Features:

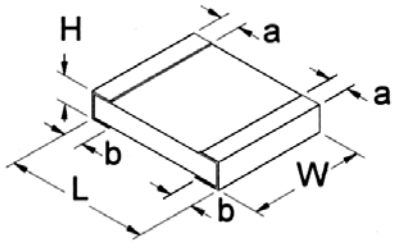
- High power metal alloy current sense resistor
- High temperature performance up to 225°C; for operation up to 275ºC, contact factory
- Excellent frequency response
- Low thermal EMF (<1µV/C)
- Proprietary processing technique produces extremely low resistance values
- Qualified to AEC-Q200
- RoHS compliant/lead-free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

Electrical Specifications

Type / Code	Maximum Power Rating (Watts)	Maximum Rating Current (A)	Maximum Overload Current (A)	TCR (ppm/ºC)	Ohmic Range (Ω) and Tolerance	
					0.5%	1%, 2%, 5%
CSS0603	0.33	8.1	16.2	±50 ppm/ºC	-	0.005, 0.01, 0.015
CSS0805	0.5	12.9	25.8	±50 ppm/ºC	-	0.005, 0.01, 0.015
CSS1206	1	31.62	63.25	±50 ppm/ºC ±25 ppm/ºC ±15 ppm/ºC	- 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/ºC ±25 ppm/ºC ±15 ppm/ºC	- - 0.007 - 0.1	0.001 - 0.003 0.004 - 0.006 0.007 - 0.1
CSS2512	2	63.25	141.42	±50 ppm/ºC ±25 ppm/ºC ±15 ppm/ºC	- - 0.007 - 0.075	0.0005 - 0.003 0.004 - 0.006 0.007 - 0.075
CSSH2512	3	77.46	134.16	±50 ppm/ºC ±25 ppm/ºC	- 0.007 - 0.01	0.0005 - 0.0025 0.003 - 0.01
CSS2725	4	126.49	252.95	±50 ppm/ºC	-	0.00025 - 0.003
CSS2728	3	27.39	47.43	±25 ppm/ºC ±15 ppm/ºC	0.004 - 0.007 0.008 - 0.1	0.004 - 0.007 0.008 - 0.1
CSSH2728	4	31.62	70.71	±25 ppm/ºC ±15 ppm/ºC	0.004 - 0.007 0.008 - 0.019	0.004 - 0.007 0.008 - 0.05
CSS4527	5	100	173	±50 ppm/ºC	0.007 - 0.12	0.0005 - 0.12

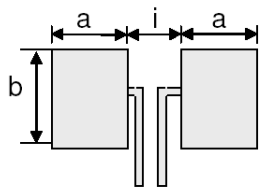
Please refer to the High Power Resistor Application Note (page 4) for more information on designing and implementing high power resistor types.

