

NTC thermistors for temperature measurement

Probe assemblies

Series/Type: B57500K, B57501K

Date: March 2013

Applications

- Evaporator sensor for air conditioning systems
- Heating systems

Features

- Copper case
- Twin cable (black)
- PVC-insulated wires with tinned ends, $T_{\max} = 105\text{ }^{\circ}\text{C}$

Options

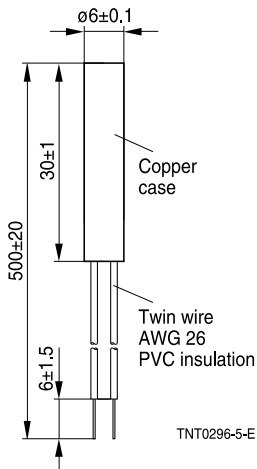
- Alternative resistance ratings, rated temperatures, resistance tolerances, wire lengths and AWG 22, AWG 24 or AWG 26 available on request.
Also available as type K800 with improved humidity resistance for temperature measurement in heat pumps.

Delivery mode

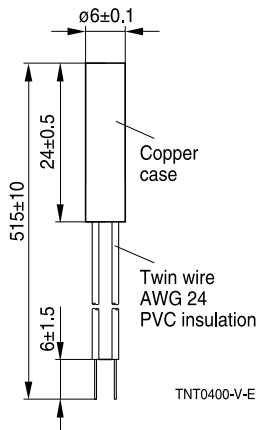
Bulk

Dimensional drawings

K500



K501



Dimensions in mm

General technical data

| | | | | |
|-------------------------------|----------------|------------------|-------------|------------|
| Climatic category | (IEC 60068-1) | | 30/100/56 | |
| Max. power | (at 25 °C) | P_{25} | 60 | mW |
| Resistance tolerance | | $\Delta R_R/R_R$ | ± 3 | % |
| Rated temperature | | T_R | 25 | °C |
| Dissipation factor | (in air) | δ_{th} | approx. 7 | mW/K |
| Thermal cooling time constant | (in air) | τ_c | approx. 130 | s |
| Thermal time constant | (in water) | τ_a | approx. 8 | s |
| Heat capacity | | C_{th} | approx. 900 | mJ/K |
| Insulation resistance | (V = 100 V DC) | R_{ins} | > 100 | M Ω |
| Test voltage | (t = 1 s) | V_{test} | 1.5 | kV AC |

Electrical specification and ordering codes

| Type | AWG | R_{25} Ω | No. of R/T characteristic | $B_{25/100}$ K | Ordering code |
|------|-----|----------------------|------------------------------|-------------------|-----------------|
| K500 | 26 | 10 k | 8016 | 3988 $\pm 0.5\%$ | B57500K0103A001 |
| K501 | 24 | 6.8 k | 8016 | 3988 $\pm 0.5\%$ | B57501K0682A002 |

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: 100 °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: -30 °C t: 1000 h | < 2% | No visible damage |
| Rapid temperature cycling (in fluid) | IEC 60068-2-14 | Lower test temperature: 0 °C Upper test temperature: 100 °C Time to change from lower to upper temperature: <30 s Number of cycles: 1000 Medium: oil | < 2% | No visible damage |
| Vibration resistance | IEC 60068-2-6 | Frequency range: 5 to 500 Hz Amplitude: 7.5 mm, 2 g Duration: 3 x 8 h | < 3% | No visible damage |
| Long-term stability (empirical value) | | Temperature: 100 °C t: 10000 h | < 3% | No visible damage |
| Voltage proof test | | 1500 V AC, 1 s | | 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 100 V DC. | | Above 100 MΩ |

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 | | | | | | | | |
|---------------------|---------------------------------|---------|--------|---------------------------------|---------|--------|---------------------------------|---------|
| T (°C) | B _{25/100} = 3988 K | | T (°C) | B _{25/100} = 3988 K | | T (°C) | B _{25/100} = 3988 K | |
| | R _T /R ₂₅ | α (%/K) | | R _T /R ₂₅ | α (%/K) | | R _T /R ₂₅ | α (%/K) |
| -55.0 | 96.3 | 7.4 | 20.0 | 1.249 | 4.5 | 95.0 | 0.07885 | 3.0 |
| -50.0 | 67.01 | 7.2 | 25.0 | 1.0000 | 4.4 | 100.0 | 0.068 | 2.9 |
| -45.0 | 47.17 | 6.9 | 30.0 | 0.8057 | 4.3 | 105.0 | 0.05886 | 2.9 |
| -40.0 | 33.65 | 6.7 | 35.0 | 0.6531 | 4.1 | 110.0 | 0.05112 | 2.8 |
| -35.0 | 24.26 | 6.4 | 40.0 | 0.5327 | 4.0 | 115.0 | 0.04454 | 2.7 |
| -30.0 | 17.7 | 6.2 | 45.0 | 0.4369 | 3.9 | 120.0 | 0.03893 | 2.6 |
| -25.0 | 13.04 | 6.0 | 50.0 | 0.3603 | 3.8 | 125.0 | 0.03417 | 2.6 |
| -20.0 | 9.707 | 5.8 | 55.0 | 0.2986 | 3.7 | 130.0 | 0.03009 | 2.5 |
| -15.0 | 7.293 | 5.6 | 60.0 | 0.2488 | 3.6 | 135.0 | 0.02654 | 2.5 |
| -10.0 | 5.533 | 5.5 | 65.0 | 0.2083 | 3.5 | 140.0 | 0.02348 | 2.4 |
| -5.0 | 4.232 | 5.3 | 70.0 | 0.1752 | 3.4 | 145.0 | 0.02083 | 2.4 |
| 0.0 | 3.265 | 5.1 | 75.0 | 0.1481 | 3.3 | 150.0 | 0.01853 | 2.3 |
| 5.0 | 2.539 | 5.0 | 80.0 | 0.1258 | 3.2 | 155.0 | 0.01653 | 2.3 |
| 10.0 | 1.99 | 4.8 | 85.0 | 0.1072 | 3.2 | — | — | — |
| 15.0 | 1.571 | 4.7 | 90.0 | 0.09177 | 3.1 | — | — | — |

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 $-25\text{ °C} \dots +45\text{ °C}$, 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 (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° of a lead bent by 90° 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 _{25/100} | B value determined by resistance measurement at 25 °C and 100 °C | B-Wert, ermittelt durch Widerstandsmessungen 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 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 _{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 |
|-------------------|--|---|
| <u>SMD</u> | 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. | Platzhalter für einen Buchstaben. 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, EPCOS is 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 an EPCOS 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 lifesaving 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.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, BAOKE, Alu-X, CeraDiode, CeraLink, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FilterCap, FormFit, MiniBlue, MiniCell, MKD, MKK, MLSC, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.