

Features:

- Higher power ratings than standard thick film chips
- Precision tolerances and TCR's
- Inner termination engineered to deter sulfur contamination
- RoHS compliant, REACH compliant, lead free, and halogen free
- AEC-Q200 compliant



Electrical Specifications									
Type/Code	Power Rating (W) ⁽¹⁾ @ 70°C	Maximum Working Voltage (V) ⁽²⁾	Maximum Overload Voltage (V)	TCR (ppm/°C)	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		1 - 10K	
				± 50		1 - 10K			
				± 100	-		1 - 10K		
RNCP0603	0.125	150	300	± 10	10 - 47K				-
				± 15					
				± 25	4.7 - 47K	2.49 - 47K		1 - 47K	
				± 50		1 - 47K			
				± 100	-		1 - 47K		
RNCP0805	0.25	200	400	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K	2.49 - 100K		1 - 100K	
				± 50		1 - 100K			
				± 100	-		1 - 100K		
RNCP1206	0.5	200	400	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K	2.49 - 100K		1 - 100K	
				± 50		1 - 100K			
				± 100	-		1 - 100K		
RNCP1210	0.5	200	400	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K	2.49 - 100K		1 - 100K	
				± 50		1 - 100K			
				± 100	-		1 - 100K		
RNCP2010	0.75	200	400	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K	2.49 - 100K		1 - 100K	
				± 50		1 - 100K			
				± 100	-		1 - 100K		
RNCP2512	1	200	400	± 10	10 - 100K				-
				± 15					
				± 25	4.7 - 100K	2.49 - 100K		1 - 100K	
				± 50		1 - 100K			
				± 100	-		1 - 100K		

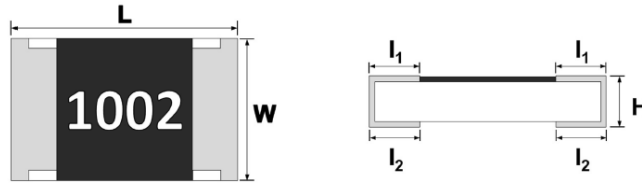
(1) Power rating for each package size is valid if ambient temp ≤ 80°C and terminal temp ≤ 105°C

(2) Lesser of √PR or maximum working voltage

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

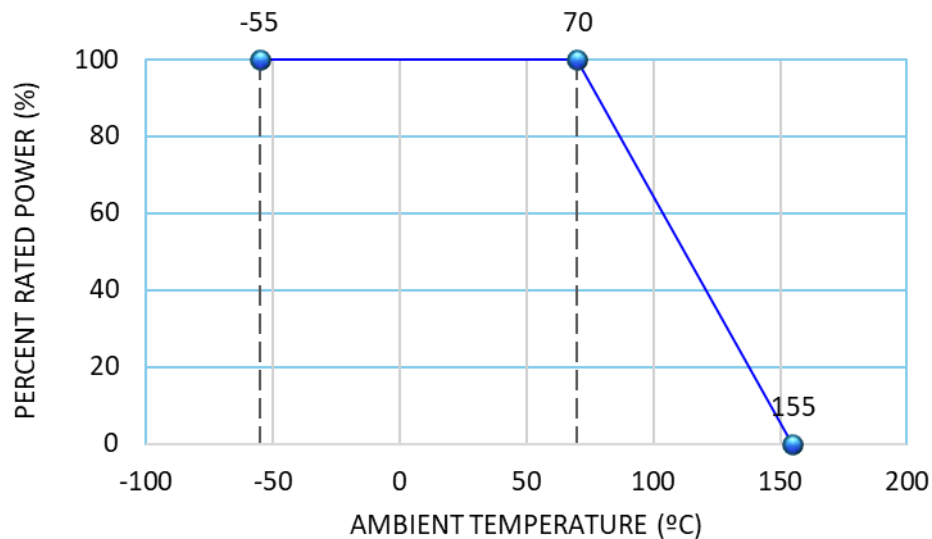
Please refer to the High-Power Resistor Application Note for more information on designing and implementing high power resistor types.

