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***

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

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

Electrical Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>CR0402-PF</th>
<th>CR0603-PF</th>
<th>CR0805-PF</th>
<th>CR1206-PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Rating @ 70 °C</td>
<td>0.0625 W</td>
<td>0.10 W</td>
<td>0.125 W</td>
<td>0.25 W</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-55 °C to +155 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Derated to Zero Load at</td>
<td>+155 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Working Voltage</td>
<td>50 V</td>
<td>75 V</td>
<td>150 V</td>
<td>200 V</td>
</tr>
<tr>
<td>Maximum Overload Voltage</td>
<td>100 V</td>
<td>150 V</td>
<td>300 V</td>
<td>400 V</td>
</tr>
</tbody>
</table>

Resistance Range
-200 to +500 PPM/°C
10 Ω ≤ R ≤ 9.76 Ω

Resistance Range
-200 to +500 PPM/°C
10 Ω ≤ R ≤ 9.76 Ω

Resistance Range
10 Ω ≤ R ≤ 1 MΩ
±200 PPM/°C

Resistance Range
10 Ω ≤ R ≤ 1 MΩ
±200 PPM/°C

Zero Ohm Jumper ≤ 0.05 Ω
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

<table>
<thead>
<tr>
<th>Model</th>
<th>L</th>
<th>W</th>
<th>C</th>
<th>d</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR0402-PF</td>
<td>1.00 ± 0.10</td>
<td>0.50 ± 0.05</td>
<td>0.20 ± 0.10</td>
<td>0.25 ± 0.10</td>
<td>0.32 ± 0.05</td>
</tr>
<tr>
<td>CR0603-PF</td>
<td>1.60 ± 0.10</td>
<td>0.80 ± 0.05</td>
<td>0.30 ± 0.20</td>
<td>0.30 ± 0.20</td>
<td>0.45 ± 0.10</td>
</tr>
<tr>
<td>CR0805-PF</td>
<td>2.00 ± 0.10</td>
<td>1.25 ± 0.10</td>
<td>0.40 ± 0.20</td>
<td>0.40 ± 0.20</td>
<td>0.50 ± 0.10</td>
</tr>
<tr>
<td>CR1206-PF</td>
<td>3.10 ± 0.10</td>
<td>1.55 ± 0.10</td>
<td>0.50 ± 0.30</td>
<td>0.40 ± 0.20</td>
<td>0.55 ± 0.10</td>
</tr>
</tbody>
</table>

Recommended Solder Pad Layout

WARNING Cancer and Reproductive Harm
www.P65Warnings.ca.gov
* Such products may contain trace amounts of lead of less than 100 ppm.
*** 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.
CR-PF Series Ultra-Low Lead Content Thick Film Resistor

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 (Ω)

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

(Solder: Sn96.5 / Ag3 / Cu05)

Derating Curve

**Solder Profile**

- **Average ramp-up rate**
  
  \[ (T_{\text{Smax}} \text{ to } T_p) \]
  
  3 °C / second max.

- **Preheat**
  - **Temperature Min.** (\( T_{\text{Smin}} \))
  - **Temperature Max.** (\( T_{\text{Smax}} \))
  - **Time** (\( T_{\text{Smin}} \text{ to } T_{\text{Smax}} \)) (\( t_b \))
    - \( 150 \) °C
    - \( 200 \) °C
    - 60–150 seconds

- **Time maintained above**
  - **Temperature** (\( T_L \))
  - **Time** (\( T_L \))
    - \( 217 \) °C
    - 60–120 seconds

- **Peak Temperature** (\( T_p \))
  - \( 260 \) °C

- **Time within +0/-5 °C of actual Peak Temperature** (\( T_p \))²
  - 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

**How to Order**

<table>
<thead>
<tr>
<th>Model</th>
<th>CR = Thick Film Fixed Resistor Chip</th>
</tr>
</thead>
</table>
| Size  | 0402 = 0402 Size  
0603 = 0603 Size  
0805 = 0805 Size  
1206 = 1206 Size |
| Resistance Tolerance | F = ±1%  
J = ±5%  
W = ±200 PPM/°C  
X = ±100 PPM/°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)  
≥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)  
≥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

### Specifications

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### Performance Characteristics

