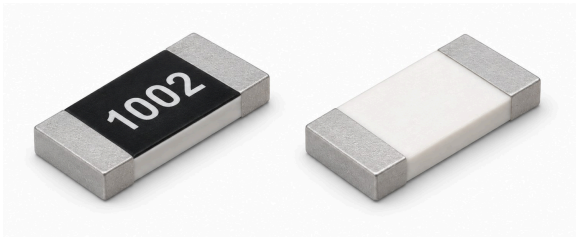


Thin Film Chip Resistors

General purpose thin film chip resistors · TR series

Features

- Tolerances down to $\pm 0.1\%$
- TCR down to $\pm 10 \text{ ppm/}^\circ\text{C}$
- Sizes down to 0201
- Halogen-free and lead-free
- RoHS compliant

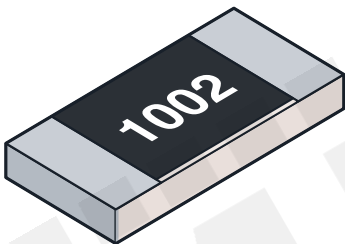


Illustration; not a photograph of a specific part.

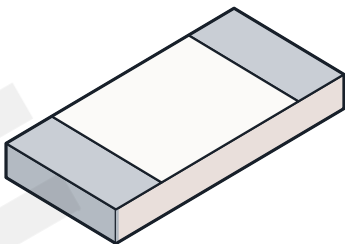
CASE SIZES 0201 – 2512	RESISTANCE RANGE 2.49 Ω – 1.5 M Ω	TOLERANCE $\pm 0.1\%$ – $\pm 1\%$	TCR ± 10 – $\pm 50 \text{ ppm/}^\circ\text{C}$
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Applications

- Computers and related products
- Communication devices
- Measuring instruments
- Converters
- Printing equipment



Top view



Bottom view

How to order

TR Product type TR series	06 Size (inch) 1206	B Tolerance $\pm 0.1\%$	10K0 Resistance 4-digit code	B TCR (ppm/ $^\circ\text{C}$) ± 10	P Packaging Paper taping
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Ordering example as given on the original sheet; the codes for each position are listed below.

Product type			
TR	General purpose thin film chip resistor (TR series)		
Size (inch)			
01	0201	06	1206
02	0402	10	1210
03	0603	20	2010
05	0805	25	2512

Tolerance	
B	±0.1%
C	±0.25%
D	±0.5%
F	±1%
TCR (ppm/°C)	
B	±10
C	±15
D	±25
E	±50

Resistance (4 digits), e.g.	
1R00	1 Ω
10R0	10 Ω
100R	100 Ω
2K20	2.2 kΩ
332K	332 kΩ
1M00	1 MΩ

Packaging	
P	Paper taping (0603~1210)
Q	Paper taping (0201, 0402)
E	Embossed taping
B	Bulk

