



### FEATURES:

- Available sizes 0402 to 1206
- Special materials and design make it resistant to humidity, moisture and Sulfur
- Values from 10Ω to 1MΩ
- TCR as low as 10PPM/°C and Tolerance down to ±0.05%
- High stability in high humidity environments
- 100% matte Tin over Nickel with wrap around termination for excellent solderability



### PART NUMBER STRUCTURE

| TNTF   | 0603 | - | S                   | E             | - | 1002             | B           | T               |
|--------|------|---|---------------------|---------------|---|------------------|-------------|-----------------|
| Series | Size |   | Power Rating        | TCR           |   | Resistance Value | Tolerance   | Packaging       |
|        | 0402 |   | P = 1/16W (0.0625W) | N = ±10ppm/°C |   | 4 DIGIT          | A = ± 0.05% | T = Tape & Reel |
|        | 0603 |   | S = 1/6W (0.167W)   | E = ±25ppm/°C |   | 10R2=10.2Ω       | B = ± 0.10% |                 |
|        | 0805 |   | U = 1/5W (0.20W)    | C = ±50ppm/°C |   | 1002=10KΩ        | C = ± 0.25% |                 |
|        | 1206 |   | V = 1/2W (0.50W)    |               |   |                  | D = ± 0.5%  |                 |
|        |      |   |                     |               |   |                  | F = ± 1.0%  |                 |

Example P/N: TNTF0603-SE-1002BT

Standard Termination is 100% matte Tin over Nickel.

### DIMENSIONS

| SIZE | L                              | W                              | T                              | C <sub>1</sub>                 | C <sub>2</sub>                 |
|------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| 0402 | 0.040 ± 0.002<br>(1.00 ± 0.05) | 0.020 ± 0.002<br>(0.50 ± 0.05) | 0.012 ± 0.002<br>(0.30 ± .05)  | 0.008 ± 0.004<br>(0.20 ± 0.10) | 0.008 ± 0.004<br>(0.20 ± 0.10) |
| 0603 | 0.062 ± 0.008<br>(1.55 ± 0.20) | 0.031 ± 0.008<br>(0.80 ± 0.20) | 0.018 ± 0.004<br>(0.45 ± 0.10) | 0.012 ± 0.007<br>(0.30 ± 0.20) | 0.012 ± 0.007<br>(0.30 ± 0.20) |
| 0805 | 0.079 ± 0.008<br>(2.00 ± 0.20) | 0.050 ± 0.008<br>(1.25 ± 0.20) | 0.022 ± 0.008<br>(0.55 ± 0.20) | 0.012 ± 0.007<br>(0.30 ± 0.20) | 0.015 ± 0.007<br>(0.40 ± 0.20) |
| 1206 | 0.122 ± 0.008<br>(3.10 ± 0.20) | 0.061 ± 0.008<br>(1.55 ± 0.20) | 0.018 ± 0.008<br>(0.55 ± 0.20) | 0.017 ± 0.01<br>(0.42 ± 0.25)  | 0.019 ± 0.01<br>(0.35 ± 0.25)  |

Unit: inches (mm)

### STRUCTURE

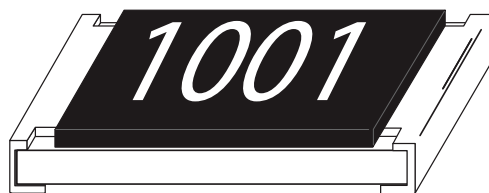
|   |                    |   |                     |
|---|--------------------|---|---------------------|
| 1 | Alumina Substrate  | 5 | TaN Resistive layer |
| 2 | Backside Electrode | 6 | Overcoat            |
| 3 | Top Electrode      | 7 | Nickel Plating      |
| 4 | Edge Electrode     | 8 | Tin Plating         |

### ELECTRICAL SPECIFICATION & RANGE

| SIZE                     | 0402                         | 0603                         | 0805                          | 1206                          |
|--------------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|
| Power Rating at 70°C (W) | 0.0625W (1/16W)              | 0.167W (1/6W)                | 0.20W (1/5W)                  | 0.50W (1/2W)                  |
| Max. Working Voltage     | √PR or 50V whichever is less | √PR or 75V whichever is less | √PR or 100V whichever is less | √PR or 200V whichever is less |
| Max. Overload Voltage    | 100V                         | 150V                         | 200V                          | 400V                          |
| Operating Temp. Range    | -55°C to +155°C              | -55°C to +155°C              | -55°C to +155°C               | -55°C to +155°C               |
| Tolerance (%)            | TCR                          | Resistance Range             | Resistance Range              | Resistance Range              |
| 0.05                     | ±10ppm                       | 40Ω - 35KΩ                   | 10Ω - 348KΩ                   | 10Ω - 1MΩ                     |
| 0.10                     | ±25ppm                       |                              |                               |                               |
| 0.25                     | ±50ppm                       |                              |                               |                               |
| 0.50                     |                              |                              |                               |                               |
| 1.00                     |                              |                              |                               |                               |

