# ***Data Sheet***

| | |
|---|---|
| Customer： | |
| Product : | Tantalum Nitride Thin Film Precision Chip Resistor - TAR Series |
| Size: | 0402/0603/0805/1206 |
| Issued Date: | 17-May-23 |
| Edition : | REV A2 |




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) |
|---|---|---|---|---|
| 17-May-23 | 17-May-23 | 17-May-23 | | |
| ***Chun*** | ***Ben Chang*** | ***Ben Chang*** | | |

# Tantalum Nitride Thin Film Precision Chip Resistor (TAR Series)



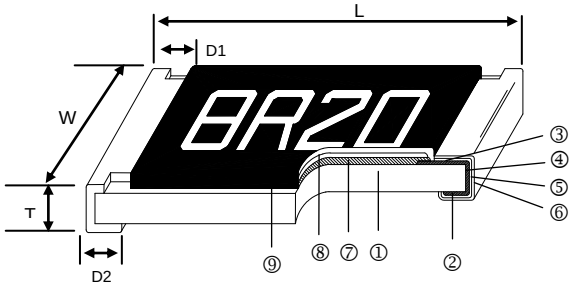

## Features

- Tantalum nitride thin film resistor
- High stability in humid environments
- AEC-Q200 Compliance
- Tight tolerance down to ±0.05%
- Extremely low TCR down to ±10PPM/°C
- Resistance values from 10 ohm to 1M ohm
- Special materials, design, and processing for high sulfur applications
- Test proven immunity to humidity, moisture, and sulfur

## Applications

- Automotive
- Medical Equipment
- Testing / Measurement Equipment
- Automatic Equipment Controller
- Converters
- Communication Device

## 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

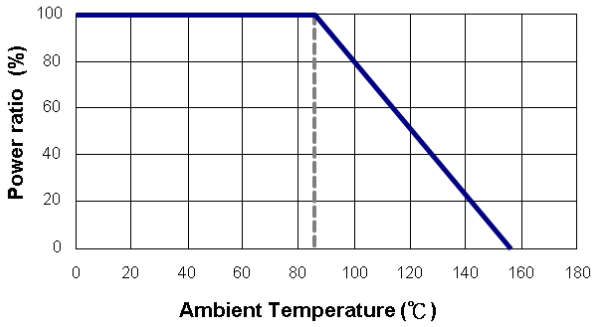
Unit: mm

| Type | Size (Inch) | L | W | T | D1 | D2 | Weight (g) (1000pcs) |
|---|---|---|---|---|---|---|---|
| TAR02 | 0402 | 1.00±0.05 | 0.50±0.05 | 0.30±0.05 | 0.20±0.10 | 0.20±0.10 | 0.54 |
| TAR03 | 0603 | 1.55±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 1.83 |
| TAR05 | 0805 | 2.00±0.15 | 1.25±0.15 | 0.55±0.10 | 0.30±0.20 | 0.40±0.20 | 4.71 |
| TAR06 | 1206 | 3.05±0.15 | 1.55±0.15 | 0.55±0.10 | 0.42±0.20 | 0.35±0.25 | 9.02 |

## Part Numbering

| TAR | 03 | A | T | C | M | 1001 | N |
|---|---|---|---|---|---|---|---|
| Product Type | Dimensions (L×W) | Resistance Tolerance | Packaging Code | TCR (PPM/°C) | Power Rating | Resistance | Marking Code |
| | 02: 0402<br>03: 0603<br>05: 0805<br>06: 1206 | A: ±0.05%<br>B: ±0.1%<br>C: ±0.25%<br>D: ±0.5%<br>F: ±1% | T: Taping Reel<br>B: Bulk | B: ±10<br>N: ±15<br>C: ±25<br>D: ±50 | Y: 1/16W<br>M: 1/6W<br>P: 1/5W<br>U: 1/2W | 0010: 1Ω<br>1001: 1KΩ<br>1004: 1MΩ | : Standard Marking for E96 / E24<br>N: No Marking |

## ■Derating Curve




## ■Standard Electrical Specifications

| Item / Type | Power Rating at 85°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | | | | TCR (PPM/•C) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ±0.05% | ±0.1% | ±0.25% | ±0.5% | ±1% | |
| TAR02 (0402) | 1/16W | -55 ~ +155°C | 50V | 100V | 40Ω – 35KΩ | | | | | ±10,±15,±25,±50 |
| TAR03 (0603) | 1/6W | -55 ~ +155°C | 75V | 150V | 40Ω – 130KΩ | | | | | ±10,±15,±25,±50 |
| TAR05 (0805) | 1/5W | -55 ~ +155°C | 100V | 200V | 10Ω – 350KΩ | | | | | ±10,±15,±25,±50 |
| TAR06 (1206) | 1/2W | -55 ~ +155°C | 200V | 400V | 10Ω – 1MΩ | | | | | ±10,±15,±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.

