# ***Data Sheet***

| | |
|---|---|
| Customer： | |
| Product : | Thin Film Precision Chip Resistor - AR Series |
| Size: | 0201/0402/0603/0805/1206/1210/2010/2512 |
| Issued Date: | 7-Apr-25 |
| Edition : | REV.F6 |

RoHS Compliant


HONG KONG HELISTO INDUSTRIAL LIMITED
香港海利斯特实业有限公司

SHENZHEN HELISTO TECHNOLOGYCOLTD
深圳市海利斯特科技有限公司

ADD:5/F., A Block, Hongdu Industrial Park, Fanshen Road, 45 Area, Baoan, Shenzhen, China
TEL:+86-755-29741555 29749555
FAX:+86-755-29742111
E-mail:donnyhai@helisto.com
www.Helisto.com


| Produced by (QC) | Checked (QC) | Approved by (QC) | Prepared by (Sales) | Accepted by (Customer) |
|---|---|---|---|---|
| 7-Apr-25 | 7-Apr-25 | 7-Apr-25 | 7-Apr-25 | |
| ***Chun*** | ***Ben Chang*** | ***Ben Chang*** | | |

# Thin Film Precision Chip Resistor
# (AR Series)



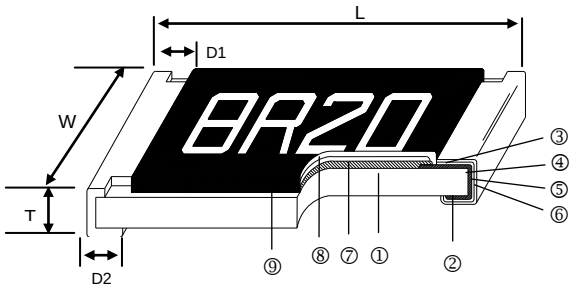

## ■Features

- Advanced thin film technology
- Very tight tolerance down to ±0.01%
- Extremely low TCR down to ±1PPM/°C
- Wide resistance range 1ohm ~ 3Mega ohm
- Miniature size 0201 available
- AEC-Q200 Compliance (0201 product is excluded)
- Test proven immunity to Biased humidity(85°C/ 85% RH)

## ■Applications

- Medical Equipment
- Testing / Measurement Equipment
- Printer Equipment
- Automatic Equipment Controller
- Converters
- Communication Device, Cell Phone, GPS, PDA

## ■Construction




| | | | | | |
|---|---|---|---|---|---|
| ① | Alumina Substrate | ④ | Edge Electrode | ⑦ | Resistor Layer |
| ② | Bottom Electrode | ⑤ | Barrier Layer | ⑧ | Overcoat |
| ③ | Top Electrode | ⑥ | External Electrode | ⑨ | Marking |

## ■Dimensions

Unit: mm

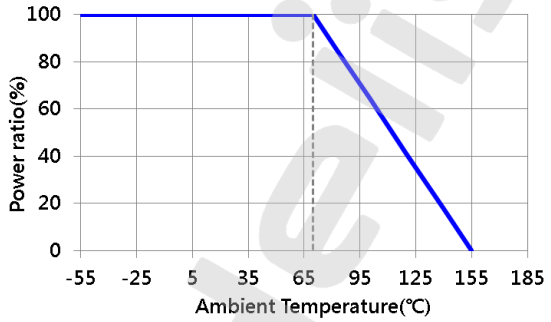
| Type | Size (Inch) | L | W | T | D1 | D2 | Weight (g) (1000pcs) |
|---|---|---|---|---|---|---|---|
| AR01 | 0201 | 0.58±0.05 | 0.29±0.05 | 0.23±0.05 | 0.12±0.05 | 0.15±0.05 | 0.14 |
| AR02 | 0402 | 1.00±0.05 | 0.50±0.05 | 0.30±0.05 | 0.20±0.15 | 0.20±0.10 | 0.54 |
| AR03 | 0603 | 1.55±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.25 | 0.30±0.20 | 1.83 |
| AR05 | 0805 | 2.00±0.15 | 1.25±0.15 | 0.55±0.10 | 0.30±0.25 | 0.40±0.20 | 4.71 |
| AR06 | 1206 | 3.05±0.15 | 1.55±0.15 | 0.55±0.10 | 0.42±0.30 | 0.35±0.25 | 9.02 |
| AR13 | 1210 | 3.10±0.15 | 2.40±0.15 | 0.55±0.10 | 0.40±0.30 | 0.55±0.25 | 10 |
| AR10 | 2010 | 4.90±0.15 | 2.40±0.15 | 0.55±0.10 | 0.60±0.40 | 0.50±0.25 | 23.61 |
| AR10(1/2W) | 2010(1/2W) | 4.90±0.15 | 2.40±0.15 | 0.55±0.10 | 0.60±0.40 | 2.20±0.25 | 26.68 |
| AR12 | 2512 | 6.30±0.15 | 3.10±0.15 | 0.55±0.10 | 0.60±0.40 | 0.50±0.25 | 38.06 |
| AR12(1W)1~100Ω | 2512(1W) | 6.30±0.15 | 3.10±0.15 | 0.55±0.10 | 0.60±0.40 | 0.50±0.25 | 44.65 |
| AR12(1W)101Ω above | 2512(1W) | 6.30±0.15 | 3.10±0.15 | 0.55±0.10 | 0.60±0.40 | 2.50±0.25 | 44.65 |

