



## Features

- Ultra-low lead (Pb) content\*
- Green technology
- High reliability and stability
- Thick film paste on high grade ceramic substrate
- RoHS compliant\*\* without exemptions
- Halogen free\*\*\*

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## CR-PF Series Ultra-Low Lead Content Thick Film Resistor

### Electrical Characteristics

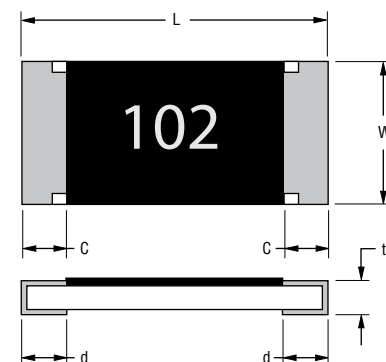
| Characteristic                                    | Model                                   |                                 |           |           |
|---------------------------------------------------|-----------------------------------------|---------------------------------|-----------|-----------|
|                                                   | CR0402-PF                               | CR0603-PF                       | CR0805-PF | CR1206-PF |
| Power Rating @ 70 °C                              | 0.0625 W                                | 0.10 W                          | 0.125 W   | 0.25 W    |
| Operating Temperature Range                       | -55 °C to +155 °C                       |                                 |           |           |
| Derated to Zero Load at                           | +155 °C                                 |                                 |           |           |
| Maximum Working Voltage                           | 50 V                                    | 75 V                            | 150 V     | 200 V     |
| Maximum Overload Voltage                          | 100 V                                   | 150 V                           | 300 V     | 400 V     |
| Resistance Range<br>(±1 %, E24 + E96 Series)      | 1 Ω ≤ R ≤ 9.76 Ω<br>-200 to +500 PPM/°C | 1 Ω ≤ R ≤ 9.76 Ω<br>±400 PPM/°C |           |           |
|                                                   | 10 Ω ≤ R < 100 Ω<br>±200 PPM/°C         | 10 Ω ≤ R ≤ 1 MΩ<br>±100 PPM/°C  |           |           |
|                                                   | 100 Ω ≤ R ≤ 1 MΩ<br>±100 PPM/°C         | --                              | --        | --        |
|                                                   | 1 MΩ < R ≤ 10 MΩ<br>±200 PPM/°C         |                                 |           |           |
| Resistance Range<br>(±5 %, E24 Series)            | 1 Ω ≤ R ≤ 9.1 Ω<br>-200 to +500 PPM/°C  | 1 Ω ≤ R ≤ 9.1 Ω<br>±400 PPM/°C  |           |           |
|                                                   | 10 Ω ≤ R ≤ 10 MΩ<br>±200 PPM/°C         |                                 |           |           |
| Zero Ohm Jumper ≤ 0.05 Ω<br>Rated/Maximum Current | 1 A / 2.5 A                             |                                 | 2 A / 5 A |           |

For Standard Values Used in Capacitors, Inductors and Resistors, [click here](#).

