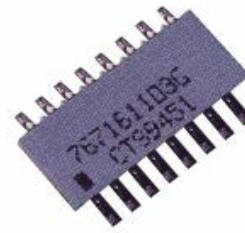


767 Series

Surface Mount Resistor Network

Features

- Surface Mount Gull Wing Package
- Solid Ceramic Construction
- Medium Body Design – 5.59mm
- No Internal Dendrite Growth
- Meets EIA PDP 100 SOGN-0002 Outline
- Requires 30% Less Board Space Than Molded Products of the Same Power Rating
- Tape and Reel Packaging or Slide Pack



RoHS Compliant in Accordance with EU Directive 2011/65/EU

- Lead-Free Termination Finish
- Exemption 7(c)-I, Electrical and electronic components containing lead [Pb] in glass

Part Weight:
14 Pin • 234.10mg
16 Pin • 266.00mg

Applications

- Telecom Infrastructure
- Optical Networking
- Wireless Networks
- Edge Routers
- Internet/Network Security
- Storage Area Networks
- Network Attached Storage
- Switches
- RAID Controllers

Description

767 Series Resistor Networks are single packaged devices containing an array of homogeneous resistor elements. CTS network designs provide a smaller circuit footprint, excellent reliability, improved TCR tracking and resistor tolerance matching; while helping to save placement costs by reducing application component count.

Ordering Information

| Model | Number of Pins | Schematic | Resistor Code | Resistor Tolerance | RoHS Compliant | Packaging | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------|---|---|---------------|--------------------|-------------------------------|----------------|---------|------------------|---|-------------------------|------------------|----------------|--|-----------------------|--|------------------|------------|------------------|------|--|-----------|---------|-----------|------------|-----------|------------------|-----------|-------|-----|---|--------|---|-----|--|--|---|----------|---|-------|--|--|--|-------------------------------|---|------------------|--|--|--|--|--|
| 767 | 16 | 3 | 103 | G | P | TR13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Code</th> <th>Pin Count</th> </tr> </thead> <tbody> <tr> <td>14</td> <td>14 Pins</td> </tr> <tr> <td>16</td> <td>16 Pins</td> </tr> </tbody> </table> | Code | Pin Count | 14 | 14 Pins | 16 | 16 Pins | | <table border="1"> <thead> <tr> <th>Code</th> <th>Resistor Value *</th> </tr> </thead> <tbody> <tr> <td>103</td> <td>10k ohm</td> </tr> </tbody> </table> <p>* See Addendum for Standard EIA Values</p> | Code | Resistor Value * | 103 | 10k ohm | | <table border="1"> <thead> <tr> <th>Code</th> <th>Compliance</th> </tr> </thead> <tbody> <tr> <td>P</td> <td>RoHS</td> </tr> </tbody> </table> | Code | Compliance | P | RoHS | <table border="1"> <thead> <tr> <th>Code</th> <th>Packing</th> </tr> </thead> <tbody> <tr> <td>Blank</td> <td>Slide Pack</td> </tr> <tr> <td>TR13</td> <td>Tape & Reel, 13"</td> </tr> </tbody> </table> | Code | Packing | Blank | Slide Pack | TR13 | Tape & Reel, 13" | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Pin Count | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | 14 Pins | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | 16 Pins | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Resistor Value * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 103 | 10k ohm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Compliance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P | RoHS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Packing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blank | Slide Pack | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TR13 | Tape & Reel, 13" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>Code</th> <th>Schematic Type</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Bussed Circuit</td> </tr> <tr> <td>3</td> <td>Isolated Circuit</td> </tr> <tr> <td>5</td> <td>Dual Terminator Circuit</td> </tr> <tr> <td>7</td> <td>Ladder Circuit</td> </tr> </tbody> </table> | Code | Schematic Type | 1 | Bussed Circuit | 3 | Isolated Circuit | 5 | Dual Terminator Circuit | 7 | Ladder Circuit | <table border="1"> <thead> <tr> <th colspan="2">Schematic Types 1 & 3</th> <th colspan="2">Schematic Type 5</th> <th colspan="2">Schematic Type 7</th> </tr> <tr> <th>Code</th> <th>Tolerance</th> <th>Code</th> <th>Tolerance</th> <th>Code</th> <th>Tolerance</th> </tr> </thead> <tbody> <tr> <td>G</td> <td>±2% [std]</td> <td>Blank</td> <td>±2%</td> <td>F</td> <td>±1 LSB</td> </tr> <tr> <td>F</td> <td>±1%</td> <td></td> <td></td> <td>D</td> <td>±0.5 LSB</td> </tr> <tr> <td>D</td> <td>±0.5%</td> <td></td> <td></td> <td></td> <td>[LSB = Least Significant Bit]</td> </tr> <tr> <td>J</td> <td>±5%²</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | Schematic Types 1 & 3 | | Schematic Type 5 | | Schematic Type 7 | | Code | Tolerance | Code | Tolerance | Code | Tolerance | G | ±2% [std] | Blank | ±2% | F | ±1 LSB | F | ±1% | | | D | ±0.5 LSB | D | ±0.5% | | | | [LSB = Least Significant Bit] | J | ±5% ² | | | | | |
| Code | Schematic Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Bussed Circuit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Isolated Circuit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Dual Terminator Circuit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Ladder Circuit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Schematic Types 1 & 3 | | Schematic Type 5 | | Schematic Type 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Code | Tolerance | Code | Tolerance | Code | Tolerance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G | ±2% [std] | Blank | ±2% | F | ±1 LSB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| F | ±1% | | | D | ±0.5 LSB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | ±0.5% | | | | [LSB = Least Significant Bit] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| J | ±5% ² | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Notes:

1. No dashes or spaces to appear in part number.
2. Not supported per PCN ECP-3200029. Use code "G" as standard platform tolerance.

**Not all performance combinations and frequencies may be available.
Contact your local CTS Representative or CTS Customer Service for availability.**

This product is specified for use only in standard commercial applications. Supplier disclaims all express and implied warranties and liability in connection with any use of this product in any non-commercial applications or in any application that may expose the product to conditions that are outside of the tolerances provided in its specification.

Electrical & Environmental Specifications

Operating Conditions

| Resistance Range [ohm] | Resistance Tolerance [%] ¹ | Operating Temperature Range | Temperature Coefficient | Dielectric Strength | Maximum Operating Voltage ² |
|------------------------|---|-----------------------------|---|---------------------|--|
| 10 - 1M | ±2% Std. or 0.5 ohm [whichever is greater] | -55°C to +125°C | ±200ppm/°C [10 ohms - 99 ohms] ±100ppm/°C [100 ohms - 1M ohms] | 100V _{AC} | 50V |

1. See Ordering Information for other options available.

2. Not to exceed rated power.

Power Rating

| Temperature | 14 Pin | 16 Pin |
|-------------|--------|--------|
| @ +25°C | 2.0W | 2.3W |
| @ +70°C | 1.3W | 1.5W |

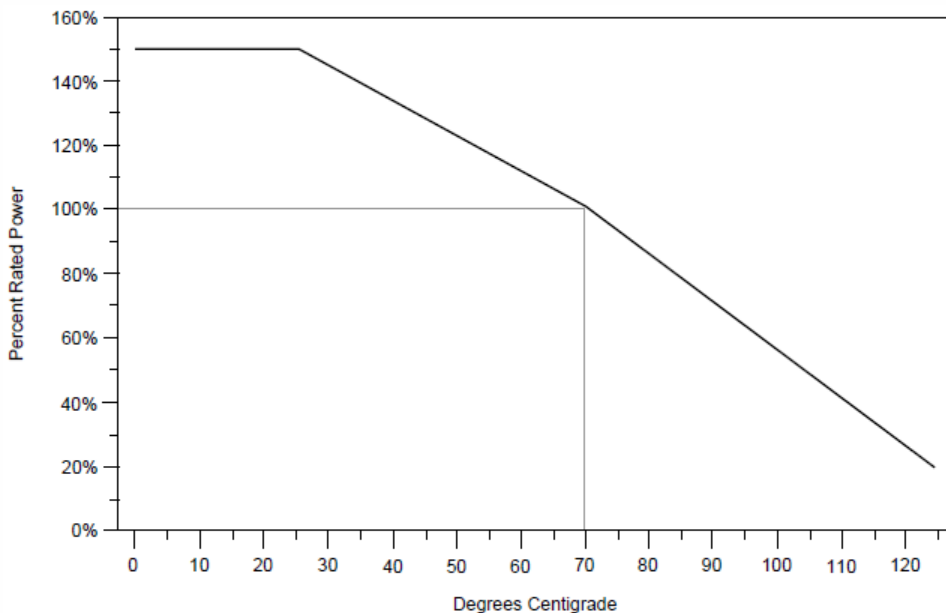
1. Total network power.

