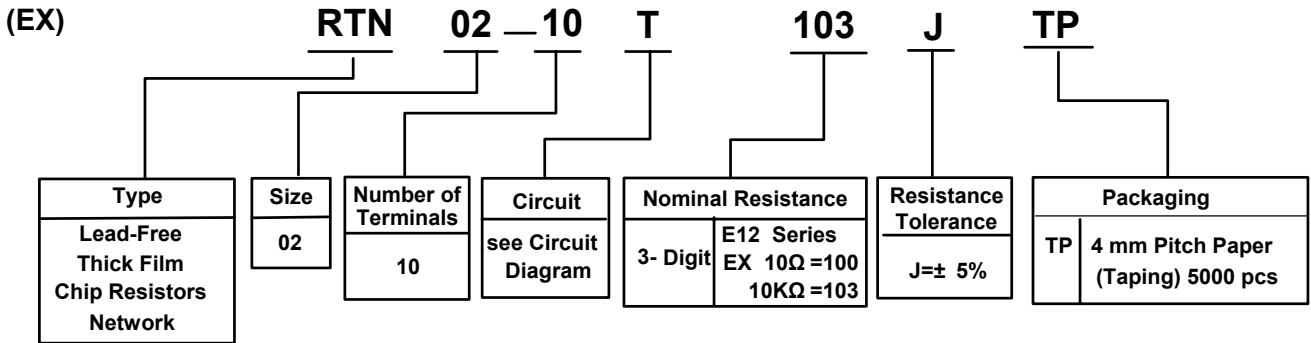


1 Scope:

This specification is applicable to lead and halogen free RTN series thick film chip resistors network.

2 Explanation Of Part Numbers:



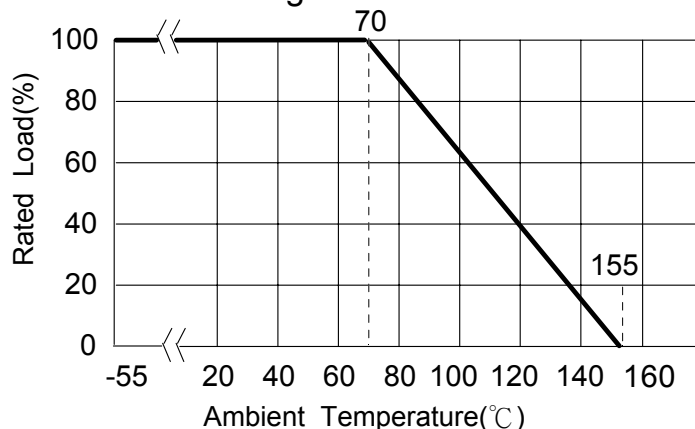
3 General Specifications:

Type	Rated Power at 70°C	Max. Working Voltage	Max. Overload Voltage	T.C.R. (ppm/°C)	Resistance	Number of Terminals	Number of Resistors	Operating Temperature Range
					J(± 5%) E-12			
RTN02-10R	$\frac{1}{16}$ W	25V	50V	± 200	56Ω~1MΩ	10	8	-55°C ~ +155°C
RTN02-10T	$\frac{1}{16}$ W	25V	50V	± 200	33Ω~1MΩ	10	8	

3.1 Power Derating Curve:

Operating Temperature Range : - 55~155 °C

For resistors operated in ambient temperatures above 70°C, power rating shall be derated in accordance with figure below.



3.2 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:

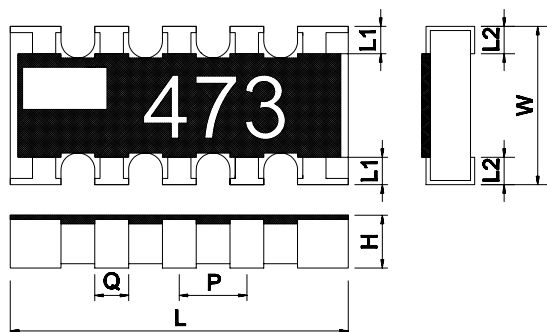
$$E = \sqrt{R \times P}$$

E= Rated voltage (v)
P= Power rating (w)
R= Nominal resistance(Ω)