## ■Part Numbering

| AR | 03 | B | T | B | X | 1001 | |
|---|---|---|---|---|---|---|---|
| Product Type | Dimensions (L×W) | Resistance Tolerance | Packaging Code | TCR (PPM/°C) | Power Rating | Resistance | Marking Code |
| | 01: 0201<br>02: 0402<br>03: 0603<br>05: 0805<br>06: 1206<br>13: 1210<br>10: 2010<br>12: 2512 | T: ±0.01%<br>A: ±0.05%<br>B: ±0.1%<br>C: ±0.25%<br>D: ±0.5%<br>F: ±1% | T: Taping Reel<br>B: Bulk | 5: ±1<br>X: ±2<br>O:±3<br>S: ±5<br>B: ±10<br>N: ±15<br>C: ±25<br>D: ±50 | : Standard<br>(see Remark)<br>N: 1/20W<br>Y: 1/16W<br>X: 1/10W<br>W: 1/8W<br>M: 1/6W<br>P: 1/5W<br>V: 1/4W<br>O: 1/3W<br>U: 1/2W<br>Q: 3/4W<br>T: 1W | 0010: 1Ω<br>4R70: 4.7Ω<br>1001: 1KΩ<br>1004: 1MΩ | : Standard Marking for E96 / E24<br>N: No Marking |

*Remark: Standard part no need for power rating code.

## ■Derating Curve




## ■Standard Electrical Specifications

| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | | | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ±0.05% | ±0.1% | ±0.25% | ±0.5% | ±1% | |
| AR01 (0201) | 1/32W | -55 ~ +155°C | 15V | 30V | — | 22Ω - 75KΩ | | | | ±25,±50 |
| AR02 (0402) | 1/16W | -55 ~ +155°C | 50V | 100V | 49.9Ω - 12KΩ | 4Ω - 511KΩ | | | | ±25,±50 |
| AR03 (0603) | 1/16W | -55 ~ +155°C | 50V | 100V | 4.7Ω -332KΩ | 1Ω - 1MΩ | | | | ±25,±50 |
| AR05 (0805) | 1/10W | -55 ~ +155°C | 100V | 200V | 4.7Ω -1MΩ | 1Ω - 2MΩ | | | | ±25,±50 |
| AR06 (1206) | 1/8W | -55 ~ +155°C | 150V | 300V | 4.7Ω - 1MΩ | 1Ω - 3MΩ | | | | ±25,±50 |
| AR13 (1210) | 1/4W | | | | | | | | | |
| AR10 (2010) | 1/4W | -55 ~ +155°C | 150V | 300V | 4.7Ω - 1MΩ | 1Ω - 3MΩ | | | | ±25,±50 |
| AR12 (2512) | 1/2W | | | | | | | | | |

■Lower Resistance:1~10Ω

## ■Special Electrical Specifications

| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | | | | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ±0.01% | ±0.05% | ±0.1% | ±0.25% | ±0.5% | ±1% | |
| AR01 (0201) | 1/32W | -55 ~ +155°C | 15V | 30V | – | | 22Ω - 7KΩ | | | | ±10,±15 |
| | | | | | – | | 7.01KΩ - 75KΩ | | | | **±10***,±15 |
| AR02 (0402) | 1/16W | -55 ~ +155°C | 50V | 100V | 49.9Ω - 4.99KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 49.9Ω - 20KΩ | | | | | | ±5 |
| | | | | | 49.9Ω - 20KΩ | | 49.9Ω - 100KΩ | | | | ±10, ±15 |
| AR03 (0603) | 1/16W | -55 ~ +155°C | 50V | 100V | 24.9Ω - 15KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 24.9Ω - 60KΩ | | | | | | ±5 |
| | | | | | 24.9Ω - 100KΩ | 4.7Ω-332KΩ | 4.7Ω - 511KΩ | | | | ±10, ±15 |
| AR05 (0805) | 1/10W | -55 ~ +155°C | 100V | 200V | 24.9Ω - 30KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 24.9Ω - 150KΩ | | | | | | ±5 |
| | | | | | 24.9Ω - 200KΩ | 4.7Ω – 1MΩ | | | | | ±10, ±15 |
| AR06 (1206) | 1/8W | -55 ~ +155°C | 150V | 300V | 24.9Ω - 49.9KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 24.9Ω - 300KΩ | | | | | | ±5 |
| | | | | | 24.9Ω - 499KΩ | 4.7Ω – 1.5MΩ | | | | | ±10, ±15 |
| AR13 (1210) | 1/ 4W | -55 ~ +155°C | 150V | 300V | 24.9Ω - 49.9KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 24.9Ω - 300KΩ | | | | | | ±5 |
| | | | | | 24.9Ω - 499KΩ | 4.7Ω - 1MΩ | | | | | ±10, ±15 |
| AR10 (2010) | 1/4W | -55 ~ +155°C | 150V | 300V | 24.9Ω - 100KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 24.9Ω - 300KΩ | | | | | | ±5 |
| | | | | | 24.9Ω - 499KΩ | 4.7Ω - 1MΩ | | | | | ±10, ±15 |
| AR12 (2512) | 1/2W | -55 ~ +155°C | 150V | 300V | 24.9Ω - 100KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 24.9Ω - 300KΩ | | | | | | ±5 |
| | | | | | 24.9Ω - 499KΩ | 4.7Ω - 1MΩ | | | | | ±10, ±15 |