Mechanical Specifications



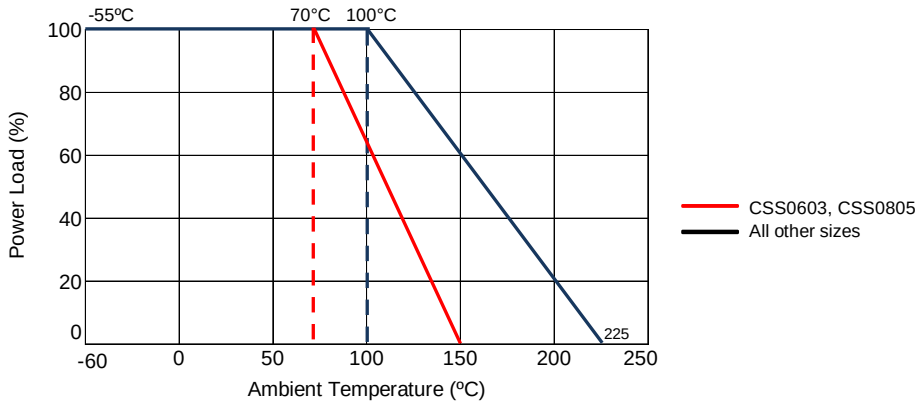
Type/Code	Maximum Power Rating (Watts)	Resistance Range (Ω)	L	W	H	a	b	Unit
CSS0603	0.33	0.005, 0.01, 0.015	0.063 ± 0.008 1.60 ± 0.20	0.031 ± 0.008 0.80 ± 0.20	0.012 ± 0.004 0.30 ± 0.10	0.012 ± 0.006 0.30 ± 0.15	0.012 ± 0.006 0.30 ± 0.15	inches mm
CSS0805	0.5	0.005, 0.01, 0.015	0.080 ± 0.008 2.03 ± 0.20	0.050 ± 0.008 1.27 ± 0.20	0.012 ± 0.004 0.30 ± 0.10	0.014 ± 0.008 0.35 ± 0.20	0.014 ± 0.008 0.35 ± 0.20	inches mm
CSS1206	1	0.001 - 0.05	0.126 ± 0.010 3.20 ± 0.25	0.063 ± 0.010 1.60 ± 0.25	0.025 ± 0.010 0.65 ± 0.25	0.020 ± 0.010 0.51 ± 0.25	0.020 ± 0.010 0.51 ± 0.25	inches mm
CSS2010	1	0.001 - 0.003	0.200 ± 0.010 5.08 ± 0.25	0.100 ± 0.010 2.54 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.051 ± 0.010 1.30 ± 0.25	0.051 ± 0.010 1.30 ± 0.25	inches mm
		0.0031 - 0.1	0.200 ± 0.010 5.08 ± 0.25	0.100 ± 0.010 2.54 ± 0.25	0.025 ± 0.010 0.65 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	inches mm
CSS2512	2	0.0005 - 0.004	0.246 ± 0.010 6.25 ± 0.25	0.130 ± 0.010 3.30 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.074 ± 0.010 1.88 ± 0.25	0.074 ± 0.010 1.88 ± 0.25	inches mm
		0.0041 - 0.075	0.246 ± 0.010 6.25 ± 0.25	0.130 ± 0.010 3.30 ± 0.25	0.025 ± 0.010 0.65 ± 0.25	0.044 ± 0.010 1.12 ± 0.25	0.044 ± 0.010 1.12 ± 0.25	inches mm
CSSH2512	3	0.0005	0.246 ± 0.010 6.25 ± 0.25	0.130 ± 0.010 3.30 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.074 ± 0.010 1.88 ± 0.25	0.074 ± 0.010 1.88 ± 0.25	inches mm
		0.0006 - 0.0029 0.0041 - 0.01	0.246 ± 0.010 6.25 ± 0.25	0.130 ± 0.010 3.30 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.044 ± 0.010 1.12 ± 0.25	0.044 ± 0.010 1.12 ± 0.25	inches mm
		0.003 - 0.004	0.246 ± 0.010 6.25 ± 0.25	0.130 ± 0.010 3.30 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.066 ± 0.010 1.68 ± 0.25	0.066 ± 0.010 1.68 ± 0.25	inches mm
CSS2725	4	0.00025, 0.0005	0.268 ± 0.010 6.81 ± 0.25	0.254 ± 0.010 6.45 ± 0.25	0.039 ± 0.010 0.99 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	inches mm
		0.001	0.268 ± 0.010 6.81 ± 0.25	0.254 ± 0.010 6.45 ± 0.25	0.043 ± 0.010 1.09 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	inches mm
		0.0015	0.268 ± 0.010 6.81 ± 0.25	0.254 ± 0.010 6.45 ± 0.25	0.039 ± 0.010 0.99 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	inches mm
		0.002	0.268 ± 0.010 6.81 ± 0.25	0.254 ± 0.010 6.45 ± 0.25	0.035 ± 0.010 0.89 ± 0.25	0.071 ± 0.010 1.80 ± 0.25	0.071 ± 0.010 1.80 ± 0.25	inches mm
		0.0025	0.268 ± 0.010 6.81 ± 0.25	0.254 ± 0.010 6.45 ± 0.25	0.035 ± 0.010 0.89 ± 0.25	0.065 ± 0.010 1.65 ± 0.25	0.065 ± 0.010 1.65 ± 0.25	inches mm
		0.003	0.268 ± 0.010 6.81 ± 0.25	0.254 ± 0.010 6.45 ± 0.25	0.035 ± 0.010 0.89 ± 0.25	0.051 ± 0.010 1.30 ± 0.25	0.051 ± 0.010 1.30 ± 0.25	inches mm
CSS2728	3	0.004 - 0.1	0.264 ± 0.010 6.71 ± 0.25	0.283 ± 0.010 7.19 ± 0.25	0.039 ± 0.010 0.99 ± 0.25	0.045 ± 0.010 1.14 ± 0.25	0.045 ± 0.010 1.14 ± 0.25	inches mm
CSSH2728	4	0.004 - 0.1	0.264 ± 0.010 6.71 ± 0.25	0.283 ± 0.010 7.19 ± 0.25	0.039 ± 0.010 0.99 ± 0.25	0.045 ± 0.010 1.14 ± 0.25	0.045 ± 0.010 1.14 ± 0.25	inches mm
CSS4527	5	0.0005 - 0.005	0.450 ± 0.010 11.43 ± 0.25	0.270 ± 0.010 6.85 ± 0.25	0.059 ± 0.010 1.50 ± 0.25	0.038 ± 0.010 0.97 ± 0.25	0.127 ± 0.010 3.22 ± 0.25	inches mm
		0.0051 - 0.1	0.450 ± 0.010 11.43 ± 0.25	0.270 ± 0.010 6.85 ± 0.25	0.059 ± 0.010 1.50 ± 0.25	0.038 ± 0.010 0.97 ± 0.25	0.071 ± 0.010 1.82 ± 0.25	inches mm

