

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 |

DIMENSIONS



| | CR03, CJ03 (0201) | CR05, CJ05 (0402) | CR10, CJ10 (0603) | CR21, CJ21 (0805) | CR32, CJ32 (1206) |
|---|----------------------------|----------------------------|--|--|--|
| W | 0.30±0.03 (0.012±0.001) | 0.50±0.05 (0.020±0.002) | 0.80 ^{+0.15} _{-0.10} (0.031 ^{+0.008} _{-0.008}) | 1.25 ^{+0.15} _{-0.10} (0.050 ^{+0.008} _{-0.008}) | 1.55 ^{+0.15} _{-0.10} (0.061 ^{+0.008} _{-0.008}) |
| L | 0.60±0.03 (0.024±0.001) | 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 | 0.15±0.10 (0.006±0.004) | 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 | 0.15±0.05 (0.006±0.002) | 0.20±0.10 (0.008±0.004) | 0.20 ^{+0.20} _{-0.15} (0.008 ^{+0.008} _{-0.008}) | 0.40±0.20 (0.016±0.008) | 0.45±0.20 (0.018±0.008) |
| T | 0.23±0.05 (0.009±0.002) | 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} _{-0.05} (0.022 ^{+0.004} _{-0.002}) |

SPECIFICATIONS

| Series | CR03 (0201) | CR05 (0402) | CR10 (0603) | CR21 (0805) | CR32 (1206) |
|------------------------|----------------|------------------------------------|--|--|--|
| Rated Power | 0.050 (1/20) W | 0.0625 (1/16) W | 0.10 (1/10) W | 0.125 (1/8) W | 0.25 (1/4) W |
| Max. Working Voltage | 15V | 50V | 50V | 100V | 200V |
| Resistance Tolerance | J = ±5% | 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 | 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 | -55 to +125°C |

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) CR03 and CR05
- D = 10" Reel/Punched Paper Tape (10,000 pcs/reel) CR32, CR21, CR10

Resistance Tolerance

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

Resistance Value (3 digits or 4 digits)

- Example: 2 significant figures and 1 multiplier
- R indicator decimal or values <10Ω
- Chip Jumper = 000

Size (EIA)

- 03 = 0201 21 = 0805
- 05 = 0402 32 = 1206
- 10 = 0603

Series

- CR = Resistor
- CJ = Jumper

Thick Film Chip Resistors



CR, CJ Series

SPECIFICATIONS

CJ Series

| Part Number | CJ03 | CJ05, CJ10, CJ21 (0402, 0603, 0805 Type) | CJ32 (1206 Type) |
|---------------------|---------------|---|---------------------|
| Rated Current | 0.5A (70°C) | 1A (70°C) | 2A (70°C) |
| Resistivity | 50mΩ max. | 50mΩ max. | 50mΩ max. |
| Working Temperature | -55 to +125°C | -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 | 0201 | 0402 | 0603 | 0805 | 1206 |
|----------|------------------|-----------------|-----------------|-----------------|-----------------|
| A | 0.25 (0.010) | 0.50 (0.020) | 0.80 (0.031) | 1.00 (0.039) | 2.00 (0.079) |
| B | 0.225 (0.009) | 0.40 (0.016) | 0.70 (0.028) | 0.80 (0.031) | 0.80 (0.031) |
| C | 0.30 (0.012) | 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

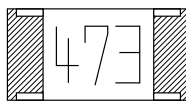
Example: 473=47x10³ = 47000 Ω = 47 kΩ

0 = 0 Ω (Jumper)

100 = 10 Ω

102 = 1 kΩ

105 = 1 MΩ



Series: CR03, CJ03, 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 | | | |

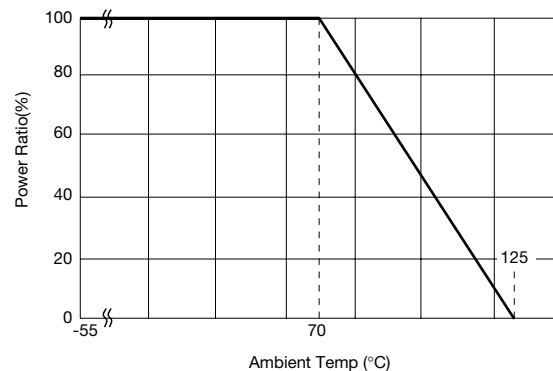
For ±1% and ±.5% Tolerance

| 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:



TEMPERATURE CHARACTERISTICS

| 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 |

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 | | 50mΩ max. | | | | | | | |
| 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, CR05 = F R < 10 10 ≤ R ≤ 1M 1M < R</td> <td>-100 to +600 -250 to +250 -500 to +300</td> </tr> </tbody> </table> | | Resistance (Ω) | TCR (ppm/°C) | *D, F 10 ≤ R ≤ 1M | -100 to +100 | J, CR05 = F R < 10 10 ≤ R ≤ 1M 1M < R | -100 to +600 -250 to +250 -500 to +300 | Power Condition A (20°C, 65% RH) 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, CR05 = F R < 10 10 ≤ R ≤ 1M 1M < R | -100 to +600 -250 to +250 -500 to +300 | | | | | | | | | | |
| Short-time Overload | ΔR/R | ±(2.0%+0.10Ω) max. of the initial value | | 50mΩ max. | | | | | | | |
| | Visual | No evidence of mechanical damage intermittent overload | | (1) Apply 2.0 x rated voltage for 5 sec. (2.5 x rated voltage for Arrays) (2) Wait 30 minutes (3) Measure resistance CR03 = 30V max. CR05 = 50V max. CR10 = 100V max. CR21 = 200V max. CR32 = 400V max. CRA3A, CRB3A, CRC3A = 100V max. | | | | | | | |
| Intermittent Overload | ΔR/R | ±(5%+0.1Ω) max. of the initial value | | 50mΩ max. | | | | | | | |
| | Visual | No evidence of mechanical damage | | (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 CR03 = 30V max. 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, CRA3A, CRB3A, CRC3A 300 VAC/1 sec. CR03 50 VAC/min.) | | | | | | | |
| Insulation Resistance | | <ul style="list-style-type: none"> • CR03, CJ03 = 10⁸Ω min. • CR05, CJ05 = 10⁸Ω min. • CR10, CJ10 = 10⁹Ω min. • CR21, CJ21 = 10¹⁰Ω min. • CR32, CJ32 = 10¹²Ω min. • CRA3A, CRB3A, CRC3A = 10⁹Ω min. | | Apply 500V DC (CR05, CRA3A, CRB3A, CRC3A 100V DC CR03 50 VDC) | | | | | | | |



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 $^{\circ}$ C for 10 \pm 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 \pm 0.5 sec. and in SN62 solder at 235 \pm 5 $^{\circ}$ C for 2 \pm 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 $^{\circ}$ C to 25 $^{\circ}$ C for 30 \pm 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 $^{\circ}$ C for 30 min. 125 \pm 3 $^{\circ}$ 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 $^{\circ}$ 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 $^{\circ}$ 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 $^{\circ}$ 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 $^{\circ}$ 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 $^{\circ}$ 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 | | | |

Packaging of Chip Component

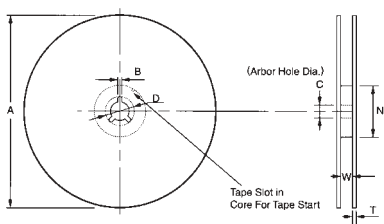


Automatic Insertion Packaging

TAPE AND REEL

REEL DIMENSIONS

millimeters (inches)



| Tape Size | A Max. | B Min. | C | D Min. | N Min. | W | T Max. |
|-----------|-------------|-----------------|----------------------------|-----------------|---------------|----------------------------|-----------------|
| 8mm | 178 (7) | 1.50 (0.059) | 13.0±0.50 (0.512±0.020) | 20.2 (0.795) | 50 (1.969) | 10.0±1.50 (0.394±0.059) | 2.50 (0.098) |
| | 260 (10) | | | | | | |

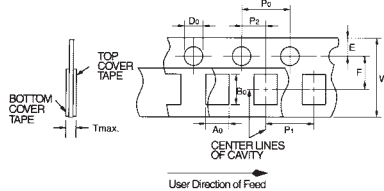
Metric dimensions will govern.
English measurements rounded and for reference only.

millimeters (inches)