***TCR(25°C/-55°C): -15 ~ +10 PPM/°C**

## ■High Power Rating Electrical Specifications

| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | | | | | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ±0.01% | ±0.05% | ±0.1% | ±0.25% | ±0.5% | ±1% | |
| AR01 (0201) | 1/20W | -55 ~ +155°C | 25V | 50V | – | | 22Ω - 7KΩ | | | | ±10,±15 ±25,±50 |
| | | | | | | | 7.01KΩ - 75KΩ | | | | ±10*,±15 ±25,±50 |
| AR02 (0402) | 1/10W | -55 ~ +155°C | 50V | 100V | 49.9Ω - 4.99KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 49.9Ω - 20KΩ | | | | | | ±5 |
| | | | | | 49.9Ω - 12KΩ | | 49.9Ω - 100KΩ | | | | ±10, ±15 |
| | | | | | – | 49.9Ω - 12KΩ | 4.7Ω~255KΩ | | | | ±25,±50 |
| AR03 (0603) | 1/10W | -55 ~ +155°C | 75V | 150V | 24.9Ω - 15KΩ | | | – | | | ±1, ±2,±3 |
| | | | | | 24.9Ω - 60KΩ | | | | | | ±5 |
| | | | | | 24.9Ω - 100KΩ | 4.7Ω - 332KΩ | 4.7Ω - 511KΩ | | | | ±10,±15 |
| | | | | | | | 1Ω -1MΩ | | | | ±25,±50 |
| | 1/6W(Ultra) | -55 ~ +155°C | 100V | 150V | – | 10Ω - 332KΩ | | | | | ±25,±50 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| AR05 (0805) | 1/8W | -55 ~ +155℃ | 150V | 300V | 24.9Ω - 30KΩ | | — | ±1, ±2,±3 |
| | | | | | 24.9Ω -150KΩ | | | ±5 |
| | | | | | 24.9Ω - 200KΩ | 4.7Ω -511KΩ | 4.7Ω -1MΩ | ±10, ±15 |
| | | | | | | | 1Ω - 2MΩ | ±25,±50 |
| | 1/4W(Ultra) | -55 ~ +155℃ | 150V | 300V | — | 10Ω - 499KΩ | | ±25,±50 |
| AR06 (1206) | 1/4W | -55 ~ +155℃ | 200V | 400V | 24.9Ω - 49.9KΩ | | — | ±1, ±2,±3 |
| | | | | | 24.9Ω - 300KΩ | | | ±5 |
| | | | | | 24.9Ω - 499KΩ | 4.7Ω - 1MΩ | | ±10,±15 |
| | | | | | | 1Ω - 1MΩ | 1Ω - 3MΩ | ±25,±50 |
| | 1/3W(Ultra) | -55 ~ +155℃ | 200V | 400V | — | 10Ω ~1MΩ | | ±25,±50 |
| AR13 (1210) | 1/3W | -55 ~ +155℃ | 200V | 400V | 24.9Ω – 49.9KΩ | | — | ±1, ±2,±3 |
| | | | | | 24.9Ω - 300KΩ | | | ±5 |
| | | | | | 24.9Ω - 499KΩ | 4.7Ω - 1MΩ | | ±10,±15 |
| | | | | | | 1Ω - 1MΩ | 1Ω - 3MΩ | ±25,±50 |
| AR10(2010) | 1/3W | -55 ~ +155℃ | 200V | 400V | 24.9Ω - 49.9KΩ | | — | ±1, ±2,±3 |
| | | | | | 24.9Ω - 300KΩ | | | ±5 |
| | | | | | 24.9Ω - 499KΩ | 4.7Ω - 1MΩ | | ±10,±15 |
| | | | | | | 1Ω - 1MΩ | 1Ω - 3MΩ | ±25,±50 |
| | 1/2W(Ultra) | -55 ~ +155℃ | 200V | 400V | 24.9Ω - 2KΩ | 4.7Ω –1MΩ | 1Ω –1MΩ | ±10,±15 |
| | | | | | 24.9Ω - 2KΩ | 4.7Ω –1MΩ | 4.7Ω – 3MΩ / 1Ω –3MΩ | ±25,±50 |
| AR12(2512) | 3/4W | -55 ~ +155℃ | 200V | 400V | 24.9Ω - 2KΩ | 4.7Ω – 2KΩ | 1Ω – 2KΩ | ±10,±15 |
| | | | | | 24.9Ω - 2KΩ | 4.7Ω – 2KΩ | 4.7Ω – 3MΩ / 1Ω – 3MΩ | ±25,±50 |
| | 1W(Ultra) | -55 ~ +155℃ | 200V | 400V | 24.9Ω - 2KΩ | 4.7Ω –1MΩ | 1Ω –1MΩ | ±10,±15 |
| | | | | | 24.9Ω - 2KΩ | 4.7Ω –1MΩ | 4.7Ω – 3MΩ / 1Ω – 3MΩ | ±25,±50 |

