PTC thermistors for overcurrent protection

SMDs, EIA sizes 3225 and 4032, 63 V

Series/Type: **B59115, B59215, B59315**

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Overcurrent protection

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Applications

- Overcurrent protection
- Short circuit protection

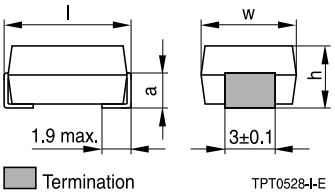
Features

- Molded epoxy encapsulation, lead-free tinned solder terminals
- Marking: Type, manufacturer's logo, reference temperature in °C
- Suitable for wave and reflow soldering
- Suitable for automatic placement
- Qualification based on AEC-Q200, Rev. D
- Moisture sensitivity level (MSL) 1 acc. to JEDEC J-STD-020D
- RoHS-compatible

Delivery mode

- Blister tape, 330-mm reel with 16-mm tape, taping to IEC 60286-3

Dimensional drawing

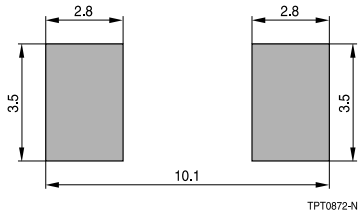


Dimensions (mm)

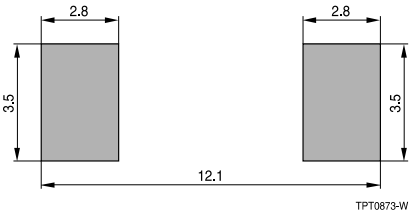
Type	h ±0.5	w ±0.5	l ±0.5	a ±0.3	Size
Reference temperature = 80 °C					
P1115	3.3	6.3	8.0	1.7	3225
P1215	3.3	6.3	8.0	1.7	3225
P1315	3.3	8.0	10.0	2.3	4032
Reference temperature = 120 °C					
P1115	3.3	6.3	8.0	1.7	3225
P1215	3.3	6.3	8.0	1.7	3225
P1315	3.3	8.0	10.0	2.3	4032

Geometry of solder pads

EIA case size 3225



EIA case size 4032



Recommended maximum dimensions (mm)

General technical data

Max. operating voltage	(T_A = 60 °C)	V_{max}	80	V DC or V AC
Rated voltage		V_R	63	V DC or V AC
Switching cycles		N	100	
Tolerance of R_R		ΔR_R	±25	%
Operating temperature range	(V = 0)	T_{op}	−40/+125	°C
Operating temperature range	($V = V_{max}$)	T_{op}	−40/+60	°C

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Electrical specifications and ordering codes

Type	I_R	I_S	I_{Smax} ($V = V_{max}$)	I_r (typ.) ($V = V_{max}$)	R_R	R_{min}	Ordering code
	mA	mA	A	mA	Ω	Ω	
Reference temperature T_{ref} = 80 °C							
P1315	80	165	1.6	15.0	16	9.6	B59315P1080A062
P1215	65	135	1.0	11.5	25	15.0	B59215P1080A062
P1115	40	85	0.7	9.0	55	32.2	B59115P1080A062
Reference temperature T_{ref} = 120 °C							
P1315	150	310	1.6	20.0	16	9.6	B59315P1120A062
P1215	100	210	1.0	14.0	25	15.0	B59215P1120A062
P1115	70	145	0.7	13.0	55	32.2	B59115P1120A062

Reliability data

Test	Standard	Test conditions	$\lvert\Delta R_{25}/R_{25}\rvert$
Electrical endurance, cycling	IEC 60738-1	Room temperature, I_{Smax}; V_{max} Number of cycles: 100	< 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: 5 Test duration: 30 min Test according to IEC 60068-2-14, test Na	< 10%
Shock	IEC 60738-1	Acceleration: 400 m/s² Pulse duration: 6 ms; 6 × 5000 pulses	< 5%
Bending test	IEC 60738-1	Components reflow-soldered to test board Maximum bending: 2 mm Test according to IEC 60068-2-21, test Ue	< 10%

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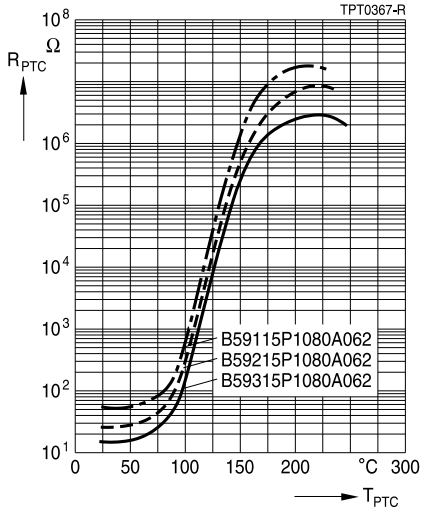
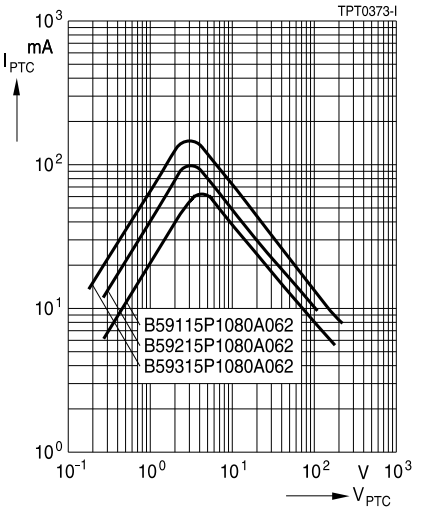
Characteristics (typical) for T_{ref} = 80 °C

