

## NTC Thermistors, Coated



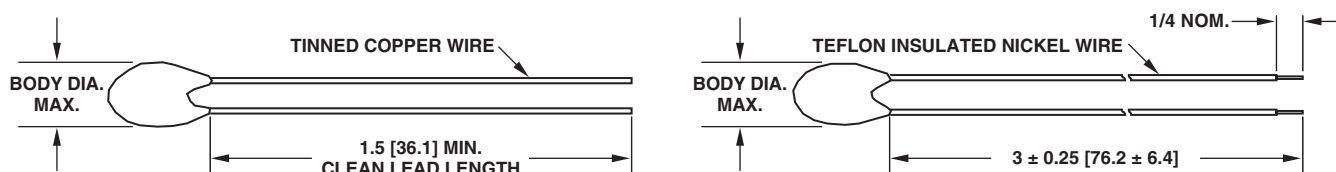
### FEATURES

- Small size - conformally coated
- Wide resistance range
- Available in 11 different R-T curves

### DESCRIPTION

Models M, C, and T are conformally coated, leaded thermistors for standard PC board mounting or assembly in probes. 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 to provide isolation when assembled in metal probes or housings.

### DIMENSIONS in inches [millimeters]



| LD DIAMETER | WIRE SIZE              |
|-------------|------------------------|
| Type M      | AWG 30: 0.0100 [0.254] |
| Type C      | AWG 28: 0.0126 [0.320] |
| Type T      | AWG 30: 0.0100 [0.254] |

### GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: 01C2001FP (preferred part numbering format)

0 1 C 2 0 0 1 F P

CURVE  
01  
02  
03  
04  
07  
08  
09  
12  
13  
14  
17

GLOBAL MODEL  
C  
M  
T

RESISTANCE VALUE  
2001 = 2K

POINT MATCH TOLERANCE  
F = ± 1 %  
J = ± 5 %  
K = ± 10 %

PACKAGING  
F = Lead (Pb)-free, Bulk  
P = Tin/Lead, Bulk

Historical Part Number example: 1C2001FP (will continue to be accepted)

01

C

2001

F

P

HISTORICAL CURVE

GLOBAL MODEL

RESISTANCE VALUE

TOLERANCE CODE

PACKAGING

New Global Part Numbering: 01C2001SPC3 (preferred part numbering format)

0 1 C 2 0 0 1 S P C 3

CURVE  
01  
02  
03  
04  
07  
08  
09  
12  
13  
14  
17

GLOBAL MODEL  
C  
M  
T

RESISTANCE VALUE  
2001 = 2K

CHARACTERISTICS  
S

PACKAGING  
F = Lead (Pb)-free, Bulk  
P = Tin/Lead, Bulk

CURVE TRACK TOLERANCE\*  
A3  
B3  
C3  
A2  
B2  
C2  
A4  
B4  
A5  
B5  
C5  
A8  
B8  
C8

\* See following pages for Tolerance explanations and details.

Historical Part Number example: 1C2001SPC3 (will continue to be accepted)

