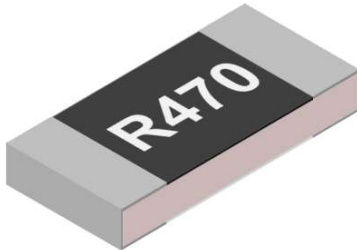




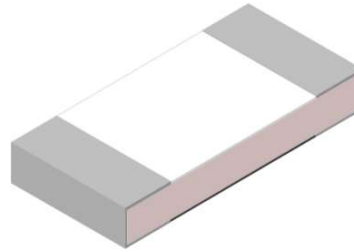
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Ultra Anti-Surge Low-Resistance Metal Film Chip Resistor — TUL Series



Top view



Bottom view

Application

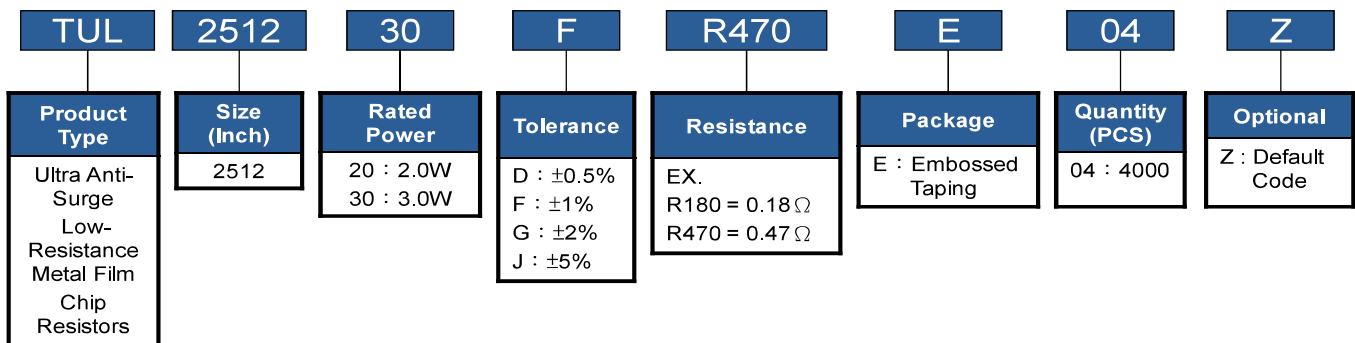
- Consumer electronics
- Computer & relative products
- Communication devices
- Measuring instrument
- Industrial / Power supply
- Battery management system

Features

- Low Resistance / TCR
- Excellent high-frequency characteristics($\leq 2nH$)
- Excellent long-term stability
- High precision current sensing
- Ultra Anti-surge characteristics superior to standard Others metal film resistors
- Halogen free and lead free
- RoHS compliant
- AEC-Q200 compliant

Parts Number Explanation

Example:





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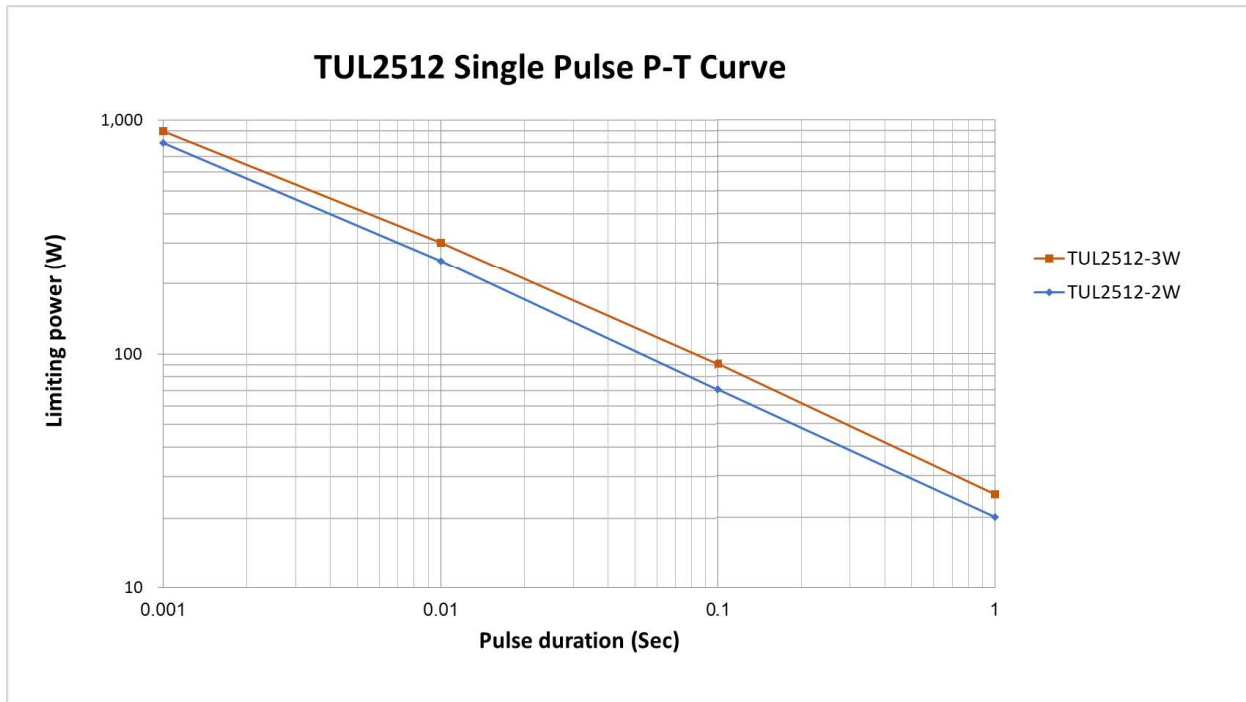
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■ **Standard Electrical Specifications**

