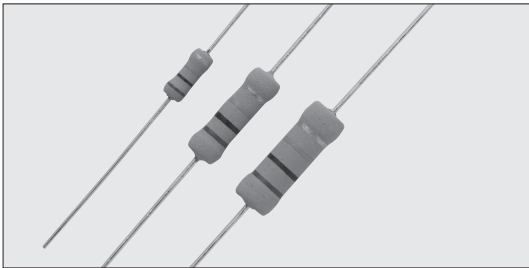
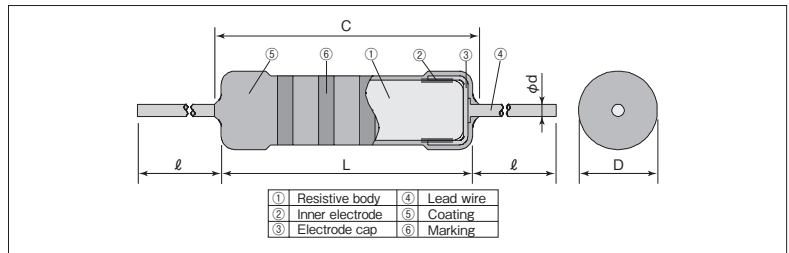


## PCF Ceramic Resistors for Anti Pulse · Surge



Coating color : Light green  
Marking : Color code

### Construction



### Features

- KOA original bulk ceramic resistors.
- Excellent in anti-pulse resistance and inrush current characteristics.
- Higher reliability against disconnection compared to wirewound resistors and film resistors.
- Products meet EU-RoHS requirements.
- Flame retardant coating. (Equivalent to UL-94 V-0)
- Non-Inductive resistors.
- AEC-Q200 Tested.

### Applications

- High voltage circuits for X-ray generators and electron microscopes.
- Power supply circuits for machine tools, etc.

### Reference Standards

IEC 60115-1  
JIS C 5201-1

### Dimensions

| Type   | Dimensions (mm) |        |         |            |                   | Weight (g)<br>(1000pcs) |
|--------|-----------------|--------|---------|------------|-------------------|-------------------------|
|        | L±1             | C max. | D       | d(Nominal) | ℓ±3 <sup>*1</sup> |                         |
| PCF1/2 | 9.0             | 11.1   | 3.5±0.5 | 0.7        | 30.0              | 450                     |
| PCF1   | 16.5            | 19.0   | 5.5±1.0 | 0.8        | 38.0              | 1340                    |
| PCF2   | 19.0            | 22.5   | 7.0±1.0 |            |                   | 2240                    |

\*1 Lead length changes depending on taping type.

### Type Designation

Example

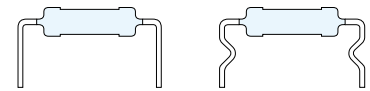
| PCF          | 1                            | C                         | T631            | R                   | 103                | K                    |
|--------------|------------------------------|---------------------------|-----------------|---------------------|--------------------|----------------------|
| Product Code | Power Rating                 | Terminal Surface Material | Taping          | Packaging           | Nominal Resistance | Resistance Tolerance |
| PCF          | 1/2:0.5W<br>1:1.0W<br>2:2.0W | C: SnCu                   | See table Below | R: REEL<br>Nil: BOX | 3 digits           | K: ±10%<br>M: ±20%   |

Contact us when you have control request for environmental hazardous material other than the substance specified by EU-RoHS.

For further information on taping, please refer to APPENDIX C on the back pages.

### Taping

| Type   | Axial Taping |      |
|--------|--------------|------|
|        | T52          | T631 |
| PCF1/2 | ○            | —    |
| PCF1   | —            | ○    |
| PCF2   | —            | ○    |



Contact us for lead forming details.

### Ratings

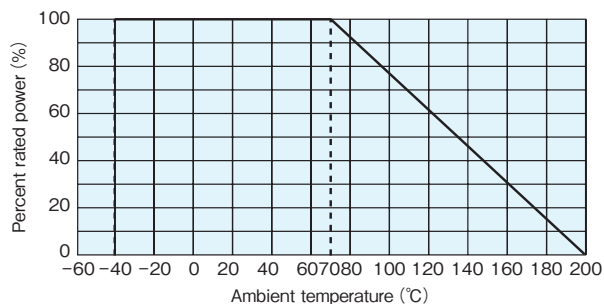
| Type   | Power Rating | Resistance Range (Ω) |               | T.C.R.<br>(×10 <sup>-6</sup> /K)  | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | Taping & Q'ty/reel (pcs) |       |
|--------|--------------|----------------------|---------------|---|----------------------|-----------------------|---------------------------------|--------------------------|-------|
|        |              | K: ±10%<br>E12       | M: ±20%<br>E6 |   |                      |                       |                                 | T52R                     | T631R |
| PCF1/2 | 0.5W         | 4.7~100k             | 4.7~100k      | -500~-1300: 3.3Ω ≤ R < 10Ω<br>-600~-1500: 10Ω ≤ R < 100Ω<br>-700~-1800: 100Ω ≤ R < 1kΩ<br>-900~-1900: 1kΩ ≤ R < 100kΩ<br>-900~-2000: 100kΩ ≤ R < 200kΩ<br>-900~-2200: 200kΩ ≤ R ≤ 390kΩ | 200V                 | 400V                  | 500V                            | 2,000                    | —     |
| PCF1   | 1.0W         | 3.3~390k             | 3.3~330k      | 300V  | 600V                 | —                     |                                 | 1,000                    |       |
| PCF2   | 2.0W         |                      |               | 400V  | 800V                 | 700V                  | —                               | 500                      |       |