4 Circuit diagram:



5 Dimensions:



Unit: mm

Type	DIM	L	W	H	L1	L2	P	Q
RTN 02-10R RTN 02-10T		3.20± 0.20	1.60± 0.15	0.55± 0.10	0.30± 0.15	0.30± 0.15	0.64± 0.10	0.32± 0.10

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Series No. **60**

6 Reliability Test:

6.1 Electrical Performance Test

ITEM	Conditions	Specifications
		Resistors
Temperature Coefficient of Resistance	$TCR (ppm/^{\circ}C) = \frac{(R2 - R1)}{R1 (T2 - T1)} \times 10^6$ 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	Refer item 3. general Specifications
Short Time Overload	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	± (2.0% + 0.10Ω) No evidence of mechanical damage.
Insulation Resistance	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	≥ 10 ⁹ Ω
Dielectric Withstand Voltage	Put the resistor in the fixture, add 300 VAC in +,- terminal for 60 sec. 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°C 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. Refer to JIS-C5201-1 4.13	± (5.0% + 0.10Ω)

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Thick Film Chip Resistors Network Product Specification

6.2 Mechanical Performance Test

ITEM	Conditions	Specifications																								
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 hr, then measure its resistance variance rate. Refer to JIS-C5201-1 4.29	± (0.5%+0.05Ω) No evidence of mechanical damage, no G2 overcoating and Sn layer by leaching.																								
Resistance to soldering heat	<p>◎Test method 1 (Reflow test): The tested resistor should be subject in the following procedure, and after finish each step, it should be left for a duration of 2 hours or longer at a temperature of 30°C or lower and a humidity of 70% RH or lower.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 5px;"> <thead> <tr> <th>Step</th> <th>Procedure</th> <th>Environmental test condition</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Resistance measuring</td> <td>Room temperature</td> </tr> <tr> <td>2</td> <td>Baking</td> <td>125°C , 24 hours</td> </tr> <tr> <td>3</td> <td>Humidification</td> <td>85°C , 85% , 168 hours</td> </tr> <tr> <td>4</td> <td>Reflow (1)</td> <td>Reflow temperature curve and component surface temperature Table 1</td> </tr> <tr> <td>5</td> <td>Humidification</td> <td>85°C , 65% , 24 hours</td> </tr> <tr> <td>6</td> <td>Reflow (2)</td> <td>Reflow temperature curve and component surface temperature Table 2</td> </tr> <tr> <td>7</td> <td>Resistance measuring</td> <td>Room temperature</td> </tr> </tbody> </table> <p>◎Reflow temperature curve</p> <div style="text-align: center;"> </div>	Step	Procedure	Environmental test condition	1	Resistance measuring	Room temperature	2	Baking	125°C , 24 hours	3	Humidification	85°C , 85% , 168 hours	4	Reflow (1)	Reflow temperature curve and component surface temperature Table 1	5	Humidification	85°C , 65% , 24 hours	6	Reflow (2)	Reflow temperature curve and component surface temperature Table 2	7	Resistance measuring	Room temperature	<p>1.Variance rate on resistance ΔR%=± (1.0%+0.05Ω)</p> <p>2.No evidence of electrode damage. No side conductive peel off.</p>
Step	Procedure	Environmental test condition																								
1	Resistance measuring	Room temperature																								
2	Baking	125°C , 24 hours																								
3	Humidification	85°C , 85% , 168 hours																								
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Thick Film Chip Resistors Network Product Specification

