

NTC Thermistor for Automotive: TSM-C Series



SMD NTC Thermistor for Temperature Sensing

■ Features

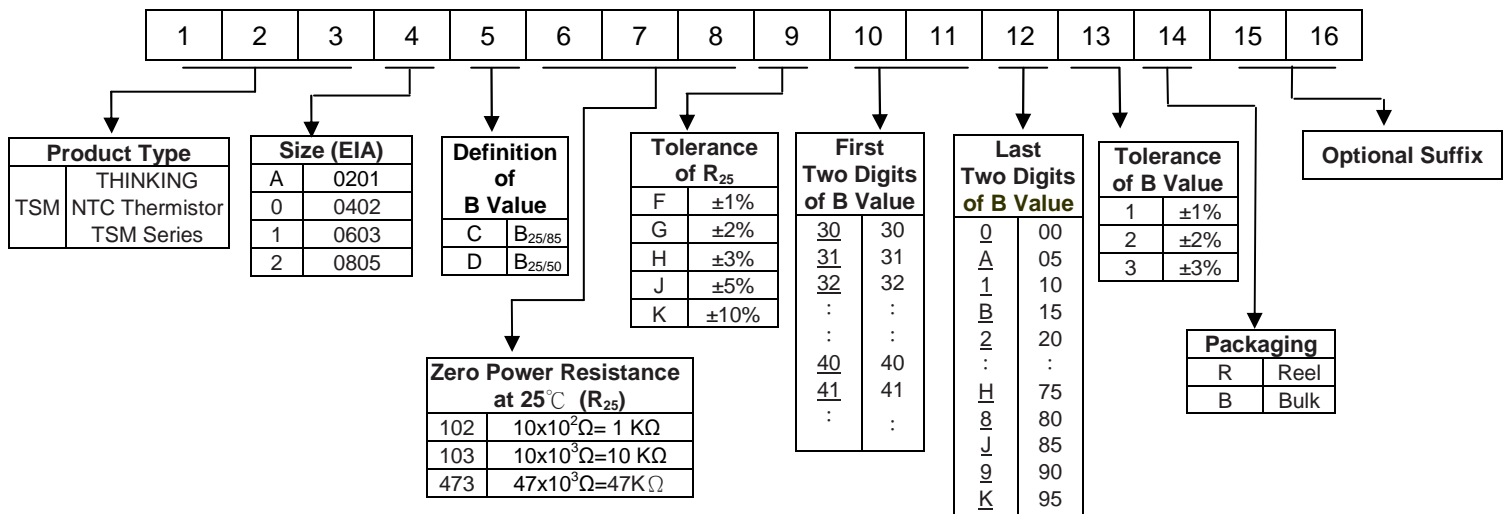
1. Qualification based on AEC-Q200 Rev-C
2. Operating temperature range: -50 ~ +150 °C
3. Superior stability in high-temperature and high-humidity environment
4. RoHS compliant



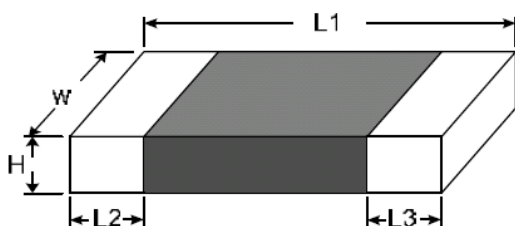
■ Recommended Applications

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 | L1. | W | H max. | L2 & L3 |
|----------|------|-----------|-----------|--------|-----------|
| 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 | 1.20 | 0.40±0.20 |

