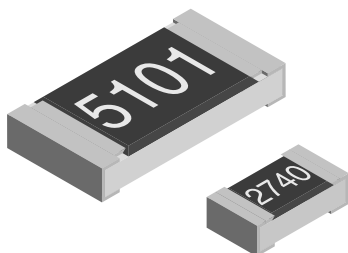


## High Stability Thin Film Chip Resistor

≤ 0.05 % (1000 h rated power at 70 °C)



TNPW Precision Thin Film Flat Chip Resistors are the perfect choice for most fields of modern electronics where reliability and stability is of major concern. Typical applications include telecommunication, industrial, medical equipment, high-end computer and audio/video electronics.

### FEATURES

- Metal film layer on high quality ceramic
- Protective top coat
- Tin/lead (Pb) solder contacts
- Excellent overall stability at different environmental conditions ≤ 0.05 % (1000 h rated power at + 70 °C)
- Low temperature coefficient and tight tolerances (± 0.1 %; ± 10 ppm/K)

### APPLICATIONS

- Automotive
- Telecommunication
- Medical Equipment
- Industrial Equipment

### STANDARD ELECTRICAL SPECIFICATIONS

|                                           | TNPW0402                                       | TNPW0603                    | TNPW0805                    | TNPW1206                    | TNPW1210 <sup>1)</sup>      | TNPW2010                    | TNPW2512 <sup>1)</sup>      |
|-------------------------------------------|------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Metric Size                               | RR 1005M                                       | RR 1608M                    | RR 2012M                    | RR 3216M                    | RR 3225M                    | RR 5025M                    | RR 6332M                    |
| Resistance range                          | 10 Ω to 100 kΩ                                 | 10 Ω to 332 kΩ              | 10 Ω to 1 MΩ                | 10 Ω to 2 MΩ                | 10 Ω to 3.01 MΩ             | 10 Ω to 4.99 MΩ             | 10 Ω to 8.87 MΩ             |
| Resistance tolerance                      | ± 1 %; ± 0.5 %; ± 0.1 %                        |                             |                             |                             |                             |                             |                             |
| Temperature Coefficient                   | ± 50 ppm/K; ± 25 ppm/K; ± 15 ppm/K; ± 10 ppm/K |                             |                             |                             |                             | ± 50 ppm/K; ± 25 ppm/K      |                             |
| Climatic category (LCT/UCT/days)          | 55/125/56                                      | 55/125/56                   | 55/125/56                   | 55/125/56                   | 55/125/56                   | 55/125/56                   | 55/125/56                   |
| Rated dissipation, $P_{70}$ <sup>2)</sup> | 0.063 W                                        | 0.1 W                       | 0.125 W                     | 0.25 W                      | 0.33 W                      | 0.4 W                       | 0.5 W                       |
| Operating voltage, $U_{max}$ AC/DC        | 50 V                                           | 75 V                        | 150 V                       | 200 V                       | 200 V                       | 300 V                       | 300 V                       |
| Maximum permissible film temperature      | 155 °C                                         | 155 °C                      | 155 °C                      | 155 °C                      | 155 °C                      | 155 °C                      | 155 °C                      |
| Thermal resistance <sup>3)</sup>          | 870 K/W                                        | 550 K/W                     | 440 K/W                     | 220 K/W                     | 170 K/W                     | 140 K/W                     | 110 K/W                     |
| Insulation voltage:                       |                                                |                             |                             |                             |                             |                             |                             |
| $U_{ins}$ 1 min                           | 75 V                                           | 100 V                       | 200 V                       | 300 V                       | 300 V                       | 300 V                       | 300 V                       |
| continuous                                | 75 V                                           | 75 V                        | 75 V                        | 75 V                        | 75 V                        | 75 V                        | 75 V                        |
| Failure rate                              | ≤ 0.3 x 10 <sup>-9</sup> /h                    | ≤ 0.3 x 10 <sup>-9</sup> /h | ≤ 0.3 x 10 <sup>-9</sup> /h | ≤ 0.3 x 10 <sup>-9</sup> /h | ≤ 0.3 x 10 <sup>-9</sup> /h | ≤ 0.3 x 10 <sup>-9</sup> /h | ≤ 0.3 x 10 <sup>-9</sup> /h |
| Weight/1000 pcs.                          | 0.65 g                                         | 2 g                         | 5.5 g                       | 10 g                        | 16 g                        | 28 g                        | 39 g                        |

