

1 Scope

- 1.1 This specification is applicable to lead free and halogen free of RoHS directive for RTH series high power thick film chip resistors.
- 1.2 The product is for general electronic purpose.

2 Explanation Of Part Numbers

(EX)

Type	Size	Nominal Resistance		Resistance Tolerance	Packaging(Refer to IE-SP-055)
High Power Thick Film Chip Resistors	01(0201) 02(0402) 03(0603) 05(0805) 06(1206) 12(1210) 20(2010) 25(2512)	5% (3-Digit)	EX. 10 Ω =100 4.7 Ω =4R7 JUMPER=000	B=± 0.1% D=± 0.5% F=± 1% J=± 5%	Q1 : 1 mm Pitch Carrier Tape 20000 pcs QE : 1 mm Pitch Carrier Tape 150000 pcs TH : 2 mm Pitch Carrier Tape 10000 pcs H0 : 2 mm Pitch Carrier Tape 15000 pcs H2 : 2 mm Pitch Carrier Tape 20000 pcs H3 : 2 mm Pitch Carrier Tape 30000 pcs H4 : 2 mm Pitch Carrier Tape 40000 pcs H5 : 2 mm Pitch Carrier Tape 50000 pcs H6 : 2 mm Pitch Carrier Tape 60000 pcs TP : 4 mm Pitch Carrier Tape 5000 pcs P2 : 4 mm Pitch Carrier Tape 10000 pcs P3 : 4 mm Pitch Carrier Tape 15000 pcs P4 : 4 mm Pitch Carrier Tape 20000 pcs TE : 4 mm Pitch Carrier Tape 4000 pcs BA : Bulk Case
		0.1% 0.5% 1% (4-Digit)	EX. 10.2 Ω =10R2 10K Ω =1002 JUMPER=0000		

3 General Specifications

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm/℃)	Resistance Range				JUMPER (0Ω)		JUMPER (0Ω)	
					B(±0.1%) E-24、E-96	D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	J(±5%) E-24	J (±5%)	F (±1%)	J (±5%)	F (±1%)
RTH01 (0201)	$\frac{1}{16}$ W	25V	50V	-200 +400	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	0.5A	0.5A	50mΩ MAX.	35mΩ MAX.
				±200	-----	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$				
RTH02 (0402)	$\frac{1}{8}$ W	50V	100V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 20M\Omega$	1.5A	2A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RTH03 (0603)	$\frac{1}{5}$ W	75V	150V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 20M\Omega$	1.5A	2.5A	50mΩ MAX.	20mΩ MAX.
				±200	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RTH05 (0805)	$\frac{1}{4}$ W	150V	300V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 20M\Omega$	2.5A	3.5A	50mΩ MAX.	20mΩ MAX.
				±200	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RTH06 (1206)	$\frac{1}{2}$ W	200V	400V	±100	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 20M\Omega$	3A	5A	50mΩ MAX.	20mΩ MAX.
				±200	$3\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RTH12 (1210)	$\frac{3}{4}$ W	200V	400V	±100	$100\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 20M\Omega$	4A	6A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RTH20 (2010)	1W	200V	400V	±100	-----	-----	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$	4.5A	7A	50mΩ MAX.	20mΩ MAX.
				±200			$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
RTH25 (2512)	2W	200V	400V	±100	$100\Omega \leq R \leq 100K$	$100\Omega \leq R \leq 100K$	$10\Omega \leq R \leq 10M\Omega$	$10\Omega \leq R \leq 10M\Omega$	6A	10A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$				
Operating Temperature Range				-55℃ ~ +155℃ (0201:-55℃ ~ +125℃)								

3.1 Power Derating Curve:

Type	RTH01 (0201)	Other
Operating Temperature Range	- 55°C ~ + 125°C	- 55°C ~ + 155°C
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		

