

# Radial Leaded PTC - Nickel Thin Film Linear Thermistors



## DESCRIPTION

These thermistors are based on a Nickel thin film resistor technology as thermal sensitive material. The device consists of a thin film ceramic chip with two tinned copper clad steel wire leads.

## FEATURES

- Nickel thin film PTC element
- High stability over the entire temperature range
- cUL recognized component: File E148885
- Epoxy coated UL 94 V-0 approved
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT

## APPLICATIONS

Temperature measurement, sensing, compensation and control in industrial and consumer applications. For on-board or remote sensing.

## MARKING

The thermistors are laser marked with value and tolerance reference on an epoxy based coating.  
(Example: 102F = 10 x 10<sup>2</sup> = 1000 Ω 1 %)

## MOUNTING

By soldering or welding in any position.

| QUICK REFERENCE DATA  |                               |           |       |
|---|-------------------------------|-----------|-------|
| PARAMETER   | VALUE                         |           | UNIT  |
| DESCRIPTION   | TFPTL10                       | TFPTL15   |       |
| Resistance value at 25 °C <sup>(2)</sup>                              | 100 to 1K                     | 100 to 5K | Ω     |
| Tolerance on R <sub>25</sub> -value <sup>(2)</sup>                    | ± 1; ± 5                      |           | %     |
| TCR at 25 °C  | 4110                          |           | ppm/K |
| Tolerance on TCR at 25 °C <sup>(1)</sup>                              | ± 400                         |           | ppm/K |
| Operating temperature range:<br>at rated power<br>at zero dissipation | - 55 to + 70<br>- 55 to + 150 |           | °C    |
| Response time (in oil)  | ≈ 1.1                         | ≈ 1.6     | s     |
| Dissipation factor δ (for information only)                           | 2.9                           | 3.4       | mW/K  |
| Maximum rated power at 70 °C (P <sub>70</sub> )                       | 75                            | 100       | mW    |
| Maximum working voltage RCWV <sup>(3)</sup>                           | 30                            | 40        | V     |
| Climatic category (LCT/UCT/days)                                      | 55/150/56                     |           | -     |
| Weight  | 0.12                          | 0.14      | g     |

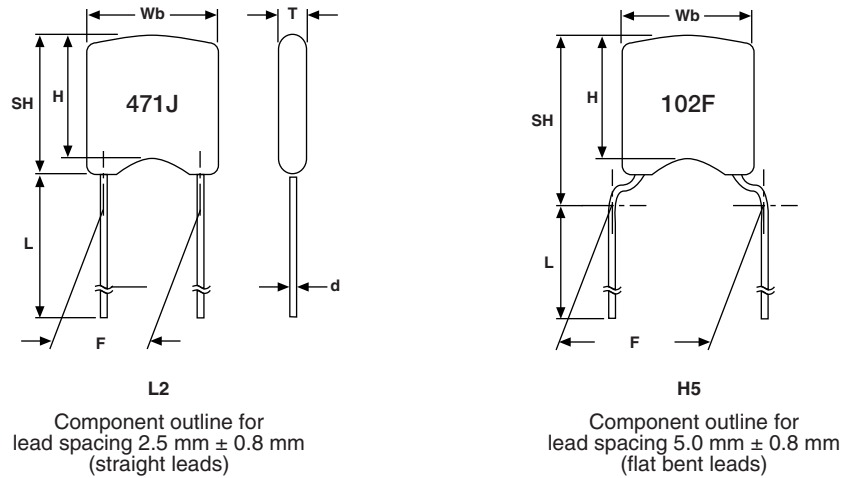
| STANDARD RESISTANCE VALUES at 25 °C in Ω <sup>(2)</sup> |     |     |     |     |     |      |      |      |      |      |
|---|-----|-----|-----|-----|-----|------|------|------|------|------|
| 100   | 150 | 220 | 330 | 470 | 680 | 1K   | 1.5K | 2.2K | 3.3K | 4.7K |
| 120   | 180 | 270 | 390 | 560 | 820 | 1.2K | 1.8K | 2.7K | 3.9K | 5.0K |