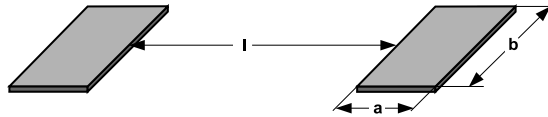
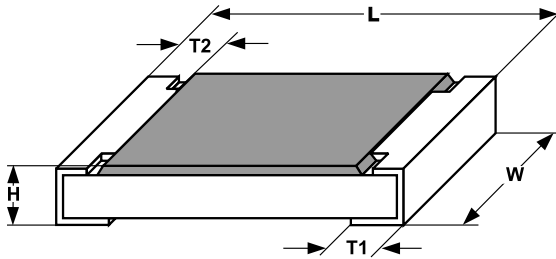
<sup>1)</sup> Size not specified in EN 140401-801

<sup>2)</sup> Rated voltage  $\sqrt{P \times R}$ . The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded

<sup>3)</sup> Measuring conditions in accordance with EN 140401-801

- TNPW 0402 without marking
- Extended values, tighter tolerances and temperature coefficient available on request

## DIMENSIONS



| SIZE |        | DIMENSIONS millimeters |             |             |            |    |
|------|--------|------------------------|-------------|-------------|------------|----|
| INCH | METRIC | L                      | W           | H           | T1         | T2 |
| 0402 | 1005   | 1.0 ± 0.05             | 0.5 ± 0.05  | 0.35 ± 0.05 | 0.2 ± 0.10 |    |
| 0603 | 1608   | 1.6 ± 0.10             | 0.85 ± 0.10 | 0.45 ± 0.10 | 0.3 ± 0.20 |    |
| 0805 | 2012   | 2.0 ± 0.15             | 1.25 ± 0.15 | 0.45 ± 0.10 | 0.4 ± 0.20 |    |
| 1206 | 3216   | 3.2 ± 0.15             | 1.6 ± 0.15  | 0.55 ± 0.10 | 0.5 ± 0.25 |    |
| 1210 | 3225   | 3.2 ± 0.15             | 2.45 ± 0.15 | 0.60 ± 0.15 | 0.5 ± 0.25 |    |
| 2010 | 5025   | 5.0 ± 0.15             | 2.5 ± 0.15  | 0.60 ± 0.15 | 0.6 ± 0.25 |    |
| 2512 | 6332   | 6.3 ± 0.20             | 3.1 ± 0.15  | 0.60 ± 0.15 | 0.6 ± 0.25 |    |

| SOLDER PAD DIMENSIONS millimeters |        |                  |     |     |                |     |     |
|-----------------------------------|--------|------------------|-----|-----|----------------|-----|-----|
| SIZE                              |        | REFLOW SOLDERING |     |     | WAVE SOLDERING |     |     |
| INCH                              | METRIC | a                | b   | l   | a              | b   | l   |
| 0402                              | 1005   | 0.4              | 0.6 | 0.5 | -              | -   | -   |
| 0603                              | 1608   | 0.5              | 0.9 | 1.0 | 0.9            | 0.9 | 1.0 |
| 0805                              | 2012   | 0.7              | 1.3 | 1.2 | 0.9            | 1.3 | 1.3 |
| 1206                              | 3216   | 0.9              | 1.7 | 2.0 | 1.1            | 1.7 | 2.3 |
| 1210                              | 3225   | 0.9              | 2.5 | 2.0 | 1.1            | 2.5 | 2.3 |
| 2010                              | 5025   | 1.0              | 2.5 | 3.9 | 1.2            | 2.5 | 3.9 |
| 2512                              | 6332   | 1.0              | 3.2 | 5.2 | 1.2            | 3.2 | 5.2 |

