



## 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	<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	• <u>R&lt;100 ohms:</u> "R" represents decimal point (example: 22R0 = 22 ohms) • <u>R<math>\geq</math>100 ohms:</u> 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.

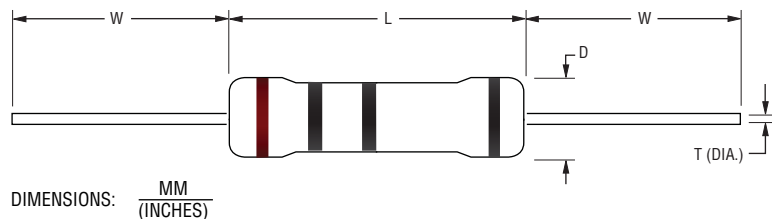
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# WS Series High Surge Withstand Wirewound Resistor

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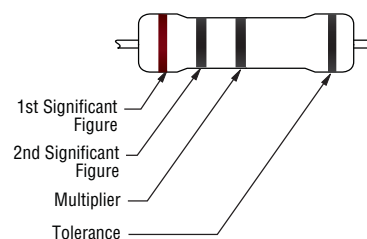
## Product Dimensions



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

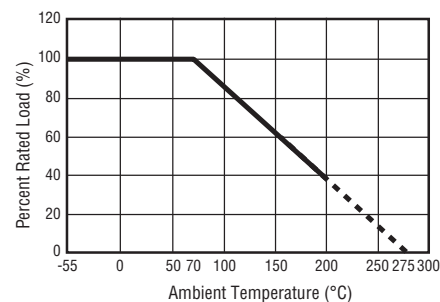
## Typical Part Marking

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

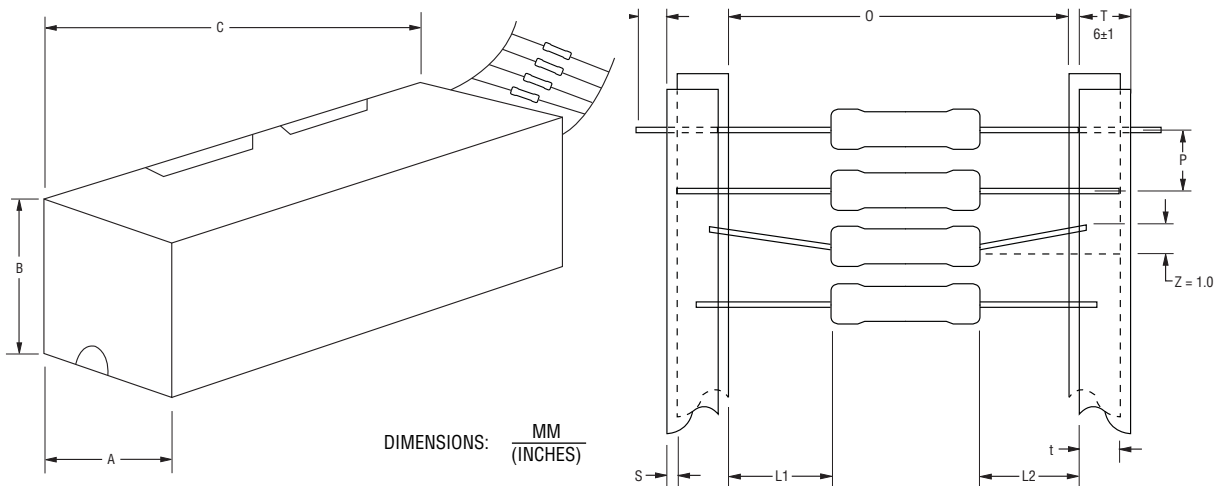


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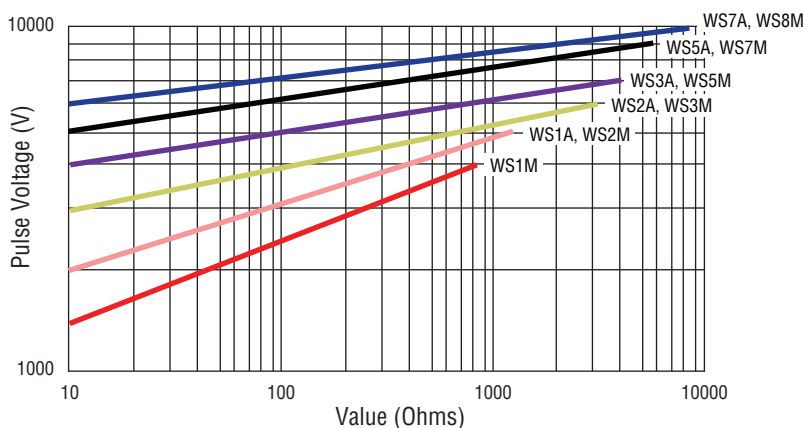
## Packaging Specifications



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