Maximum Resistor Power

| Schematic | 1 | 3 | 5 | 7 |
|-----------|-------|-------|-------|-------|
| @ +25°C | 0.15W | 0.30W | 0.15W | 0.15W |
| @ +70°C | 0.10W | 0.20W | 0.10W | 0.10W |

1. Not to exceed total network power.

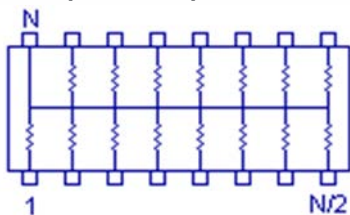
Power Derating Curve



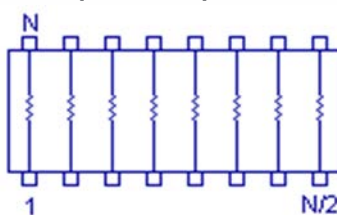
Electrical & Environmental Specifications

Circuit Types

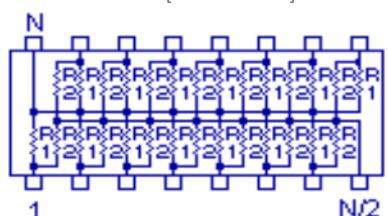
Bussed [Schematic 1]



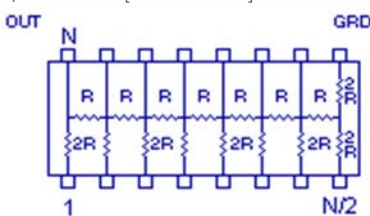
Isolated [Schematic 3]



Dual Terminator [Schematic 5]



R/2R Ladder [Schematic 7]



Note: Pin N is common to R_1 and Pin N/2 common to R_2 .

