1 Scope:

1.1 This specification is applicable to lead free and halogen free for LRH series low-inductance metal alloy low-resistance resistor.

1.2 The product is belong to the universal series.

2 Explanation Of Part Numbers:

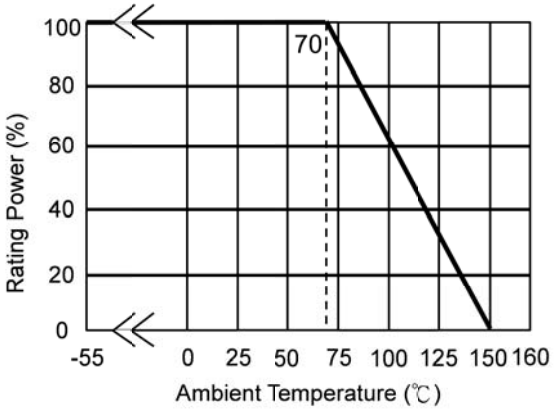
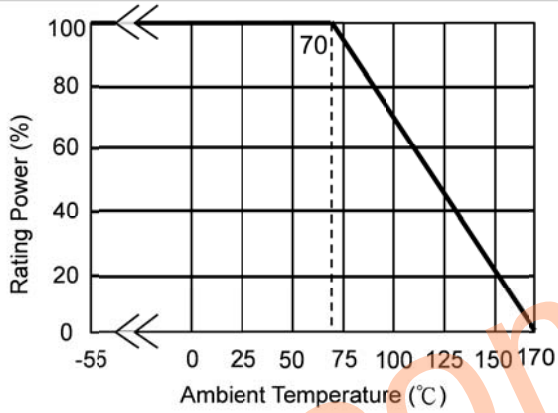
LRH — 2512 - 2 — 2 — R003 — F — 5

Type	Size (inch)	Number of Terminals	Rated Power	Resistance (4~6 Digits)	Tolerance	Packaging
Low-Inductance Metal Alloy Low Resistance Resistor	0402 0805 1206 2512	2: 2 terminals	H=0.20W C=0.50W A=1.50W 1=1.00W 2=2.00W 3=3.00W	EX: R003 = 3mΩ R0015 = 1.50mΩ R0005 = 0.50mΩ R00075= 0.75mΩ	D=±0.5% F=±1.0% G=±2.0% J=±5.0%	4=4,000pcs 5=5,000pcs 10=10,000pcs

3 Product Specifications:

Type	# of Terminals	Max. Rating Power	Max. Rating Current	Max. Overload Current	T.C.R. (ppm/°C)	Inductance	Resistance Range (mΩ)		Operating Temperature Range
							D (±0.5%)	F (±1%) G (±2%) J (±5%)	
0402	2	0.20W	14.1	28.2A	≦±800	< 5nH	--	1.5m	-55~+150°C
					≦±200		--	3≦R≦4	
					≦±125		--	5m	
					≦±50		--	10m	
0805	2	0.5W	22.36A	44.72A	≦±450		--	1≦R<2	
					≦±100		--	2≦R<3	
					≦±75		--	3≦R<5	
					≦±50		--	5≦R≦19	
1206	2	0.5W	22.3A	44.6A	≦±400		--	1≦R<2	
					≦±75		--	2≦R<4	
					≦±50		--	4≦R≦21	
		1.0W	31.6A	63.2A	≦±400		--	1≦R<2	
					≦±75		--	2≦R<4	
					≦±50		--	4≦R≦10	
2512	2	1.5W	22.3 6A	50.00A	≦±50		7~100	3~100	-55~+170°C
		2.0W	25.82A	57.73A			7~70	3~70	
		3.0W	31.62A	70.71A			7~10	3~10	

3.1 Power Derating Curve:

Type	0402/0805/1206	2512
Operating Temperature Range	－55℃ ~ ＋150℃	－55℃ ~ ＋170℃
Explain	For resistors operated in ambient temperatures above 70℃, power rating shall be derated in accordance with figure below.	For resistors operated in ambient temperatures above 70℃, power rating shall be derated in accordance with figure below.
Figure		

