

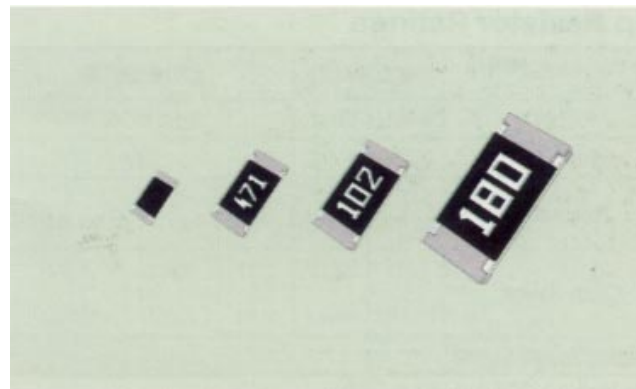
# Thick Film Chip Resistors



## CR05 / CR10 / CR21 / CR32 Series

### Features:

- 1) Wave, IR reflow and vapor phase soldering compatible.
- 2) Wrap-around nickel barrier terminations.
- 3) Suitable size & packaging for surface mount assembly.
- 4) Low noise.



### How To Order:

#### CR 32 – 101 J – T

##### Packaging

- B = Bulk (1,000 pcs/bag)
- 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

- Blank = Jumper
- K =  $\pm 10\%$
- J =  $\pm 5\%$
- G =  $\pm 2\%$
- F =  $\pm 1\%$
- D =  $\pm 0.5\%$

##### Resistance Code

- For G, J, and K Tolerances  
3 digit code (E-24)  
2 significant digits plus  
number of zeros  
Examples:  
2.2 $\Omega$  = 2R2  
10 $\Omega$  = 100  
100 $\Omega$  = 101  
1k $\Omega$  = 102  
0 $\Omega$  = 000 (Jumper)
- For D and F Tolerances  
4 digit code (E-96)  
3 significant digits plus  
number of zeros  
Examples:  
10 $\Omega$  = 10R0  
100 $\Omega$  = 1000  
1k $\Omega$  = 1001

##### Case Size

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

##### Style

- CR = Chip Resistor
- CJ = Zero Ohm Jumper

### Dimensions:

|          | CR05<br>(CJ05)                    | CR10<br>(CJ10)                                     | CR21<br>(CJ21)                                     | CR32<br>(CJ32)                                     |
|----------|-----------------------------------|----------------------------------------------------|----------------------------------------------------|----------------------------------------------------|
| <b>L</b> | 1.00 $\pm$ 0.05 (.039 $\pm$ .002) | 1.60 $\pm$ 0.10 (.063 $\pm$ .004)                  | 2.00 $\pm$ 0.10 (.079 $\pm$ .004)                  | 3.10 $\pm$ 0.10 (.122 $\pm$ .004)                  |
| <b>W</b> | 0.50 $\pm$ 0.05 (.020 $\pm$ .002) | 0.80 $^{+0.15}_{-0.10}$ (.031 $^{+0.06}_{-.004}$ ) | 1.25 $^{+0.15}_{-0.10}$ (.049 $^{+0.06}_{-.004}$ ) | 1.55 $^{+0.15}_{-0.10}$ (.061 $^{+0.06}_{-.004}$ ) |
| <b>T</b> | 0.35 $\pm$ 0.05 (.014 $\pm$ .002) | 0.50 $\pm$ 0.10 (.020 $\pm$ .004)                  | 0.55 $\pm$ 0.10 (.022 $\pm$ .004)                  | 0.55 $^{+0.10}_{-0.05}$ (.022 $^{+0.04}_{-.002}$ ) |
| <b>C</b> | 0.20 $\pm$ 0.15 (.008 $\pm$ .006) | 0.25 $\pm$ 0.20 (.010 $\pm$ .008)                  | 0.35 $\pm$ 0.20 (.014 $\pm$ .008)                  | 0.45 $\pm$ 0.20 (.018 $\pm$ .008)                  |
| <b>D</b> | 0.20 $\pm$ 0.10 (.008 $\pm$ .004) | 0.20 $^{+0.20}_{-0.15}$ (.008 $^{+0.08}_{-.006}$ ) | 0.40 $\pm$ 0.20 (.016 $\pm$ .008)                  | 0.45 $\pm$ 0.20 (.018 $\pm$ .008)                  |

mm (inches)