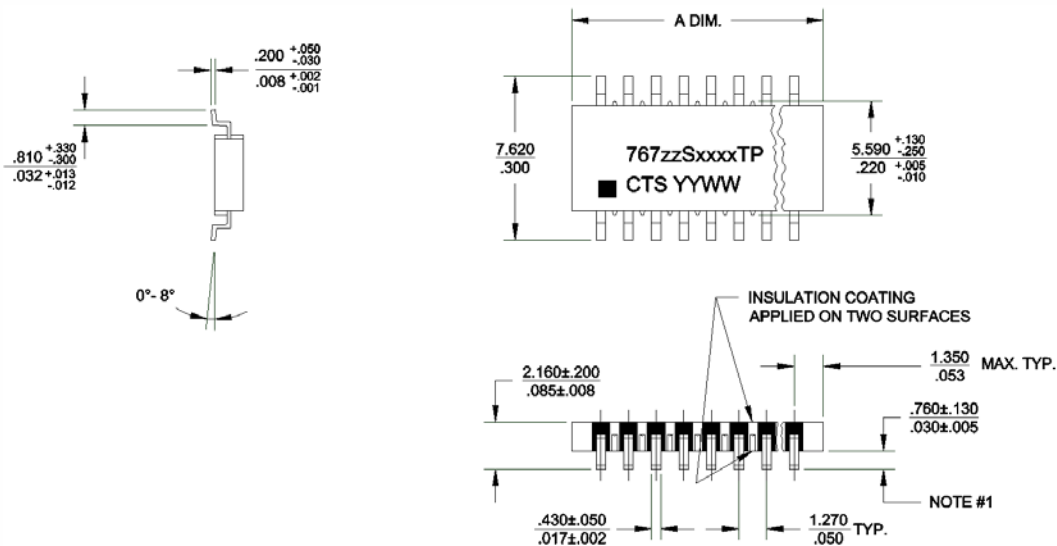
Environmental Parameters

| Test | Maximum Delta R [%] | MIL-STD-202 Method | Test Description |
|---------------------------|---------------------|--------------------|---|
| Thermal Cycle | 0.25 | 107 Condition B | 5 cycles -65°C to +125°C |
| Short Time Overload | 0.25 | | 2½ times rated working voltage for 5 seconds [100V maximum] |
| Moisture Resistance | 0.50 | 106 | 240 hours, 0.1 rated load, -10°C to +65°C, 90% RH |
| Load Humidity | 1.00 | | 1,000 hours, 0.1 rated load, +70°C, 85% - 92% RH |
| High Temperature Exposure | 1.00 | | 240 hours @ +125°C, no load |
| Load Life | 1.00 | 108 Condition F | 2,000 hours @ +70°C, rated load |
| Resistance to Solder Heat | 0.25 | | 30 seconds @ +218°C, dwell |
| Mechanical Shock | 0.25 | 213 Condition I | 100g, 1m second, 3 shocks each plane |
| Vibration | 0.25 | 204 Condition D | 20g, 10Hz - 2,000Hz, 4 hours per plane |
| Terminal Strength | 0.25 | | 0.9kg pull, 30 seconds; two 45° bends |
| Low Temperature Storage | 0.25 | | 24 hours @ -65°C, no load |
| Low Temperature Operation | 0.25 | | 45 minutes @ -65°C, full load |
| Flammability | N/A | | 94V-0 |
| Non-Fungus | Pass | --- | MIL-STD-810C |
| Resistance to Solvents | Pass | | Isopropyl alcohol, Freon TMC |
| Solderability | Pass | | RMA Flux, +230°C, 5 seconds dip, 95% coverage |

Mechanical Specifications

Package Drawing

| Package | "A" Dimension | |
|---------|---------------|--------------|
| | mm | inch |
| 14 Pin | 9.91 ±0.25 | 0.390 ±0.010 |
| 16 Pin | 11.18 ±0.25 | 0.440 ±0.010 |



Marking Information

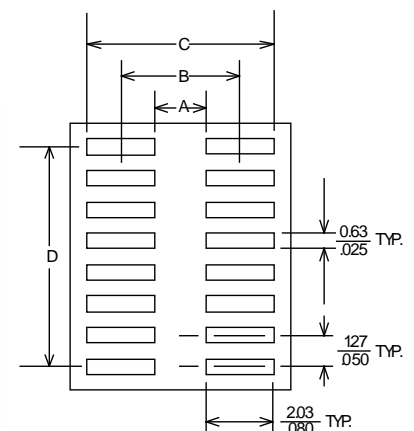
1. 767 – Product Series.
2. zz – Pin count, 14 or 16.
3. S – Schematic type, 1, 3, 5 or 7.
4. xxxx – Resistance value code, 3 or 4 digits.
5. T – Resistor tolerance code; G, F or D. Leave blank for Schematic Code 5.
6. P – RoHS compliant.
7. ■ – Pin 1 identifier.
8. CTS – Manufacturer.
9. YYWW – Date Code: YY – year, WW – week.

Notes

1. Lead Co-Planarity - 0.10mm maximum [0.004in.].
2. General Tolerances - ±0.25mm [±0.010in.].
3. Lead termination (e1). Barrier plating is nickel [Ni] with tin/silver/copper [Sn Ag Cu] finish.
4. Reflow conditions per JEDEC-J-STD-020; +260°C maximum, 30 seconds.

