

# **NTC thermistors for temperature measurement**

## **Probe assemblies**

**Series/Type:**      **B57703M**  
**Date:**              March 2013

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## Applications

- Surface temperature measurement, e.g. on housings and heat sinks

## Features

- High accuracy
- Easy mounting
- Good thermal coupling through metal tag
- Thermistor encapsulated in metal-tag case
- AWG 30, PTFE-insulated leads of silver-plated nickel wire or AWG 26 (stranded, 7 x AWG 34), PTFE-insulated leads of silver-plated copper wire
- UL approval (E69802)

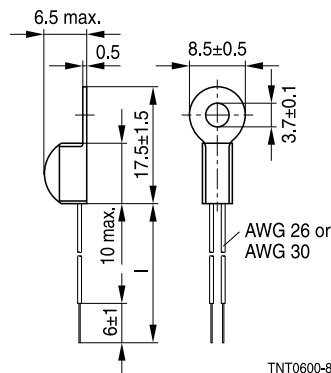
## Options

- Alternative resistance ratings, rated temperatures, resistance tolerances, lead lengths and AWG 28 stranded wires available on request.

## Delivery mode

Bulk

## Dimensional drawing



Dimensions in mm  
Approx. weight 0.8 g

| Ordering code   | Wire length<br>"l" in mm |
|-----------------|--------------------------|
| B57703M0103A017 | 115 ±10                  |
| B57703M0103A018 | 200 ±10                  |
| B57703M0103A019 | 500 ±10                  |
| B57703M0103G040 | 45 ±3                    |
| B57703M0303G040 | 45 ±3                    |
| B57703M0502G040 | 45 ±3                    |

## General technical data

|                               |               |                     |             |      |
|-------------------------------|---------------|---------------------|-------------|------|
| Climatic category             | (IEC 60068-1) | $P_{25}$            | 55/125/56   |      |
| Max. power                    | (at 25 °C)    | $\Delta R_R / R_R$  | 150         | mW   |
| Resistance tolerance          |               | $T_R$               | ±2          | %    |
| Rated temperature             |               | $\delta_{th}^{(1)}$ | 25          | °C   |
| Dissipation factor            | (in air)      | $\tau_c^{(1)}$      | approx. 3   | mW/K |
| Thermal cooling time constant | (in air)      | $C_{th}^{(1)}$      | approx. 50  | s    |
| Heat capacity                 |               | $V_{test}$          | approx. 150 | mJ/K |
| Test voltage                  | (t = 1 s)     |                     | 1000        | V AC |

1) Depends on mounting situation.

## Electrical specification and ordering codes

| $R_{25}$<br>$\Omega$ | No. of R/T<br>characteristic | $B_{25/100}$<br>K | Wire<br>length "l"<br>in mm | Wire   | Ordering code   |
|----------------------|------------------------------|-------------------|-----------------------------|--------|-----------------|
| 10 k                 | 8016                         | $3988 \pm 1\%$    | $115 \pm 10$                | AWG 26 | B57703M0103A017 |
| 10 k                 | 8016                         | $3988 \pm 1\%$    | $200 \pm 10$                | AWG 26 | B57703M0103A018 |
| 10 k                 | 8016                         | $3988 \pm 1\%$    | $500 \pm 10$                | AWG 26 | B57703M0103A019 |
| 5 k                  | 8016                         | $3988 \pm 1\%$    | $45 \pm 3$                  | AWG 30 | B57703M0502G040 |
| 10 k                 | 8016                         | $3988 \pm 1\%$    | $45 \pm 3$                  | AWG 30 | B57703M0103G040 |
| 30 k                 | 8018                         | $3964 \pm 1\%$    | $45 \pm 3$                  | AWG 30 | B57703M0303G040 |

**Note:** AWG 26 (stranded, 7 x AWG 34), PTFE-insulated wire of silver-plated copper wire.  
AWG 30, PTFE-insulated wire of silver-plated nickel wire.

