



## Features

- Surge withstand IEC 61000-4-5 1.2/50  $\mu$ s
- Low thermal resistant ceramic core
- E24 resistance values
- RoHS compliant\*
- Wide power range (1~8 W)
- Coating material meets UL 94V-0 requirements

## Applications

- Smart meters
- Renewable energy
- Industrial
- Power supplies/chargers
- Lighting
- Instruments/gauges
- White goods

# WS Series High Surge Withstand Wirewound Resistor

### Electrical Characteristics

|                               |                                     |
|-------------------------------|-------------------------------------|
| Resistance Range .....        | See Popular Resistance Values Table |
| Power Rating @ 70 °C          |                                     |
| WS1M, WS1A .....              | 1 W                                 |
| WS2M, WS2A .....              | 2 W                                 |
| WS3M, WS3A .....              | 3 W                                 |
| WS5M, WS5A .....              | 5 W                                 |
| WS7M, WS7A .....              | 7 W                                 |
| WS8M .....                    | 8 W                                 |
| Tolerance .....               | 5 %                                 |
| Operating Temperature .....   | -55 °C to +200 °C                   |
| Temperature Coefficient ..... | $\pm$ 200 ppm/°C                    |
| Maximum Voltage .....         | $\sqrt{P \cdot R}$                  |

### Popular Resistance Values

| Code | R Value     |
|------|-------------|
| 15R0 | 15 $\Omega$ |
| 20R0 | 20 $\Omega$ |
| 22R0 | 22 $\Omega$ |
| 33R0 | 33 $\Omega$ |
| 47R0 | 47 $\Omega$ |

| Code | R Value       |
|------|---------------|
| 68R0 | 68 $\Omega$   |
| 1500 | 150 $\Omega$  |
| 1001 | 1K $\Omega$   |
| 3301 | 3.3K $\Omega$ |

Other E24 resistance values available upon request.

### Physical Characteristics

|                        |                                    |
|------------------------|------------------------------------|
| Resistor .....         | Low thermal resistant ceramic core |
| Lead Wire .....        | Tin-plated copper wire             |
| Coating Material ..... | Meets UL 94V-0 requirements        |

### Environmental Characteristics

| Test                      | Conditions   | Specification                           |
|---------------------------|--|---|
| Short Time Overload       | 10 times rated power for 5 seconds.  | $\Delta R \leq \pm(5 \% + 0.05 \Omega)$ |
| Solderability             | 245 $\pm$ 3 °C for 2.5 $\pm$ 0.5 seconds.  | Over 95 % coverage                      |
| Resistance to Solder Heat | 260 $\pm$ 5 °C for 10 $\pm$ 1 seconds.   | $\Delta R \leq \pm(1 \% + 0.05 \Omega)$ |
| Temperature Cycle         | 5 cycles, -55 °C $\pm$ 3 °C for 30 minutes, Room temperature for 15 minutes, +155 $\pm$ 2°C for 30 minutes, Room temperature for 15 minutes    | $\Delta R \leq \pm(2 \% + 0.05 \Omega)$ |
| Dielectric Strength       | Test voltage >500 Vrms for >1 minute.  | Pass                                    |
| Insulation Resistance     | Test voltage >500 Vrms for 1 minute.   | >10 <sub>9</sub> $\Omega$               |
| Load Life Humidity        | Rated continuous voltage for 1000 hours, 1.5 hours ON and 0.5 hours OFF at 90~95 % relative humidity and test temperature of 40 °C $\pm$ 2 °C. | $\Delta R \leq \pm(5 \% + 0.05 \Omega)$ |
| Load Life                 | Rated continuous voltage for 1000 hours, 1.5 hours ON and 0.5 hours OFF at a test temperature of 70 °C $\pm$ 2 °C. 1000 hours at rated power.  | $\Delta R \leq \pm(5 \% + 0.05 \Omega)$ |
| Surge                     | IEC 61000-4-5 1.2/50 $\mu$ s exponential.  | $\Delta R \leq \pm(5 \% + 0.05 \Omega)$ |

### How to Order

|   |                      |
|---|----------------------|
| Product Series                                    | <b>WS 3 M 22R0 J</b> |
| WS = Wirewound, High Surge Withstand              |                      |
| Power Rating                                      |                      |
| 1 = 1 Watt  |                      |
| 2 = 2 Watts                                       |                      |
| 3 = 3 Watts                                       |                      |
| 5 = 5 Watts                                       |                      |
| 7 = 7 Watts                                       |                      |
| 8 = 8 Watts                                       |                      |
| Pin Style   |                      |
| A = Axial Standard Version                        |                      |
| M = Axial Miniaturized Version                    |                      |
| Resistance Code                                   |                      |
| • R<100 ohms:                                     |                      |
| "R" represents decimal point                      |                      |
| (example: 22R0 = 22 ohms)                         |                      |
| • R $\geq$ 100 ohms:                              |                      |
| First three digits are significant,               |                      |
| fourth digit represents number of zeros to follow |                      |
| (example: 1001 = 1K ohms)                         |                      |
| Resistance Tolerance                              |                      |
| J = $\pm$ 5 %                                     |                      |

\*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011.

