



## 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.                                                                                                            | $\Delta R \leq \pm(5 \% \pm 0.05 \Omega)$ |
| 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 $\Omega$                              |
| 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                       | WS 3 M 22R0 J                                                                                                                                                                                                                                                                                         |
| WS = Wirewound, High Surge Withstand |                                                                                                                                                                                                                                                                                                       |
| Power Rating                         | <ul style="list-style-type: none"> <li>1 = 1 Watt</li> <li>2 = 2 Watts</li> <li>3 = 3 Watts</li> <li>5 = 5 Watts</li> <li>7 = 7 Watts</li> <li>8 = 8 Watts</li> </ul>                                                                                                                                 |
| Pin Style                            | <ul style="list-style-type: none"> <li>A = Axial Standard Version</li> <li>M = Axial Miniaturized Version</li> </ul>                                                                                                                                                                                  |
| Resistance Code                      | <ul style="list-style-type: none"> <li><math>R &lt; 100</math> ohms:<br/>"R" represents decimal point (example: 22R0 = 22 ohms)</li> <li><math>R \geq 100</math> ohms:<br/>First three digits are significant, fourth digit represents number of zeros to follow (example: 1001 = 1K ohms)</li> </ul> |
| Resistance Tolerance                 | J = $\pm 5$ %                                                                                                                                                                                                                                                                                         |

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

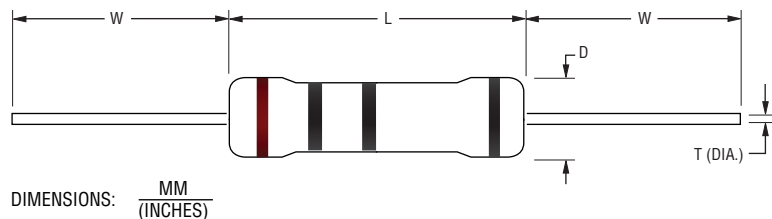
Specifications are subject to change without notice.

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# WS Series High Surge Withstand Wirewound Resistor

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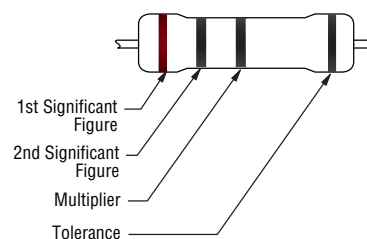
## Product Dimensions



| 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  | $\frac{29.5 \pm 1.0}{(1.161 \pm .004)}$ | $\frac{8.5 \pm 1.0}{(.335 \pm .004)}$ | $\frac{38.0 \pm 3.0}{(1.496 \pm .118)}$ | $\frac{0.75 \pm 0.05}{(.030 \pm .002)}$ |

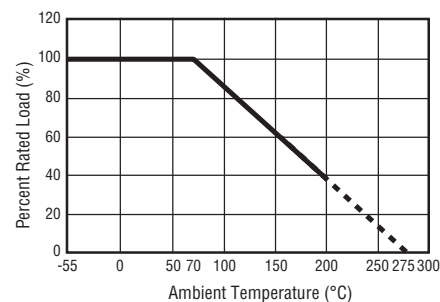
## Typical Part Marking

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 $\Omega$    |              |
| Brown  | 1        | 1        | 10 $\Omega$   | $\pm 1\%$    |
| Red    | 2        | 2        | 100 $\Omega$  | $\pm 2\%$    |
| Orange | 3        | 3        | 1K $\Omega$   |              |
| Yellow | 4        | 4        | 10K $\Omega$  |              |
| Green  | 5        | 5        | 100K $\Omega$ | $\pm 0.5\%$  |
| Blue   | 6        | 6        | 1M $\Omega$   | $\pm 0.25\%$ |
| Violet | 7        | 7        | 10M $\Omega$  | $\pm 0.10\%$ |
| Grey   | 8        | 8        |               | $\pm 0.05\%$ |
| White  | 9        | 9        |               |              |
| Gold   |          |          | 0.1 $\Omega$  | $\pm 5\%$    |
| Silver |          |          | 0.01 $\Omega$ | $\pm 10\%$   |

## Power Derating Curve

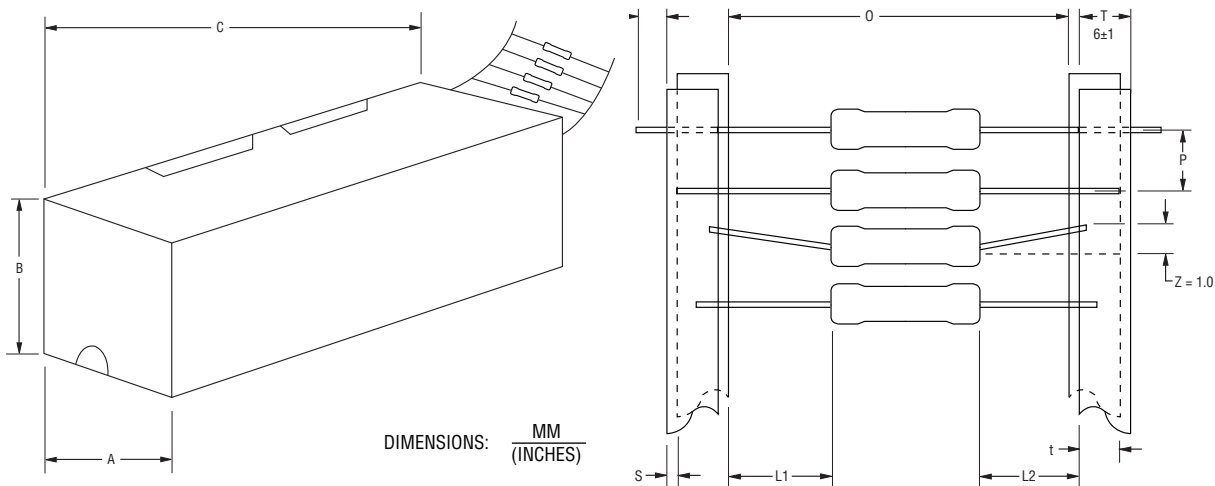


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# WS Series High Surge Withstand Wirewound Resistor

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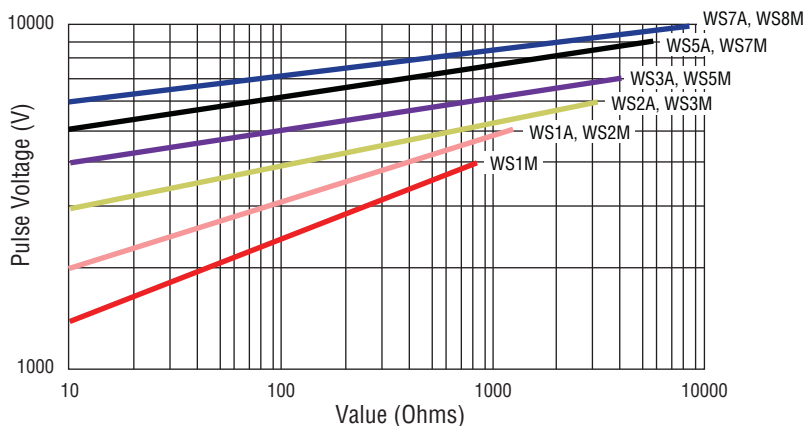
## Packaging Specifications



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

For WS7A and WS8M packaging specifications, please contact factory.

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



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