# Thick Film Chip Resistors



## CR05 / CR10 / CR21 / CR32 Series Performance Characteristics

### Chip Resistor Ratings

| Spec \ Style        | CR05 (0402)        |                    | CR10 (0603)      |                    |                    |             | CR21 (0805)      |                  |                    |                    |                     | CR32 (1206)      |                  |                    |                    |                     |
|---------------------|--------------------|--------------------|------------------|--------------------|--------------------|-------------|------------------|------------------|--------------------|--------------------|---------------------|------------------|------------------|--------------------|--------------------|---------------------|
| Power               | 0.063 (1/16) W     |                    | 0.063 (1/16) W   |                    |                    |             | 0.100 (1/10) W   |                  |                    |                    |                     | 0.125 (1/8) W*   |                  |                    |                    |                     |
| Voltage             | 50V                |                    | 50V              |                    |                    |             | 100V             |                  |                    |                    |                     | 200V             |                  |                    |                    |                     |
| Tolerance           | J<br>(±5%)         | K<br>(±10%)        | F<br>(±1%)       | G<br>(±2%)         | J<br>(±5%)         | K<br>(±10%) | D<br>(±0.5%)     | F<br>(±1%)       | G<br>(±2%)         | J<br>(±5%)         | K<br>(±10%)         | D<br>(±0.5%)     | F<br>(±1%)       | G<br>(±2%)         | J<br>(±5%)         | K<br>(±10%)         |
| Value Range         | 10Ω<br>↓<br>2.2 MΩ | 2.2Ω<br>↓<br>10 MΩ | 10Ω<br>↓<br>1 MΩ | 10Ω<br>↓<br>2.2 MΩ | 1.0Ω<br>↓<br>10 MΩ |             | 10Ω<br>↓<br>1 MΩ | 10Ω<br>↓<br>1 MΩ | 10Ω<br>↓<br>2.2 MΩ | 1.0Ω<br>↓<br>10 MΩ | 0.47Ω<br>↓<br>10 MΩ | 10Ω<br>↓<br>1 MΩ | 10Ω<br>↓<br>1 MΩ | 10Ω<br>↓<br>2.2 MΩ | 1.0Ω<br>↓<br>10 MΩ | 0.36Ω<br>↓<br>10 MΩ |
| Working Temperature | -55°C ~ +125°C     |                    |                  |                    |                    |             |                  |                  |                    |                    |                     |                  |                  |                    |                    |                     |

\*May be rated to 0.250W from 10Ω to 2.2MΩ.

### Chip Zero Ohm Jumper Ratings

| Spec \ Style        | CJ05 (0402)    | CJ10 (0603) | CJ21 (0805) | CJ32 (1206) |
|---------------------|----------------|-------------|-------------|-------------|
| Rated Current       | 1A (70°C)      |             |             | 2A (70°C)   |
| Resistivity         | 50 mΩ Maximum  |             |             |             |
| Working Temperature | -55°C ~ +125°C |             |             |             |

