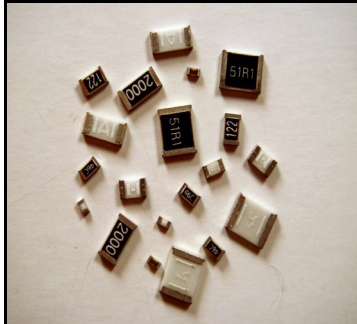


Product Family: Ultra Reliable Thin Film Chip Resistor

Part Number Series: UCR Series

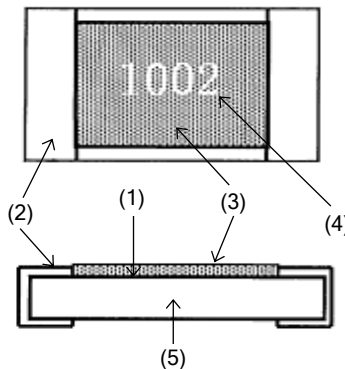


| | | |
|--|--|--|
|  | <p>Construction:</p> <ul style="list-style-type: none"> • High purity alumina substrate • Ni alloy thin-film resistive element • SiO₂ protective barrier • Wrap around electrodes • 100% matte tin over Ni terminations • RoHS compliant and Pb free • Inherently anti-sulfur | <p>Features:</p> <ul style="list-style-type: none"> • 0603, 0805, 1206, 2010 & 2512 English case sizes • Resistances from 100Ω to 200KΩ • Tolerances down to ±0.01% • TCR's down to ±1ppm/°C • High volume production suitable for commercial and special applications • AEC-Q200 qualified |
|--|--|--|

Description:

These ultra precision, highly stable chip resistors are perfect for demanding applications where high reliability and environmental stability is a must, such as automotive or test and measure applications. The incorporation of a SiO₂ protective barrier protects the products and allows for excellent stability and long term reliability.

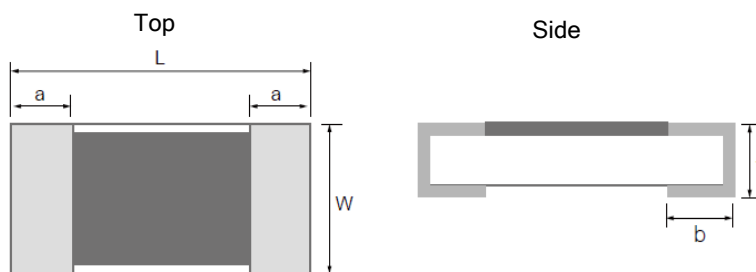
Product Construction:



| Number | Description |
|--------|--|
| 1 | Resistive element (chrome alloy thin film) |
| 2 | Electrode (tin plating) |
| 3 | Protective coat (resin coating) |
| 4 | Marking (resin) |
| 5 | Substrate (alumina ceramics) |

Part Numbering: Ex: UCR0805L2201T-T05

| Series Name | English Size (Metric Size) | Temp. Coefficient of Resistance (TCR) | Resistance Value | Resistance Tolerance | T&R Packaging Quantity |
|-------------|---|---------------------------------------|--|--|---|
| UCR | 0603 (1608) 0805 (2012) 1206 (3216) 2010 (5025) 2512 (6432) | K = ±1ppm/°C L = ±2ppm/°C | 4 digits with the first 3 being significant. The last digit specifies the number of zeros. | T = ±0.01% Q = ±0.02% A = ±0.05% B = ±0.10% D = ±0.50% | -T01 = 100 -T05 = 500 -T1 = 1,000 (Refer to electrical tables) |

Product Dimensions:

All dimensions in inches, mm in parentheses.

