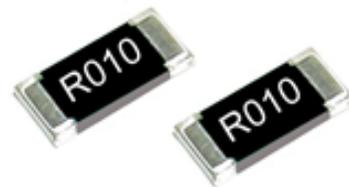


- Features:
- 0402 to 2512 & 1225 sizes available
  - Power ratings to 3W
  - Low inductance – less than 0.2nH typically
  - RoHS compliant
  - Non-standard resistance values available
  - 2010 and 2512 sizes available with narrow terminations (CSRN)



Electrical Specifications						
Type / Code	Package Type	Power Rating (Watts) @ 70°C	Dielectric Withstanding Voltage	Resistance Temperature Coefficient	Ohmic Range ( $\Omega$ ) and Tolerance	
					1%	2%, 5%
CSR 1/8S	0402	0.125W	200V	$\pm 200$ ppm/°C	0.051 - 1	0.051 - 1
CSR 1/8	0603	0.125W	200V	$\pm 300$ ppm/°C	0.02 - 1	0.02 - 1
CSR 1/4	0805	0.25W	200V	$\pm 200$ ppm/°C	0.02 - 1	0.02 - 1
CSR 1/2	1206	0.5W	200V	$\pm 100$ ppm/°C (1)	0.01 - 1	0.01 - 1
CSRN 1S	0815	1W	200V	$\pm 300$ ppm/°C $\pm 150$ ppm/°C	0.01 - 0.019 0.02 - 0.5	0.01 - 0.019 0.02 - 0.5
CSRN 1	2010	1W	200V	$\pm 250$ ppm/°C	0.01 - 1	0.01 - 1
CSRN 2	2512	2W	200V	$\pm 200$ ppm/°C	0.01 - 1	0.01 - 1
CSR 3	1225	3W	200V	$\pm 200$ ppm/°C $\pm 100$ ppm/°C	0.003 - 0.02 0.021 - 10	0.003 - 0.02 0.021 - 10

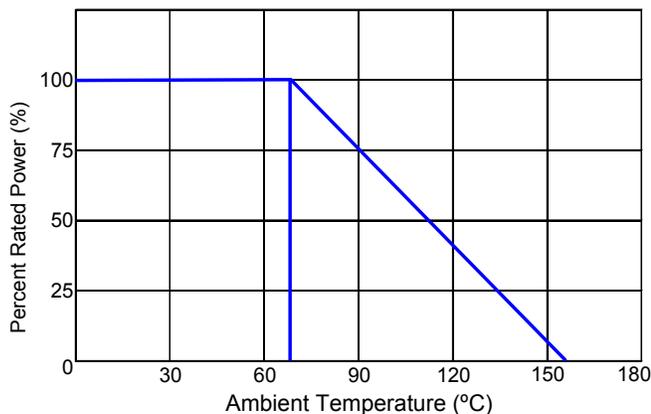
(1) Contact Factory for TCR below 50mOhm

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

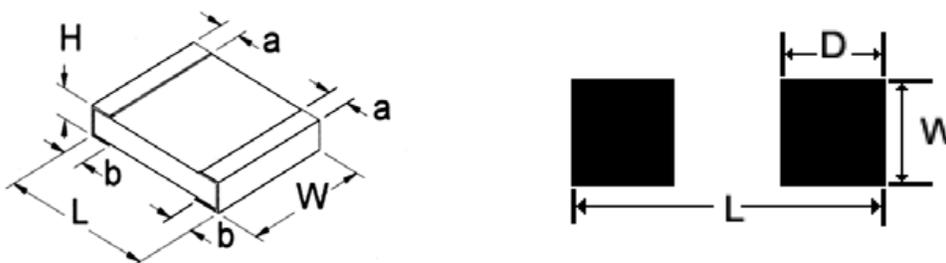
Performance Characteristics		
Test	Test Specification	Typical
Moisture Resistance	$\pm 0.5\%$	$\leq 0.5\%$
Load Life	$\pm 0.5\%$	$\leq 0.5\%$
Leach Resistance	90 seconds minimum	> 90 seconds
Resistance to Soldering Heat	$\pm 0.5\%$	$\leq 0.25\%$
Solderability	minimum 95% coverage	$\geq 95\%$
Temperature Cycling	$\pm 0.5\%$	$\leq 0.5\%$
Thermal Shock	$\pm 0.5\%$	$\leq 0.5\%$
Short Time Overload	$\pm 0.5\%$	$\leq 0.5\%$
Insulation Resistance	1M $\Omega$ minimum	$\geq 1M\Omega$