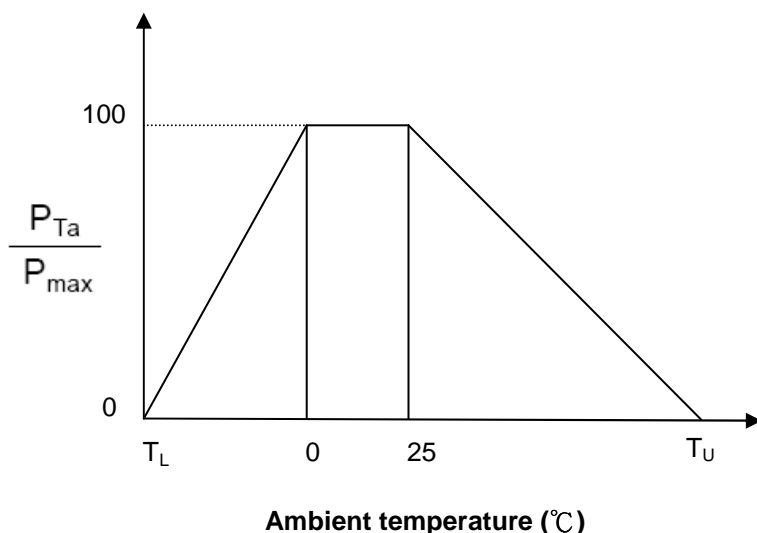
Electrical Characteristics

| Part No. | Zero Power Resistance at 25°C | Tolerance of R ₂₅ | B Value | | Tolerance of B value | Max. Power Dissipation at 25°C | Dissipation Factor | Thermal Time Constant | Operating Temperature Range |
|----------------|-------------------------------|------------------------------|---------|------|----------------------|--------------------------------|--------------------|-----------------------|-----------------------------|
| | R ₂₅ (KΩ) | | (±%) | (K) | | | | | |
| TSM1C103F34D3R | 10 | 1 · 2 · 3 | 25/85 | 3435 | 3 | 210 | Approx. 2.1 | Approx. 3.1 | -50 ~ +150 |
| TSM1C103F39H3R | 10 | | 25/85 | 3975 | | | | | |
| TSM1C473F39H3R | 47 | | 25/85 | 3975 | | | | | |
| TSM2C103F34D3R | 10 | 1 · 2 · 3 | 25/85 | 3435 | 3 | 240 | Approx. 2.4 | Approx. 5.4 | -50 ~ +150 |
| TSM2C103F39H3R | 10 | | 25/85 | 3975 | | | | | |
| TSM2C473F39H3R | 47 | | 25/85 | 3975 | | | | | |

Note 1: □ = Tolerance of R₂₅

*Special specifications are available upon request

Max. Power Dissipation Derating Curve



T_U : Maximum operating temperature (°C)

T_L : Minimum operating temperature (°C)

For example :