Mechanical Specifications



Type/Code	L Body Length	W Body Width	H Body Height	l ₁ Top Termination	l 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:

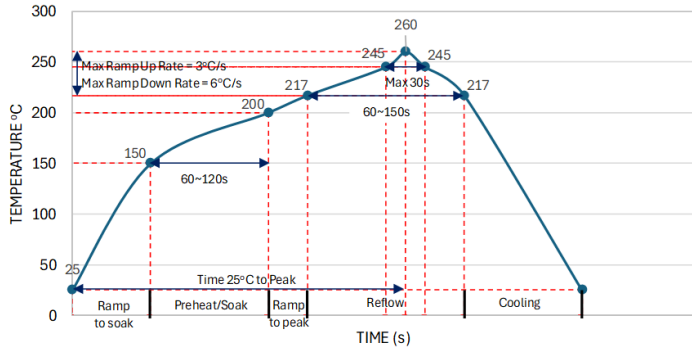


Performance Characteristics			
Test Item	Reference Standard	Procedure	Requirements
Temperature Coefficient of Resistance	JIS-C 5201-1 4.8 IEC-60115-1 4.8	At 25/-55°C and 25°C /+125°C, 25°C is the reference temperature	Refer to Electrical Specifications
Short Time Overload	JIS-C 5201-1 4.13 IEC-60115-1 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
Rapid Change of Temperature	JIS-C-5201-1 4.19 IEC-60115-1 4.19	-55 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)
Biased 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 = 5 mm 1206, 1210 = 3 mm 2010, 2512 = 2 mm	± (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)

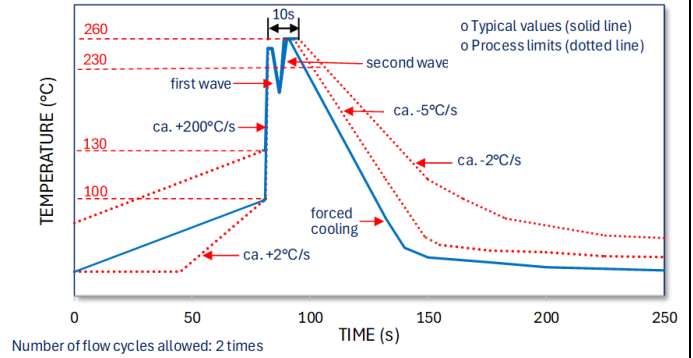
Recommended storage temperature is 15 to 28°C; Humidity < 80% R.H.

Recommended Resistor Reflow Profile

Reflow Soldering Profile



Wave Soldering Profile

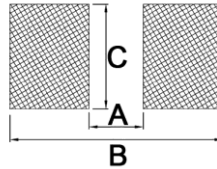


Rework temperature (hot air equipment): 350°C, 3~5 seconds

Recommended reflow methods:

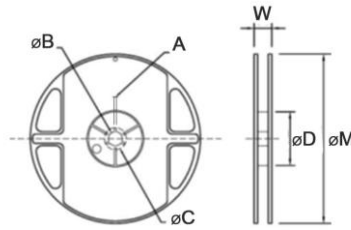
- IR, vapor phase oven, hot air oven
- If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

Recommended Solder Pad



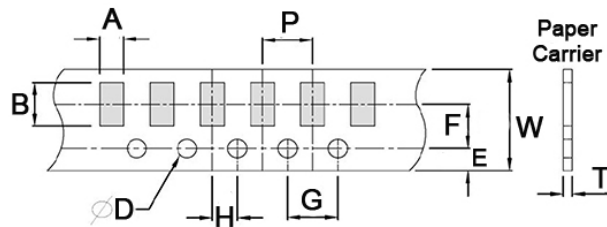
Type/Code	A	B	C	Unit
RNCP0402	0.016 0.40	0.059 1.50	0.024 0.60	inches mm
RNCP0603	0.026 0.65	0.083 2.10	0.035 0.90	inches mm
RNCP0805	0.039 1.00	0.118 3.00	0.051 1.30	inches mm
RNCP1206	0.079 2.00	0.165 4.20	0.063 1.60	inches mm
RNCP1210	0.079 2.00	0.173 4.40	0.106 2.70	inches mm
RNCP2010	0.150 3.80	0.260 6.60	0.106 2.70	inches mm
RNCP2512	0.193 4.90	0.319 8.10	0.134 3.40	inches mm

