

- Features:**
- Higher power ratings than standard thick film chips
  - Absolute TCRs to  $\pm 100$  ppm/ $^{\circ}$ C
  - Inner termination engineered to deter sulfur contamination
  - Absolute Tolerances to 1%
  - Completely lead free - RoHS compliant and halogen-free
  - Comparable in cost to standard thick film chip resistors



| Electrical Specifications |   |   |                             |                                       |  |
|---------------------------|---|---|-----------------------------|---------------------------------------|--|
| Type / Code               | Power Rating <sup>(1)</sup><br>(Watts)<br>@ 70 $^{\circ}$ C | Maximum Working<br>Voltage <sup>(2)</sup> | Maximum Overload<br>Voltage | Resistance<br>Temperature Coefficient | Ohmic Range ( $\Omega$ ) and Tolerance |
| RNCP0402                  | 0.1W  | 50V                                       | 100V                        | $\pm 100$ ppm/ $^{\circ}$ C           | 1%, 5%                                 |
| RNCP0603                  | 0.125W  | 150V                                      | 300V                        |                                       | 1 - 10K                                |
| RNCP0805                  | 0.25W   | 200V                                      | 400V                        |                                       | 1 - 47K                                |
| RNCP1206                  | 0.5W  |   |                             |                                       | 1 - 100K                               |

(1) Power rating for each package size is valid if ambient temp  $\leq 80$   $^{\circ}$ C and terminal temp  $\leq 105$   $^{\circ}$ C

(2) Lesser of  $\sqrt{PR}$  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.

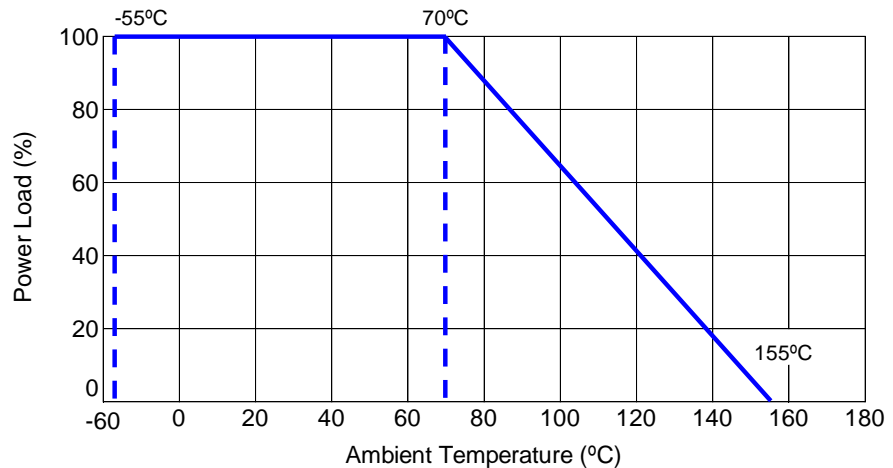
| Mechanical Specifications |  |  |  |  |  |  |
|---------------------------|--|--|--|--|--|--|
|                           |  |  |  |  |  |  |

