

## Data Sheet

Customer: \_\_\_\_\_

Product: Automotive Grade Thick Film High Precision Low  
TCR Chip Resistor – CRTC..A Series

Size: 0402/0603/0805/1206

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|---------------------|--------------------|---------------------|------------------------|---------------------------|
| 26-Mar-25           | 26-Mar-25          | 26-Mar-25           |                        |                           |
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## Automotive Grade Thick Film High Precision Low TCR Chip Resistor



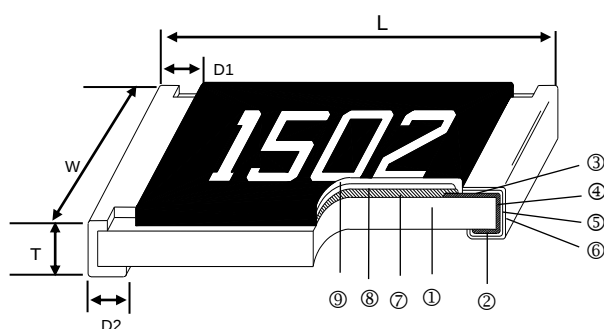
### Scope

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

### Features

- AEC-Q200 qualified
- Small size and light weight
- Highly reliable multilayer electrode construction
- Compatible with all soldering process
- 100% CCD inspection
- MSL: Level 1

### Construction



### Applications

- Industrial
- Car Media
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical 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 (mg) |
|--------|-------------|-----------|-----------|-----------|-----------|-----------|-------------|
| CRTC02 | 0402        | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.18±0.10 | 0.20±0.10 | 0.6         |
| CRTC03 | 0603        | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 2.0         |
| CRTC05 | 0805        | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 | 4.4         |
| CRTC06 | 1206        | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 8.9         |

### Part Numbering

| CRTC         | 06                                           | F                                           | T                                                          | C                | V                                                                | 1002                                                 | 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 | B: ±0.1%<br>C: ±0.25%<br>D: ±0.5%<br>F: ±1% | T: 7"Taping Reel<br>V: 10"Taping Reel<br>W: 13"Taping Reel | C: ±25<br>D: ±50 | Y: 1/16W<br>X: 1/10W<br>W: 1/8W<br>P: 1/5W<br>V: 1/4W<br>O: 1/3W | 1000: 100Ω<br>2201: 2.2KΩ<br>1002: 10KΩ<br>1004: 1MΩ | A: Automotive Grade |

**Standard Electrical Specifications**

| Item<br>Type     | Power Rating<br>at 70°C | Operating<br>Temp. Range | Max.<br>Operating<br>Voltage | Max.<br>Overload<br>Voltage | Resistance Range (E24 、E96) |           |          |     | TCR<br>(PPM/°C) |
|------------------|-------------------------|--------------------------|------------------------------|-----------------------------|-----------------------------|-----------|----------|-----|-----------------|
|                  |                         |                          |                              |                             | ±0.1%                       | ±0.25%    | ±0.5%    | ±1% |                 |
| CRTC02<br>(0402) | 1/16W                   | -55 ~ +155°C             | 50V                          | 100V                        | 300Ω~1M                     |           |          |     | ±25*<br>±50     |
| CRTC03<br>(0603) | 1/10W                   |                          | 75V                          | 150V                        | 10Ω~1MΩ                     |           |          |     |                 |
| CRTC05<br>(0805) | 1/8W                    |                          | 150V                         | 300V                        | 10Ω~3MΩ                     | 10Ω~6.8MΩ | 10Ω~10MΩ |     |                 |
| CRTC06<br>(1206) | 1/4W                    |                          | 200V                         | 400V                        | 10Ω~5.1MΩ                   |           | 10Ω~10MΩ |     |                 |

