

■ Precision Product Thin Film Chip Resistor — TP Series



Top view



Bottom view

■ Applications

- Computer & relative products
- Communication devices
- Measuring instrument
- Converters
- Printing equipment

■ Features

- Excellent long-term stability
- The variance of reliability test is reduced to $\pm 0.1\%$
- Low TCR down to $\pm 5 \text{ ppm}/^\circ\text{C}$
- Tight tolerance down to $\pm 0.01\%$
- Halogen free and lead free
- RoHS compliant

■ Parts Number Explanation

■ Example:

| TP | 1206 | B | 10K0 | P | 05 | 10 | Z |
|---|--|---|---|--|--------------------------------------|---|------------------|
| Product Type | Size (Inch) | Tolerance | Resistance | Package | Quantity (PCS) | TCR (ppm/°C) | Optional |
| TP Series Precision Product Thin Film Chip Resistor | 0402 0603 0805 1206 1210 2010 2512 | T : $\pm 0.01\%$ A : $\pm 0.05\%$ B : $\pm 0.1\%$ C : $\pm 0.25\%$ D : $\pm 0.5\%$ F : $\pm 1.0\%$ | 4 digits EX. 22R0 = 22 Ω 100R = 100 Ω 2K20 = 2.2 K Ω 22K0 = 22 K Ω 100K = 100 K Ω 1M00 = 1 M Ω | P : Paper Taping (0603~1210) Q : Paper Taping (0402) E : Embossed Taping | 04 : 4000 05 : 5000 10 : 10000 | 05 : ± 5 10 : ± 10 15 : ± 15 25 : ± 25 | Z : Default Code |



**TP Series Precision Product Thin Film
Chip Resistor Product Specifications**

| | |
|----------------------|---------------|
| Document No. | S-10-12-61-02 |
| Released Date | 2021/05/19 |
| Page No. | 2/9 |

Standard Electrical Specifications

| 項目 Item 型別 Type | 額定功率 Rated Power at 70°C | 最大 工作電壓 Max Working Voltage | 最大 過負載電壓 Max Overload Voltage | 溫度係數 T.C.R. (PPM/°C) | 阻值範圍 Resistance Range | | | | | | |
|--------------------|--------------------------------|---|---|----------------------------|--------------------------|--------------------|---------------|-------------|------------|------------|--|
| | | | | | T ±0.01% | A ±0.05% | B ±0.1% | C ±0.25% | D ±0.5% | F ±1.0% | |
| TP0402 | 0.063W | 50V | 100V | ±5 | 49.9 Ω ~ 12 KΩ | 20 Ω ~ 12 KΩ | | | | | |
| | | | | ±10, ±15 | | 10 Ω ~ 68 KΩ | | | | | |
| | | | | ±25 | | 4.7 Ω ~ 220 KΩ | | | | | |
| TP0603 | 0.1W | 75V | 150V | ±5 | 49.9 Ω ~ 30 KΩ | 20 Ω ~ 30 KΩ | | | | | |
| | | | | ±10, ±15 | | 10 Ω ~ 332 KΩ | | | | | |
| | | | | ±25 | | 4.7 Ω ~ 680 KΩ | | | | | |
| TP0805 | 0.125W | 150V | 300V | ±5 | 49.9 Ω ~ 50 KΩ | 20 Ω ~ 50 KΩ | | | | | |
| | | | | ±10, ±15 | | 10 Ω ~ 680 KΩ | | | | | |
| | | | | ±25 | | 4.7 Ω ~ 1 MΩ | | | | | |
| TP1206 | 0.25W | 200V | 400V | ±5 | 49.9 Ω ~ 100 KΩ | 20 Ω ~ 100 KΩ | | | | | |
| | | | | ±10, ±15 | | 10 Ω ~ 1 MΩ | | | | | |
| | | | | ±25 | | 4.7 Ω ~ 1.5 MΩ | | | | | |
| TP1210 | 0.25W | | | 400V | ±5 | 49.9 Ω ~ 100 KΩ | 20 Ω ~ 100 KΩ | | | | |
| | | | | | ±10, ±15 | | 10 Ω ~ 100 KΩ | | | | |
| | | | | | ±25 | | 4.7 Ω ~ 1 MΩ | | | | |
| TP2010 | 0.5W | | | 400V | ±5 | 49.9 Ω ~ 100 KΩ | 20 Ω ~ 100 KΩ | | | | |
| | | | | | ±10, ±15 | | 10 Ω ~ 100 KΩ | | | | |
| | | | | | ±25 | | 4.7 Ω ~ 1 MΩ | | | | |
| TP2512 | 0.75W | 400V | ±5 | 49.9 Ω ~ 100 KΩ | 20 Ω ~ 100 KΩ | | | | | | |
| | | | ±10, ±15 | | 10 Ω ~ 100 KΩ | | | | | | |
| | | | ±25 | | 4.7 Ω ~ 1 MΩ | | | | | | |

