1 Scope

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

2 Explanation Of Part Numbers

(EX) **RTT 03 101 J TP**

Type	Size	Nominal Resistance	Resistance Tolerance	Packaging
Lead-Free Thick Film Chip Resistors	01(0201) 02(0402) 03(0603) 05(0805) 06(1206) 12(1210) 20(2010) 25(2512)	3— Digit: E24 Series EX 10Ω =100 4.7Ω =4R7 Jumper=000 4— Digit: E96 Series EX 10.2Ω =10R2 10KΩ =1002 Jumper=0000	B=± 0.1% D=± 0.5% F=± 1% G=± 2% J=± 5%	TH 2mm Picth Carrier Tape 10000pcs TP 4mm Picth Carrier Tape 5000pcs P2 4mm Picth Carrier Tape 10000pcs P3 4mm Picth Carrier Tape 15000pcs P4 4mm Picth Carrier Tape 20000pcs TE 4mm Picth Carrier Tape 4000pcs BA Bulk Case

3 General Specifications

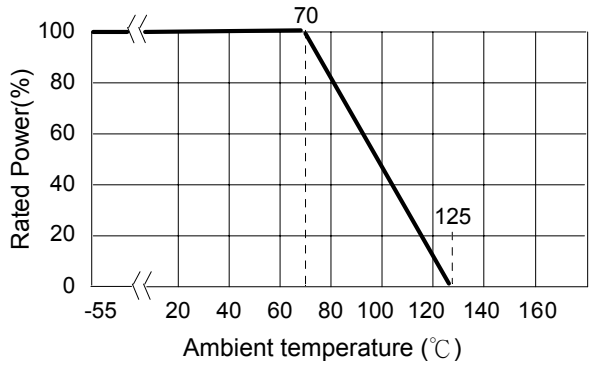
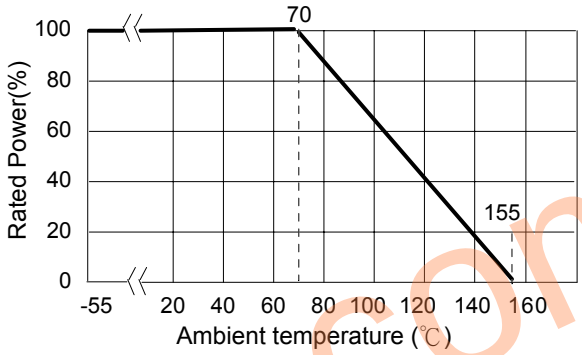
3.1 Resistance Range: ≧1Ω

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R. (ppm/℃)	Resistance Range B(± 0.1%) E-24、E-96	Resistance Range D(± 0.5%) E-24、E-96	Resistance Range F(± 1%) E-24、E-96	Resistance Range G(± 2%)、J(± 5%) E-24	Jumper Rated Current J (± 5%)	Jumper Rated Current F (± 1%)	Jumper Resistance Value J (± 5%)	Jumper Resistance Value F (± 1%)
RTT01 (0201)	1/20 w	25V	50V	-200 +400	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω	1Ω≦R＜10Ω	0.5A	0.5A	50mΩ MAX.	35mΩ MAX.
				± 200	------	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ				
RTT02 (0402)	1/16 w	50V	100V	± 100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	1A	1.5A	50mΩ MAX.	20mΩ MAX.
				± 200	------	------	1Ω≦R＜10Ω 1M＜R≦10MΩ	1Ω≦R＜10Ω 1M＜R≦20MΩ				
RTT03 (0603)	1/10 w	75V	150V	± 100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	------	1A	2A	50mΩ MAX.	20mΩ MAX.
				± 200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω 1M＜R≦10MΩ	1Ω≦R≦20MΩ				
RTT05 (0805)	1/8 w	150V	300V	± 100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	------	2A	2.5A	50mΩ MAX.	20mΩ MAX.
				± 200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω 1M＜R≦10MΩ	1Ω≦R≦20MΩ				
RTT06 (1206)	1/4 w	200V	400V	± 100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	------	2A	3.5A	50mΩ MAX.	20mΩ MAX.
				± 200	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω 1M＜R≦10MΩ	1Ω≦R≦20MΩ				
RTT12 (1210)	1/2 w	200V	400V	± 100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	------	2A	4A	50mΩ MAX.	20mΩ MAX.
				± 200	------	------	1M＜R≦10MΩ	10Ω≦R≦20MΩ				
				± 400	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
RTT20 (2010)	3/4 w	200V	400V	± 100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	------	2A	5A	50mΩ MAX.	20mΩ MAX.
				± 200	------	------	------	10Ω≦R≦10MΩ				
				± 400	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
RTT25 (2512)	1W	200V	400V	± 100	100Ω≦R≦1MΩ	10Ω≦R≦1MΩ	10Ω≦R≦1MΩ	------	2A	7A	50mΩ MAX.	20mΩ MAX.
				± 200	------	------	------	10Ω≦R≦10MΩ				
				± 400	------	------	1Ω≦R＜10Ω	1Ω≦R＜10Ω				
Operating Temperature Range	−55℃ ~ +155℃ (0201: −55℃ ~ +125℃)											

