



**THE DATASHEET OF
CR0603-FX-4532ELF**





Features

- RoHS compliant*
- Tight tolerance of bottom electrode width
- 1 % and 5 % tolerance options
- Three layer termination process with nickel barrier helps prevent leaching and provides excellent solderability
- Tape and reel packaging

Additional Information

Click these links for more information:



CR Series - Thick Film Chip Resistors

Electrical Characteristics

| Characteristic | Model No. | | | | | | | |
|---|-----------------------------|--------------------------------|--------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| | CR01005 | CR0201 | CR0402 | CR0603 | CR0805 | CR1206 | CR2010 | CR2512 |
| Power Rating @ 70 °C | 1/32 W | 1/20 W | 1/16 W | 1/10 W | 1/8 W | 1/4 W | 1/2 W | 1 W |
| Operating Temp. Range | -55 °C to +125 °C | | | -55 °C to +155 °C | | | | |
| Derated to Zero Load @ | +125 °C | | | +155 °C | | | | |
| Max. Working Voltage | 15 V | 30 V | 50 V | 75 V | 150 V | 200 V | 200 V | 200 V |
| Max. Overload Voltage | 30 V | 50 V | 100 V | 150 V | 300 V | 400 V | 400 V | 400 V |
| Resistance Tolerance | ±1 %, ±5 % | | | | | | | |
| Temperature Coefficient ±1 % (E24 & E96 Series) | 10 Ω≤R<100 Ω ±300 ppm/°C | 1 Ω≤R<10 Ω -200~+600 ppm/°C | 1 Ω≤R<10 Ω -200~+500 ppm/°C | 1 Ω≤R<10 Ω ±200 ppm/°C | 1 Ω≤R<10 Ω ±200 ppm/°C | 1 Ω≤R<10 Ω ±200 ppm/°C | 1 Ω≤R<10 Ω ±200 ppm/°C | 1 Ω≤R<10 Ω ±200 ppm/°C |
| | 100 Ω≤R<1 MΩ ±200 ppm/°C | 10 Ω≤R≤3 MΩ ±200 ppm/°C | 10 Ω≤R≤1 MΩ ±100 ppm/°C | 10 Ω≤R≤1 MΩ ±100 ppm/°C | 10 Ω≤R≤1 MΩ ±100 ppm/°C | 10 Ω≤R≤1 MΩ ±100 ppm/°C | 10 Ω≤R≤1 MΩ ±100 ppm/°C | 10 Ω≤R≤1 MΩ ±100 ppm/°C |
| Temperature Coefficient ±5 % (E24 Series) | 10 Ω≤R<100 Ω ±300 ppm/°C | 1 Ω≤R<10 Ω -200~+600 ppm/°C | 1 Ω≤R<10 Ω -200~+500 ppm/°C | 1 Ω≤R<10 Ω ±400 ppm/°C | 1 Ω≤R<10 Ω ±400 ppm/°C | 1 Ω≤R<10 Ω ±400 ppm/°C | 1 Ω≤R<10 Ω ±400 ppm/°C | 1 Ω≤R<10 Ω ±400 ppm/°C |
| | 100 Ω≤R≤1 MΩ ±200 ppm/°C | 10 Ω≤R≤10 MΩ ±200 ppm/°C | 10 Ω≤R≤10 MΩ ±200 ppm/°C | 10 Ω≤R≤10 MΩ ±200 ppm/°C | 10 Ω≤R≤10 MΩ ±200 ppm/°C | 10 Ω≤R≤10 MΩ ±200 ppm/°C | 10 Ω≤R≤10 MΩ ±200 ppm/°C | 10 Ω≤R≤10 MΩ ±200 ppm/°C |
| Zero Ohm Jumper | 50 milliohms max. | | | | | | | |
| Rated Current | 0.5 A | | 1 A | | | 2 A | | |
| Max. Overload Current | 1 A | | 2.5 A | | | 5 A | | |

Environmental Characteristics

Moisture Sensitivity Level..... 1



WARNING
Cancer and Reproductive Harm
www.P65Warnings.ca.gov

*RoHS Directive 2015/863, Mar 31, 2015 and Annex.
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CR Series - Thick Film Chip Resistors