**High Power rating Electrical Specifications**

| Item<br>Type     | Power Rating<br>at 85°C | Operating<br>Temp. Range | Max.<br>Operating<br>Voltage | Max.<br>Overload<br>Voltage | Resistance Range (E24 、E96) |           |          |     | TCR<br>(PPM/°C) |
|------------------|-------------------------|--------------------------|------------------------------|-----------------------------|-----------------------------|-----------|----------|-----|-----------------|
|                  |                         |                          |                              |                             | ±0.1%                       | ±0.25%    | ±0.5%    | ±1% |                 |
| CRTC02<br>(0402) | 1/8W                    | -55 ~ +155°C             | 75V                          | 100V                        | 300Ω~1M                     |           |          |     | ±25*<br>±50     |
| CRTC03<br>(0603) | 1/5W                    |                          | 100V                         | 150V                        | 10Ω~1MΩ                     |           |          |     |                 |
| CRTC05<br>(0805) | 1/4W                    |                          | 150V                         | 300V                        | 10Ω~3MΩ                     | 10Ω~6.8MΩ | 10Ω~10MΩ |     |                 |
| CRTC06<br>(1206) | 1/3W                    |                          | 200V                         | 400V                        | 10Ω~5.1MΩ                   |           | 10Ω~10MΩ |     |                 |

Operating Voltage= $\sqrt{(P \cdot R)}$  or Max. Operating Voltage listed above, whichever is lower.

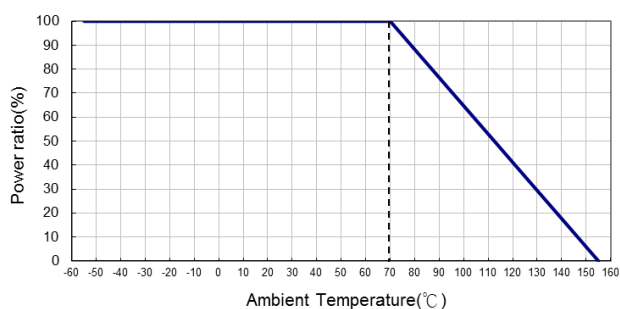
Overload Voltage= $2.5 \cdot \sqrt{(P \cdot R)}$  or Max. Overload Voltage listed above, whichever is lower.

\*TCR(25°C/-55°C): -50~+25PPM/°C

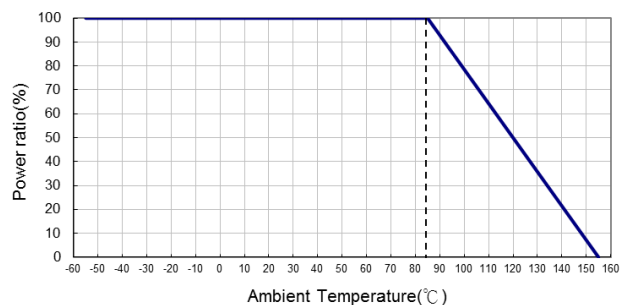
■ Viking is capable of manufacturing the optional spec based on customer's requirement.

**Derating Curve**

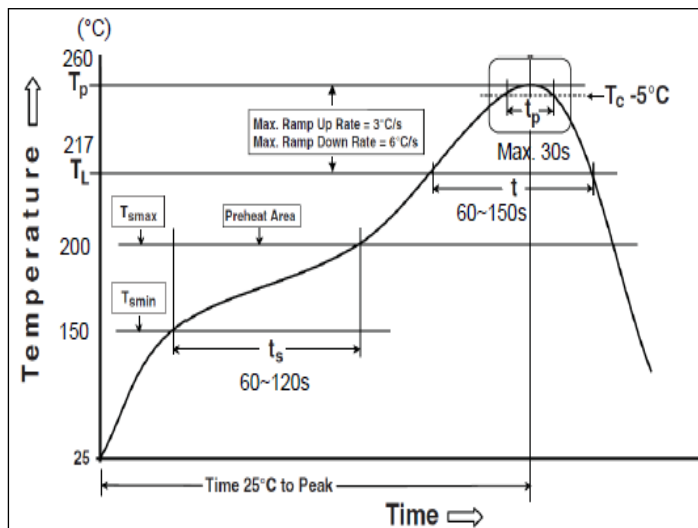
For Standard power rating:



For High power rating:



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



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

■ Environmental Characteristics

| Item                                           | Requirement                                                                                                                                                                            | Test Method                                                                                                                 |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 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/+125°C and 25°C/-55°C, 25°C is the reference temperature       |
| Short Time Overload                            | $\pm(0.2\%+0.05\Omega)$                                                                                                                                                                | <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                          | $\geq 10G$                                                                                                                                                                             | <b>JIS-C-5201-1 4.6</b><br><b>IEC-60115-1 4.6</b><br>Max. Overload Voltage for 1 minute                                     |
| Endurance                                      | For Standard power rating:<br>02( $R \leq 30K\Omega$ ): $\pm(0.2\%+0.05\Omega)$<br>02( $R > 30K\Omega$ ): $\pm(0.4\%+0.05\Omega)$<br>03,05,06: $\pm(0.2\%+0.05\Omega)$                 | <b>JIS-C-5201-1 4.25</b><br><b>IEC-60115-1 4.25.1</b><br>70 $\pm$ 2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" |
|                                                | For High power rating:<br>02( $R \leq 30K\Omega$ ): $\pm(0.2\%+0.05\Omega)$<br>02( $R > 30K\Omega$ ): $\pm(0.4\%+0.05\Omega)$<br>03,05,06: $\pm(0.2\%+0.05\Omega)$                     | <b>MIL-STD-202 Method 108</b><br>85 $\pm$ 2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"                         |
| Biased Humidity                                | $\pm(1.0\%+0.10\Omega)$                                                                                                                                                                | <b>MIL-STD-202 Method 103</b><br>1000hrs 85°C/85%RH 10% of operating power ( $\leq 100V$ ).                                 |
| High Temperature Exposure                      | 02( $R \leq 30K\Omega$ )/03( $R \leq 200K\Omega$ ): $\pm(0.2\%+0.05\Omega)$<br>02( $R > 30K\Omega$ )/03( $R > 200K\Omega$ ): $\pm(0.5\%+0.05\Omega)$<br>05,06: $\pm(0.2\%+0.05\Omega)$ | <b>MIL-STD-202 Method 108</b><br>At +155°C for 1000 hrs                                                                     |
| Board Flex                                     | $\pm(1.0\%+0.05\Omega)$                                                                                                                                                                | <b>AEC-Q200-005</b><br>Bending once for 60 seconds 3mm                                                                      |

**Automotive Grade Thick Film High Precision Low TCR Chip Resistor**

| Item                         | Requirement                                                                       | Test Method                                                                                                                         |
|------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Solderability                | 95% min. coverage                                                                 | <b>JIS-C-5201-1 4.17</b><br><b>IEC-60115-1 4.17</b><br><b>J-STD-002</b><br>260±5°C for 3 seconds                                    |
| Resistance to Soldering Heat | ±(0.2%+0.05Ω)                                                                     | <b>MIL-STD-202 Method 210</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                                                   |
| Temperature Cycling          | 02(R≤30KΩ): ±(0.2%+0.05Ω)<br>02(R>30KΩ): ±(0.5%+0.05Ω)<br>03,05,06: ±(0.2%+0.05Ω) | <b>JESD22 Method JA-104</b><br>-55°C to +125°C, 1000 cycles                                                                         |
| Mechanical Shock             | ±(0.25%+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                    | ±(0.5%+0.05Ω)                                                                     | <b>MIL-STD-202 Method 204</b><br>5 g's for 20 min., 12cycles each of 3 orientations, 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±1%                                                                             | <b>EIA-977 (Condition A)</b><br>60±2°C, no power rating for 500 hrs.                                                                |

