Features:

- Higher power ratings than standard thick film chips
- TCR as low as 10 ppm/ºC
- Inner termination engineered to deter sulfur contamination
- Tolerance to ± 0.1%
- RoHS compliant, REACH compliant, lead free, and halogen free

Electrical Specifications

Type/Code	Power Rating (W)(1) @ 70°C	Maximum Working Voltage (V)(2)	Maximum Overload Voltage (V)	TCR (ppm/ºC)	Ohmic Range (Ω) and Tolerance				
					0.1%	0.25%	0.5%	1%	5%
RNCP0402	0.1	50	100	± 10	10 - 10K				-
				± 15					
				± 25	4.7 - 10K		2.49 - 10K		
				± 50			1 - 10K		
				± 100	-			1 - 10K	
RNCP0603	0.125	150V	300V	± 10	10 - 47K				-
				± 15					
				± 25	4.7 - 47K		2.49 - 47K		
				± 50			1 - 47K		
				± 100	-			1 - 47K	
RNCP0805	0.25	200V	400V	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K		2.49 - 100K		
				± 50			1 - 100K		
				± 100	-			1 - 100K	
RNCP1206	0.5	200V	400V	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K		2.49 - 100K		
				± 50			1 - 100K		
				± 100	-			1 - 100K	
RNCP1210	0.5	200V	400V	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K		2.49 - 100K		
				± 50			1 - 100K		
				± 100	-			1 - 100K	
RNCP2010	0.75	200V	400V	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K		2.49 - 100K		
				± 50			1 - 100K		
				± 100	-			1 - 100K	
RNCP2512	1	200V	400V	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K		2.49 - 100K		
				± 50			1 - 100K		
				± 100	-			1 - 100K	

(1) Power rating for each package size is valid if ambient temp ≤ 80ºC and terminal temp ≤105ºC
(2) Lesser of √PR or maximum working voltage
Certain resistance values will require a higher minimum order quantity. Contact Stackpole Customer Service for details.

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

This specification may be changed at any time without prior notice
Please confirm technical specifications before you order and/or use.

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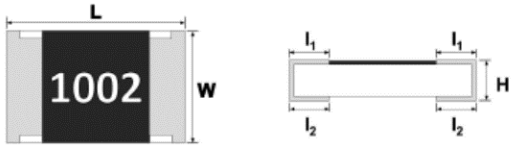
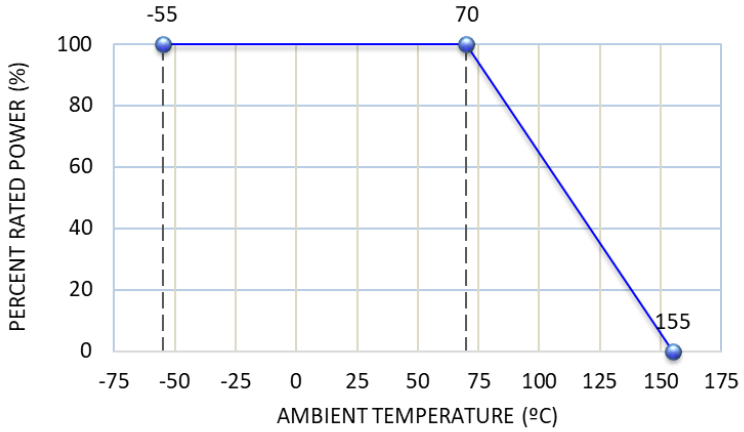
Mechanical Specifications



