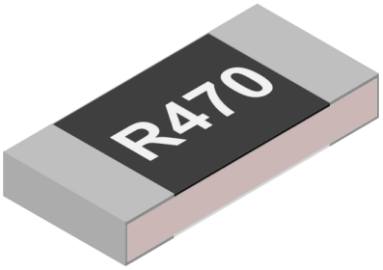
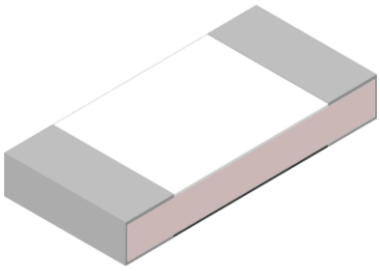
■ Ultra Anti-Surge Low-Resistance Metal Film Chip Resistor — TUL Series



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(≦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:

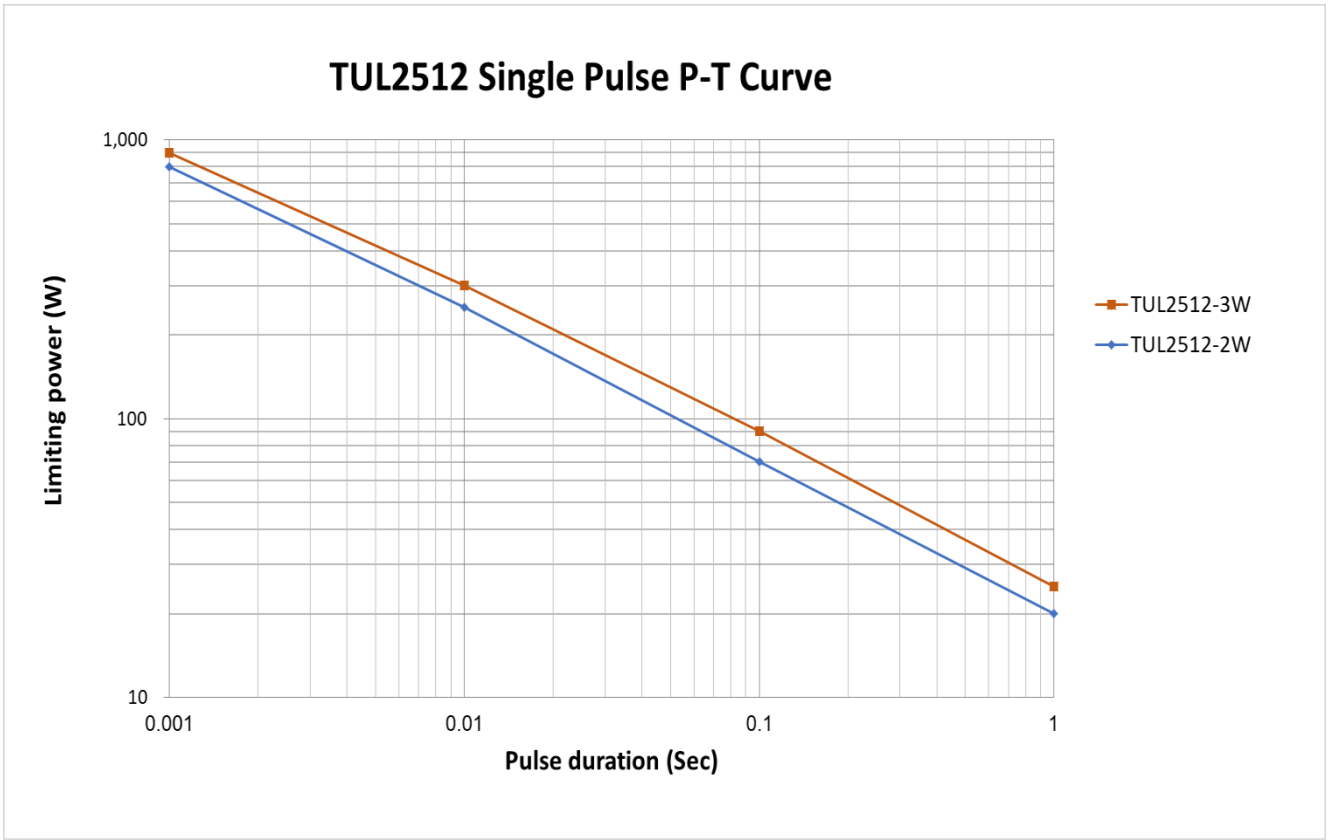
TUL	2512	20	F	R470	E	04	Z
Product Type	**Size (Inch)**	**Rated Power**	**Tolerance**	**Resistance**	**Package**	**Quantity (PCS)**	**Optional**
Ultra Anti-Surge Low-Resistance Metal Film Chip Resistors	1206 2512	10 : 1.0W 20 : 2.0W 30 : 3.0W	D : ±0.5% F : ±1% G : ±2% J : ±5%	EX. R056 = 0.056Ω R180 = 0.18Ω R470 = 0.47Ω	P : Paper Taping E : Embossed Taping	04 : 4000 05 : 5000	Z : Default Code U : High Performance