### Product Dimensions

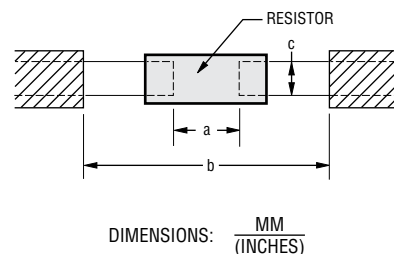
| Model     | L                                         | W                                         | C                                         | d                                         | t                                         |
|-----------|-------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|
| CR0402-PF | $\frac{1.00 \pm 0.10}{(0.039 \pm 0.004)}$ | $\frac{0.50 \pm 0.05}{(0.020 \pm 0.002)}$ | $\frac{0.20 \pm 0.10}{(0.008 \pm 0.004)}$ | $\frac{0.25 \pm 0.10}{(0.010 \pm 0.004)}$ | $\frac{0.32 \pm 0.05}{(0.013 \pm 0.002)}$ |
| CR0603-PF | $\frac{1.60 \pm 0.10}{(0.063 \pm 0.004)}$ | $\frac{0.80 \pm 0.05}{(0.031 \pm 0.002)}$ | $\frac{0.30 \pm 0.20}{(0.012 \pm 0.008)}$ | $\frac{0.30 \pm 0.20}{(0.012 \pm 0.008)}$ | $\frac{0.45 \pm 0.10}{(0.018 \pm 0.004)}$ |
| CR0805-PF | $\frac{2.00 \pm 0.10}{(0.079 \pm 0.004)}$ | $\frac{1.25 \pm 0.10}{(0.049 \pm 0.004)}$ | $\frac{0.40 \pm 0.20}{(0.016 \pm 0.008)}$ | $\frac{0.40 \pm 0.20}{(0.016 \pm 0.008)}$ | $\frac{0.50 \pm 0.10}{(0.020 \pm 0.004)}$ |
| CR1206-PF | $\frac{3.10 \pm 0.10}{(0.122 \pm 0.004)}$ | $\frac{1.55 \pm 0.10}{(0.061 \pm 0.004)}$ | $\frac{0.50 \pm 0.30}{(0.020 \pm 0.012)}$ | $\frac{0.40 \pm 0.20}{(0.016 \pm 0.008)}$ | $\frac{0.55 \pm 0.10}{(0.022 \pm 0.004)}$ |

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



### Recommended Solder Pad Layout

| Model     | a                                         | b                                         | c                                         |
|-----------|-------------------------------------------|-------------------------------------------|-------------------------------------------|
| CR0402-PF | $\frac{0.5 \sim 0.6}{(0.020 \sim 0.024)}$ | $\frac{1.4 \sim 1.6}{(0.055 \sim 0.063)}$ | $\frac{0.4 \sim 0.6}{(0.016 \sim 0.024)}$ |
| CR0603-PF | $\frac{0.7 \sim 0.9}{(0.028 \sim 0.035)}$ | $\frac{2.0 \sim 2.2}{(0.079 \sim 0.087)}$ | $\frac{0.8 \sim 1.0}{(0.031 \sim 0.039)}$ |
| CR0805-PF | $\frac{1.0 \sim 1.4}{(0.039 \sim 0.055)}$ | $\frac{3.2 \sim 3.8}{(0.126 \sim 0.150)}$ | $\frac{0.9 \sim 1.4}{(0.035 \sim 0.055)}$ |
| CR1206-PF | $\frac{2.0 \sim 2.4}{(0.079 \sim 0.094)}$ | $\frac{4.4 \sim 5.0}{(0.173 \sim 0.197)}$ | $\frac{1.2 \sim 1.8}{(0.047 \sim 0.071)}$ |



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



**WARNING**  
**Cancer and Reproductive Harm**  
[www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

\* Such products may contain trace amounts of lead of less than 100 ppm.  
\*\* RoHS Directive 2015/863, Mar 31, 2015 and Annex.

\*\*\* Bourns considers a product to be "halogen free" if (a) the Bromine (Br) content is 900 ppm or less; (b) the Chlorine (Cl) content is 900 ppm or less; (c) the total Bromine (Br) & Chlorine (Cl) content is 1500 ppm or less. Specifications are subject to change without notice. Users should verify actual device performance in their specific applications. The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at [www.bourns.com/docs/legal/disclaimer.pdf](http://www.bourns.com/docs/legal/disclaimer.pdf).

