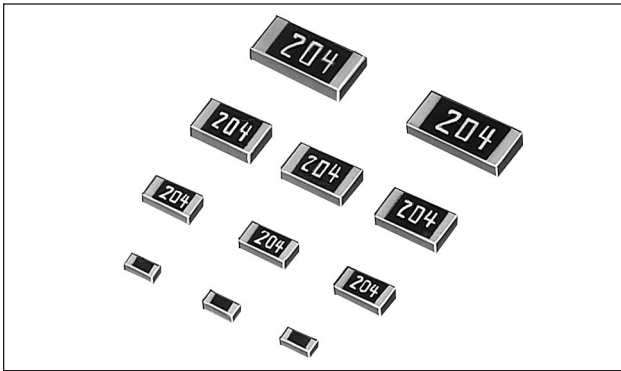


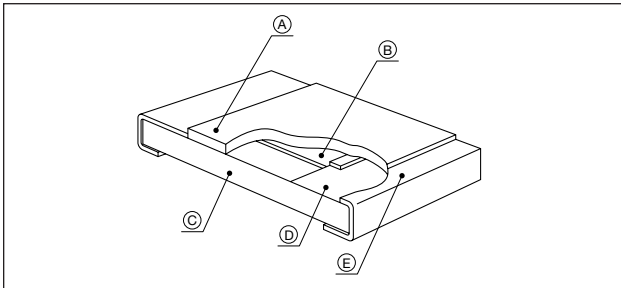
Thick Film Chip Resistors



CR, CJ Series



STRUCTURE AND MATERIAL



| Code | Structure | Material |
|------|-------------|---|
| A | Coating | Glass or Epoxy |
| B | Resistor | RuO ₂ Resistor (The same material of Termination for chip jumper) |
| C | Substrate | 96% Alumina |
| D | Termination | Silver |
| E | Plating | (Ni, Sn-Pb) Plating |

FEATURES

- Low Noise
- Nickel Barrier Terminations

APPLICATION

- General Purpose

HOW TO ORDER

CR 05 - 472 J - H

Packaging

- T = 7" Reel/Punched Paper Tape (5,000 pcs/reel) except CR05
- H = 7" Reel/Punched Paper Tape (10,000 pcs/reel, 2mm pitch taping) CR05 and CR10
- D = 10" Reel/Punched Paper Tape (10,000 pcs/reel) CR32, CR21, CR10
- K = 13" Reel/Punched Paper Tape (20,000 pcs/reel) except CR05 (optional)

Resistance Tolerance

- D = ±0.5% J = ±5%
- F = ±1% Blank = Jumper Chips

Resistance Value (3 digits or 4 digits)

Example: 562 = $56 \times 10^2 = 5600\Omega$
 4021 = $402 \times 10^1 = 4020\Omega$
 Chip Jumper = 000

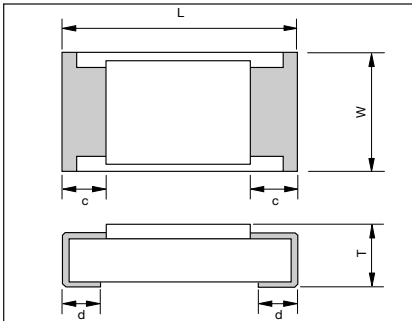
Size (EIA)

- 05 = 0402 21 = 0805
- 10 = 0603 32 = 1206

Series

CR = Resistor CJ = Jumper

DIMENSIONS



millimeters (inches)