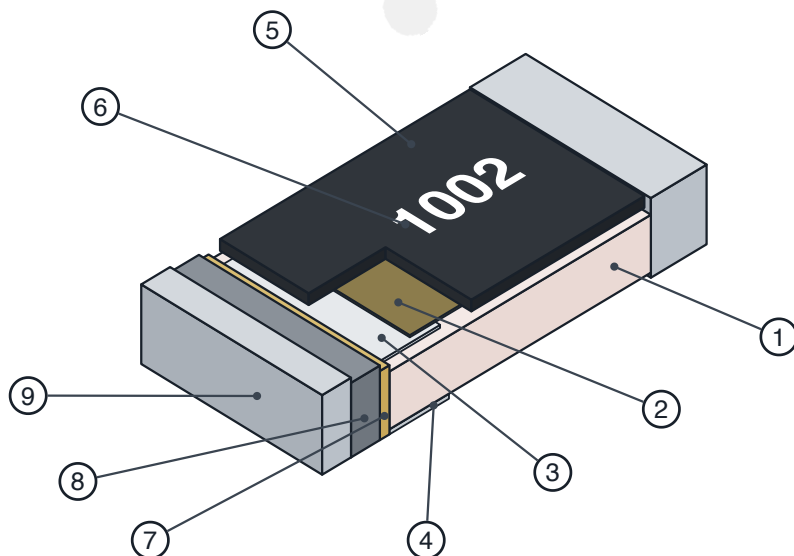
Standard electrical specifications

Type	Rated power at 70 °C	Max. working voltage	Max. overload voltage	TCR (ppm/°C)	Resistance range by tolerance			
					B ±0.1%	C ±0.25%	D ±0.5%	F ±1%
TR0201	0.05 W	25 V	50 V	±10	10 Ω ~ 5.1 kΩ			
				±15				
				±25	10 Ω ~ 82 kΩ			
				±50				
TR0402	0.063 W	50 V	100 V	±10	10 Ω ~ 68 kΩ			
				±15				
				±25	4.7 Ω ~ 220 kΩ		2.49 Ω ~ 220 kΩ	
				±50				
TR0603	0.1 W	75 V	150 V	±10	10 Ω ~ 332 kΩ			
				±15				
				±25	4.7 Ω ~ 680 kΩ		2.49 Ω ~ 680 kΩ	
				±50				
TR0805	0.125 W	150 V	300 V	±10	10 Ω ~ 680 kΩ			
				±15				
				±25	4.7 Ω ~ 1 MΩ		2.49 Ω ~ 1 MΩ	
				±50				
TR1206	0.25 W	200 V	400 V	±10	10 Ω ~ 1 MΩ			
				±15				
				±25	4.7 Ω ~ 1.5 MΩ		2.49 Ω ~ 1.5 MΩ	
				±50				
TR1210	0.25 W			±10	10 Ω ~ 1 MΩ			
				±15				
				±25	4.7 Ω ~ 1 MΩ		2.49 Ω ~ 1 MΩ	
				±50				
TR2010	0.5 W			±10	10 Ω ~ 1 MΩ			
				±15				
				±25	4.7 Ω ~ 1 MΩ		2.49 Ω ~ 1 MΩ	
				±50				
TR2512	0.75 W			±10	10 Ω ~ 1 MΩ			
				±15				
				±25	4.7 Ω ~ 1 MΩ		2.49 Ω ~ 1 MΩ	
				±50				

For non-standard parts, please contact our sales department.

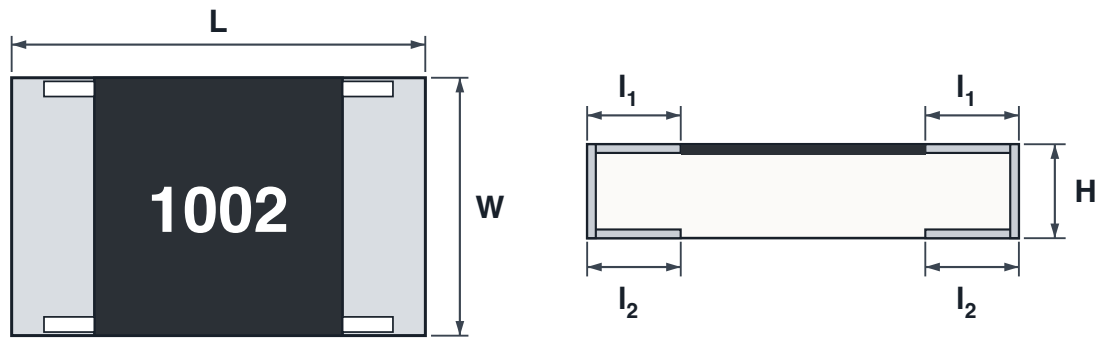
Operating temperature range: -55 °C ~ +155 °C.

Construction



No.	Part
1	Alumina substrate
2	Resistive layer
3	Top inner electrode
4	Bottom inner electrode
5	Protective overcoat
6	Marking
7	Side inner electrode
8	Nickel barrier
9	Solder coating (Sn)

Dimensions



Type	L	W	H	l ₁	l ₂
TR0201	0.60 ± 0.05	0.30 ± 0.05	0.23 ± 0.05	0.12 ± 0.05	0.15 ± 0.05
TR0402	1.00 ± 0.10	0.50 ± 0.05	0.30 ± 0.05	0.20 ± 0.10	0.20 ± 0.10
TR0603	1.60 ± 0.15	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
TR0805	2.00 ± 0.15	1.25 ± 0.15	0.55 ± 0.10	0.35 ± 0.20	0.40 ± 0.20
TR1206	3.10 ± 0.15	1.60 ± 0.15	0.55 ± 0.10	0.45 ± 0.20	0.50 ± 0.20
TR1210	3.10 ± 0.15	2.50 ± 0.15	0.55 ± 0.10	0.45 ± 0.20	0.50 ± 0.20
TR2010	5.00 ± 0.15	2.50 ± 0.15	0.55 ± 0.10	0.60 ± 0.20	0.60 ± 0.20
TR2512	6.30 ± 0.15	3.20 ± 0.15	0.55 ± 0.10	0.60 ± 0.20	0.60 ± 0.20

