# PR Series
## High Power Thick Film Chip Resistors
Version. J

## FEATURE

- Superior high-power performance with thick film technology
- High reliability
- RoHS and Halogen-free compliance
- Compatible with Reflow and Wave soldering
- MSL class: MSL 1
- Applications:
  - Adapters
  - Back-light circuit
  - Camera
  - Industrial Equipment
  - etc.

## MANUFACTURER PART NO.

For example: PR2010F0R05T4G00-PR2010 ±1% 0.05Ω T/R-4,000

| Series | Size | Tol. | Value | PKG | SPQ | Feature | TCR |
|---|---|---|---|---|---|---|---|
| 2 codes | 4 codes | 1 code | 2~5 codes | 1 code | 1 code | 1 code | 2 codes |
| PR | 2010 | F | 0R05 | T | 4 | G | 00 |
| High Power Thick Film Chip Resistors | 0402<br>0603<br>0805<br>1206<br>1210<br>1812<br>2010<br>2512 | F=±1%<br>J=±5% | 0R=Jumper<br>0R01①=0.01Ω<br>0R1=0.1Ω<br>1R=1Ω<br>4R7=4.7Ω<br>4K7②=4.7KΩ<br>100K=100KΩ<br>4M7③=4.7MΩ | T=T/R④ | 4=4K<br>5=5K<br>A=10K | G=Std.<br>S=P.C.⑤ | 00=Refer to table as below. |

Note: ① R=Radix, $10^0$, Ω ② K=Kilo, $10^3$, KΩ ③ M=Mega, $10^6$, MΩ
④ T/R=Taping in reel package type ⑤ P.C.=Personal and Customized.

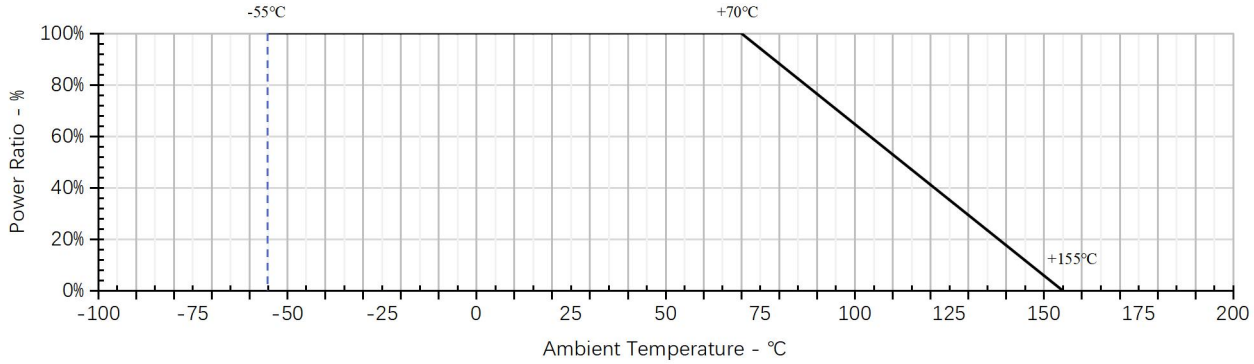
## CHARACTERISTIC

| Item | Rated Power | Resistance ≥1Ω | | Resistance <1Ω | | DWV③ | Tolerance | Resistance Range | Jumper | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MWV① | MOV② | MRC④ | MOC⑤ | | | | Max Value | MRC④ | MOC⑤ |
| PR0402 | 1/10W | 50V | 100V | / | / | 100V | ±1%, ±5% | 1Ω-10M | 10mΩ | 3A | 6A |
| PR0603 | 1/5W | 75V | 150V | 1.41A | 3.54A | 300V | ±1%, ±5% | 100mΩ-10M | 8mΩ | 5A | 10A |
| PR0805 | 1/3W | 150V | 300V | 5.77A | 14.43A | 500V | ±1%, ±5% | 10mΩ-10M | 5mΩ | 6A | 12A |
| PR1206 | 1/2W | 200V | 400V | 7.07A | 17.68A | 500V | ±1%, ±5% | 10mΩ-10M | 5mΩ | 10A | 20A |
| PR1210 | 3/4W | 200V | 500V | 2.74A | 6.85A | 500V | ±1%, ±5% | 100mΩ-10M | 4mΩ | 12A | 24A |
| PR1812 | 1.25W | 200V | 500V | 3.54A | 8.84A | 500V | ±1%, ±5% | 100mΩ-10M | 5mΩ | 12A | 24A |
| PR2010 | 1W | 200V | 500V | 10.00A | 25.00A | 500V | ±1%, ±5% | 10mΩ-10M | 5mΩ | 12A | 24A |
| PR2512 | 2W | 300V | 500V | 14.14A | 35.36A | 500V | ±1%, ±5% | 10mΩ-10M | 5mΩ | 16A | 32A |

