NTC thermistors for temperature measurement

Probe assemblies

Series/Type: **B57020M2**
Date: January 2018

EPCOS AG is a TDK Group Company.

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 × 0.34 mm²
- Construction based on DIN EN 60 730 -1/VDE protection class 2
- UL approval (E252167)

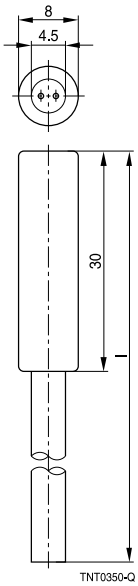
Options

- 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

Dimensional drawing



Dimensions in mm

General technical data

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

Electrical specification and ordering codes

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

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 kΩ: 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 MΩ

R/T characteristics

R/T No.	2003							
T (°C)	$B_{25/100}$ = 3980 K		T (°C)	$B_{25/100}$ = 3980 K		T (°C)	$B_{25/100}$ = 3980 K	
	R_T/R_{25}	α (%/K)		R_T/R_{25}	α (%/K)		R_T/R_{25}	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" on page 2.

Storage

- Store thermistors only in original packaging. Do not open the package prior to processing.
- Storage conditions in original packaging: storage temperature −25 °C ... +45 °C, relative humidity ≤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 (SO_x, Cl etc).
- Use the components as soon as possible after opening the original packaging.
- 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 leadless components this is 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.

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.
- The use of no-clean solder products is recommended. In any case mild, non-activated fluxes should be used. Flux residues after soldering should be minimized.

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. perfluoropolyethers such as 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.

Display of ordering codes for EPCOS products

The ordering code for one and the same EPCOS product can be represented differently in data

sheets, data books, other publications, on the EPCOS website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products**. Detailed information can be found on the Internet under www.epcos.com/orderingcodes

Symbols and terms

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

Symbol	English	German
α	Temperature coefficient	Temperaturkoeffizient
Δ	Tolerance, change	Toleranz, Änderung
δ_{th}	Dissipation factor	Wärmeleitwert
τ_c	Thermal cooling time constant	Thermische Abkühlzeitkonstante
τ_a	Thermal time constant	Thermische Zeitkonstante

Abbreviations / Notes

Symbol	English	German
SMD	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.	Platzhalter für einen Buchstaben.
	All dimensions are given in mm.	Alle Maße sind in mm angegeben.
	The commas used in numerical values denote decimal points.	Verwendete Kommas in Zahlenwerten bezeichnen Dezimalpunkte.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
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7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

8. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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