01

C

2001

S

P

C3

HISTORICAL CURVE

GLOBAL MODEL

RESISTANCE VALUE

CHARACTERISTIC

PACKAGING

CURVE TRACK TOLERANCE

**SELECTION GUIDE FOR TYPE M, C, AND T THERMISTORS**

| R <sub>25</sub><br>(Ω) | CURVE NUMBER |     |     |     |     |     |     |     |     |     |
|------------------------|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                        | 1            | 2   | 3   | 4   | 7   | 8   | 9   | 12  | 14  | 17  |
| 27                     |              |     |     |     |     |     |     |     | •   |     |
| 33                     |              |     |     |     |     |     |     |     | ••  |     |
| 50                     |              |     |     |     |     |     |     |     | ••• |     |
| 56                     |              |     |     |     |     |     |     |     | ••• |     |
| 68                     |              |     | •   |     |     |     |     |     | ••• |     |
| 82                     |              |     | ••  |     |     |     |     |     | ••• |     |
| 100                    |              |     | ••  |     |     |     |     |     | ••• |     |
| 120                    |              |     | ••  |     |     |     |     |     | ••• |     |
| 150                    |              |     | ••• |     |     |     |     |     | ••• |     |
| 180                    |              |     | ••• |     |     |     |     |     | ••• |     |
| 220                    |              |     | ••• |     |     |     |     |     | ••• |     |
| 270                    |              |     | ••• |     |     |     |     |     |     |     |
| 330                    |              | •   | ••• |     |     |     |     |     |     |     |
| 390                    |              | ••  | ••• |     |     |     |     |     |     |     |
| 470                    |              | ••  | ••• |     |     |     |     |     |     |     |
| 500                    |              | ••  | ••• |     |     |     |     |     |     |     |
| 560                    |              | ••  | ••• |     |     |     |     |     |     |     |
| 680                    |              | ••• |     |     |     |     |     |     |     |     |
| 820                    |              | ••• |     |     |     |     |     |     |     |     |
| 1K                     |              | ••• |     |     |     |     |     |     |     |     |
| 1.2K                   |              | ••• |     |     |     |     |     |     |     |     |
| 1.5K                   |              | ••• |     |     |     |     |     |     |     |     |
| 1.8K                   | •            | ••• |     |     |     |     |     |     |     |     |
| 2.2K                   | •            | ••• |     |     |     |     |     |     |     |     |
| 2.7K                   | ••           | ••• |     |     |     |     |     |     |     |     |
| 3.3K                   | ••           | ••• |     |     |     |     |     |     |     |     |
| 3.9K                   | •••          |     |     |     |     |     |     |     |     |     |
| 4.7K                   | •••          |     |     |     |     |     |     |     |     |     |
| 5K                     | •••          |     |     |     |     |     |     |     |     |     |
| 5.6K                   | •••          |     |     |     |     |     |     |     |     |     |
| 6.8K                   | •••          |     |     |     |     |     |     |     |     | •   |
| 8.2K                   | •••          |     |     |     |     |     | •   |     |     | •   |
| 10K                    | •••          |     |     | •   |     |     | ••  |     |     | ••  |
| 12K                    | •••          |     |     | •   |     |     | ••  |     |     | ••  |
| 15K                    | •••          |     |     | ••  |     |     | ••• |     |     | ••• |
| 18K                    | •••          |     |     | ••  |     |     | ••• |     |     | ••• |
| 22K                    |              |     |     | ••  |     |     | ••• |     |     | ••• |
| 27K                    |              |     |     | ••  | •   | •   | ••• |     |     | ••• |
| 33K                    |              |     |     | ••• | •   | ••  | ••• |     |     | ••• |
| 39K                    |              |     |     | ••• | ••  | ••  | ••• |     |     | ••• |
| 47K                    |              |     |     | ••• | ••  | ••• | ••• |     |     | ••• |
| 50K                    |              |     |     | ••• | ••  | ••• | ••• |     |     | ••• |
| 56K                    |              |     |     | ••• | ••• | ••• | ••• |     |     |     |
| 68K                    |              |     |     | ••• | ••• | ••• |     |     |     |     |
| 82K                    |              |     |     | ••• | ••• | ••• |     |     |     |     |
| 100K                   |              |     |     | ••• | ••• | ••• |     |     |     |     |
| 120K                   |              |     |     |     | ••• | ••• |     |     |     |     |
| 150K                   |              |     |     |     | ••• | ••• |     |     |     |     |
| 180K                   |              |     |     |     | ••• | ••• |     |     |     |     |
| 220K                   |              |     |     |     | ••• | ••• |     |     |     |     |
| 270K                   |              |     |     |     | ••• |     |     |     |     |     |
| 330K                   |              |     |     |     |     |     |     | •   |     |     |
| 390K                   |              |     |     |     |     |     |     | ••  |     |     |
| 470K                   |              |     |     |     |     |     |     | ••  |     |     |
| 500K                   |              |     |     |     |     |     |     | ••• |     |     |
| 560K                   |              |     |     |     |     |     |     | ••• |     |     |
| 680K                   |              |     |     |     |     |     |     | ••• |     |     |
| 820K                   |              |     |     |     |     |     |     | ••• |     |     |
| 1M                     |              |     |     |     |     |     |     | ••• |     |     |