Note: ① MWV=Max. Working Voltage. ② MOV=Max. Overload Voltage. ③ DWV=Dielectric Withstanding Voltage
④ MRC=Max. Rated Current ⑤ MOC=Max. Overload Current

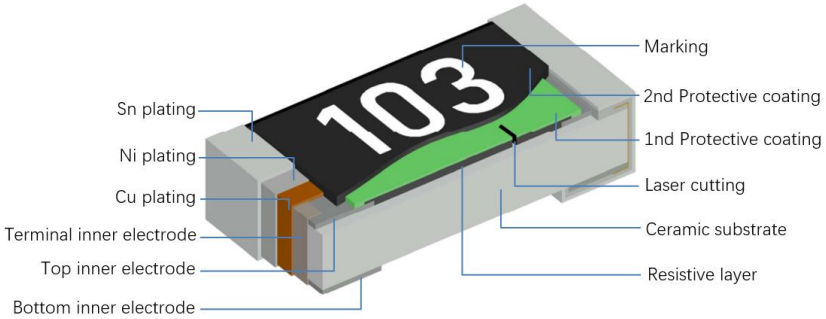
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## POWER DERATING CURVE




Note: Operating Temperature Range: -55℃~+155℃

## STRUCTURE GRAPH




Note: Cu Plating = Partial size or resistance range

## RATED VOLTAGE

- For products with resistance values higher than or equal to 1Ω

Resistors should have a Rated Voltage DC or AC corresponding to Rated Power which can be calculated by formula as below.

The Rated Voltage of certain resistance value should be the calculated result or Max. Working Voltage of product series whichever less.

Formula:

$$E = \sqrt{P \times R}$$

E=Rated voltage(V)
P=Rated power(W)
R=Nominal resistance(Ω)

## RATED CURRENT

- For products with resistance values lower than 1Ω

The resistor shall have a Rated Current which would be DC or AC corresponding to the Rated Power, and it can be calculated by formula as below.

The Rated Current of certain resistance value should be the calculated result or Max. Working Current of product series whichever less.

Formula:

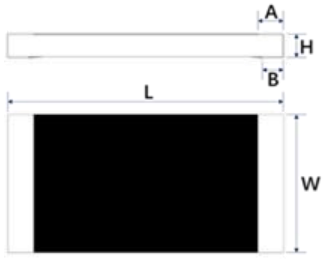
$$I = \sqrt{P/R}$$

I=Rated current (A)
P=Rated power (W)
R=Nominal resistance (Ω)

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## DIMENSIONS

Unit: mm

| Figure | Type | L | W | H | A | B |
|---|---|---|---|---|---|---|
|  | 0402 | 1.00±0.10 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 |
| | 0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 |
| | 0805 | 2.00±0.15 | 1.25±0.15 | 0.55±0.10 | 0.40±0.20 | 0.40±0.20 |
| | 1206 | 3.10±0.15 | 1.55±0.15 | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 |
| | 1210 | 3.10±0.10 | 2.60±0.20 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 |
| | 1812 | 4.50±0.20 | 3.20±0.20 | 0.55±0.20 | 0.50±0.20 | 0.50±0.20 |
| | 2010 | 5.00±0.10 | 2.50±0.20 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 |
| | 2512 | 6.35±0.10 | 3.20±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |



## RELIABILITY

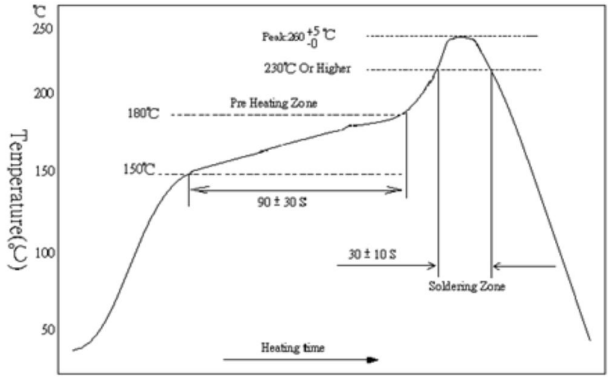
| Item | Test Method | Acceptable criterion |
|---|---|---|
| Temperature Coefficient of Resistance (T.C.R.) | $TCR(PPM/℃)=\frac{(R_2-R_1)}{R_1\times(T_2-T_1)}\times10^6$<br>$R_1$=Value in room temperature<br>$R_2$=Value in test temperature -55℃ or +125℃<br>$T_1$ =Room temperature<br>$T_2$ =Test temperature -55℃ or +125℃<br>Reference: IEC 60115-1 6.2 | 10mΩ≤R<100mΩ: ±800 PPM/℃<br>100mΩ≤R<1Ω: ±400 PPM/℃<br>1Ω≤R≤10Ω: ±200 PPM/℃<br>10Ω<R≤10M: ±100 PPM/℃ |
| Insulation Resistance | Using the parallel clamp method: 100±15$V_{DC}$ voltage is applied between the electrode and the substrate within 60 seconds. Test the insulation resistance between the terminal and the back of the part.<br>Reference: IEC 60115-1 12.1.3.5 | ⩾ $10^9$Ω |
| Dielectric Withstanding Voltage | Apply an alternating current between the electrode and substrate, with the effective value of the maximum overload voltage referring to the DWV characteristics and maintain the pressure for 60 ± 5 seconds.<br>Reference: IEC 60115-1 12.2.4 | Test to confirm if the presence of current or arc breakdown by ⩾10uA |
| Short Time Overload | Apply 2.5 times of rated voltage or maximum overload voltage whichever is less for 5 seconds.<br>Reference: IEC 60115-1 8.1.4.2 | 1% series: △R/R=±(1.0%+0.05Ω)<br>5% series: △R/R=±(2.0%+0.05Ω) |
| Intermittent Overload | Put it in the thermostat, apply 2.5 times of rated voltage, 1 second ON, 25 seconds OFF, count $10000^{+400}_{-0}$ times, take it out and stand for 60 minutes, then measure the change rate of resistance value.<br>Reference: IEC 60115-1 8.4.4 | △R/R=±(5.0%+0.05Ω) |
| Resistance to Solvent | Immerse in isopropanol solvent at room temperature (23±5℃) for 5min, wipe 10 times with a hard toothbrush, repeat 3 times, take out and blow dry for measure.<br>Reference: IEC 60115-1 11.3.2 method1 | No obvious damage, peeling, swelling phenomenon |
| Solderability | Pretreatment:<br>dry heat 155℃, 4H, after taking out, stand at room temperature for 2 hours.<br>Test method B1:<br>Dip the resistance in a tin furnace at 245±5℃ for 5 seconds, then take it out and observe the solder area under a microscope.<br>Method D: 260±5℃, T=30+5/-0s.<br>Reference: J-STD-002 & IEC 60115-1 11.1.4.3 | 1. Solder coverage over 95%<br>2. No more than 5% of the partially exposed substrate, non-wetted plating, or ceramic substrate part. |
| Resistance to Soldering Heat | Reflow test, time above 217 °C is 60s-150s, time above 250 ± 5°C is 30±5s.<br>Reference: IEC 60115-1 11.2.4.3& MIL-STD-202 Method 210 | △R/R=±(1.0%+0.05Ω) |