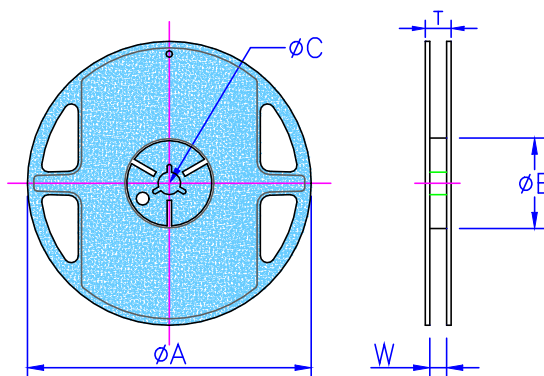
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

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

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

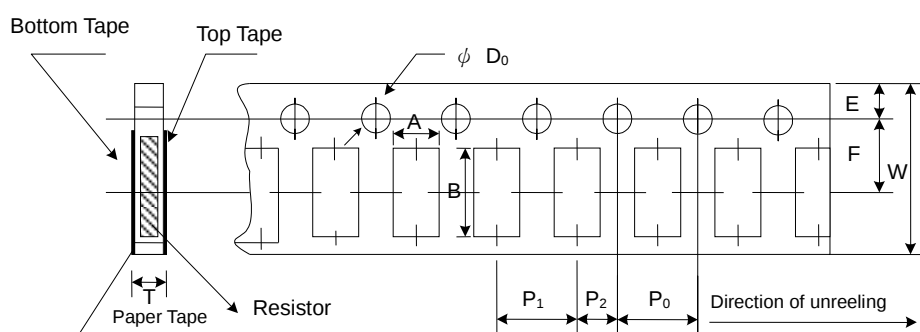
### ■Packaging

#### Reel Specifications & Packaging Quantity



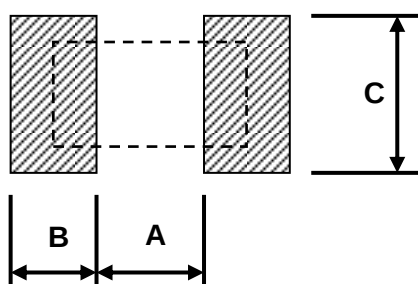
| Type                       | Packaging Quantity |     | Tape Width | Reel Diameter | ΦA (mm)   | ΦB (mm)             | ΦC (mm)  | W (mm)  | T (mm)   |
|----------------------------|--------------------|-----|------------|---------------|-----------|---------------------|----------|---------|----------|
| CRTC02                     | 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 |
| CRTC03<br>CRTC05<br>CRTC06 | 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 |

#### 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)    |
|--------|-----------|-----------|----------|-----------|-----------|---------------------|---------------------|---------------------|----------------------|-----------|
| CRTC02 | 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 |
| CRTC03 | 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 |
| CRTC05 | 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 |
| CRTC06 | 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 |

### ■Recommend Land Pattern



| Type   | A (mm) | B (mm) | C (mm) |
|--------|--------|--------|--------|
| CRTC02 | 0.50   | 0.45   | 0.60   |
| CRTC03 | 0.90   | 0.60   | 0.90   |
| CRTC05 | 1.20   | 0.70   | 1.30   |
| CRTC06 | 2.00   | 0.90   | 1.60   |

### ■ Marking

No Marking for 0402

0805/1206: 4 digits marking

Example:

| Resistance | 97.6Ω | 100Ω | 2.2KΩ | 10KΩ | 49.9KΩ | 100KΩ |
|------------|-------|------|-------|------|--------|-------|
| Marking    | 97R6  | 1000 | 2201  | 1002 | 4992   | 1003  |

0603(E24): 3 digits marking in E24, When the E24 and E96 are the same resistance, this marking in E96

Example: 01A= 100Ω    05C=11KΩ    123=12KΩ    273=27KΩ

0603(E96): 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**

| REVISION   | DATE         | CHANGE NOTIFICATION | DESCRIPTION                               |
|------------|--------------|---------------------|-------------------------------------------|
| Version A  | Apr 02, 2024 | -                   | - New product release                     |
| Version A1 | Mar 26, 2025 | -                   | - Modify the descriptions in the Features |