| Type / Code | L<br>Body Length                     | W<br>Body Width                      | H<br>Body Height                     | a<br>Top Termination                 | b<br>Bottom Termination              | Unit         |
|-------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------|
| RNCP0402    | 0.039 $\pm$ 0.004<br>1.00 $\pm$ 0.10 | 0.020 $\pm$ 0.002<br>0.50 $\pm$ 0.05 | 0.012 $\pm$ 0.002<br>0.30 $\pm$ 0.05 | 0.010 $\pm$ 0.006<br>0.25 $\pm$ 0.15 | 0.012 $\pm$ 0.006<br>0.30 $\pm$ 0.15 | inches<br>mm |
| RNCP0603    | 0.059 $\pm$ 0.004<br>1.50 $\pm$ 0.10 | 0.031 $\pm$ 0.004<br>0.80 $\pm$ 0.10 | 0.016 $\pm$ 0.004<br>0.40 $\pm$ 0.10 | 0.012 $\pm$ 0.008<br>0.30 $\pm$ 0.20 | 0.016 $\pm$ 0.008<br>0.40 $\pm$ 0.20 | inches<br>mm |
| RNCP0805    | 0.079 $\pm$ 0.006<br>2.00 $\pm$ 0.15 | 0.049 $\pm$ 0.006<br>1.25 $\pm$ 0.15 | 0.020 $\pm$ 0.004<br>0.50 $\pm$ 0.10 | 0.016 $\pm$ 0.008<br>0.40 $\pm$ 0.20 | 0.024 $\pm$ 0.008<br>0.60 $\pm$ 0.20 | inches<br>mm |
| RNCP1206    | 0.122 $\pm$ 0.008<br>3.10 $\pm$ 0.20 | 0.059 $\pm$ 0.008<br>1.50 $\pm$ 0.20 | 0.020 $\pm$ 0.004<br>0.50 $\pm$ 0.10 | 0.020 $\pm$ 0.012<br>0.50 $\pm$ 0.30 | 0.028 $\pm$ 0.008<br>0.70 $\pm$ 0.20 | inches<br>mm |

| Performance Characteristics           |   |   |  |
|---------------------------------------|---|---|--|
| Test Item                             | Reference Standard                                | Condition of Test   | Test Limits ( $\Delta R$ )                                     |
| Temperature Coefficient of Resistance | MIL-STD-202F Method 304;<br>JIS-C5201-1-4.8       | +25~ +125 $^{\circ}$ C  | $\pm 100$ ppm/ $^{\circ}$ C                                    |
| Short Time Overload                   | MIL-R-55342D Paragraph 4.7.5;<br>JIS-C5201-1-4.13 | 2.5 times rated voltage for 5 seconds.  | F: $\pm$ (1% + 0.1 $\Omega$ )<br>J: $\pm$ (2% + 0.1 $\Omega$ ) |
| High Temperature Exposure (Storage)   | MIL-STD-202<br>Method 108                         | 1000 hours at T=125 $^{\circ}$ C. Unpowered.<br>Measurement at 24 $\pm$ 2 hours<br>after test conclusion. | F: $\pm$ (2% + 0.1 $\Omega$ )<br>J: $\pm$ (2% + 0.1 $\Omega$ ) |