Rated Ambient Temperature : +70°C

Operating Temperature Range : -40°C ~ +200°C

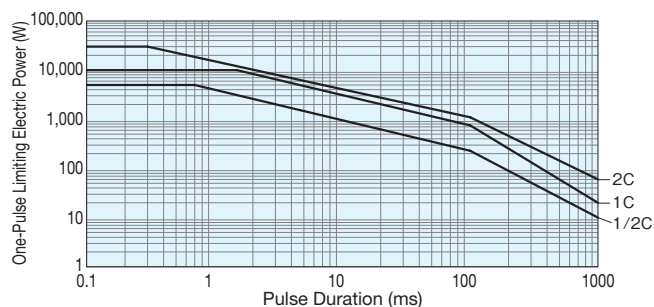
Rated voltage = √(Power Rating × Resistance value) or Max. working voltage, whichever is lower.

## Derating Curve



For resistors operated at the ambient temperature of 70°C or higher, the power rating shall be derated in accordance with the above derating curve.

## One-Pulse Limiting Electric Power



※The maximum applicable voltage is equal to the max. overload voltage.

Please ask us about the resistance characteristic of continuous applied pulse.

The pulse endurance values are not assured values, so be sure to check the products on actual equipment when you use them.

## Performance

| Test Items   | Performance Requirements<br>$\Delta R \pm (\% + 0.05\Omega)$   |  | Test Methods  |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|--|--|--|---|-------------------|--------------|--|--------|--|---|--|----|--|----|------|---|---|--|---|------|--|----|---|---|--|---|--|--|----|
|  | Limit  | Typical  |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Resistance   | Within specified tolerance   | —  | 25°C  |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  |  |  | Resistance  | Measuring voltage |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  |  |  | $3.3\Omega \leq R < 10\Omega$   | 0.3V              |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  |  |  | $10\Omega \leq R < 100\Omega$   | 1.0V              |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  |  |  | $100\Omega \leq R \leq 390k\Omega$  | 3.0V              |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| T.C.R.   | $-500 \sim -1300 : 3.3\Omega \leq R < 10\Omega$<br>$-600 \sim -1500 : 10\Omega \leq R < 100\Omega$<br>$-700 \sim -1800 : 100\Omega \leq R < 1k\Omega$<br>$-900 \sim -1900 : 1k\Omega \leq R < 100k\Omega$<br>$-900 \sim -2000 : 100k\Omega \leq R < 200k\Omega$<br>$-900 \sim -2200 : 200k\Omega \leq R \leq 390k\Omega$ | —  | +25°C/-40°C, +25°C/+75°C and +25°C/+125°C   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Voltage coefficient<br>(Apply for 1k $\Omega$ or over) | 0 ~ -0.20%/V   | —  | Rated voltage and rated voltage $\times$ 10%  |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Overload (Short time)                                  | 2  | 0.4  | Rated voltage $\times$ 2.5 or Max. overload vol., whichever is lower, for 5s.   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Resistance to pulse                                    | Refer to the right table   | —  | The resistor mounted on to the test circuit as below is applied with high voltage impulse 10000 cycles.   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  |  |  | <table border="1"> <thead> <tr> <th>Type</th> <th>Test voltage</th> <th>Performance Requirements<br/><math>\Delta R \pm (\% + 0.05\Omega)</math></th> </tr> </thead> <tbody> <tr><td rowspan="3">PCF1/2</td><td>10kV: 4.7<math>\Omega</math> <math>\leq</math> R &lt; 10k<math>\Omega</math></td><td>5</td></tr> <tr><td>10kV: 10k<math>\Omega</math> <math>\leq</math> R &lt; 33k<math>\Omega</math></td><td>10</td></tr> <tr><td>10kV: 33k<math>\Omega</math> <math>\leq</math> R <math>\leq</math> 100k<math>\Omega</math></td><td>25</td></tr> <tr><td rowspan="2">PCF1</td><td>4kV: 10k<math>\Omega</math> <math>\leq</math> R <math>\leq</math> 100k<math>\Omega</math></td><td>5</td></tr> <tr><td>14kV: 3.3<math>\Omega</math> <math>\leq</math> R &lt; 30k<math>\Omega</math></td><td>5</td></tr> <tr><td rowspan="3">PCF2</td><td>14kV: 30k<math>\Omega</math> <math>\leq</math> R <math>\leq</math> 390k<math>\Omega</math></td><td>10</td></tr> <tr><td>7kV: 30k<math>\Omega</math> <math>\leq</math> R <math>\leq</math> 390k<math>\Omega</math></td><td>5</td></tr> <tr><td>20kV: 3.3<math>\Omega</math> <math>\leq</math> R &lt; 10k<math>\Omega</math></td><td>5</td></tr> <tr><td></td><td>20kV: 10k<math>\Omega</math> <math>\leq</math> R <math>\leq</math> 390k<math>\Omega</math></td><td>10</td></tr> <tr><td></td><td>11kV: 10k<math>\Omega</math> <math>\leq</math> R <math>\leq</math> 390k<math>\Omega</math></td><td>5</td></tr> </tbody> </table> | Type              | Test voltage | Performance Requirements<br>$\Delta R \pm (\% + 0.05\Omega)$ | PCF1/2 | 10kV: 4.7 $\Omega$ $\leq$ R < 10k $\Omega$ | 5 | 10kV: 10k $\Omega$ $\leq$ R < 33k $\Omega$ | 10 | 10kV: 33k $\Omega$ $\leq$ R $\leq$ 100k $\Omega$ | 25 | PCF1 | 4kV: 10k $\Omega$ $\leq$ R $\leq$ 100k $\Omega$ | 5 | 14kV: 3.3 $\Omega$ $\leq$ R < 30k $\Omega$ | 5 | PCF2 | 14kV: 30k $\Omega$ $\leq$ R $\leq$ 390k $\Omega$ | 10 | 7kV: 30k $\Omega$ $\leq$ R $\leq$ 390k $\Omega$ | 5 | 20kV: 3.3 $\Omega$ $\leq$ R < 10k $\Omega$ | 5 |  | 20kV: 10k $\Omega$ $\leq$ R $\leq$ 390k $\Omega$ | 10 |