■ Standard Electrical Specifications

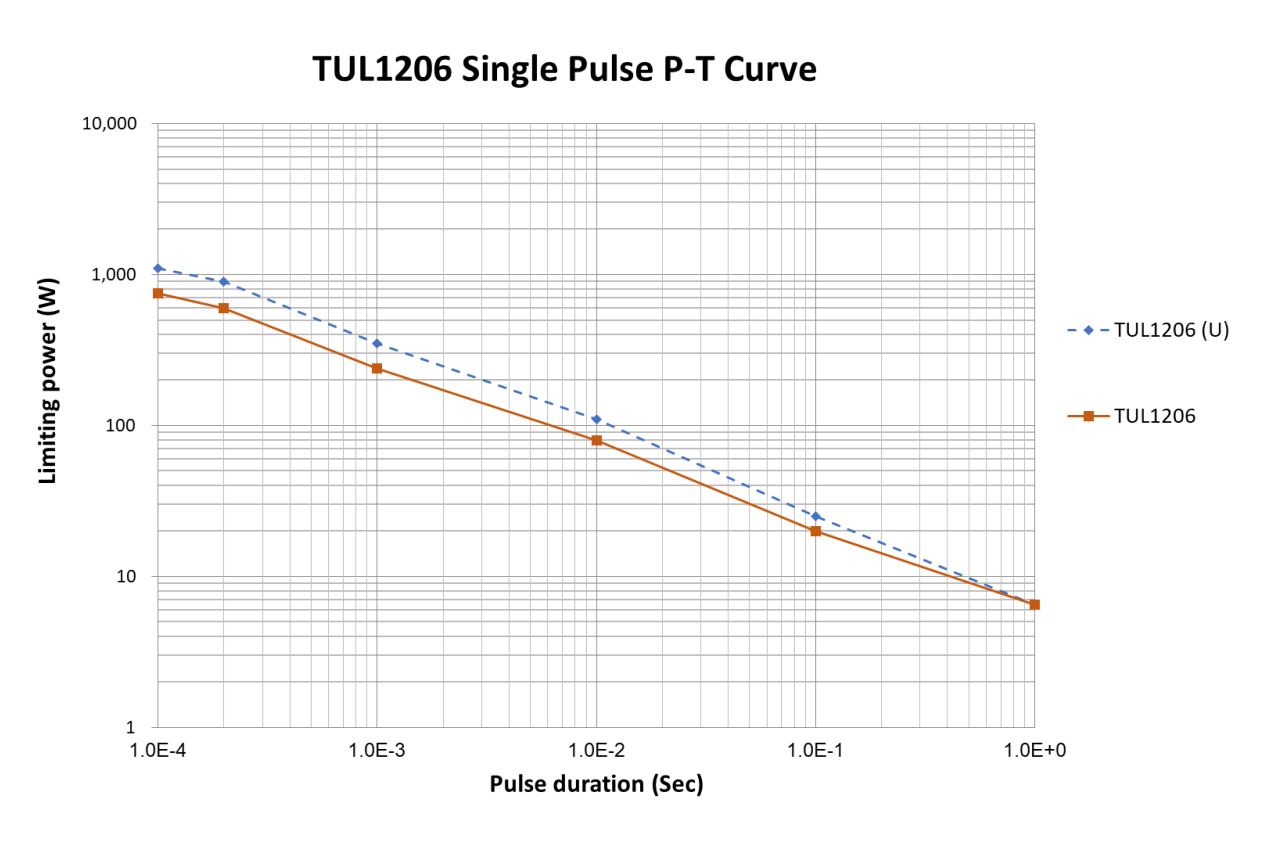
Type	Rated Power at 70℃	Max. Rated Current	Max. Overload Current	T.C.R. (ppm/℃)	Resistance Range
					D(0.5%), F(1.0%), G(2.0%), J(5.0%)
TUL1206	1 W	3.16 A	7.07 A	±50	100 mΩ ＜ R ≦ 510 mΩ
TUL1206 (U)	1 W	4.47 A	10.00 A	±50	50 mΩ ≦ R ≦ 100 mΩ
TUL2512	2 W	4.47 A	10.00 A	±50	100 mΩ ≦ R ≦ 510 mΩ
TUL2512	3 W	5.48 A	12.25 A		