3.2 Voltage Rating

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

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

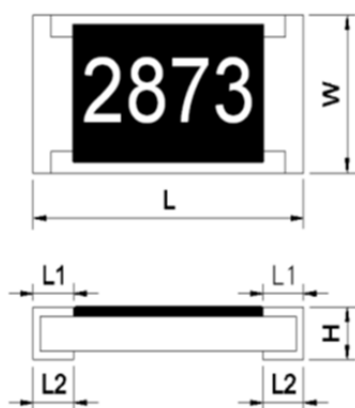
E= Rated voltage (V)

P= Power rating (W)

R= Nominal resistance(Ω)

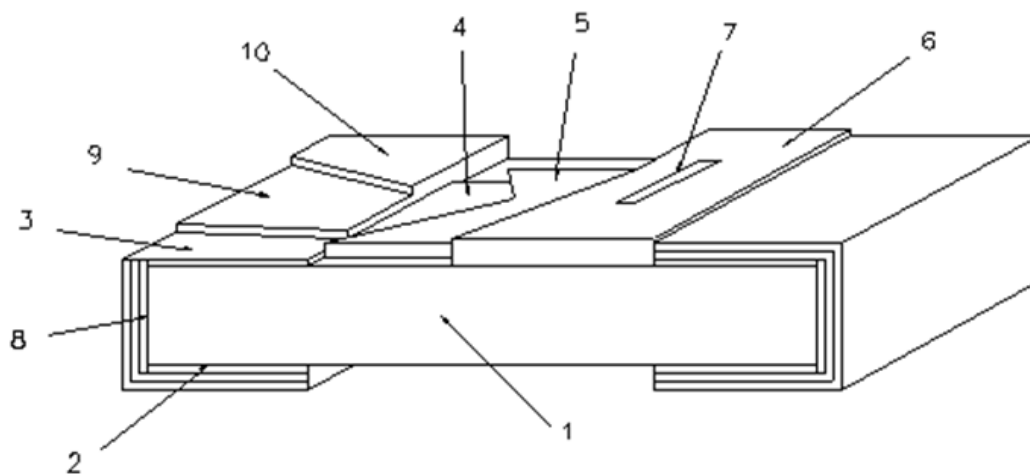
4 Dimensions

Unit: mm



Dimension		L	W	H	L1	L2
Type	Size Code					
RTH01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05
RTH02	0402	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
RTH03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
RTH05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
RTH06	1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.15
RTH12	1210	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
RTH20	2010	4.95±0.10	2.45±0.10	0.70±0.10	0.65±0.20	0.60±0.20
RTH25	2512	6.40±0.20	3.20±0.20	0.70±0.10	0.60±0.20	1.25±0.20

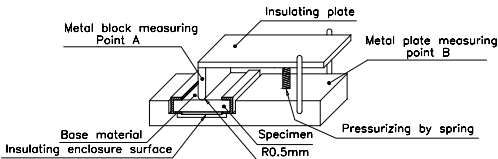
5 Structure Graph



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

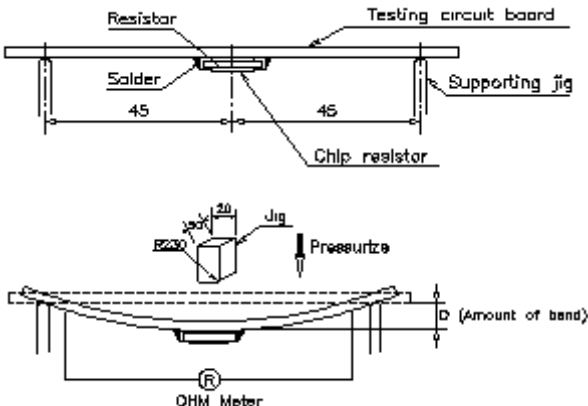
6 Reliability Test:

6.1 Electrical Performance Test

Item	Conditions	Specifications	
		Resistors	Jumper
Temperature Coefficient of Resistance	$TCR(ppm/^{\circ}C) = \frac{(R2-R1)}{R1(T2-T1)} \times 10^6$ <p>R1: Resistance at room temperature R2: Resistance at -55°C or +125°C T1: Room temperature T2: Temperature -55°C or +125°C Refer to JIS-C5201-1 4.8</p>	Refer to item 3. general specifications	NA
Short Time Overload	<p>Applied 2.5 times rated voltage for 5 seconds and release the load for about 30 minutes , then measure its resistance variance rate.(Rated voltage refer to item 3. general specifications) Refer to JIS-C5201-1 4.13</p>	0.1% 、 0.5% 、 1%: $\Delta R\% = \pm 1.0\%$ 5%: $\Delta R\% = \pm 2.0\%$	Refer to item 3. general specifications
Insulation Resistance	<p>Put the resistor in the fixture, add 100 VDC in + , - terminal for 60 sec then measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base material. Refer to JIS-C5201-1 4.6</p> 	$\geq 10^9 \Omega$	
Dielectric Withstand Voltage	<p>Put the resistor in the fixture, add VAC (see spec. below) in + , - terminal for. RTH05 、 06 、 12 、 20 、 25 apply 500 VAC 1 minute. RTH02 、 03 apply 300 VAC 1 minute. Refer to JIS-C5201-1 4.7</p>	No short or burned on the appearance.	

6.2 Mechanical Performance Test

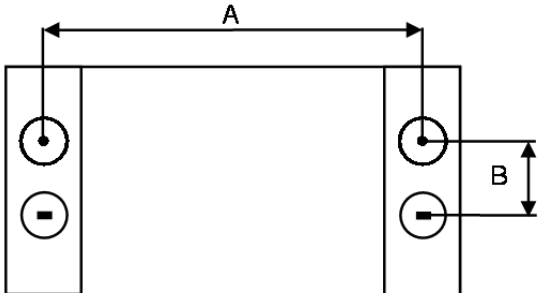
Item	Conditions	Specifications	
		Resistors	Jumper
Terminal Strength	Test1:The resistor mounted on the board applied 5N (RTH01:3N)pushing force on the sample rear for 10sec. Test2:The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown. Refer to JIS-C5201-1 4.16	Test1:No evidence of mechanical damage Test2:RTH01 \geq 3N Other type \geq 5N	
Resistance to Solvent	The tested resistor be immersed into isopropyl alcohol of 20~25°C 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	RTH01: $\Delta R\% = \pm 1.0\%$ Other type: $\Delta R\% = \pm 0.5\%$	Refer to item 3. general specifications
Solderability	Preconditioning: Put the tested resistor in the apparatus of PCT, at a temperature of 105°C, humidity of 100% RH, and pressure of 1.22×10^5 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 $235 \pm 5^\circ\text{C}$ for 2 sec, then the resistor is left as placed under microscope to observed its solder area. Refer to JIS-C5201-1 4.17	Solder coverage over 95%	
Resistance to Soldering Heat	<ul style="list-style-type: none"> ● Test method 1 (solder pot test): The tested resistor be immersed into molten solder of $260 + 5/-0^\circ\text{C}$ for $10 + 1/-0$ 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 $260 + 5/-0^\circ\text{C}$ for $30 + 1/-0$ seconds. Then the resistor is left as placed under microscope to observe its solder area. ● Test method 3 (Electric iron test): Preheating temperature : $350 \pm 10^\circ\text{C}$ 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 	Test item 1: $\Delta R\% = \pm 1.0\%$ 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: $\Delta R\% = \pm 1.0\%$	Refer to item 3. general specifications

