SCOPE

This specification describes RI series chip resistors with lead free terminations made by thick film process.

APPLICATIONS

- All general purpose application

FEATURES

- Halogen Free Epoxy
- RoHS compliant
  - Products with lead free terminations meet RoHS requirements
  - Pb-glass contained in electrodes, resistors element and glass are exempted by RoHS
- Reducing environmentally hazardous wastes
- Highcomponent and equipment reliability
- Saving of PCB space
- None forbidden-materials used in products/production

ORDERING INFORMATION

Part numbers are identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

PART NUMBER

RI	XXXX	L	XXXX	F	T
	(1)	(2)	(3)	(4)	(5)

(1) SIZE

0075/01005/0201/0402/0603/0805/ 1206/ 1210/ 1812/2010/2512

(2) TEMPERATURE COEFFICIENT OF RESISTANCE

-=Based on spec.

(3) RESISTANCE VALUE

There are 3~4 digits indicated the resistance value. Letter R/K/M is decimal point.

Example:

103 = 10KΩ 560 = 56Ω 56R0 = 56Ω
1002 = 10KΩ 561 = 560Ω 5600 = 560Ω
104 = 100KΩ

(4)TOLERANCE

B = ±0.1%
D = ±0.5%
F = ±1.0%
J = ±5.0% (for jumper ordering, use code of J)

(5)PACKAGING TYPE AND TAPING REEL

T = taping reel

ORDERING EXAMPLE

The ordering code for a RI0402 0.0625W chip resistor value 100KΩwith ±5% tolerance, supplied in tape reel is: RI0402L104JT.

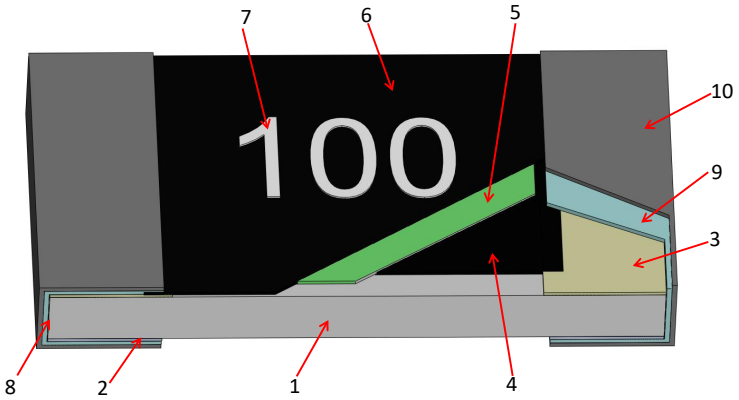
MARKING

RI0075/RI01005/RI0201 / RI0402	
FIG.1	No Marking
RI0603	
240 = 24 × 10^0 = 24 FIG.2	1%, 0.5%,E24 exception values 10/11/13/15/20/75 of E24 series
88A=806X100=806Q FIG.3	1%, 0.5%, E96 refer to EIA-96 marking method, including values 10/11/13/15/20/75 of E24 series
value=10KΩ FIG 4	5%, E24 series : 3 digits First two digits for significant figure and 3rd digit for number of zeros
RI0805 / RI1206 / RI1210 /RI1812/ RI2010 / RI2512	
value=I OKΩ FIG 5	1%, 0.5%, E24/E96 series : 4 digits First three digits for significant figure and 4th digit for number of zeros
value=10K Ω FIG 6	5%, E24 series : 3 digits First two digits for significant figure and 3rd digit for number of zeros

CONSTRUCTION

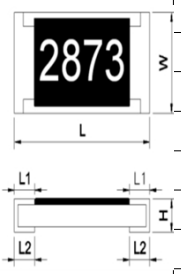
The resistor is constructed on top of a high-grade ceramic body. Internal metal electrodes are added on each end to make the contacts to the thick film resistive element. The composition of the resistive element is a noble metal imbedded into a glass and covered by a second glass to prevent environmental influences. The resistor is laser trimmed to the rated resistance value. The resistor is covered with a protective epoxy coat, finally the two external terminations (matte tin on Ni-barrier) are added,As shown in the following figure.

