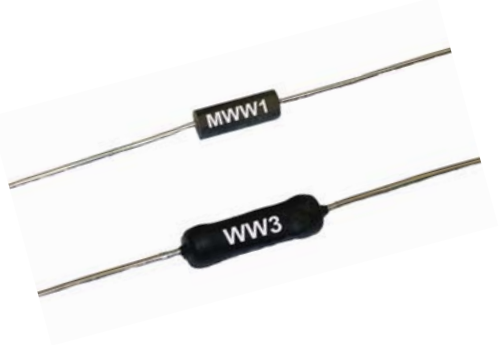
Features:

- WWS offers miniature size at higher power rating
- High performance for low cost
- High power to size ratio
- MWW – completely molded construction with welded terminations
- Complete welded terminations
- Tinned copper leads
- Available in non-inductive styles
- High temperature silicone coating
- RoHS compliant
- Higher operating temperatures may be available. Contact factory.



Electrical Specifications

Type / Code	MIL-R-26 Ref.	Dielectric Strength (V)	Power Rating (Watts) @ 25ºC	Resitance Temperature Coefficient	Ohmic Range(Ω) and Tolerance(1) 0.1%, 0.5%, 1% & 5%	
					Standard	Non-Inductive
WW12 / NWW12	-	500V	0.4W	< 1Ω = ±90ppm/ºC	0.1 - 2K	0.1 - 1K
WW1 / NWW1	-	500V	1W		0.1 - 3K	0.1 - 1.5K
WW1A / NWW1A	RW-70	500V	1W		0.1 - 7K	0.1 - 3.5K
WW2 / NWW2	RW-69	1,000V	1.5W		0.1 - 10K	0.1 - 5K
WWS2 / NWWS2	-	500V	2.5W		0.1 - 3K	0.1 - 1.5K
WW2A / NWW2A	-	1,000V	2.5W		0.1 - 15K	0.1 - 7.5K
WW3 / NWW3	RW-79	1,000V	3W		0.1 - 22K	0.1 - 11K
WWS3 / NWWS3	RW-69	1,000V	3W		0.1 - 10K	0.1 - 5K
WW3A / NWW3A	-	1,000V	3W		0.1 - 30K	0.1 - 15K
WW4 / NWW4	-	1,000V	4W		0.1 - 40K	0.1 - 20K
WWS4 / NWWS4	RW-79	1,000V	4W	1Ω to 10Ω = ±50ppmºC	0.1 - 22K	0.1 - 11K
WW5 / NWW5	RW-67, RW-74	1,000V	5W		0.1 - 50K	0.1 - 25K
WWS5 / NWWS5	-	1,000V	5W		0.1 - 40K	0.1 - 20K
WW7 / NWW7	-	1,000V	6.5W		0.1 - 70K	0.1 - 35K
WWS7 / NWWS7	RW-67, RW-74	1,000V	6.5W		0.1 - 50K	0.1 - 25K
WW7B / NWW7B	-	1,000V	7W		0.1 - 100K	0.1 - 50K
WW10 / NWW10	RW-78	1,000V	10W		0.1 - 150K	0.1 - 75K
WWS10 / NWWS10	-	1,000V	10W		0.1 - 100K	0.1 - 50K
MWW1 / NMWW1	RW-70	1,000V	1W	>10Ω = ±20ppm/ºC	0.1 - 2K	-
MWW3 / NMWW3	RW-79	1,000V	3W		0.1 - 20K	-
MWW5 / NMWW5	RW-67, RW-74	1,000V	5W		0.1 - 40K	-
MWW10 / NMWW10	RW-68, RW-74	1,000V	10W		0.1 - 150K	-

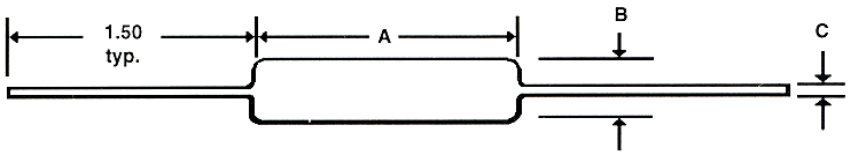
(1) Lesser of √PR or maximum working voltage

Please refer to the High Power Resistor Application Note (page 4) for more information on designing and implementing high power resistor types.