### Temperature Coefficient of Resistance

|                  | CR05            |                   |                   |                   |                   | CR10              |                   |                   |                    |                   |                 |                   |
|------------------|-----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-----------------|-------------------|
| Tolerance        | J<br>(±5%)      |                   | K<br>(±10%)       |                   |                   | F<br>(±1%)        |                   | G<br>(±2%)        |                    | J<br>(±5%)        |                 | K<br>(±10%)       |
| Resistance Range | 10Ω<br>┆<br>1MΩ | 1MΩ<br>┆<br>2.2MΩ | 2.2Ω<br>┆<br>10Ω  | 10Ω<br>┆<br>1MΩ   | 1MΩ<br>┆<br>10MΩ  | 10Ω<br>┆<br>100Ω  | 100Ω<br>┆<br>1MΩ  | 10Ω<br>┆<br>1MΩ   | 1MΩ<br>┆<br>2.2MΩ  | 1.0Ω<br>┆<br>10Ω  | 10Ω<br>┆<br>1MΩ | 1MΩ<br>┆<br>10MΩ  |
| TCR (ppm/°C)     | ±250            | -500<br>┆<br>+300 | -100<br>┆<br>+600 | ±250              | -500<br>┆<br>+300 | ±200              | ±200              | ±200              | -500<br>┆<br>+300  | -100<br>┆<br>+600 | ±200            | -500<br>┆<br>+300 |
|                  | CR21            |                   |                   |                   |                   |                   |                   |                   |                    |                   |                 |                   |
| Tolerance        | D<br>(±0.5%)    | F<br>(±1%)        |                   | G<br>(±2%)        |                   | J<br>(±5%)        |                   |                   | K<br>(±10%)        |                   |                 |                   |
| Resistance Range | 10Ω<br>┆<br>1MΩ | 10Ω<br>┆<br>100Ω  | 100Ω<br>┆<br>1MΩ  | 10Ω<br>┆<br>1MΩ   | 1MΩ<br>┆<br>2.2MΩ | 1.0Ω<br>┆<br>10Ω  | 10Ω<br>┆<br>1MΩ   | 1MΩ<br>┆<br>10MΩ  | 0.47Ω<br>┆<br>1.0Ω | 1.0Ω<br>┆<br>10Ω  | 10Ω<br>┆<br>1MΩ | 1MΩ<br>┆<br>10MΩ  |
| TCR (ppm/°C)     | ±200*           | ±200*             | ±200*             | ±200              | -500<br>┆<br>+300 | -100<br>┆<br>+600 | ±200              | -500<br>┆<br>+300 | -100<br>┆<br>+1000 | -100<br>┆<br>+600 | ±200            | -500<br>┆<br>+300 |
|                  | CR32            |                   |                   |                   |                   |                   |                   |                   |                    |                   |                 |                   |
| Tolerance        | D<br>(±0.5%)    | F<br>(±1%)        |                   | G<br>(±2%)        |                   | J<br>(±5%)        |                   |                   | K<br>(±10%)        |                   |                 |                   |
| Resistance Range | 10Ω<br>┆<br>1MΩ | 100Ω<br>┆<br>1MΩ  | 10Ω<br>┆<br>100Ω  | 1MΩ<br>┆<br>2.2MΩ | 10Ω<br>┆<br>1MΩ   | 10Ω<br>┆<br>1MΩ   | 1MΩ<br>┆<br>10MΩ  | 1.0Ω<br>┆<br>10Ω  | 0.36Ω<br>┆<br>1.0Ω | 1.0Ω<br>┆<br>10Ω  | 10Ω<br>┆<br>1MΩ | 1MΩ<br>┆<br>10MΩ  |
| TCR (ppm/°C)     | ±200*           | ±200*             | ±200*             | -500<br>┆<br>+300 | ±200              | ±200              | -500<br>┆<br>+300 | -100<br>┆<br>+600 | -100<br>┆<br>+1000 | -100<br>┆<br>+600 | ±200            | -500<br>┆<br>+300 |

\*Optional for 1% and 0.5% tolerance ±100ppm/°C

### Standard Decade Values

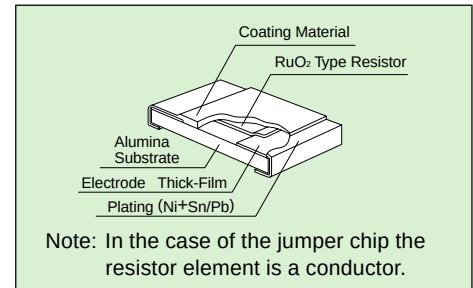
For ±10%, ±5%, ±2%, 1% and ±0.5% Tolerances (E-24)

|     |     |     |     |     |
|-----|-----|-----|-----|-----|
| 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 ±0.5% Tolerance (E-96)

|      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|
| 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 |      |      |      |      |

### Construction



### Marking

Marking available as follows:

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

3 digit indication

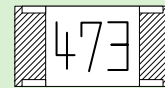
Example: 473=47 X 10<sup>3</sup>= 47000 Ω = 47 kΩ

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 available for ±1% and ±0.5% tolerances.

### Derating Curve

Under high temperature, power must not exceed derating curve.