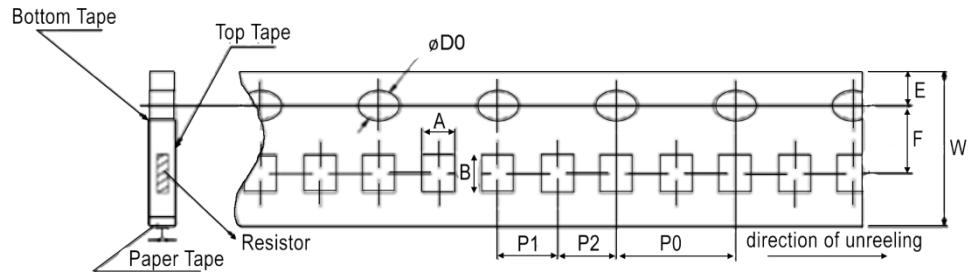
| Performance Characteristics (cont.) |                           |  |  |
|-------------------------------------|---------------------------|--|--|
| Test Item                           | Reference Standard        | Condition of Test  | Test Limits ( $\Delta R$ )   |
| Temperature Cycling                 | JESD22<br>Method JA-104   | 1000 cycles (-55°C to +125°C).<br>Measurement at 24 ± 2 hours<br>after test conclusion.  | F: ± (0.5% + 0.05Ω)<br>J: ± (1% + 0.1Ω)<br>Remark: R≤10Ω: F/J: ± (1% + 0.1Ω) |
| Moisture Resistance                 | MIL-STD-202<br>Method 106 | 1000 h., T=24 hours/cycle<br>Notes: Steps 7a & 7b not required.<br>Unpowered.  | F: ± (1% + 0.05Ω)<br>J: ± (2% + 0.1Ω)  |
| Biased Humidity                     | MIL-STD-202<br>Method 103 | 1000 hours 85°C / 85% RH.<br>Specified conditions: 10% of operating<br>power. Measurement at 24 ± 2 hours<br>after test conclusion.                  | F: ± (3% + 0.1Ω)<br>J: ± (3% + 0.1Ω)   |
| Operational Life                    | MIL-STD-202<br>Method 108 | 1000 hours TA=125°C at rated power.<br>Measurement at 24 ± 2 hours after test<br>conclusion. Remark: Mounted quantity:<br>Mounted 2 pieces on 1 PCB. | F: ± (1% + 0.05Ω)<br>J: ± (3% + 0.1Ω)  |
| Resistance to Soldering<br>Heat     | MIL-STD-202<br>Method 210 | Condition B: Immerse the specimens in an<br>eutectic solder at 260 ± 5°C<br>for 10 ± 1 seconds.  | F: ± (0.5% + 0.05Ω)<br>J: ± (1% + 0.1Ω)                                      |
| Solderability                       | J-STD-002                 | 245 ± 5°C solder, 2 ± 0.5 s. dwell<br>Solder: Sn96.5 / Ag3.0 / Cu0.5.  | >95% area covered with tin   |
| Board Flex (Bending)                | AEC-Q200-005              | 3mm deflection.  | F: ± (0.5% + 0.05Ω)<br>J: ± (1% + 0.1Ω)                                      |
| Terminal Strength (SMD)             | AEC-Q200-006              | Pressure X kgf a R0.5 pressure rod<br>for 60 seconds.<br>0201: NA<br>0402: 0.5Kg      0805: 1.0Kg<br>0603: 0.5Kg      1206: 1.8Kg                    | F: ± (0.5% + 0.05Ω)<br>J: ± (1% + 0.1Ω)                                      |

**Power Derating Curve:**

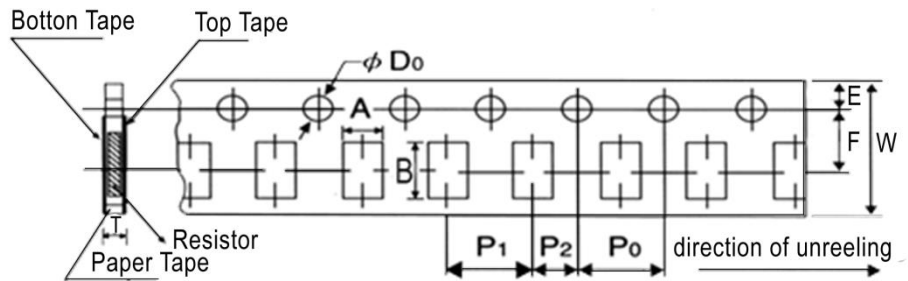


**Packaging Specifications**

RNCP0402  
(2mm Pitch Paper)



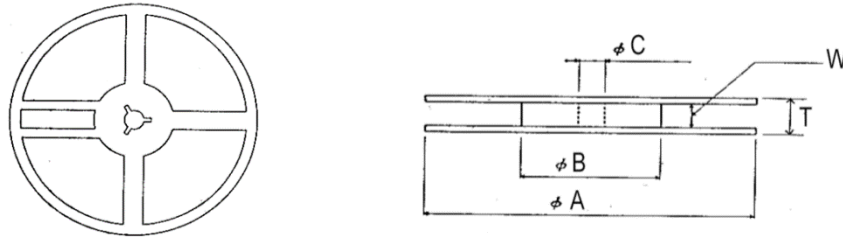
RNCP0603, 0805, 1206  
(4mm Pitch Paper)