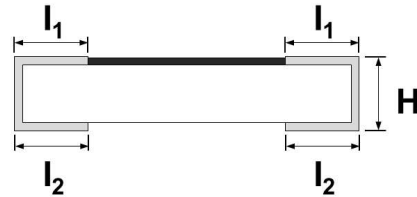
- Operating Temperature Range : -55°C ~ +155°C.
- For non-standard parts, please contact our sales department.

■ **Construction**



| | | | | | |
|---|---------------------|---|------------------------|---|----------------------|
| ① | Alumina Substrate | ④ | Bottom Inner Electrode | ⑦ | Side Inner Electrode |
| ② | Resistive Layer | ⑤ | Protective Overcoat | ⑧ | Nickel Barrier |
| ③ | Top Inner Electrode | ⑥ | Marking | ⑨ | Solder coating (Sn) |

■ **Dimensions**



Unit : mm

| TYPE | L | W | H | l ₁ | l ₂ |
|--------|-------------|-------------|-------------|----------------|----------------|
| TP0402 | 1.00 ± 0.10 | 0.50 ± 0.05 | 0.30 ± 0.05 | 0.20 ± 0.10 | 0.20 ± 0.10 |
| TP0603 | 1.60 ± 0.15 | 0.80 ± 0.10 | 0.45 ± 0.10 | 0.30 ± 0.20 | 0.30 ± 0.20 |
| TP0805 | 2.00 ± 0.15 | 1.25 ± 0.15 | 0.55 ± 0.10 | 0.35 ± 0.20 | 0.40 ± 0.20 |
| TP1206 | 3.10 ± 0.15 | 1.60 ± 0.15 | 0.55 ± 0.10 | 0.45 ± 0.20 | 0.50 ± 0.20 |
| TP1210 | 3.10 ± 0.15 | 2.50 ± 0.15 | 0.55 ± 0.10 | 0.45 ± 0.20 | 0.50 ± 0.20 |
| TP2010 | 5.00 ± 0.15 | 2.50 ± 0.15 | 0.55 ± 0.10 | 0.60 ± 0.20 | 0.60 ± 0.20 |
| TP2512 | 6.30 ± 0.15 | 3.20 ± 0.15 | 0.55 ± 0.10 | 0.60 ± 0.20 | 0.60 ± 0.20 |

■ Performance Characteristics

■ Power Derating Curve

The Operating Temperature Range: -55°C ~+155°C.

Power rating is in the case based on continuous full-load at ambient temperature of 70°C. For operation at ambient temperature in excess of 70°C, the load should be derated in accordance with figure of derating Curve.



■ Rated Voltage

Resistance Range: $\geq 1\Omega$

Rated Voltage: The resistor shall have a DC continuous working voltage or a RMS AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined formula as following:

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

V = Rated voltage (V)

P = Rated power (W)

R = Nominal resistance (Ω)



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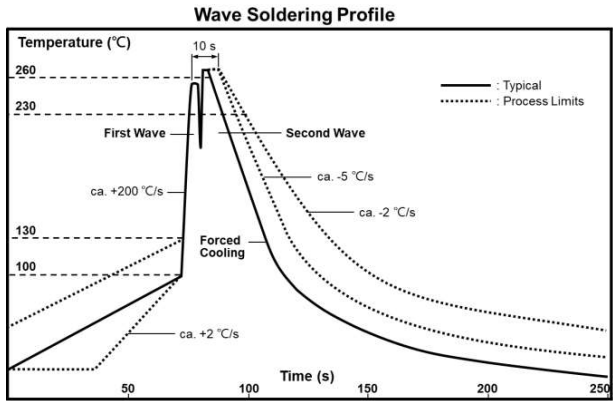
Reliability Tests and Requirements

