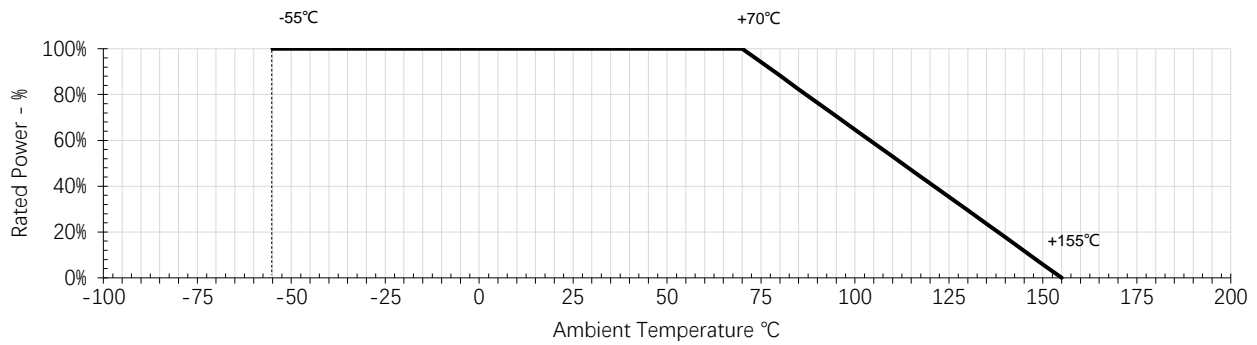


POWER DERATING CURVE



Note: Operating temperature range is from -55°C to +155°C

RATED VOLTAGE

Resistors should have a Rated Voltage DC or AC corresponding to Rated Power which can be calculated by formula as below.

The Rated Voltage of certain resistance value should be the calculated result or Max. Working Voltage of product series whichever less.

Formula:

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

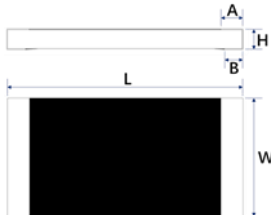
E=Rated voltage(V)

P=Rated power(W)

R=Nominal resistance(Ω)

DIMENSIONS

Unit: mm

Figure	Type	L	W	H	A	B
	TL0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
	TL0402	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
	TL0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
	TL0805	2.00±0.15	1.25±0.15	0.55±0.10	0.40±0.20	0.40±0.20
	TL1206	3.10±0.15	1.55±0.15	0.55±0.10	0.45±0.20	0.45±0.20
	TL1210	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
	TL2010	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
	TL2512	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20

RELIABILITY

Item	Test Method	Acceptable criterion
Temperature Coefficient of Resistance (T.C.R.)	$TCR(PPM/°C) = \frac{(R_2 - R_1)}{R_1 \times (T_2 - T_1)} \times 10^6$ R ₁ =Value in room temperature R ₂ =Value in test temperature -55°C or +125°C T ₁ =Room temperature T ₂ =Test temperature -55°C or +125°C Reference: IEC 60115-1 6.2	TL0201: 1Ω ≤ R ≤ 10Ω: -100~+350PPM/°C > 10Ω: ±200PPM/°C TL0402~2512: 1Ω ≤ R ≤ 10Ω: ±200PPM/°C > 10Ω: ±100PPM/°C
Insulation Resistance	Using the parallel clamp method: 100±15V _{DC} voltage is applied between the electrode and the substrate within 60 seconds. Test the insulation resistance between the terminal and the back of the part. Reference: IEC 60115-1 12.1.3.5	≥ 10 ⁹ Ω

