NTC Thermistor for Automotive: TSM-C Series

SMD NTC Thermistor for Temperature Sensing

■ Features

1. Qualification based on AEC-Q200 Rev-C
2. Operating temperature range: -50 ~ +150 ℃
3. Superior stability in high-temperature and high-humidity environment
4. RoHS & Halogen Free (HF) compliant

■ Recommended Applications

1. Car audio, car navigation
2. Various engine control units
3. Circuits for ETC equipment
4. Various motor driving circuits
5. Temperature compensation for various circuits

■ Part Number Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Product Type

TSM	THINKING SMD NTC Thermistor TSM Series

Size (EIA)

1	0402
2	0603
3	0805
4	1206

Definition of B Value

C	$B_{25/85}$
D	$B_{25/50}$

Zero Power Resistance at 25℃ (R_{25})

102	$10x10^2\Omega$=1 KΩ
103	$10x10^3\Omega$=10 KΩ
473	$47x10^3\Omega$=47 KΩ

Tolerance of R_{25}

F	±1%
G	±2%
H	±3%
J	±5%
K	±10%

B Value

338	3380
34D	3435
39H	3975
44F	4455

Tolerance of B Value

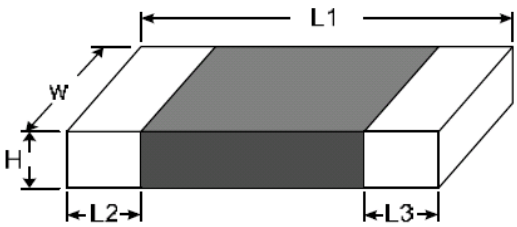
1	±1%
2	±2%
3	±3%
5	±5%

Packaging

R	Reel
B	Bulk

Optional Suffix

■ Structure and Dimensions



(Unit: mm)

Part No.	Size(EIA)	L1.	W	H max.	L2 & L3
TSM0	0402	1.00±0.15	0.50±0.10	0.60	0.20±0.10
TSM1	0603	1.60±0.15	0.80±0.15	0.95	0.40±0.15
TSM2	0805	2.00±0.20	1.25±0.20	1.00	0.40±0.20
TSM3	1206	3.20±0.30	1.60±0.20	1.50	0.50±0.20

■ Electrical Characteristics

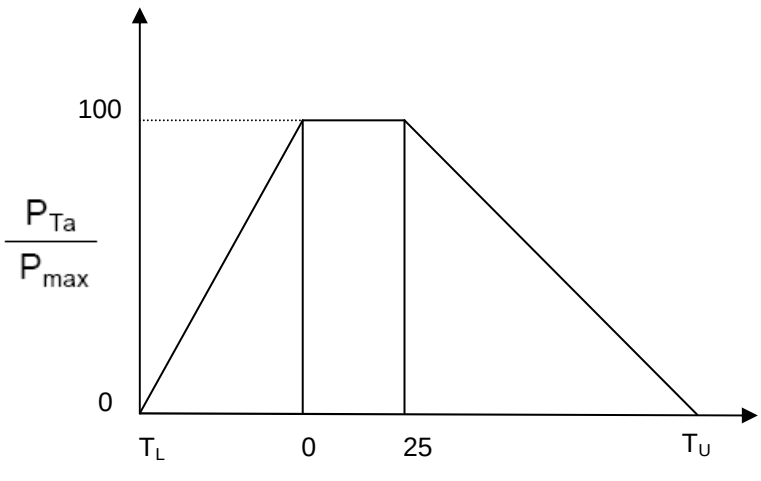
Part No.	Size	Zero Power Resistance at 25℃	Tolerance of R_{25}	B Value		Tolerance of B value	Max. Power Dissipation at 25℃	Dissipation Factor	Thermal Time Constant	Operating Temperature Range
		R_{25}(KΩ)	(±%)	(K)		(±%)	P_{max}(mW)	δ(mW/℃)	τ(Sec.)	T_L~T_U(℃)
TSM0D103□338*	0402	10	1,2,3,5	25/50	3380	1,2,3	170	Approx. 1.7	Approx. 2.0	-50 ~ +150
TSM1C472□383*	0603	4.7	1,2,3,5	25/85	3830	1,2,3	210	Approx. 2.1	Approx. 3.1	-50 ~ +150
TSM1C103□34D*		10	1,2,3,5		3435	1,2,3				
TSM1C223□44F*		22	5		4455	3				
TSM1C473□39H*		47	1,2,3,5		3975	1,2,3				
TSM1C104□410*		100	1,2,3,5		4100	1,2,3				
TSM2C472□347*	0805	4.7	1,2,3,5	25/85	3470	1,2,3	240	Approx. 2.4	Approx. 5.4	-50 ~ +150
TSM2C502□34D*		5	1,2,3,5		3435	1,2,3				
TSM2C103□34D*		10	1,2,3,5		3435	1,2,3				
TSM2C103□39H*		10	1,2,3,5		3975	1,2,3				
TSM2C473□39H*		47	1,2,3,5		3975	1,2,3				
TSM3C103□351*	1206	10	3,5	25/85	3510	3	320	Approx. 3.2	Approx. 6.7	-50 ~ +150