3.2 Rating Current:

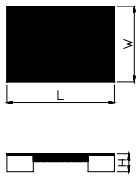
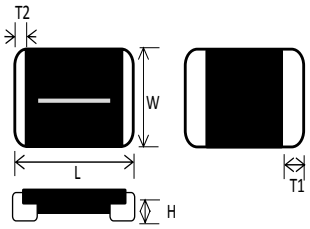
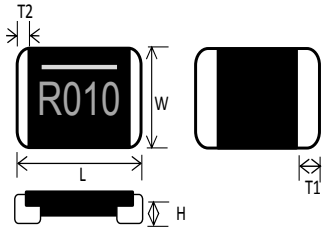
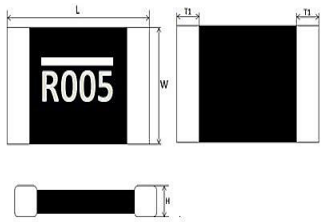
Rated Current: The resistor shall have a DC continuous working current or a RMS(Root Mean Square). AC continuous working current at commercial-line frequency and wave form corresponding to the power rating, as determined from the following:

Remark:

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

I=Rating Current(A)
P= Rating Power(W)
R=Resistance(Ω)

4 Physical Dimensions:

0402	0805	1206	2512
			

Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in inches (millimeters)				
			L	W	H	T1	T2
0402	0.20W	1.5 3~5 10	0.039±0.004 (1.00±0.100)	0.020±0.004 (0.50±0.100)	0.010±0.004 (0.25±0.100)	0.010±0.004 (0.25±0.100)	
0805	0.50W	1	0.08±0.008 (2.0320±0.20)	0.05±0.008 (1.270±0.20)	$0.014^{+0.002}_{-0.004}$ $(0.35^{+0.05}_{-0.10})$	0.023±0.006 (0.60±0.15)	0.008±0.006 (0.20±0.15)
		2			$0.014^{+0.002}_{-0.004}$ $(0.35^{+0.05}_{-0.10})$	0.02±0.006 (0.50±0.15)	0.008±0.006 (0.20±0.15)
		3~19			$0.012^{+0.002}_{-0.004}$ $(0.30^{+0.05}_{-0.10})$	0.014±0.008 (0.35±0.20)	0.008±0.006 (0.20±0.15)
1206	0.5 1	1≦R<3	0.126±0.008 (3.20±0.20)	0.063±0.008 (1.60±0.20)	0.016±0.008 (0.40±0.20)	0.035±0.008 (0.90±0.20)	0.008±0.006 (0.20±0.15)
		3≦R<4				0.024±0.008 (0.60±0.20)	0.008±0.006 (0.20±0.15)
		4≦R≦21				0.014±0.008 (0.35±0.20)	0.008±0.006 (0.20±0.15)
2512	1.50W	3~70	0.246±0.010 (6.248±0.254)	0.126±0.010 (3.202±0.254)	0.0254±0.010 (0.645±0.254)	0.044±0.010 (1.118±0.254)	
		71~100				0.034±0.010 (0.868±0.254)	
	2.00W	3~70				0.044±0.010 (1.118±0.254)	
	3.00W	3~10					

4.1 Material of Alloy

Type	Material	Resistance
0402	Manganese-Copper Alloy	1.5mΩ / 3-4mΩ / 5mΩ /10mΩ
0805	Manganese-Copper Alloy	1mΩ- 19mΩ
1206	Manganese-Copper Alloy	1mΩ- 21mΩ
2512	Manganese-Copper Alloy	3mΩ- 5mΩ
	Nickel-Chromium- Aluminum Alloy	6mΩ- 100mΩ