Performance Characteristics

Test	Test Condition	Result
Moisture Resistance	1000 hours, 95% R.H., 40ºC	1% max
Load Life	1000 hours, cycled power 1.5 hours ON, 0.5 hours OFF, 25ºC	1%
Temperature Cycling	5 cycles, -55ºC to 200ºC	0.5%
Short Time Overload	5 times rated power for 5 seconds	1%

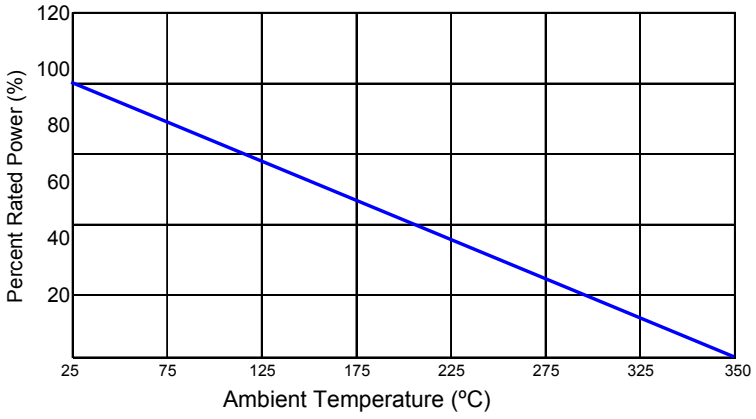
Operating Temperature Range: -55ºC to +350ºC



Mechanical Specifications				
Type / Code	A	B	C	Unit
WW12 / NWW12	0.312 ± 0.062 7.92 ± 1.57	0.110 ± 0.031 2.79 ± 0.79	0.025 ± 0.002 0.64 ± 0.05	inches mm
WW1, WWS2 / NWW1, NWWS2	0.375 ± 0.062 9.53 ± 1.57	0.110 ± 0.031 2.79 ± 0.79	0.025 ± 0.002 0.64 ± 0.05	inches mm
WW1A / NWW1A	0.420 ± 0.062 10.67 ± 1.57	0.110 ± 0.031 2.79 ± 0.79	0.025 ± 0.002 0.64 ± 0.05	inches mm
WW2, WWS3 / NWW2, NWWS3	0.370 ± 0.062 9.40 ± 1.57	0.156 ± 0.031 3.96 ± 0.79	0.032 ± 0.002 0.81 ± 0.05	inches mm
WW2A / NWW2A	0.550 ± 0.062 13.97 ± 1.57	0.156 ± 0.031 3.96 ± 0.79	0.032 ± 0.002 0.81 ± 0.05	inches mm
WW3, WWS4 / NWW3, NWWS4	0.560 ± 0.062 14.22 ± 1.57	0.187 ± 0.031 4.75 ± 0.79	0.032 ± 0.002 0.81 ± 0.05	inches mm
WW3A / NWW3A	0.500 ± 0.062 12.70 ± 1.57	0.218 ± 0.031 5.54 ± 0.79	0.032 ± 0.002 0.81 ± 0.05	inches mm
WW4, WWS5 / NWW4, NWWS5	0.700 ± 0.062 17.78 ± 1.57	0.270 ± 0.031 6.86 ± 0.79	0.036 ± 0.002 0.91 ± 0.05	inches mm
WW5, WWS7 / NWW5, NWWS7	0.875 ± 0.062 22.23 ± 1.57	0.312 ± 0.031 7.92 ± 0.79	0.036 ± 0.002 0.91 ± 0.05	inches mm
WW7 / NWW7	1.000 ± 0.062 25.40 ± 1.57	0.312 ± 0.031 7.92 ± 0.79	0.036 ± 0.002 0.91 ± 0.05	inches mm
WW7B, WWS10 / NWW7B, NWWS10	1.200 ± 0.062 30.48 ± 1.57	0.312 ± 0.031 7.92 ± 0.79	0.036 ± 0.002 0.91 ± 0.05	inches mm
WW10 / NWW10	1.780 ± 0.062 45.21 ± 1.57	0.375 ± 0.031 9.53 ± 0.79	0.040 ± 0.002 (1) 1.02 ± 0.05 (1)	inches mm
MWW1 / NMWW1	0.385 ± 0.062 9.78 ± 1.57	0.135 ± 0.031 3.43 ± 0.79	0.032 ± 0.002 0.81 ± 0.05	inches mm
MWW3 / NMWW3	0.560 ± 0.062 14.22 ± 1.57	0.205 ± 0.031 5.21 ± 0.79	0.032 ± 0.002 0.81 ± 0.05	inches mm
MWW5 / NMWW5	0.925 ± 0.062 23.50 ± 1.57	0.330 ± 0.031 8.38 ± 0.79	0.036 ± 0.002 0.91 ± 0.05	inches mm
MWW10 / NMWW10	1.965 ± 0.062 49.91 ± 1.57	0.480 ± 0.031 12.19 ± 0.79	0.040 ± 0.002 1.02 ± 0.05	inches mm