Outlines



1	Ceramic substrate	6	2nd Protective coating
2	Bottom inner electrode	7	Marking
3	Top inner electrode	8	Terminal inner electrode
4	Resistive layer	9	Ni plating
5	1st Protective coating	10	Sn plating

DIMENSION



TYPE	L (mm)	W (mm)	H (mm)	L_1 (mm)	L_2 (mm)
RI 0075	0.30±0.01	0. 15±0.01	0.10±0.01	0.08±0.03	0.08±0.03
RI 01005	0.40±0.02	0.20±0.02	0.13±0.02	0.10±0.03	0.10±0.03
RI 0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
RI 0402	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
RI 0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
RI 0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
RI 1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.15
RI 1210	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
RI 1812	4.40±0.20	3.15±0.20	0.47±0.20	0.60±0.20	0.60±0.20
RI 2010	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.20
RI 2512	6.30±0.20	3.20±0.20	0.55±0.10	0.60±0.20	0.60±0.20

General Specifications

CHARACTERISTICS	POWER	OPERATING TEMPERATURE RANGE	MAXIMUM WORKING VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	DIELECTRIC WITHSTANDING VOLTAGE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT	JUMPER CRITERIA
RI0075	1/50 W	-55℃ to 125℃	10V	25V	25V	5% (E24) 10Ω ≦ R ≦ 1MΩ 1% (E24/E96) 10Ω ≦ R ≦ 1MΩ Jumper<50mΩ	10Ω≦R<100Ω - 200~+600ppm℃ 100Ω≦R≦1MΩ ±200ppm℃	Rated Current 0.5A Maximum Current 1.0A
RI01005	1/32 W	-55℃ to 125℃	15V	30V	30V	5% (E24) 1Ω≦R≦22MΩ 1% (E24/E96) 1Ω≦R≦10MΩ 0.5% (E24/E96) 33Ω≦R≦470KΩ Jumper<50mΩ	1Ω≦R<10Ω -200~+600ppm℃ 10Ω≤R < 100Ω: ±300ppm/°C 100Ω≤R ≤10MΩ: ±200ppm/°C 10MΩ<R ≤22MΩ: ±250ppm/°C	Rated Current 0.5A Maximum Current 1.0A
RI0201	1/20 W	-55℃ to 125℃	25V	50V	50V	5% (E24) 1Ω≦R≦10MΩ 1% (E24/E96) 1Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R<10Ω -100~+350ppm℃ 10Ω≤R ≤10MΩ: ±200ppm/°C	Rated Current 0.5A Maximum Current 1.0A
RI0402	1/16W	-55℃ to 155℃	50V	100V	100V	5% (E24) 1Ω≦R≦22MΩ 1% (E24/E96) 1Ω≦R≦22MΩ 0.5% (E24/E96) 1Ω≦R≦1MΩ 0.1%(E24/E96) 100Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R<10Ω±200ppm/℃ 10Ω≤R ≤22 MΩ: ±100ppm/°C	Rated Current 1.0A Maximum Current 2.0A

RI0603	1/10W	-55℃ to 155℃	75V	150V	150V	5% (E24) 1Ω≦R≦22MΩ 1% (E24/E96) 1Ω≦R≦22MΩ 0.5%(E24/E96) 1Ω≦R≦1MΩ 0.1%(E24/E96) 100Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R<10Ω±200ppm/℃ 10Ω≦R ≤22 MΩ: ±100ppm/°C	Rated Current 1.0A Maximum Current 2.0A
RI0805	1/8W	-55℃ to 155℃	150V	300V	300V	5% (E24) 1Ω≦R≦27 MΩ 1% (E24/E96) 1Ω≦R≦27MΩ 0.5%(E24/E96) 1Ω≦R≦10 MΩ 0.1% (E24/E96) 100Ω≦R≦1.5MΩ Jumper<50mΩ	1Ω≦R<10Ω±200ppm/℃ 10Ω≦R ≤27 MΩ: ±100ppm/°C	Rated Current 2.0A Maximum Current 5.0A
RI1206	1/4W	-55℃ to 155℃	200V	400V	500V	5% (E24) 1Ω≦R≦27 MΩ 1% (E24/E96) 1Ω≦R≦27 MΩ 0.5%(E24/E96) 1Ω≦R≦10 MΩ 0.1%(E24/E96) 3Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R<10Ω ±200ppm/℃ 10Ω≦R ≤27 MΩ: ±100ppm/°C	Rated Current 2.0A Maximum Current 10.0A
RI1210	1/2W	-55℃ to 155℃	200V	500V	500V	5% (E24) 1Ω≦R≦27 MΩ 1% (E24/E96) 1Ω≦R≦27 MΩ 0.5 %(E24/E96) 10Ω≦R≦10MΩ 0.1%(E24/E96) 100Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R<10Ω ±200ppm/℃ 10Ω≦R ≤27 MΩ: ±100ppm/°C	Rated Current 2.0A Maximum Current 10.0A
RI1812	3/4W	-55℃ to 155℃	200V	500V	500V	5% (E24) 1Ω≦R≦20MΩ 1% (E24/E96) 1Ω≦R≦20MΩ 0.5%(E24/E96) 10Ω≦R≦10MΩ 0.1%(E24/E96) 100Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R≦10Ω: ±200ppm/℃ 10Ω<R ≤20 MΩ: ±100ppm/°C	Rated Current 2.0A Maximum Current 10.0A