| TEMPERATURE COEFFICIENT AND RESISTANCE RANGE |            |           |                  |          |
|----------------------------------------------|------------|-----------|------------------|----------|
| TYPE                                         | TCR        | TOLERANCE | RESISTANCE VALUE | E-SERIES |
| TNPW0402                                     | ± 50 ppm/K | ± 1 %     | 10R - 100K       | 24 -96   |
|                                              |            | ± 0.5 %   | 10R - 100K       | 24-192   |
|                                              |            | ± 0.1 %   | 47R - 100K       |          |
|                                              | ± 25 ppm/K | ± 1 %     | 10R - 100K       | 24 -96   |
|                                              |            | ± 0.5 %   | 10R - 100K       | 24-192   |
|                                              |            | ± 0.1 %   | 47R - 100K       |          |
|                                              | ± 15 ppm/K | ± 0.1 %   |                  |          |
|                                              | ± 10 ppm/K | ± 0.1 %   |                  |          |
| TNPW0603                                     | ± 50 ppm/K | ± 1 %     | 10R - 332K       | 24 -96   |
|                                              |            | ± 0.5 %   | 10R - 332K       | 24-192   |
|                                              |            | ± 0.1 %   |                  |          |
|                                              | ± 25 ppm/K | ± 1 %     | 10R - 332K       | 24 -96   |
|                                              |            | ± 0.5 %   | 10R - 332K       | 24-192   |
|                                              |            | ± 0.1 %   |                  |          |
|                                              | ± 15 ppm/K | ± 0.1 %   | 47R - 332K       |          |
|                                              | ± 10 ppm/K | ± 0.1 %   |                  |          |
| TNPW0805                                     | ± 50 ppm/K | ± 1 %     | 10R - 1M0        | 24 -96   |
|                                              |            | ± 0.5 %   | 10R - 1M0        | 24-192   |
|                                              |            | ± 0.1 %   |                  |          |
|                                              | ± 25 ppm/K | ± 1 %     | 10R - 1M0        | 24 -96   |
|                                              |            | ± 0.5 %   | 10R - 1M0        | 24-192   |
|                                              |            | ± 0.1 %   |                  |          |
|                                              | ± 15 ppm/K | ± 0.1 %   | 47R - 1M0        |          |
|                                              | ± 10 ppm/K | ± 0.1 %   |                  |          |

**TEMPERATURE COEFFICIENT AND RESISTANCE RANGE**

| TYPE     | TCR        | TOLERANCE | RESISTANCE VALUE | E-SERIES |
|----------|------------|-----------|------------------|----------|
| TNPW1206 | ± 50 ppm/K | ± 1 %     | 10R - 2M0        | 24 -96   |
|          |            | ± 0.5 %   | 10R - 2M0        | 24-192   |
|          |            | ± 0.1 %   |                  |          |
|          | ± 25 ppm/K | ± 1 %     | 10R - 2M0        | 24 -96   |
|          |            | ± 0.5 %   | 10R - 2M0        | 24-192   |
|          |            | ± 0.1 %   |                  |          |
|          | ± 15 ppm/K | ± 0.1 %   | 47R - 2M0        |          |
|          | ± 10 ppm/K | ± 0.1 %   |                  |          |
| TNPW1210 | ± 50 ppm/K | ± 1 %     | 10R - 3M01       | 24 -96   |
|          |            | ± 0.5 %   | 10R - 3M01       | 24-192   |
|          |            | ± 0.1 %   | 47R - 2M13       |          |
|          | ± 25 ppm/K | ± 1 %     | 10R - 3M01       | 24 -96   |
|          |            | ± 0.5 %   | 10R - 3M01       | 24-192   |
|          |            | ± 0.1 %   | 47R - 2M13       |          |
|          | ± 15 ppm/K | ± 0.1 %   |                  |          |
|          | ± 10 ppm/K | ± 0.1 %   |                  |          |
| TNPW2010 | ± 50 ppm/K | ± 1 %     | 10R - 4M99       | 24 -96   |
|          |            | ± 0.5 %   | 10R - 4M99       | 24-192   |
|          |            | ± 0.1 %   | 47R - 1M0        |          |
|          | ± 25 ppm/K | ± 1 %     | 10R - 4M99       | 24 -96   |
|          |            | ± 0.5 %   | 10R - 4M99       | 24-192   |
|          |            | ± 0.1 %   | 47R - 1M0        |          |
| TNPW2512 | ± 50 ppm/K | ± 1 %     | 10R - 8M87       | 24 -96   |
|          |            | ± 0.5 %   | 10R - 8M87       | 24-192   |
|          |            | ± 0.1 %   | 47R - 1M0        |          |
|          | ± 25 ppm/K | ± 1 %     | 10R - 8M87       | 24 -96   |
|          |            | ± 0.5 %   | 10R - 8M87       | 24-192   |
|          |            | ± 0.1 %   | 47R - 1M0        |          |