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

■ Anti-Surge Ability:

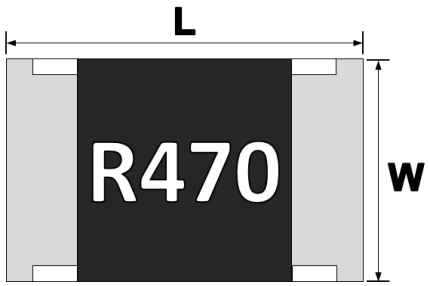


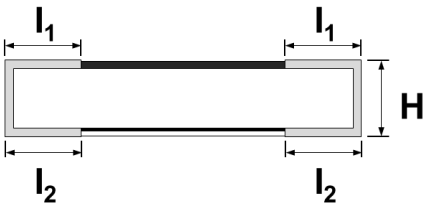
TUL2512 P-T curve; Pulse Limiting power vs duration



TUL1206 P-T curve; Pulse Limiting power vs duration

■ Type Dimension

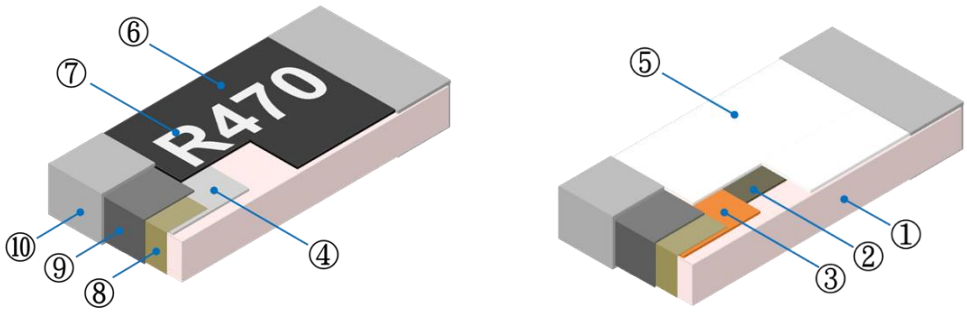




Unit：mm

Type	L	W	H	I_1	I_2
TUL1206	3.10±0.10	1.60±0.10	0.55±0.10	0.40±0.20	0.45±0.20
TUL1206 (U)	3.10±0.10	1.60±0.10	0.55±0.10	0.40±0.20	0.45±0.20
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



