

Features:

- 0201 to 1225 sizes available
- Power ratings to 3W
- Non-standard resistance values available
- E24 values standard; E96 and other values may be available upon request
- 0815, 2010 and 2512 sizes available with narrow terminations (CSRN)
- 100% RoHS compliant and lead free without exemption and halogen free
- REACH compliant



Electrical Specifications - CSR					
Type/Code	Power Rating (W) @ 70°C	Dielectric Withstanding Voltage (V)	TCR (ppm/°C)	Ohmic Range (Ω) and Tolerance	
				1%	2%, 5%
CSR0201	0.05	200	± 1000	0.1 - 0.13	
			± 600	0.15 - 0.5	
			± 300	0.51 - 1	
CSR0402	0.125	200	± 200 ⁽¹⁾	0.05 - 1	
CSR0603	0.125	200	± 300 ⁽³⁾	0.02 - 0.3	
			± 200 ⁽²⁾	0.33 - 1	
CSR0805	0.25	200	± 200 ⁽³⁾	0.02 - 1	
CSR1206	0.5	200	± 100 ⁽²⁾	0.01 - 1	
CSR1210	0.5	200	± 600	0.01 - 0.02	
			± 400	0.022 - 0.051	
			± 300	0.056 - 0.091	
			± 200	0.1 - 1	
CSR2010	1	200	± 200 ⁽³⁾	0.01 - 1	
CSR2512	2	200	± 200 ⁽³⁾	0.01 - 1	
CSR0830	2	200	± 300	-	0.001 - 0.004
			± 200	0.005 - 0.01	
			± 150	0.011 - 0.33	
CSR1225	3	200	± 300	0.003 - 0.004	
			± 200	0.005 - 0.02	
			± 150	0.022 - 0.03	
			± 100	0.033 - 7.5	

(1) Contact Stackpole for TCR below 500 mΩ

(2) Contact Stackpole for TCR below 150 mΩ

(3) Contact Stackpole for TCR below 100 mΩ

Electrical Specifications – CSRN (Narrow Termination)				
Type/Code	Power Rating (W) @ 70°C	Dielectric Withstanding Voltage (V)	TCR (ppm/°C)	Ohmic Range (Ω) and Tolerance
				1%, 2%, 5%
CSRN2010	1	200	± 200	0.01 - 1
CSRN0815	1	200	± 300	0.01 - 0.018
			± 150	0.02 - 0.47
CSRN2512 ^(*)	2	200	± 200	0.01 - 1

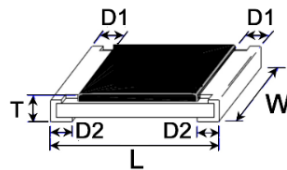
(*) AEC-Q200 Qualified

Electrical Specifications – CSR-HP

Type/Code	Power Rating (W) @ 70°C	Dielectric Withstanding Voltage (V)	TCR (ppm/°C)	Ohmic Range (Ω) and Tolerance
				1%, 2%, 5%
CSR0603...-HP	0.2	200	± 400	0.051 - 0.1
			± 300	0.11 - 0.5
			± 200	0.51 - 1
CSR1210...-HP	0.75	200	± 600	0.01 - 0.02
			± 400	0.022 - 0.05
			± 300	0.051 - 0.091
			± 200	0.1 - 1

