

## Data Sheet

Customer:

Product: Automotive Grade High Voltage Thick Film Chip Resistor –  
HVR..A Series

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

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| 01-Dec-25           | 01-Dec-25          | 01-Dec-25           |                        |                           |
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## Automotive Grade High Voltage Thick Film Chip Resistor



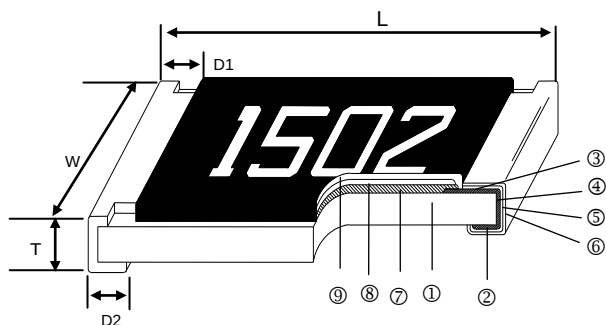
### Scope

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

### Features

- Highly reliable multilayer electrode construction
- Higher component and equipment reliability
- Excellent performance at high voltage
- Reduced size of final equipment
- Special construction to prevent sulfuration in a sulfur containing environment
- AEC-Q200 Qualified
- 100% CCD inspection
- MSL: Level 1

### Construction



### Applications

- Inverter
- Outdoor Equipments
- Converter
- High Pulse Equipment

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

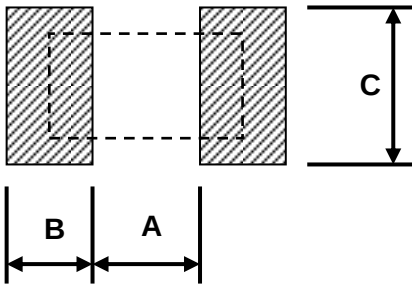
### Dimensions

| Type  | Size (Inch) | L (mm)    | W (mm)    | T (mm)    | D1 (mm)   | D2 (mm)   | Weight (g) (1000pcs) |
|-------|-------------|-----------|-----------|-----------|-----------|-----------|----------------------|
| HVR02 | 0402        | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 | 0.620                |
| HVR03 | 0603        | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 2.042                |
| HVR05 | 0805        | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 | 4.368                |
| HVR06 | 1206        | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 8.947                |
| HVR0A | 2010        | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 24.241               |
| HVR12 | 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

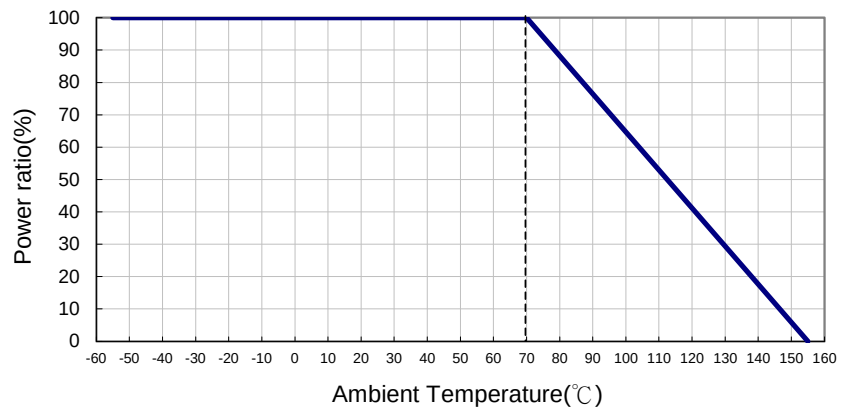
| HVR          | 03                                                                   | F                    | T                                                             | E                             | X                                                              | 1003                                   | A                                                        |
|--------------|----------------------------------------------------------------------|----------------------|---------------------------------------------------------------|-------------------------------|----------------------------------------------------------------|----------------------------------------|----------------------------------------------------------|
| Product Type | Dimensions                                                           | Resistance Tolerance | Packaging Code                                                | TCR (PPM/°C)                  | Power Rating                                                   | Resistance                             | Marking                                                  |
|              | 02: 0402<br>03: 0603<br>05: 0805<br>06: 1206<br>0A: 2010<br>12: 2512 | F: ±1%<br>J: ±5%     | T: 7" Taping Reel<br>V: 10" Taping Reel<br>W: 13" Taping Reel | E: ±100<br>F: ±200<br>H: ±400 | Y: 1/16W<br>X: 1/10W<br>W: 1/8W<br>V: 1/4W<br>U: 1/2W<br>T: 1W | 1003: 100KΩ<br>1004: 1MΩ<br>1005: 10MΩ | A: Automotive Grade<br>NA: Automotive Grade & No Marking |

