

# Data Sheet for Precision Resistors

SMD Resistor (metal thin film)

Series CPH



- Ultra-precise chip resistor
- Advanced thin film technology
- Low noise construction
- Resistance tolerance up to  $\pm 0.01\%$
- Temperature coefficient up to  $\pm 1 \text{ ppm}/^\circ\text{C}$

| Electrical Specification |                     |                   |                 |                     | CPH              |              |              |              |             |           |                       |
|--------------------------|---------------------|-------------------|-----------------|---------------------|------------------|--------------|--------------|--------------|-------------|-----------|-----------------------|
| Type                     | Power rating @ 70°C | Temperature range | Working voltage | Dielectric strength | Resistance range |              |              |              |             |           | TCR-rate (ppm/°C)     |
|                          |                     |                   |                 |                     | $\pm 0.01\%$     | $\pm 0.05\%$ | $\pm 0.10\%$ | $\pm 0.25\%$ | $\pm 0.5\%$ | $\pm 1\%$ |                       |
| 0603                     | 1/16W               | -55~+155°C        | 50V             | 100V                | 24.9Ω...15kΩ     |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...60kΩ     |              |              |              |             |           | $\pm 5$               |
| 0805                     | 1/10W               | -55~+155°C        | 100V            | 200V                | 24.9Ω...30kΩ     |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...150kΩ    |              |              |              |             |           | $\pm 5$               |
| 1206                     | 1/8W                | -55~+155°C        | 150V            | 300V                | 24.9Ω...49.9kΩ   |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...300kΩ    |              |              |              |             |           | $\pm 5$               |
| 2010                     | 1/4W                | -55~+155°C        | 150V            | 300V                | 24.9Ω...100kΩ    |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...300kΩ    |              |              |              |             |           | $\pm 5$               |

| Electrical Specification |                     |                   |                 |                     | CPHH (High Power) |              |              |              |             |           |                       |
|--------------------------|---------------------|-------------------|-----------------|---------------------|-------------------|--------------|--------------|--------------|-------------|-----------|-----------------------|
| Type                     | Power rating @ 70°C | Temperature range | Working voltage | Dielectric strength | Resistance range  |              |              |              |             |           | TCR-rate (ppm/°C)     |
|                          |                     |                   |                 |                     | $\pm 0.01\%$      | $\pm 0.05\%$ | $\pm 0.10\%$ | $\pm 0.25\%$ | $\pm 0.5\%$ | $\pm 1\%$ |                       |
| 0603                     | 1/10W               | -55~+155°C        | 75V             | 150V                | 24.9Ω...15kΩ      |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...60kΩ      |              |              |              |             |           | $\pm 5$               |
| 0805                     | 1/8W                | -55~+155°C        | 150V            | 300V                | 24.9Ω...30kΩ      |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...150kΩ     |              |              |              |             |           | $\pm 5$               |
| 1206                     | 1/4W                | -55~+155°C        | 200V            | 400V                | 24.9Ω...49.9kΩ    |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...300kΩ     |              |              |              |             |           | $\pm 5$               |
| 2010                     | 1/3W                | -55~+155°C        | 200V            | 400V                | 24.9Ω...100kΩ     |              |              | -            |             |           | $\pm 1, \pm 2, \pm 3$ |
|                          |                     |                   |                 |                     | 24.9Ω...300kΩ     |              |              |              |             |           | $\pm 5$               |

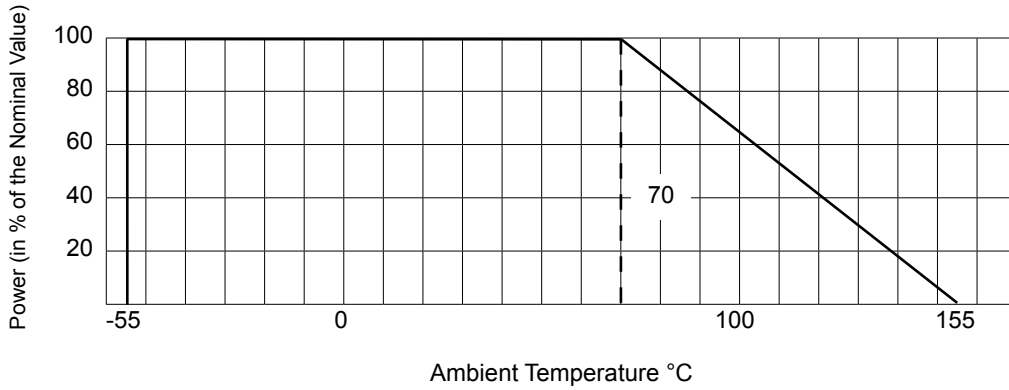
| Mechanical Specification         |                                   |
|----------------------------------|-----------------------------------|
| Resistance technology / material | Metal thin film / NiCr            |
| Design                           | SMD: 0603, 0805, 1206, 2010       |
| Housing material                 | Epoxy inorganic passivation layer |
| Connections                      | Axial tinned                      |