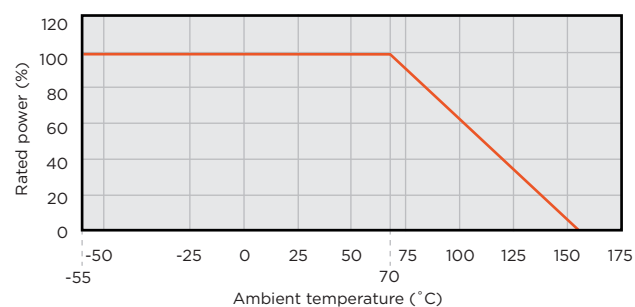
NOTE: Overload Voltage=2.5\*√(P\*R).

### MARKING CODE



- E-24 values for 0603 size and larger are typically marked with the standard 3 digit marking code.
- E-96 values for 0805 size and larger, will be marked with standard 4 digit marking code.
- 0603 - E-96 values will be marked with a standard 3 digit alpha numeric code (Please see 0603 marking codes PDF for resistors).
- 0402 size cannot be marked

### DERATING CURVE



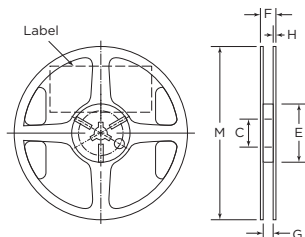
### ENVIRONMENTAL CHARACTERISTICS

| ITEM                                           | REQUIREMENT                                                        | TEST METHOD                                                                                                                                          |
|------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.                                                           | JIS-C-5201-1 4.8<br>IEC-60115-1 4.8<br>-55°C - +125°C, 25°C is the reference temperature                                                             |
| Short Time Overload                            | $\Delta R \pm 0.1\%$                                               | JIS-C-5201-1 4.13<br>RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds                                                              |
| Insulation Resistance                          | >1000M $\Omega$                                                    | JIS-C-5201-1 4.6<br>IEC-60115-1 4.6<br>Apply 100V <sub>DC</sub> for 1 minute                                                                         |
| Operational Life                               | $\Delta R \pm 0.1\%$                                               | MIL-STD-202 Method 108<br>Condition D Steady State T <sub>A</sub> =125°C at derated power.<br>Measurement taken at 24±4 hours after test conclusion. |
| Biased Humidity                                | $\Delta R \pm 0.1\%$                                               | MIL-STD-202 Method 103<br>1000 hrs 85°C/85%RH 10% of operating power.                                                                                |
| High Temperature Exposure                      | $\Delta R \pm 0.15\%$                                              | MIL-STD-202 Method 103<br>at +155°C for 1000 hours.                                                                                                  |
| Temperature Cycling                            | $\Delta R \pm 0.1\%$ for 125°C                                     | MIL-STD-202 Method 103<br>-55°C to +125°C, 1000 cycles.<br>-55°C to +155°C, 1000 cycles.                                                             |
|                                                | $\Delta R \pm 0.2\%$ for 155°C                                     |                                                                                                                                                      |
| Bending Strength (Board Flex)                  | $\Delta R \pm 0.1\%$                                               | JIS-C-5201-1 4.33<br>Bending 2mm for 60 seconds                                                                                                      |
| Solderability                                  | 95% min. coverage                                                  | JIS-C-5201-1 4.17<br>IEC-60115-1 4.17<br>245±5°C for 3 seconds                                                                                       |
| Resistance to Soldering Heat                   | $\Delta R \pm 0.1\%$                                               | JIS-C-5201-1 4.18<br>IEC-60115-1 4.18<br>260±5°C for 10 seconds.                                                                                     |
| Terminal Strength                              | No broken                                                          | AEC-Q200-006<br>Force of 1kg for 60 seconds.                                                                                                         |
| Mechanical Shock                               | $\Delta R \pm 0.1\%$                                               | MIL-STD-202 Method 213<br>Wave form: Tolerance for half sine shock pulse.<br>Peak value is 100g's. Normal duration (D) is 6.                         |
| Vibration                                      | $\Delta R \pm 0.1\%$                                               | MIL-STD-202 Method 204<br>5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz.                                                           |
| ESD                                            | $\Delta R \pm 0.1\%$                                               | AEC-Q200-002<br>Human body model<br>TAR02 - TAR03 0.2KV<br>TAR05 - TAR06 1KV                                                                         |
| Resistance to solvents                         | Marking Unsmear                                                    | MIL-STD-202 Method 215<br>Add aqueous wash chemical - OKEM Clean or equivalent.<br>Do not use banned solvents.                                       |
| Sulfur Test                                    | $\Delta R \pm 1\%$                                                 | EIA-977 (Conditions B)<br>105±2°C no power rating for 750 hrs.                                                                                       |
| Flammability                                   | No ignition of the tissue paper or scorching on the pinewood board | UL-94<br>V-0 or V-1 are acceptable. Electrical test not required.                                                                                    |
| Endurance                                      | $\Delta R \pm 0.1\%$                                               | IEC-60115-1 4.25<br>1000 +48/-0 hours, loaded with RCWV or V <sub>max</sub> in chamber controller<br>85±2°C, 1.5 hours on and 0.5 hours off.         |
| Moisture Resistance                            | $\Delta R \pm 0.1\%$                                               | MIL-STD-202 Method 106<br>65±2°C, 80-100% RH, 10 cycles, 24 hours/cycle.                                                                             |

