

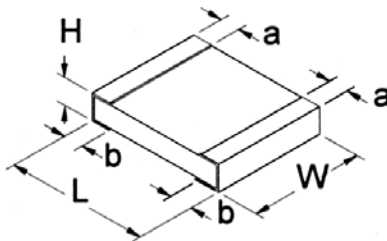
- Features:
- High power metal alloy current sense resistor
 - Very low inductance (0.5nH to 5nH)
 - High temperature performance up to 225°C; for operation up to 275°C, contact factory
 - Excellent frequency response
 - Low thermal EMF (<1μV/C)
 - Proprietary processing technique produces extremely low resistance values
 - Qualified to AEC-Q200
 - RoHS compliant / lead-free



Electrical Specifications						
Type / Code	Maximum Power Rating (Watts)	Maximum Rating Current (A)	Maximum Overload Current (A)	TCR (ppm/°C)	Ohmic Range (Ω) and Tolerance	
					0.5%	1%, 2%, 5%
CSS0603	0.33	8.1	16.2	±50 ppm/°C	-	0.005, 0.01, 0.015
CSS0805	0.5	12.9	25.8	±50 ppm/°C	-	0.005, 0.01, 0.015
CSS1206	1	31.62	63.25	±50 ppm/°C ±25 ppm/°C ±15 ppm/°C	- 0.007 - 0.015 0.016 - 0.05	0.001 - 0.004 0.005 - 0.015 0.016 - 0.05
CSS2010	1	31.62	63.25	±50 ppm/°C ±25 ppm/°C ±15 ppm/°C	- - 0.007 - 0.1	0.001 - 0.003 0.004 - 0.006 0.007 - 0.1
CSS2512	2	63.25	141.42	±50 ppm/°C ±25 ppm/°C ±15 ppm/°C	- - 0.007 - 0.075	0.0005 - 0.003 0.004 - 0.006 0.007 - 0.075
CSSH2512	3	77.46	134.16	±50 ppm/°C ±25 ppm/°C	- 0.007 - 0.01	0.0005 - 0.0025 0.003 - 0.01
CSS2725	4	126.49	252.95	±50 ppm/°C	-	0.00025 - 0.003
CSS2728	3	27.39	47.43	±25 ppm/°C ±15 ppm/°C	0.004 - 0.007 0.008 - 0.1	0.004 - 0.007 0.008 - 0.1
CSSH2728	4	31.62	63.25	±25 ppm/°C ±15 ppm/°C	0.004 - 0.007 0.008 - 0.05	0.004 - 0.007 0.008 - 0.05
CSS4527	5	100	173	±50 ppm/°C	0.007 - 0.12	0.0005 - 0.12

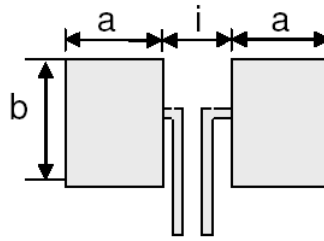
Please refer to the High Power Resistor Application Note (page 5) for more information on designing and implementing high power resistor types.