5 Reliability Performance:

5.1 Electrical Performance:

Test Item	Conditions of Test	Test Limits
Temperature Coefficient of Resistance (TCR)	• TCR (ppm/℃) = $\frac{(R2-R1)}{R1\ (T2-T1)}$ X 10^6 • R1: resistance of room temperature • R2: resistance of 150 °C • T1: Room temperature • T2: Temperature at 150 °C • Refer to JIS C 5201-1 4.8	Refer to Paragraph 3. general specifications
Short Time Overload	Applied Overload for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Overload condition refer to below): Type / Power (W) / # of rated power 0402 / 0.2 / 4 times 0805 / 0.5 / 4 times 1206 / 0.5、1 / 4 times 2512 / 1.5 / 5 times 2512 / 2.0 / 5 times 2512 / 3.0 / 5 times Refer to JIS C 5201-1 4.13	0402、0805、1206：≦±0.5% 2512：≦±2% No evidence of mechanical damage
Insulation Resistance	Put the resistor in the fixture, add 100 VDC in + ,- terminal for 60secs then measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base material. Refer to JIS-C5201-1 4.6	≧$10^9\Omega$
Dielectric Withstanding Voltage	Applied 500VAC for 1 minute, and Limit surge current 50 mA (max.) Refer to JIS-C5201-1 4.7	No short or burned on the appearance.

5.2 Mechanical /Constructional Performance:

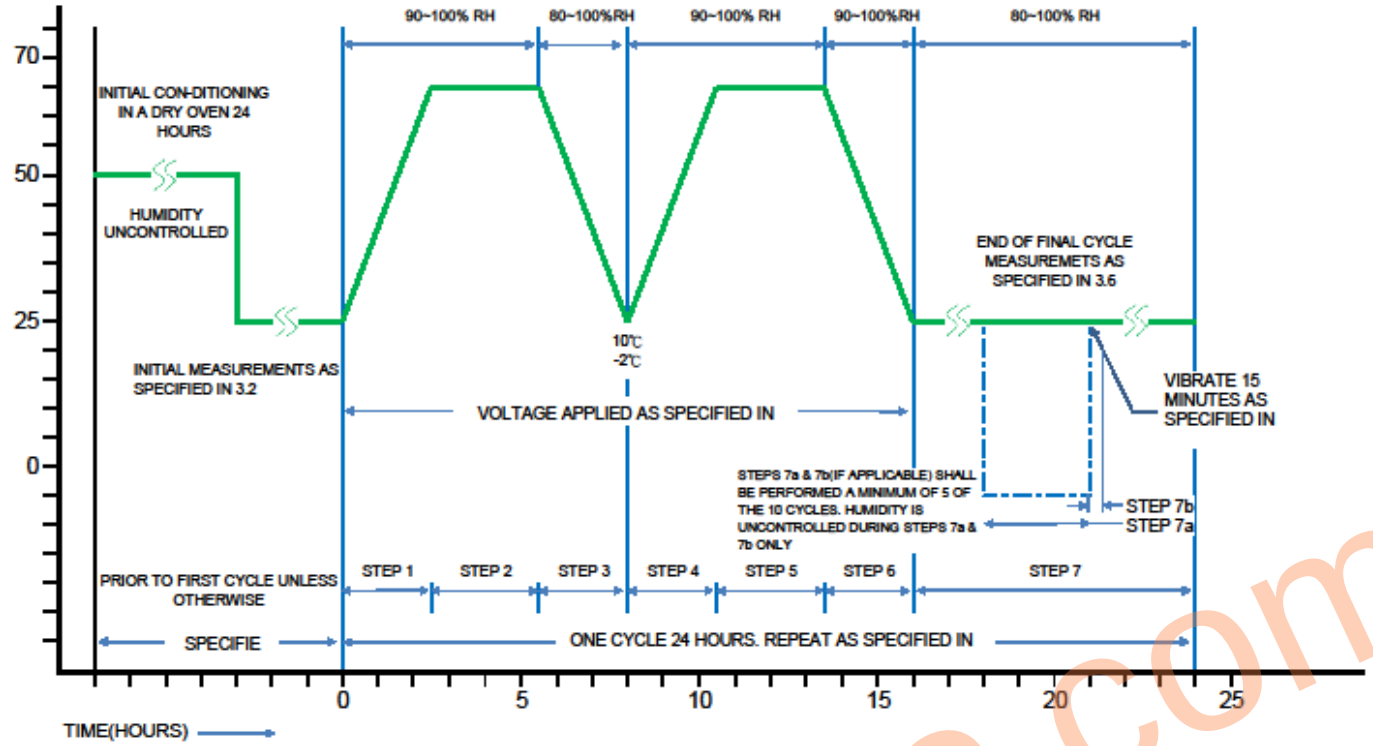
Test Item	Conditions of Test	Test Limits
Resistance to Solder Heat	The tested resistor be immersed 25 mm/sec into molten solder of 260±5℃ for 10±1secs. Then the resistor is left in the room for 1 hour, and measured its resistance variance rate. Refer to JIS-C5201-1 4.18	≦±0.5% No evidence of mechanical damage
Solderability	Add flux into tested resistors, immersion into solder bath in temperature 245±5℃ for 3±0.5secs. Refer to JIS-C5201-1 4.17	Solder coverage over 95%
Vibration	The resistor shall be mounted by its terminal leads to the supporting terminals on the solid table. The entire frequency range :from 10 Hz to 55 Hz and return to 10 Hz, shall be transferred in 1 min. Amplitude : 1.5mm This motion shall be applied for a period of 4 hours in each 3 mutually perpendicular directions (a total of 12hrs) Refer to JIS-C5201-1 4.22	≦±0.5% No evidence of mechanical damage
Resistance to solvent	The tested resistor be immersed into isopropyl alcohol of 20~25℃ for 60secs, then the resistor is left in the room for 48 hrs. Refer to JIS-C5201-1 4.29	≦±0.5% No evidence of mechanical damage