Item	Conditions	Specifications	
		Resistors	Jumper
Joint Strength of Solder	<p>● Bending Strength: Solder tested resistor on to PC board. Add force in the middle down, and under load measured its resistance variance rate.</p> <p>D:RTH02、03、05=5mm RTH01、06、12=3mm RTH20、25=2mm</p>  <p>The diagram illustrates the bending strength test setup. The top part shows a side view of a chip resistor mounted on a testing circuit board with solder. A supporting jig is used to apply a downward force to the center of the resistor, with dimensions of 45 units on either side of the center. The bottom part shows a top-down view of the resistor being bent by a jig, with a pressure applied. A dimension of 20 units is shown for the width of the resistor, and a dimension of 30 units is shown for the width of the supporting jig. A pressure gauge is connected to the jig. An OHM Meter is connected to the resistor terminals to measure the resistance change during bending. The amount of bend is denoted as 'D (Amount of bend)'.</p> <p>Refer to JIS-C5201-1 4.33</p>	$\Delta R\% = \pm 1.0\%$	Refer to item 3. general specifications

6.3 Environmental Test

Item	Conditions	Specifications									
		Resistors	Jumper								
Resistance to Dry Heat	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. Refer to JIS-C5201-1 4.25	0.1%、0.5%、1%:ΔR%=±1.0% 5%:ΔR%=±2.0%	Refer to item 3. general specifications								
Thermal Shock	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 border="1"><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	Testing Condition		Lowest Temperature	-55±5℃	Highest Temperature	125±5℃	Temperature-retaining time	15 minutes each	0.1%、0.5%、1%:ΔR%=±0.5% 5%:ΔR%=±1.0%	Refer to item 3. general specifications
Testing Condition											
Lowest Temperature	-55±5℃										
Highest Temperature	125±5℃										
Temperature-retaining time	15 minutes each										
Loading Life in Moisture	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	0.1%、0.5%、1%:ΔR%=±0.5% 5%:ΔR%=±2.0%	Refer to item 3. general specifications								
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	0.1%、0.5%、1%:ΔR%=±0.5% 5%:ΔR%=±2.0%	Refer to item 3. general specifications								

7 Measurement Point

Bottom electrode		Unit : mm	
 <p>● Current Terminal ■ Voltage Terminal</p>	DIM	A	B
	TYPE		
	RTH01	0.44±0.05	0.22±0.05
	RTH02	0.80±0.05	0.24±0.05
	RTH03	1.35±0.05	0.35±0.05
	RTH05	1.80±0.05	0.35±0.05
	RTH06	2.90±0.05	0.35±0.05
	RTH12	2.90±0.05	0.35±0.05
	RTH20	4.50±0.05	1.15±0.05
	RTH25	5.90±0.05	1.60±0.05