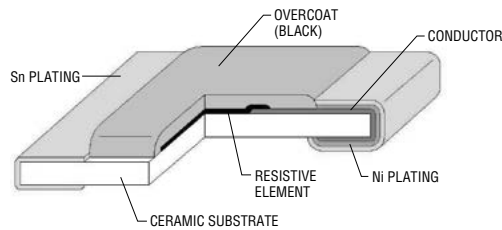
## Applications

- General purpose
- Consumer
- Industrial
- Telecommunications
- Computer technology

## CR-PF Series Ultra-Low Lead Content Thick Film Resistor

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### Construction



### Rated Voltage

The rated voltage is calculated by the following formula:

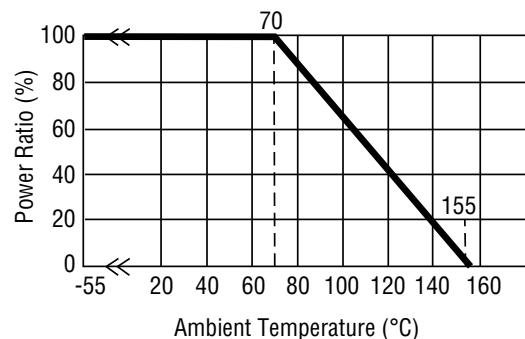
$$V = \sqrt{P \times R}$$

**V:** Rated Voltage (V)  
**P:** Rated Power (W)  
**R:** Resistance Value ( $\Omega$ )

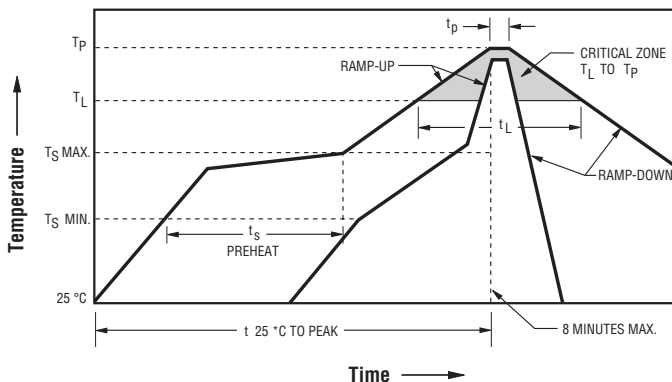
### Environmental Characteristics

Moisture Sensitivity Level ..... 1  
 Storage Conditions  
     Temperature ..... +5 °C ~ +35 °C  
     Humidity ..... 40 % ~ 75 %  
 Shelf Life ..... 2 years from manufacturing date  
 Solder Recommendations ..... Reflow profile  
     (Solder: Sn96.5 / Ag3 / Cu05)

### Derating Curve



### Solder Reflow Recommendations



| Solder Profile                                                                                                                      | Lead Free Assembly                 |
|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Average ramp-up rate ( $T_{smax}$ to $T_p$ )                                                                                        | 3 °C / second max.                 |
| Preheat:<br>- Temperature Min. ( $T_{smin}$ )<br>- Temperature Max. ( $T_{smax}$ )<br>- Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ ) | 150 °C<br>200 °C<br>60~150 seconds |
| Time maintained above:<br>- Temperature ( $T_L$ )<br>- Time ( $T_L$ )                                                               | 217 °C<br>60~120 seconds           |
| Peak Temperature ( $T_p$ )                                                                                                          | 260 °C                             |
| Time within +0/-5 °C of actual Peak Temperature ( $T_p$ ) <sup>2</sup>                                                              | 10 seconds                         |
| Ramp-down rate                                                                                                                      | 6 °C / second max.                 |
| Time 25 °C to Peak Temperature                                                                                                      | 8 minutes max.                     |

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## CR-PF Series Ultra-Low Lead Content Thick Film Resistor

