

Data Sheet

Customer:

Product: Automotive Grade Green Chip Resistor – CRG..A Series

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

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|---------------------|--------------------|---------------------|------------------------|---------------------------|
| 15-Jun-22 | 15-Jun-22 | 15-Jun-22 | | |
| Alice Hsiao | Susan Huang | Susan Huang | | |

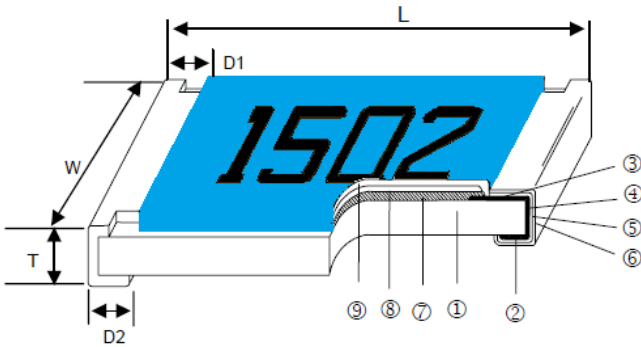
Automotive Grade Green Chip Resistor

Features

- AEC-Q200 Compliance
- Total Lead(Pb)-free without RoHS exemptions
- Highly reliable multilayer electrode construction
- Compatible with all soldering process
- 100% CCD inspection



Construction



Applications

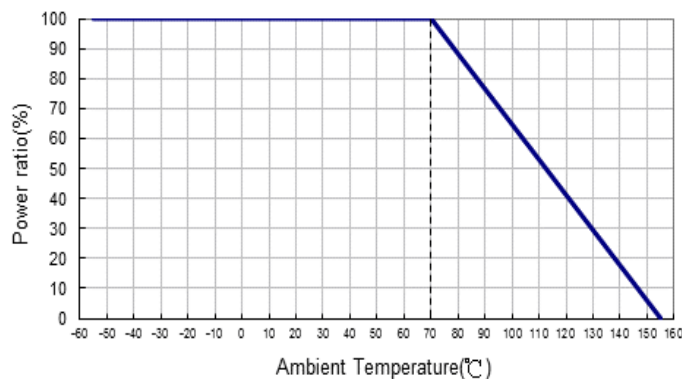
- Automotive Industry
- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

| | | |
|---------------------|----------------------|----------------------|
| 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 (g) (1000pcs) |
|-------|-------------|-----------|-----------|-----------|-----------|-----------|----------------------|
| CRG02 | 0402 | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.20±0.10 | 0.6 |
| CRG03 | 0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 2.0 |
| CRG05 | 0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 | 4.3 |
| CRG06 | 1206 | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 8.9 |
| CRG10 | 1210 | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 16 |
| CRG0A | 2010 | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 24 |
| CRG12 | 2512 | 6.35±0.10 | 3.10±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 39 |

Derating Curve



Part Numbering

Part Number : CRG03FA7---10R

Part Number : CRG03JA7----0R

| | | | | | |
|--------------|--|----------------------|---------------------|---|---|
| CRG | 03 | F | A | 7 | - - - 1 0 R |
| CRG | 03 | J | A | 7 | - - - - 0 R |
| Product Type | Dimensions | Resistance Tolerance | Function Code | Packaging Code | Resistance |
| CRG | 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512 | F: ±1% J: ±5% | A: Automotive Grade | 4: 7" Reel 4Kpcs 6: 7" Reel 10Kpcs 7: 7" Reel 5Kpcs | --- 1R2: 1.2Ω --- 3K3: 3.3KΩ --- 10K: 10KΩ -- 100K: 100KΩ “-“ to fill up 6 spaces |

