N/A.

3) Marking on outer case (see **Fig.9.2.3-4~6**):  
Out case size please refers to **Table 9.2.3-2**.

- a). Manufacturer: Sunlord ID:  
"Shenzhen Sunlord Electronics Co., Ltd."
- b). Packing label include the following:
  - i) Customer
  - ii) Manufacturer
  - iii) Date code
  - iv) C/No.

Example; "1/10" means that this case is the 1st of total 10 cases

- v) P/O No.
- vi) Customer Part No.
- vii) Sunlord Part No.
- viii) Quantity.
- ix) Inspection Stamp.

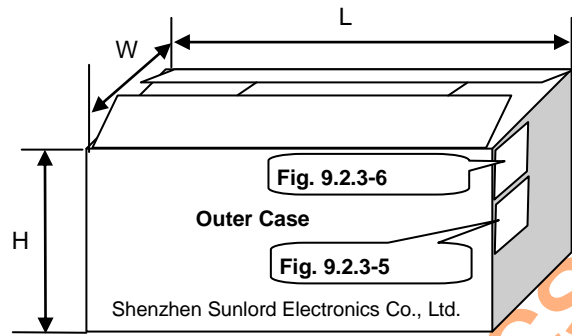


Fig. 9.2.3-4

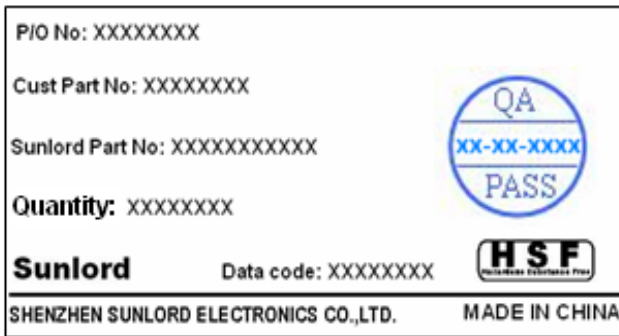


Fig.9.2.3-5

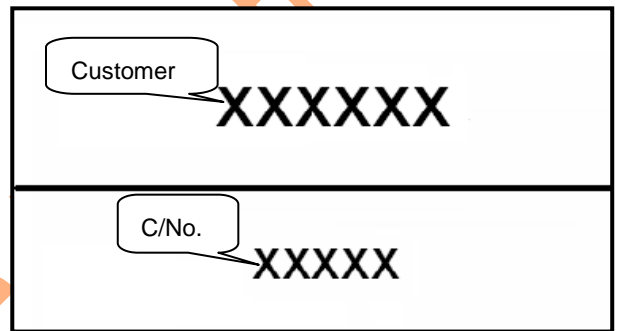
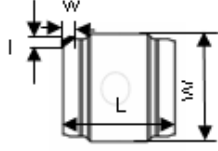

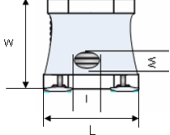
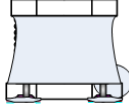
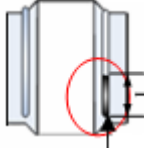
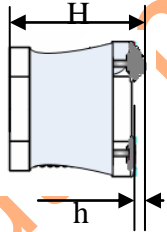
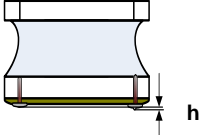
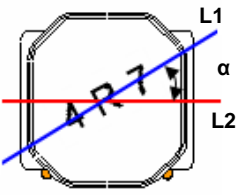


Fig.9.2.3-6

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10 Visual inspection standard of product

File No:		Applied to Wire Wound SMD Power Inductor Series		REV:01
Effective date:				
No.	Defect Item	Graphic	Rejection identification	Acceptance
1	Core defect		The defect length/width ( $l$ and $w$ ) more than $L/6$ and $W/6$ , NG.	AQL=0.065
2	Core crack		Visual cracks, NG.	AQL=0.065
3	Starvation		Resin starved length, $l$ , more than $L/2$ , and IF $W > 2\text{mm}$ , resin starved width, $w$ , more than $W/2$ , NG. IF $W \leq 2\text{mm}$ , resin starved width, $w$ , don't control.	AQL=0.065
4	Excessive glue		The length, width or height of product beyond specified value, NG.	AQL=0.065
5	Cold solder		Cold solders $l$ more than 1mm, NG.	AQL=0.065
6	Solder icicle		① The height $H$ of product beyond specified value, NG; ② The clearance $\Delta f$ beyond specified value listed in Item 5, NG;	AQL=0.065
7	Electrode uneven		The clearance $\Delta f$ beyond specified value listed in Item 5, NG;	AQL=0.065
8	Marking defect		① The content of marking 1) is indistinct, 2) disagrees with current product P/N requirements, NG; ② Intersection angle by $L1$ and $L2$ more than $45^\circ$ , NG.	AQL=0.065