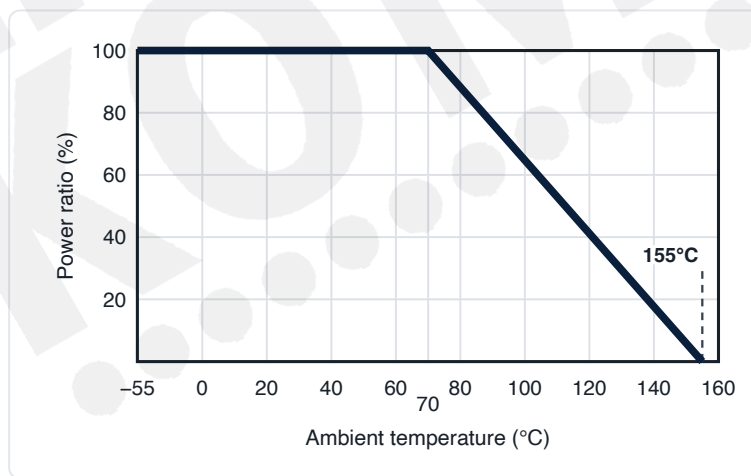
Unit: mm

Performance characteristics

Power derating curve

Operating temperature range: -55 °C ~ +155 °C.

The power rating is based on continuous full-load operation at an ambient temperature of 70 °C. For operation at ambient temperatures above 70 °C, the load should be derated in accordance with the derating curve.



Derating curve

Rated voltage

Resistance range: ≥ 1 Ω ①

Rated voltage: the resistor shall have a DC continuous working voltage or an RMS AC continuous working voltage, at commercial-line frequency and waveform, corresponding to the power rating, as determined by the following formula:

$V = \sqrt{P \times R}$	V = Rated voltage (V)
	P = Rated power (W)
	R = Nominal resistance (Ω)