Type/Code	L Body Length	W Body Width	H Body Height	I_1 Top Termination	I_2 Bottom Termination	Unit
RNCP0402	0.039 ± 0.004 1.00 ± 0.10	0.020 ± 0.002 0.50 ± 0.05	0.012 ± 0.002 0.30 ± 0.05	0.010 ± 0.006 0.25 ± 0.15	0.012 ± 0.006 0.30 ± 0.15	inches mm
RNCP0603	0.061 ± 0.008 1.55 ± 0.20	0.031 ± 0.004 0.80 ± 0.10	0.016 ± 0.006 0.40 ± 0.15	0.012 ± 0.008 0.30 ± 0.20	0.014 ± 0.010 0.35 ± 0.25	inches mm
RNCP0805	0.079 ± 0.006 2.00 ± 0.15	0.049 ± 0.006 1.25 ± 0.15	0.020 ± 0.006 0.50 ± 0.15	0.016 ± 0.010 0.40 ± 0.25	0.020 ± 0.012 0.50 ± 0.30	inches mm
RNCP1206	0.122 ± 0.008 3.10 ± 0.20	0.059 ± 0.008 1.50 ± 0.20	0.020 ± 0.006 0.50 ± 0.15	0.022 ± 0.024 0.55 ± 0.60	0.024 ± 0.012 0.60 ± 0.30	inches mm
RNCP1210	0.122 ± 0.006 3.10 ± 0.15	0.098 ± 0.006 2.50 ± 0.15	0.022 ± 0.004 0.55 ± 0.10	0.018 ± 0.008 0.45 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm
RNCP2010	0.197 ± 0.006 5.00 ± 0.15	0.098 ± 0.006 2.50 ± 0.15	0.022 ± 0.004 0.55 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm
RNCP2512	0.248 ± 0.006 6.30 ± 0.15	0.126 ± 0.006 3.20 ± 0.15	0.022 ± 0.004 0.55 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm

Power Derating Curve:



Performance Characteristics

Test Item	Reference Standard	Procedure	Requirements
Temperature Coefficient of Resistance	JIS-C 5201-1 4.8 IEC-60115-1 4.8	At 25/-55°C and 25°C /+125°C, 25°C is the reference temperature	Refer to Electrical Specifications
Short Time Overload	JIS-C 5201-1 4.13 IEC-60115-1 4.13	2.5 times RCWV or max overload voltage whichever is less for 5 seconds	± (0.5% + 0.05Ω) No visual damage
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6	Apply 100 VDC for 1 minute	≥ 10GΩ
Solderability	JIS-C-5201-1 4.17 IEC-60115-1 4.17	245 ± 5°C for 3 seconds	> 95% coverage No visual damage
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260 ± 5°C for 10 seconds	± (0.5% + 0.05Ω) No visual damage
Leaching	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1	260 ± 5°C for 30 seconds	>95% coverage No visual damage

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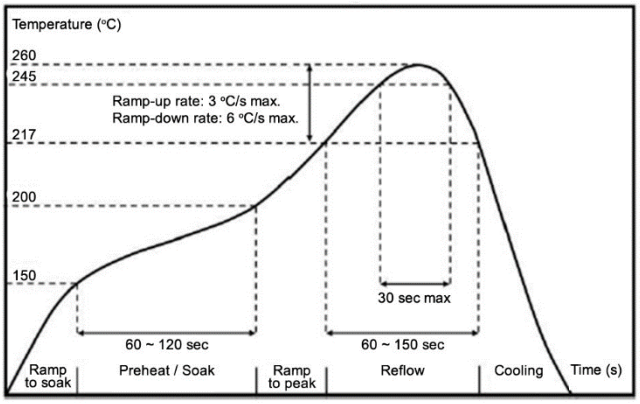
Performance Characteristics (cont.)			
Test Item	Reference Standard	Procedure	Requirements
Rapid Change of Temperature	JIS-C-5201-1 4.19 IEC-60115-1 4.19	-55°C to +155°C, 300 cycles	± (0.5% + 0.05Ω) No visual damage
High Temperature Exposure	JIS-C5201-1 4.25 IEC 60068-2-2	At 155 ± 5°C for 1000 hours	± (0.5% + 0.05Ω)
Resistance to Solvent	JIS-C-5201-1 4.29	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.	± (0.5% + 0.05Ω) No visual damage
Damp Heat with Load	JIS-C-5201-1 4.24 IEC-60115-1 4.24	40 ± 2°C, 90~95% R.H. RCWV or max working voltage whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF"	± (0.5% + 0.05Ω)
Based Humidity	MIL-STD-202 Method 103	1000 hours, 85°C / 85% RH, 10% of operating power. Measurement at 24 ± 4 hours after test conclusion.	± (0.5% + 0.05Ω)
Load Life (Endurance)	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1	70 ± 2°C, RCWV or max. working voltage whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF"	± (0.5% + 0.05Ω)
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33	Bending once for 5 seconds D: 0402, 0603, 0805 = 5mm 1206, 1210 = 3mm 2010, 2512 = 2mm	± (0.5% + 0.05Ω) No visual damage
Sulfur Test (FoS)	ASTM B809-95 ANSI/EIA-977	105 ± 2°C, no power rating for 750 hours	± (2% + 0.001Ω)