3.2 Resistance Range: < 1Ω

Type	Rated Power at 70℃	Max. Rated Current	Max. Overload Current	T.C.R (ppm / ℃)	Resistance Range F(± 1%)、G(± 2%)、J((± 5%) E-24、E-96
RTT02 (0402)	1/16W	0.88A	2.2A	± 600	80 ≦R＜200 mΩ
				± 300	200≦R＜400 mΩ
				± 250	400 ≦R＜600 mΩ
				± 200	600≦R＜1000 mΩ
RTT03 (0603)	1/10W	3.16A	7.91A	± 1500	10≦R＜37 mΩ
				± 1200	37≦R＜60 mΩ
				± 600	60≦R＜100 mΩ
				± 300	100 ≦R＜200 mΩ
				± 600	200 ≦R＜500 mΩ
				± 400	500 ≦R＜1000 mΩ
RTT05 (0805)	1/8W	3.53A	8.82A	± 1500	10 ≦R＜19 mΩ
				± 1200	19 ≦R＜33 mΩ
				± 800	33 ≦R＜50 mΩ
				± 600	50 ≦R＜100 mΩ
				± 200	100 ≦R＜1000 mΩ
RTT06 (1206)	1/3W	5.77A	14.42A	± 1500	10 ≦R＜19 mΩ
				± 1200	19 ≦R＜25 mΩ
				± 1000	25 ≦R＜50 mΩ
				± 600	50 ≦R＜100 mΩ
				± 200	100 ≦R＜1000 mΩ
RTT12 (1210)	1/2W	7.07A	17.67A	± 1500	10 ≦R＜19 mΩ
				± 1000	19 ≦R＜25 mΩ
				± 700	25 ≦R＜50 mΩ
				± 400	50 ≦R＜100 mΩ
				± 200	100 ≦R＜1000 mΩ
RTT20 (2010)	3/4W	8.66A	21.65A	± 1500	10 ≦R＜19 mΩ
				± 1200	19 ≦R＜25 mΩ
				± 900	25 ≦R＜50 mΩ
				± 500	50 ≦R＜100 mΩ
				± 200	100 ≦R＜1000 mΩ
RTT25 (2512)	1 W	10A	25A	± 1500	10 ≦R＜19 mΩ
				± 1200	19 ≦R＜25 mΩ
				± 900	25 ≦R＜50 mΩ
				± 500	50 ≦R＜100 mΩ
				± 200	100 ≦R＜1000 mΩ
Operating Temperature Range				−55℃ ~ +155℃	

3.3 Power Derating Curve:

Type	RTT01 (0201)	Other
Operating Temperature Range	**−55℃ ~ +125℃**	**−55℃ ~ +155℃**
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		

3.4 Voltage Rating or Current Rating:

3.4.1 Resistance Range: ≧1Ω

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)

3.4.2 Resistance Range: ＜1Ω

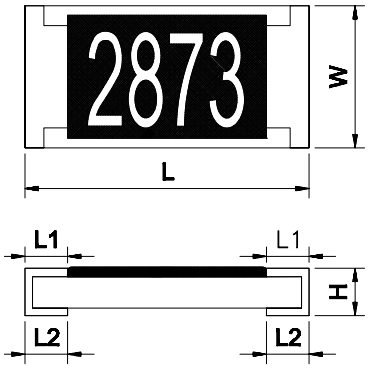
Rated Current: The resistor shall have a DC continuous working current or a rms. AC continuous working current at commercial-line frequency and wave form corresponding to the power rating, as determined from the following:

$I = \sqrt{P/R}$

I= Rated current (A)
P= Power rating (w)
R= Nominal resistance(Ω)

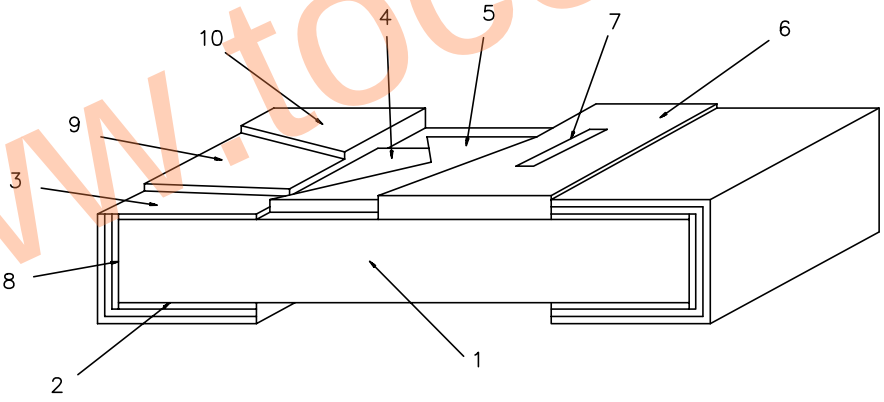
4 Dimensions

Unit : mm



TYPE \ Dimensions / Size Code	L	W	H	L1	L2
RTT01	0201	0.60± 0.03	0.30± 0.03	0.23± 0.03	0.15± 0.05	0.15± 0.05
RTT02	0402	1.00± 0.10	0.50± 0.05	0.30± 0.05	0.20± 0.10	0.25± 0.10
RTT03	0603	1.60± 0.10	0.80± 0.10	0.45± 0.10	0.30± 0.15	0.30± 0.15
RTT05	0805	2.00± 0.10	1.25± 0.10	0.50± 0.10	0.35± 0.20	0.35± 0.15
RTT06	1206	3.05± 0.10	1.55± 0.10	0.55 +0.10 -0.05	0.45± 0.20	0.35± 0.15
RTT12	1210	3.05± 0.10	2.55± 0.10	0.55± 0.10	0.50± 0.20	0.50± 0.20
RTT20	2010	5.00± 0.20	2.50± 0.20	0.55± 0.10	0.60± 0.20	0.60± 0.20
RTT25	2512	6.30± 0.20	3.20± 0.20	0.55± 0.10	0.60± 0.20	0.60± 0.20

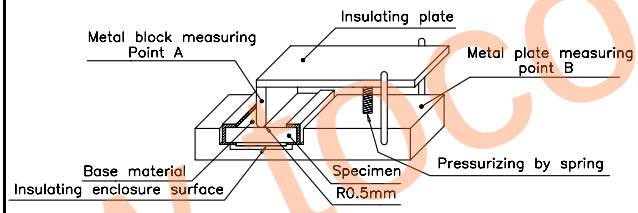
5 Structure Graph



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

<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>Temperature Coefficient of Resistance</td><td>TCR（ppm / ℃）$= \frac{(R2-R1)}{R1\,(T2-T1)} \times 10^6$
R1: Resistance at room temperature
R2: Resistance at -55℃ or +125℃
T1: Room temperature
T2: Temperature -55℃ or +125℃
Refer to JIS-C5201-1 4.8</td><td>Refer to item 3. general specifications</td><td>NA</td></tr>
<tr><td>Short Time Overload</td><td>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)
Jumper : Applied Maximum overload current
<table>
<tr><th>Jumper \ Type</th><th>RTT01 (0201)</th><th>RTT02 (0402)</th><th>RTT03 (0603)</th><th>RTT05 (0805)</th><th>RTT06 (1206)</th><th>RTT12 (1210)</th><th>RTT20 (2010)</th><th>RTT25 (2512)</th></tr>
<tr><td>± 5%</td><td>1.25A</td><td>2.5A</td><td>2.5A</td><td>5A</td><td>5A</td><td>5A</td><td>5A</td><td>5A</td></tr>
<tr><td>± 1%</td><td>1.25A</td><td>3.75A</td><td>5A</td><td>6.25A</td><td>8.75A</td><td>10A</td><td>12.5A</td><td>17.5A</td></tr>
</table>
Refer to JIS-C5201-1 4.13</td><td>1.Resistance Range:≧1Ω
0.1%、0.5%、1%:± (1.0%+0.05Ω)
2%、5%:± (2.0%+0.10Ω)
2.Resistance Range:<1Ω
1%、2%、5%:± (2.0%+0.001Ω)
No evidence of mechanical damage.</td><td>Refer to item 3. general specifications</td></tr>
<tr><td>Insulation Resistance</td><td>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
 