Operating Temperature Range: -55°C to +155°C

Power Derating Curve:



Mechanical Specifications						
Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
CSR 1/8 S	0.039 ± 0.002	0.020 ± 0.002	0.013 ± 0.004	0.010 ± 0.004	0.008 ± 0.004	inches
	1.000 ± 0.050	0.500 ± 0.050	0.320 ± 0.100	0.250 ± 0.100	0.200 ± 0.100	mm
CSR 1/8	0.063 ± 0.004	0.032 ± 0.004	0.018 ± 0.004	0.012 ± 0.008	0.012 ± 0.008	inches
	1.600 ± 0.100	0.800 ± 0.100	0.450 ± 0.100	0.300 ± 0.200	0.300 ± 0.200	mm
CSR 1/4	0.079 ± 0.006	0.049 ± 0.006	0.022 ± 0.004	0.012 ± 0.008	0.016 ± 0.010	inches
	2.000 ± 0.150	1.250 ± 0.150	0.550 ± 0.100	0.300 ± 0.200	0.400 ± 0.250	mm
CSR 1/2	0.120 ± 0.006	0.061 ± 0.006	0.022 ± 0.004	0.020 ± 0.012	0.016 ± 0.010	inches
	3.050 ± 0.150	1.550 ± 0.150	0.550 ± 0.100	0.500 ± 0.300	0.400 ± 0.250	mm
CSRN 1S	0.079 ± 0.008	0.148 ± 0.008	0.024 ± 0.004	0.016 ± 0.008	0.016 ± 0.008	inches
	2.000 ± 0.200	3.750 ± 0.200	0.600 ± 0.100	0.400 ± 0.200	0.400 ± 0.200	mm
CSRN 1	0.197 ± 0.008	0.097 ± 0.006	0.024 ± 0.006	0.024 ± 0.012	0.020 ± 0.010	inches
	5.000 ± 0.200	2.450 ± 0.150	0.600 ± 0.150	0.600 ± 0.300	0.508 ± 0.250	mm
CSRN 2	0.250 ± 0.008	0.124 ± 0.006	0.024 ± 0.004	0.024 ± 0.012	0.022 ± 0.010	inches
	6.350 ± 0.200	3.150 ± 0.150	0.600 ± 0.100	0.600 ± 0.300	0.550 ± 0.250	mm
CSR 3	0.122 ± 0.006	0.248 ± 0.006	0.035 ± 0.006	0.024 ± 0.012	0.022 ± 0.010	inches
	3.100 ± 0.150	6.300 ± 0.150	0.900 ± 0.150	0.600 ± 0.300	0.550 ± 0.250	mm



Solder Pad Dimensions						
Type / Code	L Total Length	W Total Width	D Pad Depth	Units	CSR3 (1225)	4 Terminal Bottom
CSR 1/8 S	0.05	0.03	0.02	inches		
	1.30	0.80	0.40	mm		
CSR 1/8	0.08	0.04	0.03	inches		
	2.10	1.10	0.70	mm		
CSR 1/4	0.11	0.06	0.04	inches		
	2.70	1.40	1.00	mm		
CSR 1/2	0.16	0.07	0.06	inches		
	4.00	1.80	1.40	mm		
CSRN 1S	0.15	0.18	0.06	inches		
	3.80	4.50	1.50	mm		
CSRN 1	0.25	0.14	0.06	inches		
	6.40	3.60	1.40	mm		
CSRN 2	0.31	0.15	0.10	inches		
	8.00	3.75	2.50	mm		
CSR 3	0.20	0.30	0.08	inches		
	5.08	7.60	2.00	mm		