<table>
<thead>
<tr>
<th>Test</th>
<th>Specification</th>
<th>Procedure</th>
<th>Test Limits ΔR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Coefficient of Resistance</td>
<td>IEC 60115-1-4.8</td>
<td>+25 °C ~ +125 °C</td>
<td>±(1 % + 0.05 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.8</td>
<td></td>
<td>Remarks: 0 Ω: 50 mΩ or less</td>
</tr>
<tr>
<td>Short Time Overload</td>
<td>IEC 60115-1-4.13</td>
<td>2.5 times rated power for 5 seconds</td>
<td>±(5 % + 0.1 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.13</td>
<td></td>
<td>Remarks: 0 Ω: 50 mΩ or less</td>
</tr>
<tr>
<td>Intermittent Overload</td>
<td>IEC 60115-1-4.39</td>
<td>3 times rated voltage or max. overloading voltage, 25 seconds “OFF”, 10,000 cycles</td>
<td>±(5 % + 0.1 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.39</td>
<td></td>
<td>Remarks: 0 Ω: 50 mΩ or less</td>
</tr>
<tr>
<td>Endurance (Load Life)</td>
<td>IEC 60115-1-4.25.1</td>
<td>1000 hours at rated voltage, +70 °C, 1.5 hours “ON”, 0.5 hour “OFF”</td>
<td>1 %: ±(1 % + 0.05 Ω) 5 %: ±(3 % + 0.1 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.25.1</td>
<td></td>
<td>Remarks: 0402: ±(3 % + 0.1 Ω) 0 Ω: 100 mΩ or less</td>
</tr>
<tr>
<td>Load Life with Humidity</td>
<td>IEC 60115-1-4.24</td>
<td>1000 hours at rated voltage, +40 ±2 °C, 90–95 % RH, 1.5 hours “ON”, 0.5 hour “OFF”</td>
<td>1 %: ±(1 % + 0.05 Ω) 5 %: ±(3 % + 0.1 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.24</td>
<td></td>
<td>Remarks: 0402: ±(3 % + 0.1 Ω) 0 Ω: 100 mΩ or less</td>
</tr>
<tr>
<td>Rapid Change of Temperature</td>
<td>IEC 60115-1-4.19</td>
<td>-55 °C (30 minutes) / +155 °C (30 minutes) 5 cycles</td>
<td>1 %: ±(0.5 % + 0.05 Ω) 5 %: ±(1 % + 0.05 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.19</td>
<td></td>
<td>Remarks: 0 Ω: 50 mΩ or less</td>
</tr>
<tr>
<td>Solderability</td>
<td>IEC 60115-1-4.17</td>
<td>245 ±5 °C solder for 2 ± 0.5 seconds; Solder: Sn96.5 / Ag3.0 / Cu0.5</td>
<td>At least 95 % of surface area of electrode shall be covered with new solder.</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture No Load</td>
<td>IEC 60115-1-4.24.2.1a</td>
<td>+85 °C, 85 % RH, 1000 hours</td>
<td>&lt; ±0.5 %</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.24.2.1a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Cycle</td>
<td>IEC 60115-1-4.19</td>
<td>-55 °C and +155 °C, 100 cycles, 15 minutes per extreme condition</td>
<td>&lt; ±0.5 %</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance to Soldering Heat</td>
<td>IEC 60115-1-4.18</td>
<td>260 ±5 °C for 10 ±1 seconds</td>
<td>&lt; ±0.5 %</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robustness of Termination (Bending)</td>
<td>IEC 60115-1-4.33</td>
<td>3 mm deflection</td>
<td>1 %: ±(0.5 % + 0.05 Ω) 5 %: ±(1 % + 0.05 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.33</td>
<td></td>
<td>Remarks: 0 Ω: 50 mΩ or less</td>
</tr>
<tr>
<td>Dielectric Withstanding Voltage (Voltage Proof)</td>
<td>IEC 60115-1-4.7</td>
<td>Applied voltage for 1 minute: 0402 &amp; 0603: 300 V 0805 &amp; 1206: 500 V</td>
<td>No abnormalities such as flashover, burning, or dielectric breakdown shall occur.</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>IEC 60115-1-4.6</td>
<td>Applied voltage for 1 minute: 100 V</td>
<td>≥ 1 GΩ</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance to Dry Heat</td>
<td>IEC 60115-1-4.23.2</td>
<td>155 ±5 °C for 96 ±4 hours</td>
<td>1 %: ±(1 % + 0.05 Ω) 5 %: ±(2 % + 0.1 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.23.2</td>
<td></td>
<td>Remarks: 0 Ω: 50 mΩ or less</td>
</tr>
<tr>
<td>Resistance to Solder Heat</td>
<td>IEC 60115-1-4.18</td>
<td>270 ±5 °C solder for 10 ±1 seconds</td>
<td>1 %: ±(0.5 % + 0.05 Ω) 5 %: ±(1 % + 0.05 Ω)</td>
</tr>
<tr>
<td></td>
<td>JIS-C5201-1-4.18</td>
<td></td>
<td>Remarks: 0 Ω: 50 mΩ or less</td>
</tr>
</tbody>
</table>
CR-PF Series Ultra-Low Lead Content Thick Film Resistor