TL Series

Total Lead-free Thick Film Chip Resistors

Version. A



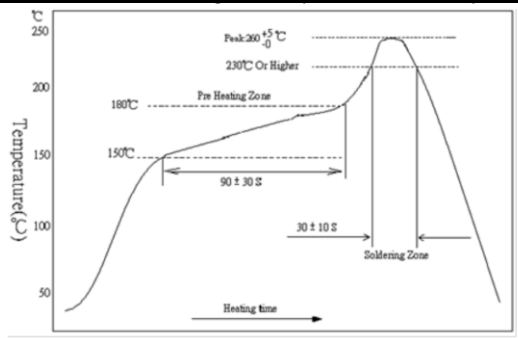
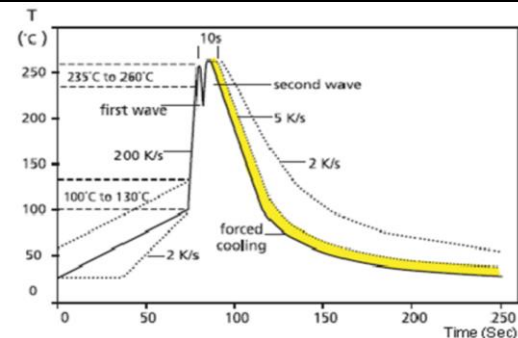
Item	Test Method	Acceptable criterion								
Dielectric Withstanding Voltage	An alternating current with an effective value of the maximum overload voltage is applied between the electrode and the substrate at a rate of approximately 100V/sec. Pressure, maintain 60± 5 sec. The test voltage reference to the DWV in characteristics. Reference: IEC 60115-1 12.2.4	Test to confirm if the presence of current or arc breakdown by $\geq 10\mu A$								
Short Time Over Load	Apply 2.5 times of rated voltage or maximum overload voltage (whichever is the smallest) for 5 seconds Reference: IEC 60115-1 8.1.4.2	1% series: $\Delta R/R=\pm 1.0\%$ 5% series: $\Delta R/R=\pm 2.0\%$								
Intermittent Overload	Put it in the thermostat, apply 2.5 times of rated voltage, 1 second ON, 25 seconds OFF, 10000_{-0}^{+400} cycles, take it out and stand for 60 minutes, then measure the change rate of resistance value. Reference: IEC 60115-1 8.4.4	$\Delta R/R=\pm 5.0\%$								
Resistance to Solvent	Immerse in isopropanol solvent at room temperature ($23\pm 5^{\circ}C$) for 5min, wipe 10 times with a hard toothbrush, repeat 3 times, take out and blow dry for examination Reference: IEC 60115-1 11.3.2 method1	No obvious damage, peeling, swelling phenomenon								
Solderability	Pretreatment: dry heat $155^{\circ}C$, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs. Test method: 1. Dip the resistance in a tin furnace at $245\pm 3^{\circ}C$ for 3 seconds, then take it out and observe the solder area under a microscope; 2. Reflow soldering test, Peak Temperature: $235^{\circ}C$, $T=40\pm 5$ sec. Reference: IEC 60115-1 11.1.4.3	1. Solder coverage over 95% 2. No welding refusal phenomenon, side soldering height is greater than 1/2 of the height								
Leaching	Pretreatment: dry heat $155^{\circ}C$, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs. dip in a tin furnace at $260_{-0}^{+5}^{\circ}C$ for 30_{-0}^{+1} seconds, remove and wash. Observe the area of solder under a microscope Reference: IEC-60068-2-58	No electrode is eroded to expose the substrate phenomenon								
Resistance to Soldering Heat	The tested resistor be immersed into molten solder of $260_{-0}^{+5}^{\circ}C$ for 10 seconds. Then the resistor is left in the room for 1 hr., then measure the change rate of resistance value Reference: IEC 60115-1 11.2.4.3	$\Delta R/R=\pm 1.0\%$								
Thermal Shock	High and low temperature test is carried out according to the upper and lower limits of the application temperature of the parts, the residence time of the upper and lower limits of the temperature is 30min, and the temperature conversion time is less than 30s, lasting 500 cycles Reference: IEC 60115-1 10.1.4	$\Delta R/R=\pm 1.0\%$								
Solder Joint Endurance Test	The SMD resistance was welded to the test board and bent with the standard pressure block. After standing for 60 sec. under the corresponding deformation condition, the change rate of resistance value of the part was tested. <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Size</td> <td style="text-align: center;">0402, 0603, 0805</td> <td style="text-align: center;">0201, 1206, 1210</td> <td style="text-align: center;">2010, 2512</td> </tr> <tr> <td style="text-align: center;">Depth</td> <td style="text-align: center;">5mm</td> <td style="text-align: center;">3mm</td> <td style="text-align: center;">2mm</td> </tr> </table> Reference: IEC 60115-1 9.8.4	Size	0402, 0603, 0805	0201, 1206, 1210	2010, 2512	Depth	5mm	3mm	2mm	$\Delta R/R=\pm 1.0\%$
Size	0402, 0603, 0805	0201, 1206, 1210	2010, 2512							
Depth	5mm	3mm	2mm							
Resistance to Dry Heat	Put it in an oven at $155\pm 5^{\circ}C$ for 1000_{-0}^{+48} hrs., take it out and let it stand for more than 1hr., then measure the change rate of resistance value Reference: IEC 60115-1 7.3	1% series: $\Delta R/R=\pm 1.0\%$ 5% series: $\Delta R/R=\pm 3.0\%$								
Loading Life in Moisture	Place it in a constant temperature and humidity box with $40\pm 2^{\circ}C$ and 90~95%RH and apply the rated voltage with 90 minutes ON and 30 minutes OFF, 1000 hrs. Take it out and stand for 60 minutes, and then measure the change rate Reference: IEC 60115-1 10.4	1% series: $\Delta R/R=\pm 1.0\%$ 5% series: $\Delta R/R=\pm 3.0\%$								
Load Life	Put in an oven at $70\pm 2^{\circ}C$, apply rated voltage, 90 min ON, 30 min OFF, 1000 hrs., take out and stand for more than 60 min, then measure the resistance change rate. Reference: IEC 60115-1 7.1	1% series: $\Delta R/R=\pm 1.0\%$ 5% series: $\Delta R/R=\pm 3.0\%$								
Low temperature load test	$-55^{\circ}C$, unpowered, 1 hr.: Rated voltage/current for 45 minutes, then unpowered within 15 minutes, return to room temperature, take out and stand for 24 hours, then measure the change rate of resistance value. Reference: IEC 60115-1 10.2.4	1% series: $\Delta R/R=\pm 1.0\%$ 5% series: $\Delta R/R=\pm 2.0\%$								

