

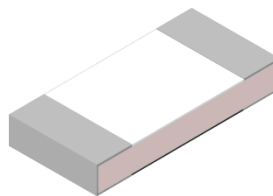
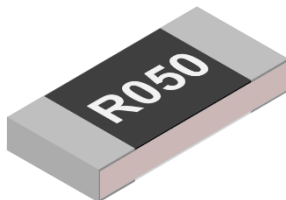


TSL Series Anti-Sulfur Low-Resistance Metal Film Chip Resistor Product Specifications

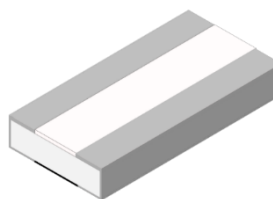
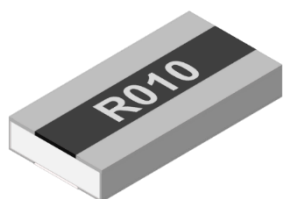
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■ Anti-Sulfur Low-Resistance Metal Film Chip Resistor — TSL Series

Standard Type



Wide Terminal Type



Top view

Bottom view

■ Applications

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

■ Features

- Low Resistance / TCR / Inductance
- High precision current sensing
- High power capability
- Sulfur resistant
- Halogen free and lead free
- RoHs compliant

■ Parts Number Explanation

■ Example:

TSL	1206	05	F	R560	P	05	Z
Product Type	Size (Inch)	Rated Power	Tolerance	Resistance	Package	Quantity (PCS)	Optional
TSL Series Anti-Sulfur Low-Resistance Metal Film Chip Resistors	0402 0603 0805 1206 1210 2010 2512 0508 0612 1020 1225	Y6 : 0.063W 01 : 0.10W X1 : 0.125W 02 : 0.20W X2 : 0.25W 04 : 0.40W 05 : 0.50W 07 : 0.75W 10 : 1.0W 15 : 1.5W 20 : 2.0W 30 : 3.0W	D : $\pm 0.5\%$ F : $\pm 1\%$ G : $\pm 2\%$ J : $\pm 5\%$	EX. R056 = 0.056Ω R560 = 0.56Ω 1R00 = 1Ω	P : Paper Taping (0603~1210) Q : Paper Taping (0402) E : Embossed Taping	04 : 4000 05 : 5000 10 : 10000	Z : Default Code



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■ Standard Electrical Specifications

■ Standard Type:

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%)
TSL0402	1/16W	1.12A	2.80A	±100	50 mΩ ≤ R < 100 mΩ
	1/8W	1.58A	3.54A		
	1/4W	2.24A	5.00A		
TSL0603	1/10W	1.41A	3.54A		
	1/5W	2.00A	4.47A		
	2/5W	2.83A	6.32A		
TSL0805	1/8W	1.58A	3.95A	±50	100 mΩ ≤ R ≤ 10 Ω
	1/4W	2.24A	5.00A		
	1/2W	3.16A	7.07A		
TSL1206	1/4W	2.24A	5.59A		
	1/2W	3.16A	7.07A		
	1W	4.47A	10.00A		
TSL1210	1/2W	3.16A	7.91A		
	1W	4.47A	10.00A		
TSL2010	3/4W	2.74A	6.85A	±50	100 mΩ ≤ R ≤ 10 Ω
	1.5W	3.87A	8.66A		
TSL2512	1W	3.16A	7.91A		
	2W	4.47A	10.00A		
	3W	5.48A	12.25A		

● If there are other TCR or power requirements, please contact our sales department.

■ Wide Terminal Type:

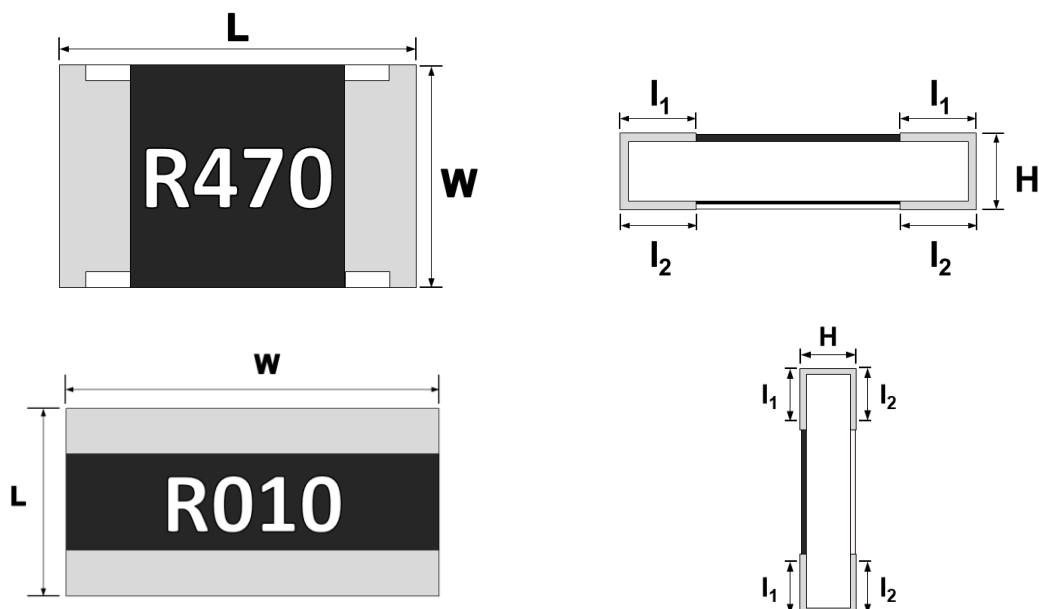
Type	Rated Power at 70°C	Max. Rated Current	Max. Overload Current	T.C.R. (ppm/°C)	Resistance Range			
					D (0.5%)	F (1.0%)	G (2.0%)	J (5.0%)
TSL0508	1W	10.00A	22.36A	±100	100mΩ ≤ R ≤ 2Ω	10mΩ ≤ R ≤ 2Ω		
TSL0612	1W	10.00A	22.36A	±100	100mΩ ≤ R ≤ 2Ω	10mΩ ≤ R ≤ 2Ω		
TSL1020	2W	14.14A	31.62A	±100	100mΩ ≤ R ≤ 2Ω	10mΩ ≤ R ≤ 2Ω		
TSL1225	3W	17.32A	38.73A	±100	100mΩ ≤ R ≤ 2Ω	10mΩ ≤ R ≤ 2Ω		



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■ Type Dimensions



Unit : mm

Type	L	W	H	l ₁	l ₂
TSL0402	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
TSL0603	1.60±0.10	0.80±0.10	0.45±0.10	0.25±0.15	0.30±0.15
TSL0805	2.00±0.10	1.25±0.10	0.55±0.10	0.35±0.20	0.40±0.20
TSL1206	3.10±0.10	1.60±0.10	0.55±0.10	0.40±0.20	0.45±0.20
TSL1210	3.10±0.10	2.50±0.15	0.55±0.10	0.50±0.20	0.50±0.20
TSL2010	5.00±0.20	2.50±0.15	0.55±0.10	0.60±0.25	0.60±0.25
TSL2512	6.30±0.20	3.20±0.20	0.55±0.10	0.65±0.25	0.65±0.25
TSL2512(3W)	6.30±0.20	3.20±0.20	0.70±0.15	0.65±0.25	0.65±0.25
TSL0508	1.25±0.10	2.00±0.10	0.55±0.15	0.25±0.15	0.35±0.15
TSL0612	1.60±0.15	3.20±0.20	0.55±0.15	0.30±0.20	0.50±0.20
TSL1020	2.50±0.15	5.00±0.15	0.55±0.15	0.40±0.20	0.50±0.20
TSL1225	3.20±0.20	6.30±0.20	0.55±0.15	0.60±0.25	0.80±0.25



TSL Series Anti-Sulfur Low-Resistance Metal Film Chip Resistor Product Specifications

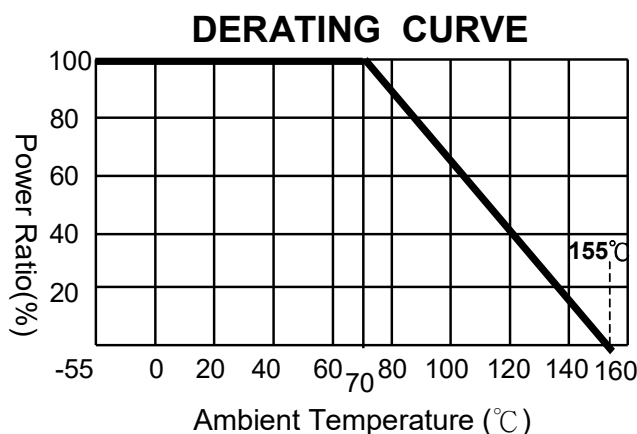
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Performance Characteristics

Power Derating Curve

The Operating Temperature Range: -55°C ~+155°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.