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### How to Order

**CR 0402 - F X - 1003 G PF**

Model \_\_\_\_\_

CR = Thick Film Fixed Resistor Chip

Size \_\_\_\_\_

0402 = 0402 Size

0603 = 0603 Size

0805 = 0805 Size

1206 = 1206 Size

Resistance Tolerance \_\_\_\_\_

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

TCR (See Electrical Characteristics chart) \_\_\_\_\_

W =  $\pm 200$  PPM/ $^{\circ}$ CX =  $\pm 100$  PPM/ $^{\circ}$ C

/ = Used for zero ohm (jumper) and values from 1 ohm through 9.1 ohms

Resistance Value \_\_\_\_\_

1 % Tolerance:<100 ohms.....“R” represents decimal point (*example: 24R3 = 24.3 ohms*) $\geq 100$  ohms.....First three digits are significant, fourth digit represents number of zeros to follow  
(*example: 8252 = 82.5K ohms*)5 % Tolerance:<10 ohms.....“R” represents decimal point (*example: 4R7 = 4.7 ohms*) $\geq 10$  ohms.....First two digits are significant, third digit represents number of zeros to follow  
(*example: 474 = 470K ohms; 000 = Jumper*)

Packaging \_\_\_\_\_

G = 10,000 pieces on 180 mm (7 inch) plastic reel, paper tape - CR0402-PF

E = 5,000 pieces on 180 mm (7 inch) plastic reel, paper tape - CR0603-PF, CR0805-PF, CR1206-PF

Feature \_\_\_\_\_

PF = Ultra-low Lead Content

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# CR-PF Series Ultra-Low Lead Content Thick Film Resistor

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## Performance Characteristics