| Type / Code | Paper Tape Pitch | A             | B             | W             | E             | F             | Unit   |
|-------------|------------------|---------------|---------------|---------------|---------------|---------------|--------|
| RNCP0402    | 0.079            | 0.028 ± 0.002 | 0.047 ± 0.002 | 0.315 ± 0.008 | 0.069 ± 0.004 | 0.138 ± 0.002 | inches |
|             | 2.00             | 0.70 ± 0.05   | 1.20 ± 0.05   | 8.00 ± 0.20   | 1.75 ± 0.10   | 3.50 ± 0.05   | mm     |
| RNCP0603    | 0.157            | 0.043 ± 0.004 | 0.075 ± 0.004 | 0.315 ± 0.008 | 0.069 ± 0.004 | 0.138 ± 0.002 | inches |
|             | 4.00             | 1.10 ± 0.10   | 1.90 ± 0.10   | 8.00 ± 0.20   | 1.75 ± 0.10   | 3.50 ± 0.05   | mm     |
| RNCP0805    | 0.157            | 0.063 ± 0.006 | 0.094 ± 0.008 | 0.315 ± 0.008 | 0.069 ± 0.004 | 0.138 ± 0.002 | inches |
|             | 4.00             | 1.60 ± 0.15   | 2.40 ± 0.20   | 8.00 ± 0.20   | 1.75 ± 0.10   | 3.50 ± 0.05   | mm     |
| RNCP1206    | 0.157            | 0.079 ± 0.006 | 0.142 ± 0.008 | 0.315 ± 0.008 | 0.069 ± 0.004 | 0.138 ± 0.002 | inches |
|             | 4.00             | 2.00 ± 0.15   | 3.60 ± 0.20   | 8.00 ± 0.20   | 1.75 ± 0.10   | 3.50 ± 0.05   | mm     |

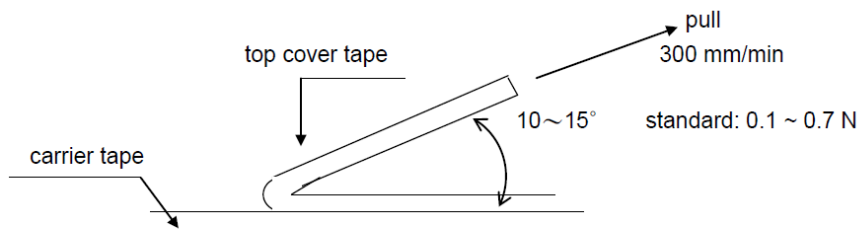
| Type / Code | P1            | P2            | P0            | D0(φ)         | T             | Unit   |
|-------------|---------------|---------------|---------------|---------------|---------------|--------|
| RNCP0402    | 0.079 ± 0.004 | 0.079 ± 0.004 | 0.157 ± 0.004 | 0.059 ± 0.004 | 0.018 ± 0.004 | inches |
|             | 2.00 ± 0.10   | 2.00 ± 0.10   | 4.00 ± 0.10   | 1.50 ± 0.10   | 0.45 ± 0.10   | mm     |
| RNCP0603    | 0.157 ± 0.004 | 0.079 ± 0.002 | 0.157 ± 0.004 | 0.059 ± 0.004 | 0.025 ± 0.004 | inches |
|             | 4.00 ± 0.10   | 2.00 ± 0.05   | 4.00 ± 0.10   | 1.50 ± 0.10   | 0.64 ± 0.10   | mm     |
| RNCP0805    | 0.157 ± 0.004 | 0.079 ± 0.002 | 0.157 ± 0.004 | 0.059 ± 0.004 | 0.033 ± 0.004 | inches |
|             | 4.00 ± 0.10   | 2.00 ± 0.05   | 4.00 ± 0.10   | 1.50 ± 0.10   | 0.84 ± 0.10   | mm     |
| RNCP1206    | 0.157 ± 0.004 | 0.079 ± 0.002 | 0.157 ± 0.004 | 0.059 ± 0.004 | 0.033 ± 0.004 | inches |
|             | 4.00 ± 0.10   | 2.00 ± 0.05   | 4.00 ± 0.10   | 1.50 ± 0.10   | 0.84 ± 0.10   | mm     |