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= Resistance(Ω)

Rated Voltage

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 formula as following:

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

V = Rated voltage (V)
P = Rated power (W)
R = Nominal resistance (Ω)



TSL Series Anti-Sulfur Low-Resistance Metal Film Chip Resistor Product Specifications

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■ Reliability Tests and Requirements

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	Standard power : 6.25 times rated power whichever is less for 5 seconds. High power (2X/4X) : 5 times rated power whichever is less for 5 seconds.	±(1.0%+0.001Ω)
Insulation Resistance	JIS-C-5201-1 4.8 IEC-60115-1 4.8	Apply 100VDC for 1 minute.	≥10GΩ
Dielectric Withstanding Voltage	JIS-C5201-1 4.7	0805、1206、1210、2010、2512 applied 500VAC for 1 minute. 0402、0603 applied 300VAC for 1 minute.	No short or burned on the appearance.
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.	±(0.5%+0.001Ω)
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" .	±(0.5%+0.001Ω)
High Temperature Exposure	JIS-C5201-1 4.25 IEC 60068-2-2	At 155±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	JIS-C5201-1 4.32 AEC Q200-006	Pressurizing force for 10 seconds 0402 / 0603 : 8N ; 0805 / 0508 and above : 17.7N	No broken
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33	Bending once for 5 seconds Bending once for 5 seconds D : 0402 / 0603 / 0805 = 5mm 1206 / 1210 / 0508 / 0612 = 3mm 2010 / 2512 / 1020 / 1225 = 2mm	±(1.0%+0.001Ω) No Visual damage
Sulfur Test (FoS)	ASTM B809-95 ANSI/EIA-977	105±2°C, no power rating for 1000 hrs.	±(2.0%+0.001Ω)

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

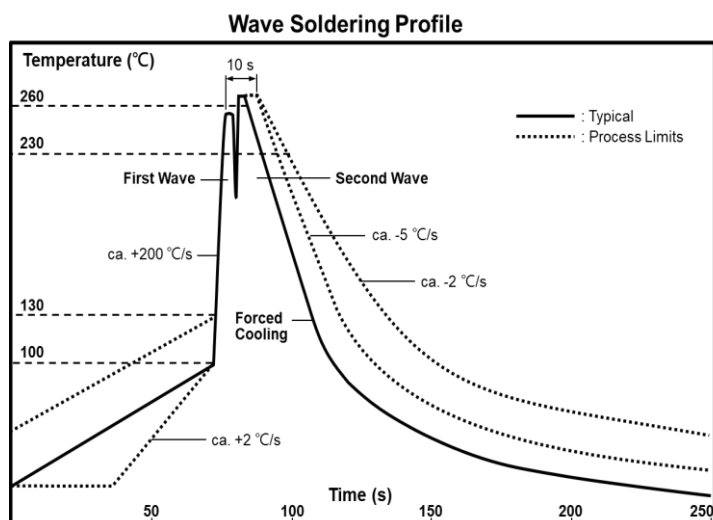


TSL Series Anti-Sulfur Low-Resistance Metal Film Chip Resistor Product Specifications

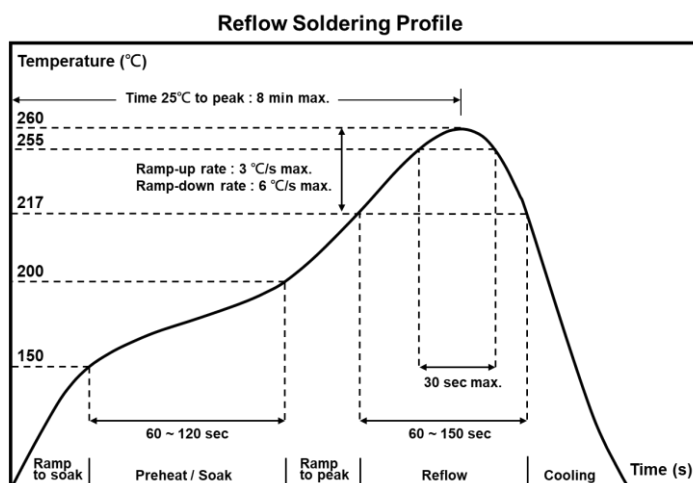
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Recommended Customer Soldering Parameters

Wave solder Temperature condition



Solder reflow Temperature condition



- The peak temperature of soldering heat is 260°C for 10s.

