

# NTC Thermistor for Automotive: TSM-C Series



## SMD NTC Thermistor for Temperature Sensing

### ■ Features

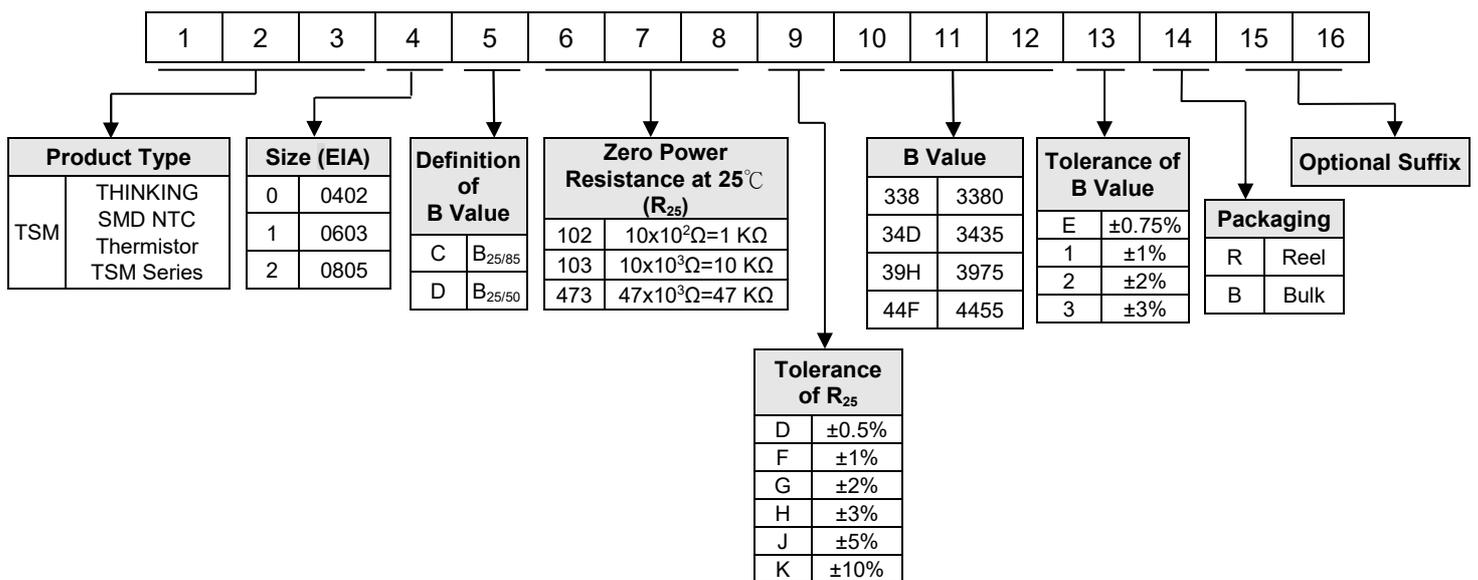
1. Qualification based on AEC-Q200 Rev-D
2. Operating temperature range: -50 ~ +150 °C
3. Superior stability in high-temperature and high-humidity environment
4. RoHS & Halogen Free (HF) compliant



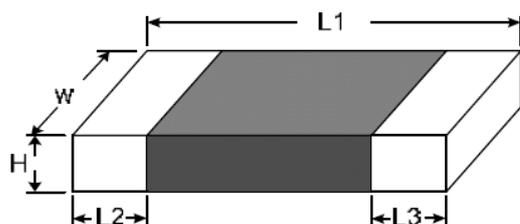
### ■ Recommended Applications

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



### ■ Structure and Dimensions



(Unit: mm)

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

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### Electrical Characteristics