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Product Dimensions

| Model | L | W | C | D | T |
|---------|--|---|---|---|--|
| CR01005 | $\frac{0.40 \pm 0.02}{(.016 \pm .0008)}$ | $\frac{0.20 \pm 0.03}{(.008 \pm .001)}$ | $\frac{0.10 \pm 0.03}{(.004 \pm .001)}$ | $\frac{0.10 \pm 0.03}{(.004 \pm .001)}$ | $\frac{0.13 \pm 0.02}{(.009 \pm .0008)}$ |
| CR0201 | $\frac{0.60 \pm 0.03}{(.024 \pm .001)}$ | $\frac{0.30 \pm 0.03}{(.012 \pm .001)}$ | $\frac{0.10 \pm 0.05}{(.004 \pm .002)}$ | $\frac{0.15 \pm 0.05}{(.006 \pm .002)}$ | $\frac{0.23 \pm 0.03}{(.009 \pm .001)}$ |
| CR0402 | $\frac{1.00 \pm 0.05}{(.039 \pm .002)}$ | $\frac{0.50 \pm 0.05}{(.020 \pm .002)}$ | $\frac{0.20 \pm 0.10}{(.008 \pm .004)}$ | $\frac{0.25 \pm 0.10}{(.010 \pm .004)}$ | $\frac{0.32 \pm 0.05}{(.013 \pm .002)}$ |
| CR0603 | $\frac{1.60 \pm 0.10}{(.063 \pm .004)}$ | $\frac{0.80 \pm 0.10}{(.031 \pm .004)}$ | $\frac{0.30 \pm 0.20}{(.012 \pm .008)}$ | $\frac{0.30 \pm 0.20}{(.012 \pm .008)}$ | $\frac{0.45 \pm 0.10}{(.018 \pm .004)}$ |
| CR0805 | $\frac{2.00 \pm 0.10}{(.079 \pm .004)}$ | $\frac{1.25 \pm 0.10}{(.049 \pm .004)}$ | $\frac{0.40 \pm 0.20}{(.016 \pm .008)}$ | $\frac{0.40 \pm 0.20}{(.016 \pm .008)}$ | $\frac{0.50 \pm 0.10}{(.020 \pm .004)}$ |
| CR1206 | $\frac{3.10 \pm 0.10}{(.122 \pm .004)}$ | $\frac{1.55 \pm 0.10}{(.061 \pm .004)}$ | $\frac{0.50 \pm 0.30}{(.020 \pm .012)}$ | $\frac{0.40 \pm 0.20}{(.016 \pm .008)}$ | $\frac{0.55 \pm 0.10}{(.022 \pm .004)}$ |
| CR2010 | $\frac{5.00 \pm 0.15}{(.197 \pm .006)}$ | $\frac{2.50 \pm 0.15}{(.098 \pm .006)}$ | $\frac{0.60 \pm 0.30}{(.024 \pm .012)}$ | $\frac{0.50 \pm 0.25}{(.020 \pm .010)}$ | $\frac{0.60 \pm 0.10}{(.024 \pm .004)}$ |
| CR2512 | $\frac{6.30 \pm 0.20}{(.248 \pm .008)}$ | $\frac{3.20 \pm 0.20}{(.126 \pm .008)}$ | $\frac{0.60 \pm 0.30}{(.024 \pm .012)}$ | $\frac{0.50 \pm 0.25}{(.020 \pm .010)}$ | $\frac{0.60 \pm 0.10}{(.024 \pm .004)}$ |