Recommended Solder Pad Layout

| Package | | Dimensions | | | |
|---------|------|------------|------|------|------|
| | | A | B | C | D |
| 14 Pin | mm | 5.34 | 7.37 | 9.40 | 7.60 |
| | inch | 0.21 | 0.29 | 0.37 | 0.30 |
| 16 Pin | mm | 5.34 | 7.37 | 9.40 | 8.90 |
| | inch | 0.21 | 0.29 | 0.37 | 0.35 |

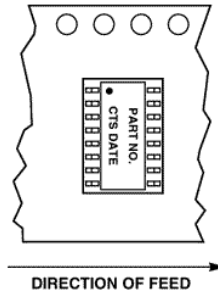


Packaging

Tape and Reel Information

| Reel Diameter 330mm [13"] | 14 Pin Package | 16 Pin Package |
|------------------------------|-------------------|-------------------|
| Parts Per Reel | 2,000 | 2,000 |
| Pitch | 12mm | 12mm |
| Carrier Width | 24mm | 24mm |
| Material | Plastic | Plastic |

1. See Ordering Information for packaging code



Plastic Tube

| Slide Pack | 14 Pin Package | 16 Pin Package |
|----------------|-------------------|-------------------|
| Tube Length | 508mm | 508mm |
| Parts Per Tube | 48 | 43 |



Addendum

Standard EIA Codes and Resistor Values – E-24 [3-Digit Resistor Code for G, F & D Tolerances]

| CODE | OHMS | CODE | OHMS | CODE | OHMS | CODE | OHMS | CODE | OHMS | CODE | OHMS |
|-------------------|------|------|------|------|-------|------|--------|------|---------|------|-----------|
| 000X ¹ | 0 | 680 | 68 | 511 | 510 | 392 | 3,900 | 303 | 30,000 | 224 | 220,000 |
| 100 | 10 | 750 | 75 | 561 | 560 | 432 | 4,300 | 333 | 33,000 | 244 | 240,000 |
| 110 | 11 | 820 | 82 | 621 | 620 | 472 | 4,700 | 363 | 36,000 | 274 | 270,000 |
| 120 | 12 | 910 | 91 | 681 | 680 | 512 | 5,100 | 393 | 39,000 | 304 | 300,000 |
| 130 | 13 | 101 | 100 | 751 | 750 | 562 | 5,600 | 433 | 43,000 | 334 | 330,000 |
| 150 | 15 | 111 | 110 | 821 | 820 | 622 | 6,200 | 473 | 47,000 | 364 | 360,000 |
| 160 | 16 | 121 | 120 | 911 | 910 | 682 | 6,800 | 513 | 51,000 | 394 | 390,000 |
| 180 | 18 | 131 | 130 | 102 | 1,000 | 752 | 7,500 | 563 | 56,000 | 434 | 430,000 |
| 200 | 20 | 151 | 150 | 112 | 1,100 | 822 | 8,200 | 623 | 62,000 | 474 | 470,000 |
| 220 | 22 | 161 | 160 | 122 | 1,200 | 912 | 9,100 | 683 | 68,000 | 514 | 510,000 |
| 240 | 24 | 181 | 180 | 132 | 1,300 | 103 | 10,000 | 753 | 75,000 | 564 | 560,000 |
| 270 | 27 | 201 | 200 | 152 | 1,500 | 113 | 11,000 | 823 | 82,000 | 624 | 620,000 |
| 300 | 30 | 221 | 220 | 162 | 1,600 | 123 | 12,000 | 913 | 91,000 | 684 | 680,000 |
| 330 | 33 | 241 | 240 | 182 | 1,800 | 133 | 13,000 | 104 | 100,000 | 754 | 750,000 |
| 360 | 36 | 271 | 270 | 202 | 2,000 | 153 | 15,000 | 114 | 110,000 | 824 | 820,000 |
| 390 | 39 | 301 | 300 | 222 | 2,200 | 163 | 16,000 | 124 | 120,000 | 914 | 910,000 |
| 430 | 43 | 331 | 330 | 242 | 2,400 | 183 | 18,000 | 134 | 130,000 | 105 | 1,000,000 |
| 470 | 47 | 361 | 360 | 272 | 2,700 | 203 | 20,000 | 154 | 150,000 | | |
| 510 | 51 | 391 | 390 | 302 | 3,000 | 223 | 22,000 | 164 | 160,000 | | |
| 560 | 56 | 431 | 430 | 332 | 3,300 | 243 | 24,000 | 184 | 180,000 | | |
| 620 | 62 | 471 | 470 | 362 | 3,600 | 273 | 27,000 | 204 | 200,000 | | |