**MAXIMUM BODY DIAMETER**

|     |             |
|-----|-------------|
| •   | 0.125 [3.2] |
| ••  | 0.110 [2.8] |
| ••• | 0.095 [2.4] |

**DISSIPATION CONSTANT**

2 - 3 mWatts/°C

**THERMAL TIME CONSTANT**

6 - 14 Seconds

**Notes**

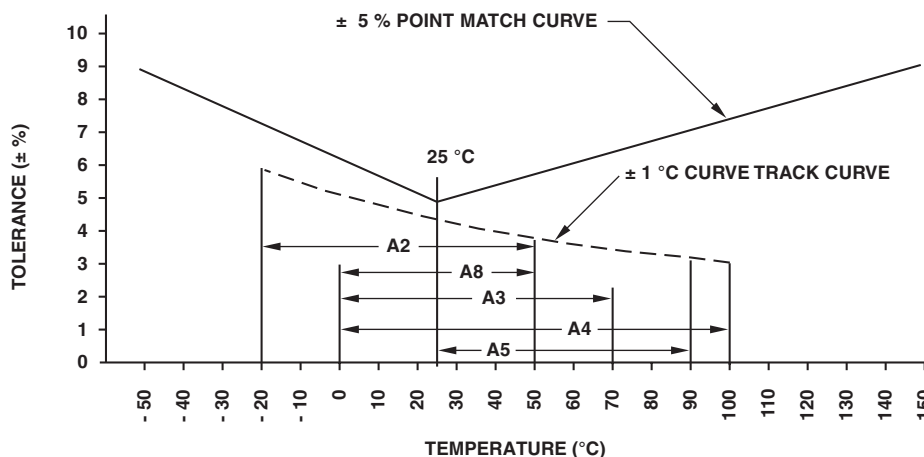
1. Intermediate resistance values between the standard value series are available. Size would be the same as the color grouping.
2. Other body diameter available. Bead diameter increases as Res. decreases. (Consult Factory)
3. Leaded series of thermistors includes additional styles: (Consult Factory)

Type B: 26AWG Lead, 0.0159 [0.40]  
Type F: 32AWG Lead, 0.008 [0.20]  
Type E: 24AWG Lead, 0.020 [0.51]  
Type D: 22AWG Lead, 0.025 [0.64]  
Type G: 20AWG Lead, 0.032 [0.81]  
Type H: 18AWG Lead, 0.040 [1.02]

## TOLERANCES AVAILABLE FOR TYPE M, C AND T 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:



### 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  $\pm 0.2\text{ }^{\circ}\text{C}$ ,  $\pm 0.5\text{ }^{\circ}\text{C}$ , and  $\pm 1.0\text{ }^{\circ}\text{C}$ . The Curve Tracking temperature ranges and their code designators are shown in Figure 1 and Table 1.

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

Example: 1M1002-B3 = Curve 1, 10 k $\Omega$  at + 25 °C, curve tracking to  $\pm 0.5\text{ }^{\circ}\text{C}$  from 0 °C to + 70 °C