| Test Item | Test Method | Procedure | Requirements |
|---|---|---|---|
| Temperature Coefficient of Resistance (T.C.R) | JIS-C-5201-1 4.8 IEC-60115-1 4.8 | At 25 / -55°C and 25°C / +125°C, 25°C is the reference temperature | Refer to Standard Electrical Specifications |
| Short Time Overload | JIS-C-5201-1 4.13 IEC-60115-1 4.13 | 2.5 times RCWW or Max. Overload voltage whichever is less for 5 seconds. | ±(0.1%+0.05Ω) No Visual damage |
| Insulation Resistance | JJIS-C-5201-1 4.6 IEC-60115-1 4.6 | Apply 100VDC for 1 minute. | ≥10GΩ |
| Solderability | JIS-C-5201-1 4.17 IEC-60115-1 4.17 | 245±5°C for 3 seconds. | >95% Coverage No Visual damage |
| Resistance to Soldering Heat | JIS-C-5201-1 4.18 IEC-60115-1 4.18 | 260±5°C for 10 seconds. | ±(0.1%+0.05Ω) No Visual damage |
| Leaching | JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1 | 260±5°C for 30 seconds. | >95% Coverage No Visual damage |
| Rapid Change of Temperature | JIS-C-5201-1 4.19 IEC-60115-1 4.19 | -55°C to +155°C, 300 cycles | ±(0.2%+0.05Ω) No Visual damage |
| High Temperature Exposure | JIS-C5201-1 4.25 IEC 60068-2-2 | At 155±5°C for 1000 hours. | ±(0.2%+0.05Ω) |
| Resistance to Solvent | JIS-C-5201-1 4.29 | The tested resistor be immersed into isopropyl alcohol of 20~25°C for 60 secs. Then the resistor is left in the room for 48 hrs. | ±(0.1%+0.05Ω) No Visual damage |
| Damp Heat with Load | JIS-C-5201-1 4.24 IEC-60115-1 4.24 | 40±2°C, 90~95% R.H. RCWW or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" | ±(0.1%+0.05Ω) |
| Biased Humidity | MIL-STD-202 Method 103 | 1,000 hours; 85°C / 85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion. | ±(0.1%+0.05Ω) |
| Load Life (Endurance) | JIS-C-5201-1 4.25 IEC-60115-1 4.25.1 | 70±2°C, RCWW or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" . | ±(0.1%+0.05Ω) |
| Bending Strength | JIS-C-5201-1 4.33 IEC-60115-1 4.33 | Bending once for 5 seconds D : 0402、0603、0805 = 5mm 1206、1210 = 3mm 2010、2512 = 2mm | ±(0.1%+0.05Ω) No Visual damage |

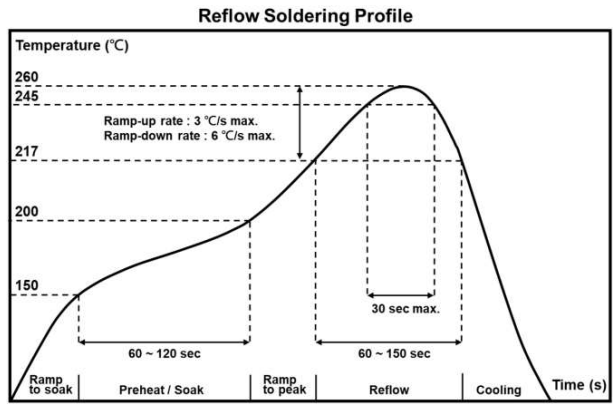
● We can also provide AEC-Q200 test reports if required by customers.

Recommended Customer Soldering Parameters

Wave solder Temperature condition



Solder reflow Temperature condition



Rework temperature (hot air equipment) : 350°C, 3~5seconds

Recommended reflow methods

IR, vapor phase oven, hot air oven

If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

Recommend Land Pattern Design



Unit: mm

| Type / Item | 0402 | 0603 | 0805 | 1206 | 1210 | 2010 | 2512 |
|-------------|------|------|------|------|------|------|------|
| A | 0.50 | 0.80 | 1.30 | 2.20 | 2.00 | 3.80 | 4.90 |
| B | 1.60 | 2.40 | 2.90 | 4.20 | 4.40 | 6.60 | 8.10 |
| C | 0.70 | 1.00 | 1.40 | 1.70 | 2.70 | 2.70 | 3.40 |



