



Lead-Free Current Sensing Resistors

RLS Series

(Halogen-Free)

AEC-Q 200-Ver D qualified

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1. Scope

This specification applied to the products of Lead-Free current sensing resistor of metal foil for Lead-Free RLS series manufactured by TA-I TECHNOLOGY CO.,LTD.

2. Type Designation

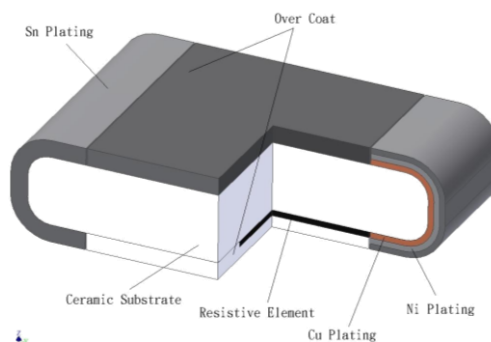
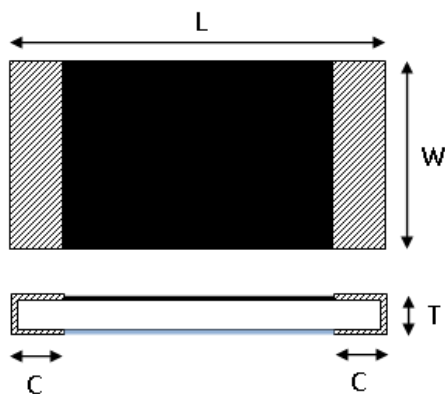
RLS12	F	T	C	R005
Series No.	Tolerance	Packaging	Power	Resistance
04 : 0402 06 : 0603 10 : 0805 12 : 1206 25 : 2512	F= $\pm 1\%$ G= $\pm 2\%$ J= $\pm 5\%$	T= Paper E= Embossed	P= 0.0625W K= 0.2W A= 0.25W S= 0.5W I= 0.75W C= 1.0W E= 2.0W	R005=5m Ω R0065=6.5m Ω R010= 10m Ω *For 0402 R0Z10=Jumper Max resistance 10m Ω

3. Construction and Dimension

3.1 RLS04 & RLS06

Marking:

For0402 & 0603: No Marking



Series	L	W	C	t
RLS04	1.10 $\pm$ 0.10	0.55 $\pm$ 0.10	0.30 $\pm$ 0.10	0.45 $\pm$ 0.10
RLS06	1.60 $\pm$ 0.20	0.80 $\pm$ 0.20	0.40 $\pm$ 0.20	0.60 $\pm$ 0.20

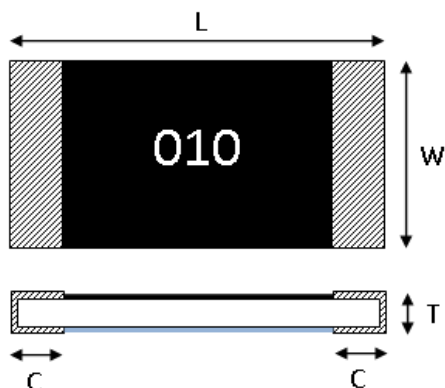
UNIT: mm



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3.2 RLS10 to RLS25



Marking

For 0805 to 2512:

Resistance value is expressed by 3 digits.

E.G.:

005 = $0.005\Omega = 5 \text{ m}\Omega$

010 = $0.010\Omega = 10\text{m}\Omega$

6.5 = $0.0065\Omega = 6.5 \text{ m}\Omega$

Series	L	W	C	T
RLS10	2.00 ± 0.20	1.25 ± 0.20	0.40 ± 0.30	0.70 ± 0.20
RLS12	3.20 ± 0.20	1.60 ± 0.20	0.50 ± 0.30	0.70 ± 0.20
RLS25	6.40 ± 0.20	3.20 ± 0.20	0.90 ± 0.20	0.70 ± 0.20

Unit: mm

4. Features

Series	Size	Power (W)	Resistance Value	Operation Temperature Range	TCR	Tolerance
RLS04	0402	0.0625W	Max. resistance 10 mΩ Max. Current 3A	-55°C~+125°C	±100ppm/°C	5%
		0.25	10 -20mΩ			±1% ±2% ±5%
RLS06	0603	0.50	5 ~ 20mΩ	-55°C~+155°C	±50ppm/°C	±1% ±2% ±5%
RLS10	0805	0.75	5 ~ 40mΩ			
RLS12	1206	1.0	3 ~ 40mΩ			
RLS25	2512	2.0	5 ~ 10mΩ			



