# PTC thermistors as limit temperature sensors

Leaded disks, coated, miniaturized

**Series/Type:** **B59008**
Date: September 2020

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## Applications

- Limit temperature monitoring

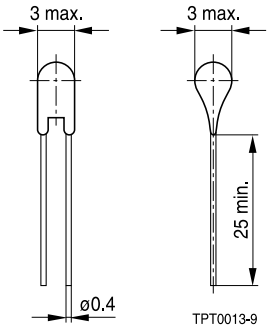
## Features

- Tinned leads
- Marked with coded sensing temperature
- Characteristics for sensing temperatures $T_{sense}$ = 90 to 160 °C conform with DIN VDE V 0898-1-401
- Extremely fast response due to small dimensions
- UL approval to UL 1434 (file number E69802)
- RoHS-compatible

## Delivery mode

- Bulk (standard)

## Dimensional drawing




Dimensions in mm

## General technical data

| | | | | |
|---|---|---|---|---|
| Max. operating voltage | ($T_A$ = 0 ... 40 °C) | $V_{max}$ | 30 | V DC |
| Measuring voltage[1)] | ($T_A$ = −40 °C ... $T_{sense}$ +5 K) | $V_{meas}$ | ≤ 2.5 | V DC |
| Max. measuring voltage[1)] | For $T_A$ see table "Electrical specifications" | $V_{meas,max}$ | 7.5 | V DC |
| Rated resistance | ($V_{PTC}$ ≤ 2.5 V) | $R_R$ | ≤ 250 | Ω |
| Thermal threshold time | | $t_a$ | < 3 | s |
| Operating temperature range | ($V \le V_{meas,max}$) | $T_{op}$ | −40/ $T_{sense}$ +23 | °C |
| Operating temperature range | ($V = V_{max}$) | $T_{op}$ | 0/+40 | °C |

1) $V_{meas}$ and $V_{meas,max}$ for 90 °C ≤ $T_{sense}$ ≤ 160 °C acc. to DIN VDE V 0898-1-401.

## Electrical specifications and ordering codes

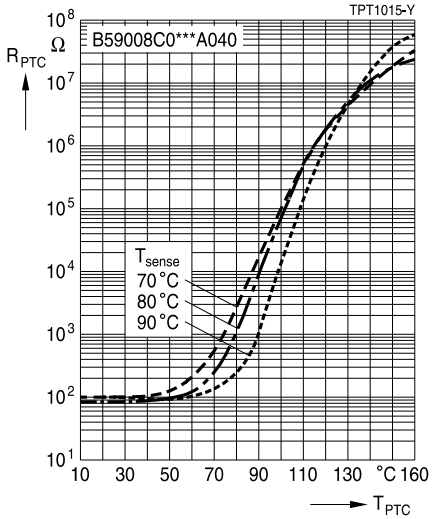
| $T_{sense}$ °C | R ($T_{sense} - \Delta T$) ($V_{PTC} \le 2.5$ V) Ω | R ($T_{sense} + \Delta T$) ($V_{PTC} \le 2.5$ V) Ω | R ($T_{sense}$ + 15 K) ($V_{PTC} \le 7.5$ V) Ω | R ($T_{sense}$ + 23 K) ($V_{PTC} \le 7.5$ V) Ω | Stamp code | Ordering code |
|---|---|---|---|---|---|---|
| ΔT = ±5 K | | | | | | |
| 70 | ≤ 570 | ≥ 570 | - | ≥ 4 k | g | B59008C0070A040 |
| 80 | ≤ 570 | ≥ 570 | - | ≥ 4 k | h | B59008C0080A040 |
| 90 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | i | B59008C0090A040 |
| 100 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | j | B59008C0100A040 |
| 110 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | k | B59008C0110A040 |
| 120 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | l | B59008C0120A040 |
| 130 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | m | B59008C0130A040 |
| 140 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | n | B59008C0140A040 |
| 150 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | p | B59008C0150A040 |
| 160 | ≤ 550 | ≥ 1330 | ≥ 4 k | - | s | B59008C0160A040 |

