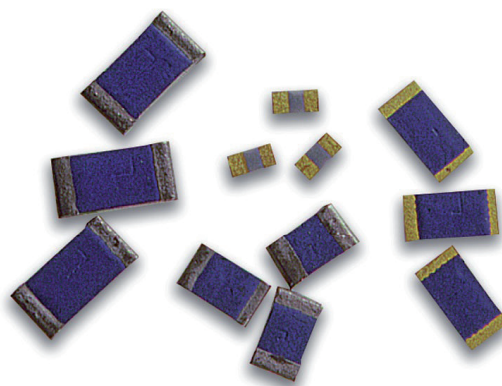


## Surface Mounted Resistors

## CR Series

- Available to EN140401 & IECQ-CECC40401 release
- 100% high temperature and overload screened versions available for high reliability applications
- Terminations available for wire bonding or soldering
- Available in sizes down to 0503
- Resistance range 1 ohm to 100M ohms
- Tolerances down to 0.1%
- Solder terminations have a nickel barrier layer
- Shorting Links available



All Pb-free parts comply with EU Directive 2011/65/EU amended by (EU) 2015/863 (RoHS3)

## Electrical Data

| Commercial                |        | CR0503                            | CR0603 | CR0805     | CR1005 | CR1206 | CR2010   | CR2512 | Notes |
|---------------------------|--------|-----------------------------------|--------|------------|--------|--------|----------|--------|-------|
| Power rating at 70°C      | watts  | 0.063                             | 0.1    | 0.125      | 0.125  | 0.25   | 0.5      | 1.0    |       |
| Resistance range          | ohms   | 1R to 10M                         |        | 1R to 100M |        |        | 1R to 1M |        |       |
| Limiting element voltage  | volts  | 50                                | 75     | 100        | 150    | 200    | 400      | 500    |       |
| TCR -55°C to +155°C       | ppm/°C | <10R: 200, 10R-1M0: 100, >1M0:250 |        |            |        |        |          |        |       |
| Resistance tolerance      | %      | 0.1, 0.25, 0.5, 1, 2, 5           |        |            |        |        |          |        |       |
| Ambient temperature range | °C     | -55 to 155                        |        |            |        |        |          |        |       |

| EN140401-802 Requirements |        |  | RR2012M                            |  | RR3216M    |  |  |  |  |
|---------------------------|--------|--|------------------------------------|--|------------|--|--|--|--|
| Power rating at 70°C      | watts  |  | 0.125                              |  | 0.25       |  |  |  |  |
| Resistance range          | ohms   |  | 1R5 to 10M                         |  | 1R5 to 10M |  |  |  |  |
| Limiting element voltage  | volts  |  | 100                                |  | 200        |  |  |  |  |
| TCR -55°C to +125°C       | ppm/°C |  | <10R: 200, 10R-1M0: 100, >1M0: 200 |  |            |  |  |  |  |
| Resistance tolerance      | %      |  | <10R: 5, 10R-1M0: 1, 2, 5, >1M0: 5 |  |            |  |  |  |  |
| Ambient temperature range | °C     |  | -55 to 155                         |  |            |  |  |  |  |

| IECQ-CECC 40401-004 Requirements |        |  | CR0805                              |  | CR1206 |  |  |  |  |
|----------------------------------|--------|--|-------------------------------------|--|--------|--|--|--|--|
| Power rating at 70°C             | watts  |  | 0.125                               |  | 0.25   |  |  |  |  |
| Resistance range                 | ohms   |  | 1R to 10M                           |  |        |  |  |  |  |
| Limiting element voltage         | volts  |  | 100                                 |  | 200    |  |  |  |  |
| TCR -55°C to +125°C              | ppm/°C |  | <10 ohms 200: 10 to 1M 100: >1M 200 |  |        |  |  |  |  |
| TCR +20°C to +70°C               | ppm/°C |  | <10 ohms 200: 10 to 1M 50: >1M 100  |  |        |  |  |  |  |
| Resistance tolerance             | %      |  | 0.5, 1, 2, 5                        |  |        |  |  |  |  |
| Ambient temperature range        | °C     |  | -55 to +125                         |  |        |  |  |  |  |