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5. Reliability Tests

Test Items	Reference standard	Condition of Test	Test Limits
Temperature Coefficient of Resistance	IEC60115-1 4.8	+25 ~ 125°C	Refer item 4
Short Time Overload	IEC60115-1 4.13	5 X rated power for 5s	< ±1%
High Temperature Exposure (Storage)	AEC-Q200-REV D-Test 3 MIL-STD-202 Method 108	1000 hrs. @ T=125°C. Unpowered. Measurement at 24±2 hours after test conclusion.	< ±1%
Temperature Cycling	AEC-Q200-REV D-Test 4 JESD22 Method JA-104	1000 Cycles (-55°C to +125°C) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme. 1 min. maximum transition time.	< ±1%
Moisture Resistance	AEC-Q200-REV D-Test 6 MIL-STD-202 Method 106	T=24 hours / Cycle ,10 Cycles. Notes: Steps 7a& 7b not required. Unpowered	< ±1%
Biased Humidity	AEC-Q200-REV D-Test 7 MIL-STD-202 Method 103	1000 hours 85°C/85%RH. Note: Specified conditions: 10% of operating power (not exceeding max working voltage). Measurement at 24±2 hours after test conclusion.	< ±1%
Operational Life	AEC-Q200-REV D-Test 8 MIL-STD-202 Method 108	1000 hours TA=125°C at 35% rated power. Measurement at 24±4 hours after test conclusion.	< ±2%
External Visual	AEC-Q200-REV D-Test 9 MIL-STD-883 Method 2009	Electrical test not required. Inspect device construction, marking and workmanship.	
Physical Dimension	AEC-Q200-REV D-Test 10 JESD22 Method JB-100	Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers spec. Electrical test not required.	
Resistance to Solvents	AEC-Q200-REV D-Test 12 MIL-STD-202 Method 215	a: Isopropyl Alcohol : Mineral Spirits= 1 : 3 b: Terpene Defluxer (Bioact EC-7R) c: Deionized water : Propylene Glycol Monomethyl Ether : monoethanolamine =42 : 1 : 1	Marking and protective layer cannot be detached
Mechanical Shock	AEC-Q200-REV D-Test 13 MIL-STD-202 Method 213	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration(D) is 6(ms)	< ±1.0%
Vibration	AEC-Q200-REV D-Test 14 MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations. Note: Test from 10-2000 Hz.	< ±1.0%
Resistance to Soldering Heat	AEC-Q200-REV D-Test 15 MIL-STD-202 Method 210	Condition B: Immerse the specimens in and eutectic solder at 260±5°C for 10±1S.	< ±0.5%



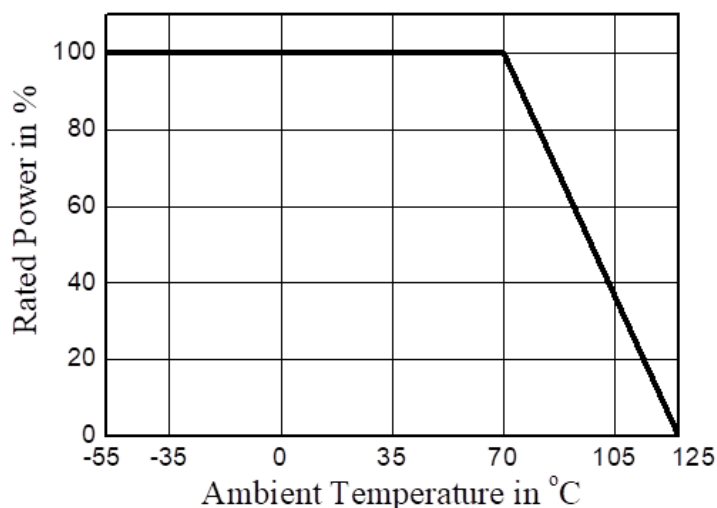
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Thermal Shock	AEC-Q200-REV D-Test 16 MIL-STD-202 Method 107	-55°C/+155°C. Note: Number of cycles required-300, Maximum transfer time-20 seconds, Dwell time-15 minutes. Air-Air.	< ±1.0%
ESD	AEC-Q200-REV D-Test 17 AEC-Q200-002 or ISO/DIS 10605	verify the voltage setting at 500V	< ±1.0%
Solderability	AEC-Q200-REV D-Test 18 J-STD-002	Method B, aging 4 hours at 155 °C dry heat Lead-free solder bath at 235±3 °C Dipping time: 3±0.5 seconds	> 95% area covered with tin
Flammability	AEC-Q200-REV D-Test 20 UL-94	V-0 are acceptable. Electrical test not required.	V-0
Board Flex (Bending)	AEC-Q200-REV D-Test 21 AEC-Q200-005	The duration of the applied forces shall be 60 (+ 5) Sec 3mm deflection (RLS04~ RLS 12) 2mm deflection (RLS 25)	< ±1.0%
Terminal Strength (SMD)	AEC-Q200-REV D-Test 22 AEC-Q200-006	RLS04: Force of 1.0 kg for 60 seconds Remarks: 0201-NA RLS06~ RLS 12: Force of 1.8kg for 60 seconds Remarks: 0201-NA	< ±1.0%