Marking



0402: no marking



0603: 3 digits code



0805~2512: 4 digits code

No marking on 0402 type

3 digits code for 0603 type

Standard E96 Values and 0603 Resistance Codes

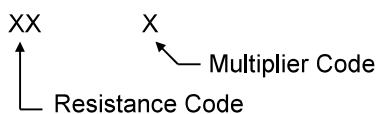
| | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| R-Value | 100 | 102 | 105 | 107 | 110 | 113 | 115 | 118 | 121 | 124 | 127 | 130 | 133 | 137 | 140 | 143 | 147 | 150 | 154 | 158 | 162 | 165 | 169 | 174 |
| Code | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| R-Value | 178 | 182 | 187 | 191 | 196 | 200 | 205 | 210 | 215 | 221 | 226 | 232 | 237 | 243 | 249 | 255 | 261 | 267 | 274 | 280 | 287 | 294 | 301 | 309 |
| Code | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| R-Value | 316 | 324 | 332 | 340 | 348 | 357 | 365 | 374 | 383 | 392 | 402 | 412 | 422 | 432 | 442 | 453 | 464 | 475 | 487 | 499 | 511 | 523 | 536 | 549 |
| Code | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
| R-Value | 562 | 576 | 590 | 604 | 619 | 634 | 649 | 665 | 681 | 698 | 715 | 732 | 750 | 768 | 787 | 806 | 825 | 845 | 866 | 887 | 909 | 931 | 953 | 976 |
| Code | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 |

E96 Multiplier Code

| Code | A | B | C | D | E | F | G | H | X | Y | Z |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|
| Multiplier | 10 ⁰ | 10 ¹ | 10 ² | 10 ³ | 10 ⁴ | 10 ⁵ | 10 ⁶ | 10 ⁷ | 10 ⁻¹ | 10 ⁻² | 10 ⁻³ |

1. 0603 3 digits coding formula for E96 values as following:

CODING FORMULA



Example: $10.2K\Omega = 102 \times 10^2\Omega = 02C$

$33.2\Omega = 332 \times 10^{-1}\Omega = 51X$

| E24 | 10 | 11 | 12 | 13 | 15 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 33 | 36 | 39 | 43 | 47 | 51 | 56 | 62 | 68 | 75 | 82 | 91 |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

2. 0603 3 digits for E24 values

Examples:

| Resistance | 33Ω | 470Ω | 5.6KΩ | 62KΩ |
|---------------|-----|------|-------|------|
| 3 digits code | 330 | 471 | 562 | 623 |

("R"= decimal point)

3. 0603 E192 values have no marking code.

4 digits code for 0805 ~ 2512 type

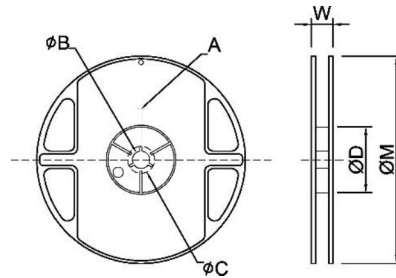
First 3 digits are the significant figures, the 4th digit is the multiplier. "R"= decimal point.

Examples:

| Resistance | 49.9Ω | 100Ω | 1.1KΩ | 10KΩ | 33.2KΩ | 1 MΩ |
|---------------|-------|------|-------|------|--------|------|
| 4 digits code | 49R9 | 1000 | 1101 | 1002 | 3322 | 1004 |

■ **Packaging Information**

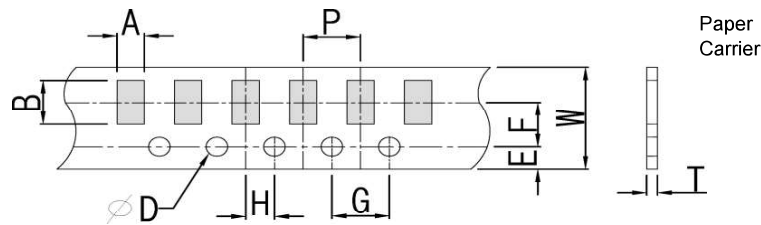
■ **Reel Dimensions**



Unit: mm

| TYPE | SIZE | A | φB | φC | φD | W | φM |
|-------------------------|------|----------|---------|----------|--------|----------|---------|
| 0402 | 7" | 10K/Reel | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 60±1.0 | 178±2.0 |
| 0603/0805/1206/ 1210 | 7" | 5K/Reel | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 60±1.0 | 178±2.0 |
| 2010/2512 | 7" | 4K/Reel | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 16.0±2.0 | 178±2.0 |