8 Plating Thickness

8.1 Ni : $\geq 2\mu\text{m}$

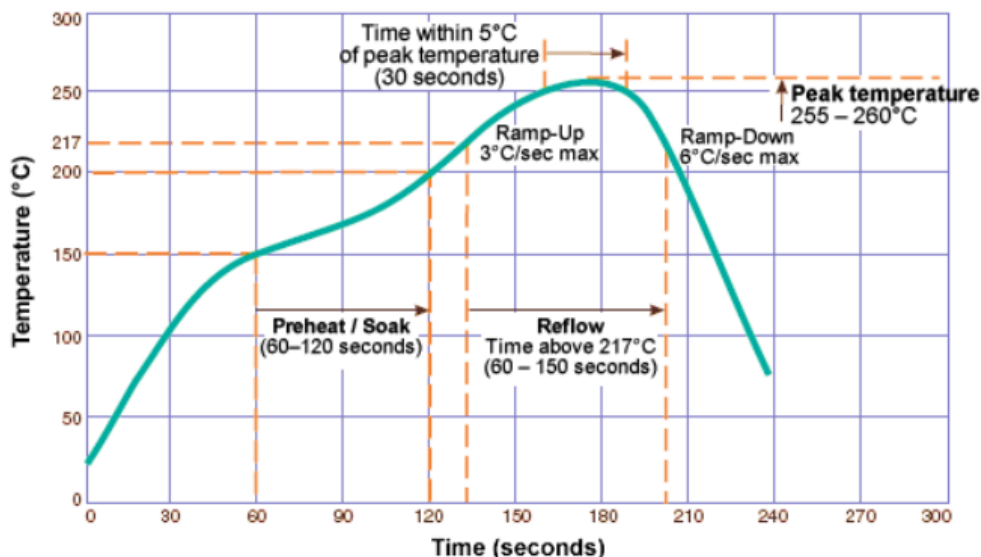
8.2 Sn(Tin) : $\geq 3\mu\text{m}$

8.3 Sn(Tin) : Matte Sn

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

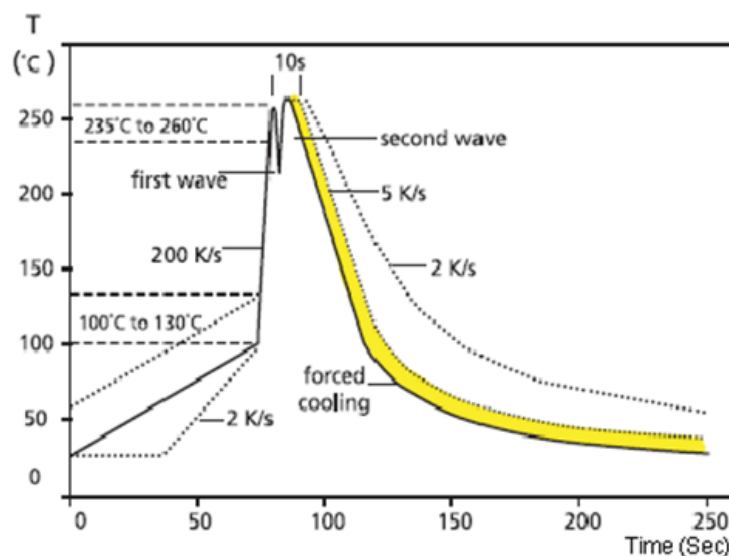
9.1 Recommend Soldering Method:

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



Remark: The peak temperature of soldering heat is $260 \pm 5/-0$ °C for 10 Seconds.

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

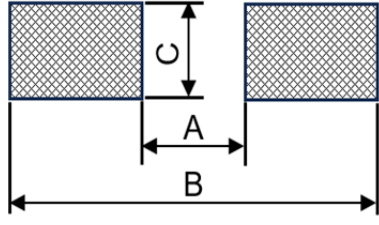


(c) Soldering Iron: temperature $350^{\circ}\text{C} \pm 10^{\circ}\text{C}$, dwell time shall be less than 3 sec.

9.2 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.

Unit : mm



DIM TYPE	A	B	C
RTH01	0.3	1.0	0.4
RTH02	0.5	1.5	0.6
RTH03	0.8	2.1	0.9
RTH05	1.2	3.0	1.3
RTH06	2.2	4.2	1.6
RTH12	2.2	4.2	2.8
RTH20	3.5	6.1	2.8
RTH25	3.8	8.0	3.5

9.3 Environment Precautions:

This specification product is for general electronic use, RALEC 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 RALEC.

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 fluxes, even though no-clean fluxes are recommended.

9.4 Momentary Overload Precautions:

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



9.5 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 resistor will be overloaded. There might be machinery damage due to the climbing temperature.
- (d) If the resistor 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 its fail-safe design to ensure the system safety.

10 Storage and transportation requirement:

- 10.1 The temperature condition must be controlled as $25\pm5^{\circ}\text{C}$, the R.H. must be controlled as $60\pm15\%$. The stock can maintain quality level in two years.
- 10.2 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 .
- 10.3 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.

11 The carton packaged for electronic-information products is made by the symbol as follows (For Cina)

	
<p>Marking for control of pollution cause by electronic-information products</p>	<p>Marking for package recovery</p>

12 Attachments:

12.1 Document Revise Record Paper (QA-QR-027)

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