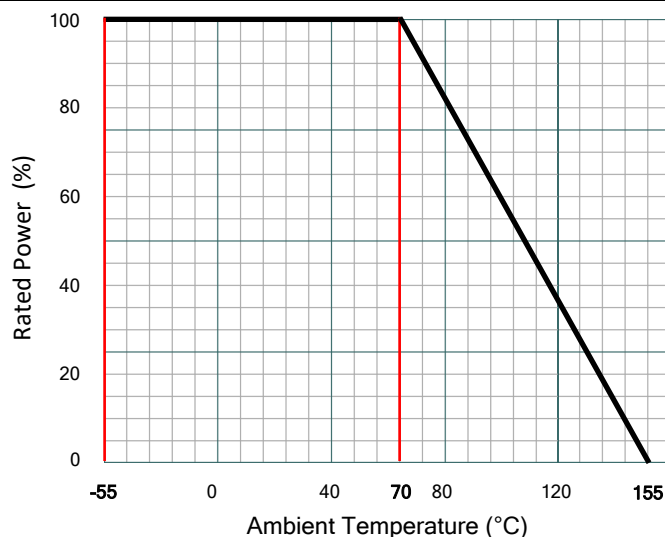
| Dimension (Metric) | L | W | a | b | t |
|--------------------|--|---|------------------------------|------------------------------|--|
| UCR0603 (1608) | 0.063 ±0.008 (1.60 ±0.20) | 0.031+0.001/-0.008 (0.80+0.25/-0.20) | 0.012 ±0.008 (0.30 ±0.20) | 0.012 ±0.008 (0.30 ±0.20) | 0.016+0.006/-0.004 (0.40+0.15/-0.10) |
| UCR0805 (2012) | 0.079 ±0.008 (2.00 ±0.20) | 0.049+0.001/-0.008 (1.25+0.25/-0.20) | 0.016 ±0.008 (0.40 ±0.20) | 0.016 ±0.008 (0.40 ±0.20) | 0.016+0.006/-0.004 (0.40+0.15/-0.10) |
| UCR1206 (3216) | 0.126 ±0.008 (3.20 ±0.20) | 0.063 ±0.001 (1.60 ±0.25) | 0.020 ±0.010 (0.50 ±0.25) | 0.020 ±0.008 (0.50 ±0.20) | 0.016 ±0.006/-0.004 (0.40+0.15/-0.10) |
| UCR2010 (5025) | 0.197 ±0.008 (5.00 ±0.20) | 0.098 ±0.010 (2.50 ±0.25) | 0.024 ±0.010 (0.60 ±0.25) | 0.024 ±0.010 (0.60 ±0.25) | 0.018 ±0.004 (0.45 ±0.10) |
| UCR2512 (6432) | 0.252 ±0.008/-0.016 (6.40+0.20/-0.40) | 0.126 ±0.010 (3.20 ±0.25) | 0.030 ±0.010 (0.75 ±0.25) | 0.031 ±0.008 (0.80 ±0.20) | 0.018 ±0.008 (0.45 ±0.20) |

Electrical Specifications:

| Type | UCR0603 | | UCR0805 | | UCR1206 | | UCR2010 | | UCR2512 | |
|-------------------------------|---|--|---------------------|--|---------------------|--|---------------------|--|---------------------|--|
| Metric Size | 1608 | | 2012 | | 3216 | | 5025 | | 6432 | |
| Power Rating | 1/16W | | 1/10W | | 1/4W | | 1/2W | | 3/4W | |
| Resistance Tolerance % (code) | ±0.01 (T) | ±0.02 (Q) ±0.05 (A) ±0.10 (B) ±0.50 (D) | ±0.01 (T) | ±0.02 (Q) ±0.05 (A) ±0.10 (B) ±0.50 (D) | ±0.01 (T) | ±0.02 (Q) ±0.05 (A) ±0.10 (B) ±0.50 (D) | ±0.01 (T) | ±0.02 (Q) ±0.05 (A) ±0.10 (B) ±0.50 (D) | ±0.01 (T) | ±0.02 (Q) ±0.05 (A) ±0.10 (B) ±0.50 (D) |
| Resistance Range (Ω) | 250 ~ 7.5K | 100 ~ 7.5K | 250 ~ 36K | 100 ~ 36K | 250 ~ 68K | 100 ~ 68K | 250 ~ 100K | 100 ~ 150K | 250 ~ 100K | 100 ~ 200K |
| Resistance Offering | E-24, E-96 Values | | | | | | | | | |
| TCR ppm/°C (code) | ±1 (K)* ±2 (L)** | | ±1 (K)* ±2 (L)** | | ±1 (K)* ±2 (L)** | | ±1 (K)* ±2 (L)** | | ±1 (K)* ±2 (L)** | |
| Max Operating Voltage | 100V | | 150V | | 200V | | 300V | | 300V | |
| Operating Temp. Range | -55°C ~ +155°C | | | | | | | | | |
| Packaging (code) | 100pcs/reel (-T01), 500pcs/reel (-T05), 1,000pcs/reel (-T1) | | | | | | | | | |

*Note: TCR ±1.0 (K) at temperature range +25°C ~ +65°C. TCR ±1.5 (K) at temperature range -20°C ~ +25°C, +65°C ~ +125°C.

