

## NTC Thermistors, Radial Leaded and Coated



### FEATURES

- Small size - conformally coated
- Wide resistance range
- Available in 7 different R-T curves
- Available in point matched tolerances down to 1 % and curve tracking precision down to  $\pm 0.2$  °C
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

| QUICK REFERENCE DATA                                   |                           |          |
|--|---------------------------|----------|
| PARAMETER  | VALUE                     | UNIT     |
| Resistance value at 25 °C                              | 30 to 1M                  | $\Omega$ |
| Tolerance on $R_{25}$ -value (point matched)           | $\pm 1, \pm 5, \pm 10$    | %        |
| Temperature accuracy (curve tracking)                  | $\pm 0.2, \pm 0.5, \pm 1$ | °C       |
| $B_{25/75}$ -value                                     | 3477 to 4842              | K        |
| $B_{25/85}$ -value                                     | 3468 to 4875              | K        |
| Maximum dissipation                                    | 50 to 100                 | mW       |
| Dissipation factor $\delta$ (for information only)     | 2 to 3.5                  | mW/K     |
| Thermal time constant $\tau$ (for information only)    | 6 to 14                   | s        |
| Response time (oil) (for information only)             | 1.3                       | s        |
| Operating temperature range at zero power (short term) | - 40 to + 125 (150)       | °C       |
| Weight   | $\approx 0.075$ to 0.15   | g        |

### APPLICATIONS

Temperature measurement, sensing and control in industrial, consumer and telecom applications. For on-board sensing or for accurate remote sensing in metal probes or housings.

### DESCRIPTION

Models T, M, and C are conformally coated, leaded thermistors. The coating is baked-on phenolic for durability and long-term stability. Models M and C have tinned solid copper leads. Model T has solid nickel wires with Teflon® insulation.

### DESIGN-IN SUPPORT

For complete Curve Computation, visit:  
[www.vishay.com/resistors-non-linear/curve-computation-list/](http://www.vishay.com/resistors-non-linear/curve-computation-list/)

| T, M, C PRODUCT DATA AND $R_{25}$ RESISTANCE RANGE AVAILABILITY |                 |                 |                  |                 |                 |                 |                                |
|---|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|--------------------------------|
| CURVE   | $B_{25/75}$ (K) | $B_{25/85}$ (K) | $TCR_{25}$ (%/K) | T (k $\Omega$ ) | M (k $\Omega$ ) | C (k $\Omega$ ) | $R_{25} \pm$ TOL. AVAILABILITY |
| 2   | 3477            | 3486            | - 3.84           | 0.03 to 3.3     |                 |                 | 1, 5, 10                       |
| 9   | 3679            | 3694            | - 4.03           | 10 to 56        |                 |                 | 1, 5, 10                       |
| 8   | 3925            | 3943            | - 4.30           | 20 to 220       |                 |                 | 1, 5, 10                       |
| 1   | 3964            | 3974            | - 4.39           | 0.2 to 18       |                 |                 | 1, 5, 10                       |
| 4   | 4247            | 4262            | - 4.67           | 10 to 100       |                 |                 | 1, 5, 10                       |
| 7   | 4437            | 4461            | - 4.83           | 10 to 270       |                 |                 | 1, 5, 10                       |
| 12  | 4842            | 4875            | - 5.23           | 47 to 1000      |                 |                 | 1, 5, 10                       |
| Maximum dissipation at 25 °C in mW                              |                 |                 |                  | 50              | 75              | 100             |                                |
| Dissipation factor in mW/K <sup>(1)</sup>                       |                 |                 |                  | 2.0             | 2.5             | 3.0             |                                |
| Response time in s <sup>(1)</sup>                               |                 |                 |                  | 1.3             | 1.2             | 1.4             |                                |
| Thermal time constant in s <sup>(1)</sup>                       |                 |                 |                  | 14              | 10              | 6               |                                |

#### Note

<sup>(1)</sup> For information only, dissipation factor, response time, and thermal time constant are wire type and product size dependent.

| STANDARD RESISTANCE VALUES at 25 °C in $\Omega$ |     |     |      |      |      |     |      |      |      |
|---|-----|-----|------|------|------|-----|------|------|------|
| 33  | 82  | 270 | 680  | 2.2K | 5.6K | 18K | 50K  | 150K | 500K |
| 39  | 100 | 330 | 820  | 2.7K | 6.8K | 22K | 56K  | 220K | 560K |
| 47  | 120 | 390 | 1K   | 3.3K | 8.2K | 27K | 68K  | 270K | 680K |
| 50  | 150 | 470 | 1.2K | 3.9K | 10K  | 33K | 82K  | 330K | 820K |
| 56  | 180 | 500 | 1.5K | 4.7K | 12K  | 39K | 100K | 390K | 1M   |
| 68  | 220 | 560 | 1.8K | 5.0K | 15K  | 47K | 120K | 470K |      |

#### Note

- Most popular and available values, intermediate resistance values and tolerances available on request.