</td><td>≧10^9Ω</td><td></td></tr>
<tr><td>Dielectric Withstand Voltage</td><td>Put the resistor in the fixture, add VAC (see SPEC below) in +,- terminal for.
RTT05、06、12、20、25 apply 500 VAC 1 minute.
RTT01、02、03 apply 300 VAC 1 minute.
Refer to JIS-C5201-1 4.7</td><td>No short or burned on the appearance.</td><td></td></tr>
<tr><td>Intermittent Overload</td><td>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
<table>
<tr><th>Jumper \ Type</th><th>RTT01 (0201)</th><th>RTT02 (0402)</th><th>RTT03 (0603)</th><th>RTT05 (0805)</th><th>RTT06 (1206)</th><th>RTT12 (1210)</th><th>RTT20 (2010)</th><th>RTT25 (2512)</th></tr>
<tr><td>± 5%</td><td>1.25A</td><td>2.5A</td><td>2.5A</td><td>5A</td><td>5A</td><td>5A</td><td>5A</td><td>5A</td></tr>
<tr><td>± 1%</td><td>1.25A</td><td>3.75A</td><td>5A</td><td>6.25A</td><td>8.75A</td><td>10A</td><td>12.5A</td><td>17.5A</td></tr>
</table>
Refer to JIS-C5201-1 4.13</td><td>1.Resistance Range:≧1Ω
± (5.0%+0.10Ω)
2.Resistance Range:<1Ω
± (5.0%+0.001Ω)</td><td>Refer to item 3. general specifications</td></tr>
<tr><td>Noise Level</td><td>Refer to JIS-C5201-1 4.12</td><td>
<table>
<tr><th>Resistance</th><th>Noise</th></tr>
<tr><td>R ＜100Ω</td><td>≦-10db(0.32 uV/V)</td></tr>
<tr><td>100Ω ≦R＜1KΩ</td><td>≦ 0db(1.0 uV/V)</td></tr>
<tr><td>1KΩ ≦R＜10KΩ</td><td>≦ 10db(3.2 uV/V)</td></tr>
<tr><td>10KΩ ≦R＜100KΩ</td><td>≦ 15db(5.6 uV/V)</td></tr>
<tr><td>100KΩ ≦R＜1MΩ</td><td>≦ 20db(10 uV/V)</td></tr>
<tr><td>1MΩ ≦R</td><td>≦ 30db(32 uV/V)</td></tr>
</table>
</td><td>NA</td></tr>
</table>

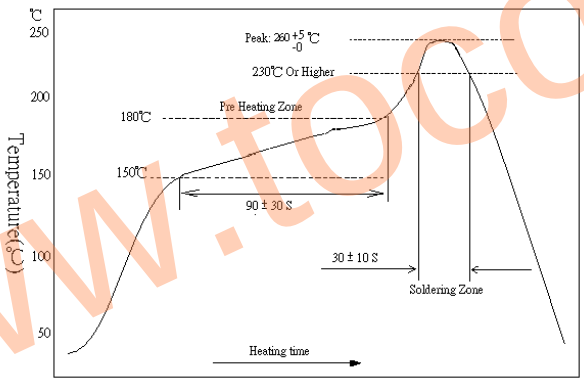
6.2 Mechanical Performance Test

<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>Core Body Strength</td><td>Applied R0.5 test probe at its central part then pushing 10N｛1.02 Kgf｝ force on the sample for 10 sec.
1.RTT02、RTT03：probe R0.2
2.RTT05、06、12、20、25：probe R0.5
Refer to JIS-C5201-1 4.15</td><td>1.Resistance Range:≧1Ω
± (1.0%＋0.05Ω)
2.Resistance Range:<1Ω
± (1.0%＋0.001Ω)
No evidence of mechanical damage.
No side conductive peel off.</td><td>Refer to item 3. general specifications</td></tr>
<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. (RTT01:3N)
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 : RTT01≧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 hr, and measured its resistance variance rate.
Refer to JIS-C5201-1 4.29</td><td>1.Resistance Range:≧1Ω
<table><tr><td>Type</td><td>RTT01</td><td>Other</td></tr><tr><td>△R%</td><td>± (1.0%+0.05Ω)</td><td>± (0.5%+0.05Ω)</td></tr></table>2.Resistance Range:<1Ω
± (1.0%＋0.001Ω)
No evidence of mechanical damage, no G2 overcoating and Sn layer by leaching.</td><td>Refer to item 3. general specifications</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× 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 (solder pot test):
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.
◎Test item 2 (wetting balance method):
Add flux into resistors, then put resistor into wetting balance machine, refer to condition as below, then must be measured and recorded its time changed.
<table><tr><td colspan="2">Testing conditions for wetting balance method with solder pot</td></tr><tr><td></td><td>Condition</td></tr><tr><td>Solder temperature</td><td>235± 2℃</td></tr><tr><td>Immersion speed</td><td>1 to 5 mm/s</td></tr><tr><td>Immersion depth</td><td>0.10 mm</td></tr><tr><td>Immersion angle</td><td>Horizontal</td></tr><tr><td rowspan="3">Mass of solder ball</td><td>5mg →0201</td></tr><tr><td>25mg →0402、0603</td></tr><tr><td>200mg→0805、1206、1210、2010、2512</td></tr></table>By SONY (SS-00254-2)
Refer to JIS-C5201-1 4.17</td><td colspan="2">1.Test item 1:
Solder coverage over 95%
2.Test item 2:
Zero cross time within 3 seconds.</td></tr>
</table>

ITEM	Conditions	Specifications	
		Resistors	Jumper
Resistance to Soldering Heat	◎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℃ or lower and a humidity of 70% RH or lower.	1.Resistance Range:≧1Ω △R%=± (1.0%+0.05Ω) 2.Resistance Range:<1Ω △R%=± (1.0%+0.001Ω)	Refer to item 3. general specifications
		No evidence of electrode damage. No side conductive peel off.	