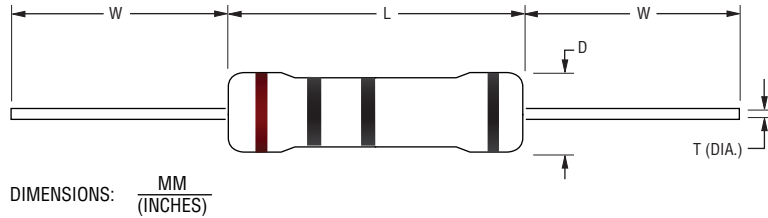
Specifications are subject to change without notice.

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# WS Series High Surge Withstand Wirewound Resistor

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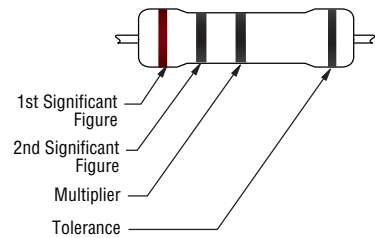
## Product Dimensions



| Model | Dimensions                              |                                       |   |   |
|-------|---|---------------------------------------|---|---|
|       | L*                                      | D                                     | W                                       | T                                       |
| WS1M  | $\frac{9.5 \pm 1.0}{(.374 \pm .004)}$   | $\frac{4.5 \pm 1.0}{(.177 \pm .004)}$ | $\frac{28.0 \pm 3.0}{(1.102 \pm .118)}$ | $\frac{0.65 \pm 0.05}{(.026 \pm .002)}$ |
| WS1A  | $\frac{11.5 \pm 1.0}{(.453 \pm .004)}$  | $\frac{5.0 \pm 1.0}{(.197 \pm .004)}$ | $\frac{28.0 \pm 3.0}{(1.102 \pm .118)}$ | $\frac{0.65 \pm 0.05}{(.026 \pm .002)}$ |
| WS2M  | $\frac{11.5 \pm 1.0}{(.453 \pm .004)}$  | $\frac{5.0 \pm 1.0}{(.197 \pm .004)}$ | $\frac{28.0 \pm 3.0}{(1.102 \pm .118)}$ | $\frac{0.65 \pm 0.05}{(.026 \pm .002)}$ |
| WS2A  | $\frac{15.5 \pm 1.0}{(.610 \pm .004)}$  | $\frac{5.5 \pm 1.0}{(.217 \pm .004)}$ | $\frac{28.0 \pm 3.0}{(1.102 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |
| WS3M  | $\frac{15.5 \pm 1.0}{(.610 \pm .004)}$  | $\frac{5.5 \pm 1.0}{(.217 \pm .004)}$ | $\frac{28.0 \pm 3.0}{(1.102 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |
| WS3A  | $\frac{17.5 \pm 1.0}{(.689 \pm .004)}$  | $\frac{6.5 \pm 1.0}{(.256 \pm .004)}$ | $\frac{28.0 \pm 3.0}{(1.102 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |
| WS5M  | $\frac{17.5 \pm 1.0}{(.689 \pm .004)}$  | $\frac{6.5 \pm 1.0}{(.256 \pm .004)}$ | $\frac{28.0 \pm 3.0}{(1.102 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |
| WS5A  | $\frac{24.5 \pm 1.0}{(.965 \pm .004)}$  | $\frac{8.5 \pm 1.0}{(.335 \pm .004)}$ | $\frac{38.0 \pm 3.0}{(1.496 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |
| WS7M  | $\frac{24.5 \pm 1.0}{(.965 \pm .004)}$  | $\frac{8.5 \pm 1.0}{(.335 \pm .004)}$ | $\frac{38.0 \pm 3.0}{(1.496 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |
| WS7A  | $\frac{29.5 \pm 1.0}{(1.161 \pm .004)}$ | $\frac{8.5 \pm 1.0}{(.335 \pm .004)}$ | $\frac{38.0 \pm 3.0}{(1.496 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |
| WS8M  | $\frac{29.5 \pm 1.0}{(1.161 \pm .004)}$ | $\frac{8.5 \pm 1.0}{(.335 \pm .004)}$ | $\frac{38.0 \pm 3.0}{(1.496 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |

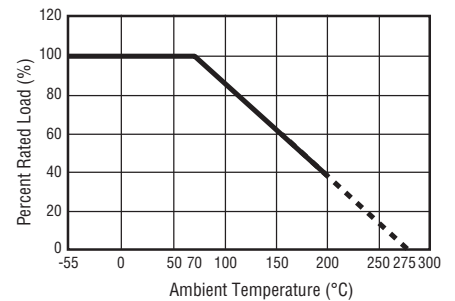
## Typical Part Marking

Resistors shall be marked with color coding. Colors shall be in accordance with JIS C 0802.