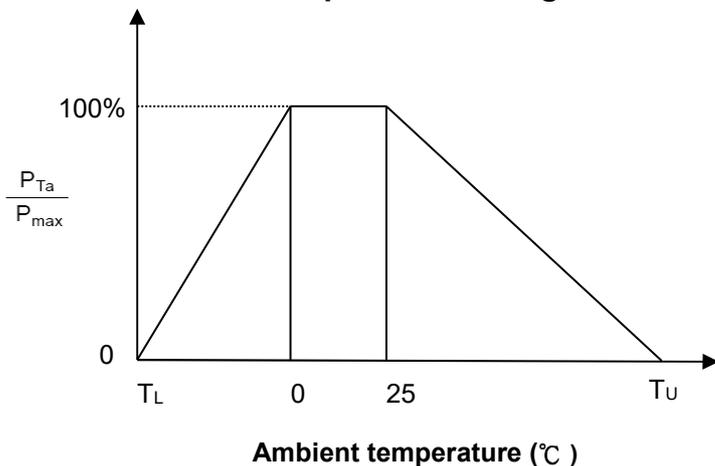
Part No.	Size	Zero Power Resistance at 25°C	Tolerance of R <sub>25</sub>	B Value		Tolerance of B value	Max. Power Dissipation at 25°C	Dissipation Factor	Thermal Time Constant	Max. Operating Current at 25°C	Operating Temperature Range			
		R <sub>25</sub> (KΩ)	(±%)	(K)		(±%)	P <sub>max</sub> (mW)	Δ (mW/°C)	τ(Sec.)	I <sub>max</sub> (mA)	T <sub>L</sub> ~T <sub>U</sub> (°C)			
TSM0C103□34D*	0402	10	0.5,1,2,3,5,10	25/85	3435	0.75,1,2,3	170	Approx. 1.7	Approx. 2.0	0.41	-50 ~ +150			
TSM0D103□338*		10			3380									
TSM0D104□425*		100	1,2,3,5,10	25/50	4250	1,2,3				0.13				
TSM1C472□385*	0603	4.7	1,2,3,5,10	25/85	3850	1,2,3	210	Approx. 2.1	Approx. 3.1	0.67	-50 ~ +150			
TSM1C682□395*		6.8			3950					0.56				
TSM1C103□34D*		10	0.5,1,2,3,5,10	25/85	3435	0.75,1,2,3				0.46				
TSM1D103□338*		10		25/50	3380									
TSM1C103□395*		10	1,2,3,5,10	25/85	3950	1,2,3				0.21				
TSM1C473□39H*		47										3975		
TSM1C104□425*		100										4250	0.14	
TSM1D103□390*		10		25/50	3900							0.46		
TSM1D473□405*		47											4050	0.21
TSM1D104□455*		100											4550	0.14
TSM2C472□347*		0805		4.7	1,2,3,5,10							25/85	3470	1,2,3
TSM2C103□34D	10			3435			0.49							
TSM2C103□395*	10			3950			0.23							
TSM2C473□39H*	47		3975	0.15										
TSM2C104□429*	100		4290	0.33										
TSM2D223□395*	22		25/50	3950										

Note 1: □ = Tolerance of R<sub>25</sub> (D: ± 0.5%, F: ± 1%, G: ±2%, H: ±3%, J: ± 5%, K: ± 10%)

Note2: \* = Tolerance of B value (E: ± 0.75%, 1: ± 1%, 2: ±2%, 3: ±3%)

Note3: R<sub>25</sub> and B are available upon request

### Max. Power Dissipation Derating Curve



T<sub>U</sub> : Maximum operating temperature (°C)

T<sub>L</sub> : Minimum operating temperature (°C)

For example :

