

## Data Sheet

Customer :

Product : Thin Film Precision Chip Resistor - AR Series

Size: 0201/0402/0603/0805/1206/1210/2010/2512

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| 24-Jul-18           | 24-Jul-18        | 24-Jul-18           | 24-Jul-18              |                           |
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## Thin Film Precision Chip Resistor (AR Series)



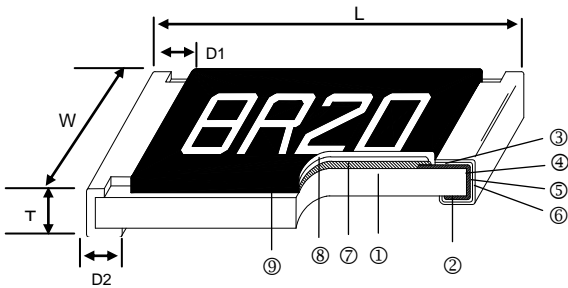
### ■ Features

- Advanced thin film technology
- Very tight tolerance down to  $\pm 0.01\%$
- Extremely low TCR down to  $\pm 1\text{PPM}/^\circ\text{C}$
- Wide resistance range 1ohm ~ 3Mega ohm
- Miniature size 0201 available

### ■ 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 $\pm$ 0.05 | 0.29 $\pm$ 0.05 | 0.23 $\pm$ 0.05 | 0.12 $\pm$ 0.05 | 0.15 $\pm$ 0.05 | 0.14                 |
| AR02 | 0402        | 1.00 $\pm$ 0.05 | 0.50 $\pm$ 0.05 | 0.30 $\pm$ 0.05 | 0.20 $\pm$ 0.10 | 0.20 $\pm$ 0.10 | 0.54                 |
| AR03 | 0603        | 1.55 $\pm$ 0.10 | 0.80 $\pm$ 0.10 | 0.45 $\pm$ 0.10 | 0.30 $\pm$ 0.20 | 0.30 $\pm$ 0.20 | 1.83                 |
| AR05 | 0805        | 2.00 $\pm$ 0.15 | 1.25 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.30 $\pm$ 0.20 | 0.40 $\pm$ 0.20 | 4.71                 |
| AR06 | 1206        | 3.05 $\pm$ 0.15 | 1.55 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.42 $\pm$ 0.20 | 0.35 $\pm$ 0.25 | 9.02                 |
| AR13 | 1210        | 3.10 $\pm$ 0.15 | 2.40 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.40 $\pm$ 0.20 | 0.55 $\pm$ 0.25 | 10                   |
| AR10 | 2010        | 4.90 $\pm$ 0.15 | 2.40 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.60 $\pm$ 0.30 | 0.50 $\pm$ 0.25 | 23.61                |
| AR12 | 2512        | 6.30 $\pm$ 0.15 | 3.10 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.60 $\pm$ 0.30 | 0.50 $\pm$ 0.25 | 38.06                |

### ■ Part Numbering

| AR           | 03   | T   | T                         | B  | Y  | 1001   | N   |
|--------------|--|---|---------------------------|--|--|--|---|
| Product Type | Dimensions (LxW)   | Resistance Tolerance  | Packaging Code            | TCR (PPM/ $^\circ$ 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: $\pm 0.01\%$<br>A: $\pm 0.05\%$<br>B: $\pm 0.1\%$<br>C: $\pm 0.25\%$<br>D: $\pm 0.5\%$<br>F: $\pm 1\%$ | T: Taping Reel<br>B: Bulk | 5: $\pm 1$<br>X: $\pm 2$<br>O: $\pm 3$<br>S: $\pm 5$<br>B: $\pm 10$<br>N: $\pm 15$<br>C: $\pm 25$<br>D: $\pm 50$ | : Standard<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: 1 $\Omega$<br>4R70: 4.7 $\Omega$<br>1001: 1K $\Omega$<br>1004: 1M $\Omega$ | : Standard Marking for E96 / E24<br>N: No Marking |