5.3 Environmental Performance:

Test Item	Conditions of Test	Test Limits
Low Temperature Exposure (Storage)	Put the tested resistor in chamber under temperature -55±2℃ for 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.23.4	≦±0.5% No evidence of mechanical damage
High Temperature Exposure (Storage)	Put tested resistor in chamber under temperature 2512:170±5℃(Others:150±5℃) for 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.23.2	≦±1.0% No evidence of mechanical damage
Temperature Cycling (Rapid Temperature Change)	Put the tested resistor in the chamber under the temperature cycling which shown in the following table shall be repeated 1,000 times consecutively. Then leaving the tested resistor in the room temperature for 60 minutes, and measure its resistance variance rate. Testing Condition: Lowest Temperature -55 +0/-10℃; Highest Temperature 150 +10/-0℃ Refer to JIS-C5201-1 4.19	0402、0805、1206：≦±1.0% 2512：≦±0.5% No evidence of mechanical damage
Moisture Resistance (Climatic Sequence)	Put the tested resistor in chamber and subject to 10 cycles of damp heat and without power. Each one of which consists of the steps 1 to 7 (Figure 1). Then leaving the tested resistor in room temperature for 24 hr, and measure its resistance variance rate. Refer to MIL-STD 202 Method 106	≦±0.5% No evidence of mechanical damage
Bias Humidity	Put the tested resistor in chamber under 85± 5℃and 85± 5%RH with 10% bias and load the rated voltage for 90 minutes on, 30 minutes off, total 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.24	0402：≦±1.0% 0805、1206、2512：≦±0.5% No evidence of mechanical damage

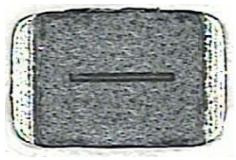
5.4 Operational Life Endurance:

Test Item	Conditions of Test	Test Limits
Load Life	Put the tested resistor in chamber under temperature 70± 2℃ and load the rated voltage for 90 minutes on 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.25	0402、0805、1206：≦±1.0% 2512：≦±2.0% No evidence of mechanical damage