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

Mechanical Specifications - CSR

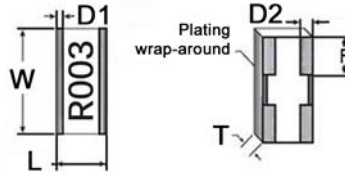


Type/Code	Weight (g) (1000 pieces)	L Body Length	W Body Width	T Body Height	D1 Top Termination	D2 Bottom Termination	Unit
CSR0201	0.18	0.024 ± 0.001 0.60 ± 0.03	0.012 ± 0.001 0.30 ± 0.03	0.009 ± 0.002 0.23 ± 0.05	0.005 ± 0.002 0.12 ± 0.05	0.006 ± 0.002 0.15 ± 0.05	inches mm
CSR0402	0.7	0.039 ± 0.002 1.00 ± 0.05	0.020 ± 0.002 0.50 ± 0.05	0.013 ± 0.004 0.32 ± 0.10	0.010 ± 0.004 0.25 ± 0.10	0.008 ± 0.004 0.20 ± 0.10	inches mm
CSR0603	1.99	0.063 ± 0.004 1.60 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.018 ± 0.004 0.45 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.008 0.30 ± 0.20	inches mm
CSR0805	5.3	0.079 ± 0.006 2.00 ± 0.15	0.049 ± 0.006 1.25 ± 0.15	0.022 ± 0.004 0.55 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.016 ± 0.010 0.40 ± 0.25	inches mm
CSR1206	8.82	0.120 ± 0.006 3.05 ± 0.15	0.061 ± 0.006 1.55 ± 0.15	0.022 ± 0.004 0.55 ± 0.10	0.020 ± 0.012 0.50 ± 0.30	0.016 ± 0.010 0.40 ± 0.25	inches mm
CSR1210	15.5	0.122 ± 0.004 3.10 ± 0.10	0.102 ± 0.006 2.60 ± 0.15	0.022 ± 0.004 0.55 ± 0.10	0.020 ± 0.012 0.50 ± 0.30	0.020 ± 0.010 0.50 ± 0.25	inches mm
CSR2010	27.03	0.197 ± 0.008 5.00 ± 0.20	0.100 ± 0.008 2.54 ± 0.20	0.020 ± 0.006 0.50 ± 0.15	0.068 ± 0.006 1.72 ± 0.15	0.067 ± 0.006 1.70 ± 0.15	inches mm
CSR2512	53.08	0.252 ± 0.008 6.40 ± 0.20	0.126 ± 0.008 3.20 ± 0.20	0.020 ± 0.006 0.50 ± 0.15	0.024 ± 0.012 0.60 ± 0.30	0.079 ± 0.010 2.00 ± 0.25	inches mm
CSR0830	35.71	0.079 ± 0.008 2.00 ± 0.20	0.295 ± 0.012 7.50 ± 0.30	0.024 ± 0.004 0.60 ± 0.10	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm

Mechanical Specifications – CSRN (Narrow Termination)

Type/Code	Weight (g) (1000 pieces)	L Body Length	W Body Width	T Body Height	D1 Top Termination	D2 Bottom Termination	Unit
CSRN0815	19.96	0.079 ± 0.008 2.00 ± 0.20	0.148 ± 0.008 3.75 ± 0.20	0.024 ± 0.004 0.60 ± 0.10	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
CSRN2010	27.03	0.197 ± 0.008 5.00 ± 0.20	0.096 ± 0.006 2.45 ± 0.15	0.024 ± 0.006 0.60 ± 0.15	0.024 ± 0.012 0.60 ± 0.30	0.020 ± 0.010 0.50 ± 0.25	inches mm
CSRN2512	53.08	0.250 ± 0.008 6.35 ± 0.20	0.124 ± 0.006 3.15 ± 0.15	0.024 ± 0.004 0.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	0.022 ± 0.010 0.55 ± 0.25	inches mm

Mechanical Specifications – CSR1225



Type/Code	Weight (g) (1000 pieces)	L	W	T	D1	D2	F	Unit
CSR1225	64.88	0.126 ± 0.006 3.20 ± 0.15	0.254 ± 0.006 6.45 ± 0.15	0.035 ± 0.006 0.90 ± 0.15	0.024 ± 0.012 0.60 ± 0.30	0.031 ± 0.010 0.80 ± 0.25	0.090 ± 0.005 2.29 ± 0.13	inches mm