ITEM	Conditions	Specifications																																										
		Resistors																																										
	<p>◎Component surface temperature Table 1 Description example in specification document (1)</p> <table border="1"> <tr> <td>Temperature-retaining time: 230°C or higher</td> <td>Peak temperature</td> <td>Temperature measured at the component body surface during preheating</td> </tr> <tr> <td>30 seconds</td> <td>240°C</td> <td>150 to 160 °C</td> </tr> </table> <p>Table 2 Description example in specification document (2)</p> <table border="1"> <tr> <td>Temperature</td> <td>Temperature-retaining time</td> <td>Temperature measured at the component body surface during preheating</td> </tr> <tr> <td>220°C or higher</td> <td>90 seconds</td> <td rowspan="4">150 to 160°C</td> </tr> <tr> <td>230°C or higher</td> <td>60 seconds</td> </tr> <tr> <td>240°C or higher</td> <td>5 seconds</td> </tr> <tr> <td>Peak</td> <td>245°C</td> </tr> </table> <p>◎Test method 2 (solder pot test): The tested resistor should be subject in the following procedure, and after finish each step, it should be left for a duration of 2 hours or lower at a temperature of 30°C or lower and a humidity of 70% RH or lower.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Procedure</th> <th>Environmental test condition</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Resistance measuring</td> <td>Room temperature</td> </tr> <tr> <td>2</td> <td>Baking</td> <td>125°C , 24 hours</td> </tr> <tr> <td>3</td> <td>Humidification</td> <td>85°C , 85% , 168 hours</td> </tr> <tr> <td>4</td> <td>Solder pot test</td> <td>260± 3°C , 10 sec</td> </tr> <tr> <td>5</td> <td>Placed</td> <td>85°C , 65% , 24 hours</td> </tr> <tr> <td>6</td> <td>Solder pot test</td> <td>260± 3°C , 10 sec</td> </tr> <tr> <td>7</td> <td>Resistance measuring</td> <td>Room temperature</td> </tr> </tbody> </table> <p>By SONY (SS-00254-5) Refer to JIS-C5201-1 4.18</p>	Temperature-retaining time: 230°C or higher	Peak temperature	Temperature measured at the component body surface during preheating	30 seconds	240°C	150 to 160 °C	Temperature	Temperature-retaining time	Temperature measured at the component body surface during preheating	220°C or higher	90 seconds	150 to 160°C	230°C or higher	60 seconds	240°C or higher	5 seconds	Peak	245°C	Step	Procedure	Environmental test condition	1	Resistance measuring	Room temperature	2	Baking	125°C , 24 hours	3	Humidification	85°C , 85% , 168 hours	4	Solder pot test	260± 3°C , 10 sec	5	Placed	85°C , 65% , 24 hours	6	Solder pot test	260± 3°C , 10 sec	7	Resistance measuring	Room temperature	
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7	Resistance measuring	Room temperature																																										
Solderability	<p>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× 10⁵ Pa for a duration of 4 hours. Then after left the tested resistor in room temperature for 2 hours or more. Test method: ◎Test item 1 (solder pot test): The tested resistor be immersed into solder pot in temperature 230± 5°C for 2 sec, then the resistor is left as placed under microscope to observed its solder area. By SONY (SS-00254-2) Refer to JIS-C5201-1 4.17</p>	Test item 1: Solder coverage over 95%																																										

Remark

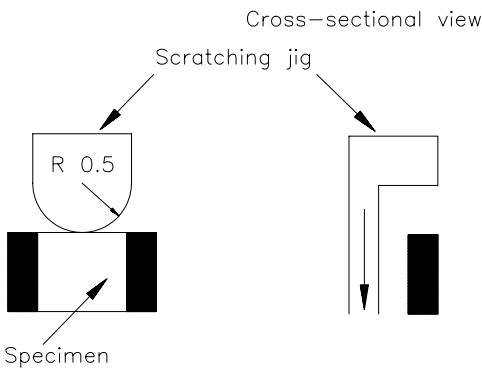
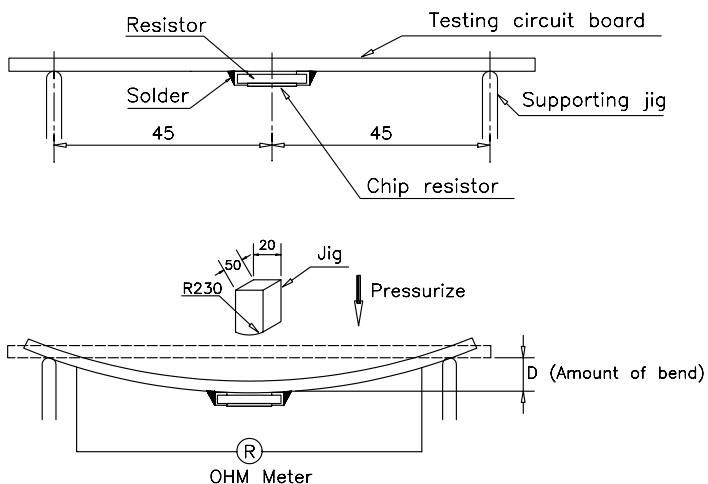
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Thick Film Chip Resistors Network Product Specification

