

## Data Sheet

Customer:

Product: Anti-Sulfurated Thick Film Chip Resistor - AS Series

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

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|---------------------|-----------------|---------------------|------------------------|---------------------------|
| 31-Oct-16           | 31-Oct-16       | 31-Oct-16           | 31-Oct-16              |                           |
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## Anti-Sulfurated Thick Film Chip Resistor



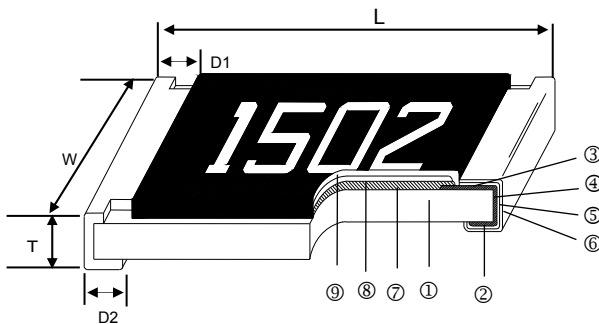
### Scope

- This specification applies to all sizes of rectangular-type fixed chip resistors with Ruthenium-base as material.

### Features

- Special construction to prevent sulfuration in a sulfur containing environment

### Construction



### Applications

- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- High-end Multimedia Electronics
- Outdoor Electronic Applications

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

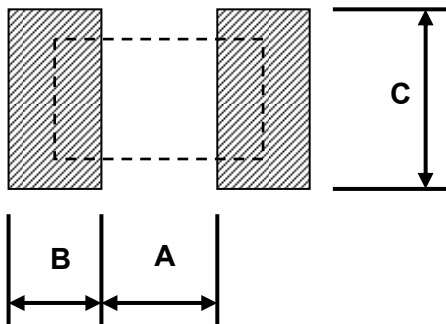
### Dimensions

| Type | Size (Inch) | L (mm)    | W (mm)    | T (mm)    | D1 (mm)   | D2 (mm)   | Weight (g) (1000pcs) |
|------|-------------|-----------|-----------|-----------|-----------|-----------|----------------------|
| AS01 | 0201        | 0.60±0.03 | 0.30±0.03 | 0.23±0.03 | 0.15±0.05 | 0.15±0.05 | 0.150                |
| AS02 | 0402        | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.20±0.10 | 0.620                |
| AS03 | 0603        | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 2.042                |
| AS05 | 0805        | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 | 4.368                |
| AS06 | 1206        | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 8.947                |
| AS10 | 1210        | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 15.959               |
| AS0A | 2010        | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 24.241               |
| AS12 | 2512        | 6.35±0.10 | 3.10±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 39.448               |

**Part Numbering**

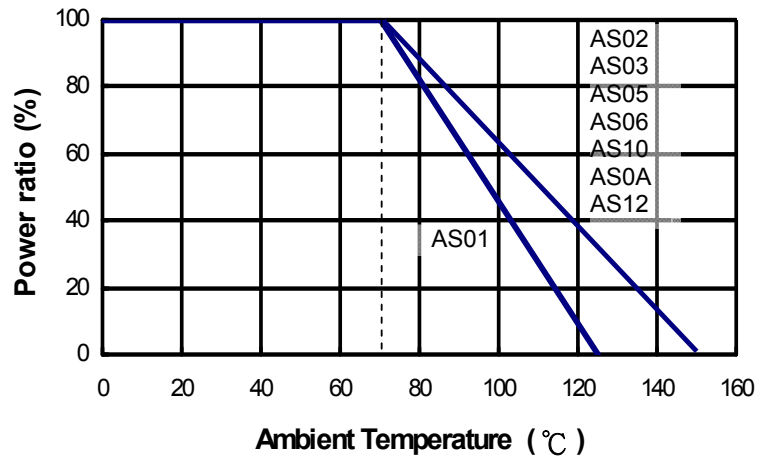
|              |  |                              |                |  |   |   |
|--------------|--|------------------------------|----------------|--|---|---|
| AS           | 03   | F                            | T              | E                                      |   | 1003  |
| Product Type | Dimensions   | Resistance Tolerance         | Packaging Code | TCR (PPM/°C)                           | Power Rating  | Resistance  |
|              | 01: 0201<br>02: 0402<br>03: 0603<br>05: 0805<br>06: 1206<br>10: 1210<br>0A: 2010<br>12: 2512 | D: ±0.5%<br>F: ±1%<br>J: ±5% | T: Taping Reel | E: ±100<br>F: ±200<br>- : No Specified | : Standard<br>L: 1/12W<br>X: 1/10W<br>W: 1/8W<br>V: 1/4W<br>O: 1/3W<br>U: 1/2W<br>T: 1W | R0R0: 0Ω<br>0010: 1Ω<br>1000: 100Ω<br>1002: 10KΩ<br>2201: 2.2KΩ<br>1003: 100KΩ<br>1004: 1MΩ |