Recommended Pad Layout



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

Power Derating Curve:



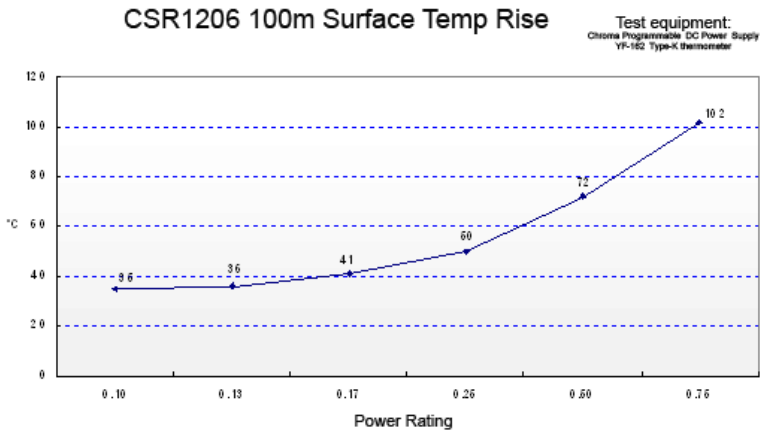
Performance Characteristics			
Test	Test Method	Test Specifications	Test Condition
Temperature Coefficient of Resistance (TCR)	JIS-C-5201-1 4.8	Per specification (refer to Electrical Specification table)	TCR (ppm/ºC) $= \frac{(R2-R1)}{R1\ (T2-T1)} \times 10^6$ R1: resistance of room temperature (T1)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

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.

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°C for the CSS / CSSH series and 70°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 105°C. 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°C heat rise shown here would indicate there will be additional thermal reduction techniques needed to keep this part under 105°C 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°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, via 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 ≤ 50mΩ. This should be taken into account when designing.

RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 2). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament.

RoHS Compliance Status						
Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)
CSS	Ultra Precision Current Sensing Chip Resistor	SMD	YES	100% Matte Sn over Ni	Always	Always
CSSH	Ultra Precision Current Sensing Chip Resistor (High Power)	SMD	YES	100% Matte Sn over Ni	Always	Always

"Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the Eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. (SEI) to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

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	
CSS	Metal Alloy
CSSH	High Power

Size	Power
0603	0.33W
0805	0.5W
1206	1W
2010	1W
2512	2W
(H)2512	3W
2725	4W
2728	3W
(H)2728	4W
4527	5W

Tolerance	
Code	Tol
D	0.5%
F	1%
G	2%
J	5%

Packaging			
Code	Description	Size	Quantity
T	7" Reel - Plastic Tape	0603, 0805	5,000
		1206	4,000
		2010, 2512 (H)2512	2,000
		2725, 2728 (H)2728	1,000
		4527	500

Resistance Value
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