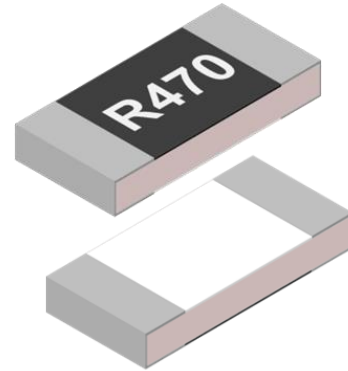


### Features:

- Low resistance
- Low TCR
- Inductance of  $\leq 5\text{nH}$
- Excellent long-term stability
- High precision current sensing
- High rated power capability and excellent anti-surge
- AEC-Q200 qualified
- RoHS compliant and lead free without exemption
- Halogen free
- REACH compliant



### Applications:

- Consumer electronics
- Computer and relative products
- Communication devices
- Measuring instruments
- Industrial / Power supplies
- Battery management systems

### Electrical Specifications

Type/Code	Power Rating (W) @ 70°C	TCR (ppm/°C)	Ohmic Range ( $\Omega$ ) and Tolerance
			0.5%, 1%, 2%, 5%
RNCL1206	1	$\pm 100$	0.05 - 0.976
		$\pm 50$	0.1 - 33
RNCL1210	1	$\pm 100$	0.05 - 0.976
		$\pm 50$	0.1 - 33
RNCL2010	1.5	$\pm 50$	0.05 - 50
RNCL2512	2	$\pm 50$	

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

P = Rated Power (W)

R = Resistance Value ( $\Omega$ )