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| Item | Test Method | Acceptable criterion |
|---|---|---|
| Thermal Shock | High and low temperature test is carried out according to the upper and lower limits of the application temperature of the parts, the residence time of the upper and lower limits of the temperature is 30min, and the temperature conversion time is less than 30s, lasting 500 cycles.<br>Reference: IEC 60115-1 10.1.4 | △R/R=±(1.0%+0.05Ω) |
| Solder Joint Endurance Test | The SMD resistance was welded to the test board and bent with the standard pressure block. After standing for 60 sec. under the corresponding deformation condition, the change rate of resistance value of the part was tested.<br>Size: 0402, 0603, 0805 \| 1206, 1210 \| 1812, 2010, 2512<br>Depth: 5mm \| 3mm \| 2mm<br>Reference: IEC 60115-1 9.8.4 | △R/R=±(1.0%+0.05Ω) |
| Resistance to Dry Heat | Put it in an oven at 155±5℃ for $1000^{+48}_{-0}$hrs., take it out and let it stand for more than 1hr., then measure the change rate of resistance value.<br>Reference: IEC 60115-1 7.3 | 1% series: △R/R=±(1.0%+0.05Ω)<br>5% series: △R/R=±(3.0%+0.05Ω) |
| Loading Life in Moisture | Place it in a constant temperature and humidity box with 40±2℃ and 90~96%RH and apply the voltage (IEC 60115-1 10.4 Table 22) for 1000 hrs. Take it out and stand for 30 minutes before applying rated voltage for 1 minute, and then measure the change rate.<br>Reference: IEC 60115-1 10.4 | 1% series: △R/R=±(1.0%+0.05Ω)<br>5% series: △R/R=±(3.0%+0.05Ω) |
| Load Life | Put in an oven at 70±2℃, apply rated voltage, 90 min ON, 30 min OFF, 1000 hrs., take out and stand for more than 60 min, then measure the resistance change rate.<br>Reference: IEC 60115-1 7.1 | 1% series: △R/R=±(1.0%+0.05Ω)<br>5% series: △R/R=±(3.0%+0.05Ω) |
| Low temperature load test | -55℃, unpowered, 1 hr.: Rated voltage/current for 45 minutes, then unpowered within 15 minutes, return to room temperature, take out and stand for 24 hours, then measure the change rate of resistance value.<br>Reference: IEC 60115-1 10.2.4 | 1% series: △R/R=±(1.0%+0.05Ω)<br>5% series: △R/R=±(2.0%+0.05Ω) |
| Shear force test | Weld the part to the PCB. Apply the corresponding test stress from the side of the part with the test terminal for 10s. Check the appearance of the welded end of the part under the stress condition.<br>Size: 0402 \| 0603, 0805, 1206, 1210, 1812, 2010, 2512<br>Test force: 10N \| 18N<br>Reference: IEC 60115-1 9.7 | Without obvious damage. |

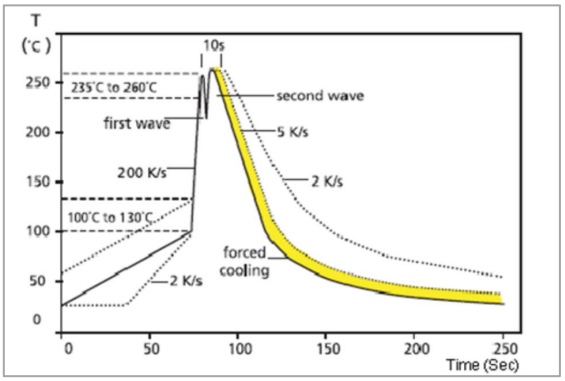
## SOLDERING

Lead Free IR Reflow Soldering Profile




- Top temperature should be under $260^{+5}_{-0}$ ℃ ,10 sec.
- Reference: J-STD-020D

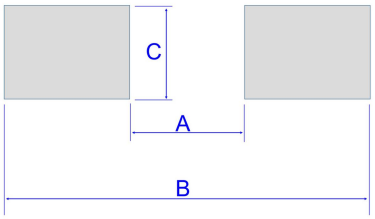
Lead Free Double-Wave Soldering Profile




- Suitable for 0603 above size products
- 350±10℃ within 3 Sec. if soldering iron.