6 Marking Format:

6.1 Marking Styles by Laser(For LRH0805/LRH1206):

LRH0805	LRH1206
	

6.2 LRH1206、LRH2512 Series:

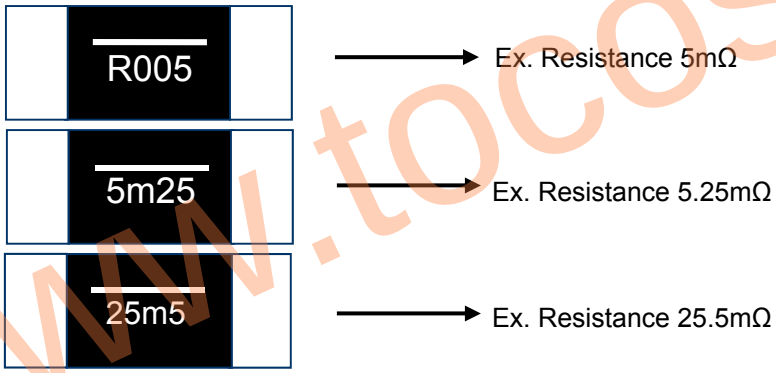
Product resistance is indicated by using two marking notation styles:

a. "**R**" designates the decimal location in ohms, e.g.

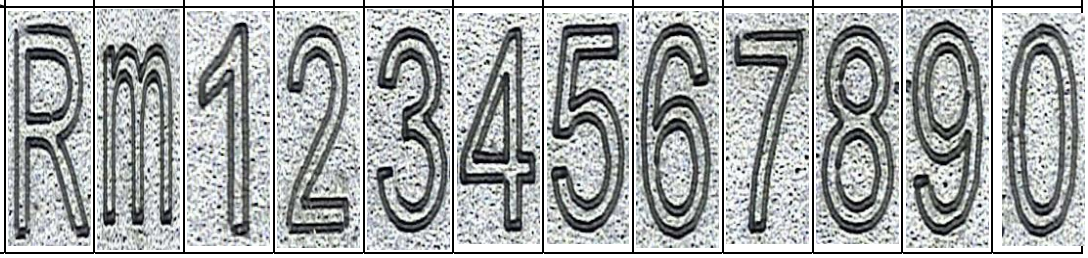
- For 1mΩ the product marking is R001;
- For 25mΩ the product marking is R025;
- For 100mΩ the product marking is R100.

b. "**m**" designates the decimal location in milliohms, e.g.

- For 0.25mΩ the product marking is 0m25;
- For 0.5mΩ the product marking is 0m50;
- For 5.5mΩ the product marking is 5m50;
- For 25.5mΩ the product marking is 25m5.



6.3 Marking Styles by Laser(For LRH1206):

Marking / Type	R	m	1	2	3	4	5	6	7	8	9	0
1206												

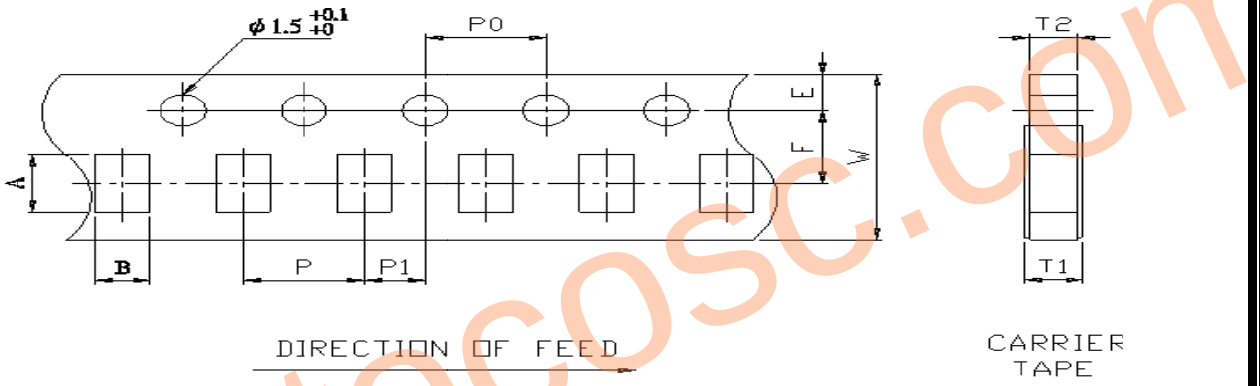
6.4 Marking Style(For LRH2512):