| IECQ-CECC 40401-008 Requirements |         | CR0603                            | CR0805 |                         | CR1206    | CR2010   | CR2512   |                           |
|----------------------------------|---------|-----------------------------------|--------|-------------------------|-----------|----------|----------|---------------------------|
| Power rating at 70° C            | watts   | 0.1                               | 0.125  |                         | 0.25      | 0.5      | 1.0      |                           |
| Resistance range                 | ohms    | 1R to 10M                         |        |                         | 1R to 10M | 1R to 1M | 1R to 1M |                           |
| Limiting element voltage         | volts   | 75                                | 100    |                         | 200       | 400      | 500      |                           |
| TCR -55° C to +155° C            | ppm/° C | <10R: 200, 10R-1M0: 100, >1M0:250 |        |                         |           |          |          |                           |
| Resistance tolerance             | %       | 0.5, 1, 2, 5                      |        | 0.1, 0.25, 0.5, 1, 2, 5 |           |          |          | See table of value ranges |
| Ambient temperature range        | ° C     | -55 to 155                        |        |                         |           |          |          |                           |

| IECQ-CECC 40401-003 Requirements |        |  | CR0805                                                            |  | CR1206   |  |  |  |  |
|----------------------------------|--------|--|-------------------------------------------------------------------|--|----------|--|--|--|--|
| Power rating at 70°C             | watts  |  | 0.063                                                             |  | 0.125    |  |  |  |  |
| Resistance range                 | ohms   |  | 1R to 3M                                                          |  | 1R to 5M |  |  |  |  |
| Limiting element voltage         | volts  |  | 100                                                               |  | 200      |  |  |  |  |
| TCR -55°C to +125°C              | ppm/°C |  | <5 ohms 500: 5 to 10 ohms 350:<br>10 to 3M ohms 100: >3M ohms 250 |  |          |  |  |  |  |
| Resistance tolerance             | %      |  | 0.25, 0.5, 1, 2, 5                                                |  |          |  |  |  |  |
| Ambient temperature range        | °C     |  | -55 to 125                                                        |  |          |  |  |  |  |

These tables indicate the EN140401 & CECC40401 specification requirements, and these are met or exceeded by the corresponding CR series products.

| Values                       |         | E24 & E96 preferred |     |     |     |     |    |    | Any value to order               |
|------------------------------|---------|---------------------|-----|-----|-----|-----|----|----|----------------------------------|
| Thermal impedance            | °C/watt | 800                 | 550 | 360 | 290 | 200 | 80 | 70 | Mounted on custom designed PCB's |
| Zero-ohm rating              | A       |                     | 1   | 1.5 |     | 2   |    | 3  |                                  |
| Zero-ohm residual resistance | mΩ      | <20                 |     |     |     |     |    |    |                                  |

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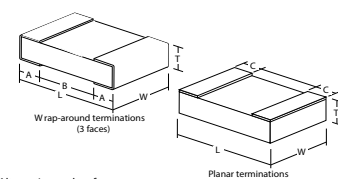
BI Technologies IRC Welwyn

www.ttelectronics.com/resistors

## CR Series

## Physical Data

| Dimensions (mm) & Weight (mg) |          |           |       |               |                |          |     |
|-------------------------------|----------|-----------|-------|---------------|----------------|----------|-----|
| Style                         | L        | W         | T max | Wrap around   |                | C        | Wt  |
|                               |          |           |       | A             | B <sup>1</sup> |          |     |
| 0503                          | 1.25±0.1 | 0.63±.1   | 0.5   | Not available |                | 0.20±0.1 | 1.5 |
| 0603                          | 1.6±0.1  | 0.8±0.1   | 0.55  | 0.3±0.15      | 0.6 min        | 0.3±0.15 | 2.2 |
| 0805                          | 2.0±0.15 | 1.25±0.15 | 0.6   | 0.3±0.15      | 0.9 min        | 0.3±0.1  | 4.7 |
| 1005                          | 2.5±0.2  | 1.25±0.2  | 0.7   | Not available |                | 0.4±0.15 | 6.5 |
| 1206                          | 3.2±0.2  | 1.6±0.2   | 0.7   | 0.4±0.2       | 1.7 min        | 0.4±0.15 | 8.5 |
| 2010                          | 5.1±0.3  | 2.5±0.2   | 0.8   | 0.6±0.3       | 3 min          | 0.6±0.25 | 36  |
| 2512                          | 6.5±0.3  | 3.2±0.2   | 0.8   | 0.6±0.3       | 4.4min         | 0.6±0.25 | 55  |