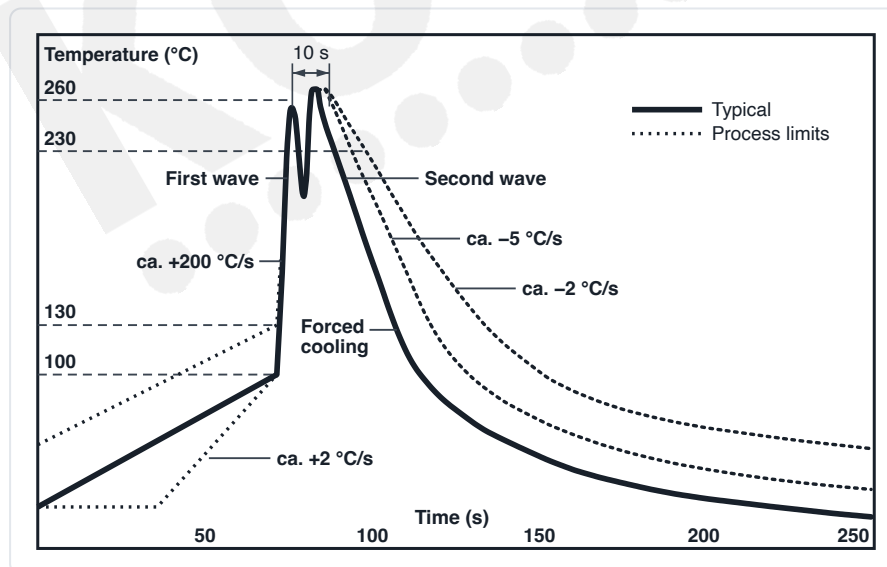
Reliability tests and requirements

Test item	Test method	Procedure	Requirements
Temperature coefficient of resistance (TCR)	JIS C 5201-1 4.8 IEC 60115-1 4.8	At 25 / -55 °C and 25 / +125 °C; 25 °C is the reference temperature	See Standard electrical specifications
Short-time overload	JIS C 5201-1 4.13 IEC 60115-1 4.13	2.5 times RCWV ② or the max. overload voltage, whichever is less, for 5 seconds	±(0.5% + 0.05 Ω) No visible damage
Insulation resistance	JIS C 5201-1 4.6 IEC 60115-1 4.6	Apply 100 V DC for 1 minute	≥ 10 GΩ
Solderability	JIS C 5201-1 4.17 IEC 60115-1 4.17	245±5 °C for 3 seconds	>95% coverage No visible damage
Resistance to soldering heat	JIS C 5201-1 4.18 IEC 60115-1 4.18	260±5 °C for 10 seconds	±(0.5% + 0.05 Ω) No visible damage
Leaching	JIS C 5201-1 4.18 ③ IEC 60068-2-58 8.2.1	260±5 °C for 30 seconds	>95% coverage No visible damage
Rapid change of temperature	JIS C 5201-1 4.19 IEC 60115-1 4.19	-55 °C to +155 °C, 300 cycles	±(0.5% + 0.05 Ω) No visible damage
High temperature exposure	JIS C 5201-1 4.25 ③ IEC 60068-2-2	At 155±5 °C for 1000 hours	±(0.5% + 0.05 Ω)
Resistance to solvent	JIS C 5201-1 4.29	Immerse the resistor in isopropyl alcohol at 20~25 °C for 60 seconds, then leave it at room conditions for 48 hours	±(0.5% + 0.05 Ω) No visible damage
Damp heat with load	JIS C 5201-1 4.24 IEC 60115-1 4.24	40±2 °C, 90~95% RH; RCWV or max. working voltage, whichever is less, for 1000 hours, cycled 1.5 hours ON / 0.5 hour OFF	±(0.5% + 0.05 Ω)
Biased humidity	MIL-STD-202 Method 103	1,000 hours; 85 °C / 85% RH, 10% of operating power. Measurement 24±4 hours after the end of the test	±(0.5% + 0.05 Ω)
Load life (endurance)	JIS C 5201-1 4.25 IEC 60115-1 4.25.1	70±2 °C; RCWV or max. working voltage, whichever is less, for 1000 hours, cycled 1.5 hours ON / 0.5 hour OFF	±(0.5% + 0.05 Ω)
Bending strength	JIS C 5201-1 4.33 IEC 60115-1 4.33	Bend once for 5 seconds; D ④: 0201, 0402, 0603, 0805 = 5 mm 1206, 1210 = 3 mm 2010, 2512 = 2 mm	±(0.5% + 0.05 Ω) No visible damage

AEC-Q200 test reports can also be provided on request.

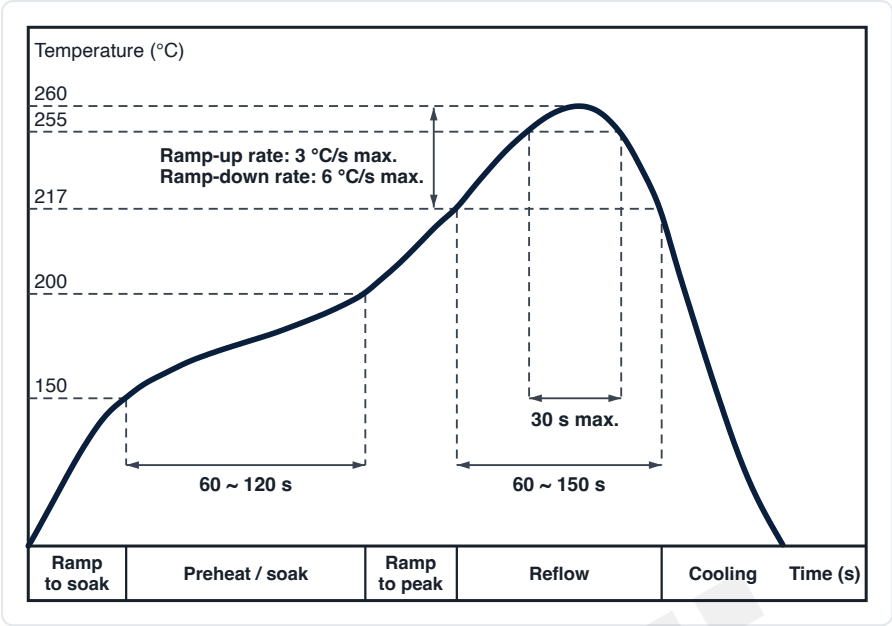
Recommended soldering parameters

Wave soldering temperature profile



Wave soldering profile

Reflow soldering temperature profile



Reflow soldering profile

The peak temperature of soldering heat is 260 °C ⑤ for 10 s.