## ■Environmental Characteristics

| Item | Requirement | Test Method |
|---|---|---|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec. | **JIS-C-5201-1 4.8**<br>**IEC-60115-1 4.8**<br>-55°C~+125°C, 25°C is the reference temperature |
| Short Time Overload | ΔR±0.1% | **JIS-C-5201-1 4.13**<br>RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds |
| Insulation Resistance | >1000 MΩ | **JIS-C-5201-1 4.6**<br>**IEC-60115-1 4.6**<br>Apply 100$V_{DC}$ for 1 minute |
| Operational Life | ΔR±0.1% | **MIL-STD-202 Method 108**<br>Condition D Steady State $T_A$=125°C at derated power.<br>Measurement at 24±4 hours after test conclusion. |
| Biased Humidity | ΔR±0.1% | **MIL-STD-202 Method 103**<br>1000 hrs 85°C/85%RH 10% of operating power. |
| High Temperature Exposure | ΔR±0.15% | **MIL-STD-202 Method 108**<br>at +155°C for 1000 hrs |
| Temperature Cycling | ΔR±0.1% for 125℃ | **JESD22 Method JA-104**<br>-55°C to +125°C, 1000 cycles |
| | ΔR±0.2% for 155℃ | -55°C to +155°C, 1000 cycles |
| Bending Strength (Board Flex) | ΔR±0.1% | **JIS-C-5201-1 4.33**<br>Bending 2mm for 60 seconds |
| Solderability | 95% min. coverage | **JIS-C-5201-1 4.17**<br>**IEC-60115-1 4.17**<br>245±5°C for 3 seconds |
| Resistance to Soldering Heat | ΔR±0.1% | **JIS-C-5201-1 4.18**<br>**IEC-60115-1 4.18**<br>260±5°C for 10 seconds |

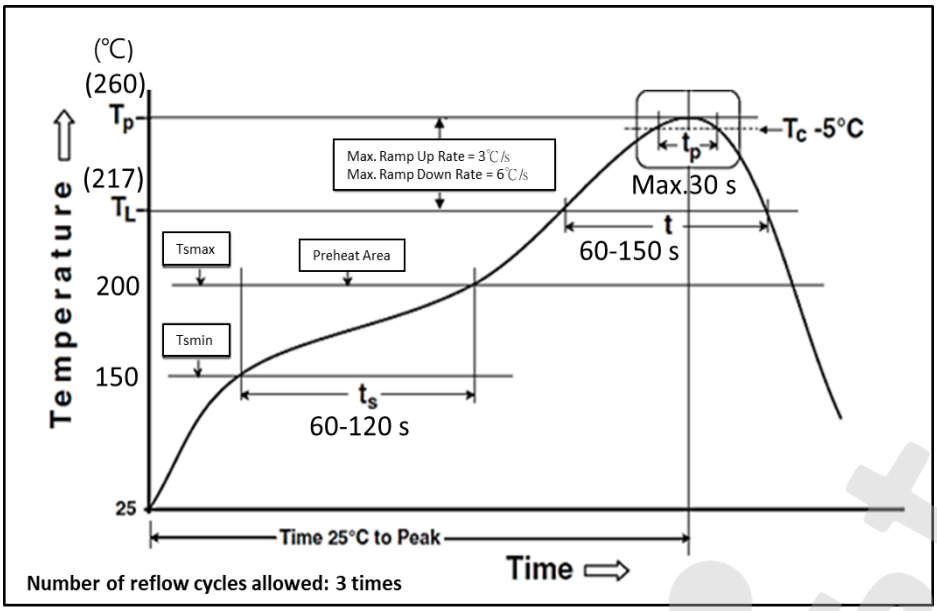
| | | |
|---|---|---|
| Terminal strength | No broken | **AEC-Q200-006**<br>Force of 1kg for 60 seconds. |
| Mechanical Shock | ΔR±0.1% | **MIL-STD-202 Method 213**<br>Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6. |
| Vibration | ΔR±0.1% | **MIL-STD-202 Method 204**<br>5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz |
| ESD | ΔR±0.1% | **AEC-Q200-002**<br>Human body model<br>TAR02、TAR03 0.2KV<br>TAR05、TAR06 1KV |
| Resistance to solvents | Marking Unsmeared | **MIL-STD-202 Method 215**<br>Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents. |
| Sulfur Test | △R±1% | **ASTM-B-809-95 Modified**<br>105±2 °C no power rating for 750 hrs. |
| Flammability | No ignition of the tissue paper or scorching or the pinewood board | **UL-94**<br>V-0 or V-1 are acceptable. Electrical test not required. |
| Endurance | △R±0.1% | **IEC60115-1 4.25**<br>1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 85 ±2ºC, 1.5 hours on and 0.5 hours off |
| Moisture Resistance | △R±0.1% | **MIL-STD-202 Method 106**<br>65±2°C, 80~100% RH, 10 cycles, 24 hours/cycle |