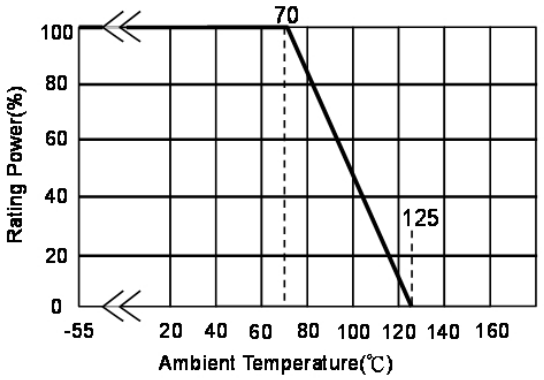
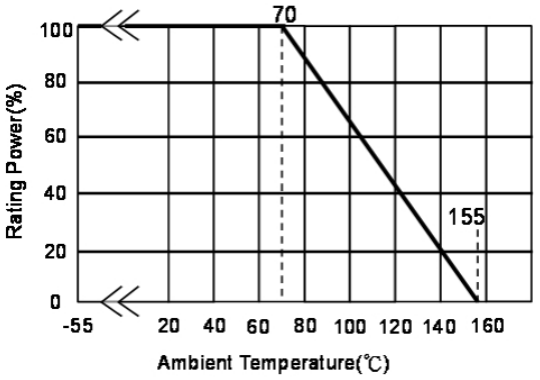
RI2010	3/4W	-55℃ to 155℃	200V	500V	500V	5% (E24) 1Ω≦R≦20MΩ 1% (E24/E96) 1Ω≦R≦20MΩ 0. 5%(E24/E96) 10Ω≦R≦10MΩ 0.1%(E24/E96) 100Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R≦10Ω: ±200ppm/℃ 10Ω<R ≤20MΩ: ±100ppm/°C	Rated Current 2.0A Maximum Current 10.0A
RI2512	1W	-55℃ to 155℃	200V	500V	500V	5% (E24) 1Ω≦R≦20MΩ 1% (E24/E96) 0.01Ω≦R≦20 MΩ 0.5%(E24/E96) 10Ω≦R≦10MΩ 0.1%(E24/E96) 100Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R≦10Ω: ±200ppm/℃ 10Ω<R ≤20MΩ: ±100ppm/°C	Rated Current 2.0A Maximum Current 10.0A

PACKING STYLE AND PACKAGING QUANTITY

PACKING STYLE	PAPER TAPING REEL(R)			ESD SAFE REEL(S) (4MM WIDTH,1MM PITCH PLASTIC EMBOSSED)	EMBOSSED TAPING REEL
REEL DIMENSION	7"(178mm)	10"(254mm)	13"(330mm)	7"(178mm)	7"(178mm)
RI0075				20000	
RI01005	20000		80000	40000	
RI0201	10000	20000	50000		
RI0402	10000	20000	50000		
RI0603	5000	10000	20000		
RI0805	5000	10000	20000		
RI1206	5000	10000	20000		
RI1210	5000	10000	20000		
RI1812					4000
RI2010					4000
RI2512					4000

NOTE: For tape and reel specification, please refer to data sheet "Chip resistors packing".