**How to Order**

SEI Type		Code			Nominal Resistance	Tolerance	Packaging			
CSR		1/2			0.01	1%	R			
Type	Description	Code	Wattage	Size		Tolerance	SEI Types	Pkg Qty	Description	Code
CSR	Standard	1/8S	0.125W	0402		1%	1/8S	10,000	7" reel	R
CSRN	Narrow Terminations	1/8	0.125W	0603		2%	1/8, 1/4, 1/2	5,000	paper tape	
		1/4	0.25W	0805		5%	1, 2	4,000	7" reel	I
		1/2	0.5W	1206			1S, 3	2,000	plastic tape	
		1S	1W	0815			1/8S	1,000	7" reel	
		1	1W	2010			1/8, 1/4, 1/2		paper tape	
		2	2W	2512			1, 2		7" reel	
		3	3W	1225			1S, 3		plastic tape	

New part number format starting January 3<sup>rd</sup>, 2011:

**How to Order**

1	2	3	4	5	6	7	8	9	10	11	12	13
C	S	R	1	2	0	6	F	T	1	0	L	0

Product Series		Size	Power	Tolerance		Packaging				Resistance Value
CSR	Standard	0402	0.125W	Code	Tol	Code	Description	Size	Quantity	Four characters with the multiplier used as the decimal holder. "L" used as multiplier of 10 <sup>-3</sup> for any value under 0.1 ohm.
CSRN	Narrow Terminations	0603	0.125W	F	1%	T	7" reel	0402	10,000	
		0805	0.25W	G	2%		paper tape	0603, 0805, 1206	5,000	0.01 ohm = 10L0 0.1 ohm = R100 1 ohm = 1R00
		1206	0.5W	J	5%		7" reel	2010, 2512	4,000	
		0815	1W			K	paper tape	0815, 1225	2,000	
		2010	1W				7" reel	0402	1,000	
		2512	2W				paper tape	0603, 0805, 1206		
		1225	3W				7" reel	2010, 2512		
							plastic tape	0815, 1225		

### 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.

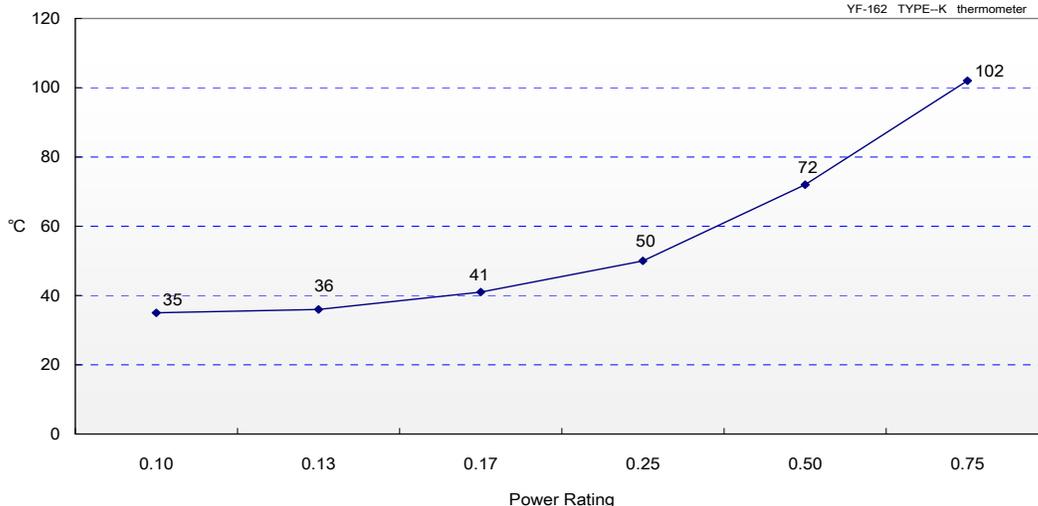
The data sheets for the RHC, RMCP, RNCP, CSR, CSRN, CSRF, CSS, and CSSH state that the rated power assumes an ambient temperature of no more than 100 degrees C for the CSS / CSSH series and 70 degrees C for all other high power resistor series. In addition, IPC and UL best practices dictate that the 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 1/2 100 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.

#### **CSR 1/2 100m Surface Temp Rise**



Test equipment:

Chroma Programmable DC Power supply  
YF-162 TYPE-K thermometer



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  $\leq 50$  m $\Omega$ . This should be taken into account when designing.