Performance Characteristics

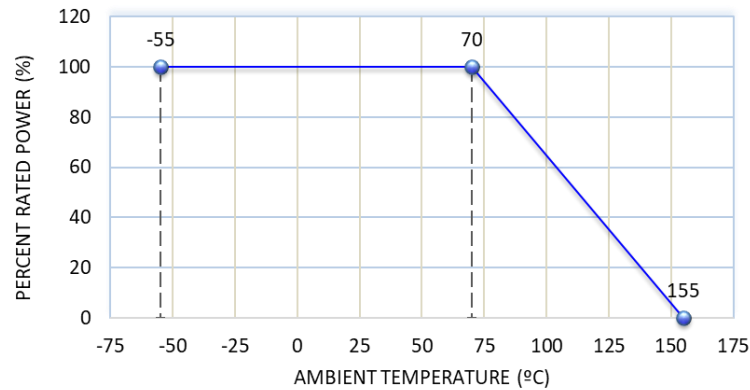
Test	Test Method	Test Specification	Typical	Test Condition
High Temperature Exposure	MIL-STD-202 Method 108	1% Tol: ($\pm 1\% + 0.05\Omega$) 2%, 5% Tol: ($\pm 1.5\% + 0.1\Omega$)	$\leq 0.5\%$	1000 hours at T = 155°C. Unpowered. Measurement at 24 ± 4 hours after test conclusion.
Short Time Overload	JIS-C-5201-1 4.13 IEC 60115-1 4.13	$\pm (0.5\% + 0.05\Omega)$ $\pm (1\% + 0.05\Omega)$ For high power rating	$\leq 0.25\%$ $\leq 0.5\%$	RCV (rated current) * 2.5 for 5 seconds.
Temperature Cycling	JESD22 Method JA-104	1% Tol: ($\pm 0.5\% + 0.05\Omega$) 2%, 5% Tol: ($\pm 1.5\% + 0.1\Omega$)	$\leq 0.5\%$	1000 Cycles (-55°C to +125°C) Measurement at 24 ± 4 hours after test conclusion. 30 minutes maximum dwell time at each temperature extreme. 1 minute maximum transition time.
Biased Humidity	MIL-STD-202 Method 103	1% Tol: ($\pm 1\% + 0.1\Omega$) 2%, 5% Tol: ($\pm 2\% + 0.1\Omega$)	$\leq 0.5\%$	1000 hours 85°C / 85% RH. Note: Specified conditions: 10% of operating power. Measurement at 24 ± 4 hours after test conclusion.
Operational Life	MIL-STD-202 Method 108	1% Tol: ($\pm 1\% + 0.1\Omega$) 2%, 5% Tol: ($\pm 2\% + 0.1\Omega$)	$\leq 0.5\%$	Condition D Steady State TA = 125°C at rated power. Measurement at 24 ± 4 hours after test conclusion.
External Visual	MIL-STD 883 Method 2009	-	Pass	Electrical test not required. Inspect device construction, marking and workmanship.
Physical Dimensions	JESD22 Method JB-100	-	Pass	Verify physical dimensions to the applicable device detail specification. Note: User(s) and supplier specification, electrical test not required.
Resistance to Solvents	MIL-STD 202 Method 215	Marking unsmear	Pass	Note: Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Mechanical Shock	MIL-STD 202 Method 213	1% Tol: ($\pm 0.25\% + 0.05\Omega$) 2%, 5% Tol: ($\pm 1\% + 0.05\Omega$)	$\leq 0.5\%$	Figure 1 of Method 213. Condition C.
Vibration	MIL-STD 202 Method 204	1% Tol: ($\pm 0.5\% + 0.05\Omega$) 2%, 5% Tol: ($\pm 1\% + 0.05\Omega$)	$\leq 0.5\%$	5g's for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8" X 5" PCB 0.031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10 - 2000Hz.
Resistance to Soldering Heat	MIL-STD 202 Method 210	1% Tol: ($\pm 0.5\% + 0.05\Omega$) 2%, 5% Tol: ($\pm 1\% + 0.05\Omega$)	$\leq 0.5\%$	Condition B no pre-heat of samples. Note: Single wave solder - Procedure 2 for SMD.
ESD	AEC-Q200-002	--	Pass	With the electrometer in direct contact with the discharge tip, verify the voltage setting at levels of $\pm 500V$, $\pm 1kV$, $\pm 2kV$, $\pm 4kV$, $\pm 8kV$. The electrometer reading shall be within $\pm 10\%$ for voltages from 500V to $\leq 8kV$.
Solderability	J-STD-002	> 95% Coverage	Pass	Electrical test not required. Magnification 50 times. Conditions: SMD: a) Method B, 4 hours @ 155°C dry heat @ 235°C. b) Method B @ 215°C category 3. c) Method D category 3 at 260°C.

Performance Characteristics (cont.)