### Notes

- (1) Contact Vishay if closer TCR lot tolerance is desired
- (2) Other R<sub>25</sub>-values and tolerances are available upon request
- (3) Rated continuous working voltage is maximum working voltage or  $\sqrt{P_{70} \times R}$ , whichever is less

| GLOBAL PART NUMBER INFORMATION          |          |                |   |                                       |   |   |                        |                    |   |  |   |   |   |   |   |
|---|----------|----------------|---|---------------------------------------|---|---|------------------------|--------------------|---|--|---|---|---|---|---|
| Global Part Numbering: TFPTL10L1001FL2B |          |                |   |                                       |   |   |                        |                    |   |  |   |   |   |   |   |
| T                                       | F        | P              | T | L                                     | 1 | 0 | L                      | 1                  | 0 | 0  | 1 | F | L | 2 | B |
| PRODUCT TYPE                            | SIZE     | CHARACTERISTIC |   | RESISTANCE VALUE                      |   |   | TOLERANCE              | LEAD CONFIGURATION |   | PACKAGING  |   |   |   |   |   |
| TFPT<br>Leaded                          | 10<br>15 | L = Linear     |   | 1000 = 100R<br>1001 = 1K<br>5001 = 5K |   |   | F = ± 1 %<br>J = ± 5 % | L2<br>H5           |   | B = Bulk (500 pieces)<br>U = Ammopack (2500 pieces)<br>T = T/R (4000 pieces) |   |   |   |   |   |

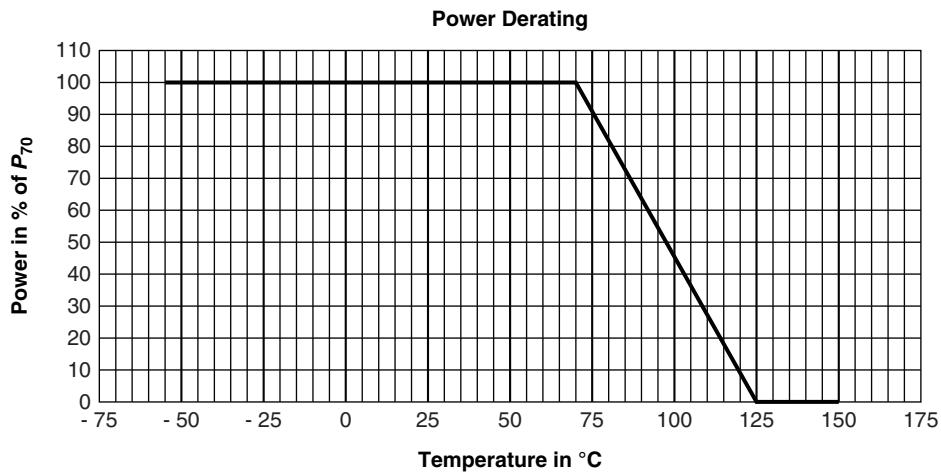
**DIMENSIONS**



| TFPTL DIMENSIONS in millimeters     |            |           |           |           |
|-------------------------------------|------------|-----------|-----------|-----------|
|                                     | SIZE L10   |           | SIZE L15  |           |
|                                     | L2         | H5        | L2        | H5        |
| Wb <sub>max.</sub>                  | 3.6        |           | 4.0       |           |
| H <sub>max.</sub>                   | 3.5        |           | 3.8       |           |
| SH <sub>max.</sub> (seating height) | 5.0        | 6.2       | 5.2       | 6.5       |
| d                                   | 0.5 ± 10 % |           |           |           |
| L                                   | 25 min.    |           |           |           |
| F                                   | 2.5 ± 0.8  | 5.0 ± 0.8 | 2.5 ± 0.8 | 5.0 ± 0.8 |
| T <sub>max.</sub>                   | 2.2        |           | 2.4       |           |

**Notes**

- Bulk packed types have a standard lead length L = 25 mm minimum
- Thickness is defined as “T”



**Note**

- Zero power is considered as measuring power max. 1 % of rated power P<sub>70</sub>



| PERFORMANCE  |                                    |
|--|------------------------------------|
| TEST   | MAXIMUM $\Delta R_{25}/R_{25}$ (1) |
| Storage dry heat (5000 h at 125 °C)                                | ± 0.25 %                           |
| High temperature exposure (1000 h at 150 °C)                       | ± 0.3 %                            |
| Damp heat steady state, unloaded (1344 h at 40 °C/95 % RH)         | ± 0.2 %                            |
| Thermal cycling (15 min at - 55 °C, 15 min at 150 °C, 100 cycles)  | ± 0.2 %                            |
| Thermal cycling (15 min at - 55 °C, 15 min at 125 °C, 1000 cycles) | ± 0.2 %                            |
| Short time overload (2.5 x $P_{70}$ for 60s at 70 °C)              | ± 0.2 %                            |
| Long term dissipation (1000 h rated power at 70 °C)                | ± 0.2 %                            |
| Resistance to soldering heat (10 s at 260 °C)                      | ± 0.25 %                           |

