

Features:

- High power metal alloy current sense resistor
- High temperature performance up to 225°C (for operation up to 275°C, contact Stackpole)
- Low thermal EMF (< 1µ V/C)
- Proprietary processing technique produces extremely low resistance values
- RoHS compliant, REACH compliant, lead free, and halogen free
- AEC-Q200 compliant



Electrical Specifications CSS					
Type/Code	Maximum Power Rating (W)	TCR (ppm/°C)	Ohmic Range (Ω) and Tolerance		
			0.5%	1%	5%
CSS0201	0.2	± 200	-	0.01, 0.02	-
CSS0402	0.33	± 150	-	0.0025	-
		± 100	-	0.005, 0.006, 0.008, 0.01, 0.015, 0.02	-
CSS0603	0.33	± 150	-	0.002	-
		± 100	-	0.0025, 0.003, 0.004, 0.005	-
		± 75	-	0.01, 0.015, 0.02	-
CSS0508	1	± 150	-	0.001, 0.0015	-
		± 100	-	0.002, 0.003, 0.004, 0.005	-
CSS0805	0.5	± 100	-	0.0015	-
		± 75	-	0.002, 0.003, 0.004, 0.005	-
		± 50	-	0.006, 0.007, 0.01, 0.015, 0.02	-
CSS1206	1	± 175	-	0.0005 - 0.0006	-
		± 75	0.005 - 0.006	-	-
		± 50	-	0.001 - 0.004	-
		± 25	0.007 - 0.015	0.005 - 0.015	-
		± 15	0.016 - 0.05	0.016 - 0.05	-
CSS2010	1	± 100	-	0.0005 - 0.0009	-
		± 50	-	0.001 - 0.003	-
		± 25	0.007 - 0.015	0.004 - 0.006	-
		± 15	0.016 - 0.049	0.007 - 0.1	-
CSS2512	2	± 150	-	0.0003	-
		± 100	-	0.0005 - 0.0009	-
		± 75	0.001	-	-
		± 50	0.0011 - 0.003	0.0005 - 0.003	-
		± 25	0.0031 - 0.0069	0.004 - 0.006	-
		± 15	0.007 - 0.05	0.08 - 0.5	-
CSS2725	4	± 100	-	0.0002	-
		± 50	-	0.00025 - 0.003	-
CSS2728	3	± 25	0.004 - 0.007	0.004 - 0.007	-
		± 15	0.008 - 0.019	0.101 - 0.2	-
CSS4527	5	± 50	0.007 - 0.12	0.008 - 0.1	-
				0.0005 - 0.2	-

Max. Working Voltage = $(P \cdot R)^{1/2}$

P = Rated Power (W)

R = Resistance Value (Ω)

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

Electrical Specifications CSSH (High Power)

Type/Code	Maximum Power Rating (W)	TCR (ppm/°C)	Ohmic Range (Ω) and Tolerance	
			0.5%	1%, 2%, 5%
CSSH0805	1	± 100	-	0.0005
		± 75	-	0.001 - 0.002
		± 50	0.007 - 0.013	0.0025 - 0.013
CSSH1206	2	± 75	0.005	0.001 - 0.005
CSSH2010	2	± 100	-	0.0005 - 0.0009
		± 75	-	0.001 - 0.0019
		± 50	-	0.002 - 0.0069
		± 25	0.007 - 0.012	0.007 - 0.012
CSSH2512	3	± 150	-	0.0003
		± 75	0.001	-
		± 50	0.0011 - 0.0025 0.011 - 0.05	0.0005 - 0.0025 0.011 - 0.1
		± 25	0.003 - 0.01	0.003 - 0.01
CSSH2728	4	± 25	0.004 - 0.007	0.004 - 0.007
		± 15	0.008 - 0.019	0.008 - 0.05
CSSH3637	7	± 100	-	0.0003

Max. Working Voltage = $(P \cdot R)^{1/2}$

P = Rated Power (W)

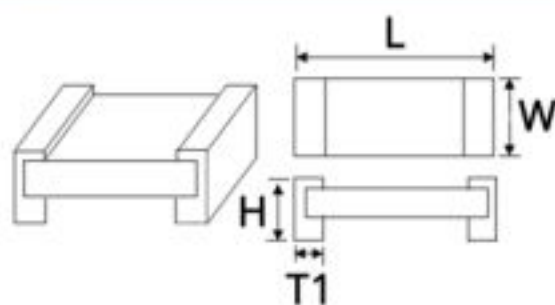
R = Resistance Value (Ω)

Mechanical Specifications CSS0201 – CSS0805



Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	L	W	H	T1	Unit
CSS0201	0.2	0.01, 0.02	0.024 ± 0.006 0.60 ± 0.15	0.012 ± 0.006 0.30 ± 0.15	0.010 ± 0.004 0.25 ± 0.10	0.006 ± 0.004 0.15 ± 0.10	inches mm
CSS0402	0.33	0.0025	0.039 ± 0.006	0.022 ± 0.006	0.012 ± 0.004	0.012 ± 0.004	inches
		0.005 - 0.02	1.00 ± 0.15	0.55 ± 0.15	0.30 ± 0.10	0.30 ± 0.10	mm
CSS0603	0.33	0.002	0.063 ± 0.010 1.60 ± 0.25	0.031 ± 0.010 0.80 ± 0.25	0.016 ± 0.010 0.40 ± 0.25	0.018 ± 0.008	inches
		0.0025, 0.003				0.45 ± 0.20	mm
		0.004 - 0.02				0.014 ± 0.008 0.35 ± 0.20	inches mm
CSS0508	1	0.001	0.049 ± 0.010 1.25 ± 0.25	0.079 ± 0.010 2.00 ± 0.25	0.017 ± 0.006 0.42 ± 0.15	0.012 ± 0.008	inches
		0.0015				0.30 ± 0.20	mm
		0.002				0.015 ± 0.010 0.38 ± 0.25	inches mm
		0.003 - 0.005				0.015 ± 0.010 0.37 ± 0.25	inches mm
CSS0805	0.5	0.0015	0.079 ± 0.010 2.00 ± 0.25	0.049 ± 0.010 1.25 ± 0.25	0.016 ± 0.010 0.40 ± 0.25	0.014 ± 0.010 0.36 ± 0.25	inches mm
		0.002				0.013 ± 0.010 0.32 ± 0.25	inches mm
		0.003 - 0.02				0.028 ± 0.008 0.70 ± 0.20	inches mm