ITEM	Conditions	Specifications
		Resistors
Joint strength of solder	<p>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: ◎Test item 1 (Adhesion): A static load using a R0.5 scratch tool shall be applied on the core of the component and in the direction of the arrow and held for 10 seconds and under load measure its resistance variance rate. 1.20N load</p>  <p>Refer to JIS-C5201-1 4.32</p> <p>◎Test item 2 (Bending Strength): Solder tested resistors on to PC board. add force in the middle down, and under load measure its resistance variance rate. D = 5 mm</p>  <p>Refer to JIS-C5201-1 4.33</p>	<p>Test item 1: 1. $\Delta R\% = \pm (1.0\% + 0.05\Omega)$ 2. No evidence of mechanical damage. No terminal peel off.</p> <p>Test item 2: 1. $\Delta R\% = \pm (1.0\% + 0.05\Omega)$ 2. No evidence of mechanical damage. No terminal peel off and core body cracked.</p> <p>Test item 3: (1). Adhesion After application of temperature cycle, adhesion should be 50% or more of initial strength. (2). Bending Strength: After application of temperature cycle, bending load should be 50% or more of initial strength.</p>

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ITEM	Conditions	Specifications								
		Resistors								
	<p>◎Test item 3 (Endurance measurement): Put the tested resistor in the chamber under the temperature cycle which shown in table 1 shall be repeated 1000± 4 times consecutively. Then separate follow test item 1 and test item 2 50% condition to test, measured its resistance variance rate.</p> <p>Table 1 Temperature cycle test condition</p> <table border="1"> <thead> <tr> <th></th> <th>Testing condition</th> </tr> </thead> <tbody> <tr> <td>Lowest temperature</td> <td>-35± 5℃</td> </tr> <tr> <td>Highest temperature</td> <td>105± 5℃</td> </tr> <tr> <td>Temperature-retaining time</td> <td>15 minutes each</td> </tr> </tbody> </table> <p>By SONY (SS-00254-7)</p>		Testing condition	Lowest temperature	-35± 5℃	Highest temperature	105± 5℃	Temperature-retaining time	15 minutes each	
	Testing condition									
Lowest temperature	-35± 5℃									
Highest temperature	105± 5℃									
Temperature-retaining time	15 minutes each									
Leaching Test	<p>The tested resistor be immersed into molten solder of 260± 5℃ for 30 seconds. Then the resistor is left as placed under microscope to observed its solder area. By SONY (SS-00254-9)</p>	<p>1.Solder coverage over 95%. 2.The underlying material (such as ceramic) shall not be visible at the crest corner area of the electrode.</p>								