Step	Procedure	Environmental test condition
1	Resistance measuring	Room temperature
2	Baking	125℃， 24 hours
3	Humidification	85℃，85%，168 hours
4	Reflow (1)	Reflow temperature curve and component surface temperature Table 1
5	Humidification	85℃，65%，24 hours
6	Reflow (2)	Reflow temperature curve and component surface temperature Table 2
7	Resistance measuring	Room temperature

◎Reflow temperature curve

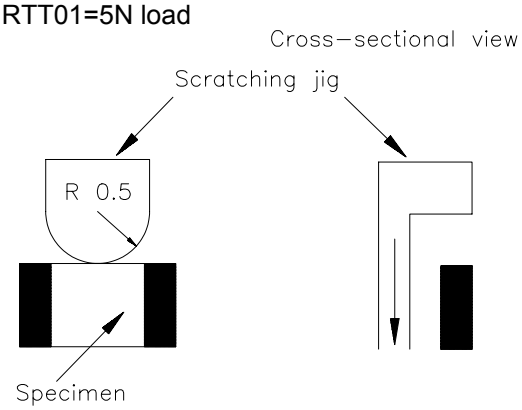
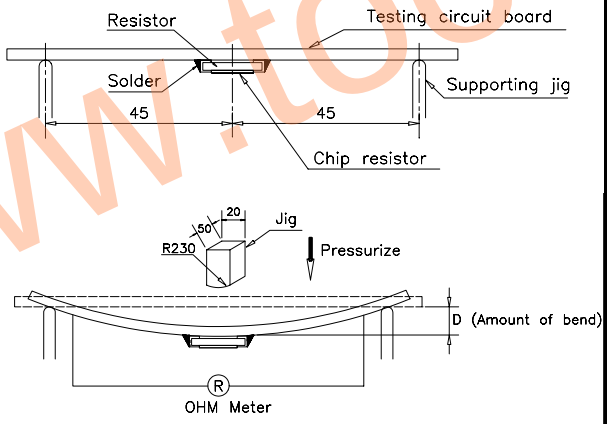


◎Component surface temperature

Table 1 Description example in specification document (1)

Temperature -retaining time :230℃ or higher	Peak temperature	Temperature measured at the component body surface during preheating
30 seconds	240℃	150 to 160 ℃

ITEM	Conditions	Specifications	
		Resistors	Jumper
	Table 2 Description example in specification document (2) Temperature / Temperature -retaining time / Temperature measured at the component body surface during preheating 220℃ or higher — 90 seconds 230℃ or higher — 60 seconds 240℃ or higher — 5 seconds Peak — 245℃ 150 to 160℃ ◎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℃ or lower and a humidity of 70% RH or lower. Step / Procedure / Environmental test condition 1 / Resistance measuring / Room temperature 2 / Baking / 125℃，24 hours 3 / Humidification / 85℃，85%，168 hours 4 / Solder pot test / 260± 3℃，10 sec 5 / Placed / 85℃，65%，24 hours 6 / Solder pot test / 260± 3℃，10 sec 7 / Resistance measuring / Room temperature ◎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. By Sony (SS-00254-5) Refer to JIS-C5201-1 4.18		
Joint Strength of Solder	Preconditioning Put tested resistor in the apparatus of PCT, at a temperature of 105℃, humidity of 100% RH, and pressure of 1.22×10^5 Pa for a duration of 4 hours. Then after left the specimen in a temperature for 2 hours or more. Test method: ◎Test item 1 (Adhesion): A static load using a R0.5 (0201:R0.1) scratch tool shall be applied on the core of the component and in the direction of the arrow and held for 10	Test item 1: (1).Vaviance rate on resistance 1.Resistance Range:≧1Ω △R%=± (1.0%+0.05Ω) 2.Resistance Range:<1Ω △R%=± (1.0%+0.001Ω) (2).No evidence of mechanical damage No terminal peel off.	Refer to item 3. general specifications

ITEM	Conditions	Specifications	
		Resistors	Jumper
	seconds and under load measured its resistance variance rate. 1.RTT02=10N load 2.Other type=20N load 3.RTT01=5N load  Refer to JIS-C5201-1 4.32	Test item 2: (1).Vaviance rate on resistance 1.Resistance Range:≧1Ω △R%=± (1.0%+0.05Ω) 2.Resistance Range:<1Ω △R%=± (1.0%+0.001Ω) (2).No evidence of mechanical damage. No terminal peel off and core body cracked. 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.	
	◎Test item 2 (Bending Strength): Solder tested resistor on to PC board. add force in the middle down , and under load measured its resistance variance rate . D:RTT02、03、05=5mm RTT01、06、12=3mm RTT20、25=2mm  Refer to JIS-C5201-1 4.33		
	◎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.		

<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></td><td>Table 1 Temperature cycle test condition
<table><tr><th></th><th>Testing condition</th></tr><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></table>By SONY (SS-00254-7)</td><td></td><td></td></tr>
<tr><td>Leaching Test</td><td>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)</td><td colspan="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.</td></tr>
<tr><td rowspan="2">Vibration</td><td rowspan="2">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 :1.5 mm
This motion shall be applied for a period of 2 hours in
each 3 mutually perpendicular directions (a total of 6 hr)
Refer to JIS-C5201-1 4.22</td><td>1.Resistance Range : ≧1 Ω
0.1%、0.5%、1%:± (0.5%+0.05Ω)
2%、5%:± (1.0%+0.05Ω)
2. :Resistance Range : <1 Ω
1%、2%、5%:± (1.0%+0.001Ω)</td><td>Refer to item 3. general specifications</td></tr>
<tr><td colspan="2">No evidence of mechanical damage.</td></tr>
</table>

