



## 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

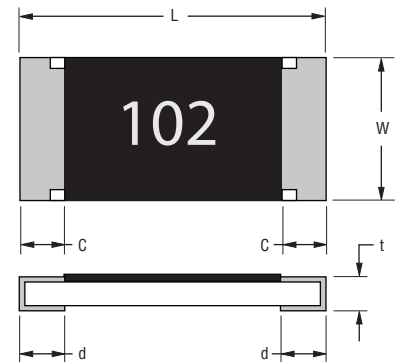
Characteristic	Model			
	CR0402-PF	CR0603-PF	CR0805-PF	CR1206-PF
Power Rating @ 70 °C	0.0625 W	0.10 W	0.125 W	0.25 W
Operating Temperature Range	-55 °C to +155 °C			
Derated to Zero Load at	+155 °C			
Maximum Working Voltage	50 V	75 V	150 V	200 V
Maximum Overload Voltage	100 V	150 V	300 V	400 V
Resistance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

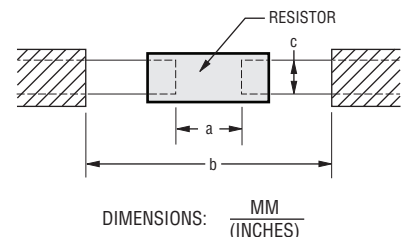
Model	L	W	C	d	t
CR0402-PF	$\frac{1.00 \pm 0.10}{(0.039 \pm 0.004)}$	$\frac{0.50 \pm 0.05}{(0.020 \pm 0.002)}$	$\frac{0.20 \pm 0.10}{(0.008 \pm 0.004)}$	$\frac{0.25 \pm 0.10}{(0.010 \pm 0.004)}$	$\frac{0.32 \pm 0.05}{(0.013 \pm 0.002)}$
CR0603-PF	$\frac{1.60 \pm 0.10}{(0.063 \pm 0.004)}$	$\frac{0.80 \pm 0.05}{(0.031 \pm 0.002)}$	$\frac{0.30 \pm 0.20}{(0.012 \pm 0.008)}$	$\frac{0.30 \pm 0.20}{(0.012 \pm 0.008)}$	$\frac{0.45 \pm 0.10}{(0.018 \pm 0.004)}$
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	$\frac{2.0 \sim 2.4}{(0.079 \sim 0.094)}$	$\frac{4.4 \sim 5.0}{(0.173 \sim 0.197)}$	$\frac{1.2 \sim 1.8}{(0.047 \sim 0.071)}$



\* 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; and (c) the total Bromine (Br) and Chlorine (Cl) content is 1500 ppm or less.

Specifications are subject to change without notice.

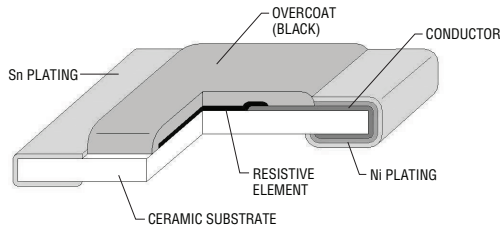
The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.

Users should verify actual device performance in their specific applications.

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

**BOURNS®**

## Construction



## Rated Voltage

The rated voltage is calculated by the following formula:

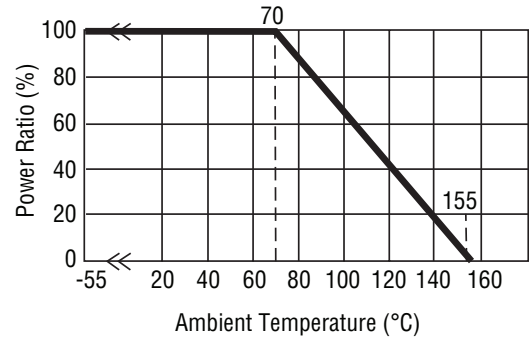
$$V = \sqrt{P \times R}$$

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

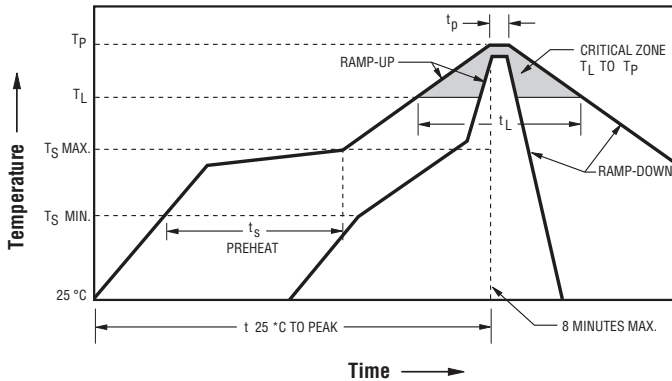
## Environmental Characteristics

Moisture Sensitivity Level..... 1  
 ESD Classification (HBM)..... 1A  
 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 <sub>smax</sub> to T <sub>p</sub> )	3 °C / second max.
Preheat: - Temperature Min. (T <sub>smin</sub> ) - Temperature Max. (T <sub>smax</sub> ) - Time (T <sub>smin</sub> to T <sub>smax</sub> ) (t <sub>s</sub> )	150 °C 200 °C 60~150 seconds
Time maintained above: - Temperature (T <sub>L</sub> ) - Time (T <sub>L</sub> )	217 °C 60~120 seconds
Peak Temperature (T <sub>p</sub> )	260 °C
Time within +0/-5 °C of actual Peak Temperature (T <sub>p</sub> ) <sup>2</sup>	10 seconds
Ramp-down rate	6 °C / second max.
Time 25 °C to Peak Temperature	8 minutes max.

Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

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

**BOURNS®**

## 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/ $^{\circ}$ C  
X =  $\pm 100$  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

Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

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

# BOURNS®

## Performance Characteristics

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

Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

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



## Typical Part Marking

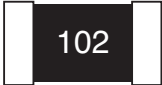
**±5 % (E24):**

**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<sup>2</sup> = 1000 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*



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:**

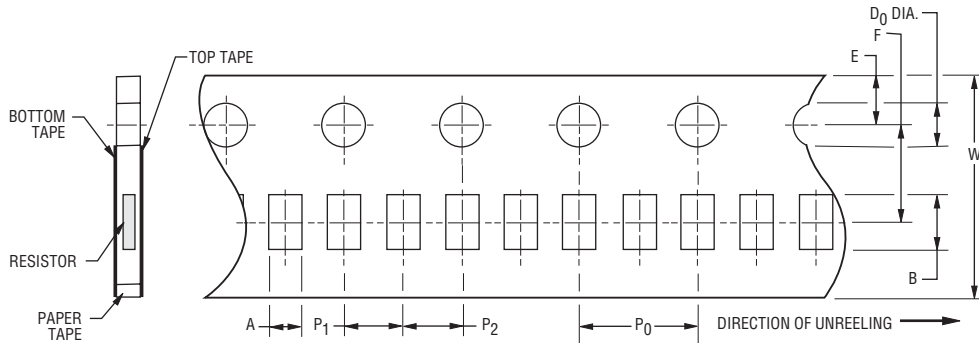
**CR0402-PF**



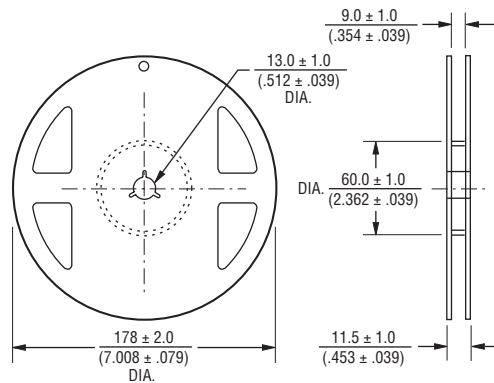
# CR-PF Series Ultra-Low Lead Content Thick Film Resistor



## 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 ± 0.05 (.028 ± .002)	1.20 ± 0.05 (.047 ± .002)	8.00 ± 0.20 (.315 ± .008)	3.50 ± 0.05 (.138 ± .002)	1.75 ± 0.10 (.069 ± .004)	2.00 ± 0.10 (.079 ± .004)	2.00 ± 0.10 (.079 ± .004)	4.00 ± 0.10 (.158 ± .004)	1.50 ± 0.10 (.006 ± .004)	0.45 ± 0.10 (.018 ± .004)
	1.10 ± 0.10 (.043 ± .004)	1.90 ± 0.10 (.075 ± .004)				4.00 ± 0.10 (.158 ± .004)	2.00 ± 0.05 (.079 ± .002)			0.64 ± 0.10 (.025 ± .004)
CR0603-PF	1.10 ± 0.10 (.043 ± .004)	1.90 ± 0.10 (.075 ± .004)	8.00 ± 0.20 (.315 ± .008)	3.50 ± 0.05 (.138 ± .002)	1.75 ± 0.10 (.069 ± .004)	4.00 ± 0.10 (.158 ± .004)	2.00 ± 0.05 (.079 ± .002)	4.00 ± 0.10 (.158 ± .004)	1.50 ± 0.10 (.006 ± .004)	0.84 ± 0.10 (.033 ± .004)
CR0805-PF	1.60 ± 0.15 (.063 ± .006)	2.40 ± 0.20 (.094 ± .008)								2.00 ± 0.15 (.079 ± .006)
CR1206-PF	2.00 ± 0.15 (.079 ± .006)	3.60 ± 0.20 (.142 ± .008)								



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