Type	Rated Power at 70°C	Max. Rated Current	Max. Overload Current	T.C.R. (ppm/°C)	Resistance Range
					D(0.5%), F(1.0%), G(2.0%), J(5.0%)
TUL2512	2 W	4.47 A	10.00 A	±50	100 mΩ ≤ R ≤ 510 mΩ
TUL2512	3 W	5.48 A	12.25 A		

- For non-standard parts, please contact our sales dept.
- Operating Temperature Range : -55°C~+170°C.

■ **Anti-Surge Ability:**

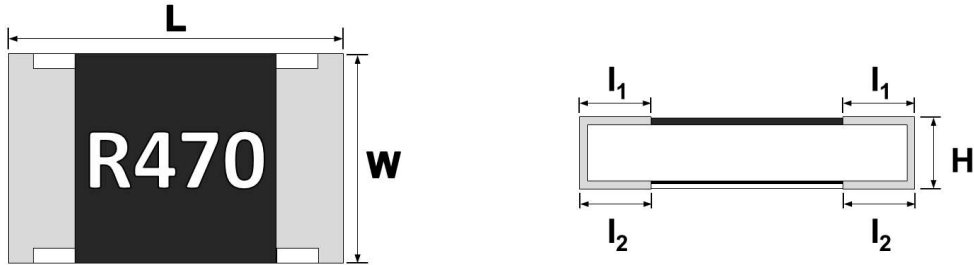




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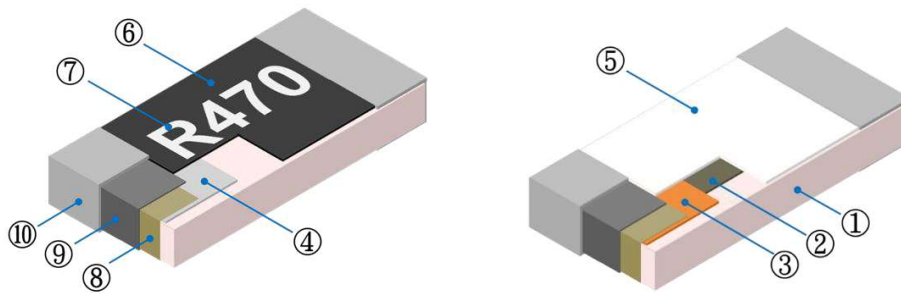
■ **Type Dimension**



Unit : mm

TYPE	L	W	H	l ₁	l ₂
TUL2512 (2W)	6.30±0.20	3.20±0.20	0.55±0.10	0.65±0.25	0.65±0.25
TUL2512 (3W)	6.30±0.20	3.20±0.20	0.70±0.15	0.65±0.25	0.65±0.25

■ **Construction**



①	Alumina Substrate	⑥	Top Protective Overcoat
②	Resistive Layer	⑦	Marking
③	Bottom Inner Electrode (Cu)	⑧	Side Inner Electrode
④	Top Inner Electrode	⑨	Barrier Layer (Ni)
⑤	Bottom Protective Overcoat	⑩	Solder coating (Sn)