**Note: TCR ±2.0 (L) at temperature range -20°C ~ +125°C.

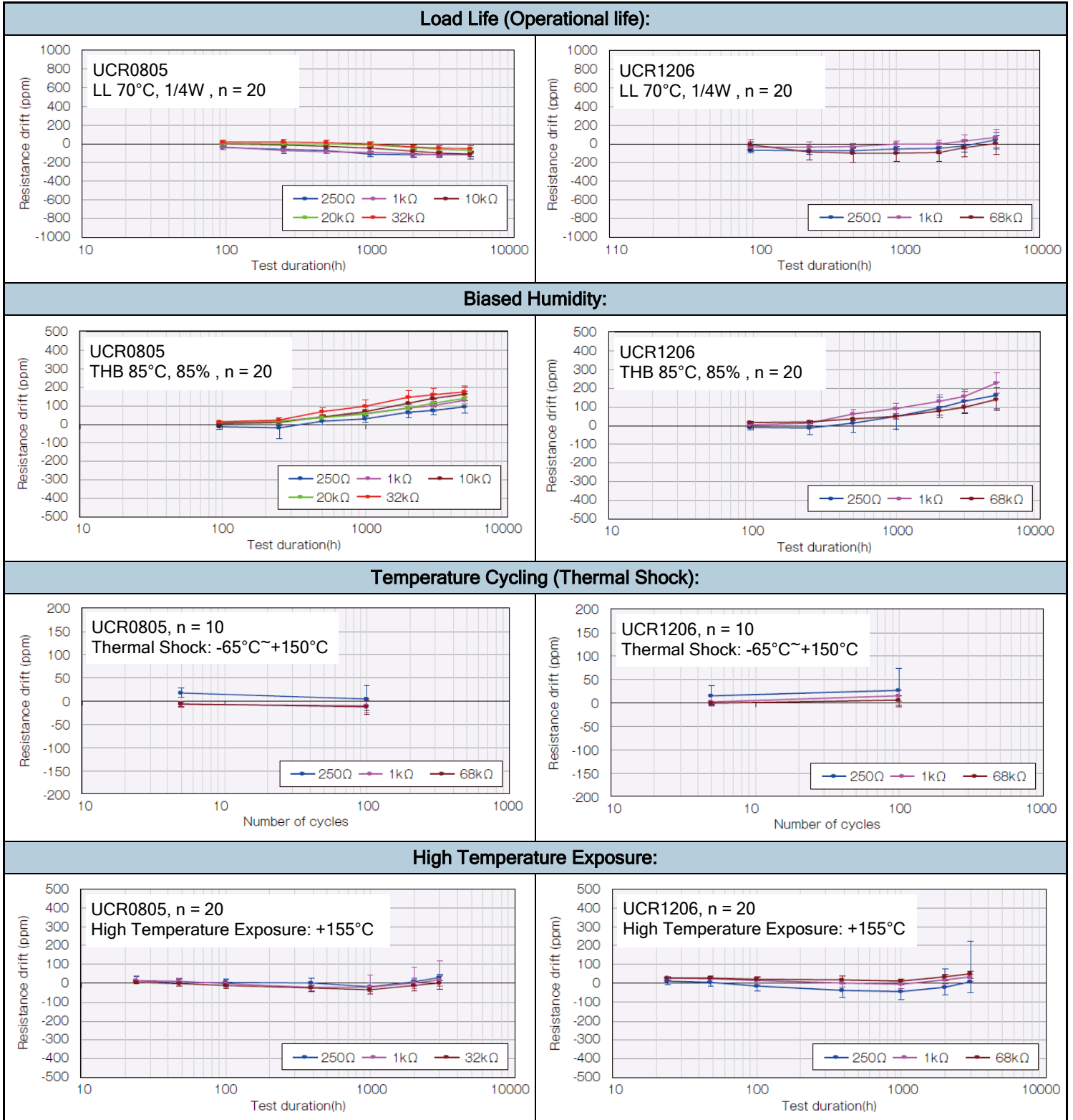
Power Derating Curve:**Reliability Specifications:**