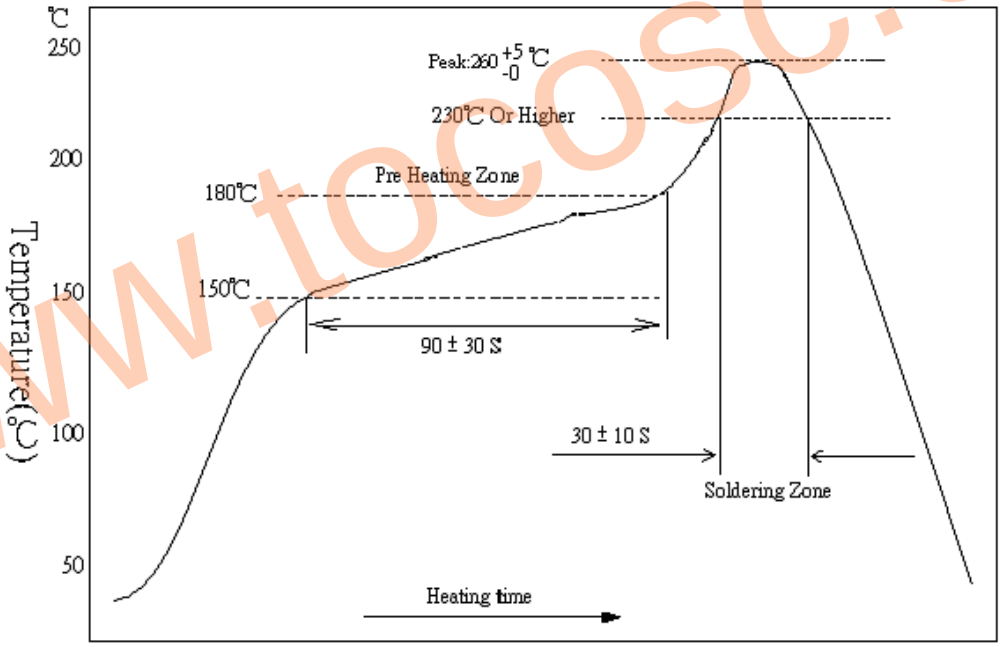
6.3 Environmental Test

<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.
P.S RTT01 for 125± 3℃
Refer to JIS-C5201-1 4.25</td><td>1.Resistance Range:≧1Ω
0.1%、0.5%、1%:± (1.0%+0.05Ω)
2%、5%:± (2.0%+0.10Ω)
2.Resistance Range:<1Ω
1%、2%、5%:± (1.0%+0.001Ω)
No evidence of mechanical damage.</td><td>Refer to item 3. general specifications</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></th><th>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>1.Resistance Range:≧1Ω
0.1%、0.5%、1%:± (0.5%+0.05Ω)
2%、5%:± (1.0%+0.05Ω)
2.Resistance Range:<1Ω
1%、2%、5%:± (1.0%+0.001Ω)
No evidence of mechanical damage.</td><td>Refer to item 3. general specifications</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>1.Resistance Range:≧1Ω
<table><tr><th>Type</th><th>RTT01</th><th>其它</th></tr><tr><td>Range</td><td>1%:± (1.0%+0.05Ω)
5%:± (3.0%+0.1Ω)</td><td>0.1%、0.5%、1%:
± (0.5%+0.05Ω)
2%、5%:
± (2.0%+0.10Ω)</td></tr></table>2.Resistance Range:<1Ω
1%、2%、5%:± (2.0%+0.001Ω)
No evidence of mechanical damage.</td><td>Refer to item 3. general specifications</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>1.Resistance Range:≧1Ω
0.1%、0.5%、1%:± (1.0%+0.05Ω)
2%、5%:± (3.0%+0.10Ω)
2.Resistance Range:<1Ω
1%、2%、5%:± (2.0%+0.001Ω)
No evidence of mechanical damage.</td><td>Refer to item 3. general specifications</td></tr>
<tr><td>Low Temperature Operation</td><td>Put the tested resistor in the chamber at room temperature 25℃. Decreasing the temperature to -55℃ and keep the temperature at -55℃ 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</td><td>1.Resistance Range:≧1Ω
0.1%、0.5%、1%:± (0.5%+0.05Ω)
2%、5%:± (1.0%+0.05Ω)
2.Resistance Range:<1Ω
1%、2%、5%:± (1.0%+0.001Ω)
No evidence of mechanical damage.</td><td>Refer to item 3. general specifications</td></tr>
<tr><td>Whisker Test</td><td>◎Test item 1 (Thermal Shock test):
<table><tr><td>Minimum storage temperature</td><td>-40± 2℃</td></tr><tr><td>Maximum storage temperature</td><td>85± 2℃</td></tr><tr><td>Temperature-retaining time</td><td>7 min.</td></tr><tr><td>Number of temperature cycles</td><td>1,500</td></tr></table></td><td colspan="2">Max. 50μm</td></tr>
</table>

ITEM	Conditions	Specifications	
		Resistors	Jumper
	◎Test item 2 (Constant temperature/humidity test): Temperature: 85℃ Humidity: 85% Testing duration: 500± 4 hours ◎Inspection: Inspect for whisker formation on specimens that underwent the acceleration test specified in subcause 4.2, with a magnifier (stere omicroscope) 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)		

7 Recommend Soldering Method

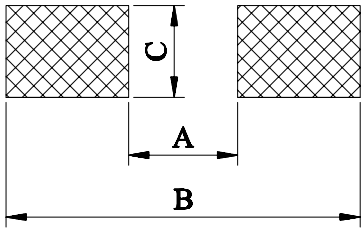
7.1 Lead Free Reflow Soldering Profile



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

7.2 Soldering Iron: temperature 350℃± 10℃, dwell time shall be less than 3 sec.

8 Recommend Land Pattern Design *(For Reflow Soldering)*



Unit : mm

TYPE \ DIM	A	B	C
RTT01	0.3	1.0	0.4
RTT02	0.5	1.5	0.6
RTT03	0.8	2.1	0.9
RTT05	1.2	3.0	1.3
RTT06	2.2	4.2	1.6
RTT12	2.2	4.2	2.8
RTT20	3.5	6.1	2.8
RTT25	3.8	8.0	3.5

9 Marking Diagrams

9.1 Resistance Range: ≧1Ω

9.1.1 RTT03、05 、06 、12 、20 、25 ± 2%、± 5% Tolerance:

9.1.1.1 Resistance Range ≧10Ω: 3 digits in E-24 series, first two digits are significant figures, third digit is multiplier (10^{x}).