Operating Voltage=$\sqrt{}$(P*R) or Max. operating voltage listed above, whichever is lower.
Overload Voltage=2.5*$\sqrt{}$(P*R) or Max. overload voltage listed above, whichever is lower.
■Viking is capable of manufacturing the optional spec based on customer's requirement.
**(Lower Resistance:1~10Ω ; High Power Rating)**
***TCR(25°C/-55°C): -15 ~ +10 PPM/°C**

## ■Environmental Characteristics

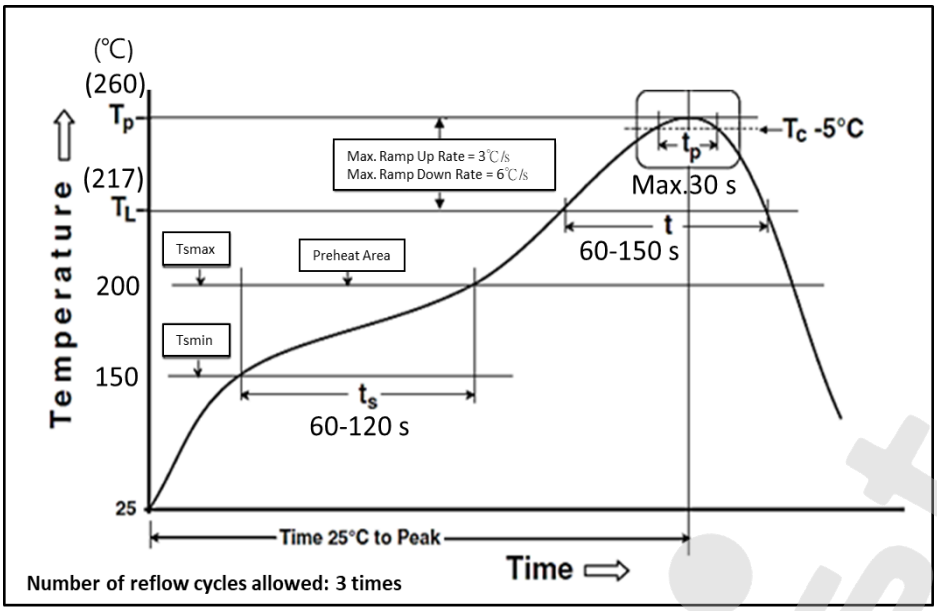
| Item | Requirement | | Test Method |
|---|---|---|---|
| | Tol. ≦ 0.05% | Tol. > 0.05% | |
| Temperature Coefficient of Resistance (T.C.R.) | As Spec. | | **MIL-STD-202 Method 304**<br>+25/-55/+25/+125/+25°C |
| Short Time Overload | ΔR±0.05% | ΔR±0.1%<br>ΔR ± 0.2% for 0201 | **JIS-C-5201-1 4.13**<br>RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds |
| | ΔR±0.2% for Ultra high power rating | | |
| Insulation Resistance | >9999 MΩ | | **MIL-STD-202 Method 302**<br>Apply 100$V_{DC}$ for 1 minute |
| Endurance | ΔR±0.05% | ΔR±0.1% | **MIL-STD-202 Method 108A**<br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF" |
| | ΔR±0.5% for Ultra high power rating | | |
| | 0201: >7kΩ →ΔR±0.5%<br>≦7kΩ→ΔR±0.2% | | |
| Bending Strength | ΔR±0.05% | ΔR±0.1% | **JIS-C-5201-1 4.33**<br>Bending amplitude 3 mm for 60 seconds<br>2010 2512 sizes: 2 mm Other sizes: 3 mm |
| Damp Heat with Load( for 0201 size) | ΔR±0.3% | | **MIL-STD-202 Method 103B**<br>40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF" |
| Solderability | 95% min. coverage | | **MIL-STD-202 Method 208H**<br>245±5°C for 3 seconds |
| Resistance to Soldering Heat | ΔR±0.05% | ΔR±0.1% | **MIL-STD-202 Method 210E**<br>260±5°C for 10 seconds |
| Dielectric Withstand Voltage | By Type | | **MIL-STD-202 Method 301**<br>Max. overload voltage for 1 minute |
| Low Temperature Operation | ΔR±0.05% | ΔR±0.2% | **JIS-C-5201-1 4.36**<br>1 hour, -65°C, followed by 45 minutes of RCWV |
| | ΔR±0.5% for high power & Ultra Power rating | | |
| High Temperature Exposure | ΔR±0.5%<br>0402 ≧255.01K<br>0603 ≧402.01K<br>0805 ≧1.01M<br>1206 ≧1.01M<br>1210 ≧1.01M<br>2010 ≧1.01M<br>2512 ≧1.01M<br>ΔR±0.2% for the other | | **MIL-STD-202 Method 108**<br>at +155°C for 1000 hrs |
| Temperature Cycling | ΔR±0.2% (0201 product is excluded) | | **JESD22 Method JA-104**<br>-55°C to +125°C, 1000 cycles |
| ESD | ΔR±0.5% (0201 product is excluded) | | **AEC-Q200-002**<br>Human body model<br>AR02 AR03 200V<br>AR05 AR06 1000V<br>AR10、AR12、AR13 2000V |
| Sulfur Test | ΔR±2% (0201 product is excluded) | | **ASTM-B-809-95 Modified**<br>105±2 °C no power rating for **1000** hrs. |
| Biased Humidity | ΔR±0.1% (0201 product is excluded) | | **MIL-STD-202 Method 103**<br>1000 hrs 85°C/85%RH 10% of operating power. |