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

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

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

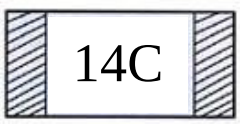
## ■Soldering Condition(IPC/JEDEC J-STD-020)




| 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=13KΩ 13C=13KΩ

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

0805~1206 4digit marking Example

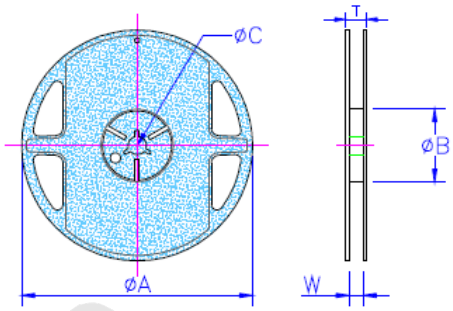
| Resistance | 100Ω | 2.2KΩ | 10KΩ | 49.9KΩ | 100KΩ |
|---|---|---|---|---|---|
| marking | 1000 | 2201 | 1002 | 4992 | 1003 |

## ■Packaging

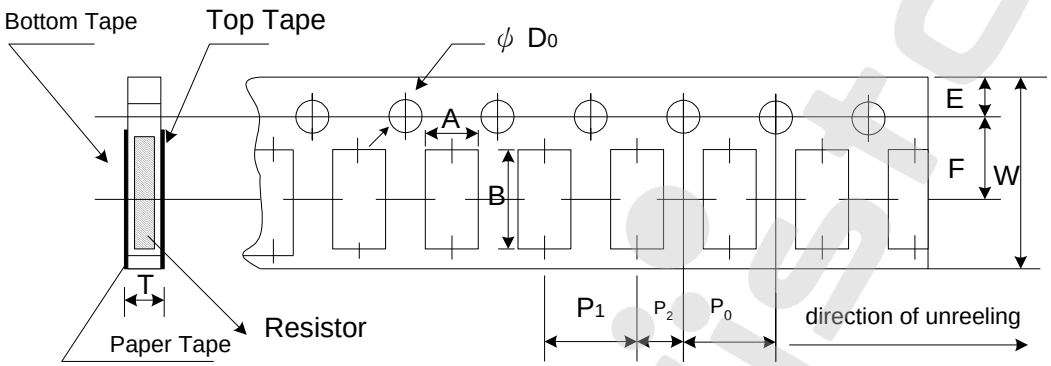
Packing Quantity & Reel Specifications

Unit :mm

| Type | ØA | ØB | ØC | W | T | Paper Tape (EA) | Emboss Plastic Tape (EA) |
|---|---|---|---|---|---|---|---|
| TAR02 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 10,000 | - |
| TAR03 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 5,000 | - |
| TAR05 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 5,000 | - |
| TAR06 | 178.0±1.0 | 60.0+1.0 | 13.5±0.7 | 9.5±1.0 | 11.5±1.0 | 5,000 | - |



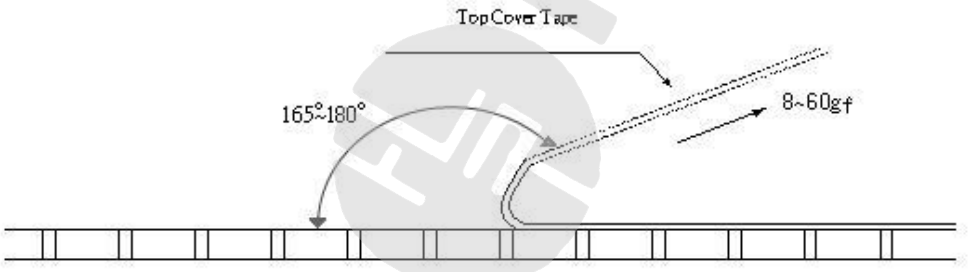

Paper Tape Specifications




Unit: mm

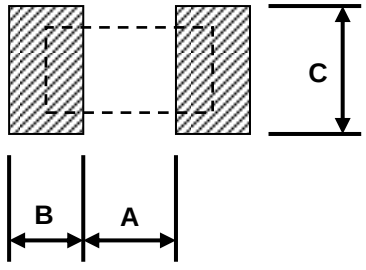
| Type | A | B | W | E | F | $P_0$ | $P_1$ | $P_2$ | $ΦD_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|
| TAR02 | 0.70±0.05 | 1.16±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.55±0.05 | 0.40±0.03 |
| TAR03 | 1.10±0.05 | 1.90±0.05 | 8.00±0.10 | 1.75±0.05 | 3.5±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.55±0.05 | 0.60±0.03 |
| TAR05 | 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 |
| TAR06 | 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 |

■ 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




## ■Recommend Land Pattern

Unit: mm




| Type | A | B | C |
|---|---|---|---|
| TAR02 | 0.50 | 0.50 | 0.60±0.2 |
| TAR03 | 0.80 | 1.00 | 0.90±0.2 |
| TAR05 | 1.00 | 1.00 | 1.35±0.2 |
| TAR06 | 2.00 | 1.15 | 1.70±0.2 |

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|---|---|---|---|
| Version A1 | Jan 26 ,2022 | - | - Add shelf life description.<br>- Modify IR reflow profile to comply IPC/JEDEC J-STD-020. |
| Version A2 | May 17 ,2023 | - | -Modify Test Method for Sulfur Test.<br>- Add Reflow Profiles table. |