| Type   | Test voltage   | Performance Requirements<br>$\Delta R \pm (\% + 0.05\Omega)$ |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| PCF1/2   | 10kV: 4.7 $\Omega$ $\leq$ R < 10k $\Omega$   | 5  |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  | 10kV: 10k $\Omega$ $\leq$ R < 33k $\Omega$   | 10   |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  | 10kV: 33k $\Omega$ $\leq$ R $\leq$ 100k $\Omega$   | 25   |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| PCF1   | 4kV: 10k $\Omega$ $\leq$ R $\leq$ 100k $\Omega$  | 5  |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  | 14kV: 3.3 $\Omega$ $\leq$ R < 30k $\Omega$   | 5  |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| PCF2   | 14kV: 30k $\Omega$ $\leq$ R $\leq$ 390k $\Omega$   | 10   |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  | 7kV: 30k $\Omega$ $\leq$ R $\leq$ 390k $\Omega$  | 5  |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  | 20kV: 3.3 $\Omega$ $\leq$ R < 10k $\Omega$   | 5  |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  | 20kV: 10k $\Omega$ $\leq$ R $\leq$ 390k $\Omega$   | 10   |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
|  | 11kV: 10k $\Omega$ $\leq$ R $\leq$ 390k $\Omega$   | 5  |   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Resistance to soldering heat                           | 2  | 0.8  | 350°C $\pm$ 10°C, 3.5s $\pm$ 0.5s   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Rapid change of temp.                                  | 2  | 0.4  | -40°C (30min.) / +85°C (30min.) 5 cycles  |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Moisture resistance                                    | 5  | 0.6  | 40°C $\pm$ 2°C, 90% ~ 95%RH, 1000h<br>1.5h ON/0.5h OFF cycles   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Load life  | 5  | 0.4  | 70°C $\pm$ 2°C, 1000h<br>1.5h ON/0.5h OFF cycles  |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |
| Resistance to solvent                                  | No abnormality in appearance.<br>Marking shall be easily legible.  | —  | Dipping in IPA or Xylene for 3 min. and leaving for 10 min. after removing drops, then brushing 10 times.   |                   |              |  |        |  |   |  |    |  |    |      |   |   |  |   |      |  |    |   |   |  |   |  |  |    |

## Precautions for Use

- Under the environment where surge like thunders etc. is apt to happen, the resistors used for open circuit, resistors connected directly to input, output or ground, and resistors used for the circuit pulse applied to, may be destructed by surge or pulse. Therefore, the resistors need to be selected after sufficient check on the supposition of the worst condition against possible surge and pulse.
- Be careful to handle these resistors because outer coatings are comparatively weak to outer shock due to flameproof special coats. Please wash them to a minimum. No external force is given to the coating films until they are well dried because the coating films become weaker right after washing. The original strength will be returned after they are dried, so please pay attention not to apply any external force onto the coating film of resistors for 20 minutes after drying. Especially no PC boards shall be piled up.
- When overload is impressed continuously by the trouble of the circuit part because this product is hard to be snapped, a resistor body continues being overheated and emits smoke from a resistor and neighboring flammable materials and may catch fire. In a steady use state and heterology, please design the circuit so that the surface temperature of this product is not as above 200 degrees Celsius.