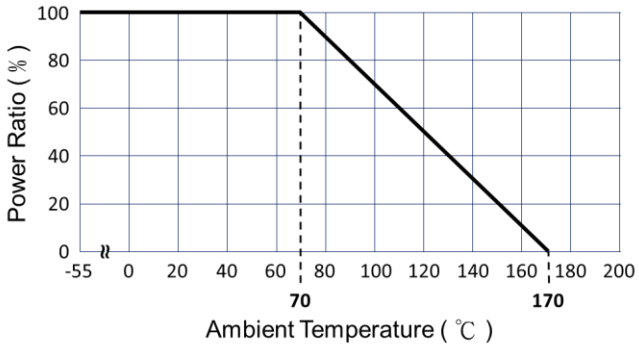
①	Alumina Substrate	⑥	Top Protective Overcoat
②	Resistive Layer	⑦	Marking
③	Bottom Inner Electrode (Cu)	⑧	Side Inner Electrode
④	Top Inner Electrode	⑨	Barrier Layer (Ni)
⑤	Bottom Protective Overcoat	⑩	Solder coating (Sn)

■ 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℃.
For operation at ambient temperature in excess of 70℃, 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)

■ 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℃ / +125℃, 25℃ 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℃ 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℃ 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℃ for 30 seconds.	>95% Coverage No Visual damage
Rapid Change of Temperature	JIS-C-5201-1 4.19 IEC-60115-1 4.19	-55℃ to +155℃, 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℃, 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℃, 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℃ 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℃ 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 1206 / 2512：17.7N	No broken
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33	Bending once for 5 seconds D：1206 = 3mm / 2512 = 2mm	±(1.0%+0.001Ω) No Visual damage

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

■ Marking

■ TUL1206 / TUL2512: 4 digits marking

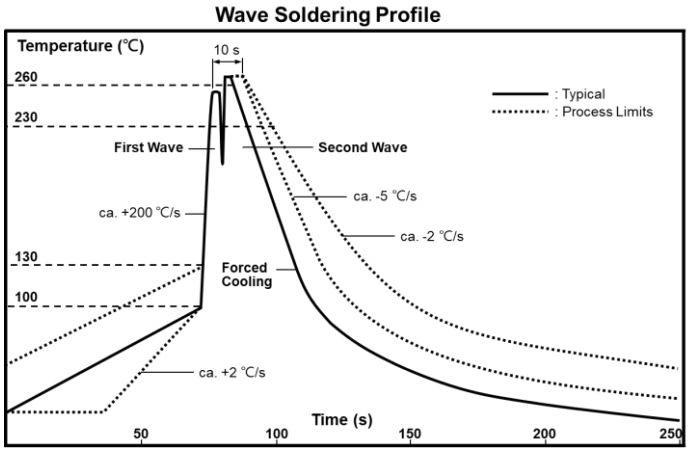
First 3 digits are the significant figures, the 4th digit is the multiplier. "R"= decimal point.

Examples:

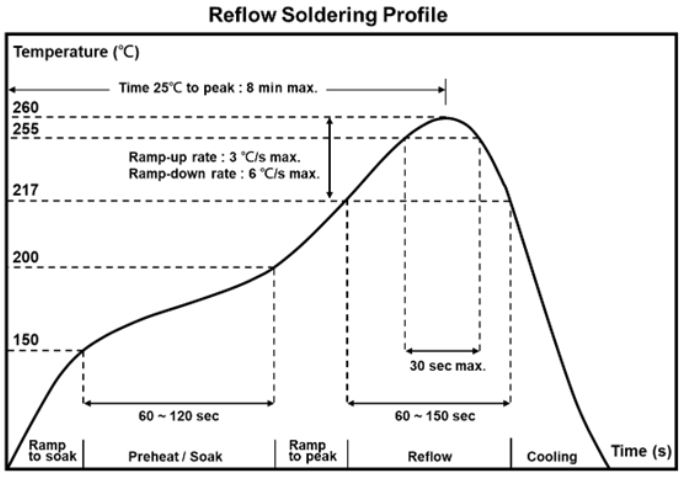
Resistance value	Code	Example
50 mΩ ~ 99 mΩ	**R0XX**	R050 = 50 mΩ
100 mΩ ~ 510 mΩ	**RXXX**	R470 = 470 mΩ

■ Recommended Customer Soldering Parameters

■ Wave solder Temperature condition



■ Solder reflow Temperature condition



・The peak temperature of soldering heat is 260℃ for 10s.