| Test | Procedure | Specifications |
|--|--|------------------------------------|
| Resistance Temperature Coefficient MIL-PRF-55342 3.16 | $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ R ₁ : Resistance (Ω) at reference temperature (25°C) R ₂ : Resistance (Ω) at test temperature t ₁ : Reference temperature (25°C) t ₂ : Test temperature (°C) Highest test temperature: 125°C Lowest test temperature: -20°C | Refer to electrical specifications |
| Short Time Overload MIL-PRF-55342 3.12 (JIS C 5201-1) | Applied voltage: 2.5X rated voltage Test duration: 5 seconds | ±(0.02% +0.01Ω) |
| High Temp. Exposure MIL-PRF-55342 3.13 (JIS C 5201-1) | +155°C for 1000 hours | ±(0.05%+0.01Ω) |
| Low Temperature Operation MIL-PRF-55342 3.11 | Temperature: -65±0/-5°C Rated voltage shall be applied for 45+5/-0 min. | ±(0.01%+0.01Ω) |
| Temperature Cycling (Thermal Shock) MIL-PRF-55342 3.9 (JIS C 5201-1) | -65°C (15 mins.), +25°C (Max 5 mins), +150°C (15mins.), +25°C (Max 5 mins), 100 Cycles | ±(0.02%+0.01Ω) |
| Endurance at Upper Category Temp. IEC 60115-1 Sub-clause 4.25.3. (JIS C 5201-1) | The specimen shall be placed in the test chamber at 155 ±2°C with no load for 1000+48/0 hrs. | ±(0.05%+0.01Ω) |
| Biased Humidity IEC 60115-1 Sub-clause 4.24 (JIS C 5201-1) | Test conditions: 85°C and 85% RH 10% of rated power Test period: 1,000 hours as follows: 90 min. power ON/30 min. power OFF | ±(0.05% +0.01Ω) |
| Load Life (Operational Life) MIL-PRF-55342 3.17 (JIS C 5201-1) | Applied voltage: rated power Test period: 2,000 hours as follows: 90 min. power ON/30 min. power OFF | ±0.02%+0.01Ω (R≥250Ω) |
| | | ±0.05%+0.01Ω (R<250Ω) |
| Resistance to Soldering Heat MIL-PRF-55342 3.14.1 (JIS C 5201-1) | Condition B (Solder dip, no pre-heat) Reflow: 235 ±5°C, 30 ±5 seconds 245°C, 30 ±5 seconds Cycles = 3 | ±(0.01% +0.01Ω) |
| Solderability IEC 60115-1 Sub-clause 4.17 (JIS C 5201-1) | Non-activated flux dip: 5-10 seconds SAC solder dip: 2 ±0.5 seconds at 245 ±5°C | >95% covered |
| Moisture Resistance MIL-PRF-55342 3.15 | Temperature Range: -10°C ~ +65°C Humidity Range: 80 ~ 100% RH 10 cycles, without load | 250Ω and more: ±(0.02%+0.01Ω) |
| | | Under 250Ω: ±(0.05%+0.01Ω) |

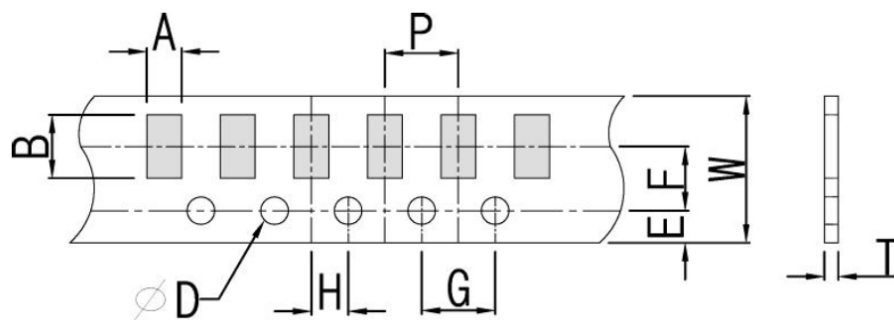
Reliability Specification (Cont.):