5.1 Derating Curve

5.1.1 RLS04

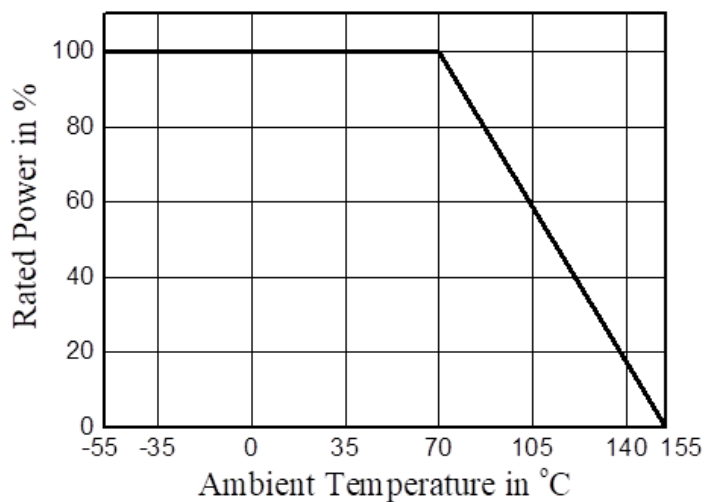




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5.1.2 RLS06 to RLS25



5.2 Rated Current

The rated current is calculated by the following formula:

$$I = \sqrt{P \div R}$$

$$V = \sqrt{P \times R}$$

I: Rated Current (A)

V: Rated Voltage (V)

P: Rated Power (W)

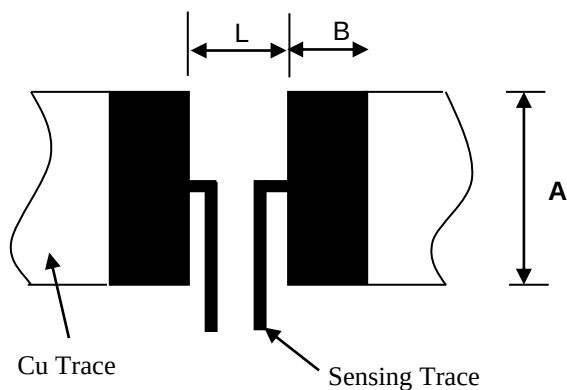
R: Resistance Value (Ω)



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6. Recommended Solder Pad Dimension



Series	Resistance (mΩ)	A	L	B
RLS04	$10 \leq R \leq 20$	0.7	0.45	0.375
RLS06	$5 \leq R \leq 20$	1.0	0.6	1.1
RLS10	$5 \leq R \leq 40$	1.4	1.2	1.0
RLS12	$5 \leq R \leq 35$	1.8	1.6	1.55
	$R = 40$	1.8	2.2	1.35
RLS25	$5 \leq R \leq 10$	4.0	4.1	2.1

Unit: mm

*1 The copper foil minimum thickness of PCB needs 3 oz

*2. PCB Dimension Tolerance is +/-0.1mm.