Note 1: □ = Tolerance of R_{25} (F : ± 1%, G: ±2%, H: ±3%, J: ± 5%, K: ± 10%)

Note2: * = Tolerance of B value (1: ± 1%, 2: ±2%, 3: ±3%)

Note3: R_{25} and B are available upon request

■ Max. Power Dissipation Derating Curve



T_U：Maximum operating temperature (℃)

T_L：Minimum operating temperature (℃)

For example：

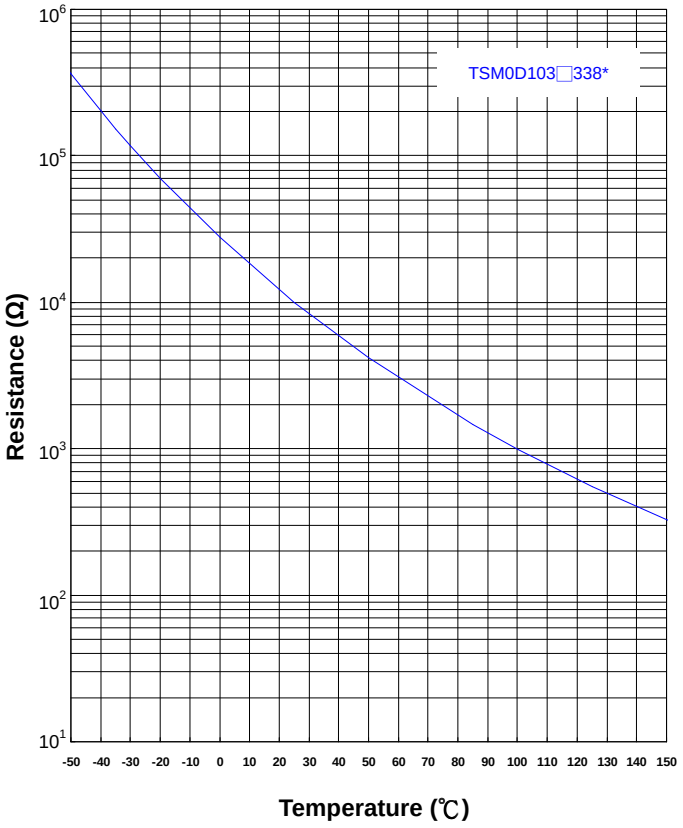
Ambient temperature (Ta)=55℃

Maximum operating temperature (T_U)＝150℃

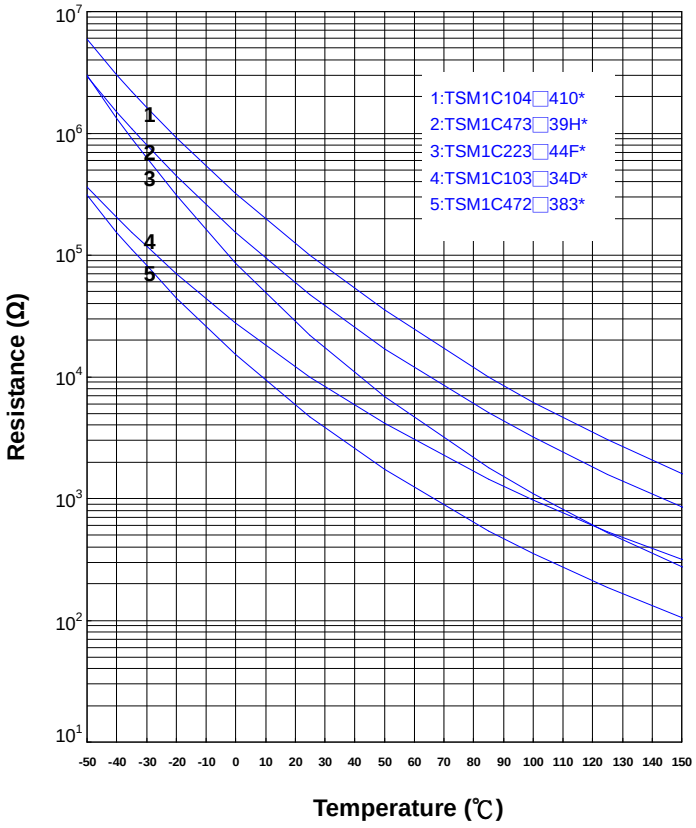
P_{Ta}=(T_U-Ta)/(T_U-25)×Pmax＝76% Pmax

■ R-T Characteristic Curves

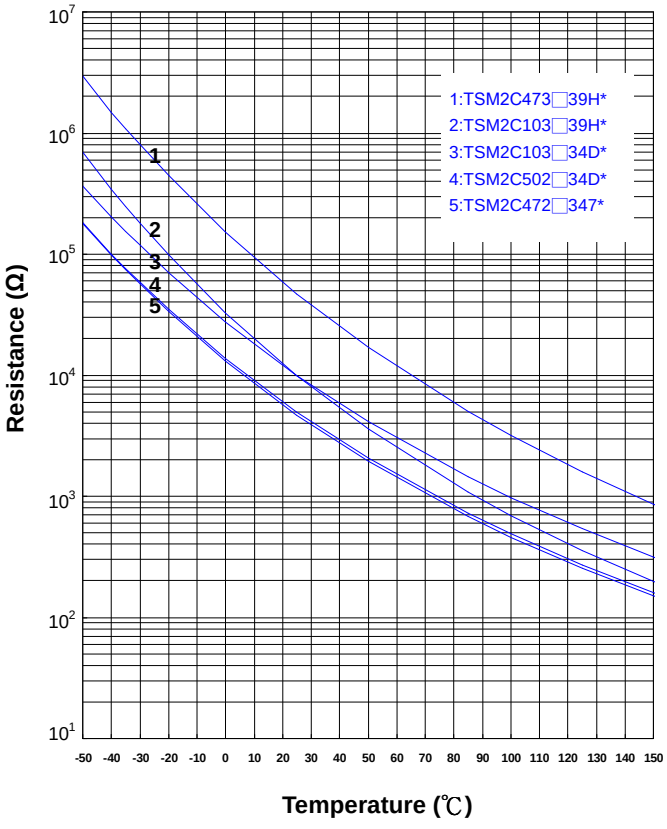
0402 Series



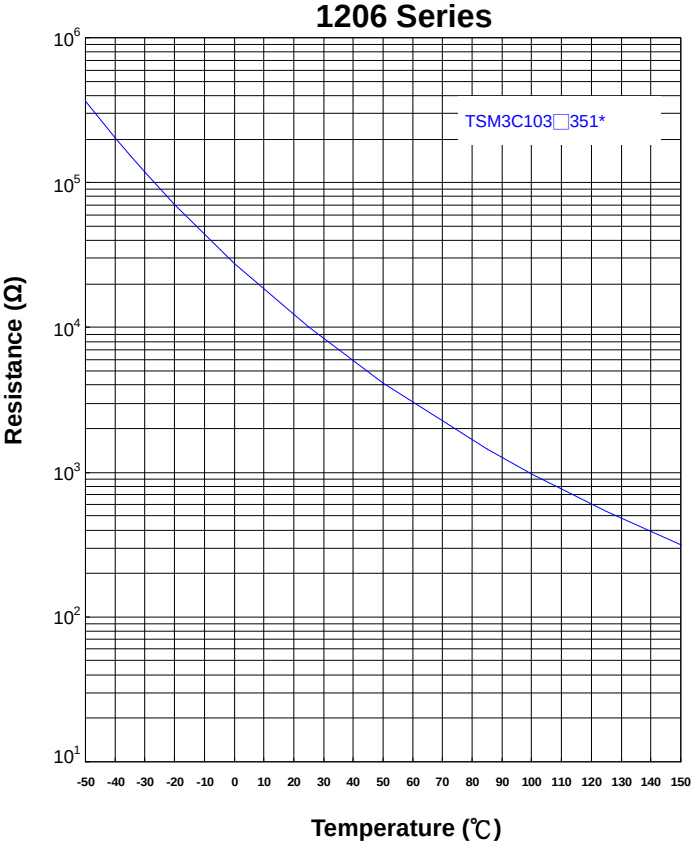