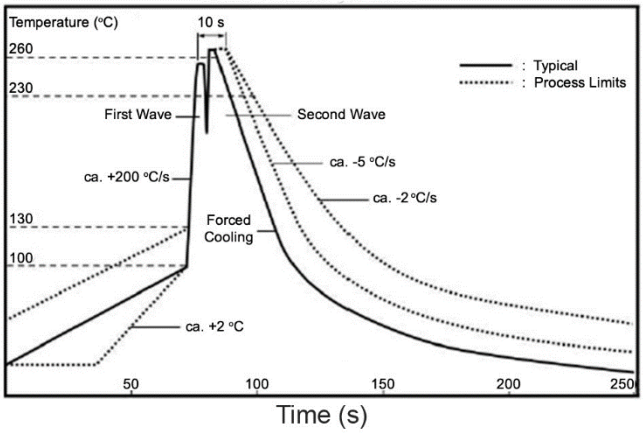
AEC-Q200 test reports are available under request.

Recommended Soldering Parameters

Reflow Soldering Profile



Wave Soldering Profile



Rework temperature (hot air equipment): 350°C, 3~5 seconds
Recommended reflow methods:

- IR, vapor phase oven, hot air oven
- If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

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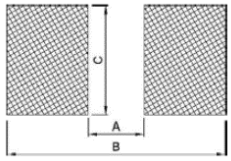
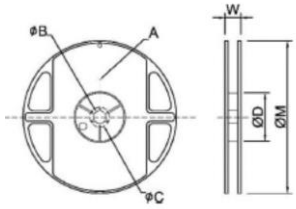
Recommended Pad Layout



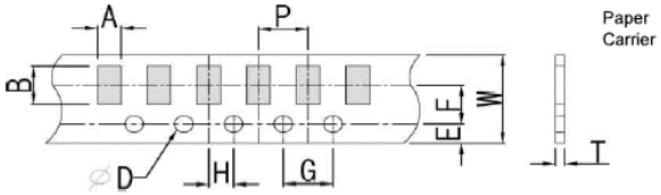
Type/Code	A	B	C	Unit
0402	0.016 0.40	0.059 1.50	0.024 0.60	inches mm
0603	0.026 0.65	0.083 2.10	0.035 0.90	inches mm
0805	0.039 1.00	0.118 3.00	0.051 1.30	inches mm
1206	0.079 2.00	0.165 4.20	0.063 1.60	inches mm
1210	0.079 2.00	0.173 4.40	0.106 2.70	inches mm
2010	0.150 3.80	0.260 6.60	0.106 2.70	inches mm
2512	0.193 4.90	0.319 8.10	0.134 3.40	inches mm

Packaging Specifications



Type	Inches	A	ØB	ØC	ØD	W	ØM	Unit
0402	7"	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.079 11.50 ± 2.00	7.008 ± 0.079 178.00 ± 2.00	Inches mm
0603, 0805 1206, 1210						0.453 ± 0.079 11.50 ± 2.00		inches mm
2010 2512						0.630 ± 0.079 16.00 ± 2.00		Inches mm

Taping Specifications – Paper Tape



Type	A	B	W	E	F	G	H	T	ØD	P	Unit
0402	0.028 ± 0.004 0.70 ± 0.10	0.047 ± 0.004 1.20 ± 0.10						0.018 ± 0.004 0.45 ± 0.10		0.079 ± 0.004 2.00 ± 0.10	inches mm
0603	0.041 ± 0.008 1.05 ± 0.20	0.071 ± 0.008 1.80 ± 0.20						0.024 ± 0.004 0.60 ± 0.10			inches mm
0805	0.061 ± 0.008 1.55 ± 0.20	0.091 ± 0.008 2.30 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.030 ± 0.004 0.75 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.157 ± 0.004 4.00 ± 0.10	inches mm
1206	0.075 ± 0.008 1.90 ± 0.20	0.138 ± 0.008 3.50 ± 0.20						0.030 ± 0.004 0.75 ± 0.10			inches mm
1210	0.112 ± 0.008 2.85 ± 0.20	0.138 ± 0.008 3.50 ± 0.20						0.030 ± 0.004 0.75 ± 0.10			inches mm