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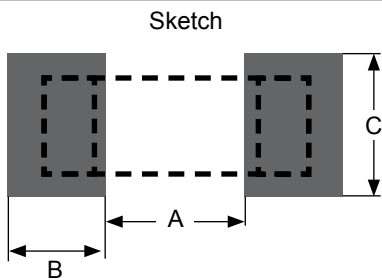
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## Power Derating Curve

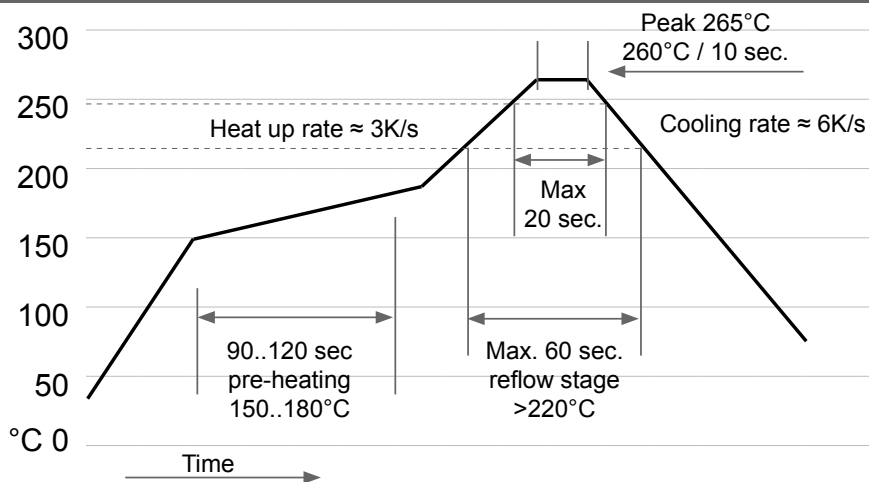


## Recommended Foot Prints



| CPH  | A      | B       | C            |
|------|--------|---------|--------------|
| 0603 | 0.8 mm | 1.0 mm  | 0.9 mm ±0.2  |
| 0805 | 1.0 mm | 1.0 mm  | 1.35 mm ±0.2 |
| 1206 | 2.0 mm | 1.15 mm | 1.7 mm ±0.2  |
| 2010 | 3.6 mm | 1.4 mm  | 2.5 mm ±0.2  |