Mechanical Specifications



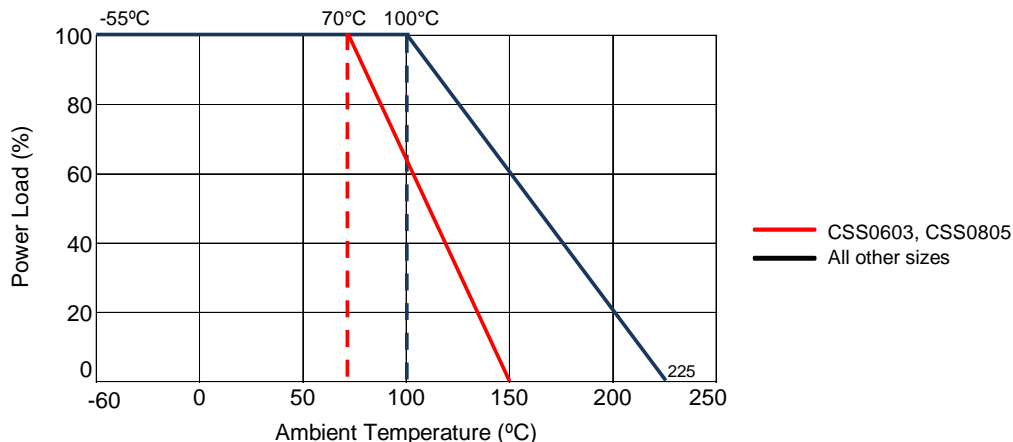
Type/Code	Maximum Power Rating (Watts)	Resistance Range (Ω)	L	W	H	a	b	Unit
CSS0603	0.33	0.005, 0.01, 0.015	0.063 ± 0.008	0.031 ± 0.008	0.012 ± 0.004	0.012 ± 0.006	0.012 ± 0.006	inches
			1.60 ± 0.20	0.80 ± 0.20	0.30 ± 0.10	0.30 ± 0.15	0.30 ± 0.15	mm
CSS0805	0.5	0.005, 0.01, 0.015	0.080 ± 0.008	0.050 ± 0.008	0.012 ± 0.004	0.014 ± 0.008	0.014 ± 0.008	inches
			2.03 ± 0.20	1.27 ± 0.20	0.30 ± 0.10	0.35 ± 0.20	0.35 ± 0.20	mm
CSS1206	1	0.001 - 0.05	0.126 ± 0.010	0.063 ± 0.010	0.025 ± 0.010	0.020 ± 0.010	0.020 ± 0.010	inches
			3.20 ± 0.25	1.60 ± 0.25	0.65 ± 0.25	0.51 ± 0.25	0.51 ± 0.25	mm
CSS2010	1	0.001 - 0.003	0.200 ± 0.010	0.100 ± 0.010	0.031 ± 0.010	0.051 ± 0.010	0.051 ± 0.010	inches
			5.08 ± 0.25	2.54 ± 0.25	0.79 ± 0.25	1.30 ± 0.25	1.30 ± 0.25	mm
CSS2512	2	0.0005 - 0.004	0.246 ± 0.010	0.130 ± 0.010	0.031 ± 0.010	0.074 ± 0.010	0.074 ± 0.010	inches
			6.25 ± 0.25	3.30 ± 0.25	0.79 ± 0.25	1.88 ± 0.25	1.88 ± 0.25	mm
CSS2512	2	0.0041 - 0.075	0.246 ± 0.010	0.130 ± 0.010	0.025 ± 0.010	0.044 ± 0.010	0.044 ± 0.010	inches
			6.25 ± 0.25	3.30 ± 0.25	0.65 ± 0.25	1.12 ± 0.25	1.12 ± 0.25	mm
CSSH2512	3	0.0005	0.246 ± 0.010	0.130 ± 0.010	0.031 ± 0.010	0.074 ± 0.010	0.074 ± 0.010	inches
		0.0006 - 0.0029	0.246 ± 0.010	0.130 ± 0.010	0.031 ± 0.010	0.044 ± 0.010	0.044 ± 0.010	inches
		0.0041 - 0.01	6.25 ± 0.25	3.30 ± 0.25	0.79 ± 0.25	1.12 ± 0.25	1.12 ± 0.25	mm
CSS2725	4	0.00025, 0.0005	0.268 ± 0.010	0.254 ± 0.010	0.039 ± 0.010	0.085 ± 0.010	0.085 ± 0.010	inches
			6.81 ± 0.25	6.45 ± 0.25	0.99 ± 0.25	2.16 ± 0.25	2.16 ± 0.25	mm
		0.001	0.268 ± 0.010	0.254 ± 0.010	0.043 ± 0.010	0.085 ± 0.010	0.085 ± 0.010	inches
			6.81 ± 0.25	6.45 ± 0.25	1.09 ± 0.25	2.16 ± 0.25	2.16 ± 0.25	mm
		0.0015	0.268 ± 0.010	0.254 ± 0.010	0.039 ± 0.010	0.085 ± 0.010	0.085 ± 0.010	inches
			6.81 ± 0.25	6.45 ± 0.25	0.99 ± 0.25	2.16 ± 0.25	2.16 ± 0.25	mm
CSS2725	4	0.002	0.268 ± 0.010	0.254 ± 0.010	0.035 ± 0.010	0.071 ± 0.010	0.071 ± 0.010	inches
			6.81 ± 0.25	6.45 ± 0.25	0.89 ± 0.25	1.80 ± 0.25	1.80 ± 0.25	mm
		0.0025	0.268 ± 0.010	0.254 ± 0.010	0.035 ± 0.010	0.065 ± 0.010	0.065 ± 0.010	inches
			6.81 ± 0.25	6.45 ± 0.25	0.89 ± 0.25	1.65 ± 0.25	1.65 ± 0.25	mm
		0.003	0.268 ± 0.010	0.254 ± 0.010	0.035 ± 0.010	0.051 ± 0.010	0.051 ± 0.010	inches
			6.81 ± 0.25	6.45 ± 0.25	0.89 ± 0.25	1.30 ± 0.25	1.30 ± 0.25	mm
CSS2728	3	0.004 - 0.1	0.264 ± 0.010	0.283 ± 0.010	0.039 ± 0.010	0.045 ± 0.010	0.045 ± 0.010	inches
			6.71 ± 0.25	7.19 ± 0.25	0.99 ± 0.25	1.14 ± 0.25	1.14 ± 0.25	mm
CSSH2728	4	0.004 - 0.1	0.264 ± 0.010	0.283 ± 0.010	0.039 ± 0.010	0.045 ± 0.010	0.045 ± 0.010	inches
			6.71 ± 0.25	7.19 ± 0.25	0.99 ± 0.25	1.14 ± 0.25	1.14 ± 0.25	mm
CSS4527	5	0.0005 - 0.005	0.450 ± 0.010	0.270 ± 0.010	0.059 ± 0.010	0.038 ± 0.010	0.127 ± 0.010	inches
			11.43 ± 0.25	6.85 ± 0.25	1.50 ± 0.25	0.97 ± 0.25	3.22 ± 0.25	mm
CSS4527	5	0.0051 - 0.1	0.450 ± 0.010	0.270 ± 0.010	0.059 ± 0.010	0.038 ± 0.010	0.071 ± 0.010	inches
			11.43 ± 0.25	6.85 ± 0.25	1.50 ± 0.25	0.97 ± 0.25	1.82 ± 0.25	mm