Thick Film Chip Resistors Network Product Specification

6.3 Environmental Test

ITEM	Conditions	Specifications														
		Resistors														
Resistance to Dry Heat	Put tested resistors in chamber under temperature $155 \pm 5^\circ\text{C}$ for $1,000 \pm 4$ hours. Then leaving in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.25	$\pm (2.0\% + 0.10\Omega)$ No evidence of mechanical damage, no short or burned on the appearance.														
Thermal Shock	Put the tested resistor in the thermal shock chamber under the temperature cycle which shown in the following table shall be repeated 300 times consecutively. Then leaving the tested resistor in the room temperature for 1 hour, and measure its resistance variance rate. <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Testing Condition</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Lowest Temperature</td> <td style="text-align: center;">$-55 \pm 5^\circ\text{C}$</td> </tr> <tr> <td style="text-align: center;">Highest Temperature</td> <td style="text-align: center;">$125 \pm 5^\circ\text{C}$</td> </tr> <tr> <td style="text-align: center;">Temperature-retaining time</td> <td style="text-align: center;">15 minutes each</td> </tr> </tbody> </table> Refer to MIL-STD 202 Method 107	Testing Condition		Lowest Temperature	$-55 \pm 5^\circ\text{C}$	Highest Temperature	$125 \pm 5^\circ\text{C}$	Temperature-retaining time	15 minutes each	$\pm (1.0\% + 0.05\Omega)$ No evidence of mechanical damage,						
Testing Condition																
Lowest Temperature	$-55 \pm 5^\circ\text{C}$															
Highest Temperature	$125 \pm 5^\circ\text{C}$															
Temperature-retaining time	15 minutes each															
Loading Life in Moisture	Put the tested resistor in the chamber under temperature $40 \pm 2^\circ\text{C}$, 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	$\pm (2.0\% + 0.10\Omega)$ No evidence of mechanical damage.														
Load Life	Put the tested resistor in chamber under temperature $70 \pm 2^\circ\text{C}$ 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	$\pm (3.0\% + 0.10\Omega)$ No evidence of mechanical damage, no short or burned on the appearance.														
Low Temperature Operation	Put the tested resistor in the chamber at room temperature 25°C . Decreasing the temperature to -55°C and keep the temperature at -55°C for 1 hour. Then load the rated voltage for 45 minutes on, and 15 minutes off. Then leaving the tested resistor in room temperature for 8 ± 1 hours, and measure its resistance variance rate. Refer to MIL-R-55342D 4.7.4	$\pm (1.0\% + 0.05\Omega)$ No evidence of mechanical damage.														
Whisker Test	<p>◎Test item 1(Thermal Shock test):</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tbody> <tr> <td style="text-align: center;">Minimum storage temperature</td> <td style="text-align: center;">$-40 \pm 2^\circ\text{C}$</td> </tr> <tr> <td style="text-align: center;">Maximum storage temperature</td> <td style="text-align: center;">$85 \pm 2^\circ\text{C}$</td> </tr> <tr> <td style="text-align: center;">Temperature-retaining time</td> <td style="text-align: center;">7 min.</td> </tr> <tr> <td style="text-align: center;">Number of temperature cycles</td> <td style="text-align: center;">1,500</td> </tr> </tbody> </table> <p>◎Test item 2 (Constant temperature / humidity test):</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tbody> <tr> <td style="text-align: center;">Temperature</td> <td style="text-align: center;">85°C</td> </tr> <tr> <td style="text-align: center;">Humidity</td> <td style="text-align: center;">85%</td> </tr> <tr> <td style="text-align: center;">Testing duration</td> <td style="text-align: center;">500 ± 4 hours</td> </tr> </tbody> </table> <p>◎Inspection: Inspect for whisker formation on specimens that underwent the acceleration test specified in subclause 4.2, with a magnifier (stereomicroscope) of about 40 or higher magnification. If judgment is hard in this method, use a scanning electron microscope (SEM) of about 1,000 or higher magnification. By SONY (SS-00254-8)</p>	Minimum storage temperature	$-40 \pm 2^\circ\text{C}$	Maximum storage temperature	$85 \pm 2^\circ\text{C}$	Temperature-retaining time	7 min.	Number of temperature cycles	1,500	Temperature	85°C	Humidity	85%	Testing duration	500 ± 4 hours	Max. $50 \mu\text{m}$
Minimum storage temperature	$-40 \pm 2^\circ\text{C}$															
Maximum storage temperature	$85 \pm 2^\circ\text{C}$															
Temperature-retaining time	7 min.															
Number of temperature cycles	1,500															
Temperature	85°C															
Humidity	85%															
Testing duration	500 ± 4 hours															