| | CR05, CJ05 (0402) | CR10, CJ10 (0603) | CR21, CJ21 (0805) | CR32, CJ32 (1206) |
|---|----------------------------|---|---|---|
| W | 0.50±0.05 (0.020±0.002) | 0.80 ^{+0.18} _{-0.004} (0.031 ^{+0.009} _{-0.004}) | 1.25 ^{+0.18} _{-0.009} (0.050 ^{+0.009} _{-0.009}) | 1.55 ^{+0.18} _{-0.009} (0.061 ^{+0.009} _{-0.009}) |
| L | 1.00±0.05 (0.039±0.002) | 1.60±0.10 (0.063±0.004) | 2.00±0.10 (0.080±0.004) | 3.10±0.10 (0.122±0.004) |
| C | 0.20±0.15 (0.008±0.006) | 0.25±0.20 (0.010±0.008) | 0.35±0.20 (0.014±0.008) | 0.45±0.20 (0.018±0.008) |
| d | 0.20±0.10 (0.008±0.004) | 0.20 ^{+0.20} _{-0.008} (0.008 ^{+0.008} _{-0.008}) | 0.40±0.20 (0.016±0.008) | 0.45±0.20 (0.018±0.008) |
| T | 0.35±0.05 (0.014±0.002) | 0.50±0.10 (0.020±0.004) | 0.55±0.10 (0.022±0.004) | 0.55 ^{+0.10} _{-0.004} (0.022 ^{+0.010} _{-0.004}) |

SPECIFICATIONS

| Series | CR05 (0402) | CR10 (0603) | CR21 (0805) | CR32 (1206) |
|------------------------|------------------------------------|--|--|--|
| Rated Power | 0.0625 (1/16) W | 0.10 (1/10) W | 0.125 (1/8) W | 0.25 (1/4) W |
| Max. Working Voltage | 50V | 50V | 100V | 200V |
| Resistance Tolerance | F = ±1% J = ±5% | D = ±0.5% F = ±1% J = ±5% | D = ±0.5% F = ±1% J = ±5% | D = ±0.5% F = ±1% J = ±5% |
| Resistance Value Range | 10Ω to 1MΩ : F 1.0Ω to 10MΩ : J | 10Ω to 1MΩ : D 10Ω to 1MΩ : F 1.0Ω to 10MΩ : J | 10Ω to 1MΩ : D 10Ω to 1MΩ : F 1.0Ω to 10MΩ : J | 10Ω to 1MΩ : D 10Ω to 1MΩ : F 1.0Ω to 10MΩ : J |
| Working Temperature | -55 to +125°C | -55 to +125°C | -55 to +125°C | -55 to +125°C |

Thick Film Chip Resistors



CR, CJ Series

SPECIFICATIONS

CJ Series

| Part Number | CJ05, CJ10, CJ21 (0402, 0603, 0805 Type) | CJ32 (1206 Type) |
|---------------------|---|---------------------|
| Rated Current | 1A (70°C) | 2A (70°C) |
| Resistivity | 50mΩ max. | 50mΩ max. |
| Working Temperature | -55 to +125°C | -55 to +125°C |

HOW TO CALCULATE RATED VOLTAGE

$$E = \sqrt{P \cdot R}$$

E = Rated Voltage (V)

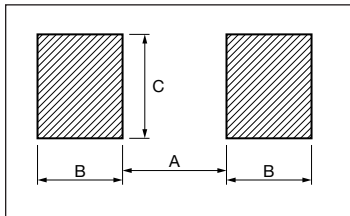
P = Rated Power (W)

R = Standard Resistance Value (Ω)

Rated voltage should be lower than max. working voltage.

RECOMMENDED LAND PATTERN

millimeters (inches)



| EIA Size | 0402 | 0603 | 0805 | 1206 |
|----------|-----------------|-----------------|-----------------|-----------------|
| A | 0.50 (0.020) | 0.80 (0.031) | 1.00 (0.039) | 2.00 (0.079) |
| B | 0.40 (0.016) | 0.70 (0.028) | 0.80 (0.031) | 0.80 (0.031) |
| C | 0.50 (0.020) | 0.80 (0.031) | 1.20 (0.047) | 1.50 (0.059) |

MARKING

Marking available as follows:

Series: CR32, CJ32, CR21, CJ21, CR10, CJ10

3 digit indication

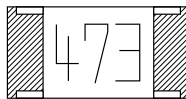
Example: 473=47x10³ = 47000 Ω = 47 kΩ

0 = 0 Ω (Jumper)

100 = 10 Ω

102 = 1 kΩ

105 = 1 MΩ



Series: CR05 and CJ05 - No marking

Note: On CR32 4 digit marking is standard for ±1% and ±0.5% tolerances.