Standard Electrical Specifications

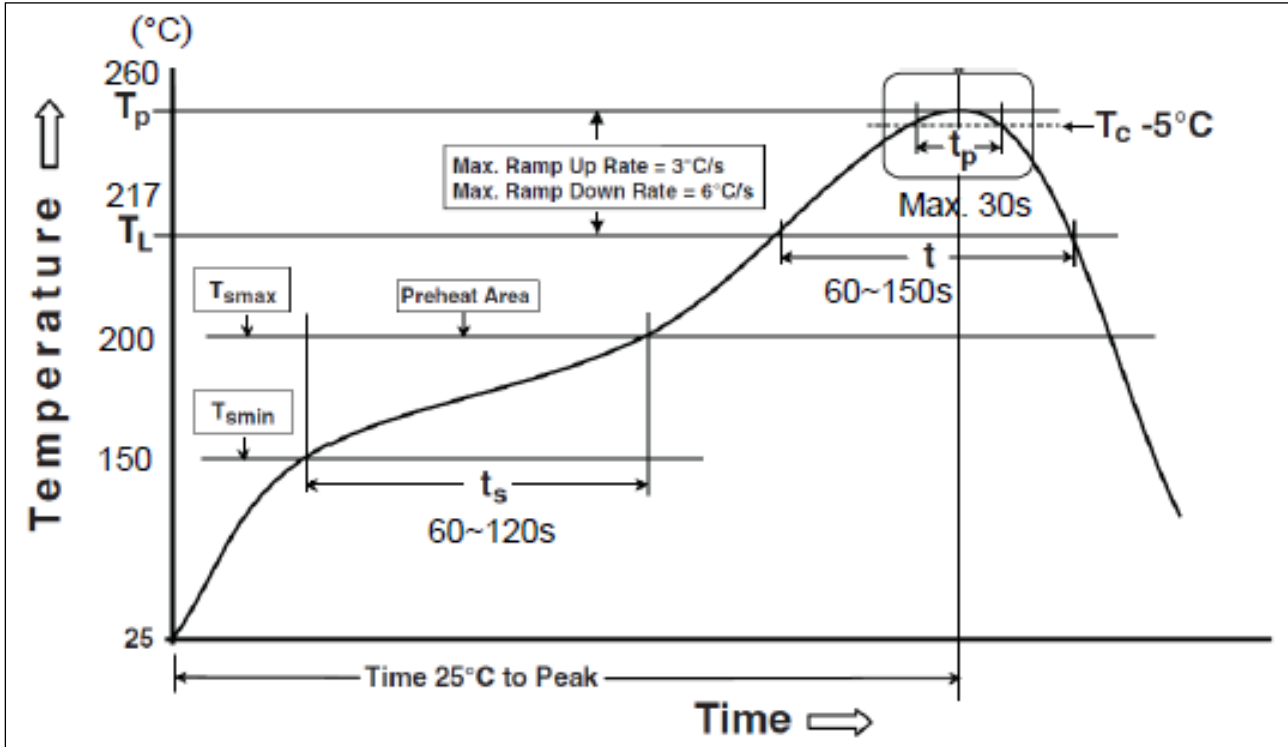
| Item Type | Power Rating at 70°C Jumper Rated Current | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range | | TCR (PPM/°C) |
|--------------|---|-----------------------|------------------------|-----------------------|--|------------|----------------------|
| | | | | | ±1%(E24、E96) | ±5%(E24) | |
| CRG02 (0402) | 1/16W | -55 ~ +155°C | 50V | 100V | 1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ | | ±200 ±100 ±200 |
| | Jumper: 1A | | | | - | 0Ω (<50mΩ) | - |
| CRG03 (0603) | 1/10W | -55 ~ +155°C | 75V | 150V | 1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ | | ±200 ±100 ±200 |
| | Jumper: 1A | | | | - | 0Ω (<50mΩ) | - |
| CRG05 (0805) | 1/8W | -55 ~ +155°C | 150V | 300V | 1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ | | ±200 ±100 ±200 |
| | Jumper: 2A | | | | - | 0Ω (<50mΩ) | - |
| CRG06 (1206) | 1/4W | -55 ~ +155°C | 200V | 400V | 1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ | | ±200 ±100 ±200 |
| | Jumper: 2A | | | | - | 0Ω (<50mΩ) | - |
| CRG10 (1210) | 1/3W | -55 ~ +155°C | 200V | 400V | 1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ | | ±200 ±100 ±200 |
| | Jumper: 2.5A | | | | - | 0Ω (<50mΩ) | - |
| CRG0A (2010) | 3/4W | -55 ~ +155°C | 200V | 400V | 1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ | | ±200 ±100 ±200 |
| | Jumper: 3.5A | | | | - | 0Ω (<50mΩ) | - |
| CRG12 (2512) | 1W | -55 ~ +155°C | 250V | 500V | 1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ | | ±200 ±100 ±200 |
| | Jumper: 4A | | | | - | 0Ω (<50mΩ) | - |

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.

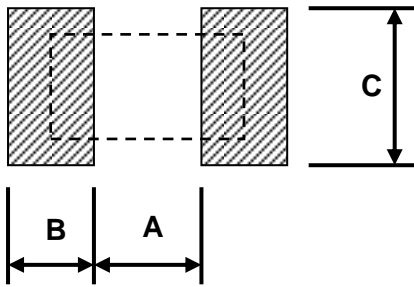
■ Viking is capable of manufacturing the optional spec based on customer's requirement.