RCWV(Rated continuous working voltage)= √(P*R) or Max. Operating voltage whichever is lower

■**Storage Temperature: 15~28℃; Humidity < 80%RH**

■**Shelf Life: 2 years from production date.**

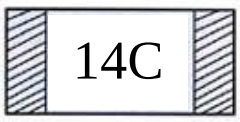
## ■Soldering Condition(IPC/JEDEC J-STD-020)




| Reflow Profiles | |
|---|---|
| **Profile Feature** | **Pb-Free Assembly** |
| **Preheat**<br>Min. Temperature ($T_{smin}$)<br>Max Temperature ($T_{smax}$)<br>Preheating time ($t_s$) from ($T_{smin}$ to $T_{smax}$) | <br>150 °C<br>200 °C<br>60-120 seconds |
| Ramp-up rate ($T_L$ to Tp) | 3 °C/second max. |
| Liquidous temperature ($T_L$)<br>Time ($t_L$) maintained above $T_L$ | 217 °C<br>60-150 seconds |
| Min. Peak temperature (Tp min) | 235°C |
| Max. Peak temperature (Tp max) | 260°C |
| Time (tp) within 5 °C of the specified classification temperature (Tc) | 30 seconds max. |
| Ramp-down rate (Tp to $T_L$) | 6 °C/second max. |
| Time 25 °C to peak temperature | 8 minutes max. |

## ■Marking

0603 3digit marking




3digit marking for Example: 14C=13K7Ω 13C=13K3Ω

68B=4K99Ω 68X=49.9Ω

**Marking Table**

| Code | E96 | Code | E96 | Code | E96 | Code | E96 |
|---|---|---|---|---|---|---|---|
| **01** | 100 | **25** | 178 | **49** | 316 | **73** | 562 |
| **02** | 102 | **26** | 182 | **50** | 324 | **74** | 576 |
| **03** | 105 | **27** | 187 | **51** | 332 | **75** | 590 |
| **04** | 107 | **28** | 191 | **52** | 340 | **76** | 604 |
| **05** | 110 | **29** | 196 | **53** | 348 | **77** | 619 |
| **06** | 113 | **30** | 200 | **54** | 357 | **78** | 634 |
| **07** | 115 | **31** | 205 | **55** | 365 | **79** | 649 |
| **08** | 118 | **32** | 210 | **56** | 374 | **80** | 665 |
| **09** | 121 | **33** | 215 | **57** | 383 | **81** | 681 |
| **10** | 124 | **34** | 221 | **58** | 392 | **82** | 698 |
| **11** | 127 | **35** | 226 | **59** | 402 | **83** | 715 |
| **12** | 130 | **36** | 232 | **60** | 412 | **84** | 732 |
| **13** | 133 | **37** | 237 | **61** | 422 | **85** | 750 |
| **14** | 137 | **38** | 243 | **62** | 432 | **86** | 768 |
| **15** | 140 | **39** | 249 | **63** | 442 | **87** | 787 |
| **16** | 143 | **40** | 255 | **64** | 453 | **88** | 806 |
| **17** | 147 | **41** | 261 | **65** | 464 | **89** | 825 |
| **18** | 150 | **42** | 267 | **66** | 475 | **90** | 845 |
| **19** | 154 | **43** | 274 | **67** | 487 | **91** | 866 |
| **20** | 158 | **44** | 280 | **68** | 499 | **92** | 887 |
| **21** | 162 | **45** | 287 | **69** | 511 | **93** | 909 |
| **22** | 165 | **46** | 294 | **70** | 523 | **94** | 931 |
| **23** | 169 | **47** | 301 | **71** | 536 | **95** | 953 |
| **24** | 174 | **48** | 309 | **72** | 549 | **96** | 976 |