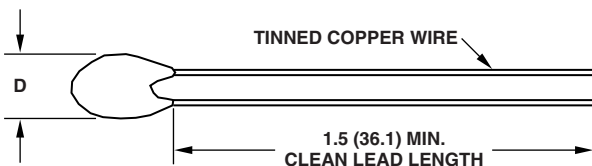
| GLOBAL PART NUMBER AND ORDERING INFORMATION                       |   |              |   |                          |   |                                      |   |  |   |   |  |  |  |
|---|---|--------------|---|--------------------------|---|--------------------------------------|---|--|---|---|--|--|--|
| Global Part Numbering: 01C2001FP for POINT MATCHED THERMISTORS    |   |              |   |                          |   |                                      |   |  |   |   |  |  |  |
| 0   | 1 | C            | 2 | 0                        | 0 | 1                                    | F | P  |   |   |  |  |  |
| CURVE NR  |   | GLOBAL MODEL |   | RESISTANCE VAL           |   | POINT MATCH TOLERANCE                |   | PACKAGING                                      |   |   |  |  |  |
| 01<br>02<br>04<br>07<br>08<br>09<br>12                            |   | T<br>M<br>C  |   | 2001 = 2K<br>1503 = 150K |   | F = ± 1 %<br>J = ± 5 %<br>K = ± 10 % |   | F = Lead (Pb)-free, bulk<br>P = Tin/lead, bulk |   |   |  |  |  |
| Global Part Numbering: 01C2001SPC3 for CURVE TRACKING THERMISTORS |   |              |   |                          |   |                                      |   |  |   |   |  |  |  |
| 0   | 1 | C            | 2 | 0                        | 0 | 1                                    | S | P  | C | 3   |  |  |  |
| CURVE   |   | GLOBAL MODEL |   | RESISTANCE VAL           |   | CHARACTERISTICS                      |   | PACKAGING                                      |   | CURVE TRACK TOLERANCE (1)                       |  |  |  |
| 01<br>02<br>04<br>08<br>09  |   | T<br>M<br>C  |   | 2001 = 2K                |   | S                                    |   | F = Lead (Pb)-free, bulk<br>P = Tin/lead, bulk |   | A2 A3 A4 A5 A8<br>B2 B3 B4 B5 B8<br>C2 C3 C5 C8 |  |  |  |

**Note**

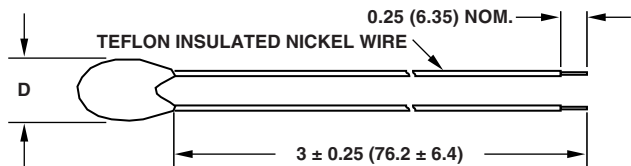
(1) See following pages for tolerance explanations and details.

**DIMENSIONS** in inches (millimeters)

TYPE M, C



TYPE T



| PRODUCT TYPE | WIRE GAUGE/DIAMETER (2)          |
|--------------|----------------------------------|
| Type M       | AWG 30: 0.0100 (0.254)           |
| Type C       | AWG 28: 0.0126 (0.320)           |
| Type T       | Insulated AWG 30: 0.0100 (0.254) |

**Note**

 (2) Additional wire gauges (non-insulated) available as AWG24 (type E), AWG26 (type B) and AWG32 (type F). Please contact vishay ([thermistor1@vishay.com](mailto:thermistor1@vishay.com)) for further details.