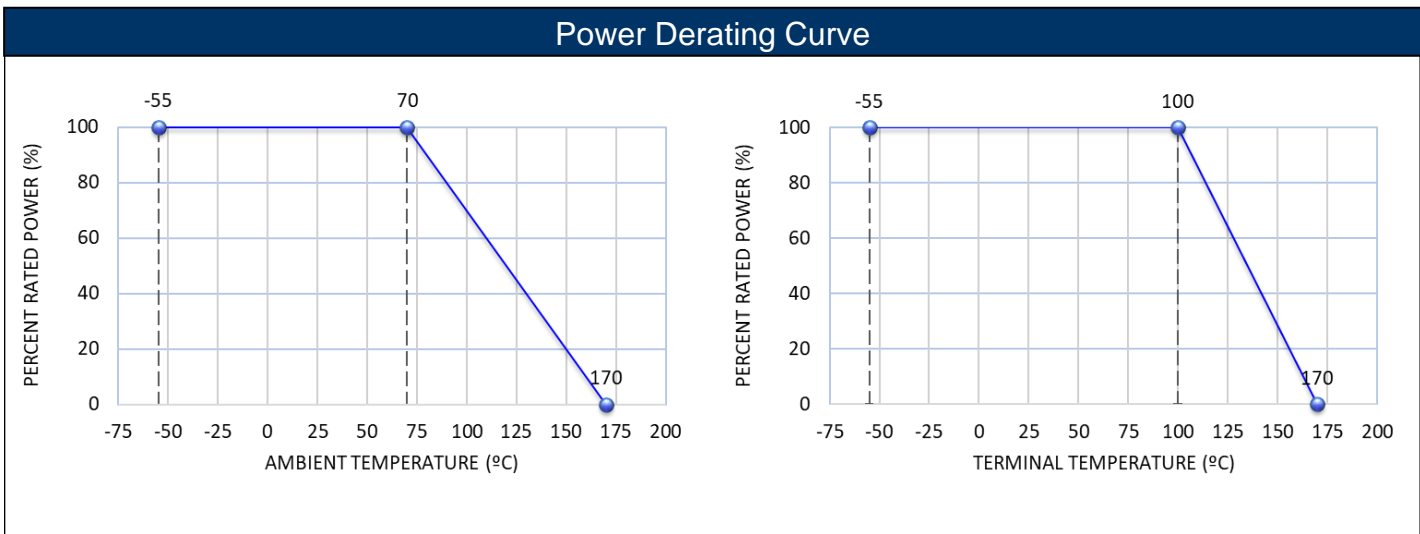
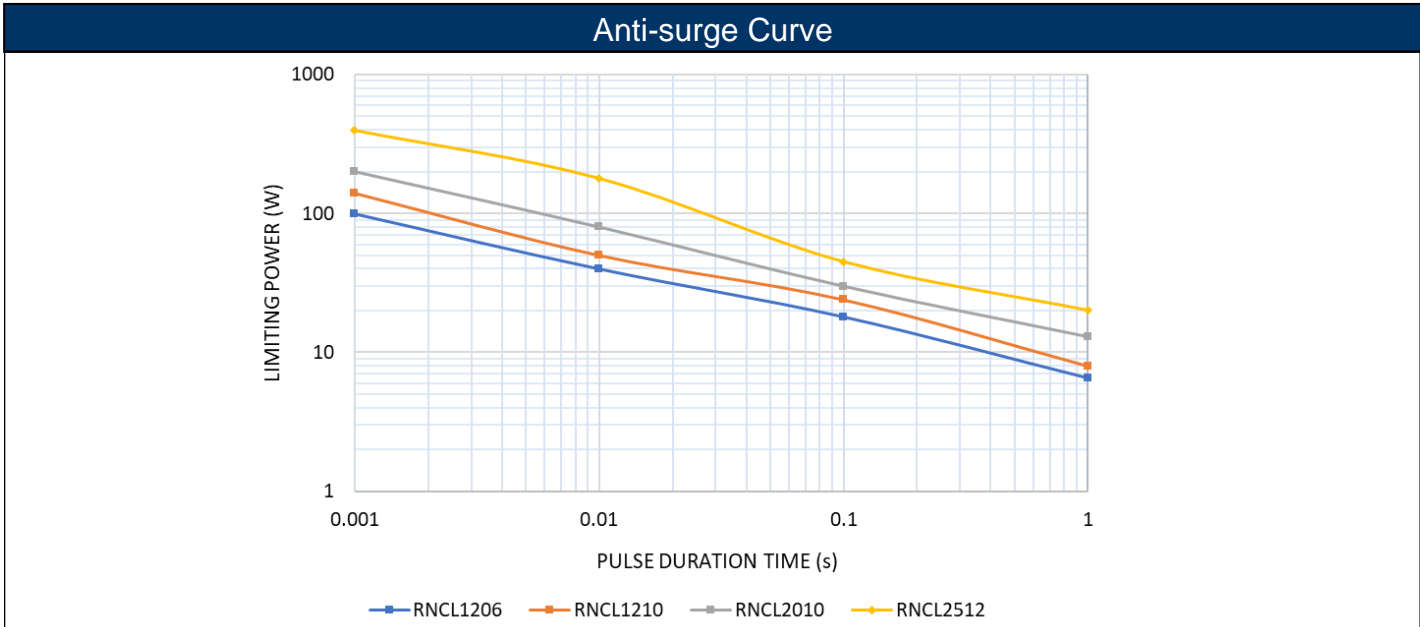
Non-standard parts may be available. Please contact Stackpole Electronics.

Operating temperature range is  $-55^\circ\text{C} \sim +170^\circ\text{C}$

### Mechanical Specifications



Type/Code	L	W	H	$l_1$	$l_2$	Unit
	Body Length	Body Width	Body Height	Top Termination	Bottom Termination	
RNCL1206	$0.122 \pm 0.004$	$0.063 \pm 0.004$	$0.022 \pm 0.004$	$0.016 \pm 0.008$	$0.018 \pm 0.008$	inches
	$3.10 \pm 0.10$	$1.60 \pm 0.10$	$0.55 \pm 0.10$	$0.40 \pm 0.20$	$0.45 \pm 0.20$	mm
RNCL1210	$0.122 \pm 0.004$	$0.098 \pm 0.006$	$0.022 \pm 0.004$	$0.020 \pm 0.008$	$0.020 \pm 0.008$	inches
	$3.10 \pm 0.10$	$2.50 \pm 0.15$	$0.55 \pm 0.10$	$0.50 \pm 0.20$	$0.50 \pm 0.20$	mm
RNCL2010	$0.197 \pm 0.008$	$0.098 \pm 0.006$	$0.022 \pm 0.004$	$0.024 \pm 0.010$	$0.024 \pm 0.010$	inches
	$5.00 \pm 0.20$	$2.50 \pm 0.15$	$0.55 \pm 0.10$	$0.60 \pm 0.25$	$0.60 \pm 0.25$	mm
RNCL2512	$0.248 \pm 0.008$	$0.126 \pm 0.008$	$0.022 \pm 0.004$	$0.026 \pm 0.010$	$0.026 \pm 0.010$	inches
	$6.30 \pm 0.20$	$3.20 \pm 0.20$	$0.55 \pm 0.10$	$0.65 \pm 0.25$	$0.65 \pm 0.25$	mm



