



# NTC thermistors for temperature measurement

Probe assemblies

**Series/Type:** B57020M2  
**Date:** February 2009

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**Applications**

- Cabinet and evaporator in refrigerators and deep freezers

**Features**

- Thermistor in molded plastic case with cable outlet
- Highly resistant to water/moisture
- PVC-insulated connecting cable (white)
- Conductor cross section:  $2 \times 0.34 \text{ mm}^2$
- Construction based on DIN EN 60 730 -1/VDE protection class 2
- UL approval (E252167)

**Options**

- Alternative head dimensions, resistance ratings, rated temperatures, resistance tolerances and cable lengths available on request
- PVC-free connecting cable on request
- Color markings on cable available on request
- Single insulated versions with twin wires available on request

**Delivery mode**

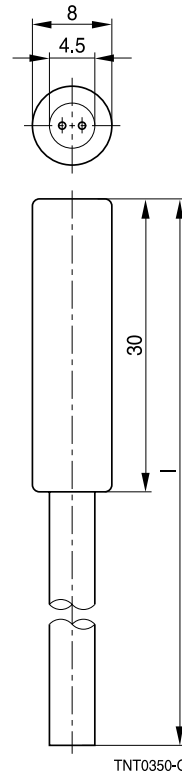
Bulk

**General technical data**

Climatic category	(IEC 60068-1)		40/080/56	
Max. power	(at 25 °C)	$P_{25}$	350	mW
Resistance tolerance		$\Delta R_R/R_R$	$\pm 2$	%
Rated temperature		$T_R$	0	°C
Dissipation factor	(in air)	$\delta_{th}$	approx. 10	mW/K
Thermal time constant	(in water)	$\tau_a$	approx. 35	s
Insulation resistance	(V = 500 V DC)	$R_{ins}$	> 1000	M $\Omega$

**Electrical specification and ordering codes**

$R_{25}$ $\Omega$	$R_0$ $\Omega$	No. of R/T characteristic	$B_{25/100}$ K	l mm	Ordering code
5000	16330	2003	$3980 \pm 1.5\%$	$900 \pm 30$	B57020M2502A017
5000	16330	2003	$3980 \pm 1.5\%$	$2000 \pm 30$	B57020M2502A020
5000	16330	2003	$3980 \pm 1.5\%$	$2800 \pm 30$	B57020M2502A001

**Dimensional drawing**


Dimensions in mm

**Reliability data**

Test	Standard	Test conditions	$\Delta R_{25}/R_{25}$ (typical)	Remarks
Storage in dry heat	IEC 60068-2-2	Storage at upper category temperature T: 80 °C t: 1000 h	< 2%	No visible damage
Storage in damp heat, steady state	IEC 60068-2-78	Temperature of air: 40 °C Relative humidity of air: 93% Duration: 56 days	< 2%	No visible damage
Storage in coldness		Storage at lower category temperature T: -40 °C t: 1000 h	< 2%	No visible damage
Rapid temperature cycling (in air)	IEC 60068-2-14	Lower test temperature: -40 °C Upper test temperature: 80 °C Time to change from lower to upper temperature: <30 s Number of cycles: 1000 Medium: air	< 2%	No visible damage
Storage in water		Temperature of water: 30 °C t: 4000 h Applied voltage with drop resistor 10 k $\Omega$ : 10 V DC switched between on ( $t_{on}$ = 30 min) and off ( $t_{off}$ = 30 min)	< 2%	No visible damage
Temperature cycling test		Lower test temperature: -30 °C Upper test temperature: 10 °C Test frequency <15 min under wetness and frozen water Number of cycles: 50000 Medium: air	< 2%	No visible damage
Voltage proof test		3750 V AC, 1 min		No flashover
Insulation test		The sensors are placed in a vessel containing metallic balls of 1 mm diameter (with total immersed head). The applied voltage is 500 V DC.		Above 1000 M $\Omega$

**R/T characteristics**

R/T No.	<b>2003</b>							
T (°C)	B <sub>25/100</sub> = 3980 K		T (°C)	B <sub>25/100</sub> = 3980 K		T (°C)	B <sub>25/100</sub> = 3980 K	
	R <sub>T</sub> /R <sub>25</sub>	α (%/K)		R <sub>T</sub> /R <sub>25</sub>	α (%/K)		R <sub>T</sub> /R <sub>25</sub>	α (%/K)
-55.0	97.578	7.5	20.0	1.2492	4.5	95.0	0.079225	3.0
-50.0	67.65	7.2	25.0	1.0000	4.4	100.0	0.068356	2.9
-45.0	47.538	7.0	30.0	0.80575	4.3	105.0	0.059247	2.8
-40.0	33.831	6.7	35.0	0.65326	4.1	110.0	0.051531	2.8
-35.0	24.359	6.5	40.0	0.5329	4.0	115.0	0.044921	2.7
-30.0	17.753	6.3	45.0	0.43715	3.9	120.0	0.039282	2.7
-25.0	13.067	6.0	50.0	0.36064	3.8	125.0	0.034387	2.6
-20.0	9.7228	5.8	55.0	0.29908	3.7	130.0	0.030186	2.5
-15.0	7.3006	5.6	60.0	0.24932	3.6	135.0	0.02665	2.5
-10.0	5.5361	5.5	65.0	0.20886	3.5	140.0	0.023594	2.4
-5.0	4.2332	5.3	70.0	0.17578	3.4	145.0	0.020931	2.4
0.0	3.266	5.1	75.0	0.14863	3.3	150.0	0.018616	2.3
5.0	2.5392	5.0	80.0	0.12621	3.2	155.0	0.016612	2.3
10.0	1.9902	4.8	85.0	0.10763	3.1	—	—	—
15.0	1.5709	4.7	90.0	0.092159	3.1	—	—	—

## Cautions and warnings General

See "Important notes" at the end of this document.

### Storage

- Store thermistors only in original packaging. Do not open the package prior to storage.
- Storage conditions in original packaging: storage temperature  $-25\text{ °C} \dots +45\text{ °C}$ , 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 SMDs 12 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.

### 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 should 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 Bestellnummerncode oder für die Typenbezeichnung.
+	To be replaced by a letter. All dimensions are given in mm. The commas used in numerical values denote decimal points.	Platzhalter für einen Buchstaben. Alle Maße sind in mm angegeben. Verwendete Kommas in Zahlenwerten bezeichnen Dezimalpunkte.



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