<sup>1</sup>This dimension determines the number of conductors which may pass under the surface mounted device.

## Construction

Thick film resistor material, overglaze and organic protection are screen printed on a 96% alumina substrate.

## Terminations

Planar (or single-sided) termination is gold and suitable for wire-bonding; wrap-around is suitable for soldering.

## Solderability

Wrap-around terminations have an electroplated nickel barrier and solder coating, this ensures excellent 'leach' resistance properties and solderability. They will withstand immersion in solder at 260°C for 30 seconds.

## Marking

All relevant information recorded on the primary package or reel.

## Performance Data

|                                             | EN140401-802<br>Requirements | IECQ-CECC 40401-008<br>Requirements                    | IECQ-CECC 40401-004<br>Requirements | IECQ-CECC 40401-003<br>Requirements | Actual                                 |               |
|---------------------------------------------|------------------------------|--------------------------------------------------------|-------------------------------------|-------------------------------------|----------------------------------------|---------------|
|                                             |                              |                                                        |                                     |                                     | Maximum                                | Typical       |
| Load at rated power: 1000 hours at 70°C ΔR% | 1                            | 2                                                      | 2                                   | ≤ 3M3 2<br>>3M3 3                   | 1                                      | 0.25          |
| Shelf life: 12 months at room temp. ΔR%     | -                            | -                                                      | -                                   | -                                   | 0.1                                    | 0.02          |
| Derating from rated power at 70°C           | Zero at 125°C                | Zero at 155°C                                          | Zero at 125°C                       | Zero at 125°C                       |                                        |               |
| Overload ΔR%                                | 1                            | 0603, 0805:1<br>1206:0.5                               | 0.5                                 | 2                                   | 1                                      | 0.1           |
| Dry Heat: 1000 hours at UCT ΔR%             | 1                            | 2                                                      | 1                                   | ≤ 3M3 2<br>>3M3 3                   | to 10M 1<br>>10M 2                     | 0.2<br>>10M 1 |
| Long term damp heat ΔR%                     | 1                            | 2                                                      | 2                                   | 2                                   | 1                                      | 0.25          |
| Temperature rapid change ΔR%                | 0.25                         | 0.5                                                    | 0.5                                 | 1                                   | 0.25                                   | 0.05          |
| Resistance to solder heat ΔR%               | 0.25                         | 0.5                                                    | 0.5                                 | 2                                   | 0.25                                   | 0.05          |
| Voltage proof volts                         | 284                          | 0603:150, 0805:200,<br>1206:300, 2010:400,<br>2512:500 | 0805:200, 1206:300                  |                                     | 0503:100, 0603:300,<br>All others: 500 |               |

Note: An 0.01 ohm addition to be added to the performance of all resistors <10 ohms

## Value Ranges (ohms)

| Tolerance | %         |          |           |           |           |           |
|-----------|-----------|----------|-----------|-----------|-----------|-----------|
| Size      | 5         | 2        | 1         | 0.5       | 0.25      | 0.1       |
| 0503      | 1 to 10M  | 1 to 10M | 10 to 10M | 100 to 1M | N/A       | N/A       |
| 0603      | 1 to 10M  | 1 to 10M | 1 to 10M  | 100 to 1M | N/A       | N/A       |
| 0805      | 1 to 100M | 1 to 50M | 1 to 20M  | 10 to 10M | 100 to 1M | 100 to 1M |
| 1005      | 1 to 100M | 1 to 50M | 1 to 20M  | 10 to 10M | 100 to 1M | 100 to 1M |
| 1206      | 1 to 100M | 1 to 50M | 1 to 25M  | 10 to 10M | 100 to 1M | 100 to 1M |
| 2010      | 1 to 1M   | 1 to 1M  | 1 to 1M   | 10 to 10M | 100 to 1M | N/A       |
| 2512      | 1 to 1M   | 1 to 1M  | 1 to 1M   | 10 to 10M | 100 to 1M | N/A       |