Ambient temperature (T<sub>a</sub>)=55°C

Maximum operating temperature (T<sub>U</sub>)= 150°C

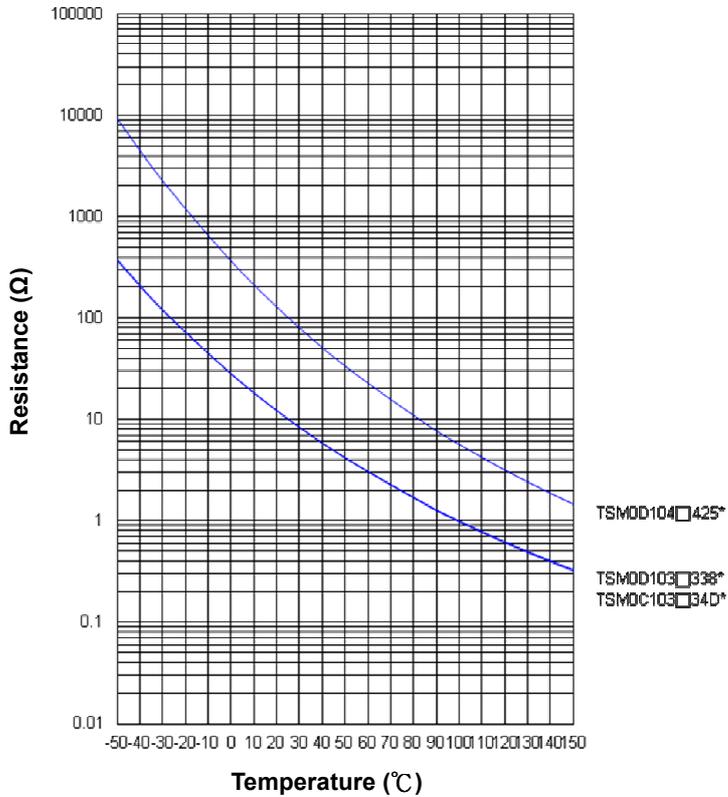
$P_{Ta}=(T_U-T_a)/(T_U-25) \times P_{max} = 76\% P_{max}$



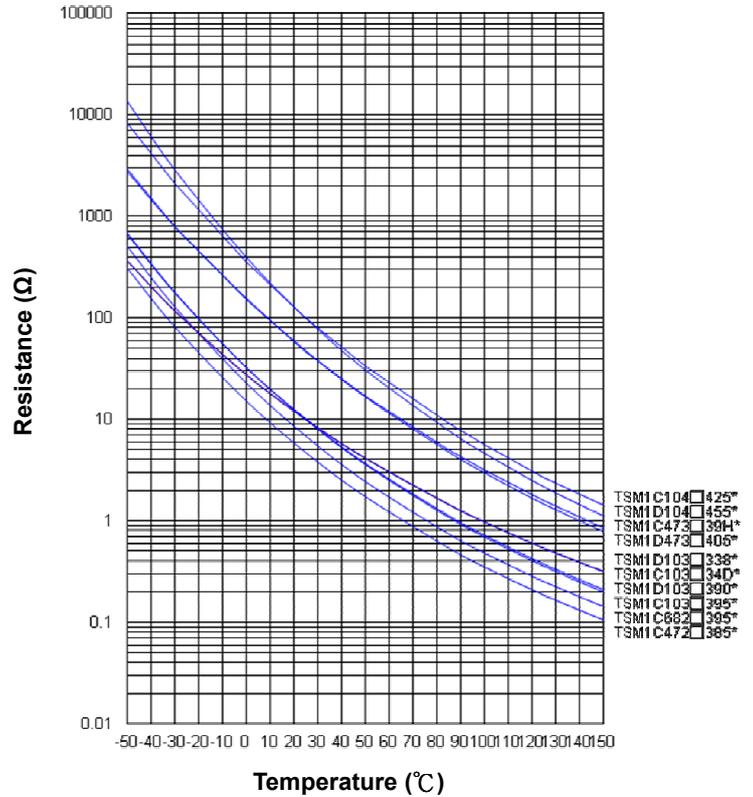
## SMD NTC Thermistor for Temperature Sensing