《EX》Marking→100

100＝10× 10^{0} ＝10Ω

9.1.1.2 Resistance Range＜10Ω: 3 digits in E-24 series, first and thrid digits are significant figures, second digit is multiplier (10^{-1}).

《EX》Marking→4R7

4R7＝47× 10^{-1} ＝4.7Ω

9.1.2 RTT05 、06 、12 、20 、25 ± 0.1%、± 0.5%、± 1% Tolerance:

9.1.2.1 Resistance Range≧100Ω: 4 digits in E-24 series or E-96 series, first three digits are significant figures, forth digit is multiplier (10^{x}).

《EX》Marking→1002

1002＝100× 10^{2} ＝10000Ω＝10KΩ

9.1.2.2 Resistance Range＜100Ω: 4 digits in E-24 series or E-96 series, three digits are significant figures, R digit is multiplier (10^{x}).

《EX》Marking→10R2 ,R digit is multiplier (10^{-1}).

10R2＝102× 10^{-1} ＝10.2Ω

Marking→1R02 ,R digit is multiplier (10^{-2}).

1R02＝102× 10^{-2} ＝1.02Ω

9.1.3 RTT03 ± 0.1%、± 0.5%、± 1% Tolerance:
For EIAJ-96 Marking.

《EX》Marking→47B

47B＝301× 10^1 ＝3010Ω＝3.01KΩ

If the resistance is not in E-96 series and in E-24 series ,the marking is expressed by E-24 series and one short bar under marking letter.

R value ＞100Ω:marking 391 391=39 x10^1=390Ω

R value ＜100Ω:marking 390 390=39 x10^0=39Ω

9.2 Resistance Range: ＜1Ω

9.2.1 RTT03、05 、06 、12、20 、25 ± 1%、± 2%、± 5% Tolerance:

9.2.1.1 Resistance Range≧100 mΩ: 4 digits in E-24 series or E-96 series, later three digits are significant figures, first digit is multiplier (10^{-3}).

《EX》Marking→R220 (E-24 series)

R220＝220× 10^{-3} ＝0.22Ω＝220mΩ

Marking→R102 (E-96 series)

R102＝102× 10^{-3} ＝0.102Ω＝102mΩ

9.2.1.2 Resistance Range＜100 mΩ: 4 digits in E-24 series, later two digits are significant figures, first digit is multiplier (10^{-3}).

《EX》Marking→R022

R022＝22× 10^{-3} ＝0.022Ω＝22mΩ

9.3 RTT 0R:

9.3.1 RTT03、05、06、12、20、25 ± 1% Tolrerance：The marking is expressed by " 000 ".

9.3.2 RTT03、05、06、12、20、25 ± 5% Tolrerance：The marking is expressed by " 0 ".

9.4 RTT01、RTT02 No Marking

9.5 Marking

9.5.1 E-24 series

10	11	12	13	15	16	18	20	22	24	27	30
33	36	39	43	47	51	56	62	68	75	82	91

9.5.2 E-96 series

100	102	105	107	110	113	115	118	121	124	127	130
133	137	140	143	147	150	154	158	162	165	169	174
178	182	187	191	196	200	205	210	215	221	226	232
237	243	249	255	261	267	274	280	287	294	301	309
316	324	332	340	348	357	365	374	383	392	402	412
422	432	442	453	464	475	487	499	511	523	536	549
562	576	590	604	619	634	649	665	681	698	715	732
750	768	787	806	825	845	866	887	909	931	953	976

9.5.3 EIAJ-96

This table shows the first two digits for the three-digits EIAJ-96 part marking scheme. The third character is a letter multiplier:

Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω
01	100	13	133	25	178	37	237	49	316	61	422	73	562	85	750
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	604	88	806
05	110	17	147	29	196	41	261	53	348	65	464	77	619	89	825
06	113	18	150	30	200	42	267	54	357	66	475	78	634	90	845
07	115	19	154	31	205	43	274	55	365	67	487	79	649	91	866
08	118	20	158	32	210	44	280	56	374	68	499	80	665	92	887
09	121	21	162	33	215	45	287	57	383	69	511	81	681	93	909
10	124	22	165	34	221	46	294	58	392	70	523	82	698	94	931
11	127	23	169	35	226	47	301	59	402	71	536	83	715	95	953
12	130	24	174	36	232	48	309	60	412	72	549	84	732	96	976

Y=10^{-2} X=10^{-1} A=10^{0} B=10^{1} C=10^{2} D=10^{3} E=10^{4} F=10^{5}

9.6 Marking Standard

Type \ Making	A	B	C	D	E	F	X	Y			
0603											

Type \ Making	1	2	3	4	5	6	7	8	9	0	R
0603											
0805											
1206											
1210											
2010 2512											