| Test | Procedure | Specification |
|---|---|---|
| Insulation Resistance IEC 60115-1 Sub-Clause 4.6. (JIS C 5201-1) | Pressurization by spring: $1.0 \pm 0.2N$ Test voltage: $100 \pm 15Vd.c.$ | Between electrodes and insulating enclosure: $100M\Omega <$ |
| | | Between electrodes and base material: $1000M\Omega <$ |
| Shelf Life | 25°C, 1 year | $\pm(0.01+0.01\Omega)$ |

Reliability Testing Graphs:



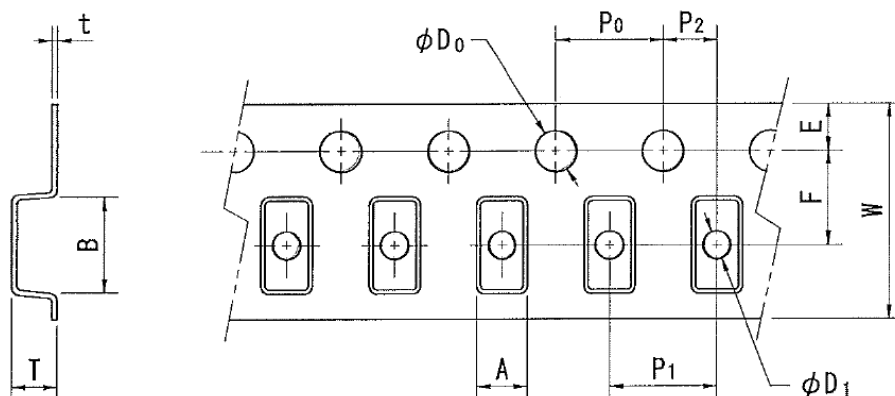
Paper Tape Dimensions:



All dimensions are in mm.

| Size | A | B | W | E | F | G | H | P | ΦD | T |
|------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------------------|---------------|
| 0603 | 1.10 ±0.10 | 1.90 ±0.10 | 8.00 ±0.30 | 1.75 ±0.10 | 3.50 ±0.05 | 4.00 ±0.10 | 2.00 ±0.05 | 4.00 ±0.10 | 1.50 +0.10/-0 | 0.60 ±0.05 |
| 0805 | 1.65 ±0.20 | 2.40 ±0.20 | 8.00 ±0.30 | 1.75 ±0.10 | 3.50 ±0.05 | 4.00 ±0.10 | 2.00 ±0.05 | 4.00 ±0.10 | 1.50 +0.10/-0 | 0.75 ±0.05 |

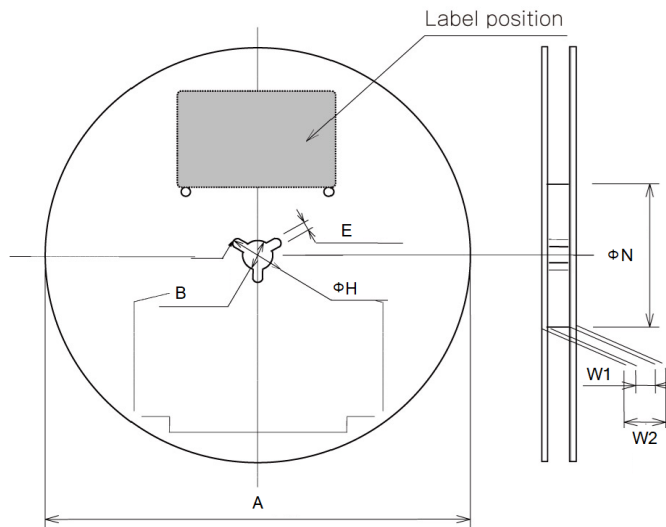
Plastic Tape Dimensions:



All dimensions are in mm.