RCWV (Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

Storage Temperature: 25±3°C; Humidity: < 80%RH

### REEL SPECIFICATIONS

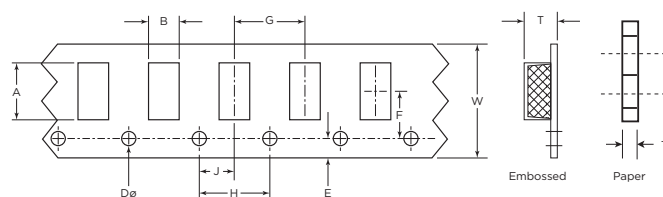


Unit: mm (inch)

| C                              | E                             | F                              | G                             | H                            | M                           |
|--------------------------------|-------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------------------|
| 13.50 ± 0.20<br>(0.54 ± 0.008) | 60.00 ± 1.00<br>(2.36 ± 0.03) | 11.50 ± 0.20<br>(0.46 ± 0.008) | 9.50 ± 1.00<br>(0.38 ± 0.014) | 1.50 ± .30<br>(0.06 ± 0.012) | 178 ± 2.00<br>(7.01 ± 0.08) |

Minimum of 30 empty pockets at the beginning of reel, 65 minimum empty pockets at the end.

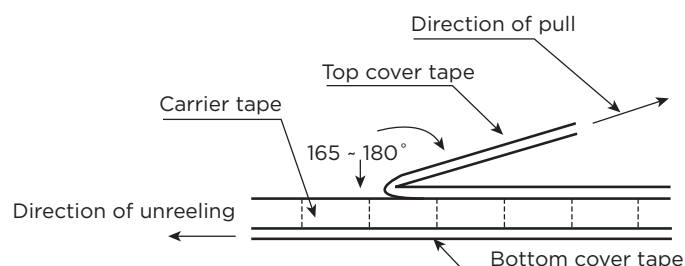
### TAPE SPECIFICATIONS



Units: mm (inches).

| TAPE  | SIZE (in) | A           | B           | W           | E           | F           | T           | G           | H           | J           | Dø          |
|-------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Paper | 0402      | 1.16 ± 0.10 | 0.70 ± 0.10 | 8.00 ± 0.20 | 1.75 ± 0.10 | 3.50 ± 0.05 | 0.40 ± 0.10 | 2.00 ± 0.05 | 4.00 ± 0.10 | 2.00 ± 0.05 | 1.55 ± 0.10 |
|       | 0603      | 1.90 ± 0.10 | 1.10 ± 0.10 | 8.00 ± 0.20 | 1.75 ± 0.10 | 3.50 ± 0.05 | 0.60 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 2.00 ± 0.05 | 1.55 ± 0.10 |
|       | 0805      | 2.37 ± 0.10 | 1.60 ± 0.10 | 8.00 ± 0.20 | 1.75 ± 0.10 | 3.50 ± 0.05 | 0.75 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 2.00 ± 0.05 | 1.55 ± 0.10 |
|       | 1206      | 3.55 ± 0.10 | 2.00 ± 0.10 | 8.00 ± 0.20 | 1.75 ± 0.10 | 3.50 ± 0.05 | 0.75 ± 0.10 | 4.00 ± 0.10 | 4.00 ± 0.10 | 2.00 ± 0.05 | 1.55 ± 0.10 |

### PEEL BACK FORCE AND DIRECTION DIAGRAM



Peel back force and direction of peel back angle should follow EIA481-1-A. Peel back force should be between 0.1N - 1.3N and peel back angle of 165° - 180°.