**PART NUMBER AND PRODUCT DESCRIPTION**

Products can be ordered using either the Product Description or the Part Number.  
For ordering TNPW with lead (Pb)-free contacts please refer to latest edition of data sheet TNPW e3.

Part Number: (TIN LEAD) TNPW12061K32DETA

T N P W 1 2 0 6 1 K 3 2 D E T A

| MODEL                                                                                   | VALUE                                                    | TOLERANCE                                             | TCR                                                                                  | PACKING <sup>1)</sup>                  | SPECIAL                            |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------|------------------------------------|
| TNPW 0402<br>TNPW 0603<br>TNPW 0805<br>TNPW 1206<br>TNPW 1210<br>TNPW 2010<br>TNPW 2512 | R = Decimal<br>K = Thousand<br>M = Million<br>(4 digits) | B = $\pm 0.1\%$<br>D = $\pm 0.5\%$<br>F = $\pm 1.0\%$ | H = $\pm 50$ ppm/K<br>E = $\pm 25$ ppm/K<br>X = $\pm 15$ ppm/K<br>Y = $\pm 10$ ppm/K | TA<br>TC<br>TD<br>TF<br>TG<br>CN<br>TY | up to 2 digits<br>Blank = standard |

Historical Part Number: TNPW-1206 1.32K 0.5 % T-9 RT1(will continue to be accepted)

| TNPW-1206                                                                               | 1.32K                                                                               | 0.5 %                                     | T-9                                                                                            | RT1                                           |
|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------|
| MODEL                                                                                   | RESISTANCE VALUE $\Omega$                                                           | TOLERANCE                                 | TCR                                                                                            | PACKING <sup>1)</sup>                         |
| TNPW-0402<br>TNPW-0603<br>TNPW-0805<br>TNPW-1206<br>TNPW-1210<br>TNPW-2010<br>TNPW-2512 | Examples:<br>1K32 = 1320 $\Omega$<br>99.68K = 99 680 $\Omega$<br>360 = 360 $\Omega$ | $\pm 0.1\%$<br>$\pm 0.5\%$<br>$\pm 1.0\%$ | T-2 = $\pm 50$ ppm/K<br>T-9 = $\pm 25$ ppm/K<br>T-10 = $\pm 15$ ppm/K<br>T-13 = $\pm 10$ ppm/K | RT1<br>RT6<br>RT7<br>R02<br>R67<br>R52<br>R75 |

<sup>1)</sup> Please refer to PACKING table



High Stability Thin Film Chip Resistor  
 $\leq 0.05\%$  (1000 h rated power at 70 °C)

| PACKING                                          |                 |            |                         |                 |                                      |                              |                      |
|--------------------------------------------------|-----------------|------------|-------------------------|-----------------|--------------------------------------|------------------------------|----------------------|
| MODEL                                            | TAPE WIDTH [mm] | PITCH [mm] | REEL DIAMETER [mm/inch] | PIECES PER REEL | PACKING CODE for PRODUCT DESCRIPTION | PACKING CODE for PART NUMBER | TYPE OF CARRIER TAPE |
| TNPW 0402                                        | 8               | 2          | 180/7                   | 10 000          | RT7                                  | TD                           | Paper                |
| TNPW 0603<br>TNPW 0805<br>TNPW 1206<br>TNPW 1210 | 8               | 4          | 180/7                   | 1000            | R52 <sup>1</sup>                     | CN <sup>1</sup>              | Paper                |
| TNPW 0603<br>TNPW 0805<br>TNPW 1206<br>TNPW 1210 | 8               | 4          | 180/7                   | 5000            | RT1                                  | TA                           | Paper                |
| TNPW 0603<br>TNPW 0805<br>TNPW 1206<br>TNPW 1210 | 8               | 4          | 330/13                  | 20 000          | RT6                                  | TC                           | Paper                |
| TNPW 2010                                        | 12              | 4          | 180/7                   | 1000            | R75                                  | TY                           | Blister              |
|                                                  |                 |            |                         | 4000            | R02                                  | TF                           | Blister              |
| TNPW 2512                                        | 12              | 4          | 180/7                   | 1000            | R75                                  | TY                           | Blister              |
|                                                  |                 |            |                         | 2000            | R67                                  | TG                           | Blister              |

