

## SMD PTC - Nickel Thin Film Linear Thermistors



### FEATURES

- Alumina substrate base with nickel based PTC thin film element
- 0603, 0805 and 1206 sizes available
- Available in tape and reel packaging
- Standard  $R_{25}$  tolerances:  $\pm 0.5\%$ ,  $\pm 1\%$ ,  $\pm 5\%$
- Operation range -  $55\text{ }^{\circ}\text{C}$  to  $+150\text{ }^{\circ}\text{C}$
- High stability over the entire temperature range
- cUL recognized component: File E148885
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### QUICK REFERENCE DATA

| PARAMETER                                                                            | VALUE                         |           |            | UNIT  |
|--------------------------------------------------------------------------------------|-------------------------------|-----------|------------|-------|
| DESCRIPTION                                                                          | TFPT0603                      | TFPT0805  | TFPT1206   |       |
| Resistance value at 25 °C <sup>(2)</sup>                                             | 100 to 1K                     | 100 to 5K | 100 to 10K | Ω     |
| Tolerance on R <sub>25</sub> -value <sup>(2)</sup>                                   | ± 0.5; ± 1; ± 5               |           |            | %     |
| TCR at 25 °C                                                                         | 4110                          |           |            | ppm/K |
| Tolerance on TCR at 25 °C <sup>(1)</sup>                                             | ± 400                         |           |            |       |
| Operating temperature range:<br>at rated power<br>at zero dissipation <sup>(4)</sup> | - 55 to + 70<br>- 55 to + 150 |           |            | °C    |
| Dissipation factor δ (for information only)                                          | 1.8                           | 2.3       | 4          | mW/K  |
| Maximum rated power at 70 °C (P <sub>70</sub> )                                      | 75                            | 100       | 125        | mW    |
| Maximum working voltage RCWV <sup>(3)</sup>                                          | 30                            | 40        | 50         | V     |
| Climatic category (LCT/UCT/days)                                                     | 55/150/56                     |           |            | -     |
| Weight                                                                               | 2                             | 5.5       | 10         | mg    |

#### Notes

- <sup>(1)</sup> Contact Vishay if closer TCR lot tolerance is desired  
<sup>(2)</sup> Other  $R_{25}$ -values and tolerances are available upon request  
<sup>(3)</sup> Rated continuous working voltage is maximum working voltage or  $\sqrt{P_{70} \times R}$ , whichever is less  
<sup>(4)</sup> Zero power or zero dissipation is considered as measuring power max. 1 % of rated power  $P_{70}$

### STANDARD RESISTANCE VALUES at $25\text{ }^{\circ}\text{C}$ in $\Omega$

|     |     |     |     |      |      |      |      |       |
|-----|-----|-----|-----|------|------|------|------|-------|
| 100 | 180 | 330 | 560 | 1.0K | 1.8K | 3.3K | 5.0K | 8.2K  |
| 120 | 220 | 390 | 680 | 1.2K | 2.2K | 3.9K | 5.6K | 10.0K |
| 150 | 270 | 470 | 820 | 1.5K | 2.7K | 4.7K | 6.8K |       |

#### Note

- Rated continuous working voltage is maximum working voltage or  $\sqrt{P_{70} \times R}$ , whichever is less

### GLOBAL PART NUMBER INFORMATION

Global Part Numbering: TFPT1206L1002FM (preferred part number format)

T F P T 1 2 0 6 L 1 0 0 2 F M

#### GLOBAL MODEL

TFPT0603  
TFPT0805  
TFPT1206

#### CHARACTERISTIC

L = Linear

#### RESISTANCE VALUE

1002 = 10K

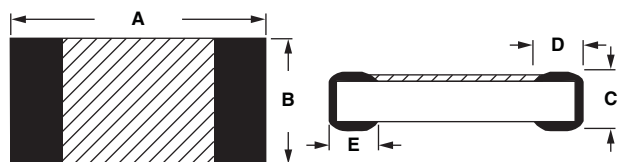
#### TOLERANCE CODE

D =  $\pm 0.5\%$   
F =  $\pm 1\%$   
J =  $\pm 5\%$

#### PACKAGING

M = Lead (Pb)-free, T/R (5000 pieces)  
V = Lead (Pb)-free, T/R (1000 pieces)  
Z = Tin/lead, T/R (5000 pieces)  
Y = Tin/lead, T/R (1000 pieces)