*3 The Resistance will change slightly after soldered, it is depended on PCB PAD size deign and its necessary to consider the effect of the resistance increase or decrease.



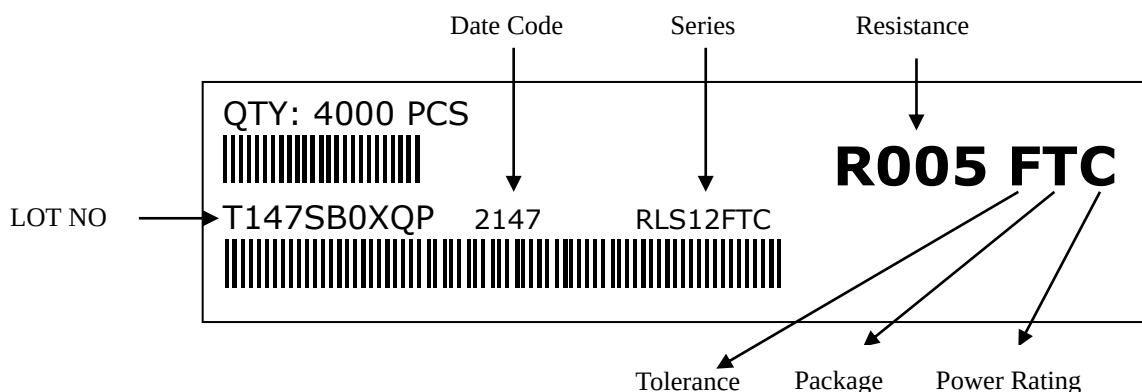
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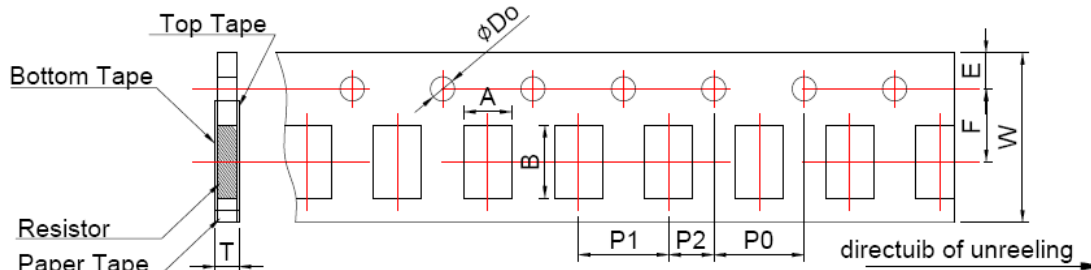
7. Number of Package

Series	RLS04	RLS06	RLS10	RLS12	RLS25
Pieces/Package	10000	5000	4000	4000	4000

8. Label



9. Packaging



Tape packaging dimension

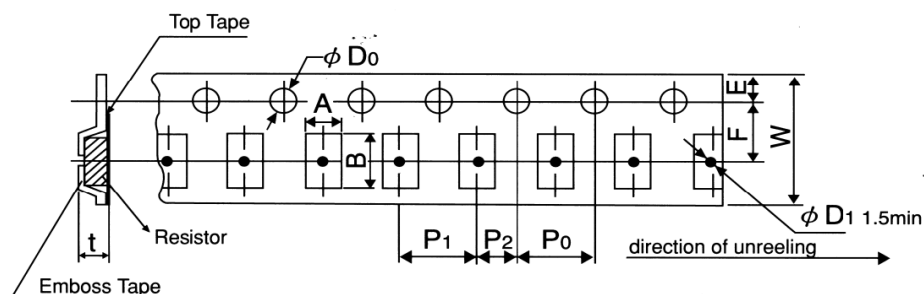
Packing	Type	A	B	W	F	E	P1	P2	P0	$\phi D0$	T
Paper	RLS04	0.75 ± 0.05	1.30 ± 0.05	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	2.00 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	1.55 ± 0.10	0.65 ± 0.10
	RLS06	1.10 ± 0.15	1.90 ± 0.20	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	1.55 ± 0.10	0.85 ± 0.10
	RLS10	1.60 ± 0.15	2.40 ± 0.20	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	1.55 ± 0.10	1.05 ± 0.10
	RLS12	2.00 ± 0.15	3.60 ± 0.20	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	1.55 ± 0.10	1.05 ± 0.10