Mechanical Specifications CSS1206 – CSS2728

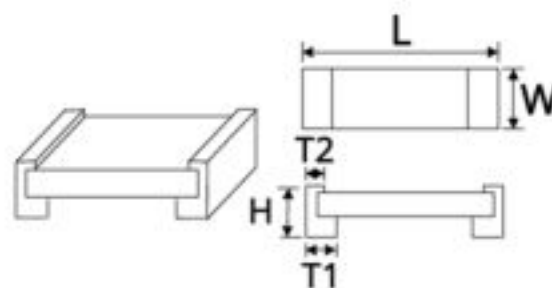


Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	L	W	H	T1	Unit
CSS1206	1	0.0005 - 0.0006	0.126 ± 0.010 3.20 ± 0.25	0.063 ± 0.010 1.60 ± 0.25	0.039 ± 0.010 1.00 ± 0.25	0.029 ± 0.010 0.73 ± 0.25	inches mm
		0.001 - 0.0015			0.025 ± 0.010 0.65 ± 0.25	0.020 ± 0.010 0.51 ± 0.25	inches mm
		0.002 - 0.004			0.022 ± 0.010 0.55 ± 0.25	0.020 ± 0.010 0.51 ± 0.25	inches mm
		0.005			0.022 ± 0.010 0.55 ± 0.25	0.024 ± 0.010 0.60 ± 0.25	inches mm
		0.006 - 0.05			0.022 ± 0.010 0.55 ± 0.25	0.020 ± 0.010 0.51 ± 0.25	inches mm
CSS2010	1	0.0005 - 0.0009	0.200 ± 0.010 5.08 ± 0.25	0.100 ± 0.010 2.54 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.057 ± 0.010 1.44 ± 0.25	inches mm
		0.001 - 0.003			0.031 ± 0.010 0.79 ± 0.25	0.051 ± 0.010 1.30 ± 0.25	inches mm
		0.0031 - 0.1			0.025 ± 0.010 0.65 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	inches mm
CSS2512	2	0.0003	0.246 ± 0.010 6.25 ± 0.25	0.126 ± 0.010 3.20 ± 0.25	0.039 ± 0.010 1.00 ± 0.25	0.080 ± 0.010 2.02 ± 0.25	inches mm
		0.0005 - 0.0007			0.031 ± 0.010 0.79 ± 0.25	0.080 ± 0.010 2.02 ± 0.25	inches mm
		0.00075			0.031 ± 0.010 0.79 ± 0.25	0.054 ± 0.010 1.37 ± 0.25	inches mm
		0.0008 - 0.004			0.031 ± 0.010 0.79 ± 0.25	0.074 ± 0.010 1.88 ± 0.25	inches mm
		0.0041 - 0.075			0.026 ± 0.010 0.65 ± 0.25	0.044 ± 0.010 1.12 ± 0.25	inches mm
		0.08 - 0.1			0.026 ± 0.010 0.65 ± 0.25	0.034 ± 0.010 0.87 ± 0.25	inches mm
		0.3 - 0.5			0.028 ± 0.010 0.72 ± 0.25	0.034 ± 0.010 0.87 ± 0.25	inches mm

Mechanical Specifications CSS1206 – CSS2728 (cont.)

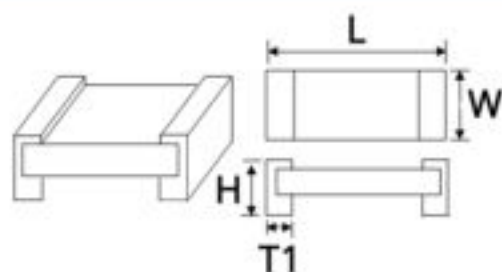
Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	L	W	H	T1	Unit
CSS2725	4	0.0002 - 0.0003	0.268 ± 0.010 6.81 ± 0.25	0.254 ± 0.010 6.45 ± 0.25	0.039 ± 0.010 0.99 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	inches mm
		0.00035				0.075 ± 0.010 1.90 ± 0.25	inches mm
		0.0004 - 0.00045				0.051 ± 0.010 1.30 ± 0.25	inches mm
		0.0005				0.085 ± 0.010 2.16 ± 0.25	inches mm
		0.0006				0.071 ± 0.010 1.80 ± 0.25	inches mm
		0.00075				0.059 ± 0.010 1.50 ± 0.25	inches mm
		0.001			0.043 ± 0.010 1.09 ± 0.25	0.085 ± 0.010 2.16 ± 0.25	inches mm
		0.0015				0.085 ± 0.010 2.16 ± 0.25	inches mm
		0.002			0.035 ± 0.010 0.89 ± 0.25	0.071 ± 0.010 1.80 ± 0.25	inches mm
		0.00225 - 0.0025				0.065 ± 0.010 1.65 ± 0.25	inches mm
		0.003				0.051 ± 0.010 1.30 ± 0.25	inches mm
CSS2728	3	0.004 - 0.2	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	inches mm

Mechanical Specifications CSS4527



Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	L	W	H	T1	T2	Unit
CSS4527	5	0.0005	0.450 ± 0.010 11.43 ± 0.25	0.270 ± 0.010 6.85 ± 0.25	0.059 ± 0.010 1.50 ± 0.25	0.137 ± 0.010 3.47 ± 0.25	0.038 ± 0.010 0.97 ± 0.25	inches mm
		0.0006 - 0.003				0.127 ± 0.010 3.22 ± 0.25		inches mm
		0.004 - 0.005				0.127 ± 0.010 3.22 ± 0.25		inches mm
		0.0051 - 0.2				0.072 ± 0.010 1.82 ± 0.25		inches mm