Type \ Marking	R	m	1	2	3	4	5	6	7	8	9	0
2512												

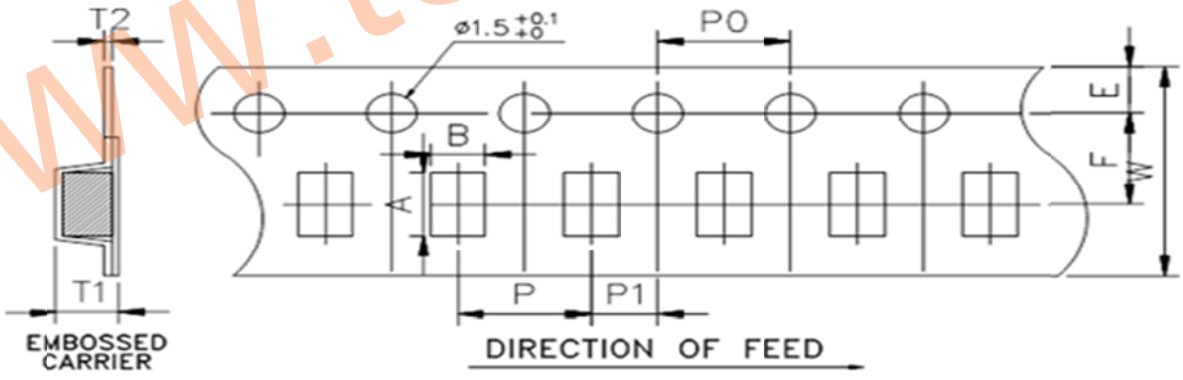
6.5 LRH0402 No Marking.

7 Taping specifications:

7.1 Carrier Tape Dimensions:



7.2 Embossed Tape Dimensions:



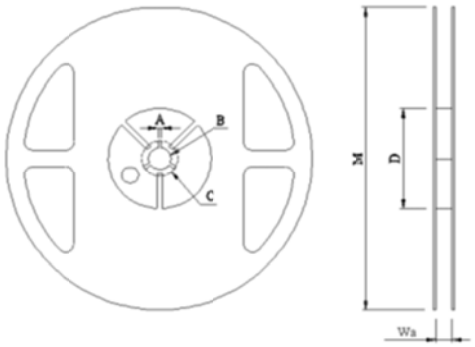
Unit: mm

Item \ DIM	A	B	W	E	F	T1	T2	P	P0	10*P0	P1
0402	1.15±0.05	0.65±0.05	8.0±0.20	1.75±0.10	3.5±0.05	0.40+0.2/-0	0.40±0.05	2.0±0.10	4.0±0.05	40.0±0.20	2.0±0.05
0805	2.30±0.10	1.55±0.10	8.0±0.20	1.75±0.10	3.5±0.05	0.40+0.2/-0	0.40±0.05	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.05
1206	3.50±0.20	1.90±0.20	8.0±0.20	1.75±0.10	3.5±0.05	0.60+0.2/-0	0.60±0.05	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.05
2512	6.75±0.10	3.50±0.10	12.0±0.15	1.75±0.10	5.5±0.10	1.30±0.10	0.20±0.05	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.10

7.3 Packaging model:

Type	Tape width	Max. Packaging Quantity (pcs/reel)		
		Carrier Tape		Embossed Plastic Type
		2mm pitch	4mm pitch	4mm pitch
0402	8mm	10,000pcs	--	--
0805	8mm	--	5,000pcs	--
1206	8mm	--	5,000pcs	--
2512	12mm	--	--	4,000pcs