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■ Performance Characteristics

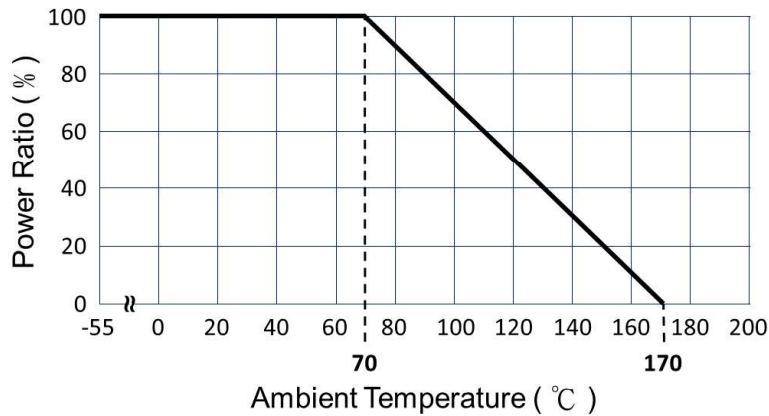
■ Power Derating Curve

The Operating Temperature Range: -55°C ~+170°C.

Power rating or current rating is in the case based on continuous full-load at ambient temperature of 70°C.

For operation at ambient temperature in excess of 70°C, the load should be derated in accordance with figure of derating Curve.

Derating Curve



■ Rated Current

Resistance Range: < 1Ω

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

$$I = \sqrt{P/R}$$

I = Rated current (A)

P = Rated power (W)

R = Nominal resistance (Ω)



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Reliability Test and Requirement

Test Item	Test Method	Procedure	Requirements
Temperature Coefficient of Resistance (T.C.R)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	At 25°C / +125°C, 25°C is the reference temperature	Refer to Standard Electrical Specifications
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	5 times rated power whichever is less for 5 seconds.	±(1.0%+0.001Ω)
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6	Applied 100VDC for 1 minute.	≥10GΩ
Dielectric Withstanding Voltage	JIS-C5201-1 4.7	Applied 500VAC for 1 minute.	No short or burned on the appearance.
Core Body Strength	JIS-C5201-1 4.15	Central part pressurizing force : 10N , 10 seconds	No broken
Solderability	JIS-C-5201-1 4.17 IEC-60115-1 4.17	245±5°C for 3 seconds.	>95% Coverage No Visual damage
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260±5°C for 10 seconds.	±(1.0%+0.001Ω) No Visual damage
Leaching	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1	260±5°C for 30 seconds.	>95% Coverage No Visual damage
Rapid Change of Temperature	JIS-C-5201-1 4.19 IEC-60115-1 4.19	-55°C to +155°C, 300 cycles.	±(1.0%+0.001Ω) No Visual damage
Damp Heat with Load	JIS-C-5201-1 4.24 IEC-60115-1 4.24	40±2°C, 90~95% R.H. RCWV or Max. working current whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" .	±(1.0%+0.001Ω)
Biased Humidity	MIL-STD-202 Method 103	1,000 hours; 85°C / 85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.	±(1.0%+0.05Ω)
Load Life (Endurance)	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1	70±2°C, Rated power, or Max. working current whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" .	±(1.0%+0.001Ω)
High Temperature Exposure	JIS-C-5201-1 4.23.2 IEC 60068-2-2	At +170±5°C for 1000 hours.	±(1.0%+0.001Ω)
Resistance to Solvent	JIS-C-5201-1 4.29	The tested resistor be immersed into isopropyl alcohol of 20~25°C for 60 secs. Then the resistor is left in the room for 48 hrs.	±(1.0%+0.001Ω) No Visual damage
Terminal Strength (SMD)	JIS-C5201-1 4.32 AEC Q200-006	Pressurizing force for 60 seconds 2512 : 17.7N	No broken
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33	Bending once for 5 seconds D : 2512 = 2mm	±(1.0%+0.001Ω) No Visual damage

- Temperature Coefficient of Resistance test to - 55 °C is available on request
- We can also provide AEC-Q200 test reports if required by customers.