**Derating Curve**



**Standard Electrical Specifications**

| Item<br>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                   | —                |               |              |       |     | ±25          |
|              |                      |                       |                        |                       | 49.9Ω - 4.99KΩ   |               |              |       |     | ±50          |
| AR02 (0402)  | 1/16W                | -55 ~ +155°C          | 25V                    | 50V                   | 49.9Ω - 12KΩ     | 10Ω - 511KΩ   | 4.7Ω - 511KΩ |       |     | ±25,±50      |
| AR03 (0603)  | 1/16W                | -55 ~ +155°C          | 50V                    | 100V                  | 4.7Ω - 332KΩ     | 4.7Ω - 1MΩ    | 1Ω - 1MΩ     |       |     | ±25,±50      |
| AR05 (0805)  | 1/10W                | -55 ~ +155°C          | 100V                   | 200V                  | 4.7Ω - 1MΩ       | 4.7Ω - 2MΩ    | 1Ω - 2MΩ     |       |     | ±25,±50      |
| AR06 (1206)  | 1/8W                 | -55 ~ +155°C          | 150V                   | 300V                  | 4.7Ω - 1MΩ       | 4.7Ω - 2.49MΩ | 1Ω - 2.49MΩ  |       |     | ±25,±50      |
| AR13 (1210)  | 1/4W                 |                       |                        |                       |                  |               |              |       |     |              |
| AR10 (2010)  | 1/4W                 | -55 ~ +155°C          | 150V                   | 300V                  | 4.7Ω - 1MΩ       | 4.7Ω - 3MΩ    | 1Ω - 3MΩ     |       |     | ±25,±50      |
| AR12 (2512)  | 1/2W                 |                       |                        |                       |                  |               |              |       |     |              |

■ Lower Resistance: 1~10Ω

**Special Electrical Specifications**

| Item<br>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% |              |
| AR02 (0402)  | 1/16W                | -55 ~ +155°C          | 25V                    | 50V                   | 49.9Ω - 4.99KΩ   |              | —             |        |       |     | ±1, ±2, ±3   |
|              |                      |                       |                        |                       | 49.9Ω - 20KΩ     |              |               |        |       |     | ±5           |
|              |                      |                       |                        |                       | 49.9Ω - 20KΩ     |              | 49.9Ω - 100KΩ |        |       |     | ±10          |
| 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     |