## Recommendation for Reflow Soldering Profile

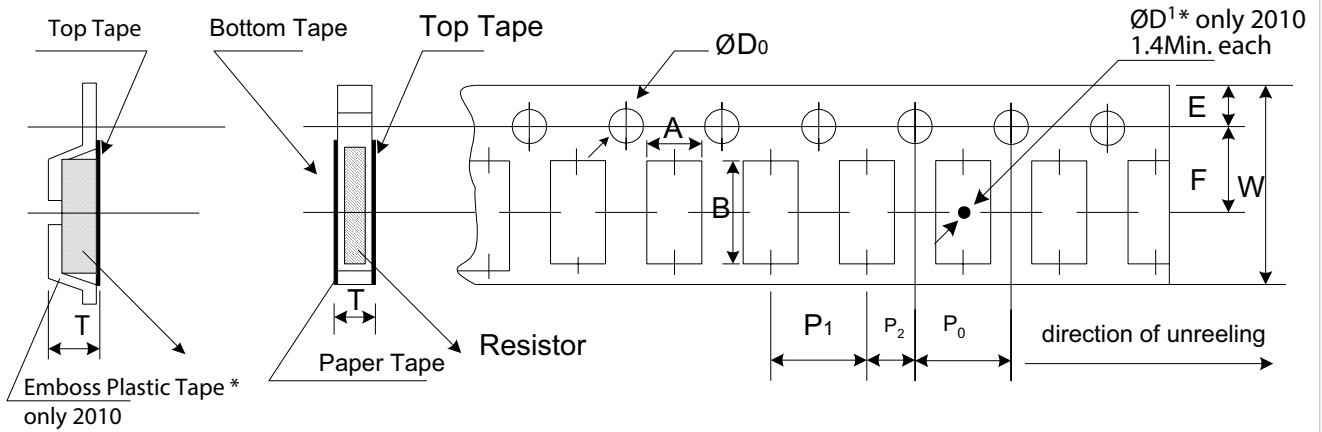


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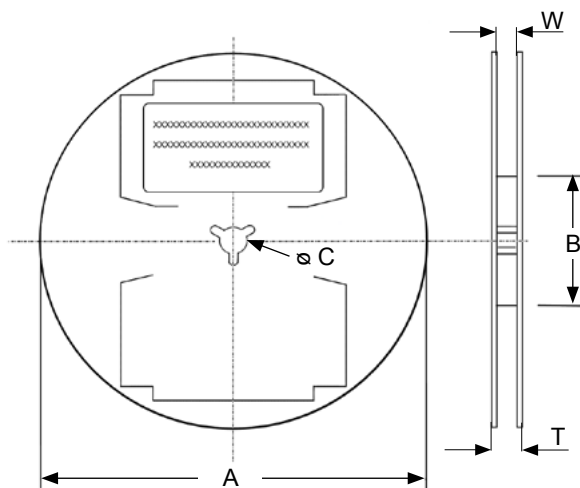
## Blister Tape Dimensions



Unit: mm

| Type   | A         | B         | W         | E         | F        | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | T         |
|--------|-----------|-----------|-----------|-----------|----------|----------------|----------------|----------------|-----------------|-----------|
| 0603   | 1.10±0.05 | 1.90±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.10      | 4.00±0.10      | 2.00±0.05      | 1.55±0.05       | 0.60±0.03 |
| 0805   | 1.60±0.05 | 2.37±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.10      | 4.00±0.10      | 2.00±0.05      | 1.55±0.05       | 0.75±0.05 |
| 1206   | 2.00±0.05 | 3.55±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.10      | 4.00±0.10      | 2.00±0.05      | 1.55±0.05       | 0.75±0.05 |
| 2010 * | 2.85±0.10 | 5.45±0.10 | 12.0±0.10 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05      | 4.00±0.10      | 2.00±0.05      | 1.50±0.10       | 1.00±0.20 |

## Reel Dimensions, quantity & packaging



Unit :mm

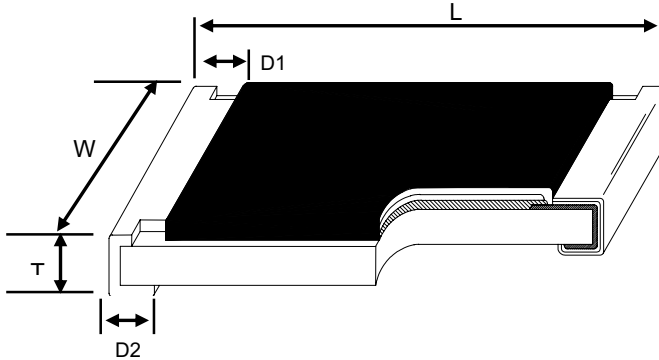
| Type | ØA        | ØB       | ØC       | W        | T        | Paper Tape (EA) | Emboss Plastic Tape (EA) |
|------|-----------|----------|----------|----------|----------|-----------------|--------------------------|
| 0603 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0  | 11.5±1.0 | 5,000           | -                        |
| 0805 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0  | 11.5±1.0 | 5,000           | -                        |
| 1206 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0  | 11.5±1.0 | 5,000           | -                        |
| 2010 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | -               | 4,000                    |

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## Drawing



Unit: mm

| Size | L         | W         | T         | D1        | D2        |
|------|-----------|-----------|-----------|-----------|-----------|
| 0603 | 1.55±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 | 0.30±0.20 | 0.40±0.20 |
| 1206 | 3.05±0.15 | 1.55±0.15 | 0.55±0.10 | 0.42±0.20 | 0.35±0.25 |
| 2010 | 4.90±0.15 | 2.40±0.15 | 0.55±0.10 | 0.60±0.30 | 0.50±0.25 |