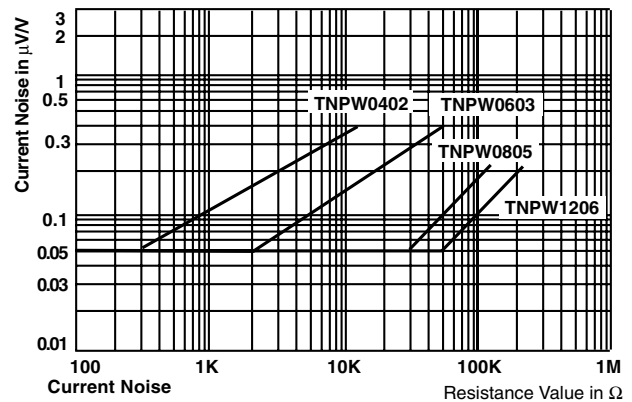
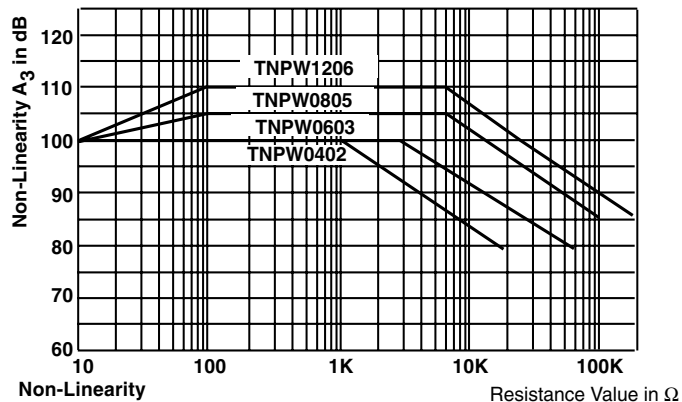
<sup>1)</sup> R52/CN only for precision resistors with tolerance  $\pm 0.1\%$  and temperature coefficient  $\leq \pm 25$  ppm/k