| Test                                            | Specification                                  | Procedure                                                                                                                                                                         | Test Limits $\Delta R$                                                                                                                                      |
|-------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Coefficient of Resistance           | IEC 60115-1-4.8<br>JIS-C5201-4.8               | +25 °C ~ +125 °C                                                                                                                                                                  | --                                                                                                                                                          |
| Short Time Overload                             | IEC 60115-1-4.13<br>JIS-C5201-1-4.13           | 2.5 times rated power for 5 seconds                                                                                                                                               | $\pm(1 \% + 0.05 \Omega)$<br><i>Remarks:</i><br>0402: $\pm(2 \% + 0.1 \Omega)$<br>0 $\Omega$ : 50 m $\Omega$ or less                                        |
| Intermittent Overload                           | IEC 60115-1-4.39<br>JIS-C5201-1-4.39           | 3 times rated voltage or max. overloading voltage, 1 second "ON", 25 seconds "OFF", 10,000 cycles<br><i>Remarks:</i><br>0402: 2.5 times rated voltage or max. overloading voltage | $\pm(5 \% + 0.1 \Omega)$<br><i>Remarks:</i><br>0 $\Omega$ : 50 m $\Omega$ or less                                                                           |
| Endurance (Load Life)                           | IEC 60115-1-4.25.1<br>JIS-C5201-1-4.25.1       | 1000 hours at rated voltage, +70 °C, 1.5 hours "ON", 0.5 hour "OFF"                                                                                                               | 1 %: $\pm(1 \% + 0.05 \Omega)$<br>5 %: $\pm(3 \% + 0.1 \Omega)$<br><i>Remarks:</i><br>0402: $\pm(3 \% + 0.1 \Omega)$<br>0 $\Omega$ : 100 m $\Omega$ or less |
| Load Life with Humidity                         | IEC 60115-1-4.24<br>JIS-C5201-1-4.24           | 1000 hours at rated voltage, +40 $\pm 2$ °C, 90~95 % RH, 1.5 hours "ON", 0.5 hour "OFF"                                                                                           | 1 %: $\pm(1 \% + 0.05 \Omega)$<br>5 %: $\pm(3 \% + 0.1 \Omega)$<br><i>Remarks:</i><br>0402: $\pm(3 \% + 0.1 \Omega)$<br>0 $\Omega$ : 100 m $\Omega$ or less |
| Rapid Change of Temperature                     | IEC 60115-1-4.19<br>JIS-C5201-1-4.19           | -55 °C (30 minutes) / +155 °C (30 minutes)<br>5 cycles                                                                                                                            | 1 %: $\pm(0.5 \% + 0.05 \Omega)$<br>5 %: $\pm(1 \% + 0.05 \Omega)$<br><i>Remarks:</i><br>0 $\Omega$ : 50 m $\Omega$ or less                                 |
| Solderability                                   | IEC 60115-1-4.17<br>JIS-C5201-1-4.17           | 245 $\pm 5$ °C solder for 2 $\pm 0.5$ seconds;<br>Solder: Sn96.5 / Ag3.0 / Cu0.5                                                                                                  | At least 95 % of surface area of electrode shall be covered with new solder.                                                                                |
| Moisture No Load                                | IEC 60115-1-4.24.2.1a<br>JIS-C5201-1-4.24.2.1a | +85 °C, 85 % RH, 1000 hours                                                                                                                                                       | < $\pm 0.5$ %                                                                                                                                               |
| Temperature Cycle                               | IEC 60115-1-4.19<br>JIS-C5201-1-4.19           | -55 °C and +155 °C, 100 cycles, 15 minutes per extreme condition                                                                                                                  | < $\pm 0.5$ %                                                                                                                                               |
| Resistance to Soldering Heat                    | IEC 60115-1-4.18<br>JIS-C5201-1-4.18           | 260 $\pm 5$ °C for 10 $\pm 1$ seconds                                                                                                                                             | < $\pm 0.5$ %                                                                                                                                               |
| Robustness of Termination (Bending)             | IEC 60115-1-4.33<br>JIS-C5201-1-4.33           | 3 mm deflection                                                                                                                                                                   | 1 %: $\pm(0.5 \% + 0.05 \Omega)$<br>5 %: $\pm(1 \% + 0.05 \Omega)$<br><i>Remarks:</i><br>0 $\Omega$ : 50 m $\Omega$ or less                                 |
| Dielectric Withstanding Voltage (Voltage Proof) | IEC 60115-1-4.7<br>JIS-C5201-1-4.7             | Applied voltage for 1 minute:<br>0402 & 0603: 300 V<br>0805 & 1206: 500 V                                                                                                         | No abnormalities such as flashover, burning, or dielectric breakdown shall occur.                                                                           |
| Insulation Resistance                           | IEC 60115-1-4.6<br>JIS-C5201-1-4.6             | Applied voltage for 1 minute: 100 V                                                                                                                                               | $\geq 1$ G $\Omega$                                                                                                                                         |
| Resistance to Dry Heat                          | IEC 60115-1-4.23.2<br>JIS-C5201-1-4.23.2       | 155 $\pm 5$ °C for 96 $\pm 4$ hours                                                                                                                                               | 1 %: $\pm(1 \% + 0.05 \Omega)$<br>5 %: $\pm(2 \% + 0.1 \Omega)$<br><i>Remarks:</i><br>0 $\Omega$ : 50 m $\Omega$ or less                                    |
| Resistance to Solder Heat                       | IEC 60115-1-4.18<br>JIS-C5201-1-4.18           | 270 $\pm 5$ °C solder for 10 $\pm 1$ seconds                                                                                                                                      | 1 %: $\pm(0.5 \% + 0.05 \Omega)$<br>5 %: $\pm(1 \% + 0.05 \Omega)$<br><i>Remarks:</i><br>0 $\Omega$ : 50 m $\Omega$ or less                                 |

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# CR-PF Series Ultra-Low Lead Content Thick Film Resistor

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## Typical Part Marking

**±5 % (E24):**



**CR0603-PF, CR0805-PF, CR1206-PF**

Resistance value is expressed by 3 digits. The first two digits represent the significant figures of the nominal resistance value in ohms; the third digit represents the exponent for a base of 10.

Example: **102** =  $10 \times 10^2 = 1000 \text{ ohms} = 1K \text{ ohms}$

Note: "R" represents the decimal point for CR1206-PF.

**±1 % (E96):**



**CR0603-PF**

In cases where the marking space is too small to accommodate 4 digits, the marking shall consist of 2 digits followed by an alpha character multiplier.