### ■ R-T Characteristic Curves

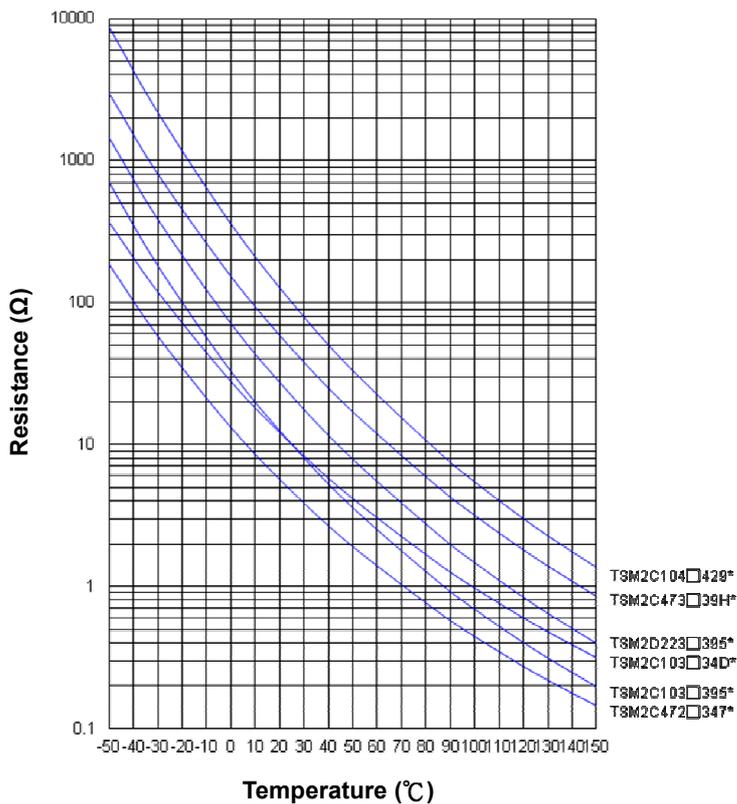
#### 0402 Series



#### 0603 Series



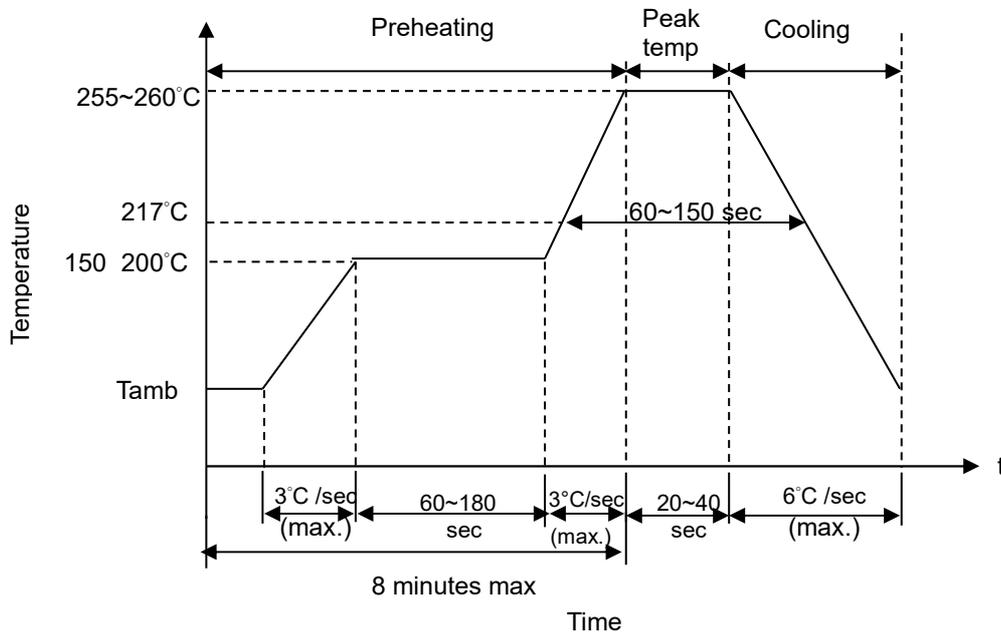
#### 0805 Series



## SMD NTC Thermistor for Temperature Sensing

### ■ Soldering Recommendation

#### ● IR-reflow Soldering Profile

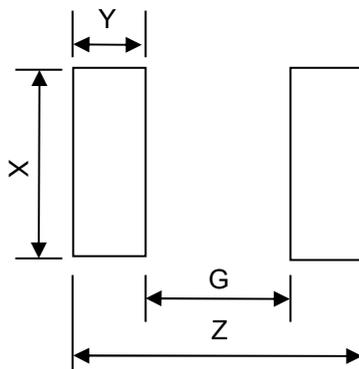


#### ● Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	360°C (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	1.4	0.4	0.5	0.5
0603	2.8	0.8	1.0	1.0
0805	3.4	1.0	1.4	1.2