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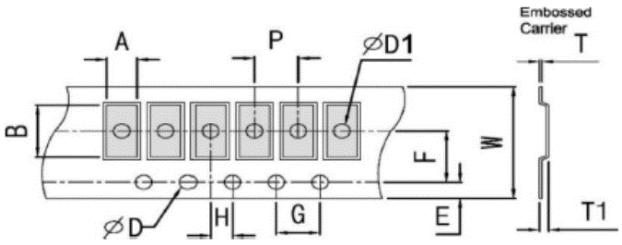
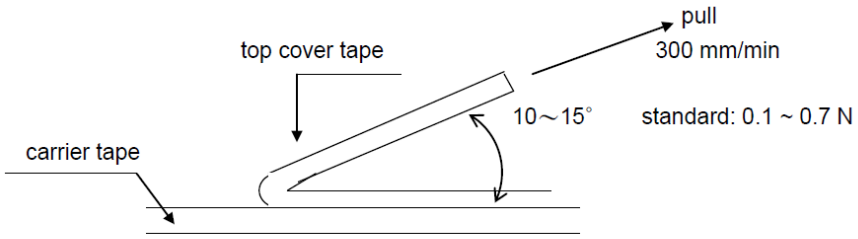
Taping Specifications – Plastic Tape



Type	A	B	W	E	F	G	Unit
2010	0.110 ± 0.008 2.80 ± 0.20	0.220 ± 0.008 5.60 ± 0.20	0.472 ± 0.004 12.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	inches mm
2512	0.134 ± 0.008 3.40 ± 0.20	0.264 ± 0.008 6.70 ± 0.20	0.472 ± 0.004 12.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	inches mm

Type	H	T	ØD	ØD1	T1	P	Unit
2010	0.079 ± 0.002 2.00 ± 0.05	0.009 ± 0.004 0.23 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.059 ± 0.004 1.50 ± 0.10	0.033 ± 0.006 0.85 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm
2512	0.079 ± 0.002 2.00 ± 0.05	0.009 ± 0.004 0.23 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.059 ± 0.004 1.50 ± 0.10	0.033 ± 0.006 0.85 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm

Peel-off Force Specifications



Peel-off force of paper and blister tape is in accordance with “JIS-C5202”, that is, 0.1 to 0.7N at a peel-off speed of 300 mm/minute.

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 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.

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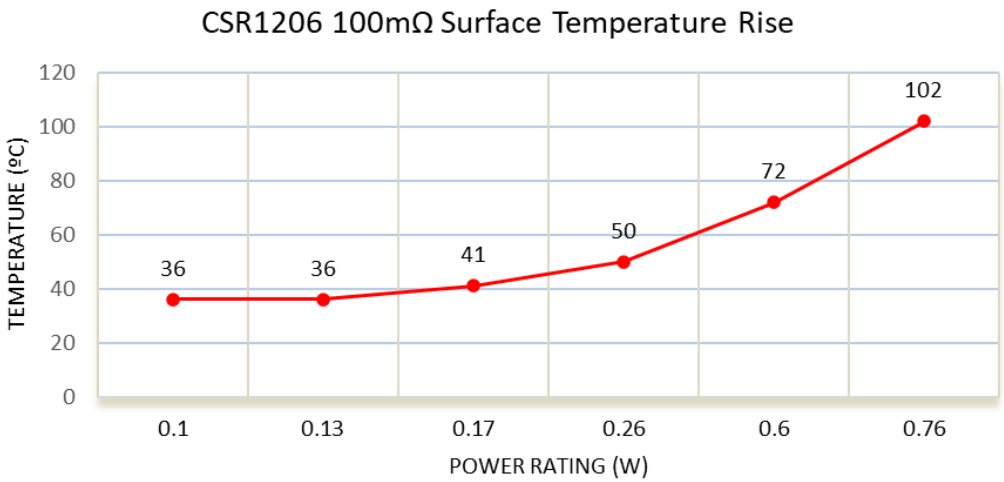

The 102°C heat rise shown here would indicate there will be additional thermal reduction techniques needed to keep this part under 105°C total hot spot temperature if this part is to be used at 0.75 watts of power. However, this same part at the usual power rating for this size would have a heat rise 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 milliohms. This should be taken into account when designing.