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



| Reflow Profiles | |
|---|------------------------------------|
| Profile Feature | Pb-Free Assembly |
| Preheat Min. Temperature (T _{smin}) Max Temperature (T _{smax}) Preheating time (t _s) from (T _{smin} to T _{smax}) | 150 °C 200 °C 60-120 seconds |
| Ramp-up rate (T _L to T _p) | 3 °C/second max. |
| Liquidous temperature (T _L) Time (t _L) maintained above T _L | 217 °C 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. |

Recommend Land Pattern



| Type | A (mm) | B (mm) | C (mm) |
|-------|--------|--------|--------|
| CRG02 | 0.50 | 0.45 | 0.60 |
| CRG03 | 0.90 | 0.60 | 0.90 |
| CRG05 | 1.20 | 0.70 | 1.30 |
| CRG06 | 2.00 | 0.90 | 1.60 |
| CRG10 | 2.00 | 0.90 | 2.80 |
| CRG0A | 3.80 | 0.90 | 2.80 |
| CRG12 | 4.90 | 1.60 | 3.50 |

Environmental Characteristics

| Item | Requirement | | Test Method |
|--|--|---------------|---|
| | ±1% | ±5% | |
| Temperature Coefficient of Resistance (T.C.R.) | As Spec. | | JIS-C-5201-1 4.8 IEC-60115-1 4.8 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) | JIS-C-5201-1 4.13 IEC-60115-1 4.13 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds |
| Insulation Resistance | ≥10G | | JIS-C-5201-1 4.6 IEC-60115-1 4.6 Max. Overload Voltage for 1 minute |
| Operational Life | ±(2.0%+0.05Ω) | ±(3.0%+0.10Ω) | MIL-STD-202 Method 108 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) | MIL-STD-202 Method 103 1000 hrs 85°C/85%RH 10% of operating power |
| High Temperature Exposure | ±(1.0%+0.05Ω) | ±(1.5%+0.10Ω) | MIL-STD-202 Method 108 at +155°C for 1000 hrs |
| Board Flex | ±(1.0%+0.05Ω) | ±(1.0%+0.05Ω) | AEC-Q200-005 Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm |
| Solderability | 95% min. coverage | | JIS-C-5201-1 4.17 IEC-60115-1 4.17 245±5°C for 3 seconds |
| Resistance to Soldering Heat | ±(0.5%+0.05Ω) | ±(1.0%+0.05Ω) | JIS-C-5201-1 4.18 IEC-60115-1 4.18 260±5°C for 10 seconds |
| Voltage Proof | No breakdown or flashover | | JIS-C-5201-1 4.7 IEC-60115-1 4.7 1.42 times Max. Operating Voltage for 1 minute |
| Leaching | Individual leaching area ≤ 5% Total leaching area ≤ 10% | | JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1 260±5°C for 30 seconds |
| Temperature Cycling | ±(1.0%+0.05Ω) | | JESD22 Method JA-104 -55°C to +125°C, 1000 cycles |

Automotive Grade Green Chip Resistor

| Item | Requirement | | Test Method |
|------------------------|--|-------|---|
| | ±1% | ±5% | |
| Mechanical Shock | ±(1.0%+0.05Ω) | | MIL-STD-202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6. |
| Vibration | ±(1.0%+0.05Ω) | | MIL-STD-202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz |
| ESD | ±(3%+0.05Ω) | | AEC-Q200-002 Human body model 0402/0603: 0.5KV 0805 and above: 2KV |
| Resistance to Solvents | No visible damage on appearance and marking. | | MIL-STD-202 Method 215 Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents. |
| Terminal Strength | No broken | | AEC-Q200-006 Force of 1.8kg for 60 seconds. |
| Flammability | No ignition of the tissue paper or scorching or the pinewood board | | UL-94 V-0 or V-1 are acceptable. Electrical test not required. |
| Sulfur Test | △R±1% | △R±5% | EIA-977 (Condition A) 60±2°C, no power rating for 500 hrs. |

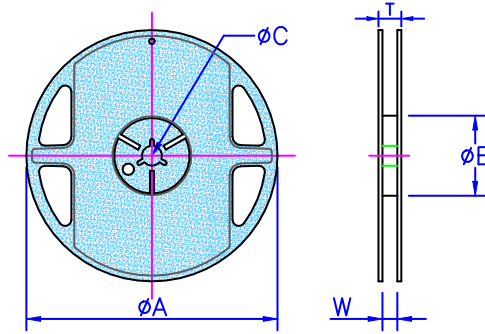
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