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

0603 3digit marking for E24 Example: 101=100Ω 102=1KΩ

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

0805~2512 4digit marking Example

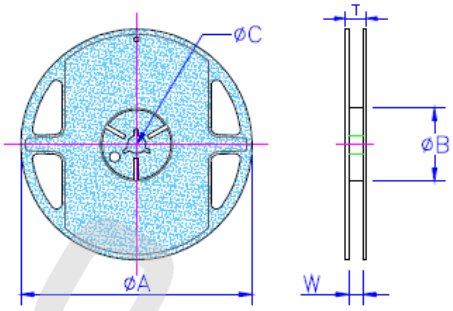
| Resistance | 100Ω | 2.2KΩ | 10KΩ | 49.9KΩ | 100KΩ |
|---|---|---|---|---|---|
| marking | 1000 | 2201 | 1002 | 4992 | 1003 |

## ■Packaging

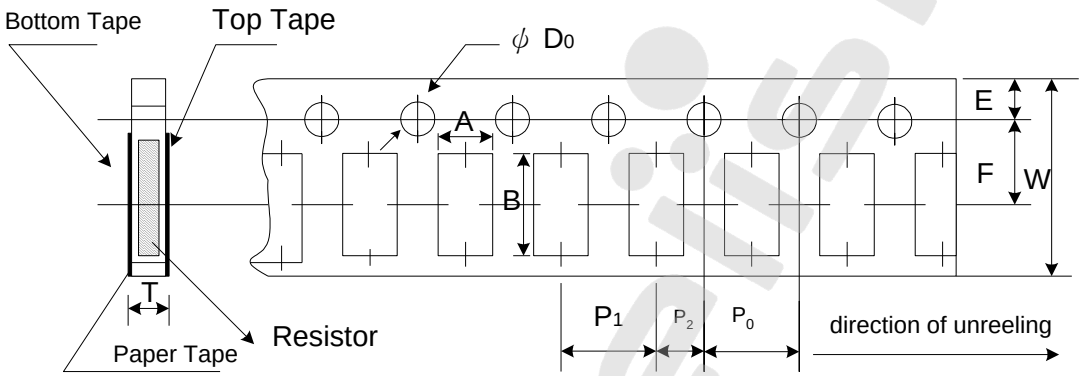
Packing Quantity & Reel Specifications

Unit :mm

| Type | ØA | ØB | ØC | W | T | Paper Tape (EA) | Emboss Plastic Tape (EA) |
|---|---|---|---|---|---|---|---|
| AR01 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 10,000 | - |
| AR02 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 10,000 | - |
| AR03 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 5,000 | - |
| AR05 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 5,000 | - |
| AR06 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 5,000 | - |
| AR13 | 178.0±1.0 | 60.0±1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 5,000 | - |
| AR10 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | - | 4,000 |
| AR12 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 13.5±1.0 | 15.5±1.0 | - | 4,000 |