The Operating Temperature Range is -55°C ~ +170°C.  
 Power rating or current rating is based on continuous full-load at ambient temperature of 70°C. For operation at ambient temperature above 70°C, the load should be derated in accordance with the Power Derating Curve. (Terminal temperature derating from 100°C.)

**Rated Current**

Resistance Range: < 1Ω

Rated Current: The resistor shall have a DC continuous working current or an AC (rms) continuous working current at commercial-line frequency and wave form corresponding to the power rating, as per formula below:

$$I = \sqrt{P/R}$$

- I = Rated current (A)
- P = Rated power (W)
- R = Nominal resistance (Ω)

### Rated Voltage

Resistance Range:  $\geq 1 \Omega$

Rated Voltage: The resistor shall have a DC continuous working voltage or an RMS AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as per formula below:

$$V = \sqrt{P \cdot R}$$

V = Rated voltage (V)

P = Rated power (W)

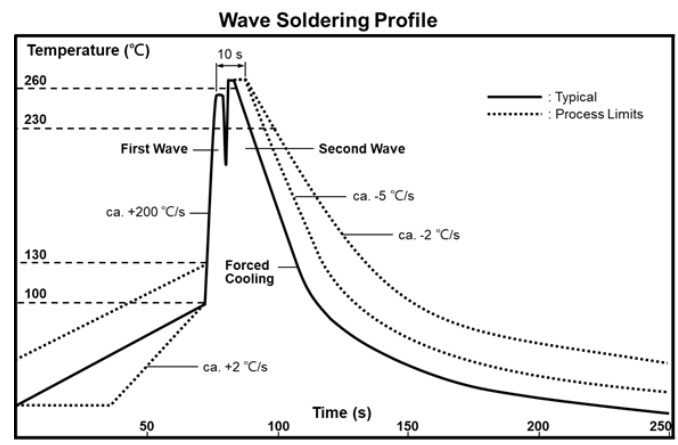
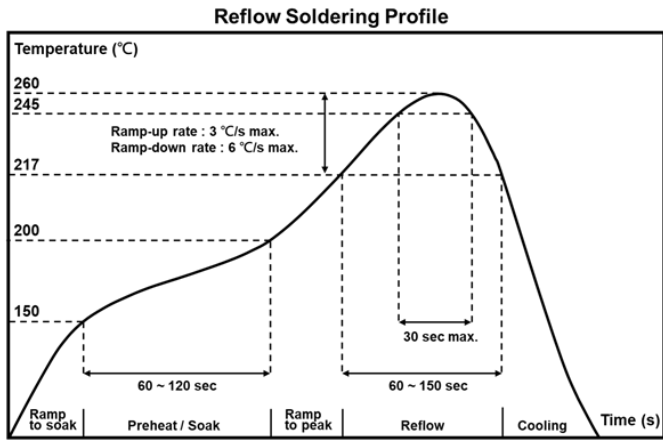
R = Nominal resistance ( $\Omega$ )