Example: **01A** =  $100 \times 10^0 = 100 \text{ ohms}$

| Code | R Value | Code | R Value | Code | R Value | Code | R Value | Code | R Value | Code | R Value | Code | R Value | Code | R Value |
|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|
| 01   | 100     | 13   | 133     | 25   | 178     | 37   | 237     | 49   | 316     | 61   | 422     | 73   | 562     | 85   | 750     |
| 02   | 102     | 14   | 137     | 26   | 182     | 38   | 243     | 50   | 324     | 62   | 432     | 74   | 576     | 86   | 768     |
| 03   | 105     | 15   | 140     | 27   | 187     | 39   | 249     | 51   | 332     | 63   | 442     | 75   | 590     | 87   | 787     |
| 04   | 107     | 16   | 143     | 28   | 191     | 40   | 255     | 52   | 340     | 64   | 453     | 76   | 604     | 88   | 806     |
| 05   | 110     | 17   | 147     | 29   | 196     | 41   | 261     | 53   | 348     | 65   | 464     | 77   | 619     | 89   | 825     |
| 06   | 113     | 18   | 150     | 30   | 200     | 42   | 267     | 54   | 357     | 66   | 475     | 78   | 634     | 90   | 845     |
| 07   | 115     | 19   | 154     | 31   | 205     | 43   | 274     | 55   | 365     | 67   | 487     | 79   | 649     | 91   | 866     |
| 08   | 118     | 20   | 158     | 32   | 210     | 44   | 280     | 56   | 374     | 68   | 499     | 80   | 665     | 92   | 887     |
| 09   | 121     | 21   | 162     | 33   | 215     | 45   | 287     | 57   | 383     | 69   | 511     | 81   | 681     | 93   | 909     |
| 10   | 124     | 22   | 165     | 34   | 221     | 46   | 294     | 58   | 392     | 70   | 523     | 82   | 698     | 94   | 931     |
| 11   | 127     | 23   | 169     | 35   | 226     | 47   | 301     | 59   | 402     | 71   | 536     | 83   | 715     | 95   | 953     |
| 12   | 130     | 24   | 174     | 36   | 232     | 48   | 309     | 60   | 412     | 72   | 549     | 84   | 732     | 96   | 976     |

This table shows the first two digits for the three-digit E96 part marking scheme. The third character is a letter multiplier:  
A=10<sup>0</sup> B=10<sup>1</sup> C=10<sup>2</sup> D=10<sup>3</sup> E=10<sup>4</sup> F=10<sup>5</sup> G=10<sup>-6</sup> H=10<sup>-7</sup> X=10<sup>-1</sup> Y=10<sup>-2</sup> Z=10<sup>-3</sup>



Note: When the resistance value is not in the E96 table, the marking shall consist of 3 digits as in E24 series, with underline.

Example: **121** = 0603, 120 ohms, 1 %

**Jumper:**



**CR0603-PF, CR0805-PF, CR1206-PF**

Example: **0** = 0 ohms

**No Marking:**

**CR0402-PF**



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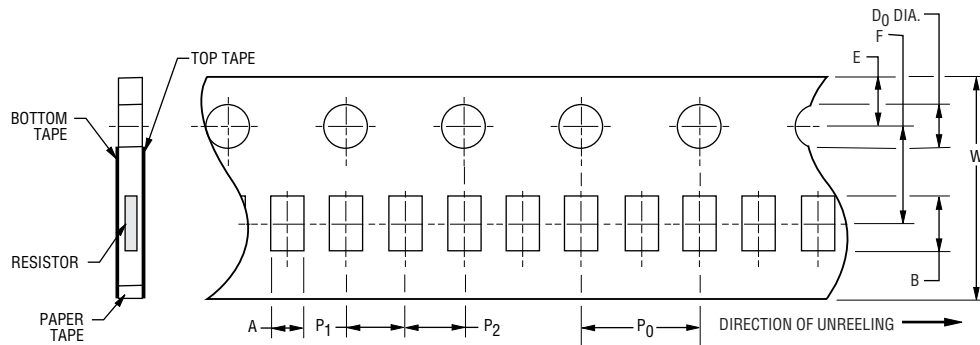
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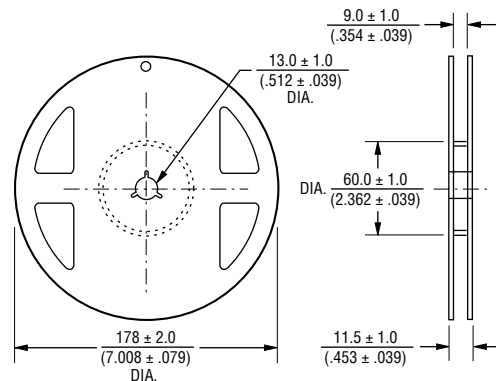
# CR-PF Series Ultra-Low Lead Content Thick Film Resistor