DIMENSIONS: $\frac{\text{MM}}{\text{(INCHES)}}$

Recommended Pad Layout

| Model | a | b | c |
|---------|---|---|---|
| CR01005 | $\frac{0.15 \sim 0.20}{(.006 \sim .008)}$ | $\frac{0.50 \sim 0.70}{(.020 \sim .028)}$ | $\frac{0.20 \sim 0.25}{(.008 \sim .010)}$ |
| CR0201 | $\frac{0.25 \sim 0.30}{(.010 \sim .012)}$ | $\frac{0.70 \sim 0.90}{(.028 \sim .035)}$ | $\frac{0.30 \sim 0.40}{(.012 \sim .016)}$ |
| CR0402 | $\frac{0.50 \sim 0.60}{(.020 \sim .024)}$ | $\frac{1.40 \sim 1.60}{(.055 \sim .063)}$ | $\frac{0.40 \sim 0.60}{(.012 \sim .024)}$ |
| CR0603 | $\frac{0.70 \sim 0.90}{(.028 \sim .035)}$ | $\frac{2.00 \sim 2.20}{(.079 \sim .087)}$ | $\frac{0.80 \sim 1.00}{(.031 \sim .039)}$ |
| CR0805 | $\frac{1.00 \sim 1.40}{(.039 \sim .055)}$ | $\frac{3.20 \sim 3.80}{(.126 \sim .150)}$ | $\frac{0.90 \sim 1.40}{(.035 \sim .055)}$ |
| CR1206 | $\frac{2.00 \sim 2.40}{(.079 \sim .094)}$ | $\frac{4.40 \sim 5.00}{(.173 \sim .197)}$ | $\frac{1.20 \sim 1.80}{(.047 \sim .071)}$ |
| CR2010 | $\frac{3.30 \sim 3.70}{(.130 \sim .146)}$ | $\frac{5.70 \sim 6.50}{(.224 \sim .256)}$ | $\frac{2.30 \sim 3.50}{(.091 \sim .138)}$ |
| CR2512 | $\frac{3.60 \sim 4.00}{(.142 \sim .157)}$ | $\frac{7.60 \sim 8.60}{(.299 \sim .339)}$ | $\frac{2.30 \sim 3.50}{(.091 \sim .138)}$ |



DIMENSIONS: $\frac{\text{MM}}{\text{(INCHES)}}$

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CR Series - Thick Film Chip Resistors



Soldering Profile



Derating Curve



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CR Series - Thick Film Chip Resistors



Performance Characteristics

| Test | Procedure (IEC 60115-1) | Test Limits ΔR |
|---------------------------------|---|--|
| Short Time Overload | 2.5 x rated voltage for 5 seconds | $\leq \pm (1 \% + 0.05 \Omega)$ <i>Remarks:</i> CR01005, CR0201 $\pm (3 \% + 0.1 \Omega)$ CR0402 $\pm (2 \% + 0.1 \Omega)$ 0 Ω Jumper 50 m Ω or less |
| Intermittent Overload | 3.0 x rated voltage or max. overloading voltage, 1 sec. "ON", 25 sec. "OFF", 10,000 cycles <i>Remarks:</i> CR01005, CR0201 not applicable CR0402 2.5 x rated continuous working voltage | 1 %: $\leq \pm (1 \% + 0.05 \Omega)$ 5 %: $\leq \pm (3 \% + 0.1 \Omega)$ <i>Remarks:</i> CR01005, CR0201 $\pm (5 \% + 0.1 \Omega)$ CR0402 $\pm (3 \% + 0.1 \Omega)$ 0 Ω Jumper 100 m Ω or less |
| Load Life | 1000 hours at rated voltage, 70 °C , 1.5 hours "ON", 0.5 hour "OFF" | 1 %: $\leq \pm (1 \% + 0.05 \Omega)$ 5 %: $\leq \pm (3 \% + 0.1 \Omega)$ <i>Remarks:</i> CR01005, CR0201 $\pm (5 \% + 0.1 \Omega)$ CR0402 $\pm (3 \% + 0.1 \Omega)$ 0 Ω Jumper 100 m Ω or less |
| Load Life Humidity | 1000 hours at rated voltage , 40 \pm 2 °C, 90~95 % RH 1.5 hours "ON", 0.5 hour "OFF" | 1 %: $\leq \pm (1 \% + 0.05 \Omega)$ 5 %: $\leq \pm (3 \% + 0.1 \Omega)$ <i>Remarks:</i> CR01005, CR0201 $\pm (5 \% + 0.1 \Omega)$ CR0402 $\pm (3 \% + 0.1 \Omega)$ 0 Ω Jumper 100 m Ω or less |
| Rapid Change of Temperature | -55 °C (30 min.) / +155 °C (30 min.) 5 cycles | 1 %: $\leq \pm (0.5 \% + 0.05 \Omega)$ 5 %: $\leq \pm (1 \% + 0.05 \Omega)$ <i>Remarks:</i> CR01005, CR0201 $\pm (3 \% + 0.1 \Omega)$ 0 Ω Jumper 50 m Ω or less |
| Resistance to Solder Heat | 270 \pm 5 °C, 10 \pm 1 sec. | 1 %: $\leq \pm (0.5 \% + 0.05 \Omega)$ 5 %: $\leq \pm (1 \% + 0.05 \Omega)$ <i>Remarks:</i> CR01005 $\pm (3 \% + 0.05 \Omega)$ CR0201 $\pm (3 \% + 0.1 \Omega)$ 0 Ω Jumper 50 m Ω or less |
| Solderability | 245 \pm 5 °C solder, 2 \pm 0.5 seconds dwell Solder: Sn96.5 / Ag3.0 / Cu0.5 | Over 95 % of termination must be covered with solder |
| Resistance to Dry Heat | 155 \pm 5 °C for 96 \pm 4 hours <i>Remarks:</i> CR0201 125 \pm 5 °C | 1 %: $\leq \pm (1 \% + 0.05 \Omega)$ 5 %: $\leq \pm (1 \% + 0.05 \Omega)$ <i>Remarks:</i> CR01005, CR0201 $\pm (1 \% + 0.1 \Omega)$ 0 Ω Jumper 50 m Ω or less |
| Bending | 3 mm deflection <i>Remarks:</i> CR2010, CR2512 2 mm deflection | 1 %: $\leq \pm (0.5 \% + 0.05 \Omega)$ 5 %: $\leq \pm (2 \% + 0.1 \Omega)$ <i>Remarks:</i> CR01005, CR0201 $\pm (3 \% + 0.1 \Omega)$ CR0402 $\pm (2 \% + 0.1 \Omega)$ 0 Ω Jumper 50 m Ω or less |
| Dielectric Withstanding Voltage | 500 V, 1 minute <i>Remarks:</i> CR01005, CR0201 50 V CR0402 300 V | No abnormalities such as flashover, burning or dielectric breakdown shall appear |
| Insulation Resistance | 100 V, 1 minute <i>Remarks:</i> CR0201 50 V | ≥ 1 G Ω <i>Remarks:</i> CR01005 ≥ 100 M Ω) |