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

Recommended reflow methods

IR, vapor phase oven, hot air oven

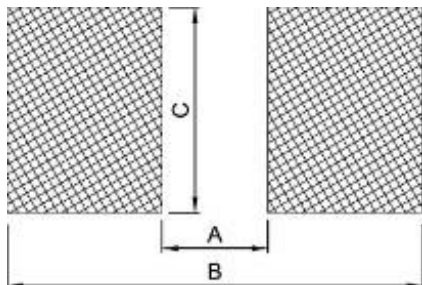
If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.



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■ Recommend Land Pattern Design



Unit: mm

Type	A	B	C
TSL0402	0.50	1.60	0.70
TSL0603	0.80	2.40	1.00
TSL0805	1.30	2.90	1.45
TSL1206	2.20	4.20	1.80
TSL1210	2.00	4.40	2.70
TSL2010	3.80	6.60	2.70
TSL2512	4.90	8.10	3.40
TSL0508	0.40	1.80	2.00
TSL0612	0.50	2.60	3.20
TSL1020	1.00	4.05	5.50
TSL1225	1.20	5.20	7.00



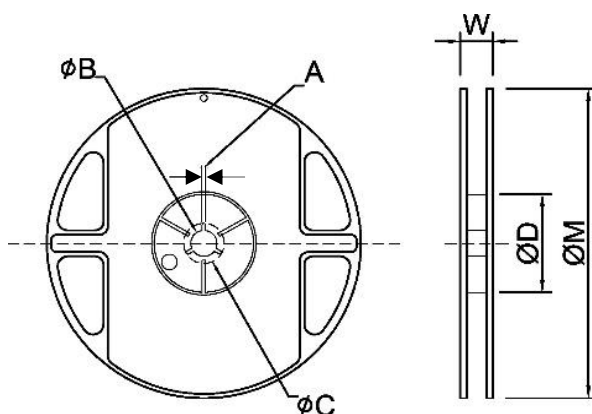
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■ Appendix For SMD Chip Resistor

■ Packaging Information

■ Reel Dimensions



Unit: mm

Type	Size		A	φB	φC	φD	W	φM
TSL0402	7"	10K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TSL0603	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TSL0805	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TSL1206	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TSL1210	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TSL2010	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0	178±2.0
TSL2512	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0	178±2.0
TSL0508	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TSL0612	7"	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TSL1020	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0	178±2.0
TSL1225	7"	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0	178±2.0