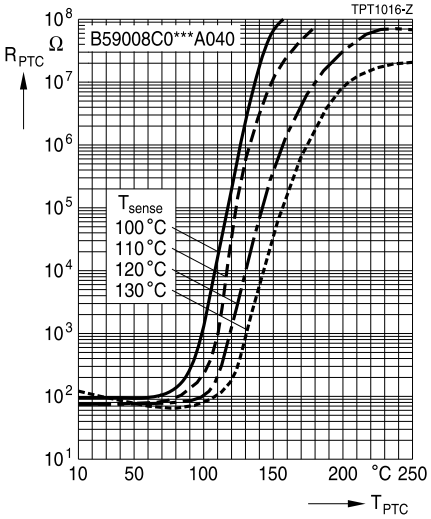
**Reliability data**

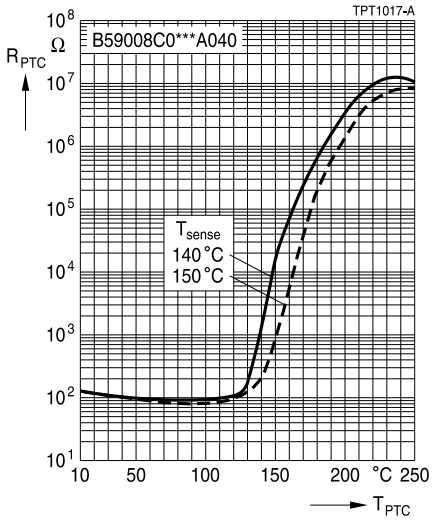
| Test | Standard | Test conditions | $\lvert\Delta R_{25}/R_{25}\rvert$ |
|---|---|---|---|
| Electrical endurance, constant | IEC 60738-1 | Storage at $V_{max}$ and $T_{op,max}$ (@ $V_{max}$)<br>Test duration: 1000 h | < 25% |
| Damp heat | IEC 60738-1 | Temperature of air: 40 °C<br>Relative humidity of air: 93%<br>Duration: 56 days<br>Test according to IEC 60068-2-78 | < 10% |
| Rapid change of temperature | IEC 60738-1 | $T_1 = T_{op,min}$ (0 V), $T_2 = T_{op,max}$ (0 V)<br>Number of cycles: 5<br>Test duration: 30 min<br>Test according to IEC 60068-2-14, test Na | < 25% |
| Vibration | IEC 60738-1 | Frequency range: 10 to 55 Hz<br>Displacement amplitude: 0.75 mm<br>Test duration: $3 \times 2$ h<br>Test according to IEC 60068-2-6, test Fc | < 5% |

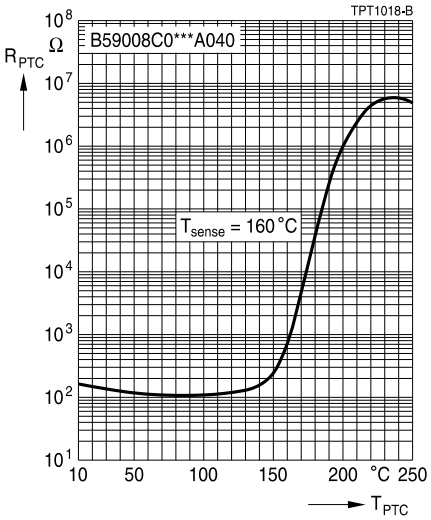
## Characteristics (typical)

PTC resistance $R_{PTC}$ versus PTC temperature $T_{PTC}$
(measured at low signal voltage)



## Cautions and warnings

### General

- TDK Electronics thermistors are designed for specific applications and should not be used for purposes not identified in our specifications, application notes and data books unless otherwise agreed with TDK Electronics during the design-in-phase.
- Ensure suitability of thermistor through reliability testing during the design-in phase. The thermistors should be evaluated taking into consideration worst-case conditions.

### 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, maximum 95%, dew precipitation is inadmissible.
- Avoid contamination of thermistors surface during storage, handling and processing.
- Avoid storage of thermistor in harmful environment with effect on function on long-term operation (examples given under operation precautions).
- Use thermistor within the following period after delivery:
  - Through-hole devices (housed and leaded PTCs): 24 months
  - Motor protection sensors, glass-encapsulated sensors and probe assemblies: 24 months
  - Telecom pair and quattro protectors (TPP, TQP): 24 months
  - Leadless PTC thermistors for pressure contacting: 12 months
  - Leadless PTC thermistors for soldering: 6 months
  - SMDs in EIA sizes 3225 and 4032, and for PTCs with metal tags: 24 months
  - SMDs in EIA sizes 1210 and smaller: 12 months

### Handling

- PTCs must not be dropped. Chip-offs must not be caused during handling of PTCs.
- The ceramic and metallization of the components must not be touched with bare hands. Gloves are recommended.
- Avoid contamination of thermistor surface during handling.

### Soldering (where applicable)

- Use rosin-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.
- Standard PTC heaters are not suitable for soldering.