## Reliability data

| Test                                  | Standard       | Test conditions                                                                          | $\Delta R_{25}/R_{25}$<br>(typical) | Remarks           |
|---------------------------------------|----------------|------------------------------------------------------------------------------------------|-------------------------------------|-------------------|
| Storage in dry heat                   | IEC 60068-2-2  | Storage at upper category temperature<br>T: 125 °C<br>t: 1000 h                          | $< 1\%^{(1)}$                       | No visible damage |
| Storage in damp heat, steady state    | IEC 60068-2-78 | Temperature of air: 40 °C<br>Relative humidity of air: 93%<br>Duration: 56 days          | $< 1\%^{(1)}$                       | No visible damage |
| Rapid temperature cycling             | IEC 60068-2-14 | Lower test temperature: -55 °C<br>Upper test temperature: 125 °C<br>Number of cycles: 10 | $< 0.5\%^{(1)}$                     | No visible damage |
| Endurance                             |                | $P_{max}$ : 150 mW<br>t: 1000 h                                                          | $< 1\%^{(1)}$                       | No visible damage |
| Long-term stability (empirical value) |                | Temperature: 70 °C<br>t: 10000 h                                                         | $< 2\%$                             | No visible damage |

1) Exept: B57703M0103A017, B57703M0103A018, B57703M0103A019  $\Delta R_{25}/R_{25}$  (typical)  $< 2\%$

## Note

- Contact of NTC thermistors with any liquids and solvents shall be prevented. It must be ensured that no water enters the NTC thermistors (e.g. through plug terminals).
- Avoid dewing and condensation unless thermistor is specified for these conditions.

## R/T characteristics

| R/T No. | 8016                            |         | 8018                            |         |
|---------|---------------------------------|---------|---------------------------------|---------|
| T (°C)  | B <sub>25/100</sub> = 3988 K    |         | B <sub>25/100</sub> = 3964 K    |         |
|         | R <sub>T</sub> /R <sub>25</sub> | α (%/K) | R <sub>T</sub> /R <sub>25</sub> | α (%/K) |
| -55.0   | 96.3                            | 7.4     | —                               | —       |
| -50.0   | 67.01                           | 7.2     | —                               | —       |
| -45.0   | 47.17                           | 6.9     | —                               | —       |
| -40.0   | 33.65                           | 6.7     | 30.24                           | 6.3     |
| -35.0   | 24.26                           | 6.4     | 22.1                            | 6.1     |
| -30.0   | 17.7                            | 6.2     | 16.32                           | 5.9     |
| -25.0   | 13.04                           | 6.0     | 12.17                           | 5.8     |
| -20.0   | 9.707                           | 5.8     | 9.153                           | 5.6     |
| -15.0   | 7.293                           | 5.6     | 6.945                           | 5.4     |
| -10.0   | 5.533                           | 5.5     | 5.313                           | 5.2     |
| -5.0    | 4.232                           | 5.3     | 4.097                           | 5.1     |
| 0.0     | 3.265                           | 5.1     | 3.183                           | 4.9     |
| 5.0     | 2.539                           | 5.0     | 2.491                           | 4.8     |
| 10.0    | 1.99                            | 4.8     | 1.963                           | 4.7     |
| 15.0    | 1.571                           | 4.7     | 1.557                           | 4.6     |
| 20.0    | 1.249                           | 4.5     | 1.244                           | 4.4     |
| 25.0    | 1.0000                          | 4.4     | 1.0000                          | 4.3     |
| 30.0    | 0.8057                          | 4.3     | 0.8083                          | 4.2     |
| 35.0    | 0.6531                          | 4.1     | 0.6572                          | 4.1     |
| 40.0    | 0.5327                          | 4.0     | 0.5373                          | 4.0     |
| 45.0    | 0.4369                          | 3.9     | 0.4418                          | 3.9     |
| 50.0    | 0.3603                          | 3.8     | 0.365                           | 3.7     |
| 55.0    | 0.2986                          | 3.7     | 0.303                           | 3.7     |
| 60.0    | 0.2488                          | 3.6     | 0.2527                          | 3.6     |
| 65.0    | 0.2083                          | 3.5     | 0.2118                          | 3.5     |
| 70.0    | 0.1752                          | 3.4     | 0.1783                          | 3.4     |
| 75.0    | 0.1481                          | 3.3     | 0.1508                          | 3.3     |
| 80.0    | 0.1258                          | 3.2     | 0.128                           | 3.2     |
| 85.0    | 0.1072                          | 3.2     | 0.1091                          | 3.2     |
| 90.0    | 0.09177                         | 3.1     | 0.0933                          | 3.1     |
| 95.0    | 0.07885                         | 3.0     | 0.08016                         | 3.0     |
| 100.0   | 0.068                           | 2.9     | 0.0691                          | 2.9     |
| 105.0   | 0.05886                         | 2.9     | 0.05974                         | 2.9     |
| 110.0   | 0.05112                         | 2.8     | 0.05183                         | 2.8     |
| 115.0   | 0.04454                         | 2.7     | 0.04512                         | 2.8     |
| 120.0   | 0.03893                         | 2.6     | 0.0394                          | 2.7     |
| 125.0   | 0.03417                         | 2.6     | 0.0345                          | 2.6     |
| 130.0   | 0.03009                         | 2.5     | 0.03032                         | 2.6     |
| 135.0   | 0.02654                         | 2.5     | 0.02672                         | 2.5     |
| 140.0   | 0.02348                         | 2.4     | 0.02361                         | 2.5     |
| 145.0   | 0.02083                         | 2.4     | 0.02091                         | 2.4     |
| 150.0   | 0.01853                         | 2.3     | 0.01857                         | 2.4     |
| 155.0   | 0.01653                         | 2.3     | 0.016537                        | 2.3     |

## Cautions and warnings

See "Important notes".