1. Include "X" in tolerance code.



Addendum

Dual Terminator Resistor Values [Schematic 5 - 4-Digit Resistor Code]

The 766 Series part number includes the EIA Code value of the Thevenin equivalent resistances of R₁ and R₂.

The Thevenin equivalent resistance is calculated using the following formula; $R_{EQ} = R_1 * R_2 / (R_1 + R_2)$.

| R1 [ohms] | R2 [ohms] | Thevenin Equivalent [ohms] | CTS Resistor Code | R1 [ohms] | R2 [ohms] | Thevenin Equivalent [ohms] | CTS Resistor Code | R1 [ohms] | R2 [ohms] | Thevenin Equivalent [ohms] | CTS Resistor Code | R1 [ohms] | R2 [ohms] | Thevenin Equivalent [ohms] | CTS Resistor Code |
|-----------|-----------|----------------------------|-------------------|-----------|-----------|----------------------------|-------------------|-----------|-----------|----------------------------|-------------------|-----------|-----------|----------------------------|-------------------|
| 22 | 50 | 15 | 150A | 118 | 178 | 71 | 710A | 240 | 620 | 173 | 171C | 680 | 1,500 | 468 | 471A |
| 25 | 50 | 17 | 170A | 120 | 120 | 60 | 600B | 250 | 250 | 125 | 131B | 715 | 240 | 180 | 181B |
| 30 | 50 | 19 | 190A | 120 | 150 | 67 | 670C | 260 | 162 | 100 | 101G | 750 | 750 | 375 | 381A |
| 30 | 620 | 29 | 290A | 120 | 180 | 72 | 720A | 270 | 130 | 88 | 880B | 750 | 2,300 | 566 | 571A |
| 33 | 680 | 31 | 310A | 120 | 200 | 75 | 750B | 270 | 180 | 108 | 111C | 780 | 390 | 260 | 261A |
| 33 | 4,700 | 33 | 330A | 120 | 220 | 78 | 780B | 270 | 270 | 135 | 141A | 820 | 560 | 333 | 331B |
| 36 | 620 | 34 | 340A | 121 | 195 | 75 | 750C | 270 | 470 | 171 | 171A | 1,000 | 1,000 | 500 | 501A |
| 38 | 125 | 29 | 290B | 122 | 253 | 82 | 820A | 271 | 131 | 88 | 880A | 1,000 | 1,500 | 600 | 601B |
| 43 | 620 | 40 | 400A | 130 | 210 | 80 | 800A | 330 | 220 | 132 | 131D | 1,000 | 2,000 | 667 | 671A |
| 47 | 68 | 28 | 280A | 133 | 154 | 71 | 710B | 330 | 330 | 165 | 171B | 1,000 | 2,200 | 688 | 691A |
| 47 | 270 | 40 | 400B | 150 | 150 | 75 | 750A | 330 | 390 | 179 | 181A | 1,000 | 3,300 | 767 | 771A |
| 65 | 90 | 38 | 380A | 150 | 180 | 82 | 820B | 330 | 470 | 194 | 191A | 1,100 | 820 | 470 | 471B |
| 68 | 189 | 50 | 500B | 150 | 1,000 | 130 | 131E | 330 | 680 | 222 | 221A | 1,100 | 2,200 | 733 | 731A |
| 75 | 620 | 67 | 670A | 160 | 240 | 96 | 960A | 330 | 3,900 | 304 | 301A | 1,200 | 1,200 | 600 | 601A |