(1) Available in 0.036" / 0.91mm

Power Derating Curve:



How to Order

1	2	3	4	5	6	7	8	9
W	W	1	F	T	1	K	0	0

Product Series	
WW	Standard
WWS	Mini
MWW	Molded
NWW	Non-Inductive
NWWS	Mini Non-Inductive

Type/Code	Power Rating @ 25ºC
WW12 / NWW12	0.4W
WW1 / NWW1	1W
WW1A / NWW1A	1W
WW2 / NWW2	1.5W
WWS2 / NWWS2	2.5W
WW2A / NWW2A	2.5W
WW3 / NWW3	3W
WWS3 / NWWS3	3W
WW3A / NWW3A	3W
WW4 / NWW4	4W
WWS4 / NWWS4	4W
WW5 / NWW5	5W
WWS5 / NWWS5	5W
WW7 / NWW7	6.5W
WWS7 / NWWS7	6.5W
WW7B / NWW7B	7W
WW10 / NWW10	10W
WWS10 / NWWS10	10W
MWW1 / NMWW1	1W
MWW3 / NMWW3	3W
MWW5 / NMWW5	5W
MWW10 / NMWW10	10W

Tolerance	
Code	Tol
B	0.1%
D	0.5%
F	1%
J	5%

Packaging			
Code	Description	Size	Quantity
T	11" Tape and Reel	WW12 / NWW12 WW1 / NWW1 WWS2 / NWWS2 WW1A / NWW1A MWW1 / NMWW1	2,500
		WW2 / NWW2 WWS3 / NWWS3 WW2A / NWW2A WW3 / NWW3 WWS4 / NWWS4 MWW3 / NMWW3	2,000
		WW3A / NWW3A WW4 / NWW4 WWS5 / NWWS5 WW5 / NWW5 WWS7 / NWWS7 WW7 / NWW7 WW7B / NWW7B WWS10 / NWWS10 MWW5 / NMWW5	500
		WW10 / NWW10 MWW10 / NMWW10	250

Resistance Value
Four characters with the multiplier used as the decimal holder.
0.1 ohm = R100 2 Kohm = 2K00

Legacy Part Number (before January 3, 2011):

SEI Type	Code	Nominal Resistance	Tolerance	Packaging
WW	1	10K	1%	R

Type	Description
WW	Standard
WWS	Mini
MWW	Molded
NWW	Non-Inductive
NWWS	Mini Non-Inductive