0603 Series



0805 Series

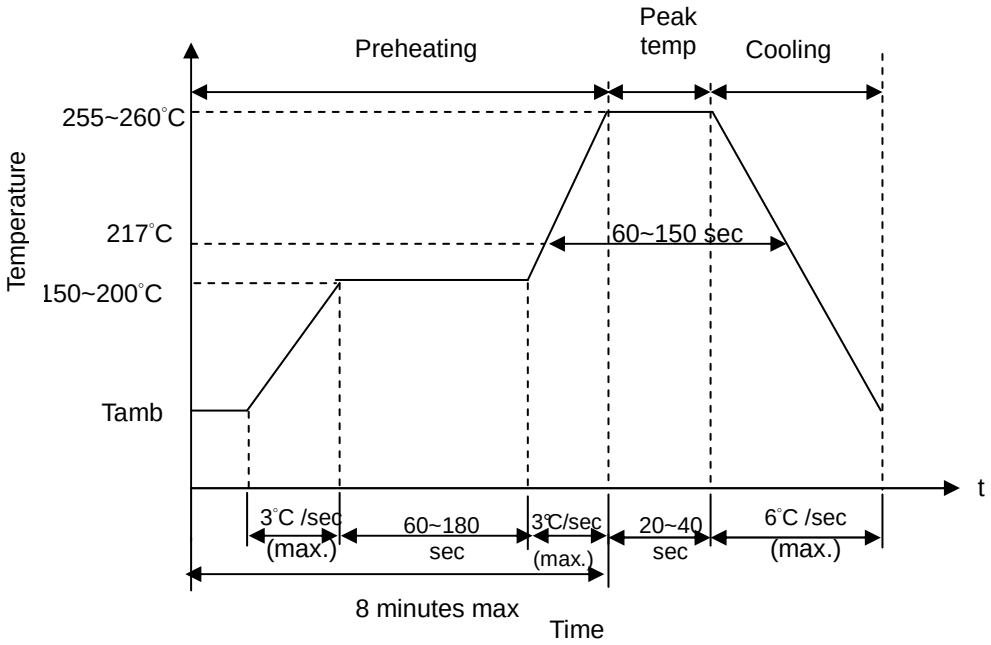


1206 Series



■ Soldering Recommendation

● IR-reflow Soldering Profile

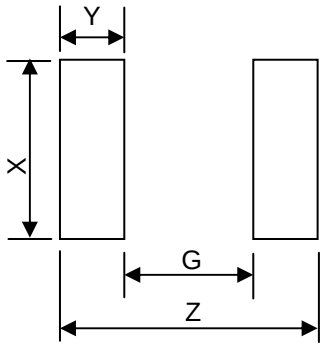


● Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	360℃(max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ3mm (max.)