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 x 10^2 = 100 ohms = 1K 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 x 100 = 100 ohms

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

This table shows the first two digits for the three-digit E96 part marking scheme. The third character is a letter multiplier:

- A=10^0
- B=10^1
- C=10^2
- D=10^3
- E=10^4
- F=10^5
- G=10^-6
- H=10^-7
- X=10^-1
- Y=10^-2
- Z=10^-3

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

Packaging Dimensions (Conforms to EIA RS-481A)

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>W</th>
<th>F</th>
<th>E</th>
<th>P1</th>
<th>P2</th>
<th>P0</th>
<th>D0</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR0402-PF</td>
<td>0.70</td>
<td>1.20</td>
<td>8.00</td>
<td>3.50</td>
<td>1.75</td>
<td>2.00</td>
<td>2.00</td>
<td>1.50</td>
<td>0.45</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.10</td>
</tr>
<tr>
<td></td>
<td>(.28 ± .02)</td>
<td>(.47 ± .02)</td>
<td>(.28 ± .02)</td>
<td>(.94 ± .02)</td>
<td>(.10 ± .01)</td>
<td>(.10 ± .01)</td>
<td>(.35 ± .01)</td>
<td>(.39 ± .01)</td>
<td>(.20 ± .01)</td>
<td>(.20 ± .01)</td>
</tr>
<tr>
<td>CR0603-PF</td>
<td>1.10</td>
<td>1.90</td>
<td>1.05</td>
<td>1.38</td>
<td>1.58</td>
<td>1.50</td>
<td>1.50</td>
<td>1.06</td>
<td>0.64</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.10</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.10</td>
<td>±0.10</td>
</tr>
<tr>
<td></td>
<td>(.43 ± .04)</td>
<td>(.075 ± .04)</td>
<td>(.035 ± .04)</td>
<td>(.039 ± .04)</td>
<td>(.10 ± .01)</td>
<td>(.10 ± .01)</td>
<td>(.06 ± .01)</td>
<td>(.025 ± .04)</td>
<td>(.025 ± .04)</td>
<td>(.025 ± .04)</td>
</tr>
<tr>
<td>CR0805-PF</td>
<td>1.60</td>
<td>2.40</td>
<td>1.35</td>
<td>1.18</td>
<td>1.58</td>
<td>1.50</td>
<td>1.50</td>
<td>1.06</td>
<td>0.84</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>±0.15</td>
<td>±0.20</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.10</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.10</td>
<td>±0.10</td>
</tr>
<tr>
<td></td>
<td>(.63 ± .006)</td>
<td>(.094 ± .008)</td>
<td>(.035 ± .008)</td>
<td>(.039 ± .008)</td>
<td>(.10 ± .01)</td>
<td>(.10 ± .01)</td>
<td>(.06 ± .01)</td>
<td>(.025 ± .04)</td>
<td>(.025 ± .04)</td>
<td>(.025 ± .04)</td>
</tr>
<tr>
<td>CR1206-PF</td>
<td>2.00</td>
<td>3.60</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>1.50</td>
<td>1.50</td>
<td>1.06</td>
<td>0.84</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>±0.15</td>
<td>±0.20</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.10</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.10</td>
<td>±0.10</td>
</tr>
<tr>
<td></td>
<td>(.79 ± .006)</td>
<td>(.142 ± .008)</td>
<td>(.035 ± .008)</td>
<td>(.039 ± .008)</td>
<td>(.10 ± .01)</td>
<td>(.10 ± .01)</td>
<td>(.06 ± .01)</td>
<td>(.025 ± .04)</td>
<td>(.025 ± .04)</td>
<td>(.025 ± .04)</td>
</tr>
</tbody>
</table>

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