| CURVE NUMBER | R <sub>25</sub> MIN. (Ω) | MAX. DIAMETER (INCH (mm)) | STANDARD R <sub>25</sub> RANGE (Ω) | MAX. DIAMETER (INCH (mm))    |
|--------------|--------------------------|---------------------------|------------------------------------|------------------------------|
| 2            | 30                       | 0.342 (8.69)              | 330 to 3K                          | 0.095 (2.41) to 0.136 (3.45) |
| 9            | 10K                      | 0.150 (3.81)              | 10K to 56K                         | 0.095 (2.41) to 0.150 (3.81) |
| 8            | 20K                      | 0.131 (3.33)              | 27K to 220K                        | 0.095 (2.41) to 0.125 (3.18) |
| 1            | 200                      | 0.315 (8.00)              | 1.8K to 18K                        | 0.095 (2.41) to 0.136 (3.45) |
| 4            | 10K                      | 0.136 (3.45)              | 10K to 100K                        | 0.095 (2.41) to 0.136 (3.45) |
| 7            | 10K                      | 0.177 (4.50)              | 27K to 270K                        | 0.095 (2.41) to 0.136 (3.45) |
| 12           | 47K                      | 0.252 (6.40)              | 330K to 1M                         | 0.095 (2.41) to 0.136 (3.45) |

**Note**

 (3) Maximum body diameter is dependent on selected curve number and value, the lower resistance values have the largest diameter. For a specific part number within the given resistance ranges, please contact [thermistor1@vishay.com](mailto:thermistor1@vishay.com) for maximum diameter information.



**TOLERANCES AVAILABLE FOR TYPE T, M, AND C THERMISTORS**

**DESCRIPTION OF THERMISTOR TOLERANCES**

The many applications of thermistors have mandated the need for two basic tolerance schemes for these products - curve tracking and point match thermistors. An example of the resistance tolerance at various temperatures for the two different tolerancing methods is described in the following graph:

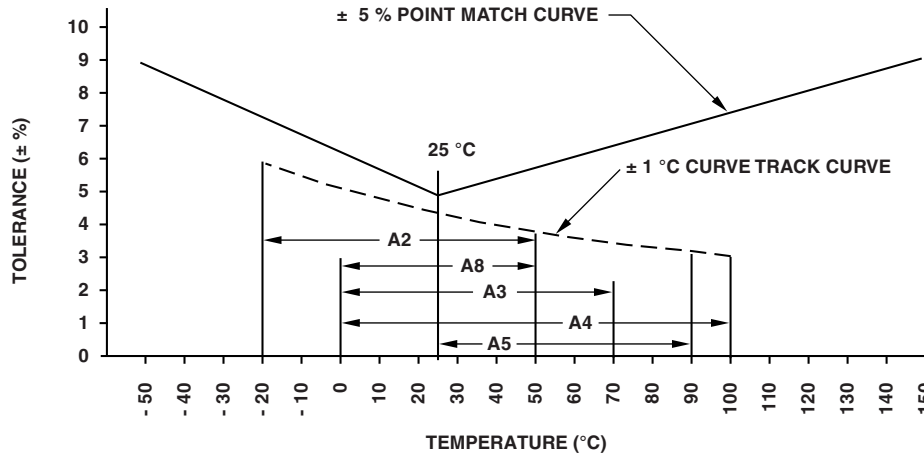


Fig. 1

**CURVE TRACKING TOLERANCE**

Thermistors are calibrated at the high temperature of the curve track range and then final tested at the low temperature of the curve track range. This ensures that the thermistor will meet the specified temperature accuracy at every temperature within the desired temperature range. Several temperature ranges are available and the accuracy of the thermistor may be  $\pm 0.2^\circ\text{C}$ ,  $\pm 0.5^\circ\text{C}$ , and  $\pm 1.0^\circ\text{C}$ . The curve tracking temperature ranges and their code designators are shown in figure 1 and "Standard Electrical Specifications for Curve Tracking Thermistors" table.

To specify, add the appropriate suffix from the following table to the part number.

Example: 01M1002SFB3 = curve 1, 10 k $\Omega$  at + 25  $^\circ\text{C}$ , curve tracking to  $\pm 0.5^\circ\text{C}$  from 0  $^\circ\text{C}$  to + 70  $^\circ\text{C}$