Ambient temperature (T_a)=55°C

Maximum operating temperature (T_U)=150°C

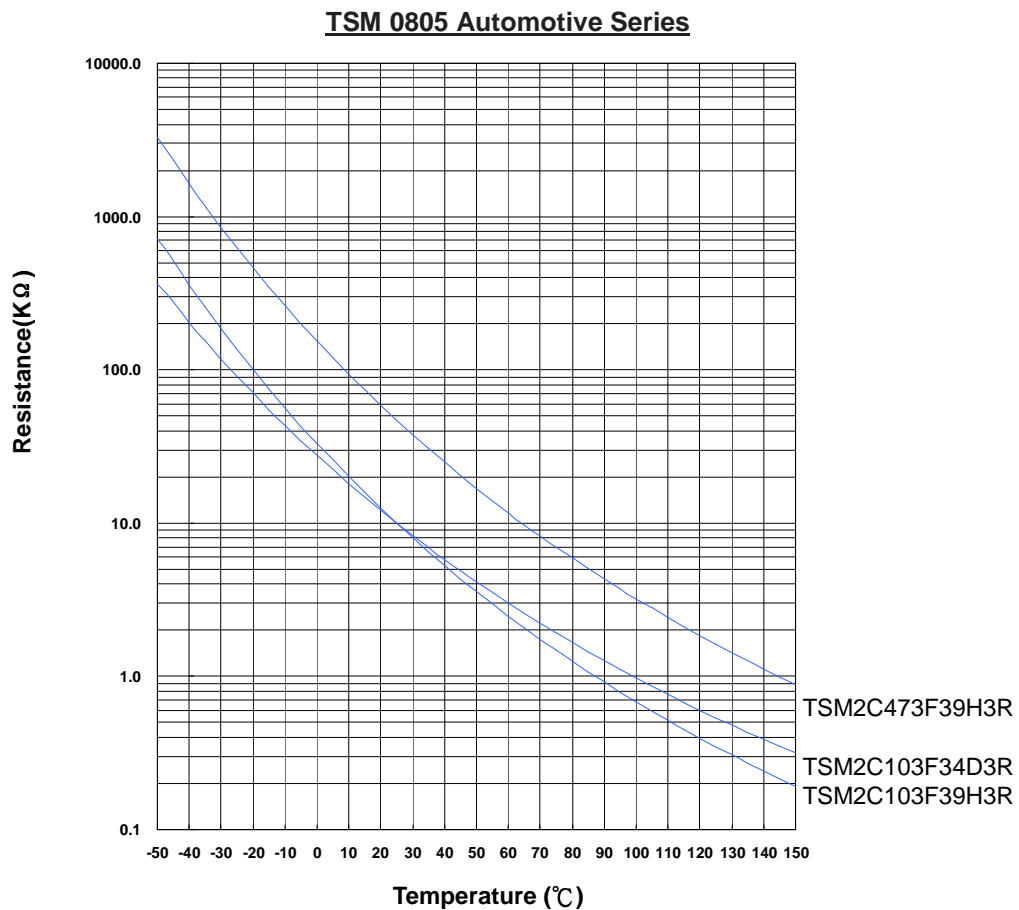
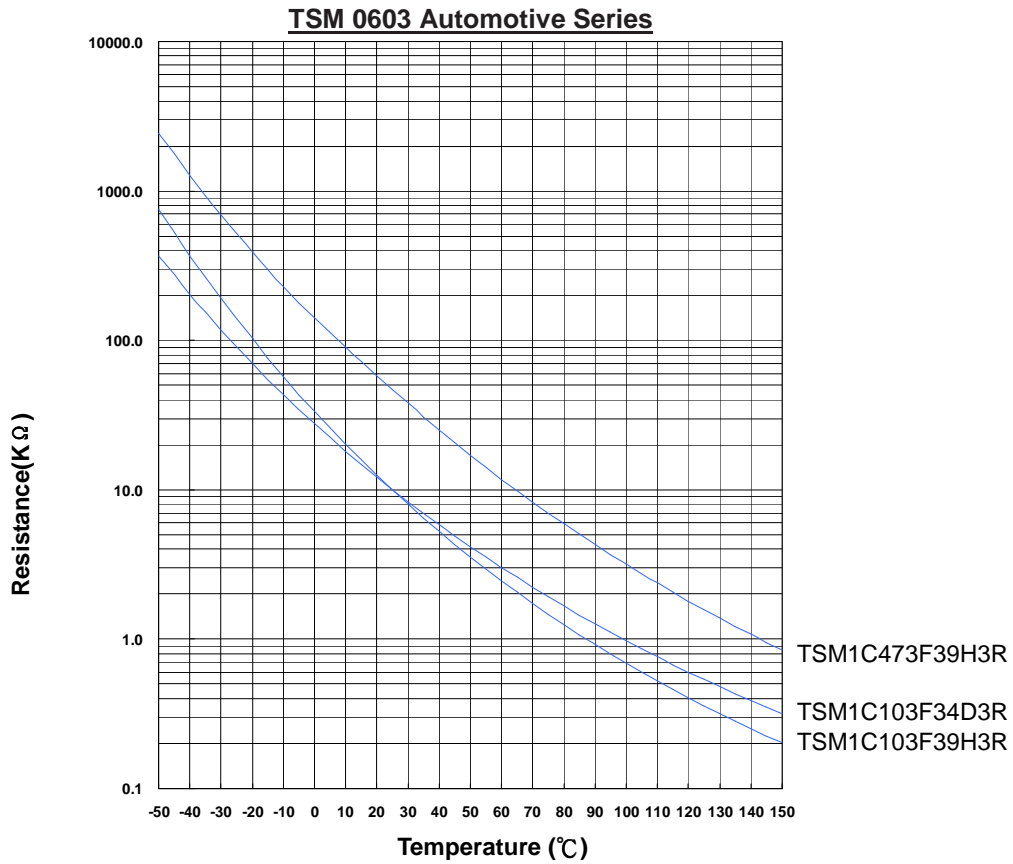
$P_{Ta} = (T_U - T_a) / (T_U - 25) \times P_{max} = 76\% P_{max}$

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■ R-T Characteristic Curves (representative)



