

# Ceramic Composition Resistors

## Type CCR Series

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The CCR series of resistors is constructed utilising solid ceramic composition, which is the traditional medium for absorbing high energy pulses, in cases of high inrush current. These resistors have evolved over many years to have excellent pulse withstand capabilities, whilst remaining very stable. These improved characteristics have been achieved by prudent selection of materials of optimum physical properties and by advances in the manufacturing process. The CCR series are ideal for circuitry associated performance in high voltage power supplies, R-C snubber circuits, and inrush limiters.

### Key Features

- Designed for Pulse Withstand
- Range of Resistance Tolerances
- Solid Ceramic Composition
- Low Cost, High Performance
- Two Sizes Available
- Wide Range of Resistance Values
- Available on Tape

### Characteristics - Electrical

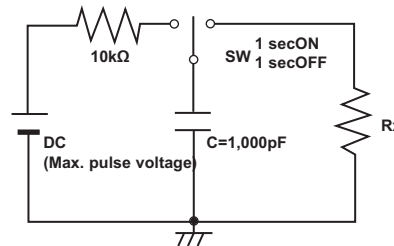
|                                       |                        |                        |                        |
|---------------------------------------|------------------------|------------------------|------------------------|
| <b>Power at 70°C Ambient:</b>         | 0.5 Watt.              | 1.0 Watt.              | 2.0 Watt.              |
| <b>Derating:</b>                      | Derating to 0 at 200°C | Derating to 0 at 200°C | Derating to 0 at 200°C |
| <b>Resistance Range:</b>              | 10R – 100K             | 3R3 – 390K             | 3R3 – 390K             |
| <b>Resistance Tolerance:</b>          | 10% E12 series         | 10% E12 series         | 10% E12 series         |
| <b>Temp. Coefficient (ppm/°C):</b>    | <100R: -900 to ±300    |                        | >100R: -1300 to ±300   |
| <b>Max. Working Voltage:</b>          | 200V                   | 300V                   | 400V                   |
| <b>Max. Overload Voltage:</b>         | 400V                   | 600V                   | 800V                   |
| <b>Dielectric Withstand Voltage:</b>  | 500 volts              | 500 volts              | 700 volts              |
| <b>Impulse Withstanding Voltage*:</b> | 10 Kv                  | 14 Kv                  | 20 Kv                  |

NB \*: Please refer to Resistance to Pulse Circuit

### Characteristics - Environmental

|  |                 |
|--|-----------------|
| <b>Operating Temperature Range:</b>                          | -40°C to +200°C |
| <b>Temperature Cycles (-40°C to 85°C, 5 cycles):</b>         | ΔR/R ± 2%       |
| <b>Load Life (1000 hours at 70°C):</b>                       | ΔR/R ± 5%       |
| <b>Resistance to Solder Heat (360°C for 3 seconds):</b>      | ΔR/R ± 3%       |
| <b>Short Time Overload (2x rated voltage for 5 seconds):</b> | ΔR/R ± 2%       |
| <b>Humidity (40°C, 95%RH 240 hrs.):</b>                      | ΔR/R ± 5%       |

### Resistance to Pulse Circuit



### Resistance to Pulse Graphs CCR1



### CCR2



### Dimensions



| BULK   | L          | D         | d (nom) | I      |
|--------|------------|-----------|---------|--------|
| CCR1/2 | 9.0 ± 1.0  | 3.5 ± 0.5 | 0.7     | 30 ± 3 |
| CCR1   | 16.5 ± 1.0 | 5.5 ± 1.0 | 0.8     | 38 ± 3 |
| CCR2   | 19.0 ± 1.0 | 7.0 ± 1.0 | 0.8     | 38 ± 3 |

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### Application Notes

#### Limitations of Potential Pulsing on Fixed Ceramic Composition Resistors

Ceramic Composition resistors are susceptible to failure under some high voltage conditions. In circuitry where there is a possibility of transient potentials, considerable high voltage may be applied to a resistor for a short period of time. These notes are intended to aid the determining of "safe" potential level for the CCR Series when used in pulse application.

For Pulse Power limitations please refer to the graph (fig.1). Power below that specified on the graph will, generally not cause any significant degradation to the resistor, but please note that the resistance value may vary slightly due to repeated pulsing over a long period of time. The circuit designer should also be aware of the fact that the pulse voltage is limited even under the conditions on which the graph is based. The maximum peak pulse voltage for these resistors is the lesser of (A) or (B) below.