Mechanical Specifications - CSSH

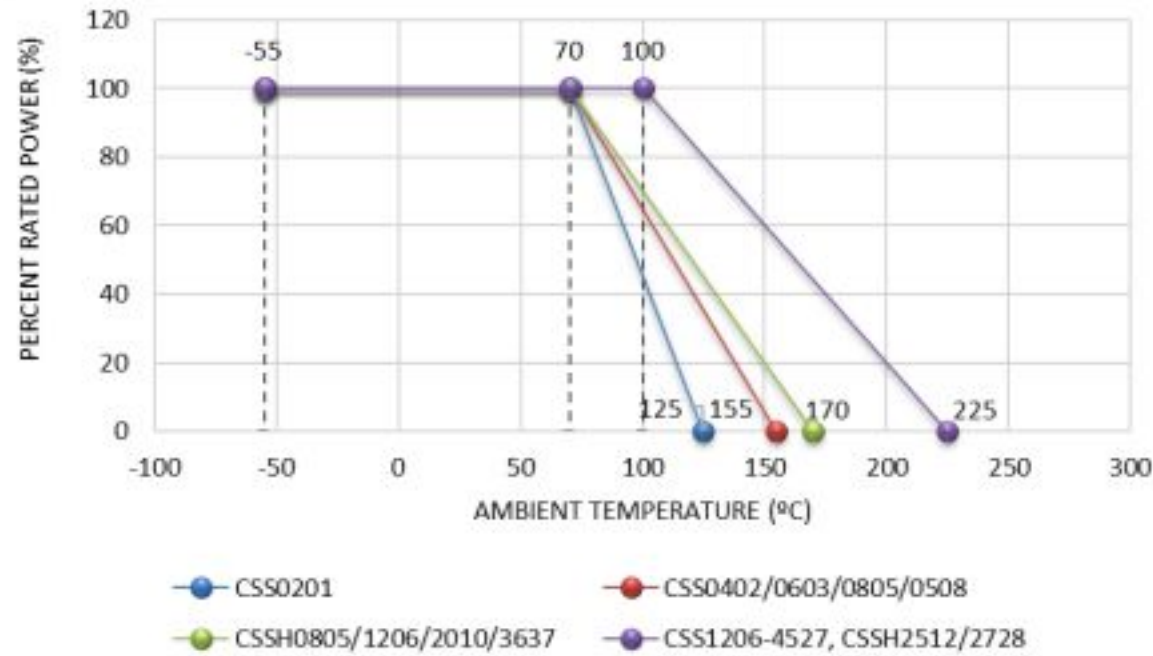


Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	L	W	H	T1	Unit
CSSH0805	1	0.0005	0.081 ± 0.010 2.05 ± 0.25	0.051 ± 0.012 1.30 ± 0.30	0.024 ± 0.008 0.60 ± 0.20	0.030 ± 0.008 0.75 ± 0.20	inches mm
		0.001			0.022 ± 0.008 0.55 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
		0.0015			0.018 ± 0.008 0.45 ± 0.20		inches mm
		0.002			0.014 ± 0.008 0.35 ± 0.20		inches mm
		0.0025			0.018 ± 0.008 0.45 ± 0.20		inches mm
		0.003 - 0.008			0.014 ± 0.008 0.35 ± 0.20		inches mm
		0.009 - 0.013			0.015 ± 0.008 0.37 ± 0.20		inches mm
CSSH1206	2	0.001	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	inches mm
		0.002 - 0.004			0.021 ± 0.010 0.55 ± 0.25	0.020 ± 0.010 0.51 ± 0.25	inches mm
		0.005			0.021 ± 0.010 0.55 ± 0.25	0.024 ± 0.010 0.60 ± 0.25	inches mm
CSSH2010	2	0.0005 - 0.0009	0.200 ± 0.010 5.08 ± 0.25	0.100 ± 0.010 2.54 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	0.057 ± 0.010 1.44 ± 0.25	inches mm
		0.001 - 0.003			0.031 ± 0.010 0.79 ± 0.25	0.051 ± 0.010 1.30 ± 0.25	inches mm
		0.0031 - 0.004			0.025 ± 0.010 0.65 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	inches mm
		0.0041 - 0.012			0.025 ± 0.010 0.65 ± 0.25	0.031 ± 0.010 0.79 ± 0.25	inches mm
CSSH2512	3	0.0003	0.246 ± 0.010 6.25 ± 0.25	0.126 ± 0.010 3.20 ± 0.25	0.039 ± 0.010 1.00 ± 0.25	0.080 ± 0.010 2.02 ± 0.25	inches mm
		0.0005			0.031 ± 0.010 0.79 ± 0.25	0.080 ± 0.010 2.02 ± 0.25	inches mm
		0.0006 - 0.0007				0.080 ± 0.010 2.02 ± 0.25	inches mm
		0.00075				0.054 ± 0.010 1.37 ± 0.25	inches mm
		0.0008 - 0.0029				0.044 ± 0.010 1.12 ± 0.25	inches mm
		0.003 - 0.0035				0.074 ± 0.010 1.88 ± 0.25	inches mm
		0.0036 - 0.004				0.066 ± 0.010 1.68 ± 0.25	inches mm
		0.0041 - 0.01				0.044 ± 0.010 1.12 ± 0.25	inches mm
					0.026 ± 0.010 0.65 ± 0.25		inches mm

Mechanical Specifications – CSSH (cont.)

Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	L	W	H	T1	Unit
CSSH2728	4	0.004 - 0.05	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	inches mm
CSSH3637	7	0.0003	0.360 ± 0.010 9.14 ± 0.25	0.378 ± 0.010 9.60 ± 0.25	0.029 ± 0.010 0.73 ± 0.25	0.091 ± 0.010 2.30 ± 0.25	inches mm

Power Derating Curve:



Performance Characteristics

Test	Test Method	Test Specification	Test Condition																																																																																																												
Temperature Coefficient of Resistance (TCR)	JIS-C-5201-1 4.8	Per specification (refer to Electrical Specification table)	$TCR (ppm/^{\circ}C) = \frac{(R2 - R1)}{R1 (T2 - T1)} \times 10^6$ R1: resistance of room temperature (T1) R2: resistance of 125^{\circ}C (T2)																																																																																																												
Short Time Overload	JIS C 5201-1 4.13		The number of rated power are as follows:																																																																																																												
		<table><tr><th>Size</th><th>Power (W)</th><th>Max. R Change</th></tr><tr><td>CSS0201</td><td>0.2</td><td>≤ ± 0.5%</td></tr><tr><td>CSS0402</td><td>0.33</td><td>± 1% + 0.5mΩ</td></tr><tr><td>CSS0603</td><td>0.33</td><td>± 1% + 0.5mΩ</td></tr><tr><td>CSS0508</td><td>1</td><td>± 1% + 0.5mΩ</td></tr><tr><td>CSS0805</td><td>0.5</td><td>± 1% + 0.5mΩ</td></tr><tr><td>CSS1206</td><td>1</td><td>≤ ± 0.5%</td></tr><tr><td>CSS2010</td><td>1</td><td>≤ ± 0.5%</td></tr><tr><td>CSS2512</td><td>2</td><td>≤ ± 0.5%</td></tr><tr><td>CSS2725</td><td>4</td><td>≤ ± 0.5%</td></tr><tr><td>CSS2728</td><td>3</td><td>≤ ± 0.5%</td></tr><tr><td>CSS4527</td><td>5</td><td>≤ ± 2%</td></tr><tr><td>CSSH0805</td><td>1</td><td>≤ ± 1%</td></tr><tr><td>CSSH1206</td><td>2</td><td>≤ ± 0.5%</td></tr><tr><td>CSSH2010</td><td>2</td><td>≤ ± 0.5%</td></tr><tr><td>CSSH2512</td><td>3</td><td>≤ ± 0.5%</td></tr><tr><td>CSSH2728</td><td>4</td><td>≤ ± 0.5%</td></tr><tr><td>CSSH3637</td><td>7</td><td>≤ 0.5% + 0.5mΩ</td></tr></table>	Size	Power (W)	Max. R Change	CSS0201	0.2	≤ ± 0.5%	CSS0402	0.33	± 1% + 0.5mΩ	CSS0603	0.33	± 1% + 0.5mΩ	CSS0508	1	± 1% + 0.5mΩ	CSS0805	0.5	± 1% + 0.5mΩ	CSS1206	1	≤ ± 0.5%	CSS2010	1	≤ ± 0.5%	CSS2512	2	≤ ± 0.5%	CSS2725	4	≤ ± 0.5%	CSS2728	3	≤ ± 0.5%	CSS4527	5	≤ ± 2%	CSSH0805	1	≤ ± 1%	CSSH1206	2	≤ ± 0.5%	CSSH2010	2	≤ ± 0.5%	CSSH2512	3	≤ ± 0.5%	CSSH2728	4	≤ ± 0.5%	CSSH3637	7	≤ 0.5% + 0.5mΩ	<table><tr><th>Size</th><th>Power (W)</th><th>Rated Power</th></tr><tr><td>CSS0201</td><td>0.2</td><td>2.5 times</td></tr><tr><td>CSS0402</td><td>0.33</td><td>2.5 times</td></tr><tr><td>CSS0603</td><td>0.33</td><td>2.5 times</td></tr><tr><td>CSS0508</td><td>1</td><td>2.5 times</td></tr><tr><td>CSS0805</td><td>0.5</td><td>2.5 times</td></tr><tr><td>CSS1206</td><td>1</td><td>5 times</td></tr><tr><td>CSS2010</td><td>1</td><td>5 times</td></tr><tr><td>CSS2512</td><td>2</td><td>5 times</td></tr><tr><td>CSS2725</td><td>4</td><td>5 times</td></tr><tr><td>CSS2728</td><td>3</td><td>5 times</td></tr><tr><td>CSS4527</td><td>5</td><td>5 times</td></tr><tr><td>CSSH0805</td><td>1</td><td>4 times</td></tr><tr><td>CSSH1206</td><td>2</td><td>5 times</td></tr><tr><td>CSSH2010</td><td>2</td><td>5 times</td></tr><tr><td>CSSH2512</td><td>3</td><td>5 times</td></tr><tr><td>CSSH2728</td><td>4</td><td>5 times</td></tr><tr><td>CSSH3637</td><td>7</td><td>5 times</td></tr></table>	Size	Power (W)	Rated Power	CSS0201	0.2	2.5 times	CSS0402	0.33	2.5 times	CSS0603	0.33	2.5 times	CSS0508	1	2.5 times	CSS0805	0.5	2.5 times	CSS1206	1	5 times	CSS2010	1	5 times	CSS2512	2	5 times	CSS2725	4	5 times	CSS2728	3	5 times	CSS4527	5	5 times	CSSH0805	1	4 times	CSSH1206	2	5 times	CSSH2010	2	5 times	CSSH2512	3	5 times	CSSH2728	4	5 times	CSSH3637	7	5 times
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			Rating power duration: 5 seconds.																																																																																																												