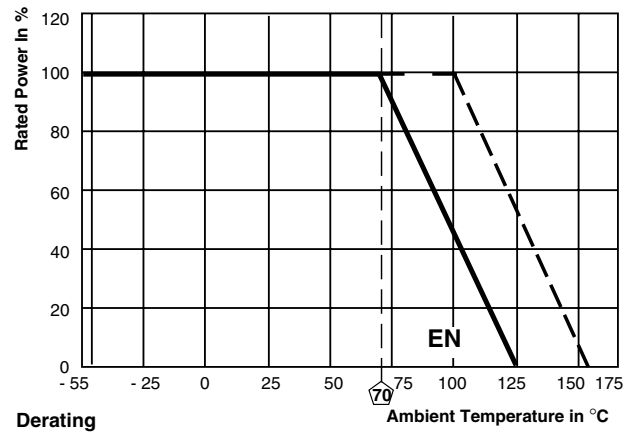
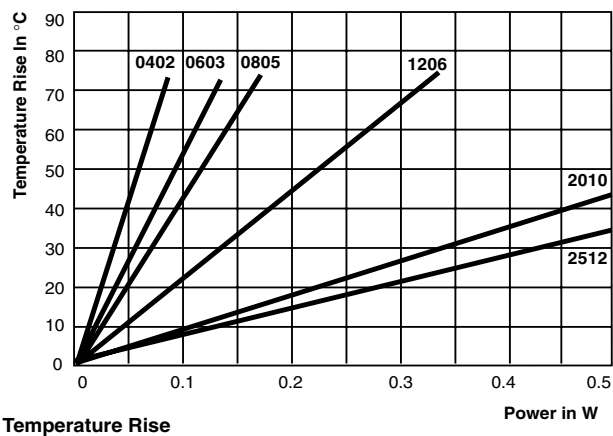
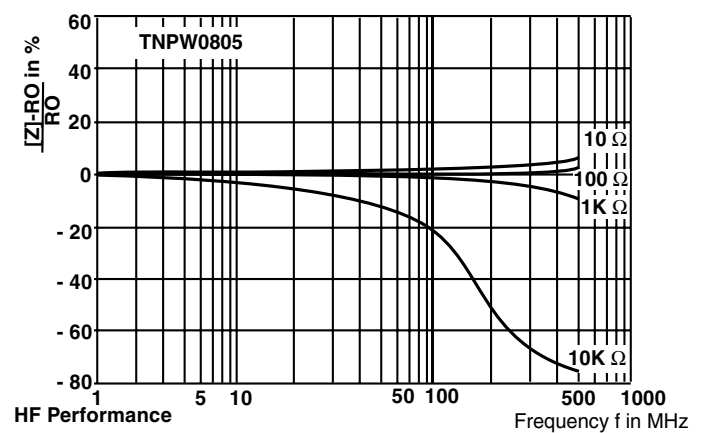
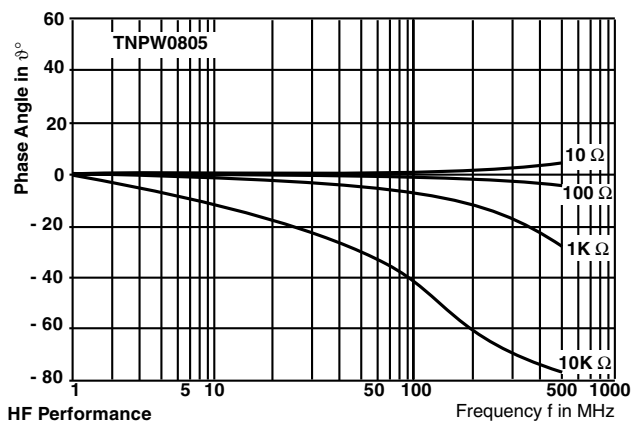
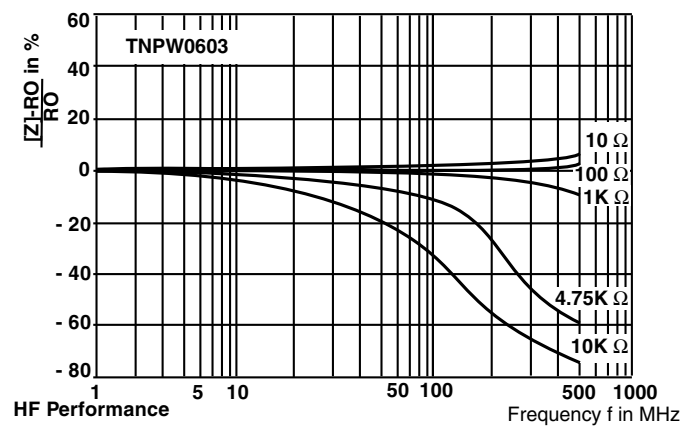
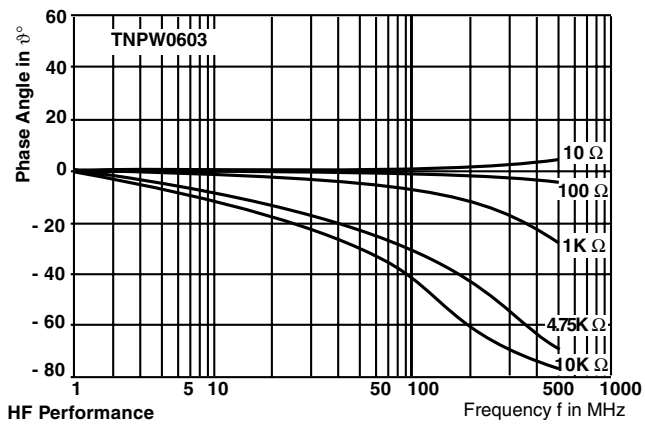
## DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a super high grade ceramic substrate and conditioned to achieve the desired temperature coefficient. A special laser is used to achieve the target value by smoothly cutting a meander groove in the resistive layer without damaging the ceramics.