Unit: mm



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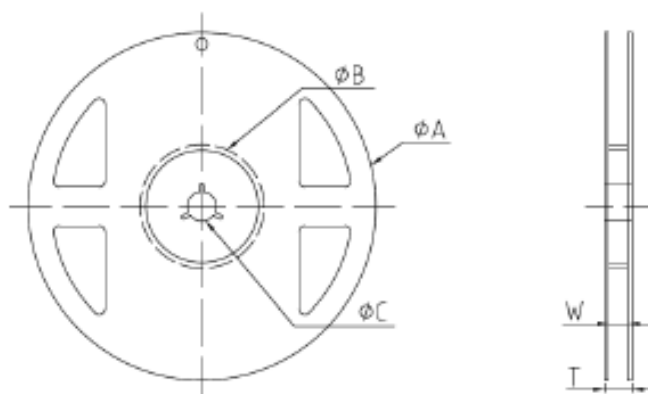


Tape packaging dimension

Packing	Type	A	B	W	F	E	P1	P2	P0	ϕ D0	T
Embossed	RLS25	3.60 ± 0.15	6.90 ± 0.20	12.0 ± 0.20	5.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	1.55 ± 0.10	0.85 ± 0.10

Unit: mm

10. Reel Specification



Series	ϕ A	ϕ B	ϕ C	W	T
RLS04	178 ± 2.0	60 ± 1.0	13.0 ± 1.0	9.0 ± 1.0	11.4 ± 1.0
RLS06 RLS10 RLS12	180 ± 2.0	60 ± 1.0	13.0 ± 1.0	9.0 ± 1.0	11.4 ± 1.0
RLS25	180 ± 2.0	60 ± 1.0	13.0 ± 1.0	13.0 ± 1.0	15.4 ± 1.0

Unit: mm

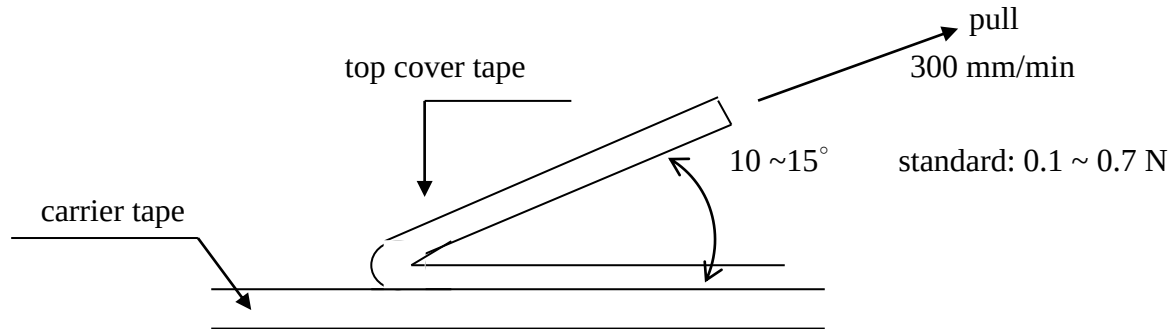


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11. Peeling Strength of Top Cover Tape

Test Condition: 0.1 to 0.7 N at a peel-off speed of 300 mm / min.