Power Derating Curve:

Type	0075/01005/0201	Other
Operating Temperature Range	－55℃～ ＋125℃	－55℃～ ＋155℃
Explain	If the ambient temperature exceeds 70 degrees centigrade to 125 degrees centigrade, the power can be modified by the curve as below.	If the ambient temperature exceeds 70 degrees centigrade to 155 degrees centigrade, the power can be modified by the curve as below.
Figure		

Voltage Rating ：

Rated Voltage: The resistor shall have a DC continuous working voltage or a rms. AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined from the following

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

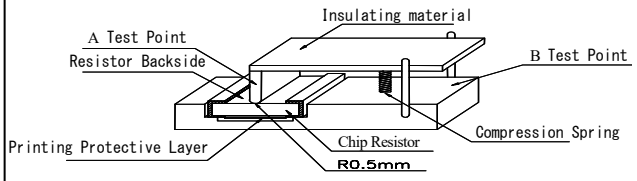
E= Rated voltage (v)

P= Power rating (w)

R= Nominal resistance(Ω)

Reliability Test:

Electrical Performance Test

Item	Conditions	Specifications	
		Resistors	Jumper
Temperature Coefficient of Resistance	$TCR\ (ppm/℃) = \frac{(R2-R1)}{R1(T2-T1)} \times 10^6$ R1:TestResistance at room temperature R2: Resistance at -55℃ or +125℃ T1: Room temperature T2:Temperature -55℃ or +125℃ Refer to JIS-C5201-1 4.8	Reference specification table	NA
Short Time Overload	Applied 2.5 times rated voltage for 5 seconds and release theload for about 30 minutes, then measure its resistance variance rate. Refer to JIS-C5201-1 4.13	0.1%、0.5%、1%:△R=±1.0% 2%、5%:△R=±2.0%	Reference specification table
Insulation Resistance	Put the resistor in the fixture, add 100 VDC in + ,- terminal for 60sec then measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base material. Refer to JIS-C5201-1 4.6 	≧10^9Ω	
Dielectric Withstand Voltage	Put the resistor in the fixture, add VAC (see SPEC below) in +,- terminal for. RI05 、06 、12 、18 、20 、25 apply 500 VAC 1 minute. RI01 、 02 、 03 apply 300 VAC 1 minute. Refer to JIS-C5201-1 4.7	No short or burned on the appearance.	
Intermittent Overload	Put the tested resistor in chamber under temperature 25±2℃ and load 2.5 times rated DC voltage for 1 sec on, 25 sec off,10000+400/-0 test cycles, then it be left at no-load for 1 hour , then measure its resistance variance rate. Jumper : Applied Maximum overload current Refer to JIS-C5201-1 4.13	△R%=±5.0%	Reference specification table

TyPe / Jumper	RI01 (0201)	RI02 (0402)	RI03 (0603)	RI05 (0805)	RI06 (1206)	RI12 (1210)	RI18 (1812)	RI20 (2010)	RI25 (2512)
±5%	1.25A	2.5A	2.5A	5A	5A	5A	5A	5A	5A
±1%	1.25A	3.75A	5A	6.25A	8.75A	10A	12.5A	12.5A	17.5A

Mechanical Performance Test

<table>
<tr><td>Terminal Strength</td><td>Test 1 : The resistor mounted on the board applied 5N pushing force on the sample rear for 10 sec. (RI01:3N)
Test 2 : The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown.

Refer to JIS-C5201-1 4.16</td><td colspan="2">Test 1 : No evidence of mechanical damage.
Test 2 : RI01 ≥3N
Other Type≥5N</td></tr>
<tr><td>Resistance to Solvent</td><td>The tested resistor be immersed into isopropyl alcohol of 20~25℃ for 5 minutes, then the resistor is left in the room for 48 hrs, and measured its resistance variance rate.