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## SOLDERING PAD

| Figure | Type | A | B | C |
|---|---|---|---|---|
|  | 0402 | 0.5 | 1.5 | 0.6 |
| | 0603 | 0.8 | 2.1 | 0.9 |
| | 0805 | 1.2 | 3.0 | 1.3 |
| | 1206 | 2.2 | 4.2 | 1.6 |
| | 1210 | 2.2 | 4.2 | 2.8 |
| | 1812 | 3.1 | 5.9 | 3.0 |
| | 2010 | 3.5 | 6.1 | 2.8 |
| | 2512 | 3.8 | 8.0 | 3.5 |



## WORKING ENVIRONMENT

If user intends to use products in special environments or states (including but not limited to the following), it is necessary to approve special characteristics and reliability for the following or other application environments.

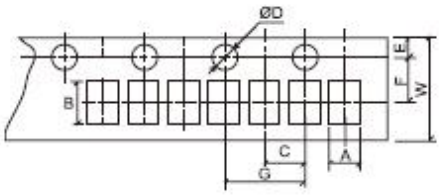
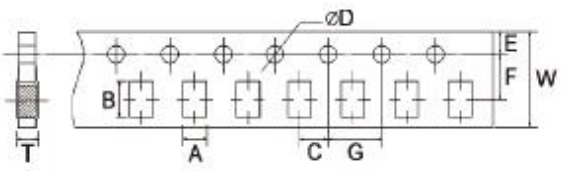
A. High temperature.
B. Near the sea, or corrosive gas, such as $Cl_2$, $H_2S$, $NH_3$, $SO_2$ and $NO_2$, etc.
C. Unverified liquids, such as water, oil, chemical or organic solvent.
D. Unverified resin or paint to cover products.
E. Products should be washed with water soluble cleaner even if non cleaning flux.

## STORAGE / CARRY CONDITIONS

A. Temperature: 25±5℃.
B. Humidity: 60±15%RH.
C. Storage life: 2 years. FIFO.
D. Please hold box correct orientation when storing and carrying. It is strictly prohibited to fall or squeeze the box, otherwise the product electrode or body may be damaged.

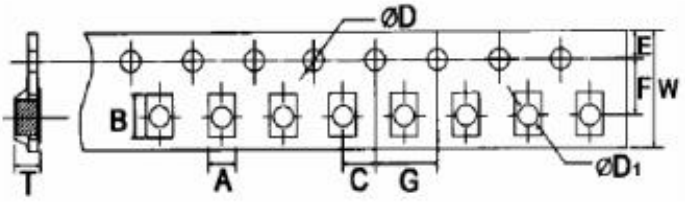
## TAPING

A. Taping drawing

| Carrier Taping A | Carrier Taping B |
|---|---|
|  |  |



Embossed Taping





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B. Taping Dimensions

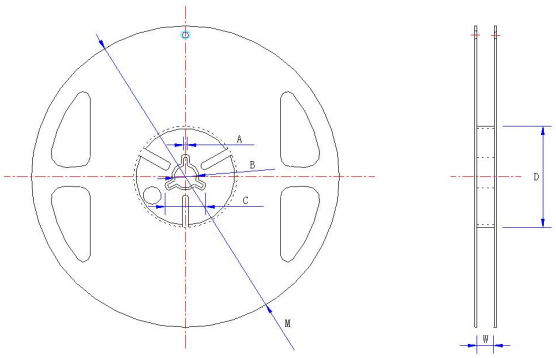
Unit: mm

| Type | Size | A±0.2 | B±0.2 | C±0.05 | ØD$^{+0.1}_{-0}$ | E±0.1 | F±0.05 | G±0.1 | W±0.2 | T±0.1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Carrier Taping A | 0402 | 0.67±0.1 | 1.17±0.1 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.47 |
| | 0603 | 1.10 | 1.90 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.67 |
| Carrier Taping B | 0603 | 1.10 | 1.90 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.67 |
| | 0805 | 1.65 | 2.40 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.81 |
| | 1206 | 1.90 | 3.45 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.81 |
| | 1210 | 2.85 | 3.50 | 2.0 | 1.5 | 1.75 | 3.5 | 4.0 | 8.0 | 0.81 |