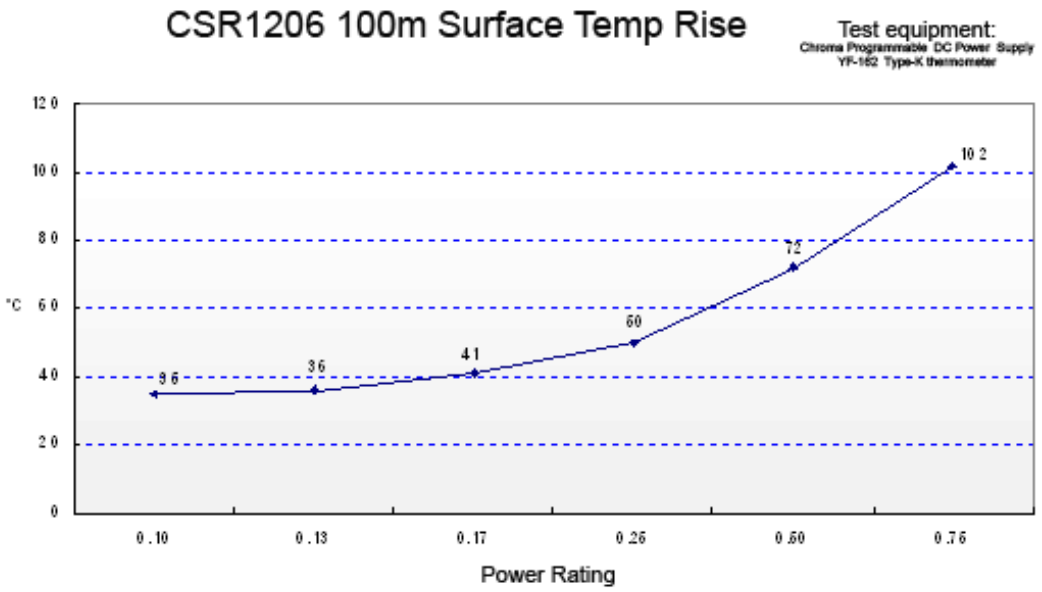
Tolerance
0.1%
0.5%
1%
5%

Types	Qty	Description	Code
WW12, NWW12, WW1, NWW1, WWS2, NWWS2 WW1A, NWW1A, MWW1, NMWW1	2,500	11" reel tape	R
WW2, NWW2, WWS3, NWWS3, WW2A, NWW2A WW3, NWW3, WWS4, NWWS4, MWW3, NMWW3	2,000		
WW3A, NWW3A, WW4, NWW4, WWS5, NWWS5 WW5, NWW5, WWS7, NWWS7, WW7, NWW7 WW7B, NWW7B, WWS10, NWWS10 MWW5, NMWW5	500		
WW10, NWW10, MWW10, NMWW10	250		

High Power Chip Resistors and Thermal Management

Stackpole has developed several surface mount resistor series in addition to our current sense resistors, which have had higher power ratings than standard resistor chips. This has caused some uncertainty and even confusion by users as to how to reliably use these resistors at the higher power ratings in their designs.

The data sheets for the RHC, RMCP, RNCP, CSR, CSRN, CSRF, CSS, and CSSH state that the rated power assumes an ambient temperature of no more than 100 degrees C for the CSS / CSSH series and 70 degrees C for all other high power resistor series. In addition, IPC and UL best practices dictate that the combined temperature on any resistor due to power dissipated and ambient air shall be no more than 105C. At first glance this wouldn't seem too difficult, however the graph below shows typical heat rise for the CSR ½ 100 milliohm at full rated power. The heat rise for the RMCP and RNCP would be similar. The RHC with its unique materials, design, and processes would have less heat rise and therefore would be easier to implement for any given customer.



The 102 degrees C heat rise shown here would indicate there will be additional thermal reduction techniques needed to keep this part under 105C total hot spot temperature if this part is to be used at 0.75 watts of power. However, this same part at the usual power rating for this size would have a heat rise of around 72 degrees C. This additional heat rise may be dealt with using wider conductor traces, larger solder pads and land patterns under the solder mask, heavier copper in the conductors, vias through PCB, air movement, and heat sinks, among many other techniques. Because of the variety of methods customers can use to lower the effective heat rise of the circuit, resistor manufacturers simply specify power ratings with the limitations on ambient air temperature and total hot spot temperatures and leave the details of how to best accomplish this to the design engineers. Design guidelines for products in various market segments can vary widely so it would be unnecessarily constraining for a resistor manufacturer to recommend the use of any of these methods over another.

Note: The final resistance value can be affected by the board layout and assembly process, especially the size of the mounting pads and the amount of solder used. This is especially notable for resistance values ≤ 50 mΩ. This should be taken into account when designing.