



## **PTC thermistors as heating elements**

Rectangular, 230 V

**Series/Type:** R102  
**Ordering code:** B59102\*  
**Date:** 2024-11-20

## Applications

Home appliances

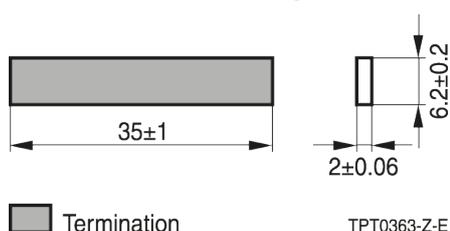
- Hair curlers
- Fan heaters
- Coffee machines
- Glue guns



## Features

- Aluminum metallization
- Suitable for clamp contacting
- Self-regulating
- UL approval to UL 1434 (file number E69802), except  $T_{ref} = 240\text{ °C}$ . UL approval for  $T_{ref} = 220\text{ °C}$  and  $270\text{ °C}$  with  $V_{max} = 140\text{ V}$  and  $V_R = 120\text{ V}$
- RoHS compatible

## Dimensional drawings in mm



## General technical data

Max. operating voltage	$V_{max}$	265	V DC
Rated voltage	$V_R$	230	V DC
Curvature		< 0.05	mm
Operating temperature range ( $V = 0$ )	$T_{op}$	-40/+200	°C
Operating temperature range ( $V = V_R$ ; $T_{ref} \leq 60\text{ °C}$ )	$T_{op}$	-40/+60	°C
Operating temperature range ( $V = V_R$ ; $T_{ref} > 60\text{ °C}$ )		-40/+100	°C
Tolerance of $R_R$	$\Delta R_R$	±50	%

## Options

Other dimensions and ratings on request.

## Delivery mode

Packed in cardboard boxes

**Electrical specifications and ordering codes**

$T_{ref}$ (typ.) °C	$V_{BD}$ V	$R_{min}$ ( $V = V_R$ ) Ω	$T_{surf}^{1)}$ ( $V = V_R$ ) °C	$R_R$ ( $V_{meas} \leq 1.5 V$ ) Ω	Ordering code
50	400	225 <sup>2)</sup>	100	700	B59102R0050A010
70	400	130	115	700	B59102R0070A010
90	400	115	130	700	B59102R0090A010
110	400	100	145	700	B59102R0110A010
130	400	105	160	700	B59102R0130A010
150	400	90	180	700	B59102R0150A010
180	400	66	205	700	B59102R0180A010
220	400	80	240	1000	B59102R0220A010
240	400	75	255	1000	B59102R0240A010
270	340	85	280	1300	B59102R0270A010

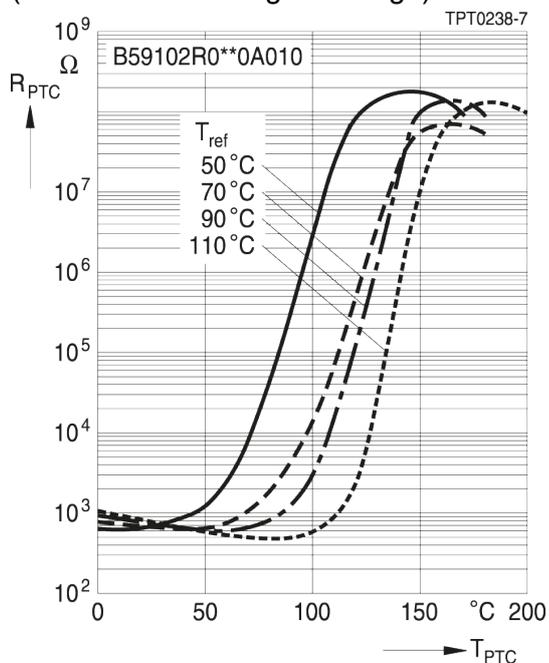
<sup>1)</sup> Measured between points

**Reliability data**

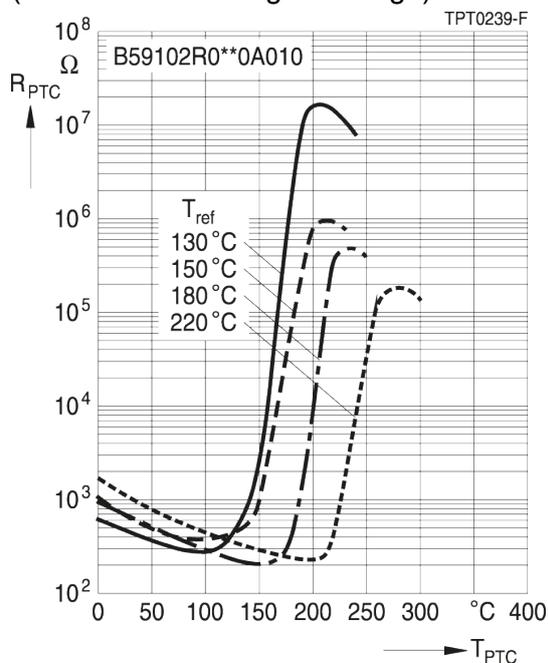
Test	Standard	Test conditions	$ \Delta R_{25}/R_{25} $
Electrical endurance, cycling	IEC 60738-1	Room temperature, $V_{max}$ Number of cycles: 10 000	< 25%
Electrical endurance, constant	IEC 60738-1	Storage at $V_{max}$ and $T_{op,max}$ (@ $V_R$ ) Test duration: 1000 h	< 25%
Damp heat	IEC 60738-1	Temperature of air: 40 °C Relative humidity of air: 93% Duration: 56 days Test according to IEC 60068-2-78	< 25%