**Recommend Land Pattern**

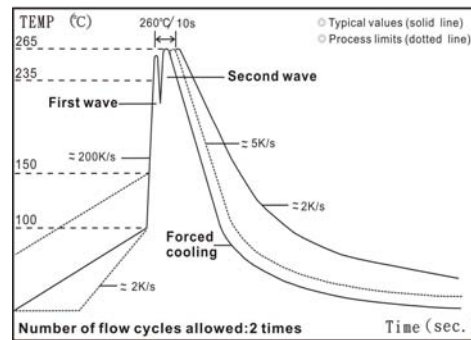
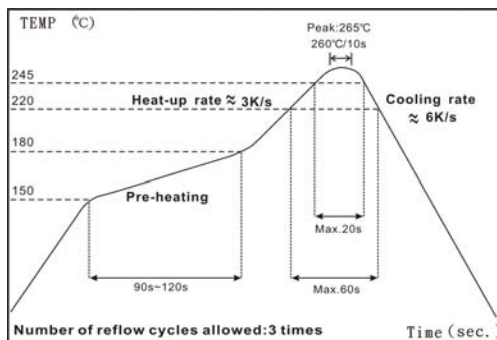


| Type | A (mm) | B (mm) | C (mm) |
|------|--------|--------|--------|
| AS01 | 0.30   | 0.25   | 0.30   |
| AS02 | 0.50   | 0.45   | 0.60   |
| AS03 | 0.90   | 0.60   | 0.90   |
| AS05 | 1.20   | 0.70   | 1.30   |
| AS06 | 2.00   | 0.90   | 1.60   |
| AS10 | 2.00   | 0.90   | 2.80   |
| AS0A | 3.80   | 0.90   | 2.80   |
| AS12 | 3.80   | 1.60   | 3.50   |

**Derating Curve**



**Soldering Condition**



- (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

**Standard Electrical Specifications**

| Item<br>Type | Power Rating<br>at 70°C<br>Jumper<br>Rated Current | Operating<br>Temp. Range | Max.<br>Operating<br>Voltage | Max.<br>Overload<br>Voltage              | Resistance Range                         |            |                      | TCR<br>(PPM/°C)      |
|--------------|--|--------------------------|------------------------------|--|--|------------|----------------------|----------------------|
|              |  |                          |                              |  | ±0.5%                                    | ±1%        | ±5%                  |                      |
| AS01 (0201)  | 1/20W  | -55 ~ +125°C             | 25V                          | 50V                                      | -  | 1Ω - 10MΩ  |                      | ±200                 |
|              | Jumper: 1A   |                          |                              |  | -  | 0Ω (<50mΩ) |                      | -                    |
| AS02 (0402)  | 1/16W  | -55 ~ +155°C             | 50V                          | 100V                                     | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 10MΩ |            |                      | ±200<br>±100<br>±200 |
|              | Jumper: 1A   |                          |                              |  | 0Ω (<50mΩ)                               |            |                      | -                    |
| AS03 (0603)  | 1/10W  |                          | 50V                          | 100V                                     | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 10MΩ |            |                      | ±200<br>±100<br>±200 |
|              | Jumper: 1A   |                          |                              |  | 0Ω (<50mΩ)                               |            |                      | -                    |
| AS05 (0805)  | 1/8W   |                          | 150V                         | 300V                                     | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 10MΩ |            |                      | ±200<br>±100<br>±200 |
|              | Jumper: 2A   |                          |                              |  | 0Ω (<50mΩ)                               |            |                      | -                    |
| AS06 (1206)  | 1/4W   |                          | 200V                         | 400V                                     | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 10MΩ |            |                      | ±200<br>±100<br>±200 |
|              | Jumper: 2A   |                          |                              |  | 0Ω (<50mΩ)                               |            |                      | -                    |
| AS10 (1210)  | 1/3W   |                          | 200V                         | 400V                                     | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 10MΩ |            |                      | ±200<br>±100<br>±200 |
|              | Jumper: 2.5A                                       |                          |                              |  | 0Ω (<50mΩ)                               |            |                      | -                    |
| AS0A (2010)  | 3/4W   |                          | 200V                         | 400V                                     | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 10MΩ |            |                      | ±200<br>±100<br>±200 |
|              | Jumper: 3.5A                                       |                          |                              |  | 0Ω (<50mΩ)                               |            |                      | -                    |
| AS12 (2512)  | 1W   | 250V                     | 500V                         | 1Ω - 9.76Ω<br>10Ω - 1MΩ<br>1.02MΩ - 10MΩ |  |            | ±200<br>±100<br>±200 |                      |
|              | Jumper: 4A   |                          |                              | 0Ω (<50mΩ)                               |  |            | -                    |                      |