| 80 | 220 | 59 | 590A | 160 | 260 | 99 | 990A | 360 | 390 | 187 | 191B | 1,500 | 1,500 | 750 | 751A |
| 81 | 130 | 50 | 500A | 160 | 270 | 100 | 101D | 360 | 600 | 225 | 231A | 1,500 | 3,300 | 1,031 | 102A |
| 81 | 220 | 59 | 600C | 160 | 440 | 117 | 121D | 360 | 720 | 240 | 241B | 2,000 | 1,000 | 667 | 671B |
| 81 | 330 | 65 | 650B | 162 | 260 | 100 | 101B | 390 | 620 | 239 | 241A | 2,000 | 2,000 | 1,000 | 102B |
| 81 | 2,200 | 78 | 780A | 180 | 220 | 99 | 101A | 400 | 200 | 133 | 131F | 2,200 | 3,300 | 1,320 | 132A |
| 82 | 120 | 49 | 490A | 180 | 240 | 103 | 101F | 400 | 600 | 240 | 241C | 2,200 | 4,400 | 1,467 | 152A |
| 82 | 130 | 50 | 500D | 180 | 270 | 108 | 111A | 470 | 330 | 194 | 191C | 2,200 | 5,600 | 1,579 | 162A |
| 83 | 128 | 50 | 500C | 180 | 300 | 113 | 111B | 470 | 680 | 278 | 281C | 3,000 | 2,000 | 1,200 | 122A |
| 95 | 156 | 59 | 590B | 180 | 390 | 123 | 121A | 470 | 940 | 313 | 311A | 3,000 | 6,200 | 2,022 | 202A |
| 100 | 75 | 43 | 430A | 180 | 470 | 130 | 131C | 470 | 1,000 | 320 | 321A | 3,300 | 4,700 | 1,939 | 192A |
| 100 | 82 | 45 | 450A | 182 | 245 | 104 | 101E | 500 | 500 | 250 | 251A | 3,900 | 3,300 | 1,788 | 182A |
| 100 | 100 | 50 | 500E | 200 | 100 | 67 | 670D | 510 | 760 | 305 | 311B | 4,400 | 2,200 | 1,467 | 152B |
| 100 | 150 | 60 | 600A | 200 | 270 | 115 | 121C | 560 | 390 | 230 | 231B | 4,700 | 4,700 | 2,350 | 242A |
| 100 | 175 | 64 | 640A | 200 | 1,500 | 176 | 171D | 560 | 820 | 333 | 331A | 4,700 | 22,000 | 3,873 | 392A |
| 100 | 200 | 67 | 670B | 220 | 220 | 110 | 111D | 560 | 910 | 347 | 351A | 5,000 | 5,000 | 2,500 | 252A |
| 100 | 220 | 69 | 690A | 220 | 270 | 121 | 121B | 560 | 1,000 | 359 | 361A | 6,800 | 22,000 | 5,194 | 522A |
| 100 | 430 | 81 | 810A | 220 | 330 | 132 | 131A | 620 | 820 | 353 | 351B | 10,000 | 20,000 | 6,667 | 672A |
| 106 | 169 | 65 | 650A | 220 | 470 | 150 | 151A | 620 | 910 | 369 | 371A | 10,000 | 51,000 | 8,361 | 842A |
| 110 | 91 | 50 | 500F | 220 | 1,800 | 196 | 201A | 660 | 990 | 396 | 401B | 50,000 | 100,000 | 33,333 | 333A |
| 110 | 220 | 73 | 730A | 240 | 170 | 100 | 101C | 680 | 1,000 | 405 | 401A | 360,000 | 390,000 | 187,200 | 194A |

1. Resistor tolerances are ±2%.

2. Suffix letter in CTS Code has no significance, assigned in sequential order.