Solder Pad Dimensions



Type/Code	Maximum Power Rating (Watts)	Resistance Range (Ω)	a	b	i	Unit
CSS0603	0.33	0.005, 0.01, 0.015	0.039	0.050	0.020	inches
			1.00	1.27	0.50	mm
CSS0805	0.5	0.005, 0.01, 0.015	0.071	0.086	0.026	inches
			1.80	2.18	0.66	mm
CSS1206	1	0.001 - 0.05	0.063	0.086	0.039	inches
			1.60	2.18	1.00	mm
CSS2010	1	0.001 - 0.003	0.114	0.115	0.048	inches
			2.89	2.92	1.22	mm
CSS2512	2	0.0031 - 0.1	0.090	0.115	0.095	inches
			2.29	2.92	2.41	mm
CSS2512	2	0.0005 - 0.004	0.120	0.145	0.050	inches
			3.05	3.68	1.27	mm
CSS2512	2	0.0041 - 0.075	0.083	0.145	0.125	inches
			2.11	3.68	3.18	mm
CSSH2512	3	0.0005	0.120	0.145	0.050	inches
			3.05	3.68	1.27	mm
			0.0006 - 0.0029	0.086	0.145	0.118
CSSH2512	3	0.0041 - 0.01	2.19	3.68	3.00	mm
			0.003 - 0.004	0.110	0.145	0.071
CSSH2512	3	0.003 - 0.004	2.79	3.68	1.80	mm
			0.00025 - 0.003	0.125	0.270	0.052
CSS2725	4	0.00025 - 0.003	3.18	6.86	1.32	mm
			0.004 - 0.1	0.108	0.308	0.138
CSS2728	3	0.004 - 0.1	2.75	7.82	3.51	mm
			0.004 - 0.1	0.108	0.308	0.138
CSSH2728	4	0.004 - 0.1	2.75	7.82	3.51	mm
			0.0005 - 0.005	0.189	0.344	0.217
CSS4527	5	0.0005 - 0.005	4.80	8.74	5.51	mm
			0.0051 - 0.12	0.134	0.344	0.327
CSS4527	5	0.0051 - 0.12	3.40	8.74	8.31	mm

Power Derating Curve:



