⌖TDK

PTC thermistors as
limit temperature sensors

Motor protection, single sensors

Series/Type: **B59100**

Date: September 2020

Sensors

**Motor protection, single sensors** **M1100**

Applications
- Thermal protection of winding in electric motors
- Limit temperature monitoring

Features
- Thermistor pellet with insulating encapsulation
- Low-resistance type, steep R/T curve
- Silver-plated and PTFE-insulated AWG 26 litz wires
- Extremely fast response due to small dimensions
- Characteristics for sensing temperatures T_{sense} = 90 up to 160 °C conform with DIN VDE V 0898-1-401
- Color coding of litz wires to DIN VDE V 0898-1-401
- UL approval to UL 1434 (file number E69802)
- RoHS-compatible

Delivery mode
- Bulk

Dimensional drawing

TPT0018-F
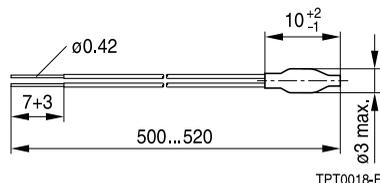
Dimensions in mm

General technical data

Max. operating voltage	(T_A = 0 ... 40 °C)	V_{max}	30	V DC
Measuring voltage[1]	($T_{A} = -25$ °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	($V_{PTC} \leq 2.5$ V)	R_R	≤ 100	Ω
Insulating test voltage		V_{ins}	2.5	kV AC
Thermal threshold time		t_a	≤ 3	s
Operating temperature range	($V \leq V_{meas,max}$)	T_{op}	$-25/ T_{sense}$ +23	°C
Operating temperature range	($V = V_{max}$)	T_{op}	0/+40	°C

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

Sensors

Motor protection, single sensors   **M1100**

Electrical specifications and ordering codes

T_{sense} °C	R ($T_{sense} - \Delta T$) ($V_{PTC} \leq 2.5$ V) Ω	R ($T_{sense} + \Delta T$) ($V_{PTC} \leq 2.5$ V) Ω	R ($T_{sense} + 15$ K) ($V_{PTC} \leq 7.5$ V) Ω	R ($T_{sense} + 23$ K) ($V_{PTC} \leq 7.5$ V) Ω	Ordering code
$\Delta T = \pm 5$ K					
60	≤ 570	≥ 570	-	≥ 10 k	B59100M1060A070
70	≤ 570	≥ 570	-	≥ 10 k	B59100M1070A070
80	≤ 570	≥ 570	-	≥ 10 k	B59100M1080A070
90	≤ 550	≥ 1330	≥ 4 k	-	B59100M1090A070
100	≤ 550	≥ 1330	≥ 4 k	-	B59100M1100A070
110	≤ 550	≥ 1330	≥ 4 k	-	B59100M1110A070
120	≤ 550	≥ 1330	≥ 4 k	-	B59100M1120A070
130	≤ 550	≥ 1330	≥ 4 k	-	B59100M1130A070
140	≤ 550	≥ 1330	≥ 4 k	-	B59100M1140A070
145	≤ 550	≥ 1330	≥ 4 k	-	B59100M1145A070
150	≤ 550	≥ 1330	≥ 4 k	-	B59100M1150A070
155	≤ 550	≥ 1330	≥ 4 k	-	B59100M1155A070
160	≤ 550	≥ 1330	≥ 4 k	-	B59100M1160A070
$\Delta T = \pm 7$ K					
170	≤ 570	≥ 570	-	≥ 10 k	B59100M1170A070
180	≤ 570	≥ 570	-	≥ 10 k	B59100M1180A070

Color coding of litz wires (to DIN VDE V 0898-1-401)

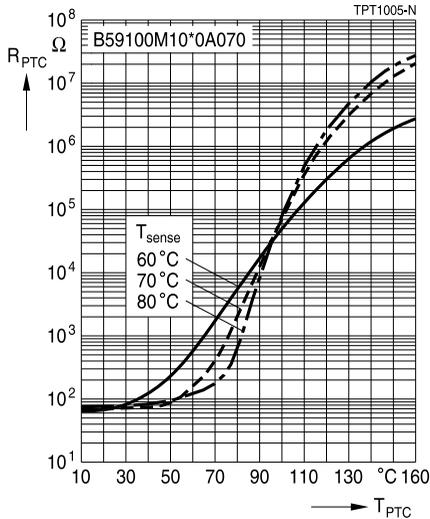| T_{sense} °C	Color
60	white/grey
70	white/brown
80	white/white
90	green/green
100	red/red
110	brown/brown
120	grey/grey
130	blue/blue
140	white/blue
145	white/black
150	black/black
155	blue/black
160	blue/red
170	white/green
180	white/red