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CR Series - Thick Film Chip Resistors

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How to Order

CR 1206 - F X - 1003 E LF

Model

(CR = Chip Resistor)

Size

01005 = 01005 size
0201 = 0201 size
0402 = 0402 size
0603 = 0603 size
0805 = 0805 size
1206 = 1206 size
2010 = 2010 size
2512 = 2512 size

Resistance Tolerance

F = $\pm 1\%$
J = $\pm 5\%$

TCR (ppm/°C) – See Electrical Characteristics Chart

X = ± 100
W = ± 200
V = ± 300
Z = ± 400
/ = Used for zero Ω (jumper) and values from 1 Ω through 9.76 Ω .

Resistance Value

For 1 % Tolerance:

<100 Ω "R" represents decimal point (example: 24R3 = 24.3 Ω).
 $\geq 100 \Omega$ First three digits are significant, fourth digit represents number of zeros to follow (example: 8252 = 82.5K Ω).

For 5 % Tolerance:

<10 Ω "R" represents decimal point (example: 4R7 = 4.7 Ω).
 $\geq 10 \Omega$ First two digits are significant, third digit represents number of zeros to follow (example: 474 = 470K Ω ; 000 = Jumper).

Packaging

G = Paper Tape (10,000 pcs.) on 7-inch Plastic Reel – CR01005, CR0201, CR0402
E = Paper Tape (5,000 pcs.) on 7-inch Plastic Reel – CR0603, CR0805, CR1206 or
Embossed Tape (4,000 pcs) on 7-inch Plastic Reel – CR2010, CR2512

Termination

LF = Tin-plated (RoHS Compliant)

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CR Series - Thick Film Chip Resistors

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EIA-96 Marking for CR0603, 1 %

| Code | R Value | Code | R Value | Code | R Value | Code | R Value |
|------|---------|------|---------|------|---------|------|---------|
| 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 |

Multipliers

| Code | A | B | C | D | E | F | G | H | X | Y | Z |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|
| Multiplier | 10 ⁰ | 10 ¹ | 10 ² | 10 ³ | 10 ⁴ | 10 ⁵ | 10 ⁶ | 10 ⁷ | 10 ⁻¹ | 10 ⁻² | 10 ⁻³ |

Marking Explanation

0Ω JUMPER:



CR1005, CR0201, CR0402:

No marking.



CR0603, CR0805, CR1206, CR2010, CR2512:

- E-24: 3 digits; first two digits are significant, third digit is number of zeros to follow.

Letter R is decimal point.



(Value = 10K Ω)

- E-96: 4 digits; first three digits are significant, fourth digit is number of zeros to follow.

Letter R is decimal point.



(Value = 44.2K Ω)

- CR0603 E-96: EIA-96 marking (see table).