Performance Characteristics (cont.)

Test	Test Method	Test Specification	Test Condition
Insulation Resistance	JIS-C-5201-1 4.6	$\geq 10^9 \Omega$	Put the resistor in the fixture, add 100 VDC in terminal for 60 seconds, then measure the insulation resistance between electrodes and insulating enclosure or between electrodes and base material
Dielectric Withstanding Voltage	JIS-C-5201-1 4.7	No short or burned in the appearance.	Applied 500 VAC for 1 minute and limit surge current 50 mA (max)

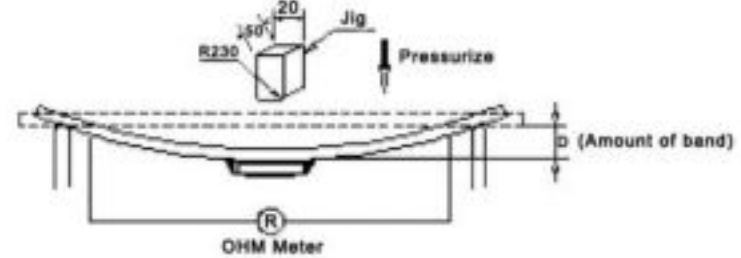
Operating Temperature Range for size CSS0201 is -55°C to +125°C.

Operating Temperature Range for sizes CSS0402, CSS0603 and CSS0805 is -55°C to +155°C.

Operating Temperature Range for size CSSH0805, CSSH3637 is -55°C to +170°C.

Operating Temperature Range for sizes CSS1206 - CSS4527, CSSH 2512 and CSSH 2728 is -55°C to +225°C.

Mechanical Performance

Test Item	Test Method	Test Specifications	Test Condition
Resistance to Solder Heat	JIS C 5201-1 4.18	0201 - 0805 $\leq \pm 1\% + 0.5\text{m}\Omega$ CSSH0805 and above 1206 $\leq \pm 0.5\% + 0.5\text{m}\Omega$ CSSH3637 $\leq \pm 0.5\% + 0.5\text{m}\Omega$ Jumper < Rmax	260 $\pm$ 5°C for 10 $\pm$ 1 seconds
Solderability	JIS C 5201-1 4.17	> 95 % coverage	245 $\pm$ 5°C for 3 $\pm$ 0.5 seconds
Substrate Bending	JIS C 5201-1 4.33	$\pm 1\% + 0.5\text{m}\Omega$ CSSH3637 $\leq \pm 0.5\% + 0.5\text{m}\Omega$	Span between fulcrums: 90 mm Bend width: 2 mm 
Resistance to Solvent	JIS C 5201-1 4.29	$\leq \pm 0.5\%$ No evidence of mechanical damage	The tested resistor is immersed into isopropyl alcohol of 20 ~ 25°C for 60 seconds, then the resistor is left in the room for 48 hours.
Vibration	JIS C 5201-1 4.22	$\leq \pm 0.5\%$ No evidence of mechanical damage	The resistor shall be mounted by its terminal leads to the supporting terminals on the solid table. The entire frequency range from 10 Hz to 55 Hz and return to 10 Hz, shall be transferred in 1 minute. Amplitude: 1.5 mm - This motion shall be applied for a period of 4 hours in each 3 mutually perpendicular directions (a total of 12 hours)
Mechanical Shock	JIS C 5202 6.7	$\pm 1\% + 0.5\text{m}\Omega$	a = 50 G, t = 11 ms, 5 times shock

Environmental Performance

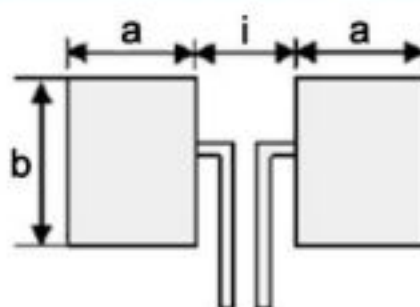
Test Item	Test Method	Test Specifications	Test Condition
Low Temperature Exposure (Storage)	JIS C 5201-1 4.23.4	0201 - 0805 $\leq \pm 1\% + 0.5\text{m}\Omega$ $\geq 1206 = \pm 0.5\%$	1000 hours at -55°C $\pm$ 2°C
High Temperature Exposure (Storage)	JIS C 5201-1 4.23.2	0201 - 0805 $\leq \pm 1\% + 0.5\text{m}\Omega$	1000 hours at + 155°C $\pm$ 2°C
		CSSH0805 $= \pm 1\%$ CSSH3637 $\leq \pm 1\% + 0.5\text{m}\Omega$ $\geq 1206 = \pm 1\%$	1000 hours at +170°C $\pm$ 5°C
		0201 Jumper < Rmax	1000 hours at + 125°C $\pm$ 2°C

Environmental Performance (cont.)

