

## NTC Thermistors, Radial Leaded and Coated



### FEATURES

- Small size - conformally coated
- Wide resistance range
- Available in 11 different R-T curves
- Available in point matched and curve tracking precision down to  $\pm 0.2\text{ }^{\circ}\text{C}$

### 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<sup>®</sup> insulation to provide isolation when assembled in metal probes or housings.

### DIMENSIONS in inches (millimeters)



PRODUCT TYPE	WIRE GAUGE/DIAMETER
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

Global Part Numbering: 01C2001FP for POINT MATCHED THERMISTORS

0 1 C 2 0 0 1 F F

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 = $\pm 1\%$
J = $\pm 5\%$
K = $\pm 10\%$

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

Global Part Numbering: 01C2001SPC3 for CURVE TRACKING THERMISTORS

0 1 C 2 0 0 1 S F C 3

CURVE
01
02
04
08
09
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 <sup>(1)</sup>
A2
B2
C2
A3
B3
C3
A4
B4
A5
B5
C5
A8
B8
C8

**Note**

<sup>(1)</sup> See following pages for tolerance explanations and details.



SELECTION GUIDE FOR TYPE M, C, AND T THERMISTORS										
R <sub>25</sub> (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 mW/°C to 3 mW/°C

**THERMAL TIME CONSTANT**

6 s to 14 s

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

<b>STANDARD ELECTRICAL SPECIFICATIONS FOR CURVE TRACKING THERMISTORS</b>																
TEMP. RANGE		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 $^\circ\text{C}$		
TOLERANCE		$\pm 1\text{ }^\circ\text{C}$	$\pm 0.5\text{ }^\circ\text{C}$	$\pm 0.2\text{ }^\circ\text{C}$	$\pm 1\text{ }^\circ\text{C}$	$\pm 0.5\text{ }^\circ\text{C}$	$\pm 0.2\text{ }^\circ\text{C}$	$\pm 1\text{ }^\circ\text{C}$	$\pm 0.5\text{ }^\circ\text{C}$	$\pm 0.2\text{ }^\circ\text{C}$	$\pm 1\text{ }^\circ\text{C}$	$\pm 0.5\text{ }^\circ\text{C}$	$\pm 0.2\text{ }^\circ\text{C}$	$\pm 1\text{ }^\circ\text{C}$	$\pm 0.5\text{ }^\circ\text{C}$	$\pm 0.2\text{ }^\circ\text{C}$
PART NO. SUFFIX		- A3	- B3	- C3	- A2	- B2	- C2	- A4	- B4	- C4	- A5	- B5	- C5	- A8	- B8	- C8
CURVE	01	X	X	X	X	X	X	X	X	N/A	X	X	X	X	X	X
	02	X	X	X	X	X	X	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**

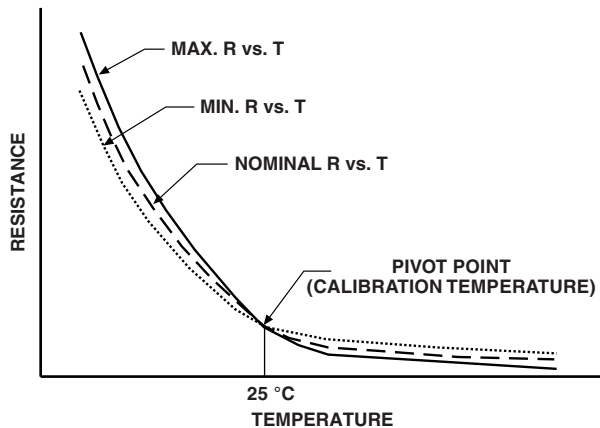
The standard leaded thermistors are calibrated and tested at 25 °C to a tolerance of ± 5 % or ± 10 %; however, tighter tolerance, point matched thermistors are readily available as are special point match temperatures to fit your application.

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. The resistance vs. temperature conversion tables can be found at: [www.vishay.com/doc?33004](http://www.vishay.com/doc?33004) and [www.vishay.com/doc?33011](http://www.vishay.com/doc?33011).

Example: 09M1002JF, + 70 °C resistance = (Resistance factor for curve 9 at 70 °C is 0.1990) x (10 000 Ω resistance at 25 °C) = 1990 Ω.

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 ± % (manufacturing tolerance).

The MT ± % may be obtained from the R vs. T conversion tables (see [www.vishay.com/doc?33004](http://www.vishay.com/doc?33004)) and is added to the point match temperature, i.e., ± 1 % Tol. at 25 °C + ± 2.6 % at - 30 °C for Curve 1 equals a total tolerance of ± 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 at [thermistor1@vishay.com](mailto:thermistor1@vishay.com).



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

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 in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

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