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■ **Marking**

■ **TUL2512 : 4 digit marking**

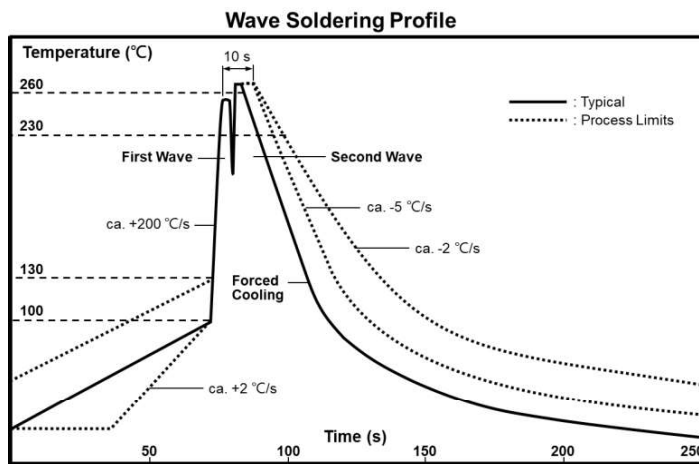
First 3 digits are the significant figures, the 4th digit is the multiplier. "R"= decimal point.

Examples:

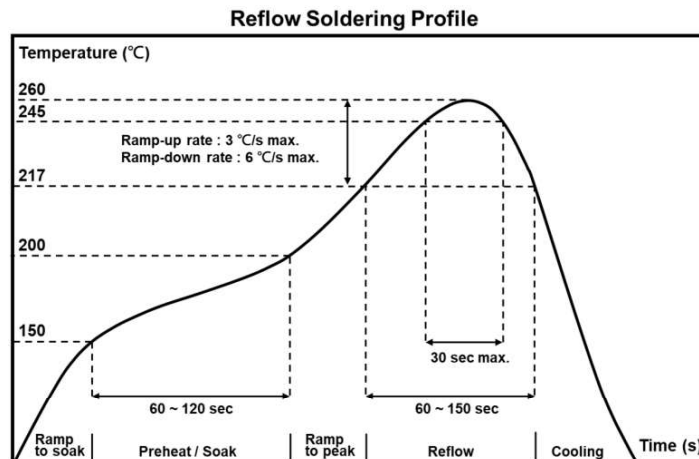
Resistance value	Code	Example
100 mΩ ~ 510 mΩ	RXXX	R470 = 0.47 Ω

■ **Recommended Customer Soldering Parameters**

■ **Wave solder Temperature condition**



■ **Solder reflow Temperature condition**





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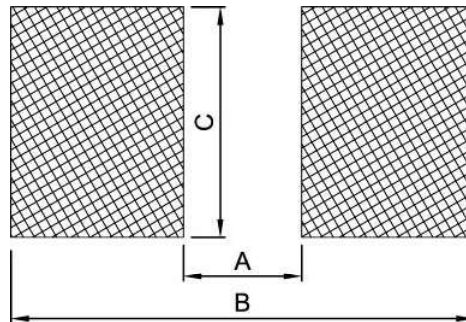
■ **Rework temperature (hot air equipment) : 350°C, 3~5seconds**

■ **Recommended reflow methods**

IR, vapor phase oven, hot air oven

If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

■ **Recommend Land Pattern Design**



Unit: mm

TYPE	A	B	C
TUL2512	4.90	8.10	3.40

■ **Plating Thickness**

Ni: $\geq 3\mu\text{m}$

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



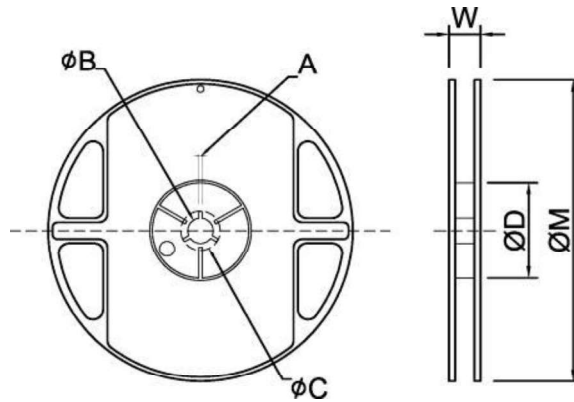
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■ **Appendix For SMD Chip Resistor**