### Storage

- Store thermistors only in original packaging. Do not open the package prior to storage.
- Storage conditions in original packaging: storage temperature  $-25\text{ }^{\circ}\text{C} \dots +45\text{ }^{\circ}\text{C}$ , relative humidity  $\leq 75\%$  annual mean,  $<95\%$  maximum 30 days per annum, dew precipitation is inadmissible.
- Do not store thermistors where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed or components may stick together, causing problems during mounting.
- Avoid contamination of thermistor surface during storage, handling and processing.
- Avoid storage of thermistors in harmful environments like corrosive gases ( $\text{SO}_x$ , Cl etc).
- Use the components as soon as possible after opening the factory seals, i.e. the polyvinyl-sealed packages.
- Solder thermistors within the time specified after shipment from EPCOS.  
For leaded components this is 24 months, for SMD components with nickel barrier termination 12 months, for SMD components with AgPd termination 6 months.

### Handling

- NTC thermistors must not be dropped. Chip-offs or any other damage must not be caused during handling of NTCs.
- Do not touch components with bare hands. Gloves are recommended.
- Avoid contamination of thermistor surface during handling.
- Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g. ultrasonic cleaning). They may cause cracks to develop on the product and its parts, which might lead to reduced reliability or lifetime.

### Bending / twisting leads

- A lead (wire) may be bent at a minimum distance of twice the wire's diameter plus 4 mm from the component head or housing. When bending ensure the wire is mechanically relieved at the component head or housing. The bending radius should be at least 0.75 mm.
- Twisting (torsion) by  $180^{\circ}$  of a lead bent by  $90^{\circ}$  is permissible at 6 mm from the bottom of the thermistor body.

### Soldering

- Use resin-type flux or non-activated flux.
- Insufficient preheating may cause ceramic cracks.
- Rapid cooling by dipping in solvent is not recommended.
- Complete removal of flux is recommended.

## Mounting

- Ensure that no thermo-mechanical stress occurs due to production processes (curing or overmolding processes) when thermistors are sealed, potted or overmolded or during their subsequent operation. The maximum temperature of the thermistor must not be exceeded. Ensure that the materials used (sealing/potting compound and plastic material) are chemically neutral.
- Electrodes/contacts must not be scratched or damaged before/during/after the mounting process.
- Contacts and housing used for assembly with the thermistor must be clean before mounting.
- Ensure that adjacent materials are designed for operation at temperatures comparable to the surface temperature of the thermistor. Be sure that surrounding parts and materials can withstand the temperature.
- Avoid contamination of the thermistor surface during processing.
- The connections of sensors (e.g. cable end, wire end, plug terminal) may only be exposed to an environment with normal atmospheric conditions.
- Tensile forces on cables or leads must be avoided during mounting and operation.
- Bending or twisting of cables or leads directly on the thermistor body is not permissible.
- Avoid using chemical substances as mounting aids. It must be ensured that no water or other liquids enter the NTC thermistors (e.g. through plug terminals). In particular, water based substances (e.g. soap suds) must not be used as mounting aids for sensors.

## Operation

- Use thermistors only within the specified operating temperature range.
- Use thermistors only within the specified power range.
- Environmental conditions must not harm the thermistors. Only use the thermistors under normal atmospheric conditions or within the specified conditions.
- Contact of NTC thermistors with any liquids and solvents shall be prevented. It must be ensured that no water enters the NTC thermistors (e.g. through plug terminals). For measurement purposes (checking the specified resistance vs. temperature), the component must not be immersed in water but in suitable liquids (e.g. Galden).
- Avoid dewing and condensation unless thermistor is specified for these conditions.
- Bending or twisting of cables and/or wires is not permissible during operation of the sensor in the application.
- Be sure to provide an appropriate fail-safe function to prevent secondary product damage caused by malfunction.

This listing does not claim to be complete, but merely reflects the experience of EPCOS AG.