7.4 Reel Dimensions:

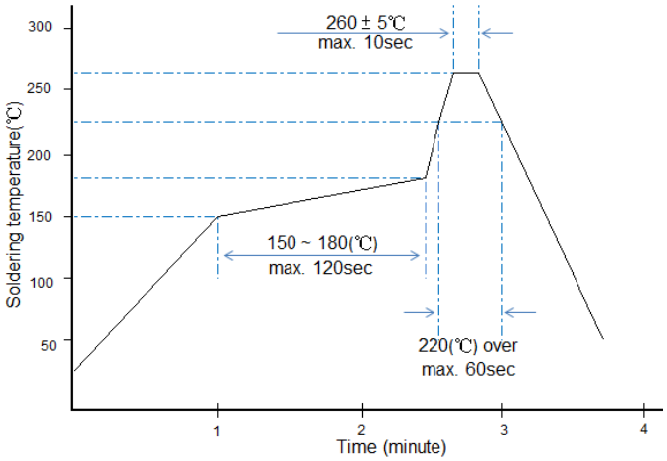


Unit: mm

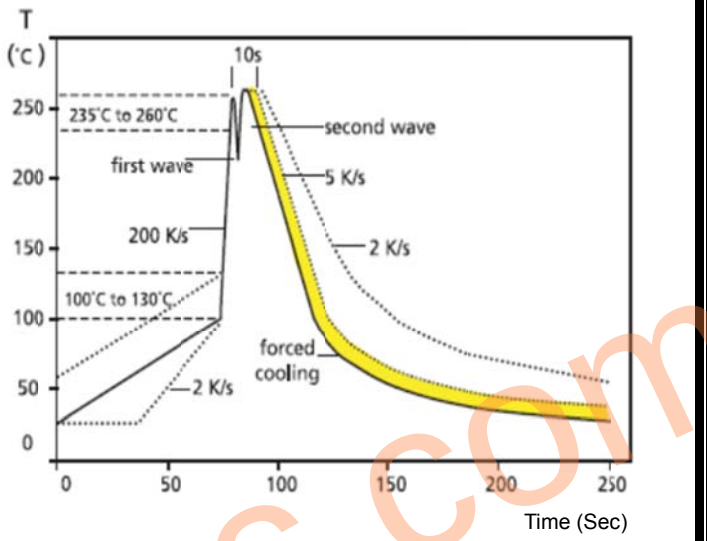
Item	Reel Type / Tape	W	M	A	B	C	D
0402	7” reel for 8 mm tape	9.0±0.5	178±2.0	2.0±0.5	13.2±0.5	21.0±0.5	60.0±1.0
0805 1206	7” reel for 8 mm tape	12.00±0.5	178±1.0	2.0±0.5	13.2±0.5	17.7±0.5	60.0±1.0
2512	7” reel for 12 mm tape	16.20±0.5	178±1.0	2.5±0.5	13.5±0.5	17.7±0.5	60.0±1.0

8 Technical note (This is for recommendation, please customer perform adjustment according to actual application)

8.1 Surface-mount components are tested for solderability at a temperature of 245 °C for 3 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in below:

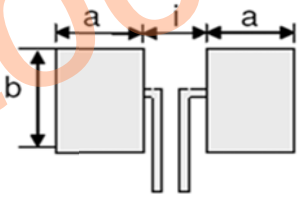


Recommended IR Reflow Soldering Profile
MEET J-STD-020D



Recommended double-wave Soldering Profile
Typical values (solid line)
Process limits (dotted line)