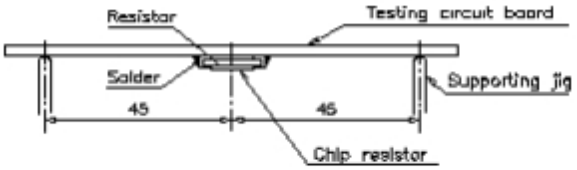
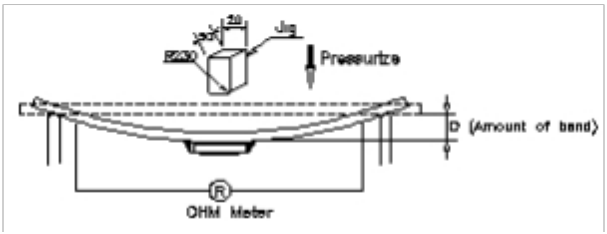
Refer to JIS-C5201-1 4.29</td><td><table><tr><td>TYPE</td><td>RI0075/RI01005/RI0201</td><td>OTHERS</td></tr><tr><td>△R%</td><td>△R=±1.0%</td><td>△R=±0.5%</td></tr></table></td><td>Reference specification table</td></tr>
<tr><td>Solderability</td><td>Preconditioning
Put the tested resistor in the apparatus of PCT, at a temperature of 105℃, humidity of 100% RH, and pressure of 1.22×105 Pa for a duration of 4 hours.
Then after left the tested resistor in room temperature for 2 hours or more.
Test method:
The resistor be immersed into solder pot in temperature 235±5℃ for 2 sec, then the resistor is left as placed under microscope to observed its solder area.

Refer to JIS-C5201-1 4.17</td><td colspan="2">Solder coverage over 95%</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>◎Test method 1 (Solder pot test):
The tested resistor be immersed into molten solder of 260+5/-0℃ for 10 seconds. Then the resistor is left in the room for 1 hour.
◎Test method 2 (Solder pot test):
The tested resistor be immersed into molten solder of 260+5/-0℃
for 30 seconds. Then the resistor is left as placed under microscope to observe its solder area.
◎Test method 3 (Electric iron test):
Preheating temperature : 350±10℃
Electric iron preheating time : 3+1/-0 sec
Preheating the electric iron on electrode termination, as after that step placed the iron over 60 min. and measured its resistance
variance rate.

Refer to JIS-C5201-1 4.18</td><td>Test item 1:
(1).Variance rate on resistance △R%=±1.0%

Test item 2:
(1).Solder coverage over 95%.
(2).The underlying material (such as ceramic) shall not be visible at the crest corner area of the electrode.

Test item 3:
(1).Variance rate on resistance △R%=±1.0%</td><td>Reference specification table</td></tr>
</table>

Item	Conditions	Specifications	
		Resistors	Jumper
Joint Strength of Solder	◎Bending Strength Solder tested resistor on to PC board add force in the middle down, and under load measured its resistance variance rate. D:RI02 、03 、05=5mm RI01 、06 、12=3mm RI18 、20 、25=2mm   Refer to JIS-C5201-1 4.33	△R%=±1.0%	Reference specification table

Environmental Test

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Resistance to Dry Heat</td><td>Put tested resistor in chamber under temperature 155±5℃ for 1000 +48/-0 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.(RI01 for 125±3℃)