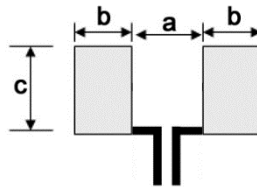
Test	Test Method	Test Specification	Typical	Test Condition
Electrical Characterization	User Spec	--	Pass	Parametrically test per lot and sample size requirements, summary to show Min, Max, Mean and Standard Deviation at room as well as Min and Max operating temperatures.
Flammability	UL-94	No ignition of tissue or scorching of pine board.	Pass	V - 0 or V - 1 are acceptable. Electrical test not required.
Board Flex	AEC-Q200-005	1% Tol: ($\pm 1\% + 0.05\Omega$) 2%, 5% Tol: ($\pm 1\% + 0.05\Omega$)	$\leq 0.5\%$	60 second minimum holding time.
Terminal Strength (SMD)	AEC-Q200-006	No breakage	Pass	
Flame Retardance	AEC-Q200-001	No flame	Pass	
Voltage Proof	JIS-C-5201-1 4.7 IEC-60115-1 4.7	No breakdown or flashover	Pass	1.42 times Max. Operating Voltage for 1 minute. 0201: 50V; 0402: 100V; 0603: 150V; 0805: 300V 1206, 1210, 2010, 2512, 0830, 1225, 0815: 400V

Operating temperature range is -55°C to +155°C

Power Derating Curve:



Recommended Pad Layouts - CSR



Type/Code	a	b	c	Unit
CSR0201	0.010	0.012	0.016 $\pm$ 0.008	inches
	0.25	0.30	0.40 $\pm$ 0.20	mm
CSR0402	0.020	0.020	0.024 $\pm$ 0.008	inches
	0.50	0.50	0.60 $\pm$ 0.20	mm
CSR0603	0.031	0.039	0.035 $\pm$ 0.008	inches
	0.80	1.00	0.90 $\pm$ 0.20	mm
CSR0805	0.039	0.039	0.053 $\pm$ 0.008	inches
	1.00	1.00	1.35 $\pm$ 0.20	mm
CSR1206	0.079	0.045	0.067 $\pm$ 0.008	inches
	2.00	1.15	1.70 $\pm$ 0.20	mm
CSR1210	0.079	0.045	0.098 $\pm$ 0.008	inches
	2.00	1.15	2.50 $\pm$ 0.20	mm

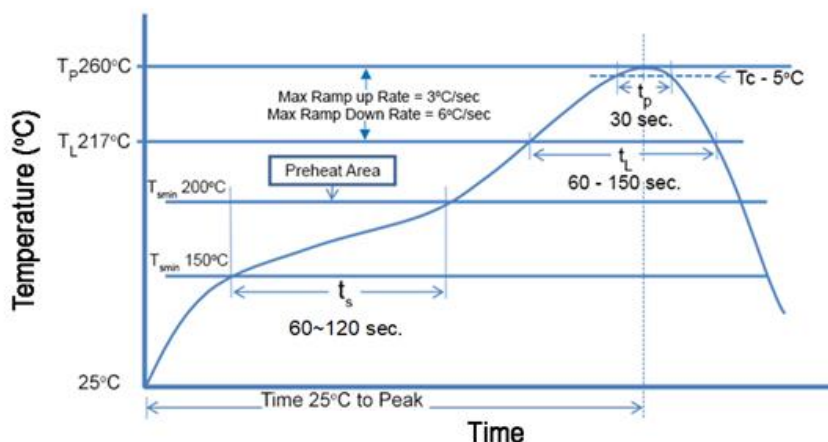
Recommended Pad Layouts – CSR (cont.)

Type/Code	a	b	c	Unit
CSR0830	0.039	0.071	0.299 ± 0.008	inches
	1.00	1.80	7.60 ± 0.20	mm
CSR2010	0.142	0.055	0.098 ± 0.008	inches
	3.60	1.40	2.50 ± 0.20	mm
CSR2512	0.193	0.063	0.126 ± 0.008	inches
	4.90	1.60	3.20 ± 0.20	mm
CSR1225	0.047	0.079	0.276 ± 0.008	inches
	1.20	2.00	7.00 ± 0.20	mm