### Recommend Land Pattern

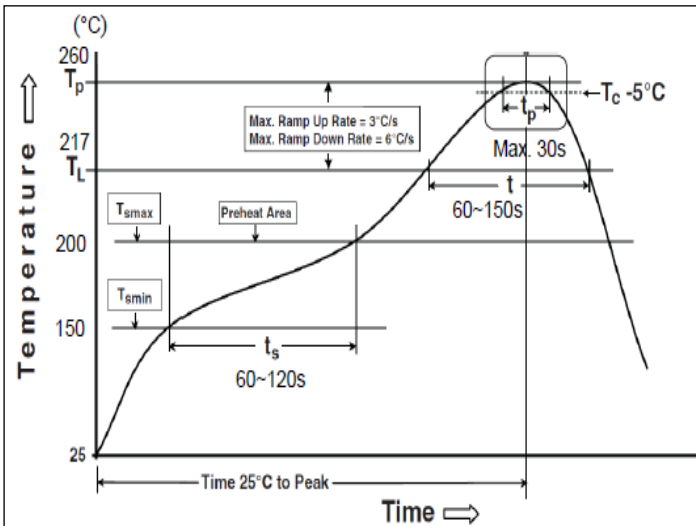


| Type  | A (mm) | B (mm) | C (mm) |
|-------|--------|--------|--------|
| HVR02 | 0.50   | 0.45   | 0.60   |
| HVR03 | 0.90   | 0.60   | 0.90   |
| HVR05 | 1.20   | 0.70   | 1.30   |
| HVR06 | 2.00   | 0.90   | 1.60   |
| HVR0A | 3.80   | 0.90   | 2.80   |
| HVR12 | 4.90   | 1.60   | 3.50   |

### Derating Curve



### Soldering Condition (Ref. IPC/JEDEC J-STD-020 & J-STD-002)



| Reflow Profiles                                                        |                  |
|------------------------------------------------------------------------|------------------|
| Profile Feature                                                        | Pb-Free Assembly |
| <b>Preheat</b>                                                         |                  |
| Min. Temperature (Tsmmin)                                              | 150 °C           |
| Max Temperature (Tsmmax)                                               | 200 °C           |
| Preheating time (ts) from (Tsmmin to Tsmmax)                           | 60-120 seconds   |
| Ramp-up rate (TL to Tp)                                                | 3 °C/second max. |
| Liquidous temperature (TL)                                             | 217 °C           |
| Time (tL) maintained above TL                                          | 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 TL)                                              | 6 °C/second max. |
| Time 25 °C to peak temperature                                         | 8 minutes max.   |

**Standard Electrical Specifications**

| Type \ Item  | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range |              | TCR (PPM/°C) |
|--------------|----------------------|-----------------------|------------------------|-----------------------|------------------|--------------|--------------|
|              |                      |                       |                        |                       | ±1%(E24、E96)     | ±5%(E24)     |              |
| HVR02 (0402) | 1/16W                | -55 ~ +155°C          | 100V                   | 200V                  | 39KΩ - 1MΩ       |              | ±100         |
|              |                      |                       |                        |                       | 1.02MΩ - 10MΩ    | 1.1MΩ - 20MΩ | ±200         |
|              |                      |                       |                        |                       | -                | 22MΩ - 100MΩ | ±400         |
| HVR03 (0603) | 1/10W                |                       | 200V                   | 400V                  | 56KΩ - 1MΩ       |              | ±100         |
|              |                      |                       |                        |                       | 1.02MΩ - 10MΩ    | 1.1MΩ - 20MΩ | ±200         |
|              |                      |                       |                        |                       | -                | 22MΩ - 100MΩ | ±400         |
| HVR05 (0805) | 1/8W                 |                       | 400V                   | 800V                  | 100KΩ - 1MΩ      |              | ±100         |
|              |                      |                       |                        |                       | 1.02MΩ - 10MΩ    | 1.1MΩ - 20MΩ | ±200         |
|              |                      |                       |                        |                       | -                | 22MΩ - 100MΩ | ±400         |
| HVR06 (1206) | 1/4W                 |                       | 500V                   | 1000V                 | 100KΩ- 1MΩ       |              | ±100         |
|              |                      |                       |                        |                       | 1.02MΩ - 10MΩ    | 1.1MΩ - 20MΩ | ±200         |
|              |                      |                       |                        |                       | -                | 22MΩ - 100MΩ | ±400         |
| HVR0A (2010) | 1/2W                 |                       | 2000V                  | 3000V                 | 51KΩ- 1MΩ        |              | ±100         |
|              |                      |                       |                        |                       | 1.02MΩ - 20MΩ    | 1.1MΩ - 20MΩ | ±200         |
|              |                      |                       |                        |                       | -                | 22MΩ - 100MΩ | ±400         |
| HVR12 (2512) | 1W                   |                       | 3000V                  | 4000V                 | 30KΩ - 1MΩ       |              | ±100         |
|              |                      |                       |                        |                       | 1.02MΩ - 20MΩ    | 1.1MΩ - 20MΩ | ±200         |
|              |                      |                       |                        |                       | -                | 22MΩ - 100MΩ | ±400         |