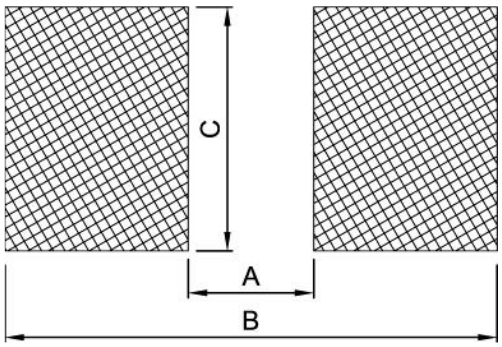
■ Rework temperature（hot air equipment）: 350℃, 3~5seconds

■ 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



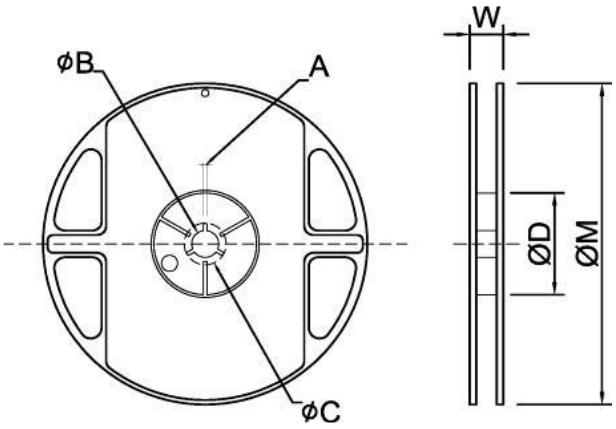
Unit: mm

Type	A	B	C
TUL1206	2.20	4.20	1.80
TUL1206 (U)	2.20	4.20	1.80
TUL2512	4.90	8.10	3.40

■ Appendix For SMD Chip Resistor

■ Packaging Information

■ Reel Dimensions

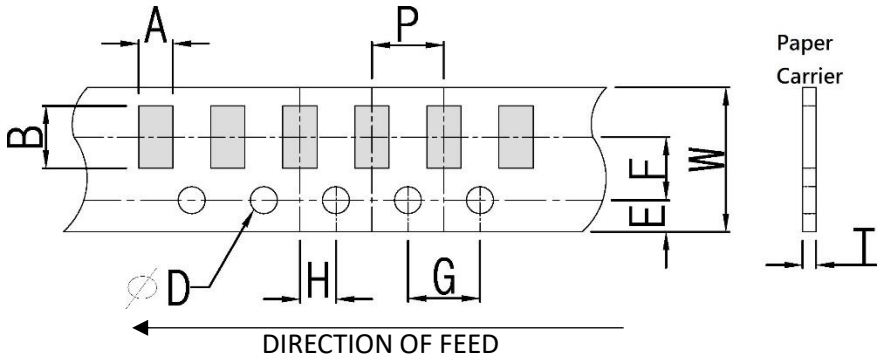


Unit: mm

Type	Size		A	ΦB	ΦC	ΦD	W	ΦM
TUL1206	7”	5K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
TUL2512	7”	4K/Reel	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0	178±2.0