■ **Packaging Information**

■ **Reel Dimensions**

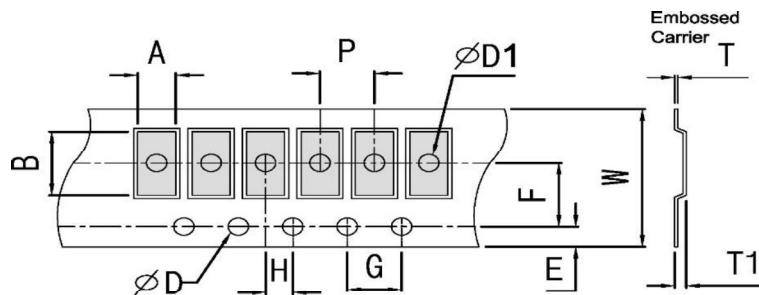


Unit: mm

TYPE	SIZE	A	φB	φC	φD	W	φM
TUL2512	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	178±2.0

■ **Packaging Information**

■ **Embossed Dimensions**



Unit: mm

Packaging Type	Type	A	B	W	E	F	G	H	T	φD	φD1	T1	P
Embossed Type	2512	3.40±0.2	6.70±0.2	12±0.1	1.75±0.1	5.5±0.05	4.0±0.1	2.0±0.05	0.23±0.1	1.50 ^{+0.1} ₋₀	1.50±0.1	0.85±0.15	4.0±0.1

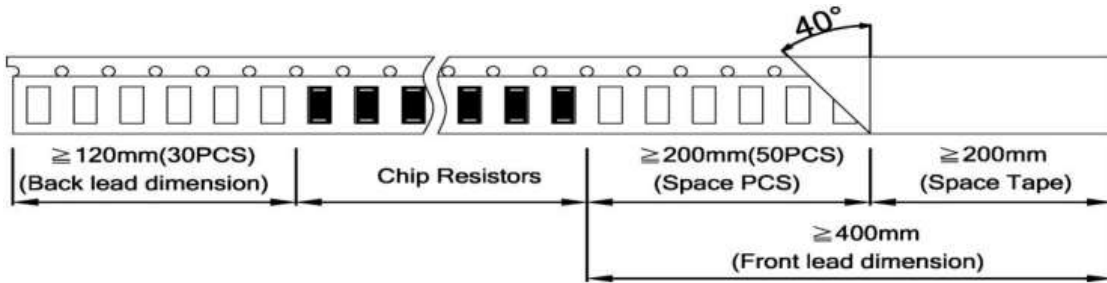


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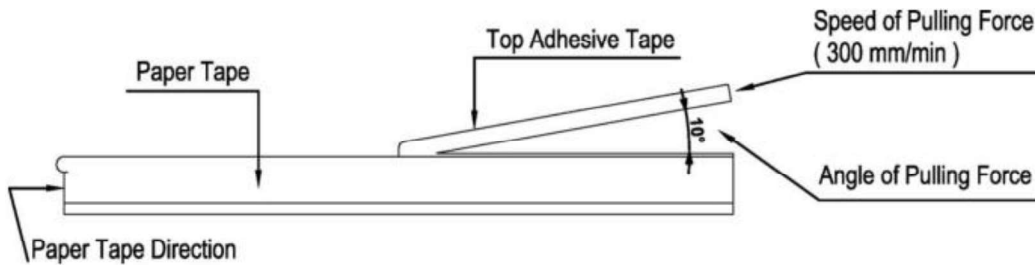
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■ **Packing Material Data / Storage Data**

■ **Front & Back Lead Dimensions**

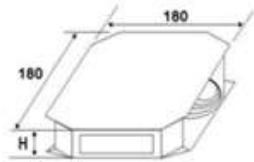


■ **Top Adhesive Peel Off Strength : 10~70g**

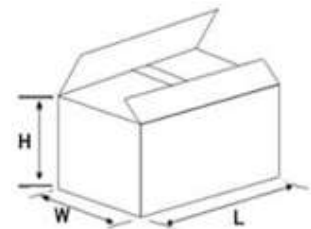


■ **Package**

Inner Box Size	
Reel	Size H(mm)
1	13
2	24
3	36
5	60
10	113



External Box Size			
Contain (Kpcs)	Length (mm)	Width (mm)	Height (mm)
25K	180	180	60
50K	180	180	110
150K	430	200	200
300K	400	400	200



■ **Storage Data :**

Storage time at the environment temp: 25±5°C & humidity: 60±20% is valid for one year from the date of delivery.