Recommended Pad Layouts - CSRN

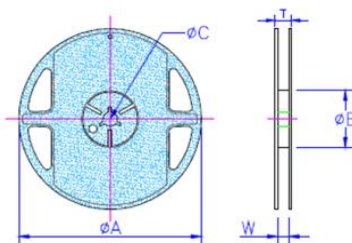
Type/Code	a	b	c	Unit
CSRN0815	0.039	0.071	0.154 ± 0.008	inches
	1.00	1.80	3.90 ± 0.20	mm
CSRN2010	0.142	0.055	0.098 ± 0.008	inches
	3.60	1.40	2.50 ± 0.20	mm
CSRN2512	0.193	0.063	0.126 ± 0.008	inches
	4.90	1.60	3.20 ± 0.20	mm

Soldering Conditions



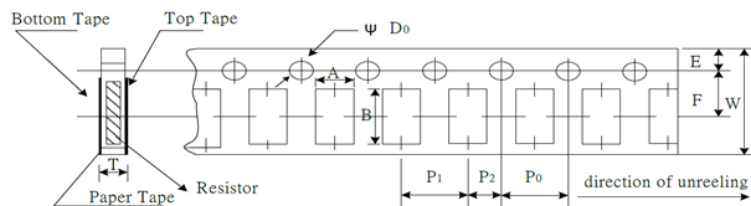
Profile Feature	Pb-Free Assembly
Preheat	
Min. Temperature (T_{smin})	150°C
Max. Temperature (T_{smax})	200°C
Preheating time (t_s) from (T_{smin} to T_{smax})	60-120 seconds
Ramp-up Rate (T_L to T_P)	$3^\circ\text{C/second max.}$
Liquidous Temperature (T_L)	217°C
Time (t_L) maintained above T_L	60-150 seconds
Min. Peak Temperature (T_{pmin})	235°C
Max. Peak Temperature (T_{pmax})	260°C
Time (t_p) within 5°C of the specified classification temperature (T_C)	30 seconds max.
Ramp-down rate (T_P to T_L)	$6^\circ\text{C/second max.}$
Time 25°C to peak temperature	8 minutes max.

Reel Specifications



Size	A	B	C	W	T	Unit
0201	7.008 ± 0.039 178.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.531 ± 0.028 13.50 ± 0.70	0.374 ± 0.004 9.50 ± 0.10	0.453 ± 0.039 11.50 ± 1.00	inches
0402						mm
0603						inches
0805						mm
1206						inches
1210						mm
2010				0.531 ± 0.039 13.50 ± 1.00	0.610 ± 0.039 15.50 ± 1.00	inches
2512						mm
1225						inches
0815						mm
0830				0.689 ± 0.039 17.50 ± 1.00	0.768 ± 0.039 19.50 ± 1.00	inches
						mm

Packaging Specifications – Paper Tape

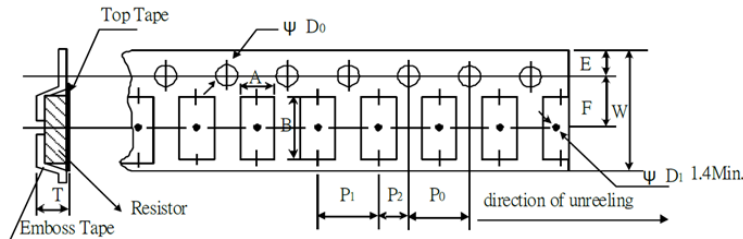


Size	A	B	W	E	F	Unit
0201	0.015 ± 0.002 0.38 ± 0.05	0.027 ± 0.002 0.68 ± 0.05	0.315 ± 0.004 8.00 ± 0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches
0402	0.026 ± 0.004 0.65 ± 0.10	0.045 ± 0.004 1.15 ± 0.10	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10		mm
0603	0.043 ± 0.004 1.10 ± 0.10	0.075 ± 0.004 1.90 ± 0.10				inches
0805	0.063 ± 0.004 1.60 ± 0.10	0.094 ± 0.008 2.40 ± 0.20				mm
1206	0.075 ± 0.004 1.90 ± 0.10	0.138 ± 0.008 3.50 ± 0.20				inches
1210	0.114 ± 0.004 2.90 ± 0.10	0.138 ± 0.008 3.50 ± 0.20				mm

Packaging Specifications – Paper Tape (cont.)

