

Radial Leaded PTC - Nickel Thin Film Linear Thermistors



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
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


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 = $10 \times 10^2 = 1000 \Omega \pm 1\%$)

MOUNTING

By soldering or welding in any position.

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.

QUICK REFERENCE DATA

| PARAMETER | VALUE | | UNIT |
|---|---------------------------|---------------|----------|
| DESCRIPTION | TFPTL10 | TFPTL15 | |
| Resistance value at 25 °C ⁽²⁾ | 100 to 1K | 100 to 5K | Ω |
| Tolerance on R_{25} -value ⁽²⁾ | $\pm 1; \pm 5$ | | % |
| TCR at 25 °C | 4110 | | ppm/K |
| Tolerance on TCR at 25 °C ⁽¹⁾ | ± 400 | | ppm/K |
| Operating temperature range: at rated power at zero dissipation | -55 to +70 -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_{70}) | 75 | 100 | mW |
| Maximum working voltage RCWW ⁽³⁾ | 30 | 40 | V |
| Climatic category (LCT/UCT/days) | 55/150/56 | | - |
| Weight | 0.12 | 0.14 | g |

Notes

- (1) Contact Vishay if closer TCR lot tolerance is desired
- (2) Other R_{25} -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

STANDARD RESISTANCE VALUES at 25 °C in Ω

| | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 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 |

Note

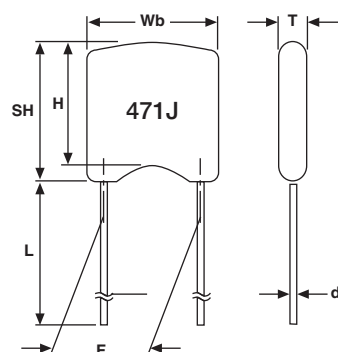
- Other R_{25} -values and tolerances are available upon request

GLOBAL PART NUMBER INFORMATION

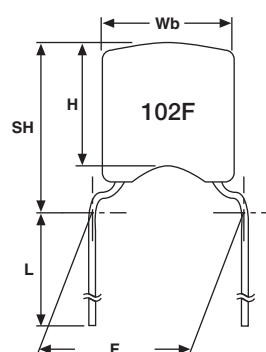
Global Part Numbering: TFPTL10L1001FL2B

| | | | | | | | | | | | | | | | |
|----------------|----------|-----------------|---------------------------------------|--------------------------------|--------------------|--|---|---|---|---|---|---|---|---|---|
| T | F | P | T | L | 1 | 0 | L | 1 | 0 | 0 | 1 | F | L | 2 | B |
| PRODUCT TYPE | SIZE | CHARACTERISTICS | RESISTANCE VALUE | TOLERANCE | LEAD CONFIGURATION | PACKAGING | | | | | | | | | |
| TFPT Leaded | 10 15 | L = Linear | 1000 = 100R 1001 = 1K 5001 = 5K | F = $\pm 1\%$ J = $\pm 5\%$ | L2 H5 | B = Bulk (500 pieces) U = Ammopack (2500 pieces) T = T/R (4000 pieces) | | | | | | | | | |

DIMENSIONS


L2

Component outline for
lead spacing $2.5 \text{ mm} \pm 0.8 \text{ mm}$
(straight leads)

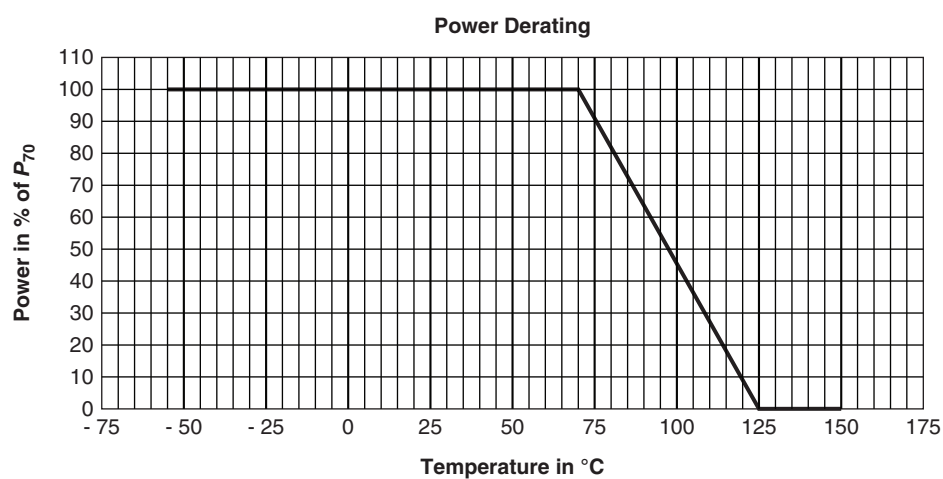

H5

Component outline for
lead spacing $5.0 \text{ mm} \pm 0.8 \text{ mm}$
(flat bent leads)