STANDARD RESISTANCE VALUE

| E24 | 1.0 | 1.1 | 1.2 | 1.3 | 1.5 | 1.6 | 1.8 | 2.0 | 2.2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 2.4 | 2.7 | 3.0 | 3.3 | 3.6 | 3.9 | 4.3 | 4.7 | 5.1 |
| | 5.6 | 6.2 | 6.8 | 7.5 | 8.2 | 9.1 | | | |

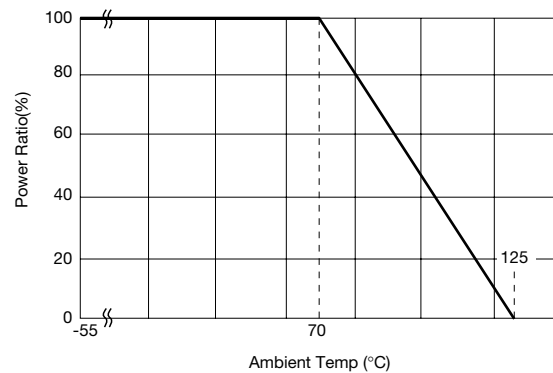
For ±1% and ±.5% Tolerance

| E96 | 10.0 | 10.2 | 10.5 | 10.7 | 11.0 | 11.3 | 11.5 | 11.8 | 12.1 | 12.4 |
|-----|------|------|------|------|------|------|------|------|------|------|
| | 12.7 | 13.0 | 13.3 | 13.7 | 14.0 | 14.3 | 14.7 | 15.0 | 15.4 | 15.8 |
| | 16.2 | 16.5 | 16.9 | 17.4 | 17.8 | 18.2 | 18.7 | 19.1 | 19.6 | 20.0 |
| | 20.5 | 21.0 | 21.5 | 22.1 | 22.6 | 23.2 | 23.7 | 24.3 | 24.9 | 25.5 |
| | 26.1 | 26.7 | 27.4 | 28.0 | 28.7 | 29.4 | 30.1 | 30.9 | 31.6 | 32.4 |
| | 33.2 | 34.0 | 34.8 | 35.7 | 36.5 | 37.4 | 38.3 | 39.2 | 40.2 | 41.2 |
| | 42.2 | 43.2 | 44.2 | 45.3 | 46.4 | 47.5 | 48.7 | 49.9 | 51.1 | 52.3 |
| | 53.6 | 54.9 | 56.2 | 57.6 | 59.0 | 60.4 | 61.9 | 63.4 | 64.9 | 66.5 |
| | 68.1 | 69.8 | 71.5 | 73.2 | 75.0 | 76.8 | 78.7 | 80.6 | 82.5 | 84.5 |
| | 86.6 | 88.7 | 90.9 | 93.1 | 95.3 | 97.6 | | | | |

DERATING CURVE

Rated power should be reduced as below when temperature become higher.

Under high temperature, power derated as follows:

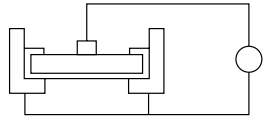


Chip Resistor Arrays



CR, CJ, CRA, CRB, CRC Series - Test Conditions

ELECTRICAL CHARACTERISTICS

| Item | Standard | | Test Conditions | | | | | | | |
|--|--|--|--|--|---|--------------|--------------------------------------|--|---|---|
| | Resistor | Jumper | Resistor | Jumper | | | | | | |
| DC Resistance | Within Initial Tolerance | | Power Condition A (20°C, 65% RH) | | | | | | | |
| Temperature Characteristics | <table border="1"> <thead> <tr> <th>Resistance (Ω)</th> <th>TCR (ppm/°C)</th> </tr> </thead> <tbody> <tr> <td>D, F 10 ≤ R ≤ 1M</td> <td>-100 to +100</td> </tr> <tr> <td>J R < 10 10 ≤ R ≤ 1M 1M < R</td> <td>-100 to +600 -200 to +200 -500 to +300</td> </tr> </tbody> </table> | | Resistance (Ω) | TCR (ppm/°C) | D, F 10 ≤ R ≤ 1M | -100 to +100 | J R < 10 10 ≤ R ≤ 1M 1M < R | -100 to +600 -200 to +200 -500 to +300 | / | Test Temperature: 25, 125(°C) $\Delta R/R = R_2 - R_1 / R_1 \times 1 / T_2 - T_1 \times 10^6$ $\Delta R/R = \text{Temp. Coefficient (ppm/°C)}$ $T_1 = 25(°C)$ $T_2 = 125(°C)$ $R_1 = T_1 \text{ Resistance at } (\Omega)$ $R_2 = T_2 \text{ Resistance at } (\Omega)$ |
| | Resistance (Ω) | TCR (ppm/°C) | | | | | | | | |
| D, F 10 ≤ R ≤ 1M | -100 to +100 | | | | | | | | | |
| J R < 10 10 ≤ R ≤ 1M 1M < R | -100 to +600 -200 to +200 -500 to +300 | | | | | | | | | |
| Short-time Overload | $\Delta R/R$ $\pm(2.0\% + 0.10\Omega)$ max. of the initial value | 50m Ω max. | (1) Apply 2.0 x rated voltage for 5 sec. (2.5 x rated voltage for Arrays) (2) Wait 30 minutes (3) Measure resistance CR05 = 50V max. CR10 = 100V max. CR21 = 200V max. CR32 = 400V max. CRA, CRB, CRC = 100V max. | | | | | | | |
| Intermittent Overload | Visual | No evidence of mechanical damage intermittent overload | | (1) 2A for 5 sec. (2) Wait 30 minutes (3) Measure resistance | | | | | | |
| | $\Delta R/R$ | $\pm(5\% + 0.1\Omega)$ max. of the initial value | 50m Ω max. | | (1) Perform 10,000 voltage cycles as follows: ON (2.0 x rated voltage, 2.5 x for Arrays) 1 sec. OFF 25 sec. (2) Stabilization time 30 min. without loading (3) Measure resistance CR05 = 50V max. CR10 = 150V max. CR21 = 200V max. CR32 = 400V max. CRA, CRB, CRC = 100V max. | | | | | |
| Dielectric Withstanding Voltage | No evidence of mechanical damage | | Apply 500 VAC for 1 min. (CR10 300 VAC) (CR05, CRA, CRB, CRC 300 VAC/1 sec.) | | | | | | | |
| Insulation Resistance | <ul style="list-style-type: none"> • CR05, CJ05 = 10⁹Ω min. • CR10, CJ10 = 10⁹Ω min. • CR21, CJ21 = 10¹⁰Ω min. • CR32, CJ32 = 10¹²Ω min. • CRA, CRB, CRC = 10⁹Ω min. | |  <p>Apply 500V DC (CR05, CRA, CRB, CRC 100V DC)</p> | | | | | | | |