Size	P0	P1	P2	D0	T	Unit	
0201	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.079 ± 0.004 2.00 ± 0.10	0.059 + 0.004/-0 1.50 + 0.10/-0	0.017 ± 0.008	inches	
0402					0.42 ± 0.20	mm	
0603		0.157 ± 0.002 4.00 ± 0.05	0.079 ± 0.002 2.00 ± 0.05		0.018 ± 0.004 0.45 ± 0.10	0.018 ± 0.004	inches
						0.45 ± 0.10	mm
0.028 ± 0.004						inches	
0.70 ± 0.10						mm	
0805						0.033 ± 0.004 0.85 ± 0.10	inches mm inches mm
1206							
1210							

Packaging Specifications – Embossed Plastic Tape



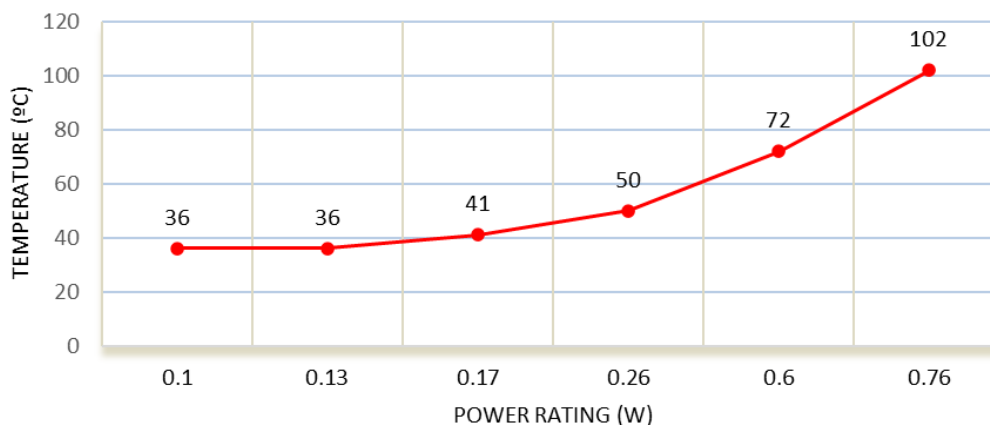
Size	A	B	W	E	F	Unit
2010	0.110 ± 0.004 2.80 ± 0.10	0.217 ± 0.004 5.50 ± 0.10	0.472 ± 0.012 12.00 ± 0.30	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	inches mm
2512	0.133 ± 0.004 3.38 ± 0.10	0.263 ± 0.004 6.68 ± 0.10			0.217 ± 0.004 5.50 ± 0.10	inches mm
1225	0.133 ± 0.004 3.38 ± 0.10	0.263 ± 0.004 6.68 ± 0.10			0.217 ± 0.004 5.50 ± 0.10	inches mm
0815	0.098 ± 0.008 2.50 ± 0.20	0.175 ± 0.008 4.45 ± 0.20			0.217 ± 0.002 5.50 ± 0.05	inches mm
0830	0.098 ± 0.008 2.50 ± 0.20	0.327 ± 0.008 8.30 ± 0.20			0.307 ± 0.002 7.80 ± 0.05	inches mm
Size	P0	P1	P2	D0	T	Unit
2010	0.157 ± 0.002 4.00 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.059 + 0.004/-0 1.50 + 0.10, -0	0.039 ± 0.008 1.00 ± 0.20	inches mm
2512	0.157 ± 0.004 4.00 ± 0.10			0.061 + 0.002/-0 1.55 + 0.05, -0	0.057 ± 0.008 1.45 ± 0.20	inches mm
1225						inches mm
0815	0.157 ± 0.002 4.00 ± 0.05			0.061 + 0.004/-0 1.55 + 0.10, -0	0.047 ± 0.008 1.20 ± 0.20	inches mm
0830						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 milliohms 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)
CSR	Thick Film Current Sensing Surface Mount Chip Resistor	SMD	YES	100% Matte Sn over Ni	May-04	04/18
CSRN	Thick Film Current Sensing Surface Mount Chip Resistor, Narrow	SMD	YES	100% Matte Sn over Ni	May-04	04/18

"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.

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