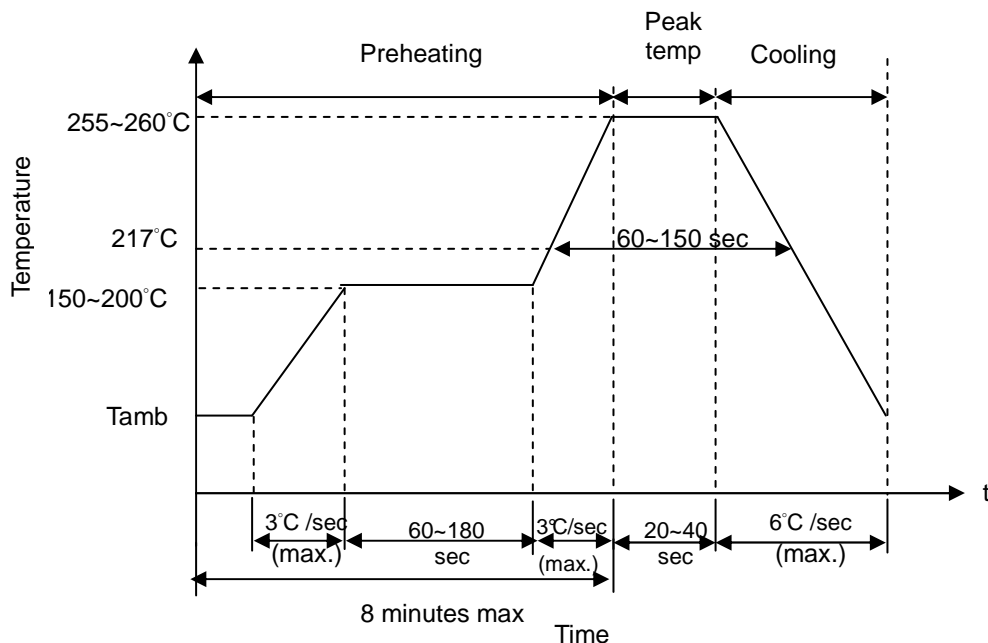
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■ Soldering Recommendation

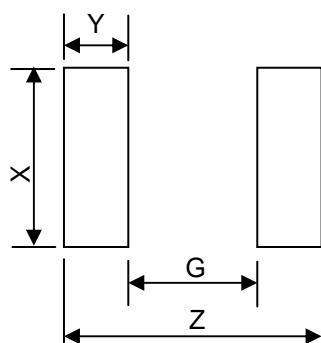
● IR-reflow Soldering Profile



● 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.) |

■ Recommended Soldering Pad Dimensions



| Size | Z (mm) | G (mm) | X (mm) | Y (mm) |
|------|--------|--------|--------|--------|
| 0603 | 3.0 | 1.0 | 1.0 | 1.0 |
| 0805 | 3.4 | 1.0 | 1.4 | 1.2 |

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

| 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. : -55 +0/-3°C Upper test temp. : 150 +3/-0°C 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. | No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moisture Resistance | MIL-STD-202 Method 106 | Duration of 1 cycle: 24 h Number of cycles: 10 , Unpowered Measurement at 24±2 hours after test conclusion. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th rowspan="2">Step</th> <th colspan="2">Temp.</th> <th rowspan="2">humidity (%)</th> <th rowspan="2">Period (hr)</th> </tr> <tr> <th>Start</th> <th>Finish</th> </tr> </thead> <tbody> <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> </tbody> </table> | Step | Temp. | | humidity (%) | Period (hr) | Start | Finish | 1 | 25 | 65 | 90~100 | 2.5 | 2 | 65 | 65 | 90~100 | 3 | 3 | 65 | 25 | 80~100 | 2.5 | 4 | 25 | 65 | 90~100 | 2.5 | 5 | 65 | 65 | 90~100 | 3 | 6 | 65 | 25 | 80~100 | 2.5 | 7 | 25 | 25 | 80~100 | 8 | No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$ |
| Step | Temp. | | | humidity (%) | Period (hr) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Start | Finish | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 25 | 65 | 90~100 | 2.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 65 | 65 | 90~100 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 65 | 25 | 80~100 | 2.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 25 | 65 | 90~100 | 2.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 65 | 65 | 90~100 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 65 | 25 | 80~100 | 2.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 25 | 25 | 80~100 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Biased Humidity | MIL-STD-202 Method 103 | Test temp. : 85°C Rel. humidity of air : 85% Duration: 1000 h 10% Rated Power. Measurement at 24±2 hours after test conclusion. | No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| Item | Standard | Test conditions / Methods | Specifications |
|------------------------------|----------------------------|--|--|
| Operational Life | MIL-STD-202 Method 108 | Test temp.: 150 +3/-0°C Duration: 1000 h Test Power : 1mW Measurement at 24±2 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 -202-213 | 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 : 25mm/s ±6 mm/s Number of heat cycles : 1 | No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$ |
| Thermal Shock | MIL-STD-202 Method 107 | Lower test temp. : -55 +0/-3°C Upper test temp. : 150 +3/-0°C Maximum transfer time : 20 seconds. Dwell time : 15 minutes. Air-Air. Number of cycles : 300 | No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$ |