Sensors

Motor protection, single sensors   **M1100**

Reliability data

| Test	Standard	Test conditions	$|\Delta R_{25}/R_{25}|$
Electrical endurance, constant	IEC 60738-1	Storage at V_{max} and $T_{op,max}$ (@ V_{max}) Test duration: 1000 h	< 25%
Damp heat	IEC 60738-1	Temperature of air: 40 °C Relative humidity of air: 93% Duration: 56 days 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) Number of cycles: 100 Test duration: 30 min Test according to IEC 60068-2-14, test Na	< 25%
Vibration	IEC 60738-1	Frequency range: 10 to 55 Hz Displacement amplitude: 0.75 mm Test duration: 3×2 h 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)

TPT1005-N

B59100M10*0A070

T_{sense}
60 °C
70 °C
80 °C

TPT1006-O

B59100M1**0A070

T_{sense}
90 °C
100 °C
110 °C

TPT1007-P

B59100M11*0A070

T_{sense}
120 °C
130 °C
140 °C

TPT1008-Q

B59100M11**A070

T_{sense}
145 °C
150 °C
155 °C

Please read *Cautions and warnings* and
Important notes at the end of this document.

Page 5 of 12
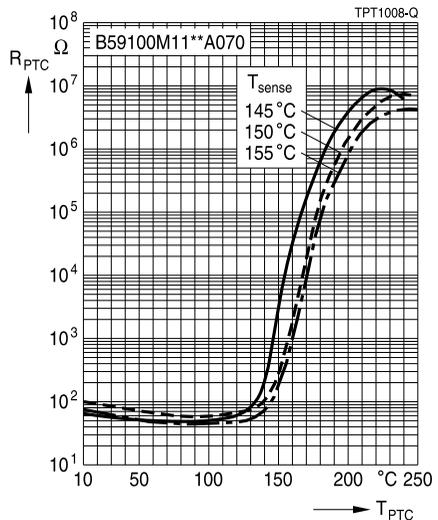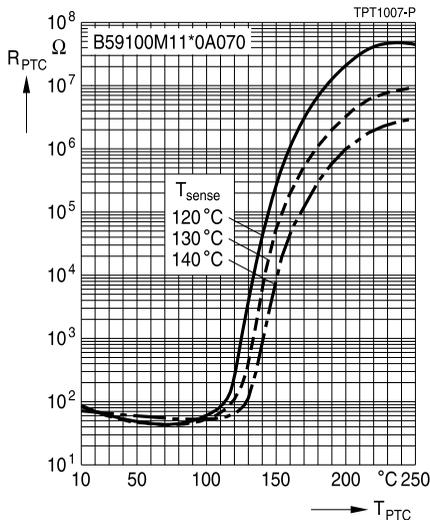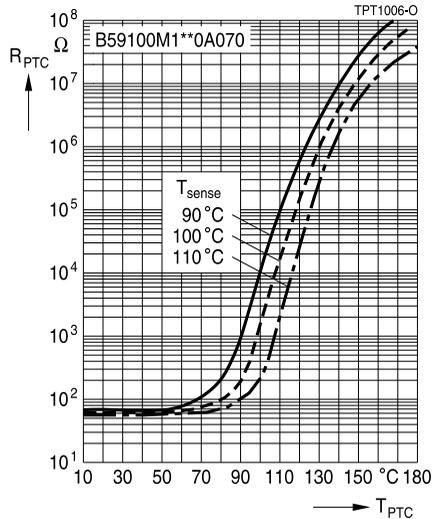
Characteristics (typical)

PTC resistance R_{PTC} versus PTC temperature T_{PTC}
(measured at low signal voltage)
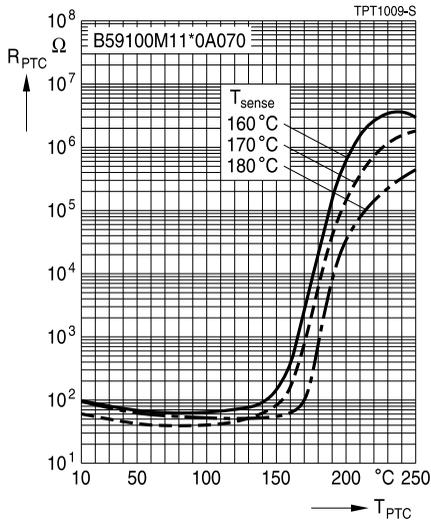
Cautions and warnings

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 $\leq 75\%$ 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.

Please read *Cautions and warnings* and
Important notes at the end of this document.

Page 7 of 12

TDK

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.

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company 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.tdk-electronics.tdk.com/orderingcodes.

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
ΔR_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
ΔR_{25}	Tolerance of R_{25}

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 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.tdk-electronics.tdk.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 our General Terms and Conditions of Supply**.

Important notes

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, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap, XieldCap 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.

Release 2020-06