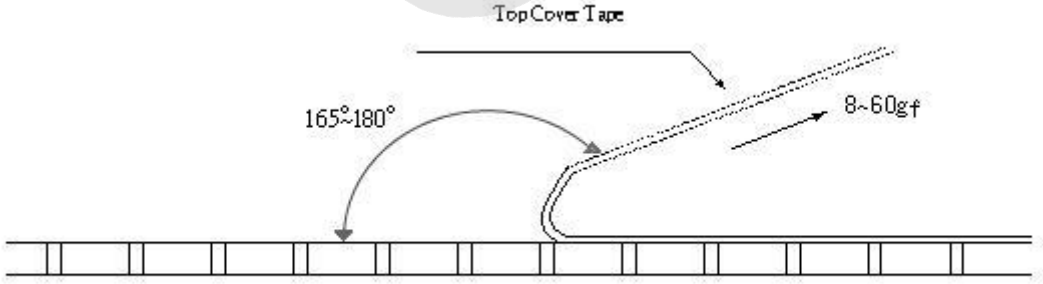

Paper Tape Specifications



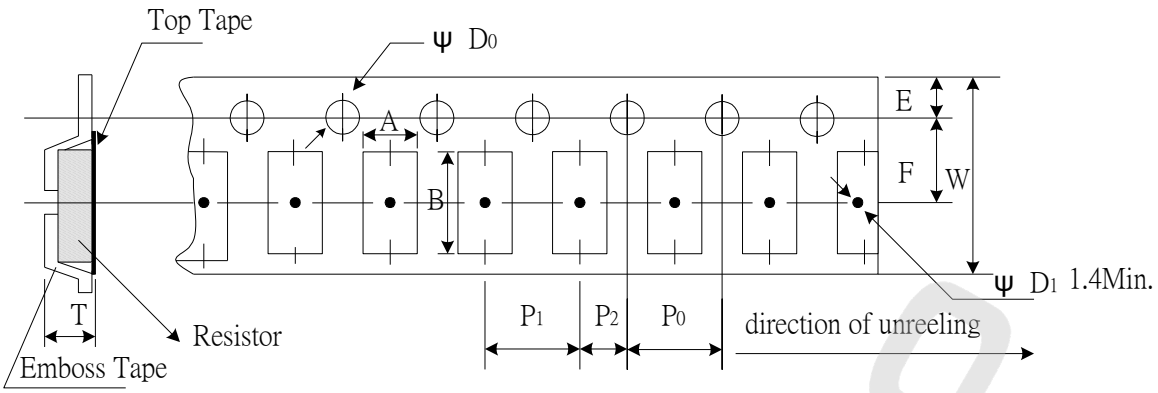

Unit: mm

| Type | A | B | W | E | F | $P_0$ | $P_1$ | $P_2$ | $\Phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|
| AR01 | 0.40±0.05 | 0.70±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.55±0.03 | 0.42±0.02 |
| AR02 | 0.70±0.05 | 1.16±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.55±0.05 | 0.40±0.03 |
| AR03 | 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 |
| AR05 | 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 |
| AR06 | 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 |
| AR13 | 2.75±0.05 | 3.40±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.60±0.10 | 0.75±0.05 |

■ Peel force of top cover tape
■ The peel speed shall be about 300mm/min±5%
■ The peel force of top cover tape shall be between 8gf to 60gf



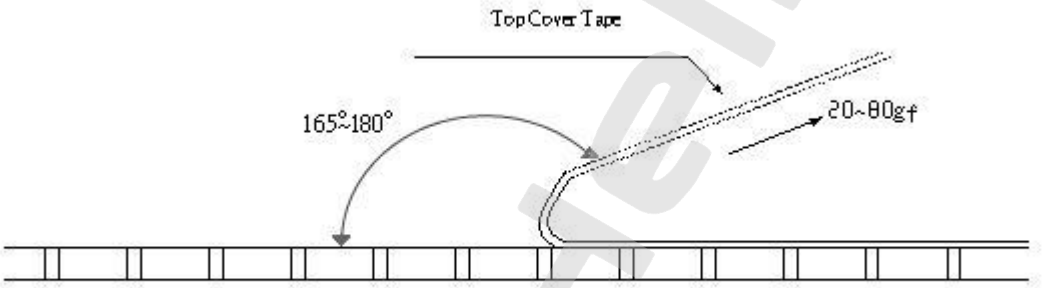
Emboss Plastic Tape Specifications




Unit: mm

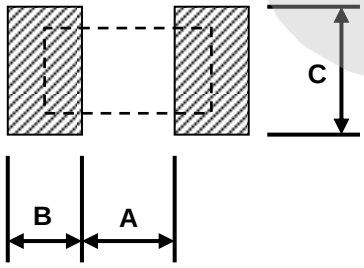
| Type | A | B | W | E | F | $P_0$ | $P_1$ | $P_2$ | ØD0 | T |
|---|---|---|---|---|---|---|---|---|---|---|
| AR10 | 2.85±0.10 | 5.45±0.10 | 12.0±0.10 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.50+0.10 | 1.00±0.20 |
| AR12 | 3.40±0.10 | 6.65±0.10 | 12.0±0.10 | 1.75±0.10 | 5.5±0.05 | 4.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.50+0.10 | 1.00±0.20 |

- Peel force of top cover tape
- The peel speed shall be about 300mm/min±5%
- The peel force of top cover tape shall be between 20gf to 80gf




## ■Recommend Land Pattern

Unit: mm




| Type | A | B | C |
|---|---|---|---|
| AR01 | 0.25 | 0.30 | 0.40±0.2 |
| AR02 | 0.50 | 0.50 | 0.60±0.2 |
| AR03 | 0.80 | 1.00 | 0.90±0.2 |
| AR05 | 1.00 | 1.00 | 1.35±0.2 |
| AR06 | 2.00 | 1.15 | 1.70±0.2 |
| AR13 | 2.00 | 1.15 | 2.50±0.2 |
| AR10 | 3.60 | 1.40 | 2.50±0.2 |
| AR10(1/2W) | 1.00 | 2.70 | 2.50±0.2 |
| AR12 | 4.90 | 1.60 | 3.10±0.2 |
| AR12(1W) 1~100Ω | 4.90 | 1.60 | 3.10±0.2 |
| AR12(1W) 101Ω above | 1.00 | 3.55 | 3.10±0.2 |

## REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|---|---|---|---|
| Version D3 | Jan. 14, 2013 | - | - Add resistance range for Special Electrical and High Power Rating Electrical Specifications.<br>- Adjust the mockup. |
| Version D4 | Apr. 10, 2013 | - | - Add "RCWV" description in Environment Characteristic Test Method. |
| Version D5 | Oct. 16, 2013 | - | - Increase the resistance range of AR05, TCR15 product. |
| Version D6 | Oct. 17, 2014 | - | - Correct the specification of top cover tape peel force.<br>- Update the resistance range of AR05 (Standard) to 4.7Ω -1MΩ |
| Version D7 | Apr. 28, 2015 | - | - Add TCR ±2ppm and ±3ppm products specification.<br>- Increase the resistance range of the products below:<br>• AR02 and AR03 of Standard Electrical Specifications.<br>• AR02, AR03 and AR05 of Special Electrical Specifications.<br>- Correct the element of Top Electrode. |
| Version D8 | May. 02, 2016 | - | - Modify Storage Temperature. |
| Version D9 | Aug.04, 2016 | - | - Update items and requirements of Environmental Characteristics.<br>- Increase the resistance range of Special Electrical Specifications products. |
| Version E | Dec.14, 2016 | - | - Add AR02 High Power Rating Electrical Specifications. |
| Version E1 | Feb. 23, 2017 | - | - Increase the resistance range of AR02 Standard Electrical Specifications. |
| Version E2 | Apr. 05, 2017 | - | - Add TCR ±1ppm and products specification. |
| Version E3 | Nov.10, 2017 | - | - Correct the reference standard in Environmental Characteristics. |
| Version E4 | Dec.26, 2017 | - | - Correct the reference standard in Environmental Characteristics. |

## REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|---|---|---|---|
| Version E5 | Feb. 06, 2018 | - | - Correct the reference standard in Environmental Characteristics. |
| Version E6 | Jul. 24, 2018 | - | - Update Environment Characteristics item. |
| Version E7 | May. 02,2019 | - | - Increase the AR01 0.1% & 0.25% Precision resistance. |
| Version E8 | Oct. 29,2019 | - | - Increase the resistance range of Standard, Special and High Power Rating Electrical Specifications. |
| Version E9 | Jan. 07,2020 | - | - Define the Dimensions specifications for AR10(1/2W) and AR12(1W).<br>- Add the part number code “N” for 1/20W Power rating.<br>- Extend the resistance range of AR01 (Standard Electrical Specifications).<br>- Add products specifications for AR01(1/20W) and AR10(1/2W).<br>- Update products specifications for AR12(1W).<br>- Define the Recommend Land Pattern for AR10(1/2W) and AR12(1W). |
| Version F | Apr. 27,2020 | - | - Modify the Max. Operating Voltage of AR02 from 25V to 50V.<br>- Modify the Max. Overload Voltage of AR02 from 50V to 100V.<br>- Correct Recommend Land Pattern Dimension A/B of AR10(1/2W) from 0.5mm/2.8mm to 1.00mm/2.70mm. |
| Version F1 | Dec. 08, 2020 | - | - Extend the resistance range of AR01 Standard and High Power Rating Electrical Specifications.<br>- Modify the test time of Bending Strength. |
| Version F2 | Jan. 22,2022 | - | - Correct the dimension specifications of D2 and land pattern for AR12.<br>- Modify IR reflow profile to comply IPC/JEDEC J-STD-020.<br>- Add shelf life description. |

## REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|---|---|---|---|
| Version F3 | Feb. 10,2022 | - | - Modify the temperature (low temperature) of Derating Curve from 0°C to -55°C. |
| Version F4 | Nov. 10,2023 | - | - Resistance range of Standard Electrical: AR06/AR13 0.1%~1% up to 3MΩ.<br>- Resistance range of High Power Electrical: AR05 TCR25/50 0.1%~1% up to 2MΩ.<br>- Resistance range of High Power Electrical: AR06~AR12 TCR25/50 0.1%~1% up to 3MΩ.<br>- Update Reflow Profiles. |
| Version F5 | May. 22,2024 | - | - Add AEC-Q200 Compliance and Biased humidity descriptions in Features.<br>-Modify the tolerance of dimension D1 for AR02~AR12.<br>-Add “Ultra” description for AR03~AR12.<br>-Update Environmental Characteristics:<br>˙Add the requirement of Ultra high power rating product for Short Time Overload and Endurance Tests.<br>˙Only keep AR01 requirement for Damp Heat with Load Test.<br>˙Add High Temperature Exposure, Temperature Cycling, ESD, Sulfur and Biased Humidity Tests. |
| Version F6 | Apr. 07,2025 | - | -Add AR0201 in Special Electrical Specifications and add note: “*TCR(25°C/-55°C): -15 ~ +10 PPM/°C”.<br>-Add AR0201 TCR ±10ppm and ±15ppm in High Power Rating Electrical Specifications and add note: “*TCR(25°C/-55°C): -15 ~ +10 PPM/°C”. |