Chip Resistor Arrays



CR, CJ, CRA, CRB, CRC Series - Test Conditions

MECHANICAL CHARACTERISTICS

| Item | | Standard | | Test Conditions | |
|---------------------------|--------------|---|-------------------|--|--------|
| | | Resistor | Jumper | Resistor | Jumper |
| Terminal Strength | $\Delta R/R$ | $\pm(1\%+0.05\Omega)$ max. of the initial value | 50m Ω max. | Apply the load as shown: Measure resistance during load application | |
| | Visual | No evidence of mechanical damage after loading | | | |
| Soldering Heat Resistance | $\Delta R/R$ | $\pm(1\%+0.05\Omega)$ max. of the initial value | 50m Ω max. | Immerse into molten solder at $260\pm 5^\circ\text{C}$ for 10 ± 1 sec. Stabilize component at room temperature for 1 hr. Measure resistance. | |
| | Visual | No evidence of leaching | | | |
| Solderability | | Coverage $\geq 95\%$ each termination end | | Immerse in Rogin Flux for 2 ± 0.5 sec. and in SN62 solder at $235\pm 5^\circ\text{C}$ for 2 ± 0.5 sec. | |
| Anti-Vibration Test | $\Delta R/R$ | $\pm(1\%+0.1\Omega)$ max. of the initial value | 50m Ω max. | 2 hrs. each in X, Y and Z axis. (TTL 6 hrs.) 10 to 55 Hz sweep in 1 min. at 1.5mm amplitude. | |
| | Visual | No evidence of mechanical damage | | | |
| Solvent Resistance | $\Delta R/R$ | $\pm(0.5\%+0.05\Omega)$ max. of the initial value | 50m Ω max. | Immerse in static state butyl acetate at 20°C to 25°C for 30 ± 5 sec. Stabilize component at room temperature for 30 min. then measure value. | |
| | Visual | No evidence of mechanical damage | | | |

ENVIRONMENTAL CHARACTERISTICS

| Item | | Standard | | Test Conditions | |
|--------------------------|--------------|---|-------------------|---|--------|
| | | Resistor | Jumper | Resistor | Jumper |
| Temperature Cycle | $\Delta R/R$ | $\pm(1\%+0.05\Omega)$ max. of the initial value | 50m Ω max. | (1) Run 5 cycles as follows: $-55\pm 3^\circ\text{C}$ for 30 min. $125\pm 3^\circ\text{C}$ for 30 min. Room temp. for 10-15 min. (2) Stabilize component at room temperature for 1 hr. then measure value. | |
| | Visual | No evidence of mechanical damage | | | |
| Low Temperature Storage | $\Delta R/R$ | $\pm(2\%+0.1\Omega)$ max. of the initial value | 50m Ω max. | (1) Dwell in -55°C chamber without loading for 1000^{+48} hrs. (2) Stabilize component at room temperature for 1 hr. then measure value. | |
| | Visual | No evidence of mechanical damage | | | |
| High Temperature Storage | $\Delta R/R$ | $\pm(3\%+0.1\Omega)$ max. of the initial value | 50m Ω max. | (1) Dwell in 125°C chamber without loading for 1000^{+48} hrs. (2) Stabilize component at room temperature for 1 hr. then measure value. | |
| | Visual | No evidence of mechanical damage | | | |
| Moisture Resistance | $\Delta R/R$ | $\pm(3\%+0.1\Omega)$ max. of the initial value | 50m Ω max. | (1) Dwell in temp.: 65°C RH90 to 95% RH chamber without loading for 1000^{+48} hrs. (2) Stabilize component at room temperature for 1 hr. then measure value. | |
| | Visual | No evidence of mechanical damage | | | |
| Life Test | $\Delta R/R$ | $\pm(3\%+0.1\Omega)$ max. of the initial value | 50m Ω max. | (1) Temp.: $70\pm 3^\circ\text{C}$ Voltage: (rated voltage) on 90 min. off 30 min. Duration: 1000^{+48} hrs. (2) Stabilize component at room temperature for 1 hr. then measure value. | |
| | Visual | No evidence of mechanical damage | | | |
| Loading Life in Moisture | $\Delta R/R$ | $\pm(3\%+0.1\Omega)$ max. of the initial value | 50m Ω max. | (1) Temp.: $40\pm 2^\circ\text{C}$ RH: 90-95% Voltage Cycle: on 90 min. (rated voltage) off 30 min. Duration: 1000^{+48} hrs. (2) Stabilize component at room temperature for 1 hr. then measure value. | |
| | Visual | No evidence of mechanical damage | | | |