| STANDARD ELECTRICAL SPECIFICATIONS FOR CURVE TRACKING THERMISTORS |   |                 |          |          |                    |          |          |                  |          |          |                  |          |          |                 |          |          |
|-------------------------------------------------------------------|---|-----------------|----------|----------|--------------------|----------|----------|------------------|----------|----------|------------------|----------|----------|-----------------|----------|----------|
| TEMP. RANGE                                                       |   | 0 °C to + 70 °C |          |          | - 20 °C to + 50 °C |          |          | 0 °C to + 100 °C |          |          | 25 °C to + 90 °C |          |          | 0 °C to + 50 °C |          |          |
| TOLERANCE                                                         |   | ± 1 °C          | ± 0.5 °C | ± 0.2 °C | ± 1 °C             | ± 0.5 °C | ± 0.2 °C | ± 1 °C           | ± 0.5 °C | ± 0.2 °C | ± 1 °C           | ± 0.5 °C | ± 0.2 °C | ± 1 °C          | ± 0.5 °C | ± 0.2 °C |
| PART NO. SUFFIX                                                   |   | - A3            | - B3     | - C3     | - A2               | - B2     | - C2     | - A4             | - B4     | - C4     | - A5             | - B5     | - C5     | - A8            | - B8     | - C8     |
| C                                                                 | 1 | X               | X        | X        | X                  | X        | X        | X                | X        | N/A      | X                | X        | X        | X               | X        | X        |
| U                                                                 | 2 | X               | X        | X        | X                  | X        | X        | X                | X        | N/A      | X                | X        | X        | X               | X        | X        |
| R                                                                 | 4 | X               | X        | X        | X                  | X        | X        | X                | X        | N/A      | X                | X        | X        | X               | X        | X        |
| V                                                                 | 8 | X               | X        | X        | X                  | X        | X        | X                | X        | N/A      | X                | X        | X        | X               | X        | X        |
| E                                                                 | 9 | X               | X        | X        | X                  | X        | X        | X                | X        | N/A      | X                | X        | X        | X               | X        | X        |

## POINT MATCH TOLERANCE

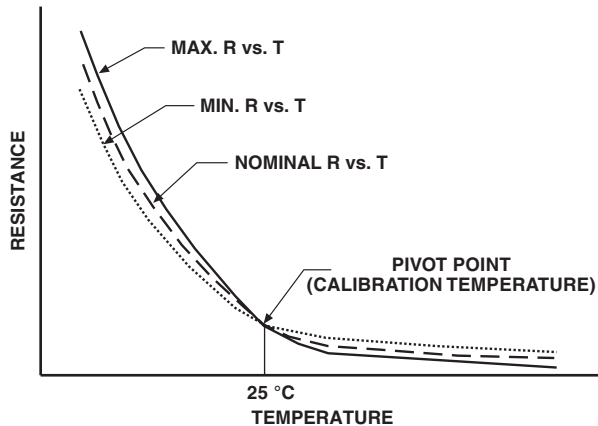
The standard leaded thermistors are calibrated and tested at 25 °C to a tolerance of  $\pm 5\%$  or  $\pm 10\%$ ; however, tighter tolerance, point matched thermistors are readily available as are special point match temperatures to fit your application.

Since these thermistors have only one controlled point of reference (the point match temperature), the resistance at other temperatures is given by the "Resistance vs. Temperature Conversion Tables" for the appropriate material curve. The resistance value at any temperature is the ratio factor times the resistance at 25 °C.

Example: 1M1002-5, + 70 °C resistance = (Resistance factor for curve 1 at 70 °C is 0.1990) x (10 000 W resistance at 25 °C) = 1990  $\Omega$ .

The tolerance of the resistance at any temperature is described by Figure 2.

**FIGURE 2**  
**POINT MATCH TOLERANCES VS. TEMPERATURE**



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

The tolerance at any given temperature is the point match tolerance + the MT  $\pm\%$  (Manufacturing Tolerance).

The MT  $\pm\%$  may be obtained from the R vs. T Conversion tables and is added to the point match temperature, i.e.,  $\pm 1\%$  Tol. at 25 °C +  $\pm 2.6\%$  at - 30 °C for Curve 1 equals a total tolerance of  $\pm 3.6\%$  at - 30 °C.

## COMPUTER AIDS FOR THERMISTOR SELECTION

A spreadsheet is available for the Vishay Thermistor Materials that calculates Beta, Steinhart-Hart Equation Constants A, B, and C, the resistance at any temperature based upon the Steinhart constants or Beta, the temperature equivalent of the resistance reading, and resistance temperature coefficients.

This spread sheet will also calculate the total resistance tolerance of any point matched thermistor for temperatures in 10 °C increments, and the resistance tolerance at any temperature within the calibrated range of curve tracking thermistors. Please contact factory if interested in this Excel™ spreadsheet.



### Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.