| Type | Size | A±0.2 | B±0.2 | C±0.05 | ØD$^{+0.1}_{-0}$ | ØD1$^{+0.25}_{-0}$ | E±0.1 | F±0.05 | G±0.1 | W±0.2 | T±0.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Embossed Taping | 2010 | 2.90 | 5.60 | 2.00 | 1.50 | 1.50 | 1.75 | 5.50 | 4.00 | 12.00 | 1.00 |
| | 1812 | 3.50 | 4.80 | 2.00 | 1.50 | 1.50 | 1.75 | 5.50 | 4.00 | 12.00 | 1.00 |
| | 2512 | 3.50 | 6.70 | 2.00 | 1.50 | 1.50 | 1.75 | 5.50 | 4.00 | 12.00 | 1.00 |

## REEL SPECIFICATION

A. Reel drawing




B. Reel dimension

Unit: mm

| Type | SPQ PCS/Rl. | A±0.5 | B±0.5 | C±0.5 | D±1 | M±2 | W±1 |
|---|---|---|---|---|---|---|---|
| 0402 | 10,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 0603 | 5,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 0805 | 5,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 1206 | 5,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 1210 | 5,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 10.0 |
| 1812 | 4,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 13.8 |
| 2010 | 4,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 13.8 |
| 2512 | 4,000 | 2.0 | 13.0 | 21.0 | 60.0 | 178.0 | 13.8 |

## LABEL SPECIFICATION

A. Process Label (Ref.)




B. Customer Label (Ref.)




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## PACKING BOX

A. Packing Type

Taping in reel / Bulk in plastic bag.

B. Inner box

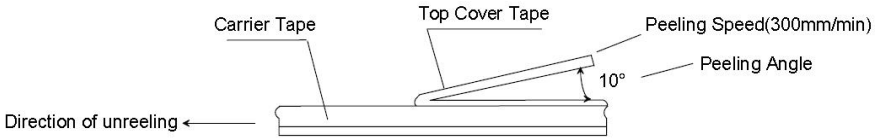
The inner box has several capacities hold 1 reel, 2 reels, 3 reels, 4 reels, 5 reels and 10 reels.

C. Out box

The out box has two capacities hold 6- or 8-pieces inner box.

## TAPING UNREEL DIRECTION

A. Figure of cover tape peel off.




B. Please keep peeling speed under 300mm per minute.

C. Please keep the angle between cover tape and direction of unreeling narrower than 10 degree.

D. There is limit of adhesive force between cover tape and carrier tape or embossed tape shown as following table.

| Size of chip resistors | 0402 | 0603 and above |
|---|---|---|
| Adhesive force limit | 10~40gf | 10~70gf |

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   - Continued use of the products by the user after the Terms update shall constitute deemed acceptance of the new Terms.
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| Version | Date | Change Item(s) | Description |
|---|---|---|---|
| A | 2022/04/07 | - | First version |
| B | 2022/10/31 | Reliability | Updated test items, method, and acceptable criterion. |
| C | 2023/07/21 | Reliability | Updated test items, test methods. |
| D | 2023/12/26 | Full | Add 1812 size.<br>Add Packing Specifications.<br>Updated test method and acceptable criterion. |
| E | 2024/01/31 | Characteristic<br>Rated current | Add low resistance characteristic.<br>Add rated current description. |
| F | 2024/05/30 | Full | Add Jumper Description in MPN<br>Add Moisture sensitivity level description. |
| G | 2025/04/08 | Legal Disclaimer<br>Taping Dimensions | Revise the entire text<br>Updated the size of the 0603 paper tape |
| H | 2025/04/25 | Feature | RoHS |
| I | 2025/07/08 | Label Specification | Correction of reference label template |
| J | 2026/01/05 | Dimensions | Correction 2010 A Value |

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