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Item	Test Method	Acceptable criterion												
Shear force test	Weld the part to the PCB. Apply the corresponding test stress from the side of the part with the test terminal for 10s. Check the appearance of the welded end of the part under the stress condition	Without obvious damage.												
	<table border="1"> <tr> <td>Size</td> <td>0201</td> <td>0402, 0603</td> <td>0805</td> <td>1206, 1210</td> <td>2010, 2512</td> </tr> <tr> <td>Test force</td> <td>2N</td> <td>5N</td> <td>9N</td> <td>25N</td> <td>45N</td> </tr> </table>		Size	0201	0402, 0603	0805	1206, 1210	2010, 2512	Test force	2N	5N	9N	25N	45N
	Size		0201	0402, 0603	0805	1206, 1210	2010, 2512							
Test force	2N	5N	9N	25N	45N									
Reference: IEC 60115-1 9.7														

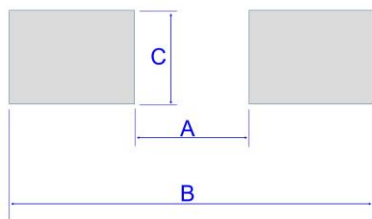
SOLDERING TEMPERATURE

- Recommendation only. Please adjust it according to the actual application

Lead-free IR Reflow Soldering Profile	Lead-free Double-Wave Soldering Profile
	
<p>Note:</p> <ul style="list-style-type: none"> • The Max. Temp. is 260^{+5}_{-0}°C within 10 sec • Reference: J-STD-020D 	<p>Note:</p> <ul style="list-style-type: none"> • Suit for \geq 0603 size • Manual soldering in 350 ± 10°C within 3 sec.

SOLDERING PAD

Resistance value would be lower than nominal value because of joint with soldering material, so designing circuit should adjust the pad size



Unit: mm

Type	A	B	C
TL0201	0.3	1.0	0.4
TL0402	0.5	1.5	0.6
TL0603	0.8	2.1	0.9
TL0805	1.2	3.0	1.3
TL1206	2.2	4.2	1.6
TL1210	2.2	4.2	2.8
TL2010	3.5	6.1	2.8
TL2512	3.8	8.0	3.5

WORKING ENVIRONMENT

If user intends to use products in special environments or states (including but not limited to the following), it is necessary to approve special characteristics and reliability for the following or other application environments.

- High temperature, high moisture.
- Near the sea, or corrosive gas, such as Cl₂, H₂S, NH₃, SO₂ and NO₂, etc.
- Unverified liquids, such as water, oil, chemical or organic solvent.
- Unverified resin or paint to cover products.
- Products should be washed with water soluble cleaner even if non cleaning flux.

STORAGE / CARRY CONDITIONS

- A. Temperature: 25±5°C
- B. Humidity: 60±15%RH
- C. Storage life: 0201 size: 1 year; ≥0402 size: 2 years. FIFO.
- D. Please hold box correct orientation when storing and carrying. It is strictly prohibited to fall or squeeze the box, otherwise the product electrode or body may be damaged.

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