| <b>STANDARD ELECTRICAL SPECIFICATIONS FOR CURVE TRACKING THERMISTORS</b> |    |   |                         |                         |  |                         |                         |  |                         |                         |  |                         |                         |   |                         |                         |
|--|----|---|-------------------------|-------------------------|--|-------------------------|-------------------------|--|-------------------------|-------------------------|--|-------------------------|-------------------------|---|-------------------------|-------------------------|
| TEMPERATURE RANGE FOR SPECIFIED ACCURACY                                 |    | 0 $^\circ\text{C}$ to + 70 $^\circ\text{C}$ |                         |                         | - 20 $^\circ\text{C}$ to + 50 $^\circ\text{C}$ |                         |                         | 0 $^\circ\text{C}$ to + 100 $^\circ\text{C}$ |                         |                         | 25 $^\circ\text{C}$ to + 90 $^\circ\text{C}$ |                         |                         | 0 $^\circ\text{C}$ to + 50 $^\circ\text{C}$ |                         |                         |
| ACCURACY   |    | $\pm 1^\circ\text{C}$                       | $\pm 0.5^\circ\text{C}$ | $\pm 0.2^\circ\text{C}$ | $\pm 1^\circ\text{C}$                          | $\pm 0.5^\circ\text{C}$ | $\pm 0.2^\circ\text{C}$ | $\pm 1^\circ\text{C}$                        | $\pm 0.5^\circ\text{C}$ | $\pm 0.2^\circ\text{C}$ | $\pm 1^\circ\text{C}$                        | $\pm 0.5^\circ\text{C}$ | $\pm 0.2^\circ\text{C}$ | $\pm 1^\circ\text{C}$                       | $\pm 0.5^\circ\text{C}$ | $\pm 0.2^\circ\text{C}$ |
| PART NO. SUFFIX  |    | - A3  | - B3                    | - C3                    | - A2   | - B2                    | - C2                    | - A4   | - B4                    | - C4                    | - A5   | - B5                    | - C5                    | - A8  | - B8                    | - C8                    |
| CURVE NUMBER   | 01 | X   | X                       | X                       | X  | X                       | X                       | X  | X                       | n/a                     | X  | X                       | X                       | X   | X                       | X                       |
|  | 02 | X   | X                       | X                       | X  | X                       | n/a                     | X  | X                       | n/a                     | X  | X                       | X                       | X   | X                       | X                       |
|  | 04 | X   | X                       | X                       | X  | X                       | X                       | X  | X                       | n/a                     | X  | X                       | X                       | X   | X                       | X                       |
|  | 08 | X   | X                       | X                       | X  | X                       | X                       | X  | X                       | n/a                     | X  | X                       | X                       | X   | X                       | X                       |
|  | 09 | X   | X                       | X                       | X  | X                       | X                       | X  | X                       | n/a                     | X  | X                       | X                       | X   | X                       | X                       |

## POINT MATCH TOLERANCE

The standard leaded thermistors are calibrated and tested at 25 °C to a tolerance of  $\pm 5\%$  or  $\pm 10\%$ ; however, tighter tolerance, point matched thermistors are readily available as are special point match temperatures to fit your application.

Since these thermistors have only one controlled point of reference (the point match temperature), the resistance at other temperatures is given by the specific curve resistance vs. temperature ratio.

## POINT MATCH TOLERANCES VS. TEMPERATURE

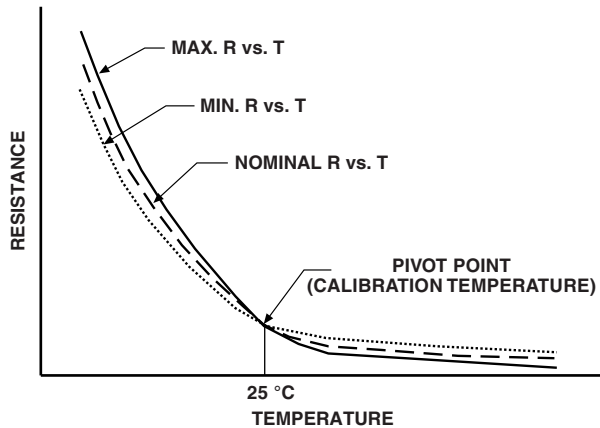


Fig. 2

Point match resistance tolerances at temperatures other than 25 °C are not the same as at the calibration temperature. This difference is presented in figure 2.

The tolerance at any given temperature is the point match tolerance plus a manufacturing tolerance depending on the specific curve.

## DESIGN-IN SUPPORT

A spreadsheet is available for the Vishay thermistor part numbers that gives you the resistance vs temperature data, the temperature coefficients and accuracy levels at any given temperature range and step. The Steinhart & Hart formula and coefficients A, B, and C are shown as well. This data can be obtained by visiting the Vishay NTC curve computation page at: [www.vishay.com/resistors-non-linear/ntc-curve-list/](http://www.vishay.com/resistors-non-linear/ntc-curve-list/) or send your part number with required temperature range and step to [thermistor1@vishay.com](mailto:thermistor1@vishay.com).



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