12. Storage Conditions

Temperature: 5°C~35°C, Humidity:40%~75%

Moisture Sensitivity Level: Level 1

13. Shelf Life

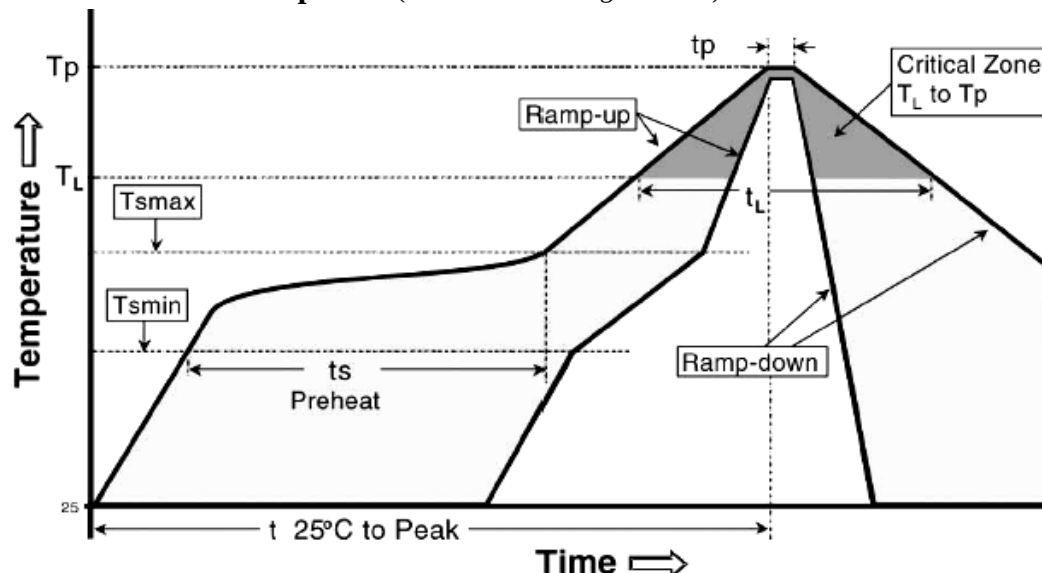
2 years from manufacturing date.



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14. Recommend IR – Reflow profile (solder: Sn96.5 / Ag3 / Cu0.5)



Allowed Re-flow times: 3 times

**Remark: To avoid discoloration phenomena of chip on terminal electrodes,
please use N2 Re-flow furnace.**

Iron Solder: 350±10°C, 3+1/-0 sec, 1 time

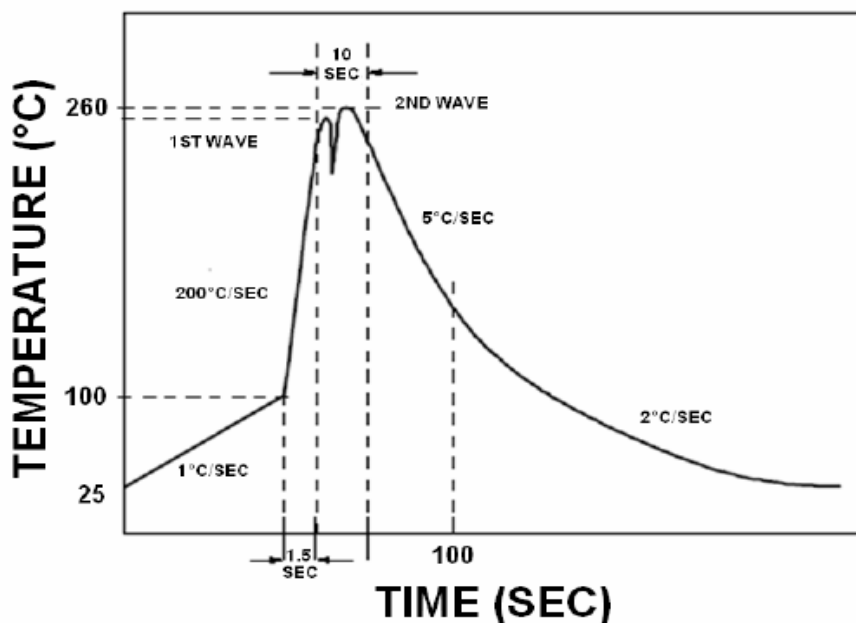
Profile Feature	Lead (Pb)-Free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C / second max.
Preheat - Temperature Min (T _{smin}) - Temperature Max (T _{smax}) - Time (T _{smin} to T _{smax}) (ts)	150°C 200°C 60 -120 seconds
Time maintained above: - Temperature (T _L) - Time (T _L)	217°C 60-150 seconds
Peak Temperature (T _p)	260°C
Time within $\begin{smallmatrix} +0 \\ -5 \end{smallmatrix}$ °C of actual Peak Temperature (tp) ²	10 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8minutes max.



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15. Recommend Wave-Solder profile (solder: Sn96.5 / Ag3 / Cu0.5)



16. ECN

Engineering Change Notice: The customer will be informed with ECN if there is significant modification on the characteristics and materials described in Approval Sheet.

17. Manufacturing Country & City

TA-I TECHNOLOGY CO., LTD. (Taiwan– Tao Yuan)

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