Caution: Do not touch the component surface with soldering iron directly to prevent it from damage.

■ Recommended Soldering Pad Dimensions



Size(EIA)	Z (mm)	G (mm)	X (mm)	Y (mm)
0402	1.7	0.5	0.6	0.6
0603	3.0	1.0	1.0	1.0
0805	3.4	1.0	1.4	1.2
1206	4.5	2.1	1.8	1.2

■ Reliability (based on AEC-Q200 Rev-C)

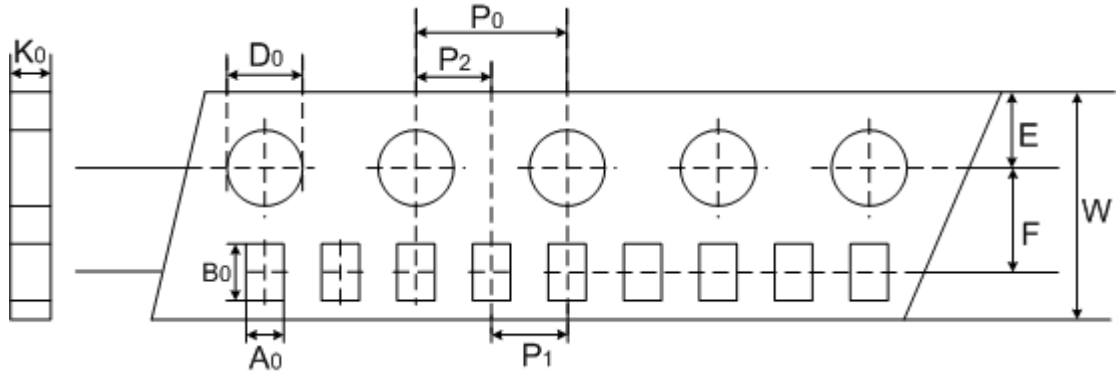
<table>
<tr><th>Item</th><th>Standard</th><th>Test conditions / Methods</th><th>Specifications</th></tr>
<tr><td>High Temperature Exposure (Storage)</td><td>MIL-STD-202 Method 108</td><td>Test temp.: 150 +3/-0℃
Duration: 1000 h Unpowered
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
$|\triangle R_{25}/R_{25}| \leqq 5\ \%$</td></tr>
<tr><td>Temperature Cycling</td><td>JESD22 Method JA-104</td><td>Lower test temp. : -55 +0/-3℃
Upper test temp. : 150 +3/-0℃
Soak Time at Lower or Upper Temperature: 1 min
Cycle time: 2 Cycles/hr
Number of cycles: 1000
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
$|\triangle R_{25}/R_{25}| \leqq 5\ \%$</td></tr>
<tr><td>Moisture Resistance</td><td>MIL-STD-202 Method 106</td><td>Duration of 1 cycle: 24 h
Number of cycles: 10, Unpowered
Measurement at 24±2 hours after test conclusion.
<table>
<tr><th rowspan="2">Step</th><th colspan="2">Temp. (℃)</th><th>Humidity</th><th>Period</th></tr>
<tr><th>Start</th><th>Finish</th><th>(%)</th><th>(hr)</th></tr>
<tr><td>1</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr>
<tr><td>2</td><td>65</td><td>65</td><td>90~100</td><td>3</td></tr>
<tr><td>3</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr>
<tr><td>4</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr>
<tr><td>5</td><td>65</td><td>65</td><td>90~100</td><td>3</td></tr>
<tr><td>6</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr>
<tr><td>7</td><td>25</td><td>25</td><td>80~100</td><td>8</td></tr>
</table></td><td>No visible damage
$|\triangle R_{25}/R_{25}| \leqq 5\ \%$</td></tr>
<tr><td>Biased Humidity</td><td>MIL-STD-202 Method 103</td><td>Test temp. : 85℃
Rel. humidity of air: 85%
Duration: 1000 h
10% Rated Power.
Measurement at 24±2 hours after test conclusion.</td><td>No visible damage
$|\triangle R_{25}/R_{25}| \leqq 5\ \%$</td></tr>
</table>