**High Power Rating Electrical Specifications**

| Item<br>Type | Power Rating<br>at 70°C | Operating<br>Temp. Range | Max.<br>Operating<br>Voltage | Max. Overload<br>Voltage | Resistance Range        |              | TCR<br>(PPM/°C) |
|--------------|-------------------------|--------------------------|------------------------------|--------------------------|-------------------------|--------------|-----------------|
|              |                         |                          |                              |                          | ±1%<br>(E24、E96)        | ±5%<br>(E24) |                 |
| AS01 (0201)  | 1/12W                   | -55 ~ +125°C             | 25V                          | 50V                      | 10Ω - 1MΩ               |              | ±200            |
| AS02 (0402)  | 1/10W                   | -55 ~ +155°C             | 50V                          | 100V                     | 1Ω - 9.76Ω<br>10Ω - 1MΩ |              | ±200<br>±100    |
| AS03 (0603)  | 1/8W                    |                          | 50V                          | 100V                     |                         |              |                 |
| AS05 (0805)  | 1/4W                    |                          | 150V                         | 300V                     |                         |              |                 |
| AS06 (1206)  | 1/3W                    |                          | 200V                         | 400V                     |                         |              |                 |
| AS10 (1210)  | 1/2W                    |                          | 200V                         | 400V                     |                         |              |                 |
| AS0A (2010)  | 1W                      |                          | 200V                         | 400V                     |                         |              |                 |
|              |                         |                          | 200V                         | 400V                     |                         |              |                 |

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.

**Environmental Characteristics**

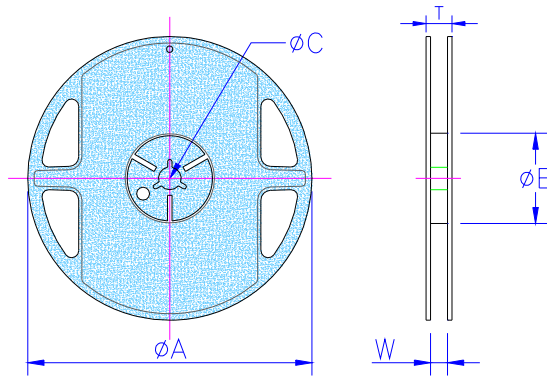
| Item   | Requirement   |               |        | Test Method  |
|--|---|---------------|--------|--|
|  | ±1% and Below   | ±5%           | Jumper |  |
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.  |               |        | <b>JIS-C-5201-1 4.8</b><br><b>IEC-60115-1 4.8</b><br>-55°C~+125°C, 25°C is the reference temperature   |
| Short Time Overload                            | ±(1.0%+0.05Ω)   | ±(2.0%+0.05Ω) | <50mΩ  | <b>JIS-C-5201-1 4.13</b><br><b>IEC-60115-1 4.13</b><br>RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series |
| Insulation Resistance                          | ≥10G  |               |        | <b>JIS-C-5201-1 4.6</b><br><b>IEC-60115-1 4.6</b><br>Max. Overload Voltage for 1 minute  |
| Endurance                                      | ±(2.0%+0.10Ω)   | ±(3.0%+0.10Ω) | <100mΩ | <b>JIS-C-5201-1 4.25</b><br><b>IEC-60115-1 4.25.1</b><br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"                                      |
| Damp Heat with Load                            | ±(2.0%+0.10Ω)   | ±(3.0%+0.10Ω) | <100mΩ | <b>JIS-C-5201-1 4.24</b><br><b>IEC-60115-1 4.24</b><br>40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"                           |
| Dry Heat                                       | ±(1.0%+0.05Ω)   | ±(1.5%+0.10Ω) | <50mΩ  | <b>JIS-C-5201-1 4.23</b><br><b>IEC-60115-1 4.23.2</b><br>at +125/+155°C for 1000 hrs   |
| Bending Strength                               | ±(1.0%+0.05Ω)   | ±(1.0%+0.05Ω) | <50mΩ  | <b>JIS-C-5201-1 4.33</b><br><b>IEC-60115-1 4.33</b><br>Bending once for 5 seconds<br>2010, 2512 sizes: 2mm Other sizes: 3mm                                |
| Solderability                                  | 95% min. coverage   |               |        | <b>JIS-C-5201-1 4.17</b><br><b>IEC-60115-1 4.17</b><br>245±5°C for 3 seconds   |
| Resistance to Soldering Heat                   | ±(0.5%+0.05Ω)   | ±(1.0%+0.05Ω) | <50mΩ  | <b>JIS-C-5201-1 4.18</b><br><b>IEC-60115-1 4.18</b><br>260±5°C for 10 seconds  |
| Voltage Proof                                  | No breakdown or flashover                                 |               |        | <b>JIS-C-5201-1 4.7</b><br><b>IEC-60115-1 4.7</b><br>1.42 times Max. Operating Voltage for 1 minute  |
| Leaching                                       | Individual leaching area ≤5%<br>Total leaching area ≤ 10% |               |        | <b>JIS-C-5201-1 4.18</b><br><b>IEC-60068-2-58 8.2.1</b><br>260±5°C for 30 seconds  |
| Rapid Change of Temperature                    | ±(0.5%+0.05Ω)   | ±(1.0%+0.05Ω) | <50mΩ  | <b>JIS-C-5201-1 4.19</b><br><b>IEC-60115-1 4.19</b><br>-55°C to +125/+155°C, 5 cycles  |
| Sulfur Test                                    | ±(0.5%+0.05Ω)   | ±(0.5%+0.05Ω) | <50mΩ  | <b>ASTM-B-809-95</b><br>H2S, 50±2°C, 91~93% R.H., no power rating for 1000 hrs   |