10 Plating Thickness

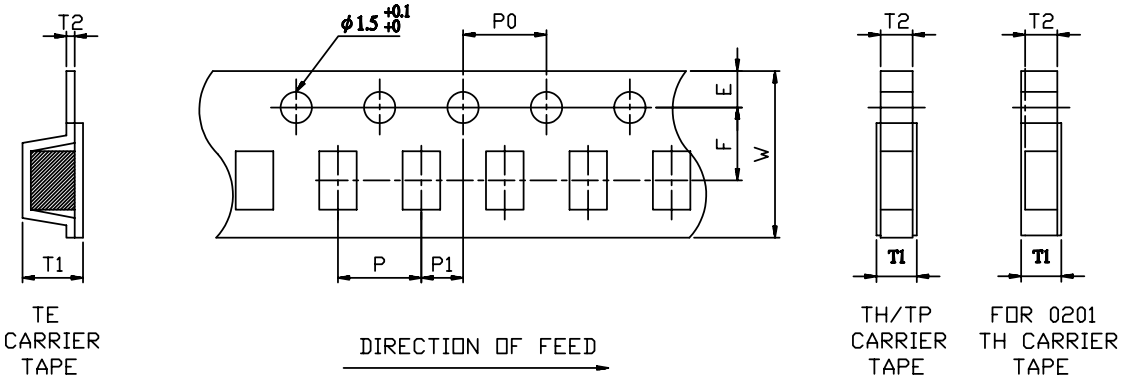
10.1Ni : ≧1μm

10.2Sn (Tin) : ≧3μm

10.3Sn (Tin) : Matte Sn

11 Taping Specifications

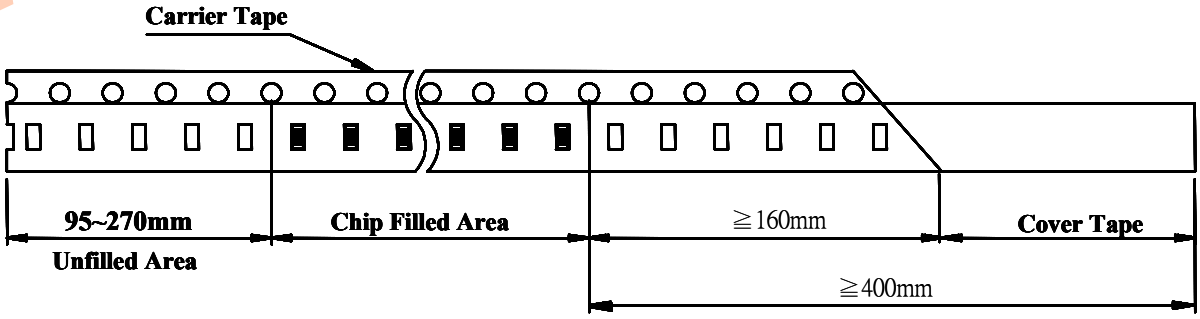
11.1 Tape Dimensions



Unit: mm

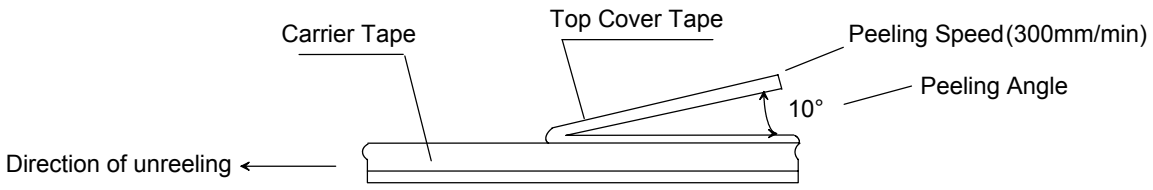
Packaging	DIM / TYPE	A	B	W	E	F	T1	T2	P	P0	10× P0	P1
TH Carrier Tape	RTT01	0.68± 0.03	0.38± 0.03	8.0± 0.1	1.75± 0.1	3.5± 0.05	0.45+0.1/-0	0.28± 0.02	2.0± 0.05	4.0± 0.05	40.0± 0.20	2.0± 0.05
	RTT02	1.15± 0.05	0.65± 0.05	8.0± 0.2	1.75± 0.1	3.5± 0.05	0.45+0.2/-0	0.45± 0.05	2.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05
TP Carrier Tape	RTT03	1.80± 0.1	1.00± 0.1	8.0± 0.2	1.75± 0.1	3.5± 0.05	0.60+0.2/-0	0.60± 0.1	4.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05
	RTT05	2.30± 0.1	1.55± 0.1	8.0± 0.2	1.75± 0.1	3.5± 0.05	0.75+0.2/-0	0.75± 0.1	4.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05
	RTT06	3.50± 0.2	1.90± 0.2	8.0± 0.2	1.75± 0.1	3.5± 0.05	0.75+0.2/-0	0.75± 0.1	4.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05
	RTT12	3.50± 0.2	2.80± 0.2	8.0± 0.2	1.75± 0.1	3.5± 0.05	0.75+0.2/-0	0.75± 0.1	4.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05
	RTT20	5.50± 0.2	2.80± 0.2	12.0± 0.2	1.75± 0.1	5.5± 0.05	0.75+0.2/-0	0.75± 0.1	4.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05
TE Carrier Tape	RTT20	5.50± 0.2	2.80± 0.2	12.0± 0.2	1.75± 0.1	5.5± 0.05	0.85± 0.15	0.23± 0.15	4.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05
	RTT25	6.70± 0.2	3.40± 0.2	12.0± 0.2	1.75± 0.1	5.5± 0.05	0.85± 0.15	0.23± 0.15	4.0± 0.1	4.0± 0.05	40.0± 0.20	2.0± 0.05

11.2 Lead Dimensions:



11.3Cover Tape Peel off Strength

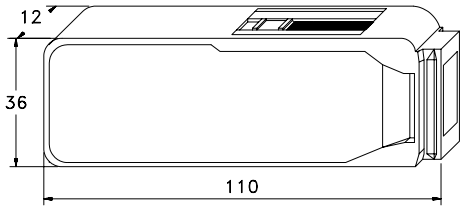
Specifications:0201、0402 => 0.07~0.5 N (7.1~51 gf)
0603、0805、1206、1210、2010、2512 => 0.07~0.7N (7.1~71.4gf)



11.4Packaging QTY:

TYPE	Tape Width	Packaging QTY (pcs / reel)													
		TH						TP				TE			
		2 mm Pitch						4 mm Pitch				4 mm Pitch			
		TH	H0	H2	H3	H4	H5	TP	P2	P3	P4	TE	E2	E3	E4
RTT01	8 mm	10,000	15,000	--	--	--	50,000	--	--	--	--	--	--	--	--
RTT02	8 mm	10,000	--	20,000	30,000	40,000	50,000	--	--	--	--	--	--	--	--
RTT03	8 mm	--	--	--	--	--	--	5,000	10,000	15,000	20,000	--	--	--	--
RTT05	8 mm														
RTT06	8 mm														
RTT12	8 mm														
RTT20	12 mm	--	--	--	--	--	--	--	--	--	--	4,000	8,000	12,000	16,000
RTT25	12 mm														
Reel Type		7”	7”	10”	13”	13”	13”	7”	10”	13”	13”	7”	10”	13”	13”

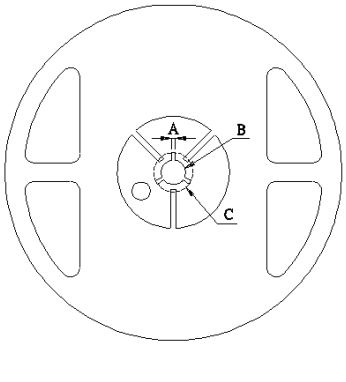
TYPE	Tape Width	Bulk Case (pcs / case)
RTT02	8 mm	50,000
RTT03	8 mm	25,000
RTT05	8 mm	10,000
RTT06	8 mm	5,000
RTT12	8 mm	--
RTT20	12 mm	
RTT25	12 mm	



11.4.1Typical taping type : TH、TP、TE
11.4.2Other taping type are upon customer’ s request.