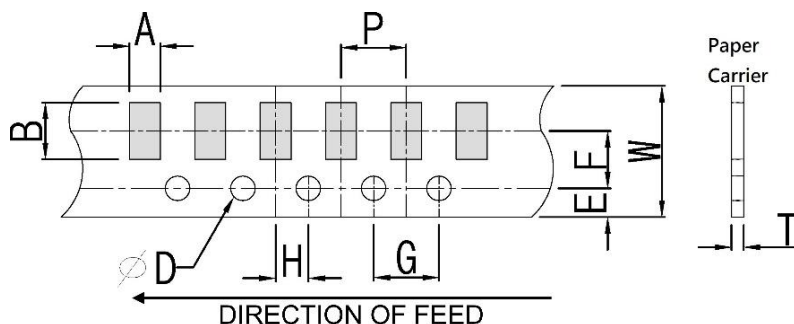


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■ Packaging Information

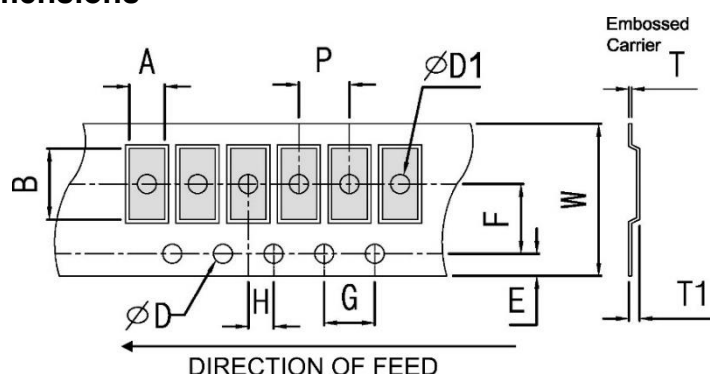
■ Tapping Specifications



Unit: mm

Packaging	Type	A	B	W	E	F	G	H	T	ϕD	P
Paper Type	0201	0.45±0.1	0.75±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.35±0.1	1.50 ^{+0.1} ₋₀	2.0±0.1
	0402	0.7±0.1	1.20±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.45±0.1		2.0±0.1
	0603	1.05±0.2	1.80±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.60±0.1		4.0±0.1
	0805	1.55±0.2	2.30±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		4.0±0.1
	1206	1.90±0.2	3.05±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		4.0±0.1
	1210	2.85±0.2	3.05±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		4.0±0.1
	0508	1.55±0.2	2.30±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		4.0±0.1
	0612	1.90±0.2	3.05±0.2	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	0.75±0.1		4.0±0.1

■ Embossed Dimensions



Unit: mm

Packaging	Type	A	B	W	E	F	G	H	T	ϕD	$\phi D1$	T1	P
Embossed Type	2010	2.80±0.2	5.60±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
	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	0.85±0.15	4.0±0.1
	1020	2.80±0.2	5.60±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	0.85±0.15	4.0±0.1
	1225	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	0.85±0.15	4.0±0.1

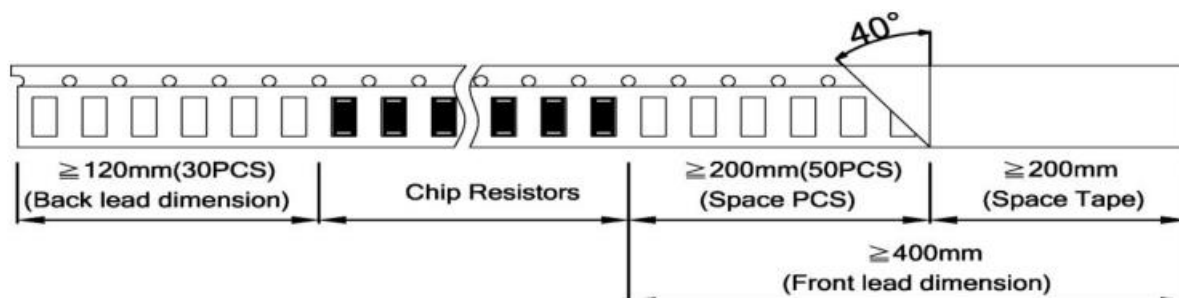


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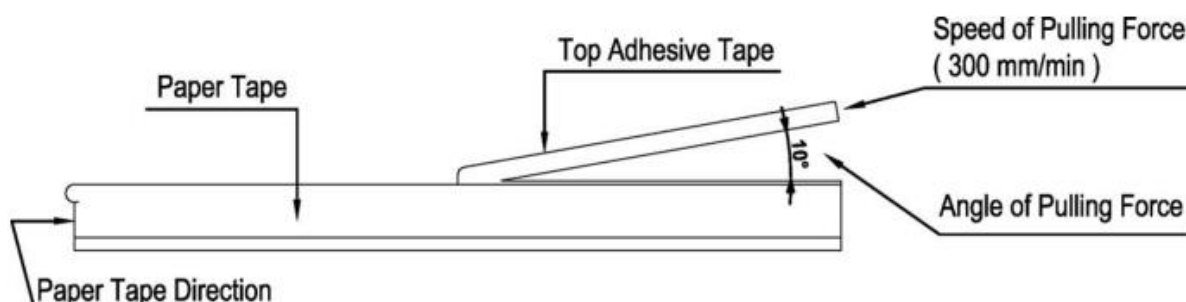
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Packing Material Data / Storage Data

Front & Back Lead Dimensions

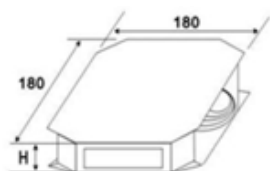


Top Adhesive Peel Off Strength : 10~70g

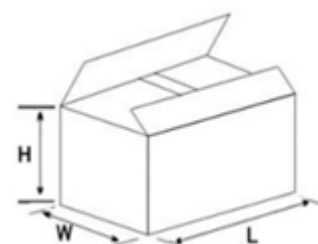


Package

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: $25\pm 5^\circ\text{C}$ & humidity: $60\pm 20\%$ is valid for two years.