RCWV(Rated Continuous Working Voltage)=√(P\*R) or Max. Operating Voltage whichever is lower.

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

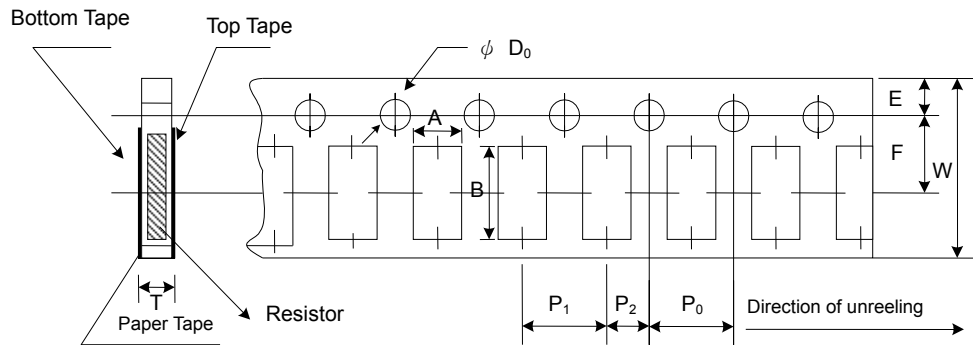
**■ Packaging**

Reel Specifications & Packaging Quantity



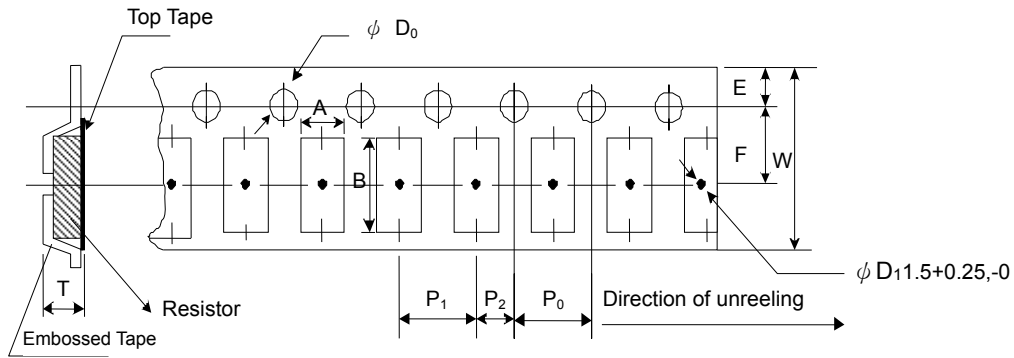
| Type                         | Packaging Quantity | Tape Width | Reel Diameter | ΦA (mm)   | ΦB (mm)             | ΦC (mm)  | W (mm)   | T (mm)   |
|------------------------------|--------------------|------------|---------------|-----------|---------------------|----------|----------|----------|
| AS01<br>AS02                 | Paper              | 10K        | 7 inch        | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
|                              |                    | 20K        | 10 inch       | 254±1.0   | 100±0.5             | 13.0±0.2 | 9.5±0.5  | 13.5±0.5 |
|                              |                    | 40K        | 13 inch       | 330±1.0   | 100±0.5             | 13.0±0.2 | 9.5±0.5  | 13.5±0.5 |
| AS03<br>AS05<br>AS06<br>AS10 | Paper              | 5K         | 7 inch        | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
|                              |                    | 10K        | 10 inch       | 254±1.0   | 100±0.5             | 13.0±0.2 | 9.5±0.5  | 13.5±0.5 |
|                              |                    | 20K        | 13 inch       | 330±1.0   | 100±0.5             | 13.0±0.2 | 9.5±0.5  | 13.5±0.5 |
| AS0A<br>AS12                 | Embossed           | 4K         | 7 inch        | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.5 | 13.0±0.5 | 15.5±0.5 |
|                              |                    | 8K         | 10 inch       | 250±1.0   | 62±0.5              | 13.0±0.5 | 12.5±0.5 | 16.5±0.5 |

Paper Tape Specifications



| Type | A (mm)    | B (mm)    | W (mm)   | E (mm)    | F (mm)    | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | ΦD <sub>0</sub> (mm) | T (mm)    |
|------|-----------|-----------|----------|-----------|-----------|---------------------|---------------------|---------------------|----------------------|-----------|
| AS01 | 0.38±0.05 | 0.68±0.05 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 2.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.42±0.20 |
| AS02 | 0.65±0.10 | 1.15±0.10 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 2.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.45±0.10 |