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

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

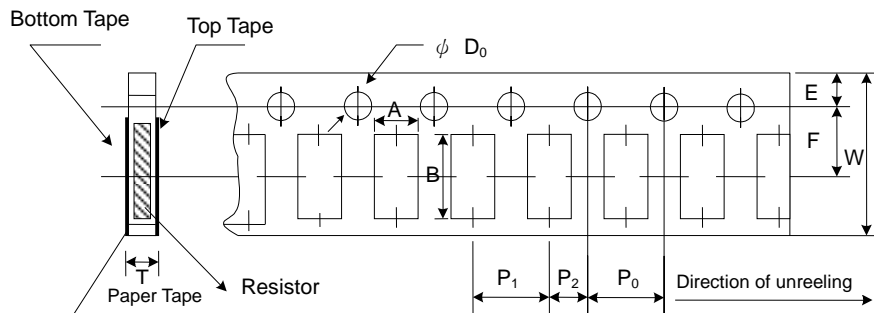
■Packaging

Reel Specifications & Packaging Quantity



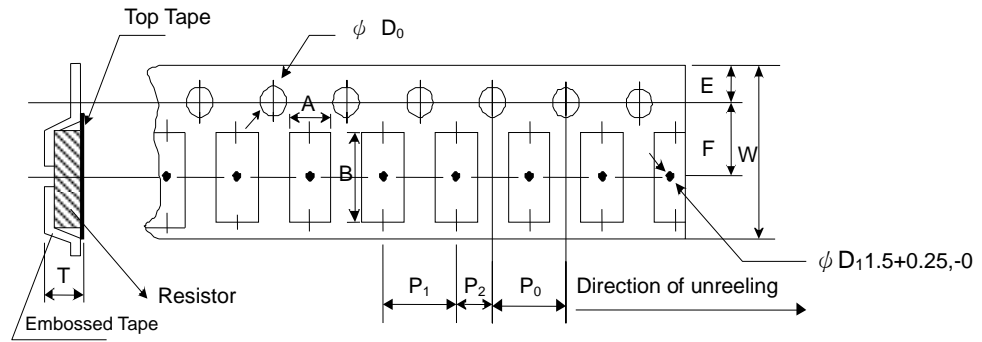
| Type | Packaging Quantity | | Tape Width | Reel Diameter | ΦA (mm) | ΦB (mm) | ΦC (mm) | W (mm) | T (mm) |
|----------------------------------|--------------------|-----|------------|---------------|-----------|---------------------|----------|----------|----------|
| CRG02 | Paper | 10K | 8mm | 7 inch | 178.5±1.5 | 60 ^{+1/-0} | 13.0±0.2 | 9.0±0.5 | 12.5±0.5 |
| CRG03 CRG05 CRG06 CRG10 | Paper | 5K | 8mm | 7 inch | 178.5±1.5 | 60 ^{+1/-0} | 13.0±0.2 | 9.0±0.5 | 12.5±0.5 |
| CRG0A CRG12 | Embossed | 4K | 12mm | 7 inch | 178.5±1.5 | 60 ^{+1/-0} | 13.0±0.5 | 13.0±0.5 | 15.5±0.5 |

Paper Tape Specifications



| Type | A (mm) | B (mm) | W (mm) | E (mm) | F (mm) | P ₀ (mm) | P ₁ (mm) | P ₂ (mm) | ΦD ₀ (mm) | T (mm) |
|-------|-----------|-----------|-----------|-----------|-----------|---------------------|---------------------|---------------------|----------------------|-----------|
| CRG02 | 0.65±0.10 | 1.15±0.10 | 8.00±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 |
| CRG03 | 1.10±0.10 | 1.90±0.10 | 8.00±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 |
| CRG05 | 1.60±0.10 | 2.40±0.20 | 8.00±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 |
| CRG06 | 1.90±0.10 | 3.50±0.20 | 8.00±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 |
| CRG10 | 2.90±0.10 | 3.50±0.20 | 8.00±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 ₀ (mm) | P ₁ (mm) | P ₂ (mm) | ΦD ₀ (mm) | T (mm) |
|-------|----------|-----------|-----------|-----------|----------|---------------------|---------------------|---------------------|----------------------|-------------------|
| CRG0A | 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 ⁺⁰ |
| CRG12 | 3.5±0.10 | 6.70±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 ⁺⁰ |

■ Marking

No Marking for 0402

Jumper for all: Letter "0"

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

Example:

| | | | | | | | |
|------------|------|-------|------|-------|------|--------|-------|
| Resistance | 5.6Ω | 97.6Ω | 100Ω | 2.2KΩ | 10KΩ | 49.9KΩ | 100KΩ |
| Marking | 5R60 | 97R6 | 1000 | 2201 | 1002 | 4992 | 1003 |

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

Example: 101=100Ω 102=1KΩ (1st and 2nd are E24 code and 3rd 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(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

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 ⁰ | 10 ¹ | 10 ² | 10 ³ | 10 ⁴ | 10 ⁵ | 10 ⁶ | 10 ⁻¹ | 10 ⁻² | | |

REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|-----------|--------------|---------------------|-----------------------|
| Version A | Jun 15, 2022 | - | - New product release |