Operating Voltage=√(P\*R) or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage=2.5\*√(P\*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%           | ±5%           |                                                                                                                                       |
| 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>At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature                 |
| Short Time Overload                            | ±(1.0%+0.05Ω) | ±(2.0%+0.05Ω) | <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             |
| 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                                               |
| Operational Life                               | ±(2.0%+0.05Ω) | ±(3.0%+0.10Ω) | <b>MIL-STD-202 Method 108</b><br>Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion. |
| Biased Humidity                                | ±(2.0%+0.05Ω) | ±(3.0%+0.10Ω) | <b>MIL-STD-202 Method 103</b><br>1000 hrs 85°C/85%RH 10% of operating power (≤100 V)                                                  |

| Item                         | Requirement                                                        |               | Test Method                                                                                                                                             |
|------------------------------|--------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | ±1%                                                                | ±5%           |                                                                                                                                                         |
| High Temperature Exposure    | ±(1.0%+0.05Ω)                                                      | ±(1.5%+0.10Ω) | <b>MIL-STD-202 Method 108</b><br>at +155°C for 1000 hrs                                                                                                 |
| Board Flex                   | ±(1.0%+0.05Ω)                                                      | ±(1.0%+0.05Ω) | <b>AEC-Q200-005</b><br>Bending once for 60 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) | <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>HVR02: 150V for 1 minute<br>HVR03: 300V for 1 minute<br>HVR05/HVR06/HVR0A/HVR12: 500V 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                                                                       |
| Temperature Cycling          | ±(1.0%+0.05Ω)                                                      |               | <b>JESD22 Method JA-104</b><br>-55°C to +125°C, 1000 cycles                                                                                             |
| Mechanical Shock             | ±(1.0%+0.05Ω)                                                      |               | <b>MIL-STD-202 Method 213</b><br>Wave Form: Tolerance for half sine shock pulse.<br>Peak value is 100g's. Normal duration (D) is 6.                     |
| Vibration                    | ±(1.0%+0.05Ω)                                                      |               | <b>MIL-STD-202 Method 204</b><br>5 g's for 20 min., 12 cycles each of 3 orientations,<br>10-2000 Hz                                                     |
| ESD                          | ±(3%+0.05Ω)                                                        |               | <b>AEC-Q200-002</b><br>Human body model<br>0402/0603: 1KV<br>0805 and above: 2KV                                                                        |
| Resistance to Solvents       | No visible damage on appearance and marking.                       |               | <b>MIL-STD-202 Method 215</b><br>Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.                                      |
| Terminal Strength            | No broken                                                          |               | <b>AEC-Q200-006</b><br>Force of 1.8kg for 60 seconds.                                                                                                   |
| Flammability                 | No ignition of the tissue paper or scorching or the pinewood board |               | <b>UL-94</b><br>V-0 or V-1 are acceptable. Electrical test not required.                                                                                |
| Sulfur Test                  | △R±5%                                                              | △R±5%         | <b>EIA-977 (Condition B)</b><br>105±2°C, no power rating for 1000 hrs.                                                                                  |

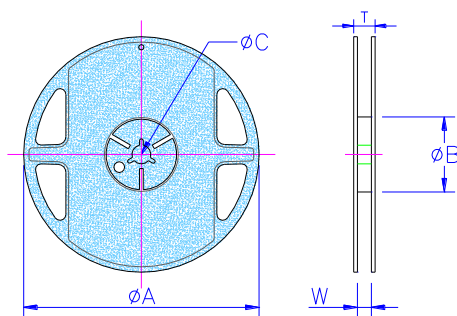
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