Test Item	Test Method	Test Specifications	Test Condition							
Temperature Cycling	JIS C 5201-1 4.19	0201 - 0805 ≤ ± 1% + 0.5mΩ	0201 = -55°C to +125°C, 100 cycles 0402 - 0805 = -55°C +155°C, 100 cycles							
		CSSH0805 = ± 0.5%	-55°C to +150°C, 100 cycles							
		CSSH3637 ≤ ± 0.5% + 0.5mΩ								
		≥ 1206 = ± 0.5%		Lowest temperature: -55 +0/-10°C Highest temperature: 150 + 10/-0°C						
Biased Humidity	JIS C 5201-1 4.24	0201 - 0805 ≤ ± 2% + 0.5mΩ 0201 Jumper < R max	T = 40 ± 2°C , RH = 90~95%, Load with Rated Current 1.5 hours "ON", 0.5 hours "OFF", 1000 hours							
		CSSH0805 = ± 0.5% CSSH3637 ≤ ± 0.5% + 0.5mΩ ≥ 1206 = ± 0.5%	1000 hours at +85°C / 85% R.H., 10% of operating power 1.5 hours "ON" and 0.5 hours "OFF"							
Load Life	JIS C 5201-1 4.25	0201 - 0805 ≤ ± 2% + 0.5mΩ 0201 Jumper = R max CSSH0805 = ± 1% CSSH3637 ≤ ± 1% + 0.5mΩ 1206 - 2728 = ± 1% 4527 = ± 2%	T = 70 ± 2°C, load with Rated Current 1.5 hours "ON", 0.5 hours "OFF", 1000 hours							
Whisker Test	JESD Standard No.22A121 class 2	Max 50 μ m	Test item (Thermal Shock Test):							
			<table><tr><th colspan="2">Testing Condition</th></tr><tr><td>Minimum Storage Temperature</td><td>-55 +0 / -10°C</td></tr><tr><td>Maximum Storage Temperature</td><td>85 + 10 / -0°C</td></tr><tr><td>Temperature-Retaining Time</td><td>10 minutes</td></tr><tr><td>Number of Temperature Cycles</td><td>1500</td></tr></table> Inspection: Inspect for whisker formation on specimens that underwent the acceleration test, with a magnifier (stereo microscope) of about 40 or higher magnification. If judgement is difficult with this method, use a scanning electron microscope (SEM) of about 1000 or higher magnification.	Testing Condition		Minimum Storage Temperature	-55 +0 / -10°C	Maximum Storage Temperature	85 + 10 / -0°C	Temperature-Retaining Time
Testing Condition										
Minimum Storage Temperature	-55 +0 / -10°C									
Maximum Storage Temperature	85 + 10 / -0°C									
Temperature-Retaining Time	10 minutes									
Number of Temperature Cycles	1500									

Storage temperature: 25 $\pm$ 5°C. Humidity: 60 $\pm$ 20%.

Recommended Pad Layouts - CSS



Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	a	b	i	Unit
CSS0201	0.2	0.01, 0.02	0.008 0.20	0.013 0.33	0.010 0.25	inches mm
CSS0402	0.33	0.0025	0.024 0.60	0.024 0.60	0.014 0.35	inches mm
		0.005 - 0.02			0.016 0.40	inches mm
CSS0603	0.33	0.002	0.056 1.41	0.036 0.92	0.015 0.38	inches mm
		0.0025, 0.003	0.053 1.35	0.036 0.92	0.020 0.50	inches mm
		0.004 - 0.02	0.051 1.30		0.024 0.60	inches mm

Recommended Pad Layouts - CSS

Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	a	b	i	Unit
CSS0508	1	0.001, 0.0015, 0.002	0.035 0.90	0.091 2.30	0.016 0.40	inches mm
		0.003 - 0.005	0.033 0.85		0.020 0.50	inches mm
CSS0805	0.5	0.0015, 0.002	0.061 1.55	0.057 1.44	0.020 0.50	inches mm
		0.003 - 0.02	0.055 1.40		0.031 0.80	inches mm
CSS1206	1	0.0005 - 0.0006	0.065 1.65	0.086 2.18	0.035 0.90	inches mm
		0.001 - 0.05	0.063 1.60	0.086 2.18	0.039 1.00	inches mm
CSS2010	1	0.0005 - 0.003	0.114 2.89	0.115 2.92	0.048 1.22	inches mm
		0.0031 - 0.1	0.090 2.29		0.095 2.41	inches mm
CSS2512	2	0.0003 - 0.0007	0.120 3.05	0.145 3.68	0.050 1.27	inches mm
		0.00075	0.086 2.19	0.145 3.68	0.118 3.00	inches mm
		0.0008 - 0.004	0.120 3.05	0.145 3.68	0.050 1.27	inches mm
		0.00041 - 0.075	0.083 2.11	0.145 3.68	0.125 3.18	inches mm
		0.08 - 0.1	0.083 2.11	0.145 3.68	0.125 3.18	inches mm
		0.3 - 0.5	0.083 2.11	0.145 3.68	0.125 3.18	inches mm
CSS2725	4	0.0002 - 0.003	0.125 3.18	0.270 6.86	0.052 1.32	inches mm
CSS2728	3	0.004 - 0.2	0.108 2.75	0.308 7.82	0.138 3.51	inches mm
CSS4527	5	0.0005 - 0.005	0.228 5.80	0.344 8.74	0.138 3.51	inches mm
		0.0051 - 0.2	0.163 4.15		0.268 6.81	inches mm

Recommended Pad Layouts - CSSH

Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	a	b	i	Unit
CSSH0805	1	0.0005	0.053 1.35	0.071 1.80	0.012 0.30	inches mm
		0.001 - 0.013	0.039 1.00		0.039 1.00	inches mm
CSSH1206	2	0.001 - 0.005	0.063 1.60	0.086 2.18	0.039 1.00	inches mm
CSSH2010	2	0.0005 - 0.003	0.114 2.89	0.115 2.92	0.048 1.22	inches mm
		0.0031 - 0.012	0.090 2.29		0.095 2.41	inches mm

Recommended Pad Layouts – CSSH (cont.)

Type/Code	Maximum Power Rating (W)	Resistance Range (Ω)	a	b	i	Unit
CSSH2512	3	0.0003 - 0.0005	0.120 3.05	0.145 3.68	0.050 1.27	inches mm
		0.0006 - 0.0029	0.086 2.19		0.118 3.00	inches mm
		0.003 - 0.004	0.110 2.79		0.071 1.80	inches mm
		0.0101 - 0.1	0.086 2.19		0.118 3.00	inches mm
CSSH2728	4	0.004 - 0.1	0.108 2.75	0.308 7.82	0.138 3.51	inches mm
CSSH3637	7	0.0003	0.152 3.85	0.413 10.50	0.114 2.90	inches mm

Recommended Solder Profiles

This information is intended as a reference for solder profiles for Stackpole resistive components. These profiles should be compatible with most soldering processes. These are only recommendations. Actual numbers will depend on board density, geometry, packages used, etc., especially those cells labeled with “**”.