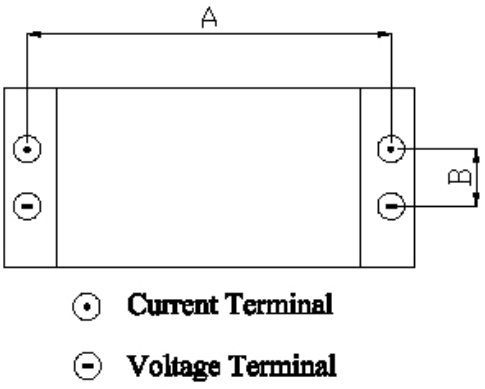
Refer to JIS-C5201-1 4.25</td><td>0.1% 、0.5% 1% :△R%=±1.0%
2% 、5%:△R%=±2.0%</td><td>Reference specification table</td></tr>
<tr><td>Thermal Shock</td><td>Put the tested resistor in the chamber under the Thermal Shock which shown in the following table shall be repeated 300 times consecutively. Then leaving the tested resistor in the room temperature for 1 hours, and measure its resistance variance rate.
<table>
<tr><th colspan="2">Testing Condition</th></tr>
<tr><td>Lowest Temperature</td><td>-55±5℃</td></tr>
<tr><td>Highest Temperature</td><td>125±5℃</td></tr>
<tr><td>Temperature-retaining time</td><td>15 minutes each</td></tr>
</table>
Refer to MIL-STD 202 Method 107</td><td>0.1% 0.5% 1% :△R%=±0.5%
2% 、5%:△R%=±1.0%</td><td>Reference specification table</td></tr>
<tr><td>Loading Life in Moisture</td><td>Put the tested resistor in the chamber under temperature 40±2℃, relative humidity 90~95% 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 4.24</td><td>
<table>
<tr><th>Type</th><th>RI0075/RI01005/RI0201</th><th>Other</th></tr>
<tr><td>Range</td><td>1%:△R%=±1.0%
5%:△R%=±3.0%</td><td>0.1% 、0.5% 、1%:△R%=±0.5%
2% 、5%:△R%=±2.0%</td></tr>
</table>
</td><td>Reference specification table</td></tr>
<tr><td>Load Life</td><td>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</td><td>
<table>
<tr><th>Type</th><th>RI0075/RI01005/RI0201</th><th>Other</th></tr>
<tr><td>Range</td><td>1%:△R%=±1.0%
5%:△R%=±3.0%</td><td>0.1% 、0.5% 、1%:△R%=±0.5%
2% 、5%:△R%=±2.0%</td></tr>
</table>
</td><td>Reference specification table</td></tr>
</table>

Measurement Point:

Backside electrode Testing



Unit : mm

TYPE \ DIM	A	B
RI0201	0.44±0.05	0.22±0.05
RI0402	0.80±0.05	0.24±0.05
RI0603	1.35±0.05	0.35±0.05
RI0805	1.80±0.05	0.35±0.05
RI1206	2.90±0.05	0.35±0.05
RI1210	2.90±0.05	0.35±0.05
RI1812	3.70±0.05	0.60±0.05
RI2010	4.50±0.05	1.15±0.05
RI2512	5.90±0.05	1.60±0.05

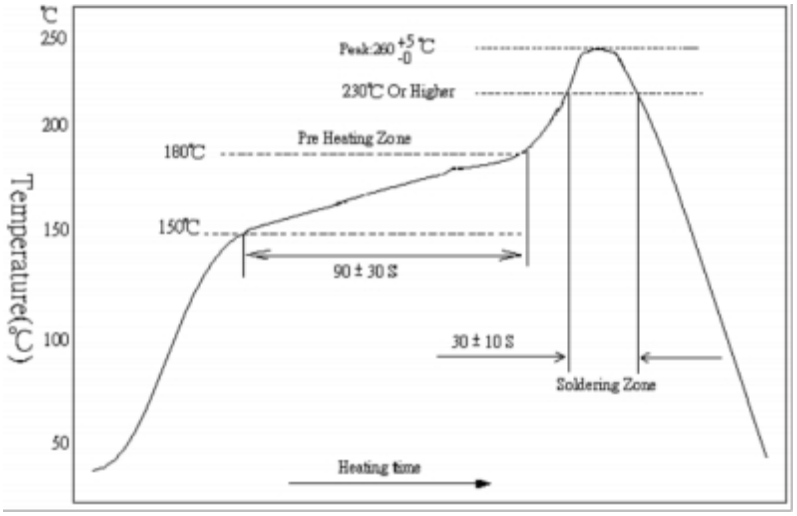
Plating Thickness:

Ni: ≥2 μm
Sn(Tin): ≥3 μm
Sn(Tin):Matte Sn

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

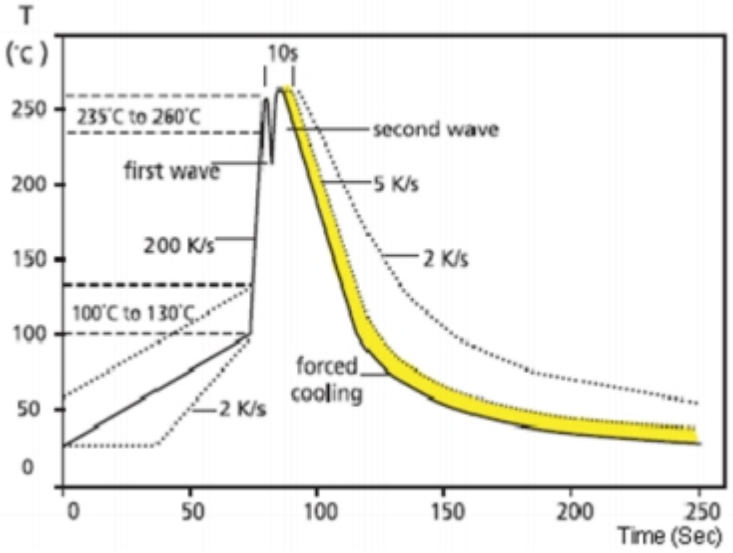
Recommend Soldering Method:

Lead Free IR Reflow Soldering Profile (MEET J-STD-020D)



Remark: The peak temperature of soldering heat is 260 +5/-0 ℃ for 10 seconds

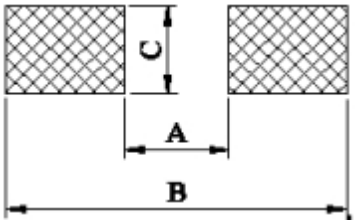
Lead Free Double-Wave Soldering Profile.(This applies to 0603 size inclusive above products)



Soldering Iron: temperature 350℃±10℃, dwell timeshall be less than 3 sec

Recommend Land Pattern Design (For Reflow Soldering)

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.



DIM / TYPE	A	B	C
RI01005	0.2	0.5	0.2
RI0201	0.3	1.0	0.4
RI0402	0.5	1.5	0.6
RI0603	0.8	2.1	0.9
RI0805	1.2	3.0	1.3
RI1206	2.2	4.2	1.6
RI1210	2.2	4.2	2.8
RI1812	3.1	5.9	3.0
RI2010	3.5	6.1	2.8
RI2512	3.8	8.0	3.5

Environment Precautions:

This specification product is for general electronic use, AHO will not be responsible for any damage, cost or loss caused by using this specification product in any special environment. If other applications need to confirm with AHO.

If consumer intends to use our Company product in special environment or condition (including but not limited to those mentioned below), then will need to make individual recognition of product features and reliability accordingly.

(a) Used in high temperature and humidity environment;

(b) Exposed to sea breeze or other corrosive gas, such as Cl2 、H2S 、NH3 、SO2 and NO2;

(c) Used in non-verified liquids including water, oil, chemical and organic solvents;

(d) Using non-verified resin or other coating material to seal or coat our Company product; (e) After soldering, it is necessary to use water-soluble detergents to clean residual solder (f) fluxes, even though no-clean fluxes are recommended.

Momentary Overload Precautions:

The product might be out of function when momentary overloaded. Please make sure to avoid momentary overloading while using and preserving.

Operation and Processing Precautions:

(a) Avoid damage to the edge of resistor and protective layer caused by mechanical stress.

(b) Handle with care when printing circuit board (PCB) is divided or fixed on support body,because bending of printing circuit board (PCB) mounting will make mechanical stress for resistors.

(c) Make sure the power rating is under the limit when using the resistor. When power rating is over the limit, the resister will be overloaded. There might be machinery damage due to the climbing temperature.

(d) If the resister will be exposed under massive impact load (shock wave) in a short period of time, the working environment must be set up well before use.

(e) Please make evaluation and confirmation when the product is well used in your company

and have a through consideration of it's fail-safe design to ensure the system safety.

Stock period:

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.

Please avoid the mentioned harsh environment below when storing to ensure product performance and its' weldability. Places exposed to sea breeze or other corrosive gas, such as Cl_2 、H_2S 、NH_3 、SO_2 and NO_2.

When the product is moved and stored, please ensure the correct orientation of the box. Do not drop or squeeze the box. Otherwise, the electrode or the body of the product may be damaged.

The carton packaged for electronic-information products is made by thesymbol as follows:

Marking for control of pollution cause by electronic-information products	Marking for package recovery

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AHO defined this product is for general electrical use, not design for any application for automotive electrical ,life-saving or life support equipment, or any application which may inflict casualties if AHO product failure occurred. When consumer is using or selling products of AHO without having discussion with the sales representatives and specifically stated the applicability mentioned above in a written form, then the client need to take a full responsibility and agree to protect AHO from punishment and damage.

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