## Order code

| Description                              | Selection: <b>standard=black/bold</b> , possible <i>options=grey/italic</i> |  |             |               |               |
|--|---|--|-------------|---------------|---------------|
| <b>Series:</b>                           | <b>CPH</b>  |  |             |               |               |
| <b>Basic</b>                             | <b>CPHH</b>   |  |             |               |               |
| <b>High power</b>                        |   |  |             |               |               |
| <b>Type / size:</b>                      |   |  |             |               |               |
| <b>0603 (max. 60kΩ)</b>                  |   |  | <b>0603</b> |               |               |
| <b>0805 (max. 150kΩ)</b>                 |   |  | <b>0805</b> |               |               |
| <b>1206 (max. 300kΩ)</b>                 |   |  | <b>1206</b> |               |               |
| <b>2010 (max. 300kΩ)</b>                 |   |  | <b>2010</b> |               |               |
| <b>Resistance tolerance:</b>             |   |  |             |               |               |
| <b>±1%</b>                               |   |  |             | <b>W1%</b>    |               |
| <b>±0,5%</b>                             |   |  |             | <b>W0,5%</b>  |               |
| <b>±0,25%</b>                            |   |  |             | <b>W0,25%</b> |               |
| <b>±0,1%</b>                             |   |  |             | <b>W0,1%</b>  |               |
| <b>±0,05%</b>                            |   |  |             | <b>W0,05%</b> |               |
| <b>±0,01%</b>                            |   |  |             | <b>W0,01%</b> |               |
| <b>Temperature coefficient:</b>          |   |  |             |               |               |
| <b>±5ppm/°C</b>                          |   |  |             |               | <b>TK5</b>    |
| <b>±3ppm/°C</b>                          |   |  |             |               | <b>TK3</b>    |
| <b>±2ppm/°C</b>                          |   |  |             |               | <b>TK2</b>    |
| <i>Option ±1ppm/°C</i>                   |   |  |             |               | <i>TK1</i>    |
| <b>Resistance value - please choose:</b> |   |  |             |               |               |
| <b>From 24,9Ω to ≤ Ω see type</b>        |   |  |             |               | <b>xxkxxx</b> |

| Order Example | Series | Type | Resistance tolerance | Temperature coefficient | Resistance value |
|---------------|--------|------|----------------------|-------------------------|------------------|
| Choice        | CPH    | 0603 | ±0,1%                | 2ppm/°C                 | 10,1kΩ           |
| Code          | CPH    | 0603 | W0,1%                | TK2                     | 10k100           |

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## Test Data

| Item   | Requirement                                  |              | Test Method  |
|--|--|--------------|--|
|  | Tol. ≤ 0.05%                                 | Tol. > 0.05% |  |
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.                                     |              | <b>MIL-STD-202 Method 304</b><br>+25/-55/+25/+125/+25°C  |
| Short Time Overload                            | ΔR±0.05%                                     | ΔR±0. 2%     | <b>JIS-C-5201-1 4.13</b><br>RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds               |
|  | ΔR±0. 2% for high power rating               |              |  |
| Insulation Resistance                          | >9999 MΩ                                     |              | <b>MIL-STD-202 Method 302</b><br>Apply 100V <sub>DC</sub> for 1 minute                                       |
| Endurance                                      | ΔR±0.05%                                     | ΔR±0.2%      | <b>MIL-STD-202 Method 108A</b><br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"              |
|  | ΔR±0.5% for high power rating                |              |  |
|  | 0201: >7kΩ ... ΔR±0.5%<br>≤ 7kΩ ... ΔR±0. 2% |              |  |
| Damp Heat with Load                            | ΔR±0.05%                                     | ΔR±0. 3%     | <b>MIL-STD-202 Method 103B</b><br>40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"  |
|  | ΔR±0.5% for high power rating                |              |  |
| Bending Strength                               | ΔR±0.05%                                     | ΔR±0. 1%     | <b>JIS-C-5201-1 4.33</b><br>Bending amplitude 3 mm for 10 seconds<br>2010 2512 sizes: 2 mm Other sizes: 3 mm |
| Solderability                                  | 95% min. coverage                            |              | <b>MIL-STD-202 Method 208H</b><br>245±5°C for 3 seconds  |
| Resistance to Soldering Heat                   | ΔR±0.05%                                     | ΔR±0. 1%     | <b>MIL-STD-202 Method 210E</b><br>260±5°C for 10 seconds   |
| Dielectric Withstand Voltage                   | By Type                                      |              | <b>MIL-STD-202 Method 301</b><br>Max. overload voltage for 1 minute  |
| Low Temperature Operation                      | ΔR±0.05%                                     | ΔR±0.2%      | <b>JIS-C-5201-1 4.36</b><br>1 hour, -65°C, followed by 45 minutes of RCWV                                    |
|  | ΔR±0.5% for high power rating                |              |  |
| High Temperature Exposure                      | ΔR±0. 5%                                     |              | <b>MIL-STD-202 Method 108</b><br>at +155°C for 1000 hrs  |

RCWV(Rated continuous working voltage)=  $\sqrt{P \cdot R}$  or Max. Operating voltage whichever is lower

■ Storage Temperature: 15~28°C; Humidity < 80%RH