| Size | A | B | W | E | F | P ₀ | P ₁ | P ₂ | ΦD ₀ | ΦD ₁ | T | t |
|------|---------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|------------------|------------------|---------------|----------|
| 1206 | 2.00 ±0.20 | 3.60 ±0.20 | 8.00 ±0.30 | 1.75 ±0.10 | 3.50 ±0.05 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.05 | 1.55 ±0.05 | 1.05 ±0.05 | 1.00 ±0.10 | 0.30 max |
| 2010 | 2.80 ±0.10 | 5.30 ±0.10 | 12.0 ±0.20 | 1.75 ±0.10 | 5.50 ±0.05 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.05 | 1.55 ±0.05 | 1.10 ±0.10 | 1.00 ±0.10 | 0.30 max |
| 2512 | 3.50 ±0.20 | 6.90 ±0.20 | 12.0 ±0.20 | 1.75 ±0.10 | 5.50 ±0.10 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.10 | 1.50 +0.10/-0 | 1.50 +0.10/-0 | 1.00 max | 0.30 max |

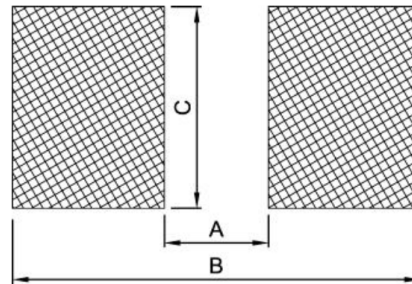
Reel Dimensions:



All dimensions are in mm.

| Size | Quantity | A | B | E | ΦH | ΦN | W1 | W2 |
|------------------------|---------------------------|--------------------|---------------|---------------|---------------|---------------------|---------------------|---------------|
| 0603, 0805, 1206, 2010 | 100, 500 & 1,000 pcs/reel | 180 +0.00/-1.50 | 13.0 ±0.20 | 2.00 ±0.50 | 21.0 ±0.80 | 60.0 +1.00/-0.00 | 9.00 +1.00/-0.00 | 13.0 ±1.00 |
| 2512 | | 180 +0.00/-1.50 | 13.0 ±0.20 | 2.00 ±0.50 | 21.0 ±0.80 | 60.0 +1.00/-0.00 | 13.0 +1.00/0.00 | 17.0 ±1.00 |

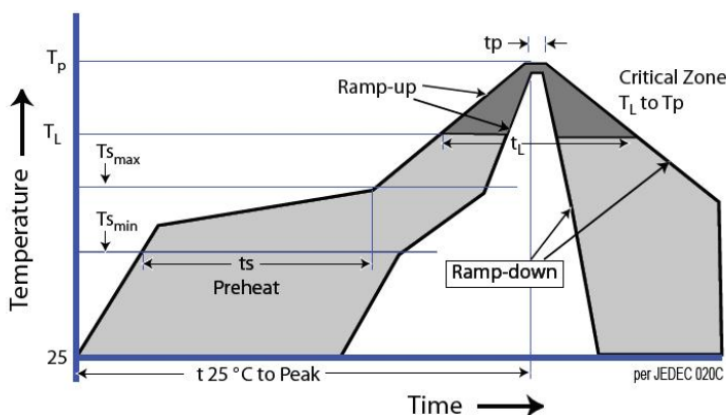
Recommended Land Pattern:



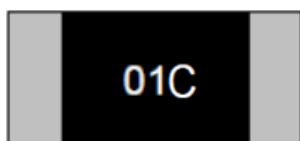
All dimensions are in mm.

| Size | 0603 | 0805 | 1206 | 2010 | 2512 |
|------|------|------|------|------|------|
| A | 1.00 | 1.20 | 2.20 | 3.80 | 4.80 |
| B | 3.00 | 4.00 | 5.00 | 6.80 | 8.20 |
| C | 1.20 | 1.65 | 2.00 | 2.90 | 3.60 |

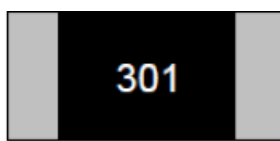
Soldering Profile:



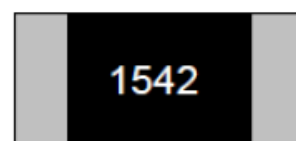
| Profile Feature | Pb-Free Assembly |
|---|------------------|
| Average Ramp-Up Rate ($T_{s_{max}}$ to T_p) | 3 °C/second max. |
| Preheat | |
| - Temperature Min ($T_{s_{min}}$) | 150 °C |
| - Temperature Max ($T_{s_{max}}$) | 200 °C |
| - Time ($t_{s_{min}}$ to $t_{s_{max}}$) | 60-180 seconds |
| Time maintained above: | |
| - Temperature (T_L) | 217 °C |
| - Time (t_L) | 60-150 seconds |
| Peak Temperature (T_p) | 260 +0 °C |
| Time within 5 °C of actual Peak Temperature (t_p) | 20-40 seconds |
| Ramp-Down Rate | 6 °C/second max. |
| Time 25 °C to Peak Temperature | 8 minutes max. |

Marking Information:

3 digits:
0603 (E-96 values)



3 digits:
0603~ 0805 (E-24 values)



4 digits:
0805 (E-96 values) & 1206~ 2512

Standard E-96 Values and 0603 Resistance Codes

| | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| R-Value | 100 | 102 | 105 | 107 | 110 | 113 | 115 | 118 | 121 | 124 | 127 | 130 | 133 | 137 | 140 | 143 | 147 | 150 | 154 | 158 | 162 | 165 | 169 | 174 |
| Code | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| R-Value | 178 | 182 | 187 | 191 | 196 | 200 | 205 | 210 | 215 | 221 | 226 | 232 | 237 | 243 | 249 | 255 | 261 | 267 | 274 | 280 | 287 | 294 | 301 | 309 |
| Code | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| R-Value | 316 | 324 | 332 | 340 | 348 | 357 | 365 | 374 | 383 | 392 | 402 | 412 | 422 | 432 | 442 | 453 | 464 | 475 | 487 | 499 | 511 | 523 | 536 | 549 |
| Code | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
| R-Value | 562 | 576 | 590 | 604 | 619 | 634 | 649 | 665 | 681 | 698 | 715 | 732 | 750 | 768 | 787 | 806 | 825 | 845 | 866 | 887 | 909 | 931 | 953 | 976 |
| Code | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 |

E-96 Multiplier Code for 0603

| | | | | | | | |
|-------------------|-----------|-----------|--------|--------|--------|--------|--------|
| Code | S | R | A | H | C | D | E |
| Multiplier | 10^{-2} | 10^{-1} | 10^0 | 10^1 | 10^2 | 10^3 | 10^4 |

Examples of E-96 Multiplier Code for 0603

| | | | | | | | |
|----------------|-------|-------|------|--------|--------|-------|-----|
| R-Value | 4.99Ω | 33.2Ω | 475Ω | 2.21KΩ | 10.2KΩ | 196KΩ | 1MΩ |
| Code | 68S | 51R | 66A | 34H | 02C | 29D | 01E |

Examples of E-24 Resistance Code for 0603 ~ 0805

| | | | | | | |
|----------------|------|-----|------|-------|------|-------|
| R-Value | 4.7Ω | 33Ω | 470Ω | 5.6KΩ | 62KΩ | 200KΩ |
| Code | 4R7 | 330 | 471 | 562 | 623 | 204 |

Examples of 4 Digit Resistance Codes for 0805 ~ 2512

| | | | | | | | | |
|----------------|------|------|-------|------|-------|------|-------|------|
| R-Value | 5.6Ω | 10Ω | 22.6Ω | 100Ω | 1.1KΩ | 10KΩ | 332KΩ | 1MΩ |
| Code | 5R60 | 10R0 | 22R6 | 1000 | 1101 | 1002 | 3323 | 1004 |

Storage Conditions:**Environment Conditions:**

Products should be stored under the following environment conditions.

- Temperature: +5 to +35°C
- Humidity: 45 to 85% relative humidity
- Do not keep products in environments where they may be subject to particulate contamination or harmful gases such as sulfuric acid or hydrogen chloride as it may cause oxidization on electrodes, resulting in poor solderability.
- Products should be stored in a space that does not expose it to high temperatures, vibration, or direct sunlight.
- Products should be stored in the original airtight packaging until use.