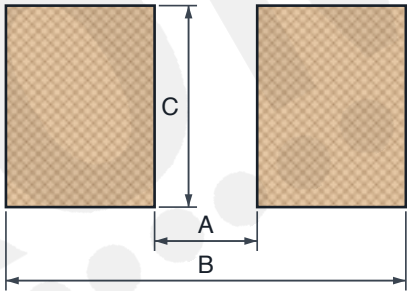
Rework

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

Recommended reflow methods

IR, vapor-phase oven, hot-air oven.
If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

Recommended land pattern



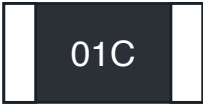
Item / Type	0201	0402	0603	0805	1206	1210	2010	2512
A	0.25	0.50	0.80	1.30	2.20	2.00	3.80	4.90
B	0.85	1.60	2.40	2.90	4.20	4.40	6.60	8.10
C	0.35	0.70	1.00	1.40	1.70	2.70	2.70	3.40

Unit: mm

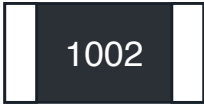
Marking



0201, 0402: no marking



0603: 3-digit code



0805 ~ 2512: 4-digit code

No marking on 0201 and 0402 types.

0603: 3-digit code

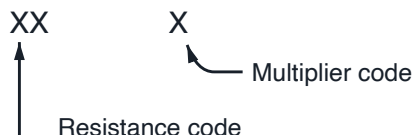
Standard E96 values and 0603 resistance codes

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

E96 multiplier code

Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^7	10^{-1}	10^{-2}	10^{-3}

1. 0603 coding formula for E96 values: code = resistance code XX (from the E96 table) followed by multiplier code X.



Resistance	Significant figures x multiplier	XX	X	Code
10.2 kΩ	$102 \times 10^2 \Omega$	02	C	02C
33.2 Ω	$332 \times 10^{-1} \Omega$	51	X	51X

Further examples: 7.5 Ω = 85Y; 11 Ω = 05X; 130 Ω = 12A; 2 kΩ = 30B; 10 kΩ = 01C; 150 kΩ = 18D.

2. 0603 3-digit code for E24 values (E24 series below; "R" = decimal point).

E24	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
Resistance			4.7 Ω	33 Ω		470 Ω		5.6 kΩ		62 kΩ		680 kΩ												
3-digit code			4R7	330		471		562		623		684												

3. 0603 E192 values have no marking code.

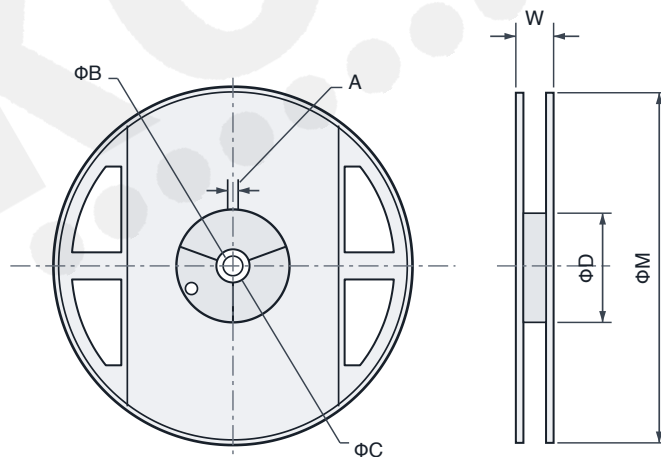
0805 ~ 2512: 4-digit code

The first 3 digits are the significant figures and the 4th digit is the multiplier; "R" = decimal point. Examples:

Resistance	5.6 Ω	10 Ω	22.6 Ω	100 Ω	1.1 kΩ	10 kΩ	332 kΩ	1 MΩ
4-digit code	5R60	10R0	22R6	1000	1101	1002	3323	1004