Soldering iron recommended temperatures: 330°C to 350°C with minimum duration.
Maximum number of reflow cycles: 3.

Wave Soldering

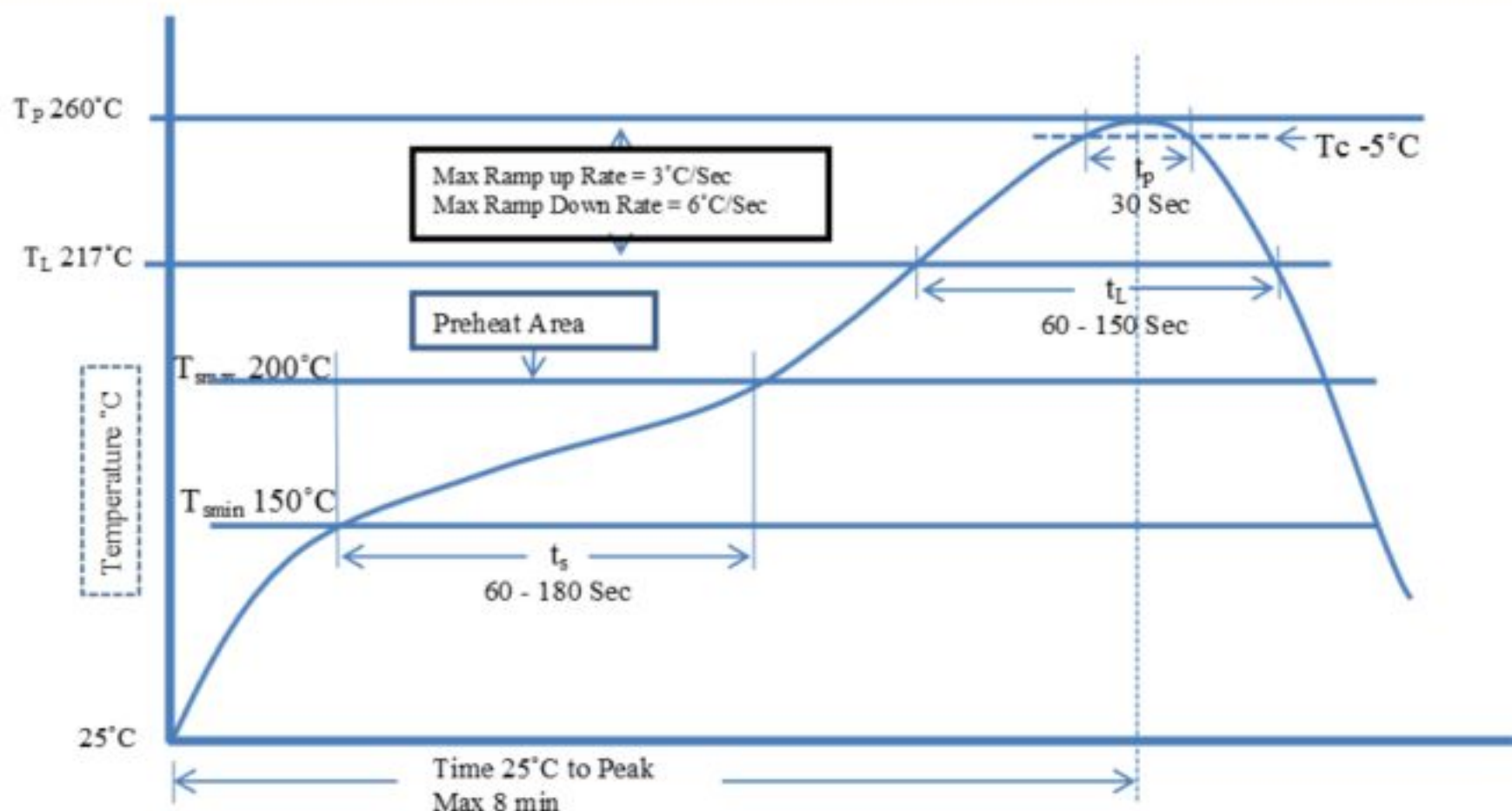
Description	Maximum	Recommended	Minimum
Preheat Time	80 seconds	70 seconds	60 seconds
Temperature Diff.	140°C	120°C	100°C
Solder Temp.	260°C	250°C	240°C
Dwell Time at Max.	10 seconds	5 seconds	*
Ramp DN (°C/sec)	N/A	N/A	N/A

Temperature Diff. = Difference between final preheat stage and soldering stage.

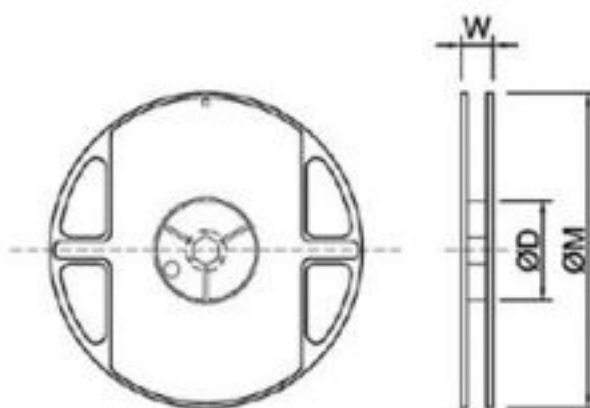
Convection IR Reflow

Description	Maximum	Recommended	Minimum
Ramp Up (°C/sec)	3°C/sec	2°C/sec	*
Dwell Time > 217°C	150 seconds	90 seconds	60 seconds
Solder Temp.	260°C	245°C	*
Dwell Time at Max.	30 seconds	15 seconds	10 seconds
Ramp DN (°C/sec)	6°C/sec	3°C/sec	*