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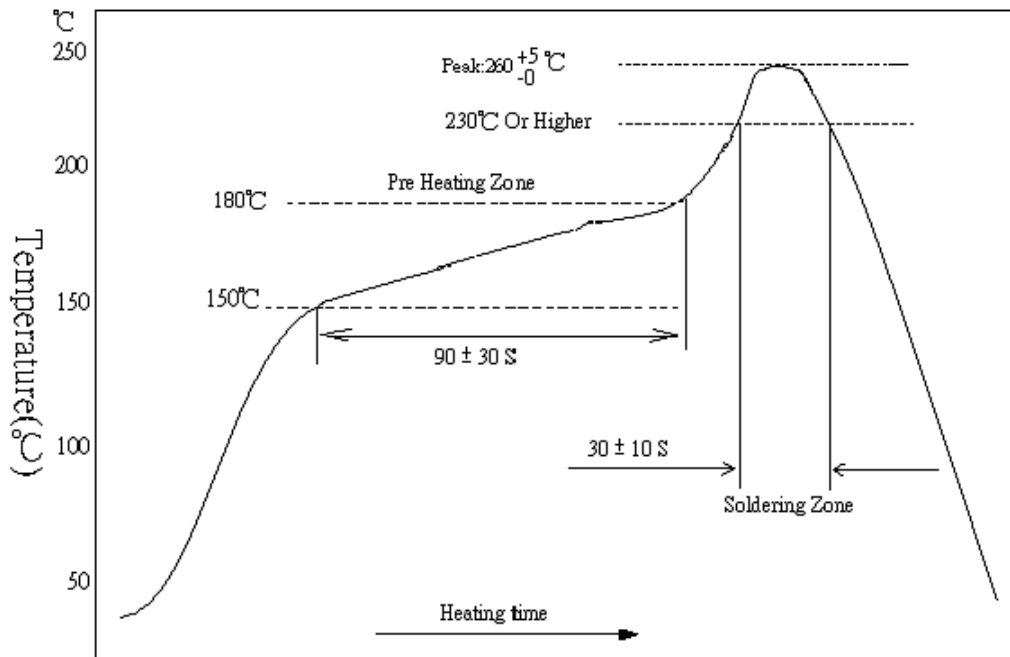
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7 Recommend Soldering Method

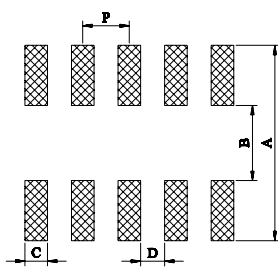
7.1 Lead Free Reflow Soldering Profile



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

8 Recommend Land Pattern Design (For Reflow Soldering) :

Unit : mm



TYPE \ DIM	A	B	C	D	P
RTN02	2.6	1.0	0.34	0.34	0.64

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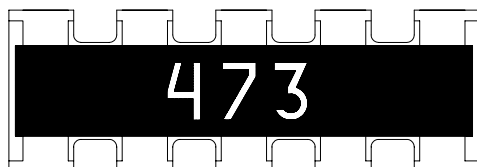
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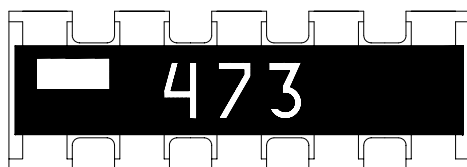
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9 Chip Resistors Network Appearance:

9.1 R type



9.2 T type



10 Marking Diagrams:

10.1 $\pm 5\%$ Tolerance: 3 digits in E-12 series, first two digits are significant figures, third digit is multiplier (10^x).

<p>《EX》 Marking → 473</p> $473 = 47 \times 10^3 = 47000 \Omega = 47K \Omega$
--

10.2 Marking

E-12 series

10	12	15	18	22	27
33	39	47	56	68	82

11 Plating Thickness:

11.1 Ni: $\geq 1 \mu m$

11.2 Sn (Lead Free): $\geq 3 \mu m$

11.3 Sn (Tin): Matte Sn

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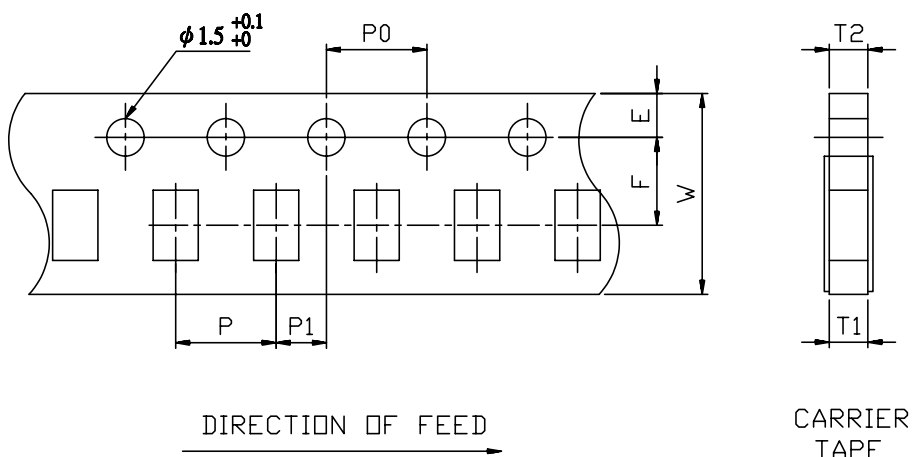
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12 Taping Specifications:

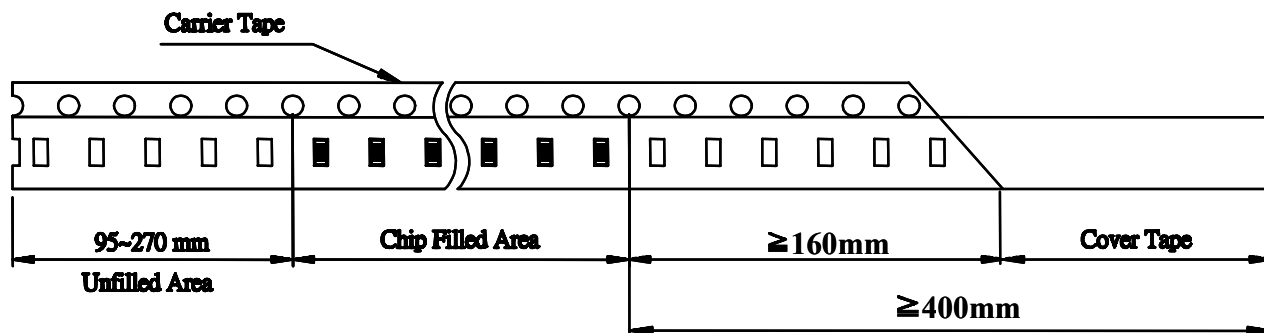
12.1 Tape Dimension:



Unit: mm

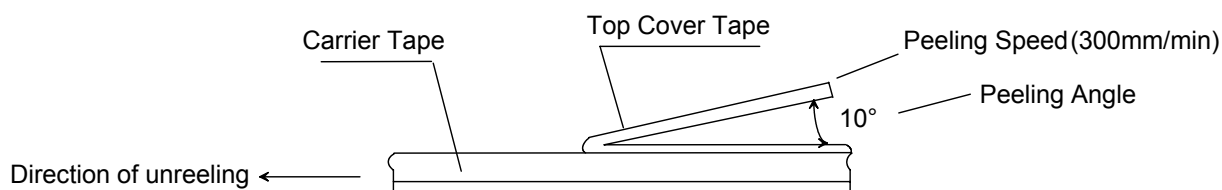
Packaging	Type	A	B	W	E	F	P0	P	10x P0	P1	T1	T2
TP Carrier Tape	RTN02-10R RTN02-10T	3.5± 0.20	1.9± 0.20	8.0± 0.20	1.75± 0.10	3.5± 0.05	4.0± 0.05	4.0± 0.10	40.0± 0.20	2.0± 0.05	0.75+0.2/-0	0.75± 0.10

12.2 Lead Dimensions:



12.3 Cover Tape Peel off Strength

Specifications : 0.07~0.7N (7.1~71.4gf)



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12.4 Packaging Qty:

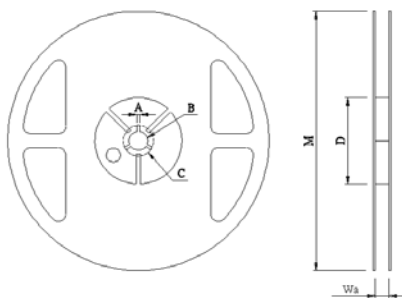
Type	Tape Width	Packaging (pcs/reel)			
		TP			
		4 mm Pitch			
		TP	P2	P3	P4
RTN02-10R	8 mm	5,000	10,000	15,000	20,000
RTN02-10T					
Reel Type		7"	10"	13"	13"