(Value = 12.4K Ω)

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CR Series - Thick Film Chip Resistors



Packaging Dimensions (Conforms to EIA RS-481A)



| Model | Tape Type | A | B | W | F | E | P1 | P2 | P0 | T |
|---------|----------------------------------|---|---|--|---|---|---|---|---|---|
| CR01005 | Paper Tape (2 mm pitch) | $\frac{0.24 \pm 0.05}{(.010 \pm .002)}$ | $\frac{0.45 \pm 0.10}{(.018 \pm .004)}$ | $\frac{8.00 \pm 0.20}{(.315 \pm .008)}$ | $\frac{3.50 \pm 0.05}{(.138 \pm .002)}$ | $\frac{1.75 \pm 0.10}{(.069 \pm .004)}$ | $\frac{2.00 \pm 0.10}{(.079 \pm .004)}$ | $\frac{2.00 \pm 0.05}{(.079 \pm .002)}$ | $\frac{4.00 \pm 0.10}{(.157 \pm .004)}$ | $\frac{0.15 \pm 0.10}{(.006 \pm .004)}$ |
| CR0201 | Paper Tape (2 mm pitch) | $\frac{0.37 \pm 0.05}{(.014 \pm .002)}$ | $\frac{0.67 \pm 0.10}{(.026 \pm .004)}$ | | | | | | | $\frac{0.37 \pm 0.10}{(.015 \pm .004)}$ |
| CR0402 | | $\frac{0.70 \pm 0.05}{(.028 \pm .002)}$ | $\frac{1.20 \pm 0.05}{(.047 \pm .002)}$ | | | | | | | $\frac{0.45 \pm 0.10}{(.018 \pm .004)}$ |
| CR0603 | Paper Tape (4 mm pitch) | $\frac{1.10 \pm 0.10}{(.043 \pm .004)}$ | $\frac{1.90 \pm 0.10}{(.075 \pm .004)}$ | | | | | | | $\frac{0.64 \pm 0.10}{(.025 \pm .004)}$ |
| CR0805 | | $\frac{1.60 \pm 0.15}{(.063 \pm .006)}$ | $\frac{2.40 \pm 0.20}{(.094 \pm .008)}$ | $\frac{0.84 \pm 0.10}{(.033 \pm .004)}$ | | | | | | |
| CR1206 | | $\frac{2.00 \pm 0.15}{(.079 \pm .006)}$ | $\frac{3.60 \pm 0.20}{(.142 \pm .008)}$ | $\frac{0.84 \pm 0.10}{(.033 \pm .004)}$ | | | | | | |
| CR2010 | Embossed Tape (4 mm pitch) | $\frac{2.80 \pm 0.20}{(.110 \pm .008)}$ | $\frac{5.30 \pm 0.20}{(.209 \pm .008)}$ | $\frac{12.00 \pm 0.20}{(.472 \pm .008)}$ | $\frac{5.50 \pm 0.05}{(.217 \pm .002)}$ | | | | | $\frac{0.85 \pm 0.15}{(.033 \pm .006)}$ |
| CR2512 | | $\frac{3.60 \pm 0.20}{(.142 \pm .008)}$ | $\frac{6.90 \pm 0.20}{(.272 \pm .008)}$ | | | | | | | $\frac{0.85 \pm 0.15}{(.033 \pm .006)}$ |

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CR Series - Thick Film Chip Resistors

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Packaging Dimensions (Conforms to EIA RS-481A)



| Model | Packaging Quantity | A | B | C | W | T |
|---------|--------------------|--|---------------------------------------|--|--|--|
| CR01005 | 10K pcs./reel | $\frac{178 \pm 2.0}{(7.008 \pm .079)}$ | $\frac{60 \pm 1.0}{(2.362 \pm .039)}$ | $\frac{13.0 \pm 1.0}{(.512 \pm .039)}$ | $\frac{9.0 \pm 1.0}{(.354 \pm .039)}$ | $\frac{11.5 \pm 1.0}{(.453 \pm .039)}$ |
| CR0201 | | | | | | |
| CR0402 | | | | | | |
| CR0603 | 5K pcs./reel | | | | | |
| CR0805 | | | | | | |
| CR1206 | | | | | | |
| CR2010 | 4K pcs./reel | | | | $\frac{13.0 \pm 1.0}{(.512 \pm .039)}$ | $\frac{15.5 \pm 1.0}{(.610 \pm .039)}$ |
| CR2512 | | | | | | |

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