#### Notice of Mounting on Flexible Printed Circuit (FPC):

1. Before SMDs mounting, a support plate should be attached to the back of the SMDs mounting position on the FPC to avoid undue stress being imposed on the SMDs body during the placing process.
2. After SMDs mounting is completed, a protective frame should be attached around the outside of the SMDs mounting position to avoid inappropriate stress being directly applied to the SMDs body during the subsequent assembly process.

### ■ Reliability (based on AEC-Q200 Rev-D)

Item	Standard	Test conditions / Methods	Specifications
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	Test temp.: 150 +3/-0°C Duration: 1000 h Unpowered Measurement at 24±2 hours after test conclusion.	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 5\%$
Temperature Cycling	JESD22 Method JA-104	Lower test temp.: -50 +0/-3°C Upper test temp.: 150 +3/-0°C Dwell Time at Lower or Upper Temperature: 30 min Maximum transition time: 1 min Number of cycles: 1000 Measurement at 24±4 hours after test conclusion.	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 5\%$
Biased Humidity	MIL-STD-202 Method 103	Test temp. : 85°C Rel. humidity of air: 85% +5/-0% Duration: 1000 h 10% Rated Power. Measurement at 24±4 hours after test conclusion.	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 5\%$
Operational Life	MIL-STD-202 Method 108	Test temp.: 150 +3/-0°C Duration: 1000 h Test power: 1mW Measurement at 24±4 hours after test conclusion.	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 5\%$
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 Method 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   $\Delta R_{25}/R_{25}$   $\leq 5\%$
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   $\Delta R_{25}/R_{25}$   $\leq 5\%$
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B No pre-heat of samples. Temperature: 260±5°C, Time: 10±1s Immersion and emersion rate: 25±6 mm/s Number of heat cycles: 1	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 3\%$
ESD	AEC-Q200 -002	Discharge capacitance : 150 pF Test from 6KV DC to 25KV AD 1 pulse in each polarity (DC=Direct Contact Discharge, AD=Air Discharge)	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 5\%$

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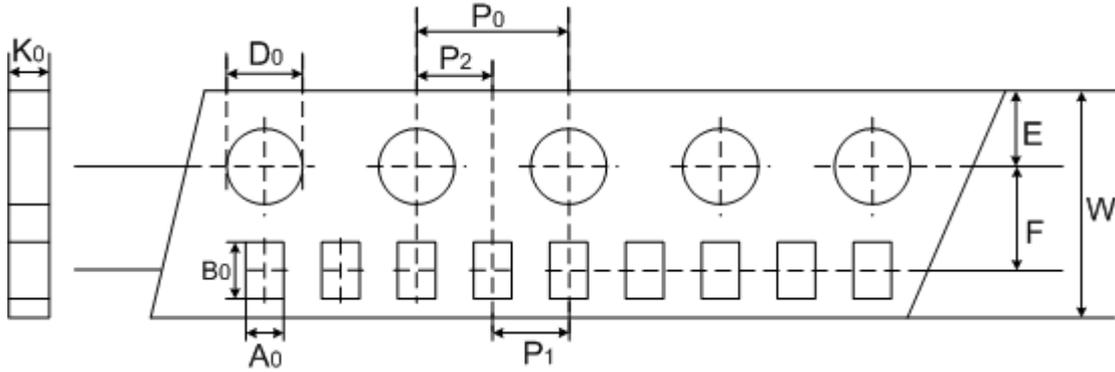
## SMD NTC Thermistor for Temperature Sensing