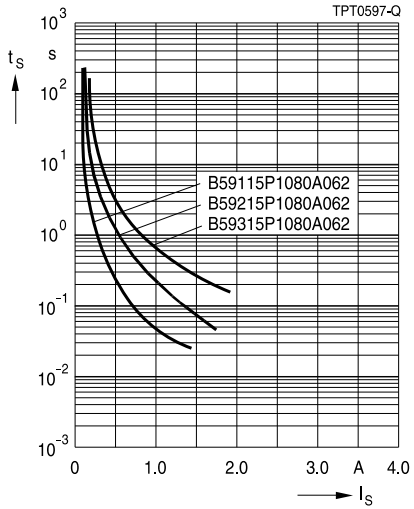
PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage)



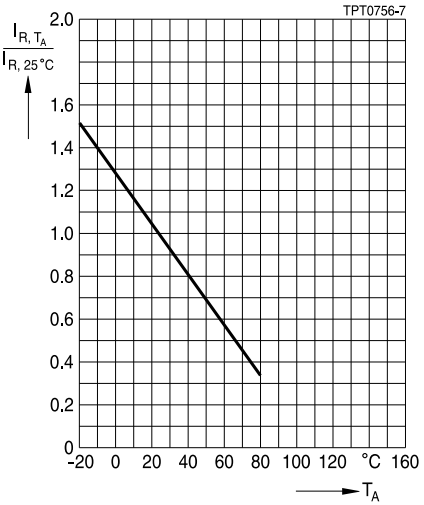
PTC current I_{PTC} versus PTC voltage V_{PTC} (measured at 25 °C in still air)



Switching time t_S versus switching current I_S (measured at 25 °C in still air)



Rated current I_R versus ambient temperature T_A (measured in still air)



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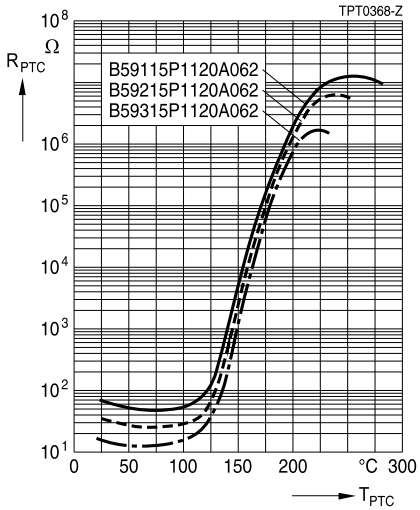
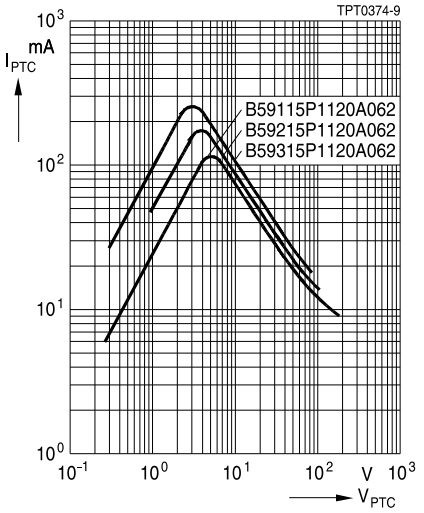
Characteristics (typical) for T_{ref} = 120 °C

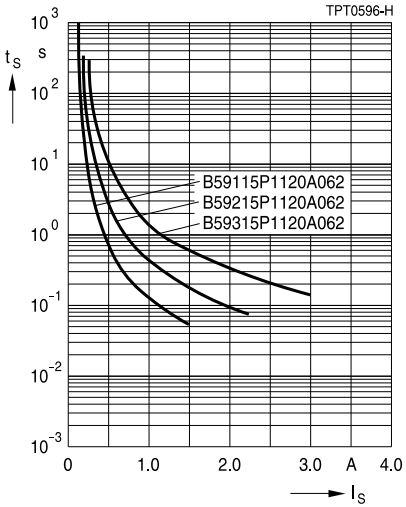
PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage)



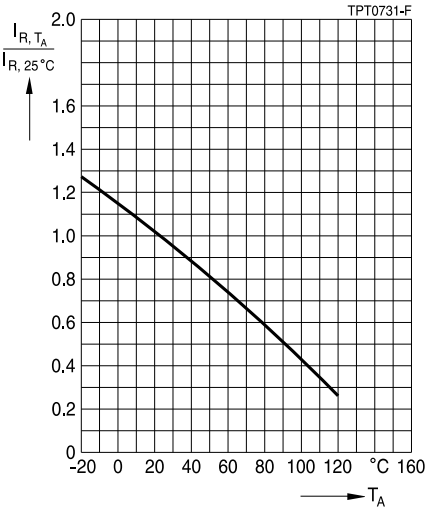
PTC current I_{PTC} versus PTC voltage V_{PTC} (measured at 25 °C in still air)



Switching time t_S versus switching current I_S (measured at 25 °C in still air)



Rated current I_R versus ambient temperature T_A (measured in still air)



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Cautions and warnings

General

- TDK 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 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.

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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 AG.

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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
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}

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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
α	Temperature coefficient
Δ	Tolerance, change
δ_{th}	Dissipation factor
τ_{th}	Thermal cooling time constant
λ	Failure rate
e	Lead spacing (in mm)

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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**.

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