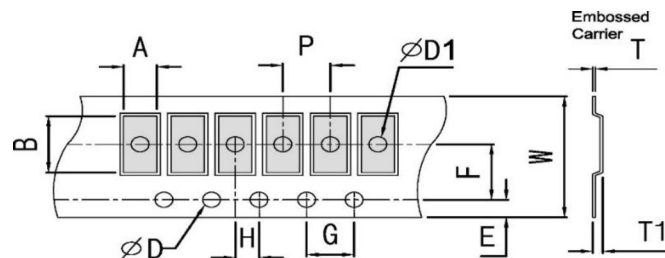
■ **Paper Tape Dimensions**



Unit: mm

| Type | A | B | W | E | F | G | H | T | φD | P |
|------|-----------|-----------|----------|-----------|----------|----------|----------|-----------|-------------------------------------|----------|
| 0402 | 0.70±0.10 | 1.20±0.10 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.45±0.10 | 1.50 ^{+0.10} ₋₀ | 2.0±0.10 |
| 0603 | 1.05±0.20 | 1.80±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.60±0.10 | | 4.0±0.10 |
| 0805 | 1.55±0.20 | 2.30±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.75±0.10 | | |
| 1206 | 1.90±0.20 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.75±0.10 | | |
| 1210 | 2.85±0.20 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.75±0.10 | | |

■ **Plastic Embossed Tape Dimensions**



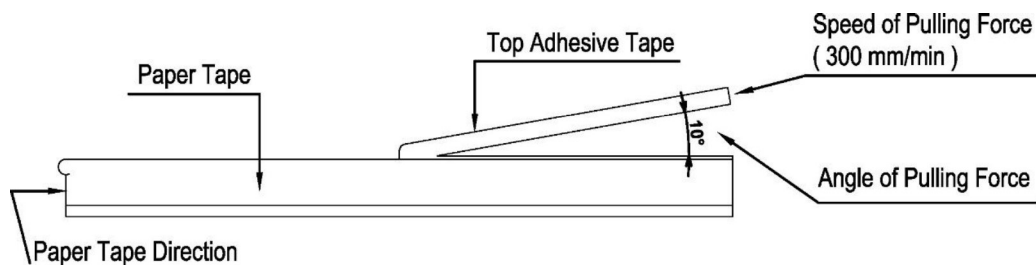
Unit: mm

| Type | A | B | W | E | F | G | H | T | φD | φD1 | T1 | P |
|------|-----------|-----------|---------|-----------|----------|----------|----------|-----------|-------------------------------------|-----------|-----------|----------|
| 2010 | 2.80±0.20 | 5.60±0.20 | 12±0.10 | 1.75±0.10 | 5.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.23±0.10 | 1.50 ^{+0.10} ₋₀ | 1.50±0.10 | 0.85±0.15 | 4.0±0.10 |
| 2512 | 3.40±0.20 | 6.70±0.20 | 12±0.10 | 1.75±0.10 | 5.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.23±0.10 | | 1.50±0.10 | 0.85±0.15 | |

■ **Front & Back Lead Dimensions**



■ **Top Adhesive Peel Off Strength : 10~70g**



■ **Package**

| Inner Box Size | |
|----------------|------------|
| Reel | Size H(mm) |
| 1 | 13 |
| 2 | 24 |
| 3 | 36 |
| 5 | 60 |
| 10 | 113 |



| External Box Size | | | |
|-------------------|-------------|------------|-------------|
| Contain (Kpcs) | Length (mm) | Width (mm) | Height (mm) |
| 25K | 180 | 180 | 60 |
| 50K | 180 | 180 | 110 |
| 150K | 430 | 200 | 200 |
| 300K | 400 | 400 | 200 |



■ **Storage Data :**

Storage time at the environment temp: $25\pm 5^{\circ}\text{C}$ & humidity: $60\pm 20\%$ is valid for one year from the date of delivery.

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