| AS03 | 1.10±0.10 | 1.90±0.10 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.70±0.10 |
| AS05 | 1.60±0.10 | 2.40±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.85±0.10 |
| AS06 | 1.90±0.10 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.85±0.10 |
| AS10 | 2.90±0.10 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.50±0.05 | 4.00±0.10           | 4.00±0.05           | 2.00±0.05           | 1.50+0.1,-0          | 0.85±0.10 |

Embossed Plastic Tape Specifications



| Type | A (mm)   | B (mm)   | W (mm)    | E (mm)    | F (mm)   | P <sub>0</sub> (mm) | P <sub>1</sub> (mm) | P <sub>2</sub> (mm) | ΦD <sub>0</sub> (mm) | T (mm)            |
|------|----------|----------|-----------|-----------|----------|---------------------|---------------------|---------------------|----------------------|-------------------|
| AS0A | 2.8±0.10 | 5.5±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.50+0.1, -0         | 1.2 <sup>+0</sup> |
| AS12 | 3.5±0.10 | 6.7±0.10 | 12.0±0.30 | 1.75±0.10 | 5.5±0.05 | 4.00±0.10           | 4.00±0.10           | 2.00±0.05           | 1.50+0.1, -0         | 1.2 <sup>+0</sup> |

**■ Marking**

No Marking for 0201 and 0402

Jumper for all: Letter "0"

1% for 0805/1206/1210/2010/2512: 4 digits marking

Example:

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

5% for 0603/0805/1206/1210/2010/2512: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ (1<sup>st</sup> and 2<sup>nd</sup> are E24 code and 3<sup>rd</sup> code is multiplier)

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

1% for 0603: 3 digits marking in E96



3 digits 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               | X                | Y                |     |  |
| 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>-1</sup> | 10 <sup>-2</sup> |     |  |



**REVISION HISTORY**

| <b>REVISION</b> | <b>DATE</b>  | <b>CHANGE NOTIFICATION</b> | <b>DESCRIPTION</b>  |
|-----------------|--------------|----------------------------|---|
| Version B3      | Jun 03, 2014 | -                          | - Environmental Characteristics updated                       |
| Version B4      | Jul 15, 2016 | -                          | - Remove Material Description<br>- Modify Storage Temperature |
| Version B5      | Oct 31, 2016 | -                          | - Increase High Power Rating Electrical Specifications        |

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