| Color  | 1st Band | 2nd Band | Multiplier | Tol.    |
|--------|----------|----------|------------|---------|
| Black  | 0        | 0        | 1 Ω        |         |
| Brown  | 1        | 1        | 10 Ω       | ±1 %    |
| Red    | 2        | 2        | 100 Ω      | ±2 %    |
| Orange | 3        | 3        | 1K Ω       |         |
| Yellow | 4        | 4        | 10K Ω      |         |
| Green  | 5        | 5        | 100K Ω     | ±0.5 %  |
| Blue   | 6        | 6        | 1M Ω       | ±0.25 % |
| Violet | 7        | 7        | 10M Ω      | ±0.10 % |
| Grey   | 8        | 8        |            | ±0.05 % |
| White  | 9        | 9        |            |         |
| Gold   |          |          | 0.1 Ω      | ±5 %    |
| Silver |          |          | 0.01 Ω     | ±10 %   |

## Power Derating Curve



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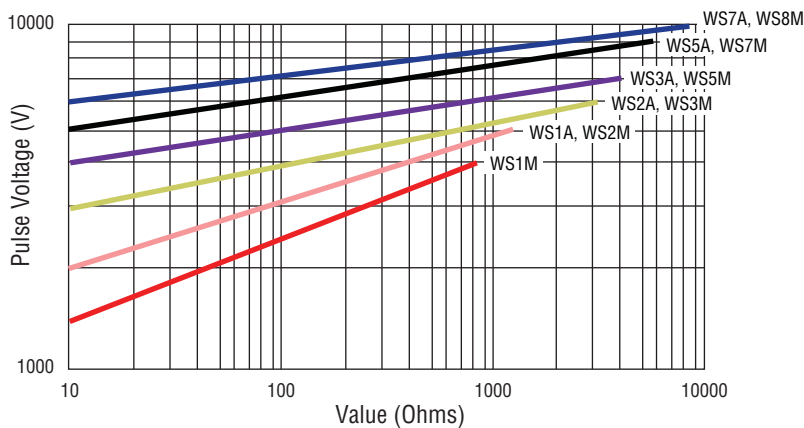
## Packaging Specifications



| Model      | O                                   | P                                    | A                                    | B                                    | C                                     | Pkg. Style | Min. Order Qty. (Pcs.) | Pcs./ Box |
|------------|-------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|------------|------------------------|-----------|
| WS1M       | $\frac{58 \pm 1}{(2.283 \pm .039)}$ | $\frac{5 \pm 0.3}{(.197 \pm .012)}$  | $\frac{75 \pm 5}{(2.953 \pm .197)}$  | $\frac{70 \pm 5}{(2.756 \pm .197)}$  | $\frac{255 \pm 5}{(10.039 \pm .197)}$ | Ammo Pack  | 5,000                  | 1,000     |
| WS1A, WS2M | $\frac{58 \pm 1}{(2.283 \pm .039)}$ | $\frac{5 \pm 0.3}{(.197 \pm .012)}$  | $\frac{80 \pm 5}{(3.150 \pm .197)}$  | $\frac{82 \pm 5}{(3.228 \pm .197)}$  | $\frac{255 \pm 5}{(10.039 \pm .197)}$ |            |                        |           |
| WS2A, WS3M | $\frac{65 \pm 5}{(2.559 \pm .197)}$ | $\frac{10 \pm 0.5}{(.394 \pm .020)}$ | $\frac{90 \pm 5}{(3.543 \pm .197)}$  | $\frac{119 \pm 5}{(4.685 \pm .197)}$ | $\frac{255 \pm 5}{(10.039 \pm .197)}$ |            |                        |           |
| WS3A, WS5M | $\frac{65 \pm 5}{(2.559 \pm .197)}$ | $\frac{10 \pm 0.5}{(.394 \pm .020)}$ | $\frac{90 \pm 5}{(3.543 \pm .197)}$  | $\frac{88 \pm 5}{(3.465 \pm .197)}$  | $\frac{255 \pm 5}{(10.039 \pm .197)}$ |            |                        |           |
| WS5A, WS7M | $\frac{90 \pm 5}{(3.543 \pm .197)}$ | $\frac{10 \pm 0.5}{(.394 \pm .020)}$ | $\frac{115 \pm 5}{(4.528 \pm .197)}$ | $\frac{124 \pm 5}{(4.882 \pm .197)}$ | $\frac{500 \pm 5}{(19.685 \pm .197)}$ |            | 2,000                  | 500       |

For WS7A and WS8M packaging specifications, please contact factory.

## Surge Performance - 1.2/50 $\mu$ s Pulse Withstanding Curve



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[WS3M15R0J](#) [WS1A47R0J](#) [WS7A15R0J](#) [WS2A15R0J](#) [WS2A47R0J](#) [WS1M15R0J](#) [WS1M1500J](#) [WS3A20R0J](#)  
[WS8M20R0J](#) [WS7M1001J](#) [WS1M20R0J](#) [WS3M47R0J](#) [WS2A1001J](#) [WS5A1500J](#) [WS5M3301J](#) [WS5A47R0J](#)  
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