## 11 Recommended Soldering Technologies

### 11.1 Re-flowing Profile:

- △ Preheat condition: 150 ~200°C/60~120sec.
- △ Allowed time above 217°C: 60~90sec.
- △ Max temp: 260°C
- △ Max time at max temp: 5sec.
- △ Solder paste: Sn/3.0Ag/0.5Cu
- △ Allowed Reflow time: 2x max

Please refer to **Fig. 11.1-1**.

[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.]

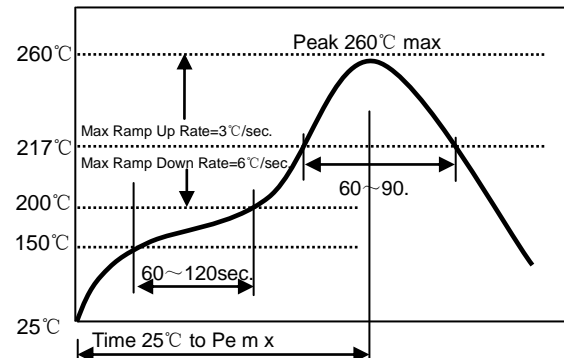


Fig. 11.1-1.

### 11.2 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

Please refer to **Fig. 11.2-1**.

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

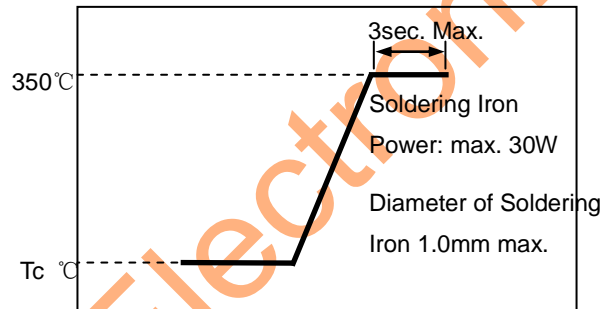


Fig. 11.2-1.

## 12 Precautions

### 12.1 Surface mounting

- Mounting and soldering condition should be checked beforehand.
- Applicable soldering process to this product is reflow soldering only.
- Recommended conditions for repair by soldering iron:  
Preheat the circuit board with product to repair at 150°C for about 1 minute.  
Put soldering iron on the land-pattern.  
Soldering iron's temperature: 350°C maximum/Duration: 3 seconds maximum/1 time for each terminal.  
The soldering iron should not directly touch the inductor.  
Product once removes from the circuit board may not be used again.

### 12.2 Handling

- Keep the products away from all magnets and magnetic objects.
- Be careful not to subject the products to excessive mechanical shocks.
- Please avoid applying impact to the products after mounted on pc board.
- Avoid ultrasonic cleaning.

### 12.3 Storage

- To maintain the solderability of terminal electrodes and to keep the packing material in good condition, temperature and humidity in the storage area should be controlled.
- Recommended conditions: -10°C~40°C, 70%RH (Max.)
- Even under ideal storage conditions, solderability of products electrodes may decrease as time passes. For this reason, product should be used with one year from the time of delivery.
- In case of storage over 6 months, solderability shall be checked before actual usage.

### 12.4 Regarding Regulations

- Any Class- I or Class- II ozone-depleting substance (ODS) listed in the Clean Air Act in US for regulation is not included in the products or applied to the products at any stage of whose manufacturing processes.
- Certain brominated flame retardants (PBBs, PBDEs) are not used at all.
- The products of this specification are not subject to the Export Trade Control Order in China or the Export Administration Regulations in US.



**12.5 Guarantee**

- The guaranteed operating conditions of the products are in accordance with the conditions specified in this specification.
- Please note that Sunlord takes no responsibility for any failure and/or abnormality which is caused by use under other than the aforesaid operating conditions.

**12.6** Please make sure to record the lot number on the label when using Sunlord's products in order for good traceability.

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