**Characteristics (typical)**

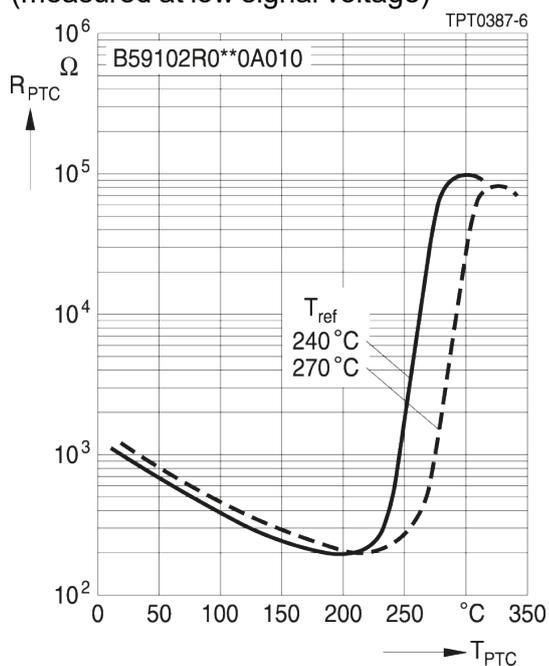
PTC resistance  $R_{PTC}$  versus  
PTC temperature  $T_{PTC}$   
(measured at low signal voltage)



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



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 the suitability of the thermistors through reliability testing during the design-in phase. The thermistors should be evaluated taking into consideration worst-case conditions.

### Storage

- Store the thermistors only in original packaging. Do not open the package prior to processing.
- Storage conditions in original packaging: storage temperature  $-25^{\circ}\text{C}$  to  $+45^{\circ}\text{C}$ , relative humidity  $< 75\%$  annual mean, maximum  $95\%$ , dew precipitation is inadmissible.
- Avoid contamination of the surface of the thermistors during storage, handling, and processing.
- Avoid storing thermistors in a harmful environment, as this will otherwise affect their function in long-term operation (examples given under *Operation*).
- 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. Suitable gloves are recommended.
- Avoid contamination of the thermistor surface during handling.

### Soldering

- 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

- The electrode must not be scratched before/during/after the mounting process.
- Contacts and housing used for the assembly with the 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 the respective datasheet (chapters *Mounting instructions* and *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 pressure of the clamping contacts pressing against the PTC must be 50 kPa. 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 surface temperature of the thermistor can be very high. Ensure that adjacent components are placed at sufficient distance from the thermistor to allow for proper cooling at the thermistors.
- Ensure that any adjacent materials are designed to operate at a temperature comparable to the surface temperature of the thermistor. Ensure 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 under 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 avoided.
- For products with silver electrode: Prevent exposure to electrolytes such as water and moisture to reduce the risk of silver migration. 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 at [www.tdk-electronics.tdk.com/orderingcodes](http://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 current
$I_{r,oil}$	Residual current in oil (for level sensors)
$I_{r,air}$	Residual current 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 <sub>A</sub>	Ambient temperature
t <sub>a</sub>	Thermal threshold time
T <sub>C</sub>	Ferroelectric Curie temperature
t <sub>E</sub>	Settling time (for level sensors)
T <sub>R</sub>	Rated temperature @ 25 °C or otherwise specified in the data sheet
T <sub>sense</sub>	Sensing temperature
T <sub>op</sub>	Operating temperature
T <sub>PTC</sub>	PTC temperature
t <sub>R</sub>	Response time
T <sub>ref</sub>	Reference temperature
T <sub>Rmin</sub>	Temperature at minimum resistance
t <sub>S</sub>	Switching time
T <sub>surf</sub>	Surface temperature
UCT	Upper category temperature
V or V <sub>el</sub>	Voltage (with subscript only for distinction from volume)
V <sub>c(max)</sub>	Maximum DC charge voltage of the surge generator
V <sub>F,max</sub>	Maximum voltage applied at fault conditions in protection mode
V <sub>RMS</sub>	Root-mean-square value of voltage
V <sub>BD</sub>	Breakdown voltage
V <sub>ins</sub>	Insulation test voltage
V <sub>link,max</sub>	Maximum link voltage
V <sub>max</sub>	Maximum operating voltage
V <sub>max,dyn</sub>	Maximum dynamic (short-time) operating voltage
V <sub>meas</sub>	Measuring voltage
V <sub>meas,max</sub>	Maximum measuring voltage
V <sub>R</sub>	Rated voltage
V <sub>PTC</sub>	Voltage drop across a PTC thermistor
α	Temperature coefficient
Δ	Tolerance, change
δ <sub>th</sub>	Dissipation factor
τ <sub>th</sub>	Thermal cooling time constant
λ	Failure rate
e	Lead spacing (in mm)

## 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](http://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**.
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.

## Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, FilterCap, FormFit, InsuGate, LeaXield, MediPlas, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PiezoBrush, PlasmaBrush, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SurfIND, 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](http://www.tdk-electronics.tdk.com/trademarks).

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