Reel Specifications



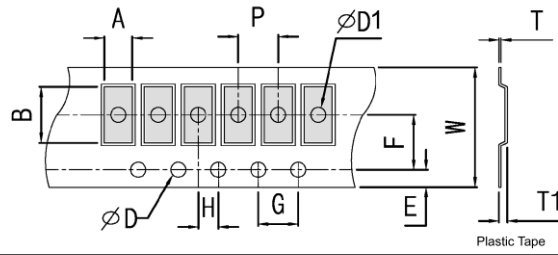
Type	Inches	A	ØB	ØC	ØD	W	ØM	Unit
0402	7"	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.079 11.50 ± 2.00	7.008 ± 0.079 178.00 ± 2.00	Inches mm
0603, 0805 1206, 1210	7"	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039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

Taping Specifications - Paper Tape



Type	A	B	W	E	F	Unit
RNCP0402	0.028 ± 0.004 0.70 ± 0.10	0.047 ± 0.004 1.20 ± 0.10	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm
RNCP0603	0.041 ± 0.008 1.05 ± 0.20	0.071 ± 0.008 1.80 ± 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	inches mm
RNCP0805	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	inches mm
RNCP1206	0.075 ± 0.008 1.90 ± 0.20	0.138 ± 0.008 3.50 ± 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	inches mm
RNCP1210	0.112 ± 0.008 2.85 ± 0.20	0.138 ± 0.008 3.50 ± 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	inches mm
Type	G	H	T	ØD	P	Unit
RNCP0402	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.018 ± 0.004 0.45 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.079 ± 0.004 2.00 ± 0.10	inches mm
RNCP0603	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.024 ± 0.004 0.60 ± 0.10	0.059 +0.004/-0 1.50 +0.10/-0	0.157 ± 0.004 4.00 ± 0.10	inches mm
RNCP0805	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
RNCP1206	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
RNCP1210	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

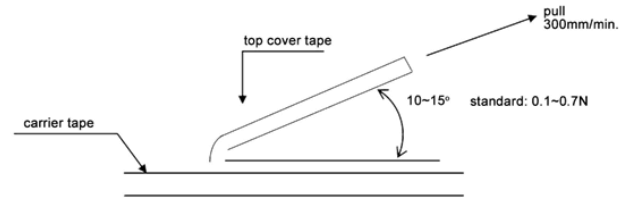
Taping Specifications - Plastic Tape



Type	A	B	W	E	F	G	Unit
RNCP2010	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
RNCP2512	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
RNCP2010	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
RNCP2512	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 Force of Top Cover Tape

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

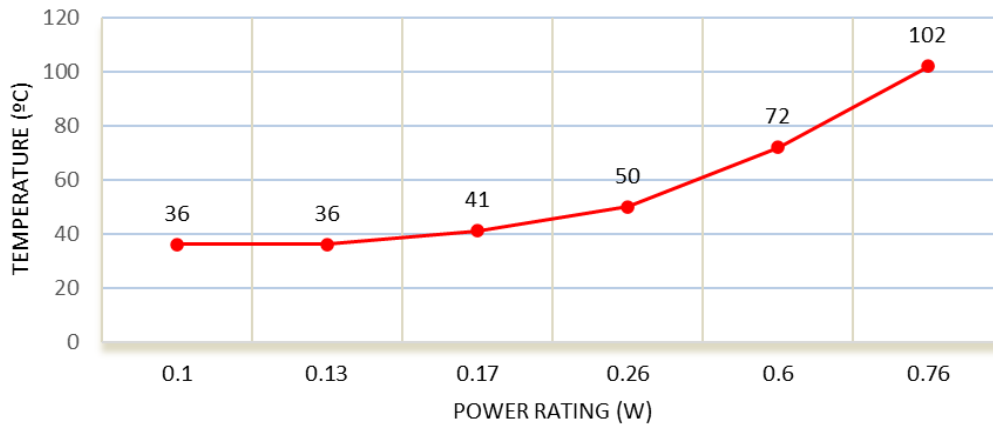


High Power Chip Resistors and Thermal Management

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.