Packaging

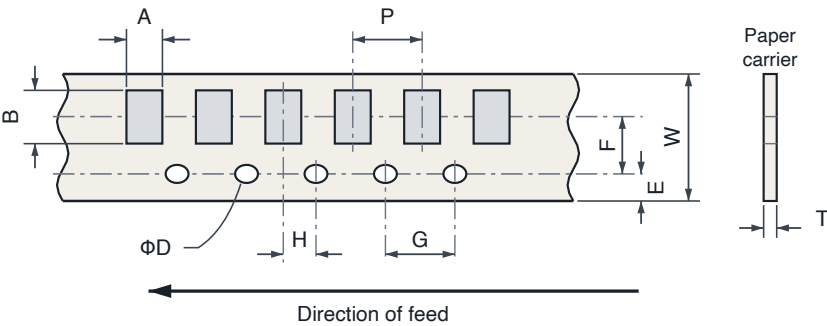
Reel dimensions



Type	Reel	Quantity per reel	A	ΦB	ΦC	ΦD	W	ΦM
0201	7"	10K	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
0402	7"	10K	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
0402	13"	40K / 50K	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0	330±2.0
0603/0805/1206/1210	7"	5K	2.0±0.5	13.5±1.0	21±1.0	60±1.0	11.5±2.0	178±2.0
0603/0805/1206	10"	10K	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0	254±2.0
	13"	20K	2.0±0.5	13.5±1.0	21±1.0	100±1.0	11.5±2.0	330±2.0
2010/2512	7"	4K	2.0±0.5	13.5±1.0	21±1.0	60±1.0	16.0±2.0	178±2.0

Unit: mm

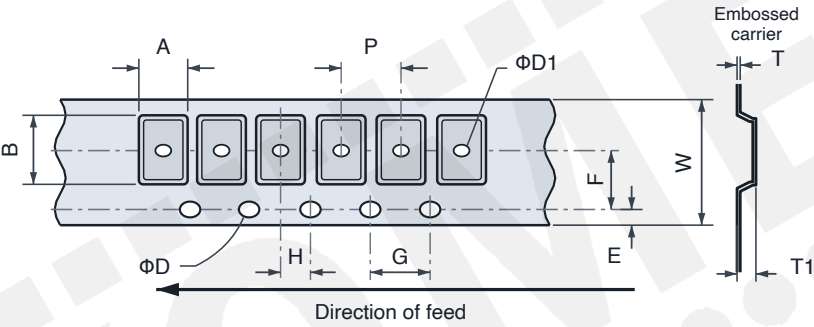
Paper tape dimensions



Type	A	B	W	E	F	G	H	T	ΦD	P
0201	0.40±0.05	0.70±0.05	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.45±0.10	1.50 +0.10/-0	2.0±0.10
0402	0.70±0.10	1.20±0.10	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.45±0.10		4.0±0.10
0603	1.05±0.20	1.80±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.60±0.10		
0805	1.55±0.20	2.30±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		
1206	1.90±0.20	3.50±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		
1210	2.85±0.20	3.50±0.20	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	0.75±0.10		