Performance Characteristics			
Test Item	Test Method	Test Condition	Test Limits
Temperature Coefficient of Resistance (TCR)	JIS C-5201-1 4.8 IEC-60115-1 4.8	At 25°C / +125°C, 25°C is the reference temperature.	Refer to Electrical Specifications table
Short Time Overload	JIS C-5201-1 4.13 IEC-60115-1 4.13	5 times rated power whichever is less for 5 seconds	$\pm (1\% + 0.001\Omega)$
Insulation Resistance	JIS C-5201-1 4.6 IEC-60115-1 4.6	Applied 100 VDC for 1 minute	$\geq 10G\Omega$
Dielectric Withstanding Voltage	JIS C-5201-1 4.7	Applied 500 VAC for 1 minute	No short or burned on the appearance
Core Body Strength	JIS C-5201-1 4.15	Central part pressurizing force: 10N for 10 seconds	No breakage.
Solderability	JIS C-5201-1 4.17 IEC-60115-1 4.17	245°C $\pm$ 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°C $\pm$ 5°C for 10 seconds	$\pm (1\% + 0.001\Omega)$ No visual damage
Leaching	JIS C-5201-1 4.18 IEC-60068-2-58 8.2.1	260°C $\pm$ 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°C to +155°C, 300 cycles	$\pm (1\% + 0.001\Omega)$ No visual damage
Damp Heat with Load	JIS C-5201-1 4.24 IEC-60115-1 4.24	40°C $\pm$ 2°C, 90 ~ 95% R.H., RCWV or max. working current whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF"	$\pm (1\% + 0.001\Omega)$
Biased Humidity	MIL-STD-202 Method 103	1000 hours; 85°C/85% RH, 10% of operating power. Measurement at 24 $\pm$ 4 hours after test conclusion.	$\pm (1\% + 0.05\Omega)$
Load Life (Endurance)	JIS C-5201-1 4.25 IEC-60115-1 4.25.1	70°C $\pm$ 2°C, rated power or max. working current whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hours "OFF"	$\pm (1\% + 0.001\Omega)$
High Temperature Exposure	JIS C-5201-1 4.23.2 IEC 60068-2-2	At +170 $\pm$ 5°C for 1000 hours	$\pm (1\% + 0.001\Omega)$
Resistance to Solvent	JIS C-5201-1 4.29	The tested resistor will be immersed into isopropyl alcohol of 20°C ~ 25°C for 60 seconds. Then the resistor is left in room for 48 hours	$\pm (1\% + 0.001\Omega)$ No visual damage
Terminal Strength	JIS C-5201-1 4.32 AEC Q200-006	Pressurizing force for 60 seconds. 1206 and above 17.7N	No breakage
Bending Strength	JIS C-5201-1 4.33 IEC-60115-1 4.33	Bending once for 5 seconds. D: 1206-1210 = 3mm; 2010-2512 = 2mm	$\pm (1\% + 0.001\Omega)$ No visual damage

Temperature coefficient of resistance test to -55°C and AEC-Q200 test reports available upon request. Contact Stackpole Electronics.

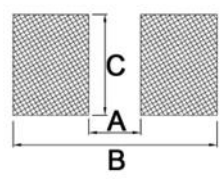
Storage time at environment temperature is 25  $\pm$  5°C and R.H. of 60  $\pm$  20%.

**Soldering Profiles**



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.

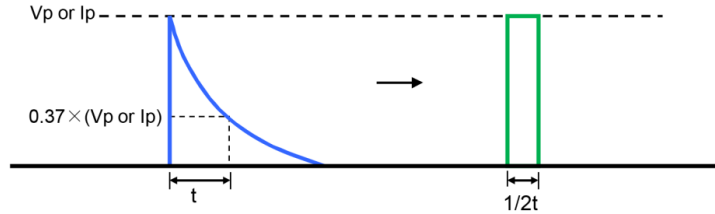
**Recommended Pad Layout**



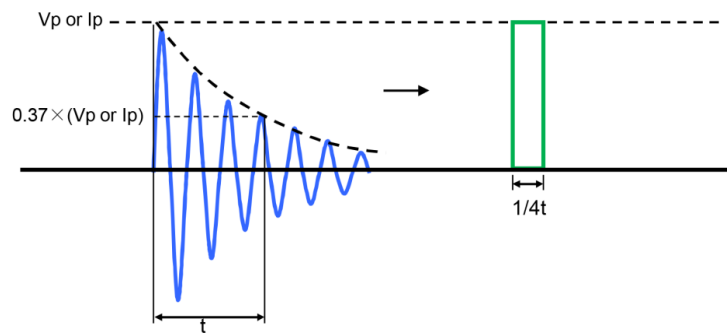
Type/Code	A	B	C	Unit
RNCL1206	0.087	0.165	0.071	inches
	2.20	4.20	1.80	mm
RNCL1210	0.079	0.173	0.106	inches
	2.00	4.40	2.70	mm
RNCL2010	0.150	0.260	0.106	inches
	3.80	6.60	2.70	mm
RNCL2512	0.193	0.319	0.134	inches
	4.90	8.10	3.40	mm