PUNCHED TAPE CONFIGURATION 8MM TAPE ONLY

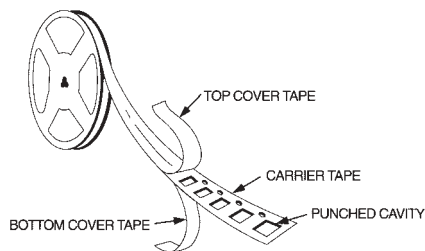
| Tape Size | D ₀ | E | P ₀ | P ₂ | W | F |
|-----------|---|----------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| 8mm | 1.50 ^{+0.10} / _{-0.004} (0.059 ^{+0.004} / _{-0.000}) | 1.75±0.10 (0.069±0.004) | 4.0±0.10 (0.157±0.004) | 2.00±0.05 (0.079±0.002) | 8.00±0.20 (0.135±0.008) | 3.50±0.05 (0.138±0.002) |

VARIABLE DIMENSIONS



| Style | P ₁ | A ₀ | B ₀ | T max. |
|-------------------------|--|----------------------------|----------------------------|-----------------|
| CR/CJ03 CR/CJ05 | 2.00±0.10 (0.079±0.004) | 0.65±0.10 (0.026±0.004) | 1.15±0.10 (0.045±0.004) | 0.60 (0.024) |
| CR/CJ/FR10 | 4.00±0.10 (0.157±0.004) or 2.00±0.10 (0.079±0.004) | 1.10±0.20 (0.043±0.008) | 1.90±0.20 (0.075±0.008) | 1.10 (0.043) |
| CR/CJ/FR21 | 4.00±0.10 (0.157±0.004) | 1.65±0.20 (0.065±0.008) | 2.40±0.20 (0.094±0.008) | |
| CR/CJ/FR32 | | 2.00±0.20 (0.079±0.008) | 3.60±0.20 (0.142±0.008) | |
| CRB1A | | 1.90±0.20 (0.075±0.008) | 1.90±0.20 (0.075±0.008) | |
| CRA3A CRB3A CRC3A | | 2.00±0.20 (0.079±0.008) | 3.60±0.20 (0.142±0.008) | |
| CRB2A | | 2.00±0.10 (0.079±0.004) | 1.25±0.20 (0.049±0.008) | |

PUNCHED CARRIER



RECOMMENDED LAND PATTERNS IS REFERRED THE FOLLOWING FOR EXAMPLE

millimeters (inches)

CRA3A4E Series



RNA4A8E Series



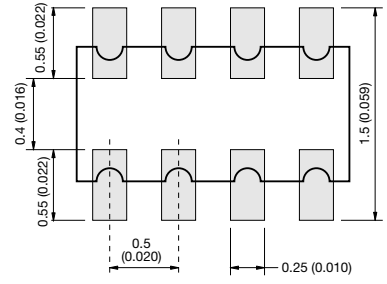
CRB1A2E Series



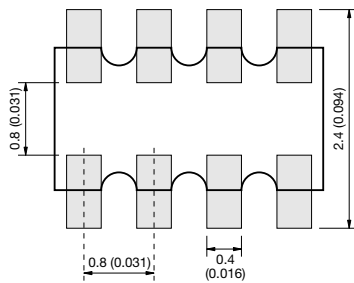
CRB3A4E Series



CRB2A4E Series



CRC3A4E Series



CRC2A4E Series



CRC4A8E Series



CRB6A8E Series



SAMPLE KIT PART NUMBERS

| Part Number | Description |
|------------------------|--|
| CRJ-E6-Kit | Combination 0603, 0805, 1206, 5% parts 21 values per case size 100 pcs. per value (approx.) |
| CR05-E12-Kit | 0402, 5% parts 63 values 100 pcs. per value |
| CR10J-E12-Kit | 0603, 5% parts 63 values 100 pcs. per value (approx.) |
| CR21J-E12-Kit | 0805, 5% parts 63 values 100 pcs. per value (approx.) |
| CR32J-E12-Kit | 1206, 5% parts 63 values 100 pcs. per value (approx.) |
| CR05F-E24-Kit | 0402, 1% parts 63 values 100 pcs. per value |
| CR10F-E24-Kit | 0603, 1% parts 63 values 100 pcs. per value |
| CR-ARRAY-E6-Kit | Arrays, Various styles, CRA, CRB, CRC, RNA, 5% 13 values per style (approx.) 20 pcs. per value |