**Reel Specifications**



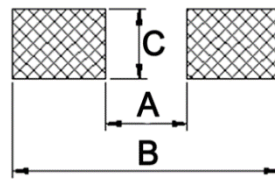
| Type / Code | ØA                             | ØB                            | Øc                            | W                            | T                             | Unit         |
|-------------|--------------------------------|-------------------------------|-------------------------------|------------------------------|-------------------------------|--------------|
| RNCP        | 7.008 ± 0.079<br>178.00 ± 2.00 | 2.362 ± 0.039<br>60.00 ± 1.00 | 0.512 ± 0.039<br>13.00 ± 1.00 | 0.354 ± 0.039<br>9.00 ± 1.00 | 0.453 ± 0.039<br>11.50 ± 1.00 | inches<br>mm |

**Peel-off Force Specifications**

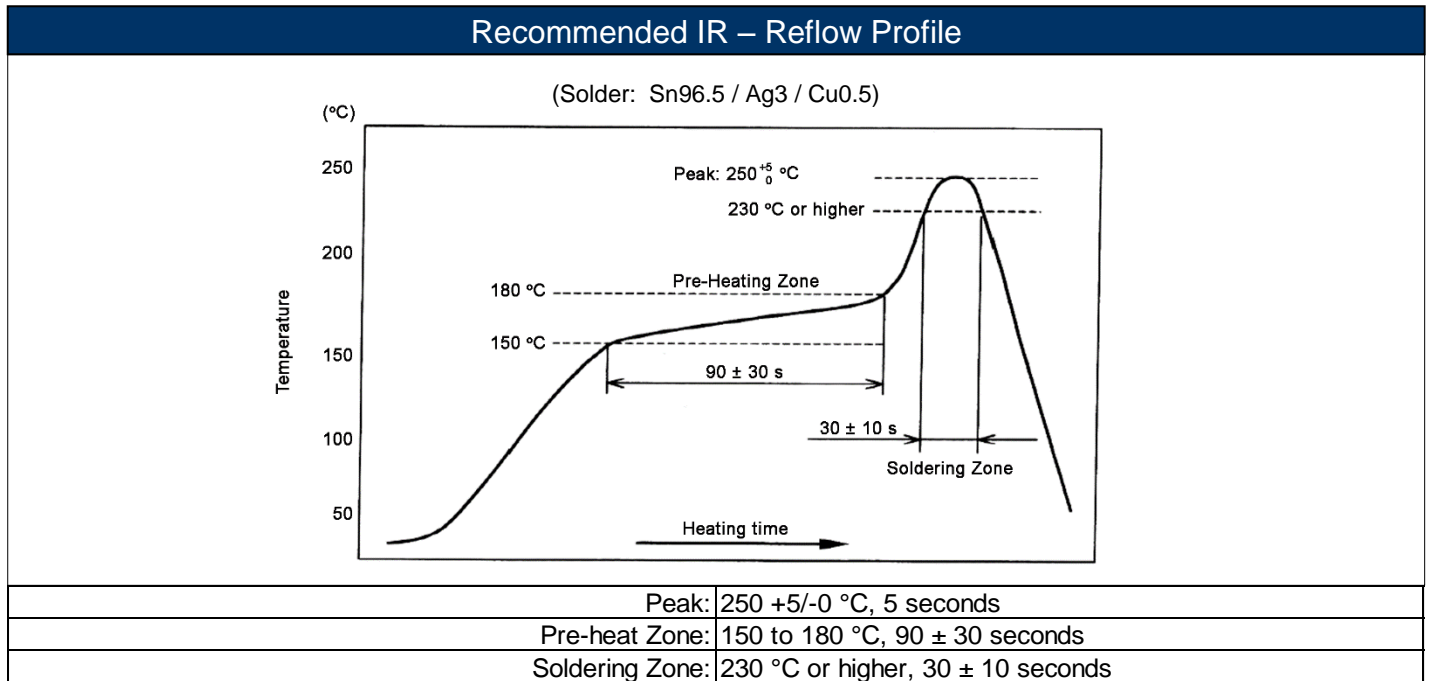


Peel-off force of paper and blister tape is in accordance with "JIS-C5202", that is, 0.1 to 0.7N at a peel-off speed of 300 mm/minute.