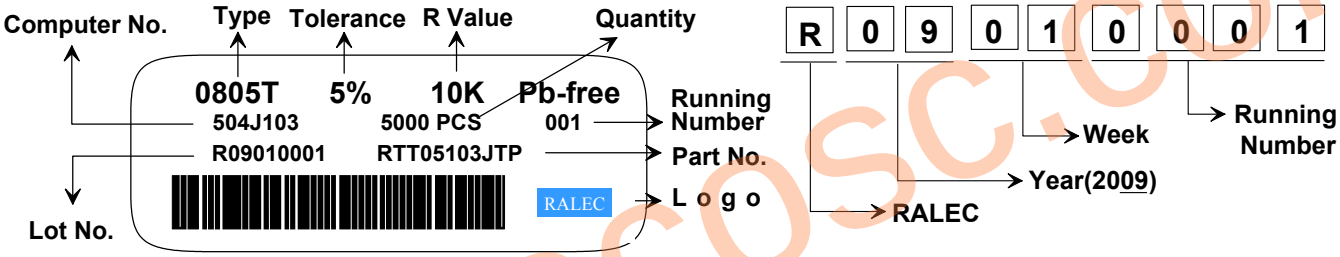
11.5Reel Dimensions:

Unit: mm



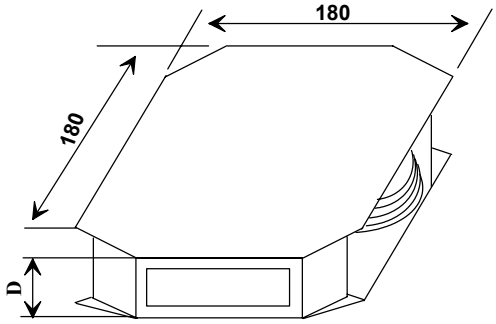
Reel Type/ Tape	Wa	M	A	B	C	D
7" reel for 8 mm tape	9.0 ± 0.5	178 ± 2.0	2.0 ± 0.5	13.5 ± 0.5	21.0 ± 0.5	60.0 ± 1.0
7" reel for 12 mm tape	13.8 ± 0.5	178 ± 2.0				80.0 ± 1.0
10" reel for 8 mm tape	10.0 ± 0.5	254 ± 2.0				100.0 ± 1.0
13" reel for 8 mm tape	10.0 ± 0.5	330 ± 2.0				100.0 ± 1.0

11.6Label:



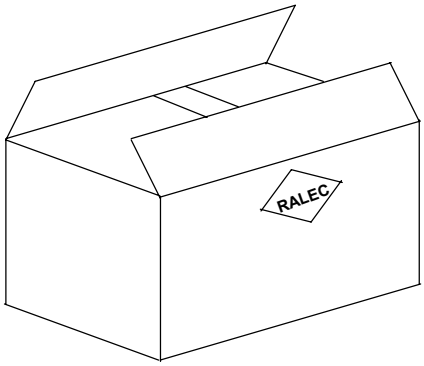
11.7 Inner Box

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



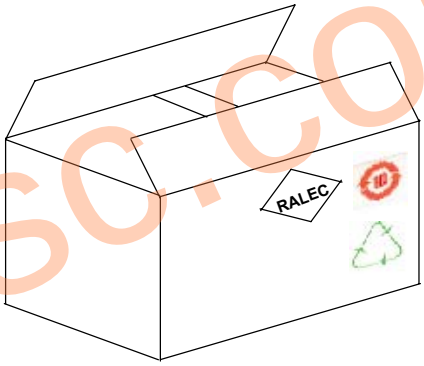
11.8Box

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



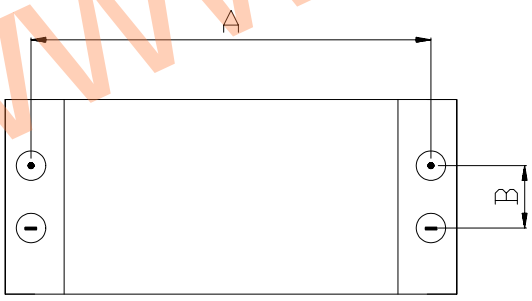
11.9Box (For China)

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



12Measurement Point

Bottom electrode



⊙ Current Terminal

⊖ Voltage Terminal

Unit : mm

TYPE \ DIM	A	B
RTT01	0.44± 0.05	0.22 ± 0.05
RTT02	0.80± 0.05	0.24 ± 0.05
RTT03	1.35± 0.05	0.35 ± 0.05
RTT05	1.80 ± 0.05	0.35 ± 0.05
RTT06	2.90 ± 0.05	0.35 ± 0.05
RTT12	2.90 ± 0.05	0.35 ± 0.05
RTT20	4.50 ± 0.05	1.15 ± 0.05
RTT25	5.90 ± 0.05	1.60 ± 0.05

13 Stock period

13.1 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.

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

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

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 exchusion items in RoHS(2002/95/EC).

15.1 Cadmium and cadmium compounds (permissive content＜100 ppm)

15.2 Lead and lead compounds (permissive content＜1000 ppm)

15.2.1 Exceptions specified:

15.2.1.1 Lead contained in the glass of cathode ray tubes, electronic components and fluorescent tubes.

15.2.1.2 The glass material used in the electronic components, which includes resistor elements, conductive pastes (silver or copper ones), adhesives, glass frit and sealing materials.

15.3 Mercury and its mercury compounds (permissive content＜100 ppm)

15.4 Hexavalent chromium compounds (permissive content＜100 ppm)

15.5 Polybrominated biphenyls(PBB)(permissive content＜100 ppm)

15.6 Polybrominated diphenylethers(PBDE)(permissive content＜100 ppm)

16 Attachments

16.1 Document Revise Record Paper