**Mounting**

- Electrode must not be scratched before/during/after the mounting process.
- Contacts and housing used for assembly with thermistor have to be clean before mounting. Especially grease or oil must be removed.
- When PTC thermistors are encapsulated with sealing material, the precautions given in chapter "Mounting instructions", "Sealing and potting" must be observed.
- When the thermistor is mounted, there must not be any foreign body between the electrode of the thermistor and the clamping contact.
- The minimum force and pressure of the clamping contacts pressing against the PTC must be 10 N and 50 kPa, respectively. In case the assembly is exposed to mechanical shock and/ or vibration this force should be higher in order to avoid movement of the PTC during operation.
- During operation, the thermistor's surface temperature can be very high. Ensure that adjacent components are placed at a sufficient distance from the thermistor to allow for proper cooling at the thermistors.
- Ensure that adjacent materials are designed for operation at temperatures comparable to the surface temperature of thermistor. Be sure that surrounding parts and materials can withstand this temperature.
- Avoid contamination of thermistor surface during processing.

**Operation**

- Use thermistors only within the specified temperature operating range.
- Use thermistors only within the specified voltage and current ranges.
- Environmental conditions must not harm the thermistors. Use thermistors only in normal atmospheric conditions. Avoid use in deoxidizing gases (chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas etc), corrosive agents, humid or salty conditions. Contact with any liquids and solvents should be prevented.
- Be sure to provide an appropriate fail-safe function to prevent secondary product damage caused by abnormal function (e.g. use VDR for limitation of overvoltage condition).

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

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## Symbols and terms

| Symbol | Term |
|---|---|
| A | Area |
| C | Capacitance |
| $C_{th}$ | Heat capacity |
| f | Frequency |
| I | Current |
| $I_{max}$ | Maximum current |
| $I_R$ | Rated current |
| $I_{res}$ | Residual current |
| $I_{PTC}$ | PTC current |
| $I_r$ | Residual currrent |
| $I_{r,oil}$ | Residual currrent in oil (for level sensors) |
| $I_{r,air}$ | Residual currrent in air (for level sensors) |
| $I_{RMS}$ | Root-mean-square value of current |
| $I_S$ | Switching current |
| $I_{Smax}$ | Maximum switching current |
| LCT | Lower category temperature |
| N | Number (integer) |
| $N_c$ | Operating cycles at $V_{max}$, charging of capacitor |
| $N_f$ | Switching cycles at $V_{max}$, failure mode |
| P | Power |
| $P_{25}$ | Maximum power at 25 °C |
| $P_{el}$ | Electrical power |
| $P_{diss}$ | Dissipation power |
| $R_G$ | Generator internal resistance |
| $R_{min}$ | Minimum resistance |
| $R_R$ | Rated resistance @ rated temperature $T_R$ |
| $\Delta R_R$ | Tolerance of $R_R$ |
| $R_P$ | Parallel resistance |
| $R_{PTC}$ | PTC resistance |
| $R_{ref}$ | Reference resistance |
| $R_S$ | Series resistance |
| $R_{25}$ | Resistance at 25 °C |
| $R_{25,match}$ | Resistance matching per reel/ packing unit at 25 °C |
| $\Delta R_{25}$ | Tolerance of $R_{25}$ |

| | |
|---|---|
| $T$ | Temperature |
| $t$ | Time |
| $T_A$ | Ambient temperature |
| $t_a$ | Thermal threshold time |
| $T_C$ | Ferroelectric Curie temperature |
| $t_E$ | Settling time (for level sensors) |
| $T_R$ | Rated temperature @ 25 °C or otherwise specified in the data sheet |
| $T_{sense}$ | Sensing temperature |
| $T_{op}$ | Operating temperature |
| $T_{PTC}$ | PTC temperature |
| $t_R$ | Response time |
| $T_{ref}$ | Reference temperature |
| $T_{Rmin}$ | Temperature at minimum resistance |
| $t_S$ | Switching time |
| $T_{surf}$ | Surface temperature |
| UCT | Upper category temperature |
| $V$ or $V_{el}$ | Voltage (with subscript only for distinction from volume) |
| $V_{c(max)}$ | Maximum DC charge voltage of the surge generator |
| $V_{F,max}$ | Maximum voltage applied at fault conditions in protection mode |
| $V_{RMS}$ | Root-mean-square value of voltage |
| $V_{BD}$ | Breakdown voltage |
| $V_{ins}$ | Insulation test voltage |
| $V_{link,max}$ | Maximum link voltage |
| $V_{max}$ | Maximum operating voltage |
| $V_{max,dyn}$ | Maximum dynamic (short-time) operating voltage |
| $V_{meas}$ | Measuring voltage |
| $V_{meas,max}$ | Maximum measuring voltage |
| $V_R$ | Rated voltage |
| $V_{PTC}$ | Voltage drop across a PTC thermistor |
| $\alpha$ | Temperature coefficient |
| $\Delta$ | Tolerance, change |
| $\delta_{th}$ | Dissipation factor |
| $\tau_{th}$ | Thermal cooling time constant |
| $\lambda$ | Failure rate |
| $\boxed{e}$ | Lead spacing (in mm) |

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