### Waveform Transformation to Square Wave

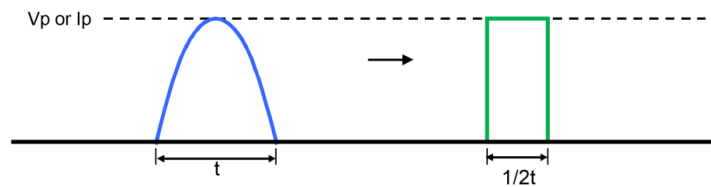
1. Discharge curve wave with time constant "t" → Square wave



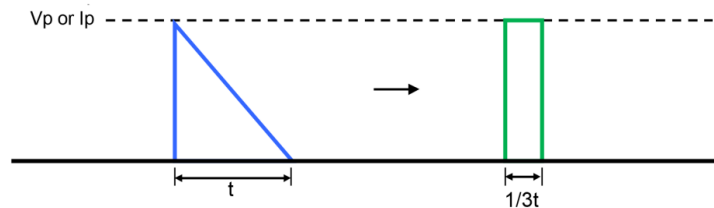
2. Damping oscillation wave with time constant of envelope "t" → Square wave



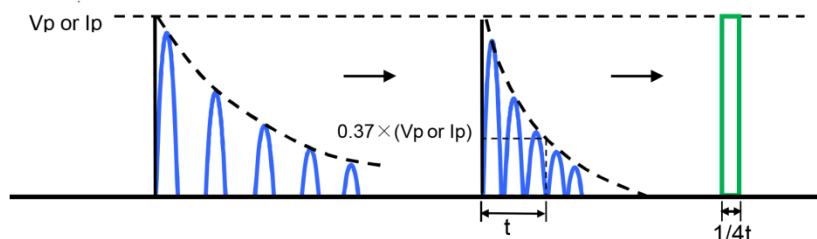
3. Half-wave rectification wave → Square wave



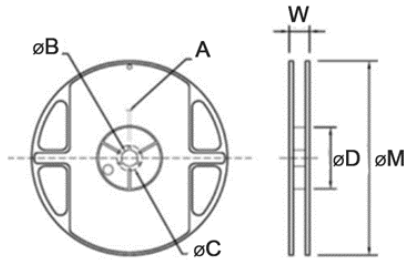
4. Triangular wave → Square wave



5. Special wave → Square wave

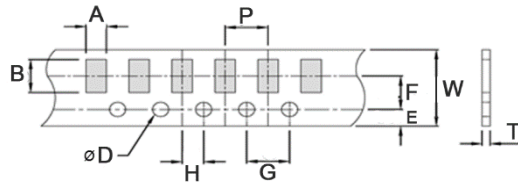


### Reel Specifications



Type/Code	A	B	C	D	W	M	Unit
RNCL1206	0.079 ± 0.020	0.531 ± 0.039	0.827 ± 0.039	2.362 ± 0.039	0.453 ± 0.079	7.008 ± 0.079	inches
	2.00 ± 0.50	13.50 ± 1.00	21.00 ± 1.00	60.00 ± 1.00	11.50 ± 2.00	178.00 ± 2.00	mm
RNCL1210	0.079 ± 0.020	0.531 ± 0.039	0.827 ± 0.039	2.362 ± 0.039	0.453 ± 0.079	7.008 ± 0.079	inches
	2.00 ± 0.50	13.50 ± 1.00	21.00 ± 1.00	60.00 ± 1.00	11.50 ± 2.00	178.00 ± 2.00	mm
RNCL2010	0.079 ± 0.020	0.531 ± 0.039	0.827 ± 0.039	2.362 ± 0.039	0.630 ± 0.079	7.008 ± 0.079	inches
	2.00 ± 0.50	13.50 ± 1.00	21.00 ± 1.00	60.00 ± 1.00	16.00 ± 2.00	178.00 ± 2.00	mm
RNCL2512	0.079 ± 0.020	0.531 ± 0.039	0.827 ± 0.039	2.362 ± 0.039	0.630 ± 0.079	7.008 ± 0.079	inches
	2.00 ± 0.50	13.50 ± 1.00	21.00 ± 1.00	60.00 ± 1.00	16.00 ± 2.00	178.00 ± 2.00	mm