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Part Marking Instructions

1% Marking
The nominal resistance is marked on the surface of the overcoating with the use of 4 digit markings.
0201 and 0402 are not marked.

5% Marking
The nominal resistance is marked on the surface of the overcoating with the use of 3 digit markings.
0201 and 0402 are not marked.

For shared E24/E96 values, 1% tolerance product may be marked with three-digit marking instead of the standard four-digit marking for all other E96 values. All E24 values available in 1% tolerance are also marked with three-digit marking.

Marking Instructions for 0603 1% Chip Resistors (per EIA-J)

A two-digit number is assigned to each standard R-Value (E96) as shown in the chart below. This is followed by one alpha character which is used as a multiplier. Each letter represents a specific multiplier as follows:

Z = 0.01	A = 10	D = 10,000
Y = 0.1	B = 100	E = 100,000
X = 1	C = 1,000	F = 1,000,000

EXAMPLE:

Chip Marking	Explanation	Value
01B	01 means 10.0 and B = 100	10.0 x 100 = 1 Kohm
25C	25 means 17.8 and C = 1,000	17.8 x 1,000 = 17.8 Kohm
93D	93 means 90.9 and D = 10,000	90.9 x 10,000 = 909 Kohm

E96											
#	R-Value	#	R-Value	#	R-Value	#	R-Value	#	R-Value	#	R-Value
01	10.0	**17**	14.7	**33**	21.5	**49**	31.6	**65**	46.4	**81**	68.1
02	10.2	**18**	15.0	**34**	22.1	**50**	32.4	**66**	47.5	**82**	69.8
03	10.5	**19**	15.4	**35**	22.6	**51**	33.2	**67**	48.7	**83**	71.5
04	10.7	**20**	15.8	**36**	23.2	**52**	34.0	**68**	49.9	**84**	73.2
05	11.0	**21**	16.2	**37**	23.7	**53**	34.8	**69**	51.1	**85**	75.0
06	11.3	**22**	16.5	**38**	24.3	**54**	35.7	**70**	52.3	**86**	76.8
07	11.5	**23**	16.9	**39**	24.9	**55**	36.5	**71**	53.6	**87**	78.7
08	11.8	**24**	17.4	**40**	25.5	**56**	37.4	**72**	54.9	**88**	80.6
09	12.1	**25**	17.8	**41**	26.1	**57**	38.3	**73**	56.2	**89**	82.5
10	12.4	**26**	18.2	**42**	26.7	**58**	39.2	**74**	57.6	**90**	84.5
11	12.7	**27**	18.7	**43**	27.4	**59**	40.2	**75**	59.0	**91**	86.6
12	13.0	**28**	19.1	**44**	28.0	**60**	41.2	**76**	60.4	**92**	88.7
13	13.3	**29**	19.6	**45**	28.7	**61**	42.2	**77**	61.9	**93**	90.9
14	13.7	**30**	20.0	**46**	29.4	**62**	43.2	**78**	63.4	**94**	93.1
15	14.0	**31**	20.5	**47**	30.1	**63**	44.2	**79**	64.9	**95**	95.3
16	14.3	**32**	21.0	**48**	30.9	**64**	45.3	**80**	66.5	**96**	97.6

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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)
RNCP	High Power Anti-Sulfur Thin Film Chip Resistor	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

R	N	C	P	0	6	0	3	F	T	D	4	K	7	5

Product Series

RNCP	High Power Anti-Sulfur Thin Film

Power Rating

Size	W
0402	0.1
0603	0.125
0805	0.25
1206	0.5
1210	0.5
2010	0.75
2512	1

Tolerance

Code	Tol	Value
B	0.1%	E96, E24
C	0.25%	
D	0.5%	
F	1%	
J	5%	E24

Packaging

Code	Description	Size	Quantity
T	7" Reel - Paper Tape	0402	10000
		0603, 0805	5000
		1206, 1210	
	7" Reel - Plastic Tape	2010, 2512	4000

TCR

Code	ppm
T	10
S	15
E	25
C	50
D	100

Resistance Value

Four characters with the multiplier used as the decimal holder.

1 ohm = 1R00
47 Kohm = 47K0
100 Kohm = 100K

Certain resistance values will require a higher minimum order quantity. Contact Stackpole Customer Service for details.

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