Recommended Lead Free Resistor Reflow Profile

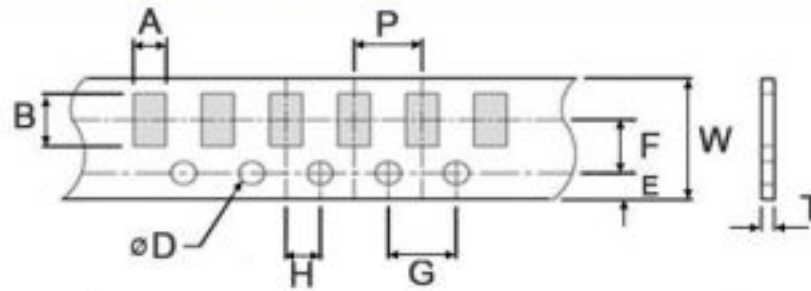


Packaging Specifications



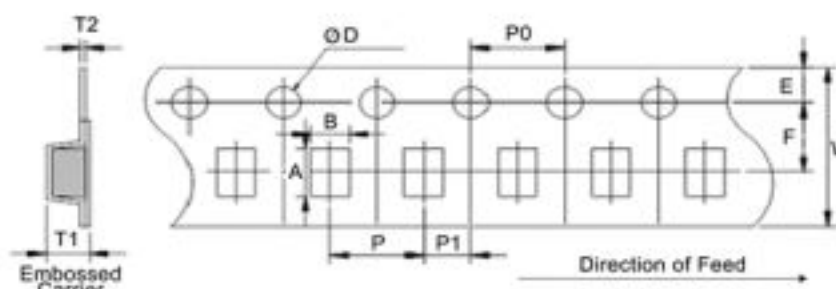
Type/Code	Tape Width	W	ØD	ØM	Unit
0201, 0402, 0603 0508, 0805, 1206	8 mm	0.354 ± 0.020 9.00 ± 0.50	2.362 ± 0.079 60.00 ± 2.00	7.008 ± 0.197 178.00 ± 5.00	inches mm
CSSH0805	8 mm	0.472 ± 0.020 12.00 ± 0.50	2.362 ± 0.079 60.00 ± 2.00	7.008 ± 0.197 178.00 ± 5.00	inches mm
CSSH3637	16 mm	0.685 ± 0.039 17.40 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	7.008 ± 0.079 178.00 ± 2.00	inches mm
2010, 2512, 2725, 2728	12 mm	0.543 ± 0.020 13.80 ± 0.50	3.150 ± 0.039 80.00 ± 1.00	7.008 ± 0.197 178.00 ± 5.00	inches mm
4527	24 mm	0.984 ± 0.039 25.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	7.008 ± 0.197 178.00 ± 5.00	inches mm

Plastic Tape Specifications 0201 – 0805



Type/Code	W	P	E	F	ØD	Unit
CSS0201	0.315 ± 0.012 8.00 ± 0.30	0.079 ± 0.004 2.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.004 3.50 ± 0.10	0.059 +0.004 / -0 1.50 +0.1 / -0	inches
CSS0402						mm
CSS0603		0.157 ± 0.004 4.00 ± 0.10				inches
CSS0508						mm
CSS0805						mm
Type/Code	G	H	A	B	T	Unit
CSS0201	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.016 ± 0.008 0.40 ± 0.20	0.028 ± 0.008 0.70 ± 0.20	0.018 ± 0.002 0.45 ± 0.05	inches
CSS0402			0.026 ± 0.008 0.65 ± 0.20	0.043 ± 0.008 1.10 ± 0.20	0.017 ± 0.002 0.42 ± 0.05	mm
CSS0603			0.039 ± 0.008 0.98 ± 0.20	0.073 ± 0.008 1.85 ± 0.20	0.024 ± 0.004 0.60 ± 0.10	inches
CSS0508			0.061 ± 0.008 1.55 ± 0.20	0.091 ± 0.008 2.30 ± 0.20	0.028 ± 0.008 0.70 ± 0.20	mm
CSS0805					0.030 ± 0.008 0.75 ± 0.20	inches

Plastic Tape Specifications 1206 – 4227

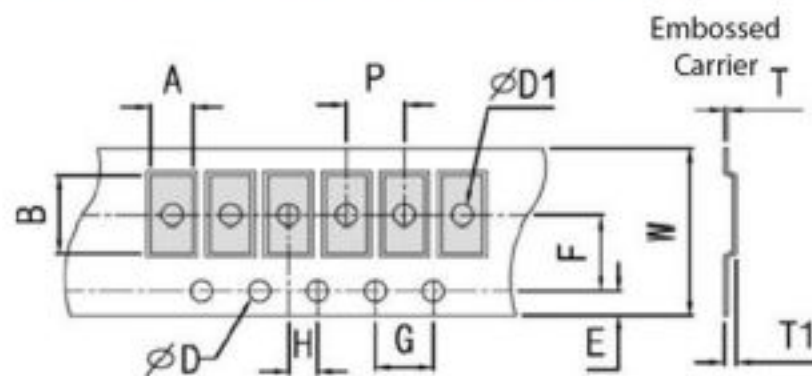


Type/Code	A	B	W	E	F	T1	Unit
CSS1206/CSSH1206 (0.0005Ω - 0.0006Ω)	0.138 ± 0.004 3.50 ± 0.10	0.075 ± 0.004 1.90 ± 0.10	0.315 ± 0.006 8.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.004 3.50 ± 0.10	0.050 ± 0.004 1.27 ± 0.10	inches
CSS1206/CSSH1206 (≥ 0.001Ω)	0.137 ± 0.004 3.48 ± 0.10	0.072 ± 0.004 1.83 ± 0.10	0.315 ± 0.006 8.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.004 3.50 ± 0.10	0.043 ± 0.004 1.10 ± 0.10	mm
CSS2010/CSSH2010	0.215 ± 0.004 5.45 ± 0.10	0.114 ± 0.004 2.90 ± 0.10	0.472 ± 0.006 12.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.004 5.50 ± 0.10	0.052 ± 0.004 1.33 ± 0.10	inches
CSS2512/CSSH2512 (0.0003Ω)	0.265 ± 0.004 6.74 ± 0.10	0.138 ± 0.004 3.50 ± 0.10	0.472 ± 0.006 12.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.004 5.50 ± 0.10	0.063 ± 0.004 1.60 ± 0.10	mm
CSS2512/CSSH2512	0.266 ± 0.004 6.75 ± 0.10	0.138 ± 0.004 3.50 ± 0.10	0.472 ± 0.006 12.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.004 5.50 ± 0.10	0.051 ± 0.004 1.30 ± 0.10	inches
CSS2725	0.281 ± 0.004 7.15 ± 0.10	0.266 ± 0.004 6.75 ± 0.10	0.472 ± 0.006 12.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.004 5.50 ± 0.10	0.077 ± 0.004 1.95 ± 0.10	mm
CSS2728	0.281 ± 0.004 7.15 ± 0.10	0.303 ± 0.004 7.70 ± 0.10	0.472 ± 0.006 12.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.004 5.50 ± 0.10	0.057 ± 0.004 1.45 ± 0.10	inches
CSS4527	0.465 ± 0.004 11.80 ± 0.10	0.283 ± 0.004 7.20 ± 0.10	0.945 ± 0.006 24.00 ± 0.15	0.069 ± 0.004 1.75 ± 0.10	0.453 ± 0.004 11.50 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	mm

Plastic Tape Specifications 1206 – 4227 (cont.)