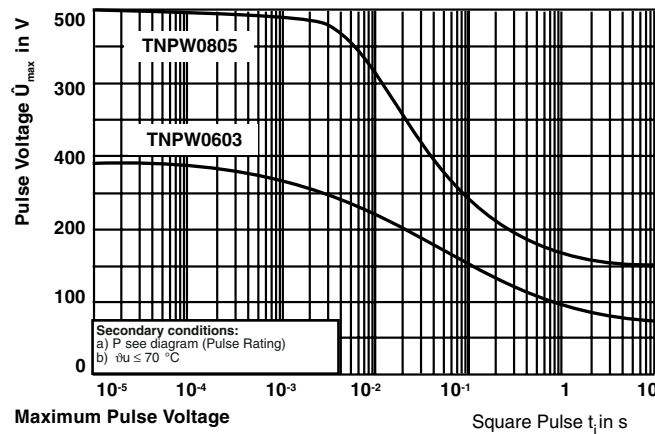
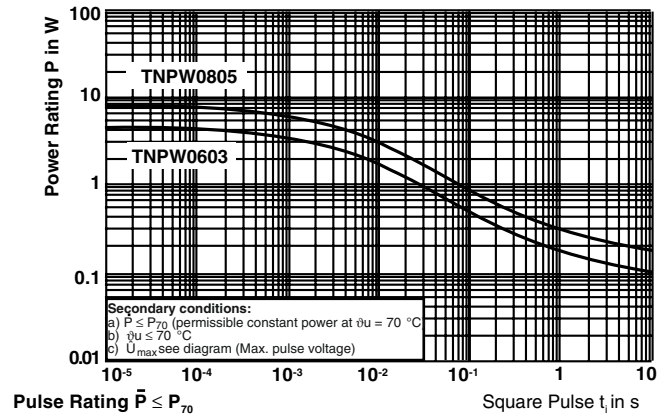
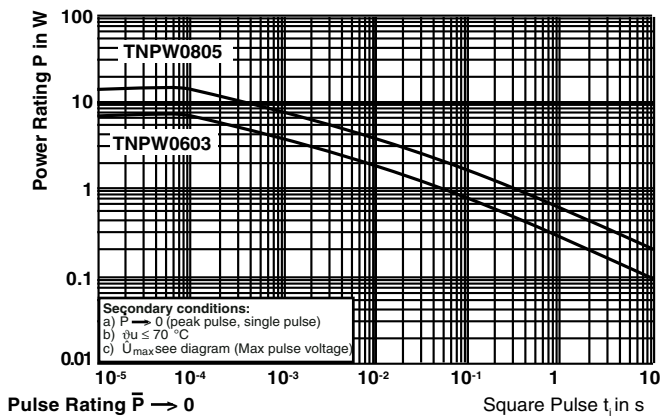
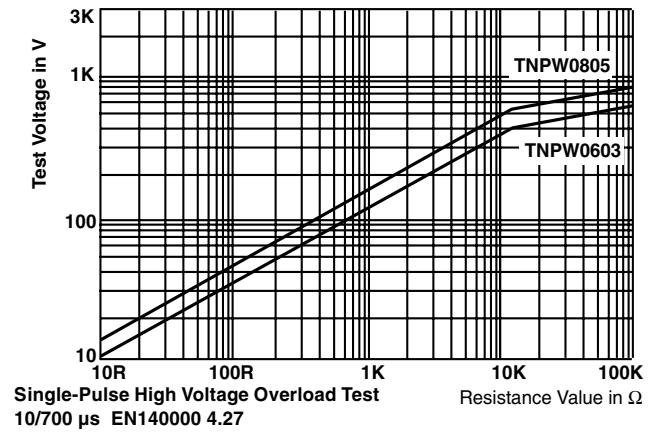
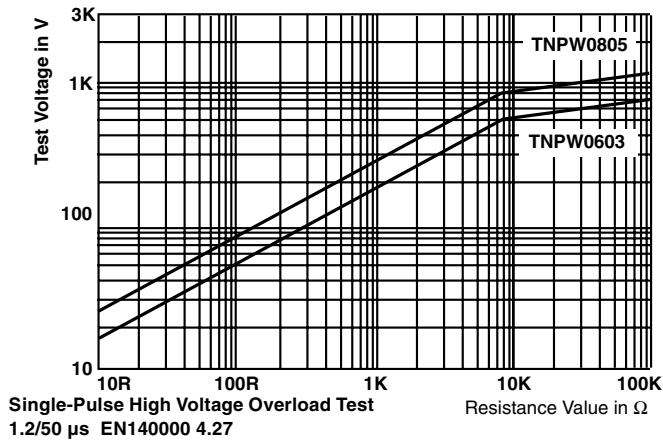
## ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems.