## DIMENSIONS in millimeters



| PART NUMBER | A              | B              | C              | D              | E              |
|-------------|----------------|----------------|----------------|----------------|----------------|
| TFPT 0603   | 1.60<br>± 0.10 | 0.85<br>± 0.10 | 0.45<br>± 0.10 | 0.30<br>± 0.20 | 0.30<br>± 0.20 |
| TFPT 0805   | 2.00<br>± 0.15 | 1.25<br>± 0.15 | 0.45<br>± 0.10 | 0.40<br>± 0.20 | 0.40<br>± 0.20 |
| TFPT 1206   | 3.20<br>± 0.15 | 1.60<br>± 0.15 | 0.55<br>± 0.10 | 0.50<br>± 0.25 | 0.50<br>± 0.25 |

## CONSTRUCTION



### Note

- Zero power is considered as measuring power max. 1 % of rated power  $P_{70}$

| PERFORMANCE <sup>(1)</sup>                                            |                                          |
|-----------------------------------------------------------------------|------------------------------------------|
| TEST                                                                  | MAXIMUM $\Delta R/R_{25}$ <sup>(2)</sup> |
| High temperature exposure (100 h at 125 °C)                           | 0.25 %                                   |
| Effects of bonding (10 s solder dip at 260 °C)                        | 0.25 %                                   |
| Thermal shock (30 min at - 55 °C, 30 min at 125 °C, 5 cycles)         | 0.25 %                                   |
| Low temperature operation (maximum rated power for 2 h at - 55 °C)    | 0.25 %                                   |
| Short time overload (2.5 x RCWV for 5 s)                              | 0.25 %                                   |
| Load life (1000 h 70 °C, maximum rated power 1.5 h "ON", 0.5 h "OFF") | 0.25 %                                   |
| Solderability (95 % coverage P/F)                                     | P                                        |
| Leaching (physical damage P/F)                                        | P                                        |

### Notes

- (1) Environmental performance specifications use test procedures as outlined in MIL-R-23648D and MIL-STD-202
- (2) TFPTs are ESD sensitive