Performance Characteristics										
Test Item	Condition of Test	Test Method	Test Limits							
Temperature Coefficient of Resistance (TCR)	$TCR (ppm/^{\circ}C) = \frac{R2-R1}{R1 (T2-T1)} \times 10^6$ R1: resistance of room temperature (T1) R2: resistance of 150°C (T2)	JIS C 5201-1 4.8	Per specification (refer to Electrical Specification table)							
Short Time Overload (rating power duration = 5 seconds)	The number of rated power are as follows:	JIS C 5201-1 4.13	$(\Delta R/R1) \leq \pm 0.5\%$							
	<table border="1"> <tr><td>CSS0603-0.33W: 4 times rated power</td></tr> <tr><td>CSS0805-0.5W: 4 times rated power</td></tr> <tr><td>CSS1206-1W: 4 times rated power</td></tr> <tr><td>CSS2010-1W: 4 times rated power</td></tr> <tr><td>CSS2512-2W: 5 times rated power</td></tr> <tr><td>CSSH2512-3W: 3 times rated power</td></tr> <tr><td>CSS2725-4W: 4 times rated power</td></tr> <tr><td>CSS2728-3W: 3 times rated power</td></tr> <tr><td>CSSH2728-4W: 4 times rated power</td></tr> <tr><td>CSS4527-5W: 3 times rated power</td></tr> </table>			CSS0603-0.33W: 4 times rated power	CSS0805-0.5W: 4 times rated power	CSS1206-1W: 4 times rated power	CSS2010-1W: 4 times rated power	CSS2512-2W: 5 times rated power	CSSH2512-3W: 3 times rated power	CSS2725-4W: 4 times rated power
CSS0603-0.33W: 4 times rated power										
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CSS2725-4W: 4 times rated power										
CSS2728-3W: 3 times rated power										
CSSH2728-4W: 4 times rated power										
CSS4527-5W: 3 times rated power										
Insulation Resistance	100±15V DC for 1 minute	JIS C 5201-1 4.6	$\geq 10^9 \Omega$							
Dielectric Withstanding Voltage	Applied 500V AC for 1 minute and limit surge current 50mA (max)	JIS C 5201-1 4.7	Without break down							

Operating Temperature Range for sizes 0603 and 0805: -55°C to +150°C. Contact factory for operation at higher temperatures.
 Operating Temperature Range for all other sizes: -55°C to +225°C. Contact factory for operation at higher temperatures.

How to Order

1 2 3 4 5 6 7 8 9 10 11 12 13

C S S 2 7 2 5 F T 3 L 0 0

Product Series		Size	Power	Tolerance		Packaging				Resistance Value
CSS	Metal Alloy	0603	0.33W	Code	Tol	Code	Description	Size	Quantity	Four characters with the multiplier used as the decimal holder. "L" used as multiplier of 10 ⁻³ for any value under 0.1 ohm. 0.00025 ohm = L250 0.004 ohm = 4L00 0.05 ohm = 50L0 0.12 ohm = R120
CSSH	High Power	0805	0.5W	D	0.5%	T	7" Reel - Plastic Tape	0603, 0805	5,000	
		1206	1W	F	1%			1206	4,000	
		2010	1W	G	2%			2010, 2512 (H)2512	2,000	
		2512	2W	J	5%			2725, 2728 (H)2728	1,000	
		(H)2512	3W					4527	500	
		2725	4W							
		2728	3W							
		(H)2728	4W							
		4527	5W							

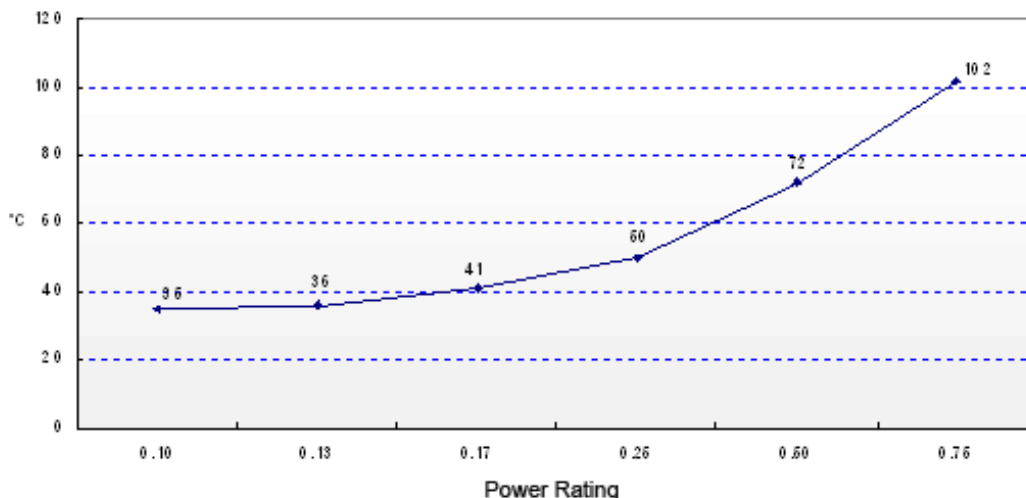
High Power Chip Resistors and Thermal Management

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.

CSR1206 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 ≤ 50 m Ω . This should be taken into account when designing.