**Solder Land Pattern**



| Type / Code | A             | B             | C             | Unit         |
|-------------|---------------|---------------|---------------|--------------|
| 0402        | 0.016<br>0.40 | 0.059<br>1.50 | 0.024<br>0.60 | inches<br>mm |
| 0603        | 0.026<br>0.65 | 0.083<br>2.10 | 0.035<br>0.90 | inches<br>mm |
| 0805        | 0.039<br>1.00 | 0.118<br>3.00 | 0.051<br>1.30 | inches<br>mm |
| 1206        | 0.079<br>2.00 | 0.165<br>4.20 | 0.063<br>1.60 | inches<br>mm |

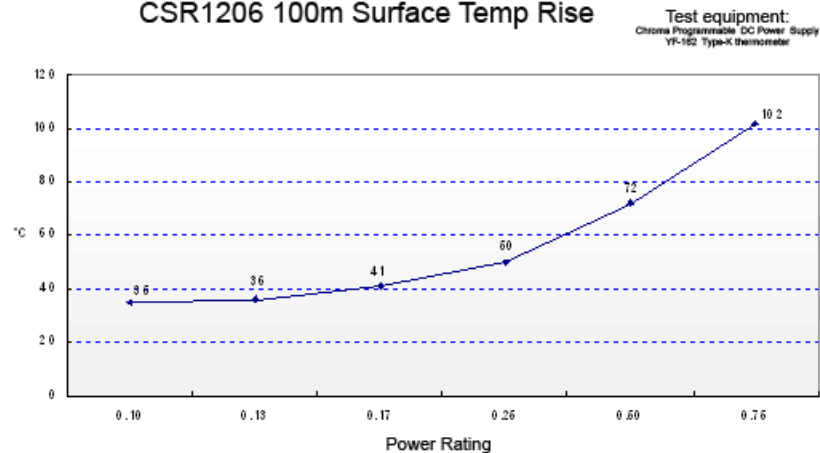


**High Power Chip Resistors and Thermal Management**

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 CSR ½ 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 100m Surface Temp 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 ≤ 50mΩ. 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) |
| 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.

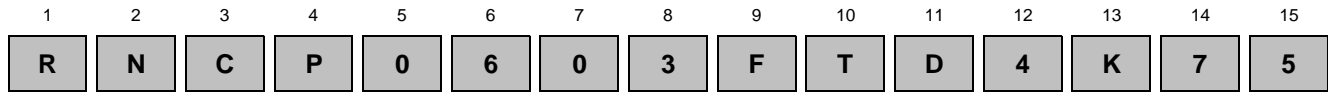
**Compliance to “REACH”**

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**



| Product Series |  | Size | Power  | Tolerance |     |          | Packaging |                      |                  |          | TCR  |     | Resistance Value   |
|----------------|--|------|--------|-----------|-----|----------|-----------|----------------------|------------------|----------|------|-----|--|
| Product Series | High Power<br>Anti-Sulfur<br>Thin Film |      |        | Code      | Tol | Value    | Code      | Description          | Size             | Quantity | Code | ppm |  |
| RNCP           |  | 0402 | 0.1W   | F         | 1%  | E96, E24 | T         | 7" Reel - Paper Tape | 0402             | 10,000   | D    | 100 | Four characters<br>with the multiplier<br>used as the<br>decimal holder. |
|                |  | 0603 | 0.125W | J         | 5%  | E24      |           |                      | 0603, 0805, 1206 | 5,000    |      |     |  |
|                |  | 0805 | 0.25W  |           |     |          |           |                      |                  |          |      |     |  |
|                |  | 1206 | 0.5W   |           |     |          |           |                      |                  |          |      |     |  |

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

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