**AVERAGE RATIO  $R/R_{25}$  TFPT ALL SIZES AND VALUES**

| TEMP. | $R/R_{25}$ | TEMP. | $R/R_{25}$ | TEMP.     | $R/R_{25}$   | TEMP. | $R/R_{25}$ | TEMP. | $R/R_{25}$ | TEMP. | $R/R_{25}$ |
|-------|------------|-------|------------|-----------|--------------|-------|------------|-------|------------|-------|------------|
|       |            | - 20  | 0.825      | 20        | 0.980        | 60    | 1.150      | 100   | 1.337      | 140   | 1.541      |
|       |            | - 19  | 0.828      | 21        | 0.984        | 61    | 1.155      | 101   | 1.342      | 141   | 1.547      |
|       |            | - 18  | 0.832      | 22        | 0.988        | 62    | 1.159      | 102   | 1.347      | 142   | 1.552      |
|       |            | - 17  | 0.836      | 23        | 0.992        | 63    | 1.164      | 103   | 1.352      | 143   | 1.557      |
|       |            | - 16  | 0.839      | 24        | 0.996        | 64    | 1.168      | 104   | 1.357      | 144   | 1.563      |
| - 55  | 0.702      | - 15  | 0.843      | <b>25</b> | <b>1.000</b> | 65    | 1.173      | 105   | 1.362      | 145   | 1.568      |
| - 54  | 0.705      | - 14  | 0.847      | 26        | 1.004        | 66    | 1.177      | 106   | 1.367      | 146   | 1.574      |
| - 53  | 0.708      | - 13  | 0.851      | 27        | 1.008        | 67    | 1.182      | 107   | 1.372      | 147   | 1.579      |
| - 52  | 0.712      | - 12  | 0.854      | 28        | 1.012        | 68    | 1.186      | 108   | 1.377      | 148   | 1.584      |
| - 51  | 0.715      | - 11  | 0.858      | 29        | 1.017        | 69    | 1.191      | 109   | 1.382      | 149   | 1.590      |
| - 50  | 0.719      | - 10  | 0.862      | 30        | 1.021        | 70    | 1.196      | 110   | 1.387      | 150   | 1.595      |
| - 49  | 0.722      | - 9   | 0.866      | 31        | 1.025        | 71    | 1.200      | 111   | 1.392      |       |            |
| - 48  | 0.725      | - 8   | 0.869      | 32        | 1.029        | 72    | 1.205      | 112   | 1.397      |       |            |
| - 47  | 0.729      | - 7   | 0.873      | 33        | 1.033        | 73    | 1.209      | 113   | 1.402      |       |            |
| - 46  | 0.732      | - 6   | 0.877      | 34        | 1.037        | 74    | 1.214      | 114   | 1.407      |       |            |
| - 45  | 0.736      | - 5   | 0.881      | 35        | 1.042        | 75    | 1.219      | 115   | 1.412      |       |            |
| - 44  | 0.739      | - 4   | 0.885      | 36        | 1.046        | 76    | 1.223      | 116   | 1.417      |       |            |
| - 43  | 0.743      | - 3   | 0.889      | 37        | 1.050        | 77    | 1.228      | 117   | 1.422      |       |            |
| - 42  | 0.746      | - 2   | 0.892      | 38        | 1.054        | 78    | 1.232      | 118   | 1.427      |       |            |
| - 41  | 0.749      | - 1   | 0.896      | 39        | 1.059        | 79    | 1.237      | 119   | 1.432      |       |            |
| - 40  | 0.753      | 0     | 0.900      | 40        | 1.063        | 80    | 1.242      | 120   | 1.437      |       |            |
| - 39  | 0.756      | 1     | 0.904      | 41        | 1.067        | 81    | 1.246      | 121   | 1.442      |       |            |
| - 38  | 0.760      | 2     | 0.908      | 42        | 1.071        | 82    | 1.251      | 122   | 1.448      |       |            |
| - 37  | 0.763      | 3     | 0.912      | 43        | 1.076        | 83    | 1.256      | 123   | 1.453      |       |            |
| - 36  | 0.767      | 4     | 0.916      | 44        | 1.080        | 84    | 1.261      | 124   | 1.458      |       |            |
| - 35  | 0.771      | 5     | 0.920      | 45        | 1.084        | 85    | 1.265      | 125   | 1.463      |       |            |
| - 34  | 0.774      | 6     | 0.924      | 46        | 1.089        | 86    | 1.270      | 126   | 1.468      |       |            |
| - 33  | 0.778      | 7     | 0.927      | 47        | 1.093        | 87    | 1.275      | 127   | 1.473      |       |            |
| - 32  | 0.781      | 8     | 0.931      | 48        | 1.097        | 88    | 1.280      | 128   | 1.478      |       |            |
| - 31  | 0.785      | 9     | 0.935      | 49        | 1.102        | 89    | 1.284      | 129   | 1.484      |       |            |
| - 30  | 0.788      | 10    | 0.939      | 50        | 1.106        | 90    | 1.289      | 130   | 1.489      |       |            |
| - 29  | 0.792      | 11    | 0.943      | 51        | 1.110        | 91    | 1.294      | 131   | 1.494      |       |            |
| - 28  | 0.796      | 12    | 0.947      | 52        | 1.115        | 92    | 1.299      | 132   | 1.499      |       |            |
| - 27  | 0.799      | 13    | 0.951      | 53        | 1.119        | 93    | 1.303      | 133   | 1.505      |       |            |
| - 26  | 0.803      | 14    | 0.955      | 54        | 1.124        | 94    | 1.308      | 134   | 1.510      |       |            |
| - 25  | 0.806      | 15    | 0.959      | 55        | 1.128        | 95    | 1.313      | 135   | 1.515      |       |            |
| - 24  | 0.810      | 16    | 0.963      | 56        | 1.133        | 96    | 1.318      | 136   | 1.520      |       |            |
| - 23  | 0.814      | 17    | 0.967      | 57        | 1.137        | 97    | 1.323      | 137   | 1.526      |       |            |
| - 22  | 0.817      | 18    | 0.971      | 58        | 1.141        | 98    | 1.328      | 138   | 1.531      |       |            |
| - 21  | 0.821      | 19    | 0.975      | 59        | 1.146        | 99    | 1.333      | 139   | 1.536      |       |            |

**RATIO FORMULA**

$$R_T = R_{25} \times (9.0014 \times 10^{-1} + 3.87235 \times 10^{-3} (^\circ\text{C})^{-1} \times T + 4.86825 \times 10^{-6} (^\circ\text{C})^{-2} \times T^2 + 1.37559 \times 10^{-9} (^\circ\text{C})^{-3} \times T^3)$$

$$T(^{\circ}\text{C}) = 28.54 \times (R_T/R_{25})^3 - 158.5 \times (R_T/R_{25})^2 + 474.8 \times (R_T/R_{25}) - 319.85$$

**RATIO TOLERANCES**

| LOW TEMP. | HIGH TEMP. | TOL.    |
|-----------|------------|---------|
| - 55 °C   | + 150 °C   | ± 4 %   |
| - 40 °C   | + 125 °C   | ± 3 %   |
| - 20 °C   | + 85 °C    | ± 2 %   |
| 0 °C      | + 55 °C    | ± 1 %   |
| + 12 °C   | + 40 °C    | ± 0.5 % |

**Ratio Tolerance Examples:**

At 40 °C, ratio =  $1.063 \pm 0.5 \%$  (0.005)

so, ratio = 1.058 to 1.068

At 125 °C, ratio =  $1.460 \pm 3 \%$  (0.044)

so, ratio = 1.416 to 1.504





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