Item	Standard	Test conditions / Methods	Specifications
Solderability	IEC60068-2-58 J-STD-002	a) 4 h @ 155°C dry heat Dip @245±5°C 3±0.3sec b) Steam aging 8h±15min @93±3°C Dip @260±5°C 7±0.5sec	95% of termination wetted
Electrical Characterization	Specifications	R(-50°C), R(25°C), R(150°C) B(R25°C/R50°C) or B(R25°C/R85°C)	Within the specified values
Board Flex	AEC-Q200 -005	Bend the board: 2mm (Min.) Duration: 60 (+5) Sec	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 5\%$
Terminal Strength	AEC-Q200 -006	Apply force : 0201=0.15kg (1.5 N) 0402=0.5kg (5 N) 0603=1.0kg (10 N) $\geq 0805=1.8kg (17.7 N)$ Duration : 60 (+1) Sec	No visible damage   $\Delta R_{25}/R_{25}$   $\leq 5\%$

## SMD NTC Thermistor for Temperature Sensing

### ■ Package

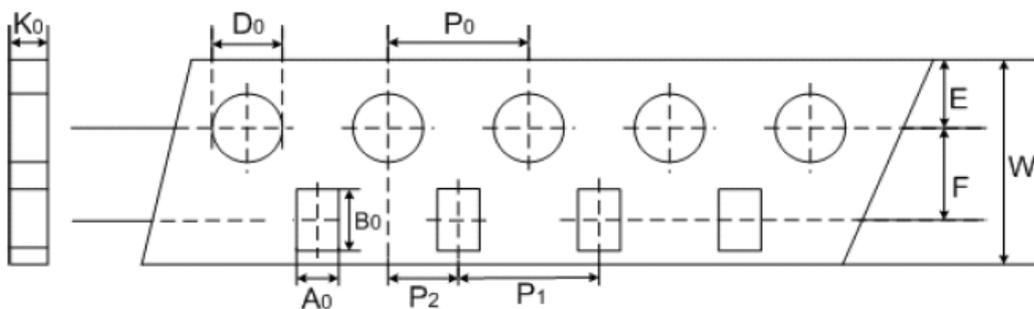
#### ● Taping Specification (SMD 0402)



(Unit: mm)

Index Size	$A_0$	$B_0$	$W$	$E$	$F$	$P_1$	$P_2$	$P_0$	$D_0$	$K_0$
0402	$\pm 0.05$	$\pm 0.12$	$\pm 0.2$	$\pm 0.1$	$\pm 0.05$	$\pm 0.1$	$\pm 0.05$	$\pm 0.1$	$\pm 0.1$	$\pm 0.1$

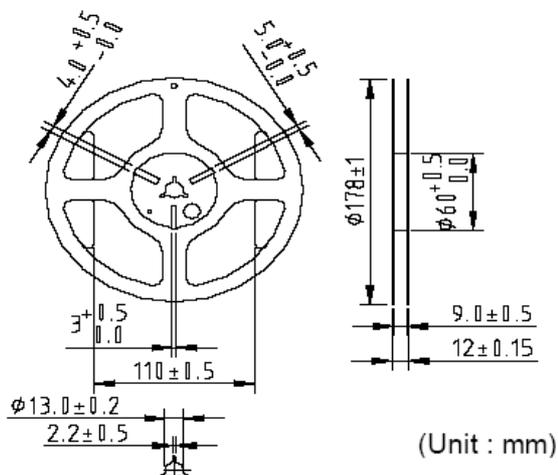
#### ● Taping Specification (SMD 0603 & 0805)



(Unit: mm)

Index Size	$A_0$	$B_0$	$W$	$E$	$F$	$P_1$	$P_2$	$P_0$	$D_0$	$K_0$
0603	$\pm 0.2$	$\pm 0.2$	$\pm 0.2$	$\pm 0.1$	$\pm 0.05$	$\pm 0.1$	$\pm 0.05$	$\pm 0.1$	$\pm 0.1$	$\pm 0.1$
0805	1.5	2.3	8	1.75	3.5	4	2	4	1.55	1.0

### ■ 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:  $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$
  2. Relative Humidity:  $\leq 75\% \text{RH}$
  3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage : 1 year