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| 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 $ \Delta R_{25}/R_{25} \leq 5\%$ |
| Solderability | J-STD-002 | a) 4 h @ 155°C dry heat Dip @235±5°C 5 +0/-0.5sec b) Steam aging 8 h±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/R85°C) | Within the specified values |
| Board Flex | AEC-Q200 -005 (JIS-C-6429) | Bend the board : 2mm (Min.) Duration of the applied forces : 60 (+5) Sec | No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$ |
| Terminal Strength | AEC-Q200 -006 (JIS-C-6429) | Apply force : 0603=1.0kg (10 N) 0805=1.8kg (17.7 N) Duration of the applied forces : 60 (+1) Sec | No visible damage $ \Delta R_{25}/R_{25} \leq 5\%$ |

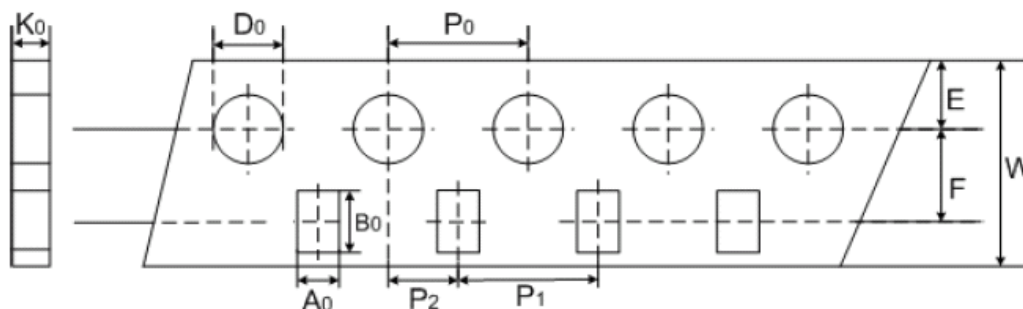
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■ Package

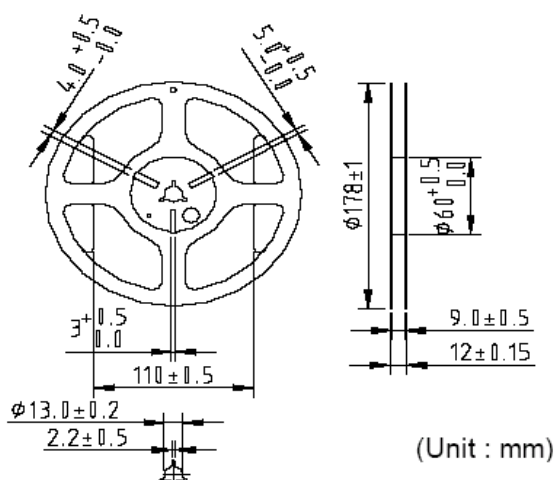
● Taping Specification



(Unit: mm)

| Index Type | A ₀ | B ₀ | W | E | F | P ₁ | P ₂ | P ₀ | D ₀ | K ₀ |
|---------------|----------------|----------------|------|------|-------|----------------|----------------|----------------|----------------|----------------|
| 0603 | ±0.2 | ±0.2 | ±0.2 | ±0.1 | ±0.05 | ±0.1 | ±0.05 | ±0.1 | ±0.1 | ±0.1 |
| 0805 | 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 | 0.95 |

■ Quantity



(Unit : mm)

| Type | Quantity (pcs/reel) |
|------|---------------------|
| 0603 | 4,000 |
| 0805 | 3,500 |

■ Storage Conditions of Products

- Storage Conditions :
 1. Storage Temperature: -10°C ~ +40°C
 2. Relative Humidity: ≤ 75%RH
 3. Keep away from corrosive atmosphere and sunlight.
- Shelf Life : 1 year