CSR1206 100mΩ Surface Temperature Rise



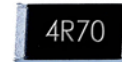
The 102°C heat rise shown here would indicate there will be additional thermal reduction techniques needed to keep this part under 105°C total hot spot temperature if this part is to be used at 0.75 watts of power. However, this same part at the usual power rating for this size would have a heat rise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

Part Marking Specifications

E96 and E24 Values 0805-2512 (0.1%, 0.25%, 0.5%, and 1% tolerances)

The nominal resistance is marked on the surface of the overcoating with the use of **four character markings**. Values below 10Ω will use "R" as the decimal holder.



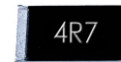
4.7 Ω



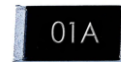
1.21 KΩ

E24 Values 0603-2512 (5% tolerance)

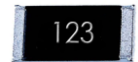
The nominal resistance is marked on the surface of the overcoating with the use of **three character markings**. Values below 10Ω will use "R" as the decimal holder.



4.7 Ω



100 Ω



12 KΩ

Values that are both E24 and E96 follow E96 marking rules.

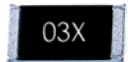
E24 10 11 12 13 15 16 18 20 22 24 27 30 33 36 39 43 47 51 56 62 68 75 82 91

E96 Values for 0603 size (0.1%, 0.25%, 0.5%, and 1% tolerances)

A two character 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 from "Y" - "F" represents a specific multiplier.



10.5 Ω

Alpha Character = Multiplier		Chip Marking	Value
Y = 0.1	C = 1000	01B	10.0 x 100 = 1 KΩ
X = 1	D = 10000	25C	17.8 x 1000 = 17.8 KΩ
A = 10	E = 100000	93D	90.9 x 10000 = 909 KΩ
B = 100	F = 1000000		

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

Note: 0402 sizes are unmarked.

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.

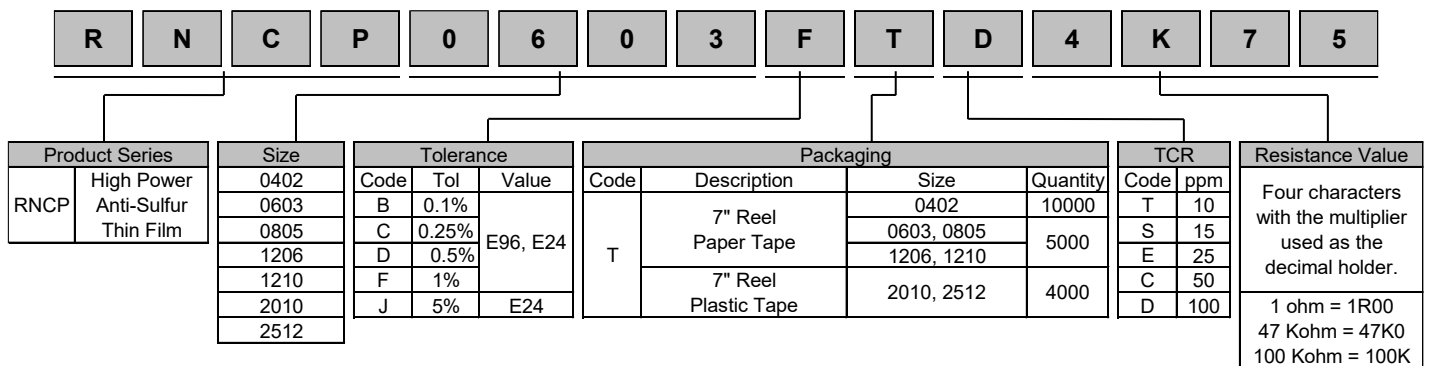
Compliance to “REACH”

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



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