



## 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 <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	<ul style="list-style-type: none"> <li>• R&lt;100 ohms: "R" represents decimal point (example: 22R0 = 22 ohms)</li> <li>• R<math>\geq</math>100 ohms: 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.

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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.

# 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	$\frac{58 \pm 1}{(2.283 \pm .039)}$	$\frac{5 \pm 0.3}{(.197 \pm .112)}$	$\frac{75 \pm 5}{(2.953 \pm .197)}$	$\frac{70 \pm 5}{(2.756 \pm .197)}$	$\frac{255 \pm 5}{(10.039 \pm .197)}$	Ammo Pack	5,000	1,000 pcs.
WS1A, WS2M	$\frac{58 \pm 1}{(2.283 \pm .039)}$	$\frac{5 \pm 0.3}{(.197 \pm .112)}$	$\frac{80 \pm 5}{(3.150 \pm .197)}$	$\frac{82 \pm 5}{(3.228 \pm .197)}$	$\frac{255 \pm 5}{(10.039 \pm .197)}$			
WS2A, WS3M	$\frac{65 \pm 5}{(2.559 \pm .197)}$	$\frac{10 \pm 0.3}{(.393 \pm .112)}$	$\frac{90 \pm 5}{(3.543 \pm .197)}$	$\frac{119 \pm 5}{(4.685 \pm .197)}$	$\frac{255 \pm 5}{(10.039 \pm .197)}$			
WS3A, WS5M	$\frac{65 \pm 5}{(2.559 \pm .197)}$	$\frac{10 \pm 0.3}{(.393 \pm .112)}$	$\frac{90 \pm 5}{(3.543 \pm .197)}$	$\frac{88 \pm 5}{(3.465 \pm .197)}$	$\frac{255 \pm 5}{(10.039 \pm .197)}$			
WS5A, WS7M	$\frac{90 \pm 5}{(3.543 \pm .197)}$	$\frac{10 \pm 0.3}{(.393 \pm .112)}$	$\frac{115 \pm 5}{(4.528 \pm .197)}$	$\frac{124 \pm 5}{(4.882 \pm .197)}$	$\frac{500 \pm 5}{(19.685 \pm .197)}$		2,000	500 pcs.

For WS7A and WS8M packaging specifications, please contact factory.

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



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