(A)

$$V_{\text{peak}} = \sqrt{P_o \times R}$$

Where:

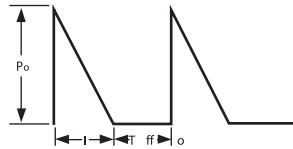
"P<sub>o</sub>" is the pulse limit power taken from the graph.

"R" is the resistance value in ohms.

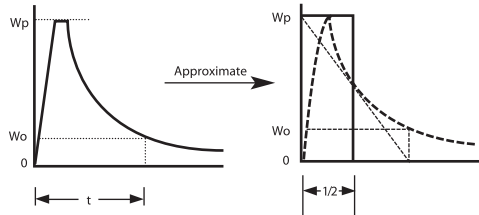
(B)

|      |        |      |
|------|--------|------|
|      | CCR1/2 | 800V |
| CCR1 | 1200V  |      |
| CCR2 | 1600V  |      |

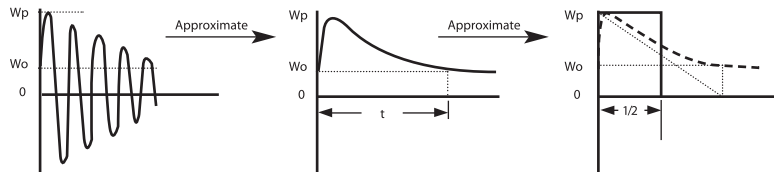
The Peak Power is defined as the maximum power dissipated at any point in time regardless of the waveform shape.



The Pulse Waveform, if other than square wave, must first be converted to an approximate square wave as shown below.



$W_p$  - Peak Power.  $W_o$  - Rated Power.  $t$  - Time to attenuate down to the rated power.



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### Application Notes

The following design rules determine if derating of the Pulse Limit Power ( $P_o$ ) obtained from the graph is required for repetitive pulse applications.

1. If  $T_{\text{off}} < 4\mu$  seconds, or  $T_{\text{off}} < 5$  milliseconds and  $(T_{\text{off}}/t) < 1$ , then the peak power is treated as continuous power and, therefore,  $P_m =$  the resistor's rated wattage.
2. If  $T_{\text{off}}$  is  $> 4\mu$  sec, but is  $< 100\mu$  sec, and  $(T_{\text{off}}/t) < 700$ , then  $P_m = P_o \times 0.01 \times (T_{\text{off}}/t)^{0.7}$ .
3. If  $T_{\text{off}}$  is  $> 100\mu$  sec, and  $(T_{\text{off}}/t) < 200$ , then  $P_m = P_o \times 0.01 \times (T_{\text{off}}/t)^{0.85}$ .
4. If  $T_{\text{off}}$  is  $> 4\mu$  sec, but is  $< 100\mu$  sec, and  $(T_{\text{off}}/t) < 700$ , or  $T_{\text{off}}$  is  $> 100\mu$  sec, and  $(T_{\text{off}}/t) > 200$ , then  $P_m = P_o$  as obtained from the pulse power graph.

Where:

$P_m$ : Derated Pulse Power (W)  
 $P_o$ : Pulse Power from graph below (W)  
 $T_{\text{off}}$ : Off time between pulses (sec)  
 $t$ : Pulse width (sec)

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### Application Notes (continued)

**Notes**

- Graph pulse power ( $P_o$ ) is for ambient temperatures of 70°C or less. For ambient operating temperatures greater than 70°C, pulse power ( $P_o$ ) or ( $P_m$ ) must be further derated by 1.18% per °C above 70°C in accordance with the power derating schedule of the resistor.
- If derated pulse power ( $P_m$ ) is calculated to be less than the resistor's rated continuous power, the resistor's rated wattage should be used.

### Pulse Limiting Power ( $P_o$ ) One Pulse



### How to Order

| CCR                | 1  | 10R  | K                | B                     |
|--------------------|--|--|------------------|-----------------------|
| <b>Common Part</b> | <b>Power Rating</b>                          | <b>Resistance Value</b>  | <b>Tolerance</b> | <b>Packaging</b>      |
| CCR                | _ - 0.5 Watt<br>1 - 1.0 Watt<br>2 - 2.0 Watt | 10 ohm (10 ohms)<br>10R<br>1K ohms (1000 ohms)<br>1K0<br>100K ohms (100000 ohms)<br>100K | K - 10%          | B - Bulk<br>T - Taped |

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