Item	Standard	Test conditions / Methods	Specifications
Operational Life	MIL-STD-202 Method 108	Test temp. : 150 +3/-0℃ Duration: 1000 h Test Power: 1mW Measurement at 24±2 hours after test conclusion.	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$
External Visual	MIL-STD-883 Method 2009	Inspect device construction, marking and workmanship.	No visible damage
Physical Dimension	JESD22 Method JB-100	Verify physical dimensions to the applicable device specification.	Within the specified values
Resistance to Solvents	MIL-STD-202 Method 215	Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol 3 part (by volume) of mineral spirits.	No visible damage
Mechanical Shock	MIL-STD -202-213	Test Condition F Peak value: 1500g's Half sine Waveform Normal duration (D) : 0.5ms In 3 directions perpendicularly intersecting each other (total 18 times).	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$
Vibration	MIL-STD-202 Method 204	Acceleration: 5 g's Sweep time: 20 min Frequency range: 10 to 2000 Hz 3×12 cycles	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B No pre-heat of samples. Temperature: 260±5℃,Time: 10±1s Immersion and emersion rate: 25mm/s ±6 mm/s Number of heat cycles: 1	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 3\%$
Thermal Shock	MIL-STD-202 Method 107	Lower test temp. : -55 +0/-3℃ Upper test temp. : 150 +3/-0℃ Maximum transfer time: 20 seconds. Dwell time: 15 minutes. Air-Air. Number of cycles: 300	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$

Item	Standard	Test conditions / Methods	Specifications
ESD	AEC-Q200 -002	Discharge capacitance: 150 pF Charging voltage: 6 KV Contact discharge 1 pulse in each polarity	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$
Solderability	IEC60068-2-58 J-STD-002	a) 4 h @ 155℃ dry heat Dip @245±5℃ 3±0.3sec b) Steam aging 8h±15min @93±3℃ Dip @260±5℃ 7±0.5sec	95% of termination wetted
Electrical Characterization	Specifications	R(-50℃) 、R(25℃) 、R(150℃) B(R25℃/R50℃) or B(R25℃/R85℃)	Within the specified values
Board Flex	AEC-Q200 -005 (JIS-C-6429)	Bend the board: 2mm (Min.) Duration: 60 (+5) Sec	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$
Terminal Strength	AEC-Q200 -006 (JIS-C-6429)	Apply force: 0402=0.5kg (5 N) 0603=1.0kg (10 N) 0805,1206=1.8kg (17.7 N) Duration of the applied forces: 60 (+1) Sec	No visible damage $\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$

■ Package

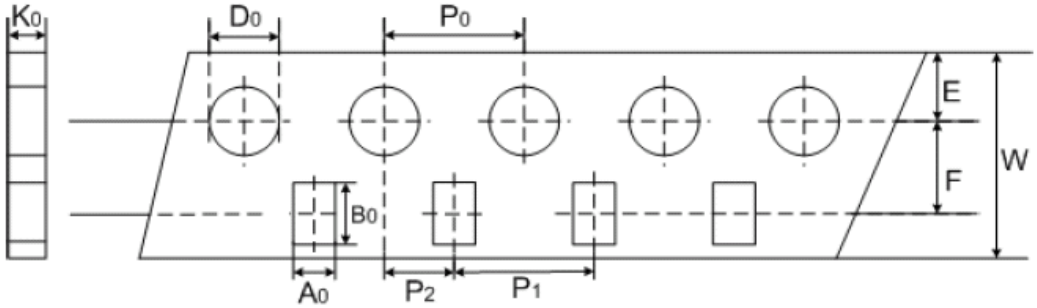
● Taping Specification (SMD 0402)