■ Packaging Information

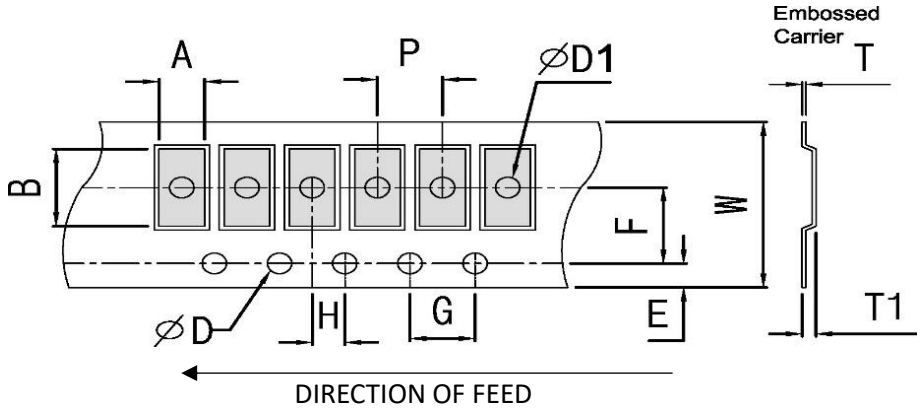
■ Tapping Specifications



Unit: mm

Packaging	Type	A	B	W	E	F	G	H	T	ΦD	P
Paper Type	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	$1.50^{+0.1}_{-0}$	4.0±0.1

■ Embossed Dimensions

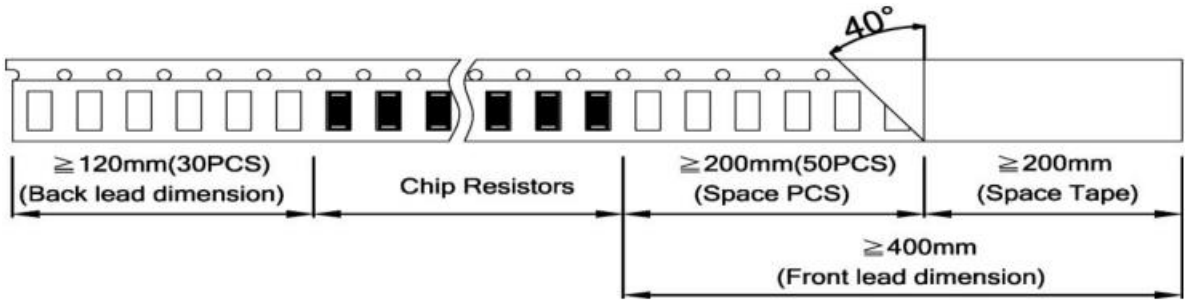


Unit: mm

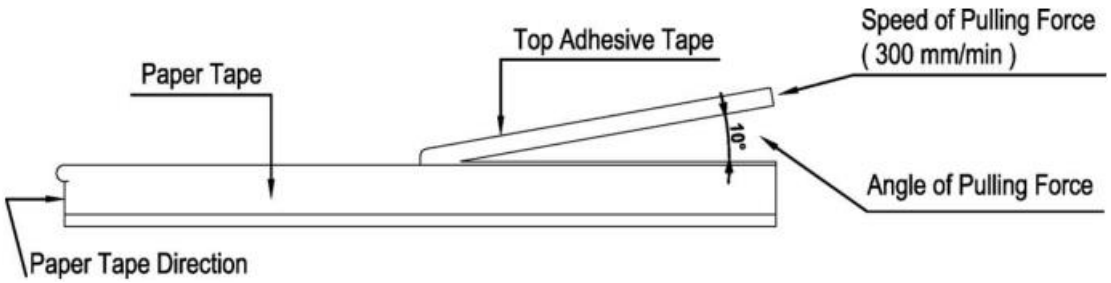
Packaging	Type	A	B	W	E	F	G	H	T	ΦD	ΦD1	T1	P
Embossed Type	2512	3.40±0.2	6.70±0.2	12±0.1	1.75±0.1	5.5±0.05	4.0±0.1	2.0±0.05	0.23±0.1	$1.50^{+0.1}_{-0}$	1.50±0.1	0.85±0.15	4.0±0.1

■ Packing Material Data / Storage Data

■ Front & Back Lead Dimensions

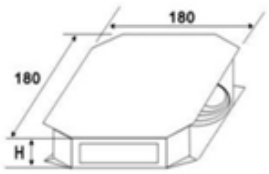


■ Top Adhesive Peel Off Strength：10~70g

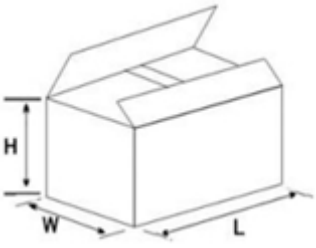


■ Package

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℃& humidity: 60±20% is valid for one year from the date of delivery.