| TFPTL DIMENSIONS in millimeters | | | | |
|-------------------------------------|-----------------|---------------|---------------|---------------|
| | SIZE L10 | | SIZE L15 | |
| | L2 | H5 | L2 | H5 |
| $Wb_{\text{max.}}$ | 3.6 | | 4.0 | |
| $H_{\text{max.}}$ | 3.5 | | 3.8 | |
| $SH_{\text{max.}}$ (seating height) | 5.0 | 6.2 | 5.2 | 6.5 |
| d | $0.5 \pm 10 \%$ | | | |
| L | 25 min. | | | |
| F | 2.5 ± 0.8 | 5.0 ± 0.8 | 2.5 ± 0.8 | 5.0 ± 0.8 |
| $T_{\text{max.}}$ | 2.2 | | 2.4 | |

Notes

- Bulk packed types have a standard lead length $L = 25 \text{ mm}$ minimum
- Thickness is defined as "T"



Note

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



| 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} | 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 | 25 | 1.000 | 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**

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

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

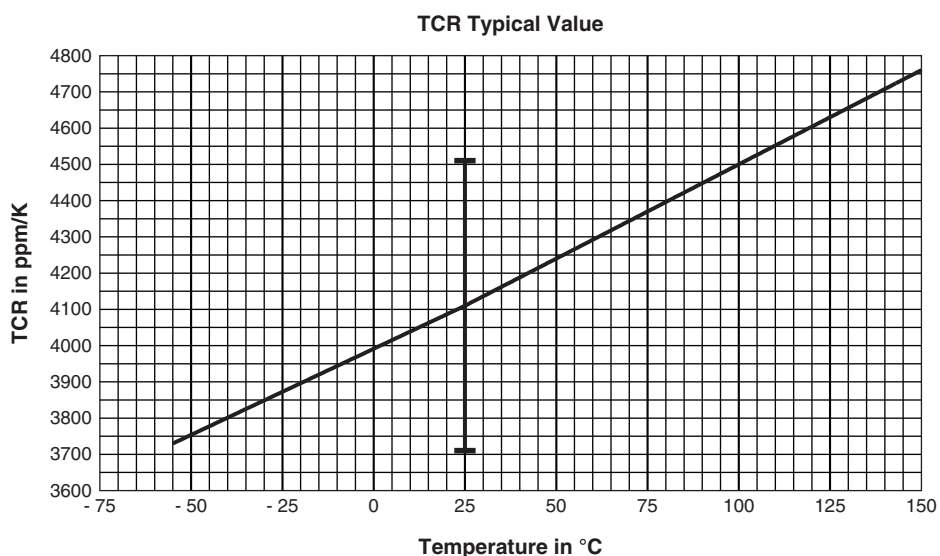
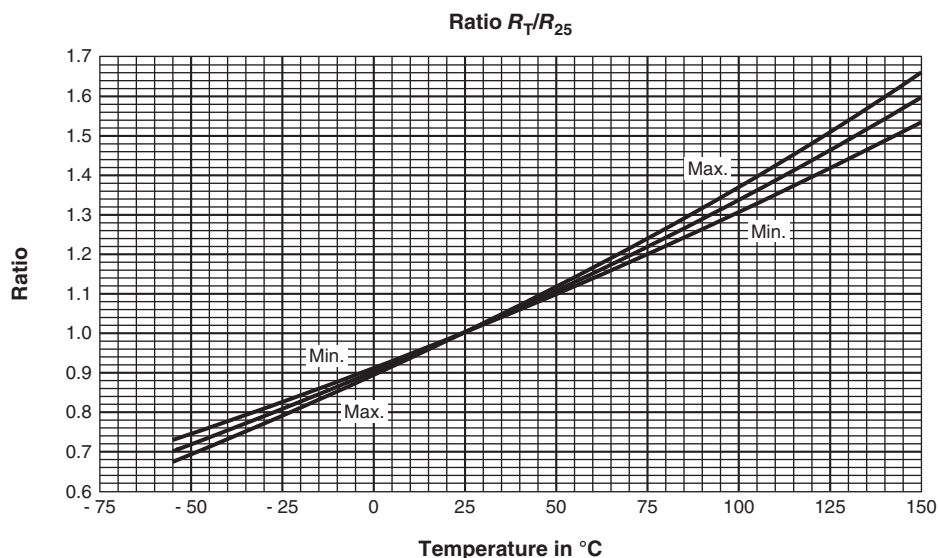
RATIO TOLERANCES

| 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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