### Packaging Specifications - Paper Tape

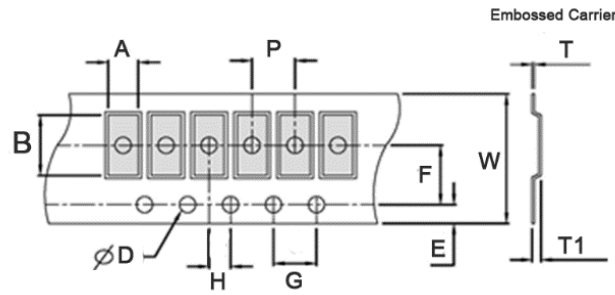


Type/Code	A	B	W	E	F	Unit
RNCL1206	0.075 ± 0.008	0.120 ± 0.008	0.315 ± 0.008	0.069 ± 0.004	0.138 ± 0.002	inches
	1.90 ± 0.20	3.05 ± 0.20	8.00 ± 0.20	1.75 ± 0.10	3.50 ± 0.05	mm
RNCL1210	0.112 ± 0.008	0.120 ± 0.008	0.315 ± 0.008	0.069 ± 0.004	0.138 ± 0.002	inches
	2.85 ± 0.20	3.05 ± 0.20	8.00 ± 0.20	1.75 ± 0.10	3.50 ± 0.05	mm

Type/Code	G	H	T	P	D	Unit
RNCL1206	0.157 ± 0.004	0.079 ± 0.002	0.030 ± 0.004	0.157 ± 0.004	0.059 +0.004/-0	inches
	4.00 ± 0.10	2.00 ± 0.05	0.75 ± 0.10	4.00 ± 0.10	1.50 +0.10/-0	mm
RNCL1210	0.157 ± 0.004	0.079 ± 0.002	0.030 ± 0.004	0.157 ± 0.004	0.059 +0.004/-0	inches
	4.00 ± 0.10	2.00 ± 0.05	0.75 ± 0.10	4.00 ± 0.10	1.50 +0.10/-0	mm

**Packaging Specifications - Embossed Tape**

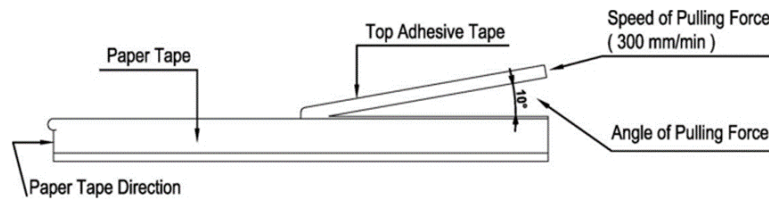


Type/Code	A	B	W	E	F	G	Unit
RNCL2010	0.110 ± 0.008	0.220 ± 0.008	0.472 ± 0.004	0.069 ± 0.004	0.217 ± 0.002	0.157 ± 0.004	inches
	2.80 ± 0.20	5.60 ± 0.20	12.00 ± 0.10	1.75 ± 0.10	5.50 ± 0.05	4.00 ± 0.10	mm
RNCL2512	0.134 ± 0.008	0.264 ± 0.008	0.472 ± 0.004	0.069 ± 0.004	0.217 ± 0.002	0.157 ± 0.004	inches
	3.40 ± 0.20	6.70 ± 0.20	12.00 ± 0.10	1.75 ± 0.10	5.50 ± 0.05	4.00 ± 0.10	mm

Type/Code	H	T	T1	P	D	D1	Unit
RNCL2010	0.079 ± 0.002	0.009 ± 0.004	0.033 ± 0.006	0.157 ± 0.004	0.059 +0.004/-0	0.059 ± 0.004	inches
	2.00 ± 0.05	0.23 ± 0.10	0.85 ± 0.15	4.00 ± 0.10	1.50 +0.10/-0	1.50 ± 0.10	mm
RNCL2512	0.079 ± 0.002	0.009 ± 0.004	0.033 ± 0.006	0.157 ± 0.004	0.059 +0.004/-0	0.059 ± 0.004	inches
	2.00 ± 0.05	0.23 ± 0.10	0.85 ± 0.15	4.00 ± 0.10	1.50 +0.10/-0	1.50 ± 0.10	mm

**Top Adhesive Peel Off**



Top adhesive peel off strength is 10 ~ 70g.

**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



**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)
RNCL	Thin Film High Power Anti-surge	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. 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**