(Unit: mm)

Index / Size	A_0 ±0.05	B_0 ±0.12	W ±0.2	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	K_0 ±0.1
0402	0.62	1.12	8	1.75	3.5	2	2	4	1.55	0.60

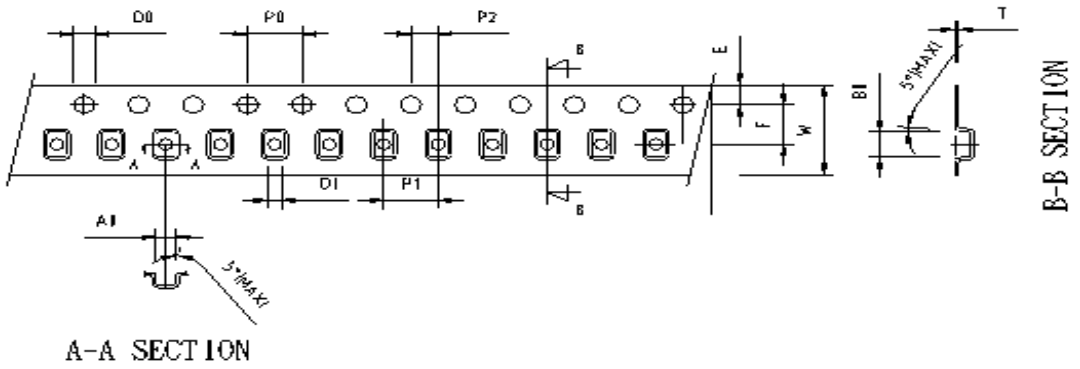
● Taping Specification (SMD 0603 & 0805)



(Unit: mm)

Index / Size	A_0 ±0.2	B_0 ±0.2	W ±0.2	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	K_0 ±0.1
0603	1.1	1.9	8	1.75	3.5	4	2	4	1.55	0.95
0805	1.5	2.3	8	1.75	3.5	4	2	4	1.55	1.0

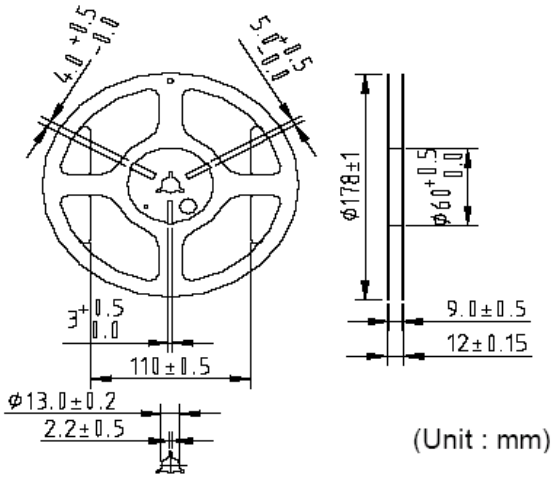
● Taping Specification (SMD 1206)



(Unit: mm)

Index / Size	A_0 ±0.2	B_0 ±0.2	W ±0.2	E ±0.1	F ±0.05	P_1 ±0.1	P_2 ±0.05	P_0 ±0.1	D_0 ±0.1	D_1 ±0.1	T ±0.1
1206	1.85	3.45	8	1.75	3.5	4	2	4	1.55	1	0.25

■ Quantity



Type	Quantity (pcs/reel)
0402	10,000
0603	4,000
0805	3,500
1206	2,500

■ Warehouse Storage Conditions of Products

- Storage Conditions :
  1. Storage Temperature: -10℃~+40℃
  2. Relative Humidity: ≦75%RH
  3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage : 1 year