**Symbols and terms**

| Symbol              | English                                                                  | German                                                                    |
|---------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------|
| A                   | Area                                                                     | Fläche                                                                    |
| AWG                 | American Wire Gauge                                                      | Amerikanische Norm für Drahtquerschnitte                                  |
| B                   | B value                                                                  | B-Wert                                                                    |
| B <sub>25/100</sub> | B value determined by resistance measurement at 25 °C and 100 °C         | B-Wert, ermittelt durch Widerstandsmessungen bei 25 °C und 100 °C         |
| C <sub>th</sub>     | Heat capacitance                                                         | Wärmekapazität                                                            |
| I                   | Current                                                                  | Strom                                                                     |
| N                   | Number (integer)                                                         | Anzahl (ganzzahliger Wert)                                                |
| P <sub>25</sub>     | Maximum power at 25 °C                                                   | Maximale Leistung bei 25 °C                                               |
| P <sub>diss</sub>   | Power dissipation                                                        | Verlustleistung                                                           |
| P <sub>el</sub>     | Electrical power                                                         | Elektrische Leistung                                                      |
| P <sub>max</sub>    | Maximum power within stated temperature range                            | Maximale Leistung im angegebenen Temperaturbereich                        |
| $\Delta R_B/R_B$    | Resistance tolerance caused by spread of B value                         | Widerstandstoleranz, die durch die Streuung des B-Wertes verursacht wird  |
| R <sub>ins</sub>    | Insulation resistance                                                    | Isolationswiderstand                                                      |
| R <sub>P</sub>      | Parallel resistance                                                      | Parallelwiderstand                                                        |
| R <sub>R</sub>      | Rated resistance                                                         | Nennwiderstand                                                            |
| $\Delta R_R/R_R$    | Resistance tolerance                                                     | Widerstandstoleranz                                                       |
| R <sub>S</sub>      | Series resistance                                                        | Serienwiderstand                                                          |
| R <sub>T</sub>      | Resistance at temperature T (e.g. R <sub>25</sub> = resistance at 25 °C) | Widerstand bei Temperatur T (z.B. R <sub>25</sub> = Widerstand bei 25 °C) |
| T                   | Temperature                                                              | Temperatur                                                                |
| $\Delta T$          | Temperature tolerance                                                    | Temperaturtoleranz                                                        |
| t                   | Time                                                                     | Zeit                                                                      |
| T <sub>A</sub>      | Ambient temperature                                                      | Umgebungstemperatur                                                       |
| T <sub>max</sub>    | Upper category temperature                                               | Obere Grenztemperatur (Kategorietemperatur)                               |
| T <sub>min</sub>    | Lower category temperature                                               | Untere Grenztemperatur (Kategorietemperatur)                              |
| T <sub>op</sub>     | Operating temperature                                                    | Betriebstemperatur                                                        |
| T <sub>R</sub>      | Rated temperature                                                        | Nenntemperatur                                                            |
| T <sub>surf</sub>   | Surface temperature                                                      | Oberflächentemperatur                                                     |
| V                   | Voltage                                                                  | Spannung                                                                  |
| V <sub>ins</sub>    | Insulation test voltage                                                  | Isolationsprüfspannung                                                    |
| V <sub>op</sub>     | Operating voltage                                                        | Betriebsspannung                                                          |
| V <sub>test</sub>   | Test voltage                                                             | Prüfspannung                                                              |

| Symbol        | English                       | German                         |
|---------------|-------------------------------|--------------------------------|
| $\alpha$      | Temperature coefficient       | Temperaturkoeffizient          |
| $\Delta$      | Tolerance, change             | Toleranz, Änderung             |
| $\delta_{th}$ | Dissipation factor            | Wärmeleitwert                  |
| $\tau_c$      | Thermal cooling time constant | Thermische Abkühlzeitkonstante |
| $\tau_a$      | Thermal time constant         | Thermische Zeitkonstante       |

### Abbreviations / Notes

| Symbol            | English                                                                                                                      | German                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b><u>SMD</u></b> | Surface-mounted devices                                                                                                      | Oberflächenmontierbares Bauelement                                                                                                  |
| *                 | To be replaced by a number in ordering codes, type designations etc.                                                         | Platzhalter für Zahl im Bestellnummern-code oder für die Typenbezeichnung.                                                          |
| +                 | To be replaced by a letter.<br>All dimensions are given in mm.<br>The commas used in numerical values denote decimal points. | Platzhalter für einen Buchstaben.<br>Alle Maße sind in mm angegeben.<br>Verwendete Kommas in Zahlenwerten bezeichnen Dezimalpunkte. |



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