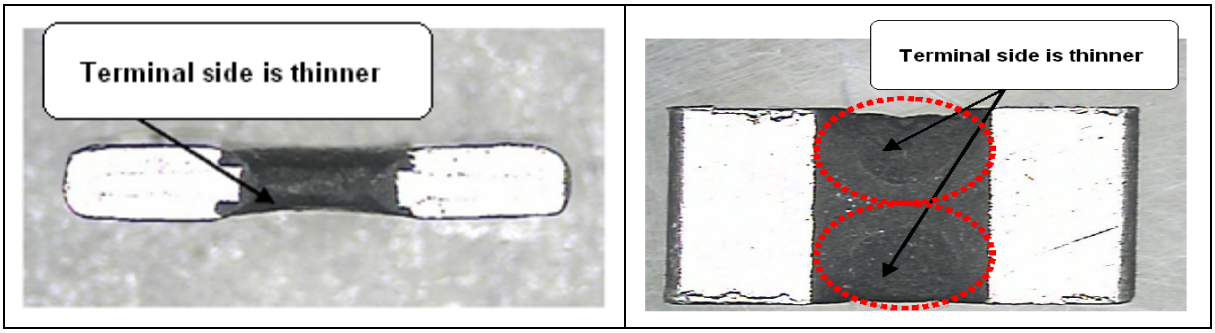
8.2 Recommend Land Pattern:



Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in millimeters		
			a	b	i
0402	0.20	1.5	0.65	0.50	0.50
		3≦R≦4			
		5			
		10			
0805	0.50	1~19	1.45	1.78	0.66
1206	0.50 1.00	1≦R<3	1.65	2.18	0.60
		3≦R<4	1.65	2.18	0.90
		4≦R≦21	1.65	2.18	1.00
2512	1.50	3~100	2.11	3.68	3.18
	2.00	3 ~ 70			
	3.00	3 ~ 10			

8.3 Recommend dispensing method (for LRH2512)

8.3.1 The structure of RALEC metal alloy resistor that both side of main body would be thinner due to process factor (as the photo below).



8.3.2 When customer performs wave solder process shall take note on the dispensing gap. If the gap between two dispensing is over, the red-glue will not adhesive the resistor body and be dropped out (as photo 1). Therefore, we suggest customer to narrow down the dispenser gap (as photo 2), or dispenser on the body center (as photo 3)

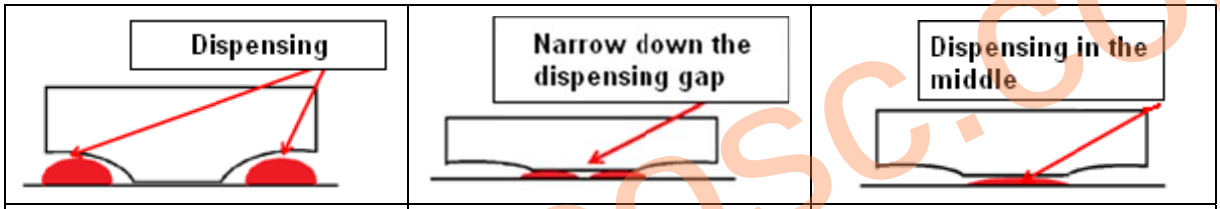
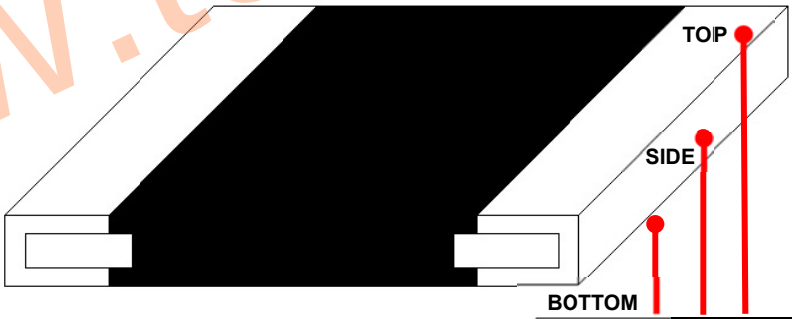


Photo 1	Photo 2	Photo 3

8.4 Product warranted solder area



Solder coverage could be over 95%

9 Inductance

Inductance characteristics: <5nH(Circuit frequency is below 1MHz)

10 Stock period:

10.1 The temperature condition must be controlled at 25±5℃, the R.H. must be controlled at 60±15%. The stock can maintain quality level in two years.

11 Attachments

11.1 Document Revise Record (QA-QR-027)