Type/Code	T2	P	P0	P1	ΦD	Unit
CSS1206/CSSH1206 (0.0005Ω - 0.0006Ω)	0.009 ± 0.004 0.23 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm
CSS1206/CSSH1206 (≥ 0.001Ω)	0.008 ± 0.002 0.20 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm
CSS2010/CSSH2010	0.009 ± 0.002 0.23 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm
CSS2512/CSSH2512 (0.0003Ω)	0.009 ± 0.002 0.24 ± 0.05	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm
CSS2512/CSSH2512	0.008 ± 0.002 0.20 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm
CSS2725	0.010 ± 0.002 0.25 ± 0.05	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm
CSS2728	0.010 ± 0.002 0.25 ± 0.05	0.472 ± 0.004 12.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm
CSS4527	0.012 ± 0.004 0.30 ± 0.10	0.472 ± 0.004 12.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059 +0.004 / -0 1.50 +0.10 / -0	inches mm

Plastic Tape Specifications (CSSH0805 and CSSH3637)



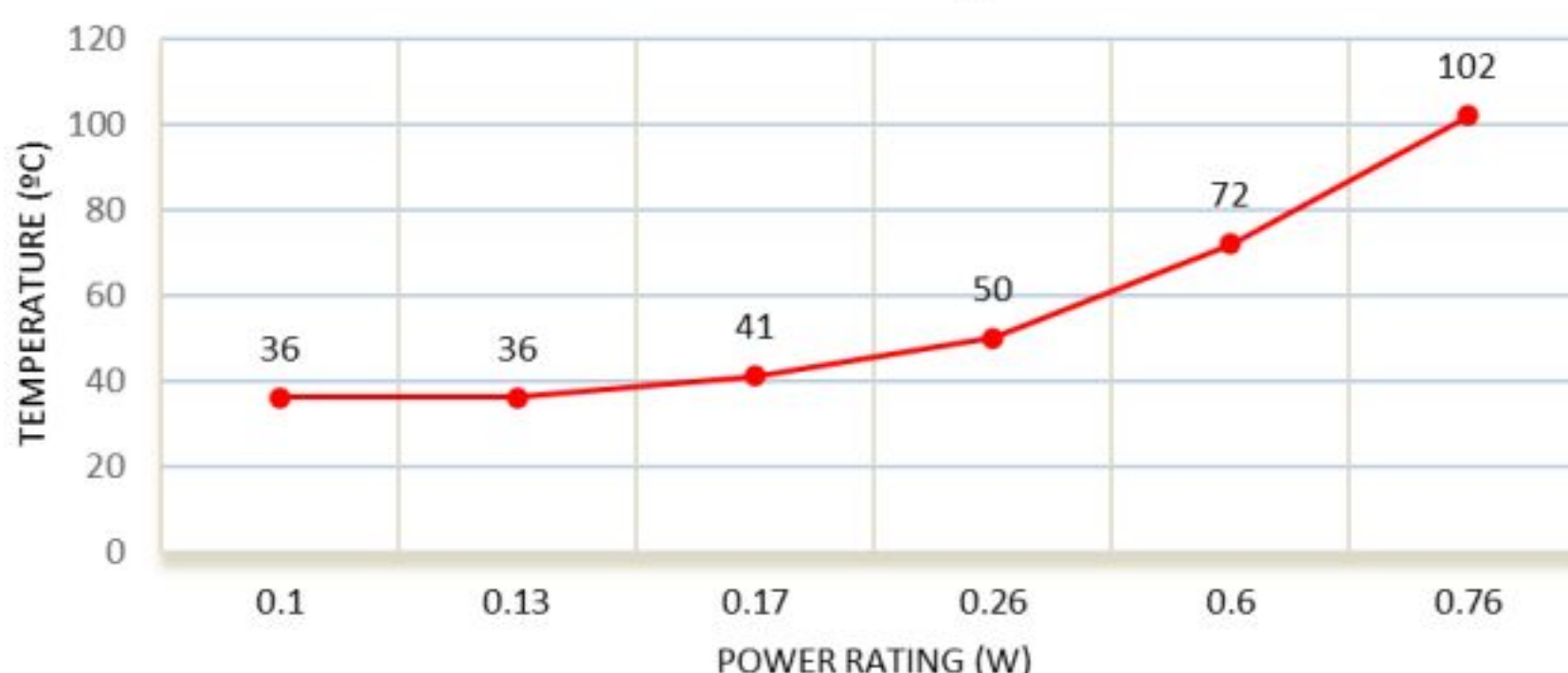
Type/Code	W	P	E	F	ΦD	ΦD1	Unit
CSSH0805 (0.0005Ω-0.001Ω)	0.315 ± 0.012 8.00 ± 0.30	0.157 ± 0.004 4.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.004 3.50 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.039 ± 0.004 1.00 ± 0.10	inches mm
	G	H	A	B	T1	T	Unit
	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.067 ± 0.004 1.70 ± 0.10	0.096 ± 0.004 2.45 ± 0.10	0.035 ± 0.010 0.90 ± 0.25	0.008 ± 0.002 0.20 ± 0.05	inches mm
Type/Code	W	P	E	F	ΦD	ΦD1	Unit
CSSH0805 (0.0015Ω-0.013Ω)	0.315 ± 0.012 8.00 ± 0.30	0.157 ± 0.004 4.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.004 3.50 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.039 ± 0.004 1.00 ± 0.10	inches mm
	G	H	A	B	T1	T	Unit
	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.067 ± 0.004 1.70 ± 0.10	0.096 ± 0.004 2.45 ± 0.10	0.022 ± 0.010 0.55 ± 0.25	0.008 ± 0.002 0.20 ± 0.05	inches mm
Type/Code	W	P	E	F	ΦD	ΦD1	Unit
CSSH3637	0.630 ± 0.008 16.00 ± 0.20	0.472 ± 0.004 12.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.295 ± 0.004 7.50 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.059 ± 0.004 1.50 ± 0.10	inches mm
	G	H	A	B	T1	T	Unit
	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.378 ± 0.004 9.60 ± 0.10	0.394 ± 0.004 10.00 ± 0.10	0.051 ± 0.004 1.30 ± 0.10	0.010 ± 0.002 0.25 ± 0.05	inches mm

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 CSR1206 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 100mΩ Surface Temperature Rise



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 ≤ 50 mΩ. 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 3). 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 as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

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

C S S 2 7 2 5 F T 3 L 0 0											
Product Series		Size		Tolerance		Packaging				Resistance Value	
Code	Description	Size	W	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.	
CSS	Metal Alloy	0201	0.2	D	0.5%	T	Plastic Tape	0201, 0402	10000		
CSSH	High Power	0402	0.33	F	1%			0603, 0508	5000	0.00025 ohm = L250 0.004 ohm = 4L00 0.05 ohm = 50L0 0.12 ohm = R120	
		0603	0.33	G	2%			0805	4000		
		0805	0.5	J	5%			1206	2000		
		0508	1					2010, 2512	1000		
		(H)0805	1					2725, 2728	500		
		1206	1					3637			
		(H)1206	2					4527			
		2010	1								
		(H)2010	2								
		2512	2								
		(H)2512	3								
		2728	3								
		2725	4								
		(H)2728	4								
		4527	5								
		(H)3637	7								