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## Packaging Dimensions (Conforms to EIA RS-481A)



| Model     | A                                | B                                | W                                | F                                | E                                | P <sub>1</sub>                   | P <sub>2</sub>                   | P <sub>0</sub>                   | D <sub>0</sub>                   | T                                |  |  |
|-----------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|--|--|
| CR0402-PF | $0.70 \pm 0.05$<br>(.028 ± .002) | $1.20 \pm 0.05$<br>(.047 ± .002) | $8.00 \pm 0.20$<br>(.315 ± .008) | $3.50 \pm 0.05$<br>(.138 ± .002) | $1.75 \pm 0.10$<br>(.069 ± .004) | $2.00 \pm 0.10$<br>(.079 ± .004) | $2.00 \pm 0.10$<br>(.079 ± .004) | $4.00 \pm 0.10$<br>(.158 ± .004) | $1.50 \pm 0.10$<br>(.006 ± .004) | $0.45 \pm 0.10$<br>(.018 ± .004) |  |  |
| CR0603-PF | $1.10 \pm 0.10$<br>(.043 ± .004) | $1.90 \pm 0.10$<br>(.075 ± .004) |                                  |                                  |                                  | $4.00 \pm 0.10$<br>(.158 ± .004) | $2.00 \pm 0.05$<br>(.079 ± .002) |                                  |                                  | $0.64 \pm 0.10$<br>(.025 ± .004) |  |  |
| CR0805-PF | $1.60 \pm 0.15$<br>(.063 ± .006) | $2.40 \pm 0.20$<br>(.094 ± .008) |                                  |                                  |                                  |                                  |                                  |                                  |                                  | $0.84 \pm 0.10$<br>(.033 ± .004) |  |  |
| CR1206-PF | $2.00 \pm 0.15$<br>(.079 ± .006) | $3.60 \pm 0.20$<br>(.142 ± .008) |                                  |                                  |                                  |                                  |                                  |                                  |                                  |                                  |  |  |



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

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- Bourns expressly identifies those Bourns® standard products that are suitable for use in typical automotive applications associated with any Automate Safety Integrity Level (ASIL) in its publication entitled "Bourns Automotive Grade Component Guide." Bourns' designation of Bourns® product as compliant with the AEC-Q standard does not by itself mean that Bourns has approved such product for use in an automotive application.
- Bourns expressly identifies Bourns® standard products that are suitable for use in the typical aviation applications/systems requiring System Design Assurance Level (RTCA DO-254 DAL) of C, D or E in its publication entitled "Bourns Civilian Aerospace/Aviation Grade Component Guide." Bourns does not test its products for compliance with United States Federal Aviation Administration standards or any other generally equivalent governmental organization standard applicable to products designed or manufactured for use in aviation applications. Use of Bourns® standard components in aviation applications associated with RTCA DO-254 DAL A or B without proper approval noted above shall be at the user's sole risk.
- Bourns will review and authorize on a case-by-case basis the use of Bourns® standard products which are at least AEC-Q compliant in space-related civil applications (rockets, satellites) with a negotiated cross-waiver and indemnity agreement.

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