# High Stability Thin Film Chip Resistor ≤ 0.05 % (1000 h rated power at 70 °C)



## TEST AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

EN 60115-1, Generic specification (includes tests)

EN 140 400, Sectional specification (includes schedule for qualification approval)

EN 140 401-801, Detail specification (includes schedule for conformance inspection)

The following table contains only the most important tests. For the full test schedule refer to the documents listed above. The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5202. The tests are carried out in accordance with IEC 60068 and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3. Climatic category LCT/UCT/56 (rated temperature range: Lower

Category Temperature, Upper Category Temperature; damp heat, long term, 56 days) is valid. Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar).

The components are mounted for testing on boards in accordance with EN 60115-1, 4.31 unless otherwise specified. The parameters stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140 401-801. However, some additional tests and a number of improvements against those minimum requirements have been included.

| TEST PROCEDURES AND REQUIREMENTS                                 |                                                                                            |                      |            |                  |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------|------------|------------------|
| TEST                                                             | CONDITIONS OF TEST                                                                         | TEST RESULTS         |            |                  |
|                                                                  |                                                                                            | TNPW0402 TO TNPW2512 |            |                  |
|                                                                  |                                                                                            | TOLERANCES           |            |                  |
|                                                                  |                                                                                            | ± 0.1 %; ± 0.25 %    |            | ± 0.5 %; ± 1.0 % |
|                                                                  |                                                                                            | < 100R               | ≥ 100R     |                  |
| Endurance Test at 70 °C<br>IEC 60115-1 4.25.1                    | 1000 hours at 70 °C, 1.5 hours "ON", 0.5 hours "OFF"                                       | ≤ ± 0.1 %            | ≤ ± 0.05 % | ≤ ± 0.25 %       |
| Endurance at UCT<br>IEC 60115-1 4.25.3                           | 1000 hours at 125 °C without load                                                          | ≤ ± 0.1 %            | ≤ ± 0.05 % | ≤ ± 0.5 %        |
| Overload Test<br>IEC 60115-1 4.13                                | Short time overload for 2 seconds<br>2.5 x rated voltage or ≤ 2 x limiting element voltage | ≤ ± 0.05 %           | ≤ ± 0.02 % | ≤ ± 0.1 %        |
| Thermal Shock<br>IEC 60115-1 4.19, IEC 60068-2-14                | Rapid change between upper and lower category temperature                                  | ≤ ± 0.05 %           | ≤ ± 0.02 % | ≤ ± 0.1 %        |
| Damp Heat Steady State<br>IEC 60115-1 4.24, IEC 60068-2-3        | 56 days at 40 °C and 93 % relative humidity                                                | ≤ ± 0.1 %            | ≤ ± 0.05 % | ≤ ± 0.5 %        |
| Resistance to Soldering Heat<br>IEC 60115-1 4.18, IEC 60068-2-20 | 10 seconds at 260 °C solder bath temperature                                               | ≤ ± 0.05 %           | ≤ ± 0.02 % | ≤ ± 0.1 %        |

| APPLICABLE SPECIFICATIONS                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• CECC40000/40400</li> <li>• EN140400</li> <li>• EIA 575</li> <li>• EN 140401-801</li> <li>• EN 60115-1</li> <li>• IEC 60286-3</li> </ul> |



### Disclaimer

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