Note

(1) TFPTs are ESD sensitive

| AVERAGE RATIO $R/R_{25}$ TFPTL ALL SIZES AND VALUES |            |       |            |           |              |       |            |       |            |
|---|------------|-------|------------|-----------|--------------|-------|------------|-------|------------|
| 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      |
| - 54  | 0.705      | - 14  | 0.847      | 26        | 1.004        | 66    | 1.177      | 106   | 1.367      |
| - 53  | 0.708      | - 13  | 0.851      | 27        | 1.008        | 67    | 1.182      | 107   | 1.372      |
| - 52  | 0.712      | - 12  | 0.854      | 28        | 1.012        | 68    | 1.186      | 108   | 1.377      |
| - 51  | 0.715      | - 11  | 0.858      | 29        | 1.017        | 69    | 1.191      | 109   | 1.382      |
| - 50  | 0.719      | - 10  | 0.862      | 30        | 1.021        | 70    | 1.196      | 110   | 1.387      |
| - 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**

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

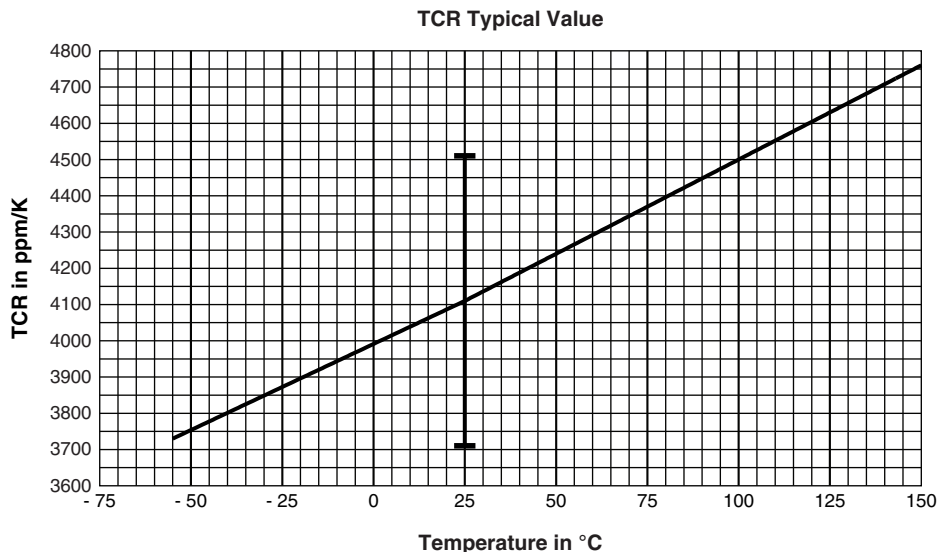
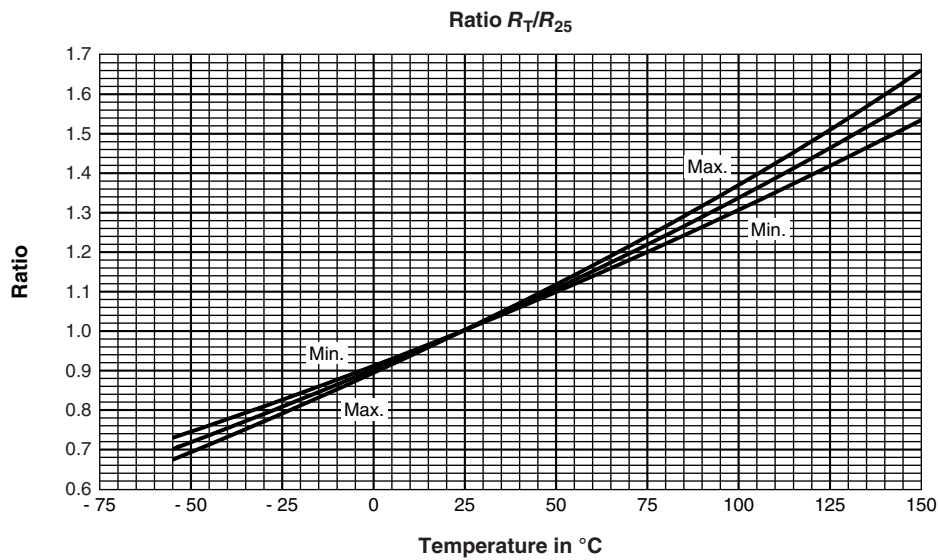
$$T(\text{°C}) = 28.54 \times (R_T/R_{25})^3 - 158.5 \times (R_T/R_{25})^2 + 474.8 \times (R_T/R_{25}) - 319.85$$

| 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 ± 0.5 % (0.005)  
so, ratio = 1.058 to 1.068

At 125 °C, ratio = 1.460 ± 3 % (0.044)  
so, ratio = 1.416 to 1.504





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#### Как с нами связаться

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