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CR Series

Application Notes

Operating Temperature Range

The chips themselves can operate at a maximum temperature of 155°C (see performance claims above). For soldered chips, the joint temperature should not exceed 110°C. This condition is met when the stated power levels at 70°C are used.

Mounting

This chip resistor is ideally suited for handling by automatic methods due to its rectangular shape and the small dimensional tolerances. Electrical connection to a ceramic substrate or to a printed circuit board can be made by wire bonding (eg suffix 'G' in CR0805G) or by reflow soldering of wrap-around terminations (eg suffix 'F' in CR0805F).

The 'F' terminations provide good leach properties and ensure reliable contact. Due to the robust construction the resistor chip can be immersed in the solder bath for 30 seconds at 260°C. This enables the resistor to be mounted on one side of a printed circuit board and other wire-led components on the other side.

Packaging

Wrap-around Termination

Chip resistors are supplied taped and reeled on standard 8mm tape to IEC 286-3.

Planar Terminations

Resistor chips are supplied in waffle packs.

Ordering Procedure

Example: CR2512F-10KFI (2512 with solderable wraparound terminations, 10 kilohms ±1%, Pb-free)

|   |   |   |   |   |   |   |   |   |   |   |  |   |   |  |  |
|---|---|---|---|---|---|---|---|---|---|---|--|---|---|--|--|
| C | R | 2 | 5 | 1 | 2 | F | - | 1 | 0 | K |  | F | I |  |  |
| 1 |   | 2 | 3 |   | 4 | 5 | 6 |   | 7 |   |  |   |   |  |  |

| 1    | 2    | 3           |                              | 4                     | 5                                                                      | 6                         |                     | 7                                                             |
|------|------|-------------|------------------------------|-----------------------|------------------------------------------------------------------------|---------------------------|---------------------|---------------------------------------------------------------|
| Type | Size | Termination |                              | Value                 | Tolerance                                                              | Termination & Packing     |                     | Release                                                       |
| CR   | 0503 | F           | 0603, 0805, 1206, 2010, 2512 | Solderable wraparound | E24 or E96<br>3/4 characters<br>R = ohms<br>K = kilohms<br>M = megohms | Pb-free solderable (RoHS) |                     | Omit for commercial or CECC <sup>1</sup><br>EN = EN140401-802 |
|      | 0603 |             |                              |                       |                                                                        | I                         | 0603F               | Standard 2000 (max 5000)/reel                                 |
|      | 0805 |             |                              |                       |                                                                        |                           | 0805F, 1206F, 2010F | Standard 800 (max 3000)/reel                                  |
|      | 1005 |             |                              |                       |                                                                        |                           | 2512F               | Standard 800 (max 1800)/reel                                  |
|      | 1206 |             |                              |                       |                                                                        | SnPb solderable           |                     |                                                               |
|      | 2010 | G           | All                          | Gold planar           | R005J = zero ohm jumper                                                | PB                        | 0603F               | Standard 2000 (max 5000)/reel                                 |
|      | 2512 |             |                              |                       |                                                                        |                           | 0805F, 1206F, 2010F | Standard 800 (max 3000)/reel                                  |
|      |      |             |                              |                       |                                                                        |                           | 2512F               | Standard 800 (max 1800)/reel                                  |
|      |      |             |                              |                       |                                                                        |                           | Gold planar         |                                                               |
|      |      |             |                              |                       |                                                                        | I                         | xxxxG               | Waffle pack                                                   |

Note 1: For CECC released product state on order the CECC number. Example: CR2512F-10KFI IECQ-CECC40401-008

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