Unit: mm

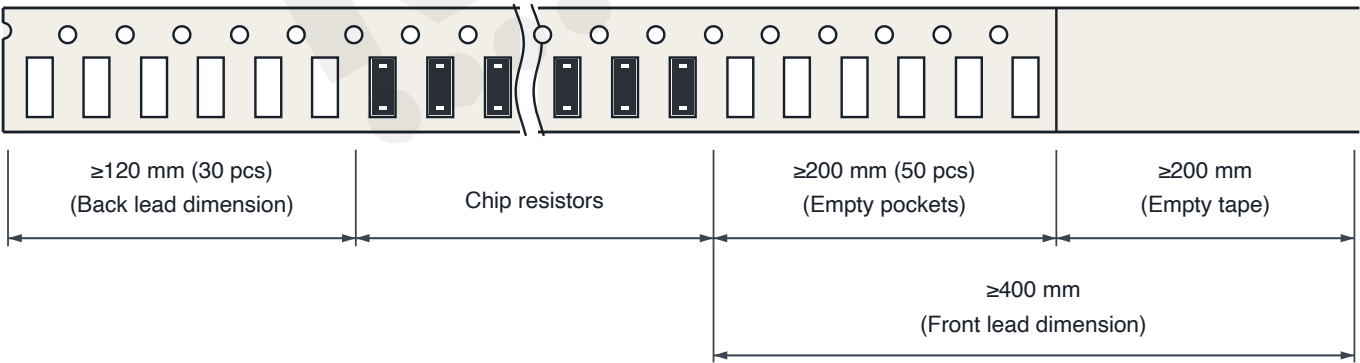
Plastic embossed tape dimensions



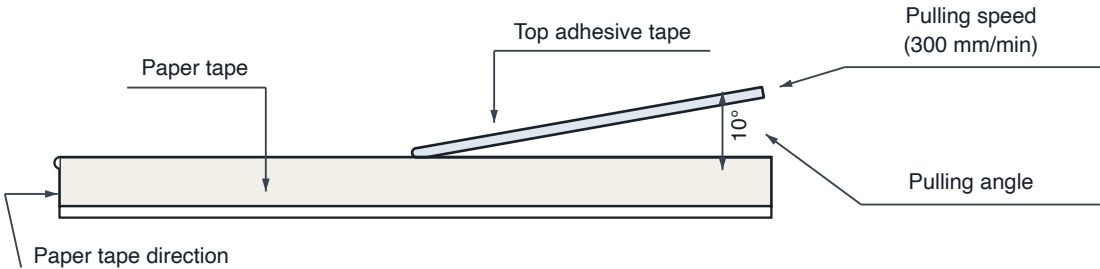
Type	A	B	W	E	F	G	H	T	ΦD	ΦD1	T1	P
2010	2.80±0.20	5.60±0.20	12±0.10	1.75±0.10	5.5±0.05	4.0±0.10	2.0±0.05	0.23±0.10	1.50 +0.10/-0	1.50±0.10	0.85±0.15	4.0±0.10
2512	3.40±0.20	6.70±0.20	12±0.10	1.75±0.10	5.5±0.05	4.0±0.10	2.0±0.05	0.23±0.10		1.50±0.10	0.85±0.15	

Unit: mm

Front and back lead dimensions (leader and trailer)

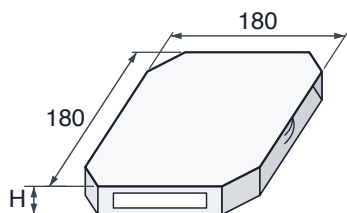


Top adhesive tape peel-off strength: 10~70 g

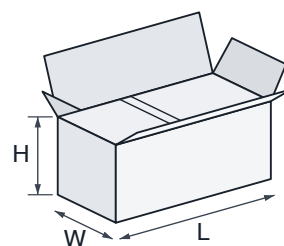


Boxes

Inner box	
Reels	H (mm)
1	13
2	24
3	36
5	60
10	113



External box ⑥			
Quantity	Length (mm)	Width (mm)	Height (mm)
25K	180	180	60
50K	180	180	110
150K	430	200	200
300K	400	400	200



Storage

Storage life: one year from the date of delivery, when stored at an ambient temperature of 25 ± 5 °C and a humidity of $60 \pm 20\%$.

① Rated voltage: the resistance range is given as " $\geq 1 \Omega$ ", while the lowest resistance in the Standard electrical specifications is 2.49Ω — subject to manufacturer confirmation.

② "RCWV" is used in the reliability tests but not defined on the original sheet; it is read here as the rated continuous working voltage (see Rated voltage). The Standard electrical specifications give a maximum working voltage — subject to manufacturer confirmation.

③ Test methods: Leaching cites JIS C 5201-1 clause 4.18, the same clause as Resistance to soldering heat, and High temperature exposure cites clause 4.25, the same clause as Load life — subject to manufacturer confirmation.

④ Bending strength: the symbol D (5 mm, 3 mm or 2 mm depending on size) is not defined on the original sheet — subject to manufacturer confirmation.

⑤ The peak temperature of soldering heat is printed as "260" without a unit; °C is taken from the soldering profiles (peak 260 °C) — subject to manufacturer confirmation.

⑥ Boxes: at 5K per 7-inch reel (0603–1210), 25K is 5 reels and 50K is 10 reels. The external box for 25K is 60 mm high, the same as the inner box for 5 reels, but the external box for 50K is 110 mm high, lower than the inner box for 10 reels (113 mm) — subject to manufacturer confirmation.