12.4.1 Typical taping type : TP

12.4.2 Other taping type are upon customer's request.

12.5 Reel Dimensions:

Unit : mm



Reel Type / Tape	Wa	M	A	B	C	D
7" reel for 8 mm tape	9.0 ± 0.5	178 ± 2.0	2.0 ± 0.5	13.5 ± 0.5	21.0 ± 0.5	60.0 ± 1.0
7" reel for 12 mm tape	13.8 ± 0.5	178 ± 2.0				80.0 ± 1.0
10" reel for 8 mm tape	10.0 ± 0.5	254 ± 2.0				100.0 ± 1.0
13" reel for 8 mm tape	10.0 ± 0.5	330 ± 2.0				100.0 ± 1.0

12.6 Label:

Computer No. Type Tolerance R Value Quantity

RTN02-10T 5% 10K Pb-free

512J103 5000 PCS 001

R09010001 RTN02-10T103JTP

RALEC

Running Number
Part No.
Logo

Lot No.

R	0	9	0	1	0	0	0	1
→ RALEC			→ Year(2009)		→ Week		→ Running Number	

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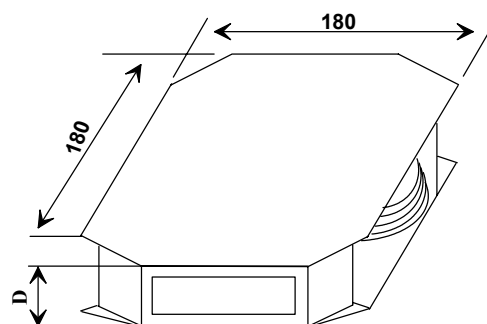
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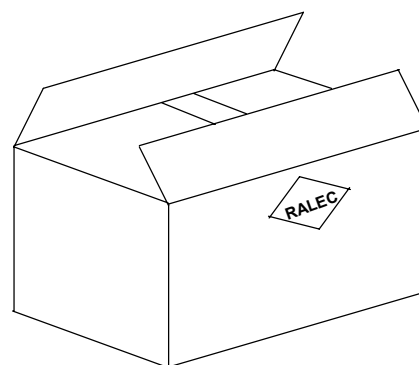
12.7 Inner Box

Reel Number	D Dimension (mm)
1	12
2	24
3	36
4	48
5	60
6	72
7	84
8	96
9	108
10	120



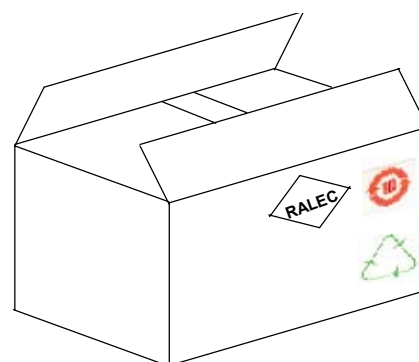
12.8 Box

10R Inner Box Number	L(mm)	W(mm)	D(mm)
2	272	205	210
4	375	280	210
8	544	380	210



12.9 Box (For China)

10R Inner Box Number	L(mm)	W(mm)	D(mm)
2	272	205	210
4	375	280	210
8	544	380	210



Remark

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13 Stock period

13.1 The temperature condition must be controlled at $25 \pm 5 \text{ }^\circ\text{C}$, the R.H. must be controlled at $60 \pm 15\%$. The stock can maintain quality level in two years.

14 The carton packaged for electronic-information products is made by the symbol as follows: (For china)

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

15 For this part. It does not use the materials that include the substances specified in RoHS , the detail refer to the part of prohibition or exclusion items in RoHS (2002/95/EC).

1. Cadmium and cadmium compounds (*permissive content <100 ppm*)
2. Lead and lead compounds (*permissive content <1000 ppm*)

Exceptions specified:

- (1). Lead contained in the glass of cathode ray tubes, electronic components and fluorescent tubes.
- (2). The glass material used in the electronic components, which includes resistor elements, conductive pastes (silver or copper ones), adhesives, glass frit and sealing materials.
3. Mercury and its mercury compounds (*permissive content <100 ppm*)
4. Hexavalent chromium compounds (*permissive content <100 ppm*)
5. Polybrominated biphenyls(PBB)(*permissive content <100 ppm*)
6. Polybrominated diphenylethers(PBDE)(*permissive content <100 ppm*)

16 Attachments

16.1 Document Revise Record Paper

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