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

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

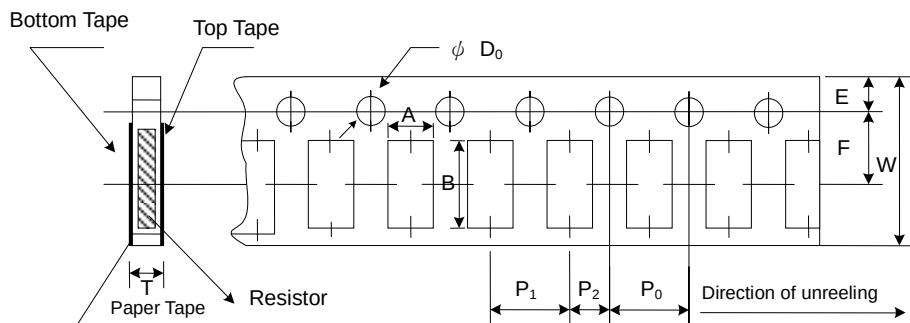
## ■Packaging

### Reel Specifications & Packaging Quantity



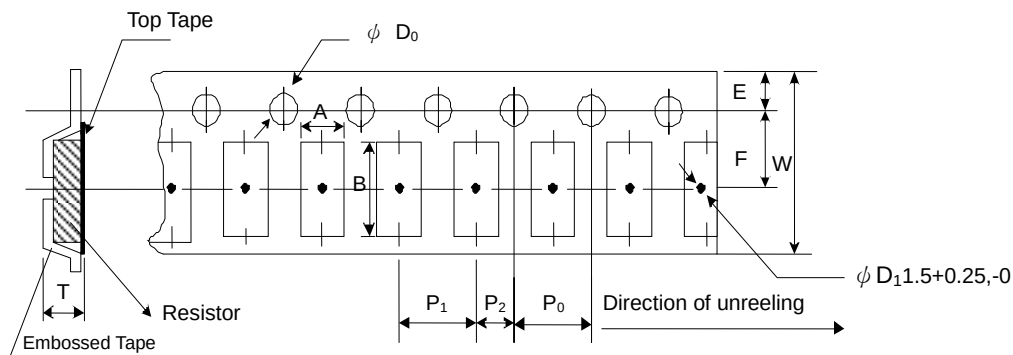
| Type                    | Packaging Quantity |     | Tape Width | Reel Diameter | ΦA (mm)   | ΦB (mm)             | ΦC (mm)  | W (mm)   | T (mm)   |
|-------------------------|--------------------|-----|------------|---------------|-----------|---------------------|----------|----------|----------|
| HVR02                   | Paper              | 10K | 8mm        | 7 inch        | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
|                         |                    | 20K | 8mm        | 10 inch       | 254±1.0   | 100±0.5             | 13.0±0.2 | 9.5±0.5  | 13.5±0.5 |
|                         |                    | 40K | 8mm        | 13 inch       | 330±1.0   | 100±0.5             | 13.0±0.2 | 9.5±0.5  | 13.5±0.5 |
| HVR03<br>HVR05<br>HVR06 | Paper              | 5K  | 8mm        | 7 inch        | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
| 10K                     |                    | 8mm | 10 inch    | 254±1.0       | 100±0.5   | 13.0±0.2            | 9.5±0.5  | 13.5±0.5 |          |
| 20K                     |                    | 8mm | 13 inch    | 330±1.0       | 100±0.5   | 13.0±0.2            | 9.5±0.5  | 13.5±0.5 |          |
| HVR0A<br>HVR12          | Embossed           | 4K  | 12mm       | 7 inch        | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.5 | 13.0±0.5 | 15.5±0.5 |
|                         |                    | 8K  | 12mm       | 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)    |
|-------|-----------|-----------|----------|-----------|-----------|---------------------|---------------------|---------------------|----------------------|-----------|
| HVR02 | 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 |
| HVR03 | 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 |
| HVR05 | 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 |
| HVR06 | 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 |

### 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)            |
|-------|----------|-----------|-----------|-----------|----------|---------------------|---------------------|---------------------|----------------------|-------------------|
| HVR0A | 2.8±0.10 | 5.40±0.20 | 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> |
| HVR12 | 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 0402

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

Example:

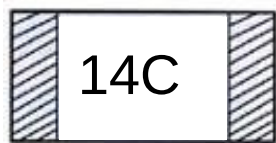
| Resistance | 49.9KΩ | 100KΩ | 1MΩ  | 4.99MΩ | 10MΩ |
|------------|--------|-------|------|--------|------|
| Marking    | 4992   | 1003  | 1004 | 4994   | 1005 |

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

Example: 124=120KΩ 106=10MΩ (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: 75C=59KΩ 39E=2.49MΩ

**■ 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               | 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>-1</sup> | 10 <sup>-2</sup> |      |     |  |



**REVISION HISTORY**

| REVISION   | DATE         | CHANGE NOTIFICATION | DESCRIPTION                                                           |
|------------|--------------|---------------------|-----------------------------------------------------------------------|
| Version A  | Mar 10, 2021 | -                   | - New product release                                                 |
| Version A1 | Nov 15, 2021 | -                   | - Increase the shelf life description                                 |
| Version A2 | Feb 15, 2022 | -                   | - Derating Curve changes the temperature range                        |
| Version A3 | Jun 15, 2022 | -                   | - Modify Soldering Condition                                          |
| Version A4 | Jul 08, 2024 | -                   | - Modify the descriptions in the Features                             |
| Version A5 | Aug 26, 2025 | -                   | - Modify the descriptions in the Features<br>- Modify 0402 Dimensions |
| Version A6 | Dec 01, 2025 | -                   | - Environmental Characteristics updated                               |