**High Power Rating Electrical Specifications**

| Item<br>Type   | Power<br>Rating<br>at 70°C | Operating<br>Temp.<br>Range | Max.<br>Operating<br>Voltage | Max.<br>Overload<br>Voltage | Resistance Range |              |              |                |                    |                    | TCR<br>(PPM/°C) |
|----------------|----------------------------|-----------------------------|------------------------------|-----------------------------|------------------|--------------|--------------|----------------|--------------------|--------------------|-----------------|
|                |                            |                             |                              |                             | ±0.01%           | ±0.05%       | ±0.1%        | ±0.25%         | ±0.5%              | ±1%                |                 |
| AR02<br>(0402) | 1/10W                      | -55 ~ +155°C                | 50V                          | 100V                        | 49.9Ω - 4.99KΩ   |              |              | —              |                    |                    | ±1, ±2, ±3      |
|                |                            |                             |                              |                             | 49.9Ω - 4.99KΩ   |              |              |                |                    |                    | ±5              |
|                |                            |                             |                              |                             | 49.9Ω - 12KΩ     |              |              | 49.9Ω - 60KΩ   |                    |                    | ±10             |
|                |                            |                             |                              |                             |                  |              |              | 49.9Ω - 69.8KΩ |                    |                    | ±15             |
| —              | 49.9Ω - 12KΩ               | 10Ω - 255KΩ                 | 4.7Ω ~ 255KΩ                 |                             |                  | ±25, ±50     |              |                |                    |                    |                 |
| AR03 (0603)    | 1/10W                      | -55 ~ +155°C                | 75V                          | 150V                        | 24.9Ω - 15KΩ     |              |              | —              |                    |                    | ±1, ±2, ±3      |
|                |                            |                             |                              |                             | 24.9Ω - 15KΩ     |              |              |                |                    |                    | ±5              |
|                |                            |                             |                              |                             | 24.9Ω - 100KΩ    | 4.7Ω - 332KΩ | 4.7Ω - 332KΩ |                |                    | ±10, ±15           |                 |
|                | 4.7Ω - 1MΩ                 |                             |                              | ±25, ±50                    |                  |              |              |                |                    |                    |                 |
| 1/6W           | -55 ~ +155°C               | 100V                        | 150V                         | —                           | 10Ω - 332KΩ      |              |              | ±25, ±50       |                    |                    |                 |
| AR05 (0805)    | 1/8W                       | -55 ~ +155°C                | 150V                         | 300V                        | 24.9Ω - 30KΩ     |              |              | —              |                    |                    | ±1, ±2, ±3      |
|                |                            |                             |                              |                             | 24.9Ω - 30KΩ     |              |              |                |                    |                    | ±5              |
|                |                            |                             |                              |                             | 24.9Ω - 200KΩ    | 4.7Ω - 511KΩ | 4.7Ω - 511KΩ |                |                    | ±10                |                 |
|                | 4.7Ω - 1MΩ                 |                             |                              | ±15                         |                  |              |              |                |                    |                    |                 |
| 1/4W           | -55 ~ +155°C               | 150V                        | 300V                         | —                           | 4.7Ω - 1MΩ       | 1Ω - 1MΩ     | ±25, ±50     |                |                    |                    |                 |
| AR06 (1206)    | 1/4W                       | -55 ~ +155°C                | 200V                         | 400V                        | 24.9Ω - 49.9KΩ   |              |              | —              |                    |                    | ±1, ±2, ±3      |
|                |                            |                             |                              |                             | 24.9Ω - 49.9KΩ   |              |              |                |                    |                    | ±5              |
|                |                            |                             |                              |                             | 24.9Ω - 499KΩ    | 4.7Ω - 1MΩ   |              |                | ±10, ±15, ±25, ±50 |                    |                 |
|                | 1/3W                       | -55 ~ +155°C                | 200V                         | 400V                        | —                | 10Ω ~ 1MΩ    |              |                | ±25, ±50           |                    |                 |
| AR13 (1210)    | 1/ 3W                      | -55 ~ +155°C                | 200V                         | 400V                        | 24.9Ω - 49.9KΩ   |              |              | —              |                    |                    | ±1, ±2, ±3      |
|                |                            |                             |                              |                             | 24.9Ω - 49.9KΩ   |              |              |                |                    |                    | ±5              |
|                |                            |                             |                              |                             | 24.9Ω - 499KΩ    | 4.7Ω - 1MΩ   |              |                | ±10, ±15, ±25, ±50 |                    |                 |
| AR10(2010)     | 1/3W                       | -55 ~ +155°C                | 200V                         | 400V                        | 24.9Ω - 49.9KΩ   |              |              | —              |                    |                    | ±1, ±2, ±3      |
|                |                            |                             |                              |                             | 24.9Ω - 49.9KΩ   |              |              |                |                    |                    | ±5              |
|                |                            |                             |                              |                             | 24.9Ω - 499KΩ    | 4.7Ω - 1MΩ   |              |                | ±10, ±15, ±25, ±50 |                    |                 |
| AR12(2512)     | 3/4W                       | -55 ~ +155°C                | 200V                         | 400V                        | 24.9Ω - 2KΩ      | 4.7Ω - 2KΩ   |              | 1Ω - 2KΩ       |                    | ±10, ±15, ±25, ±50 |                 |
|                | 1W                         | -55 ~ +155°C                | 200V                         | 400V                        | —                | 4.7Ω - 100Ω  | 1Ω - 100Ω    |                |                    | ±25, ±50           |                 |

Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.  
 Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  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)**

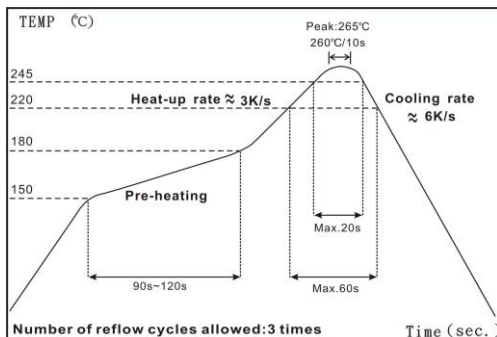
**Environmental Characteristics**

| 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  |

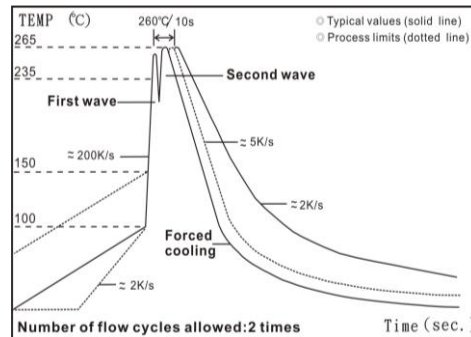
RCWV(Rated continuous working voltage)=  $\sqrt{P \cdot R}$  or Max. Operating voltage whichever is lower

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

**Soldering Condition**



IR Reflow Soldering



Wave Soldering (Flow Soldering)

- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

**■ 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 <sup>0</sup> | 10 <sup>1</sup> | 10 <sup>2</sup> | 10 <sup>3</sup> | 10 <sup>4</sup> | 10 <sup>5</sup> | 10 <sup>6</sup> | 10 <sup>7</sup> | 10 <sup>-1</sup> | 10 <sup>-2</sup> | 10 <sup>-3</sup> |

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                    |



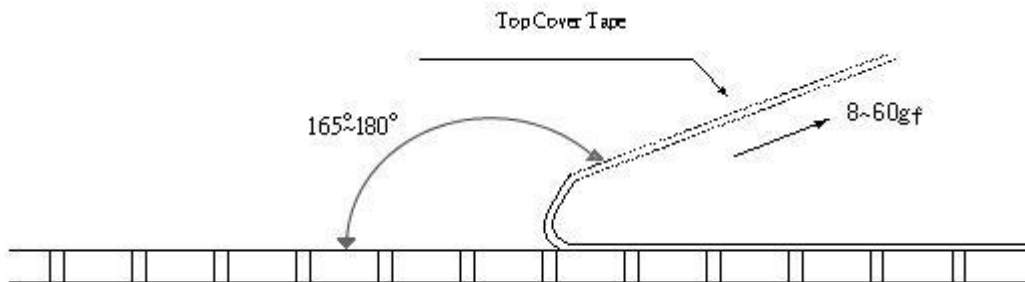
Paper Tape Specifications



Unit: mm

| Type | A         | B         | W         | E         | F        | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ΦD <sub>0</sub> | 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 <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ∅D <sub>0</sub> | 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 |
| AR12 | 4.90 | 1.60 | 3.10±0.2 |



**REVISION HISTORY**

| <b>REVISION</b> | <b>DATE</b>   | <b>CHANGE NOTIFICATION</b> | <b>DESCRIPTION</b>  |
|-----------------|---------------|----------------------------|---|
| Version D3      | Jan. 14, 2013 | -                          | <ul style="list-style-type: none"> <li>- Add resistance range for Special Electrical and High Power Rating Electrical Specifications.</li> <li>- Adjust the mockup.</li> </ul>  |
| Version D4      | Apr. 10, 2013 | -                          | <ul style="list-style-type: none"> <li>- Add "RCWV" description in Environment Characteristic Test Method.</li> </ul>   |
| Version D5      | Oct. 16, 2013 | -                          | <ul style="list-style-type: none"> <li>- Increase the resistance range of AR05, TCR15 product.</li> </ul>   |
| Version D6      | Oct. 17, 2014 | -                          | <ul style="list-style-type: none"> <li>- Correct the specification of top cover tape peel force.</li> <li>- Update the resistance range of AR05 (Standard) to 4.7Ω -1MΩ</li> </ul>  |
| Version D7      | Apr. 28, 2015 | -                          | <ul style="list-style-type: none"> <li>- Add TCR ±2ppm and ±3ppm products specification.</li> <li>- Increase the resistance range of the products below: <ul style="list-style-type: none"> <li>• AR02 and AR03 of Standard Electrical Specifications.</li> <li>• AR02, AR03 and AR05 of Special Electrical Specifications.</li> </ul> </li> <li>- Correct the element of Top Electrode.</li> </ul> |
| Version D8      | May. 02, 2016 | -                          | <ul style="list-style-type: none"> <li>- Modify Storage Temperature.</li> </ul>   |
| Version D9      | Aug.04, 2016  | -                          | <ul style="list-style-type: none"> <li>- Update items and requirements of Environmental Characteristics.</li> <li>- Increase the resistance range of Special Electrical Specifications products.</li> </ul>   |
| Version E       | Dec.14, 2016  | -                          | <ul style="list-style-type: none"> <li>- Add AR02 High Power Rating Electrical Specifications.</li> </ul>   |

**REVISION HISTORY**

| <b><u>REVISION</u></b> | <b><u>DATE</u></b> | <b><u>CHANGE NOTIFICATION</u></b> | <b><u>DESCRIPTION</u></b>   |
|------------------------|--------------------|-----------------------------------|---|
| Version E1             | Feb. 23, 2017      | -                                 | - Increase the resistance range of AR02 Standard Electrical Specifications. |
| Version E2             | Apr. 05, 2017      | -                                 | - Add TCR $\pm 1$ ppm 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.          |
| Version E5             | Feb. 06, 2018      | -                                 | - Correct the reference standard in Environmental Characteristics.          |
| Version E6             | Jul. 24, 2018      | -                                 | - Update Environment Characteristics item.                                  |

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