

PTC thermistors for overcurrent protection

SMDs, EIA sizes 3225 and 4032, 63 V

Series/Type: B59115, B59215, B59315

Date: August 2014

© EPCOS AG 2015. Reproduction, publication and dissemination of this publication, enclosures hereto and the information contained therein without EPCOS' prior express consent is prohibited.

EPCOS AG is a TDK Group Company.



SMDs, EIA sizes 3225 and 4032, 63 V

Applications

- Overcurrent protection
- Short circuit protection

Features

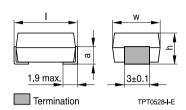
- Molded epoxy encapsulation, lead-free tinned solder terminals
- Marking: Type, manufacturer's logo, reference temperature in °C
- Suitable for wave and reflow soldering
- Suitable for automatic placement
- Qualification based on AEC-Q200, Rev. D
- Moisture sensitivity level (MSL) 1 acc. to JEDEC J-STD-020D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

Delivery mode

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

SMD

Dimensional drawing

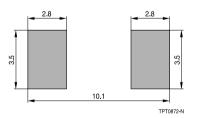


Dimensions (mm)

Туре	h ±0.5	w ±0.5	I ±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	

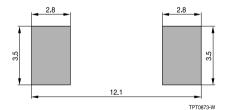
Geometry of solder pads

EIA case size 3225



Recommended maximum dimensions (mm)

EIA case size 4032



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



SMDs, EIA sizes 3225 and 4032, 63 V

SMD

Electrical specifications and ordering codes

Туре	I _R	Is	I _{Smax}	I _r	R _R	R _{min}	Ordering code
			$(V = V_{max})$	(typ.)			
				$(V = V_{max})$			
	mA	mA	Α	mA	Ω	Ω	
Reference	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	$ \Delta R_{25}/R_{25} $
Electrical endurance,	IEC 60738-1	Room temperature, I _{Smax} ; V _{max}	< 25%
cycling		Number of cycles: 100	
Electrical endurance,	IEC 60738-1	Storage at V _{max} /T _{op,max} (V _{max})	< 25%
constant		Test duration: 1000 h	
Damp heat	IEC 60738-1	Temperature of air: 40 °C	< 10%
		Relative humidity of air: 93%	
		Duration: 56 days	
		Test according to IEC 60068-2-78	
Rapid change	IEC 60738-1	$T_1 = T_{op,min}(0 \text{ V}), T_2 = T_{op,max}(0 \text{ V})$	< 10%
of temperature		Number of cycles: 5	
		Test duration: 30 min	
		Test according to IEC 60068-2-14, test Na	
Shock	IEC 60738-1	Acceleration: 390 m/s ²	< 5%
		Pulse duration: 6 ms; 6 × 4000 pulses	
Bending test	IEC 60738-1	Components reflow-soldered to test board	< 10%
		Maximum bending: 2 mm	
		Test according to IEC 60068-2-21, test Ue	

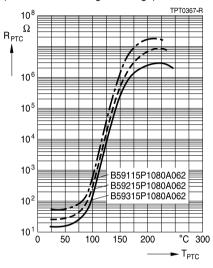


SMDs, EIA sizes 3225 and 4032, 63 V

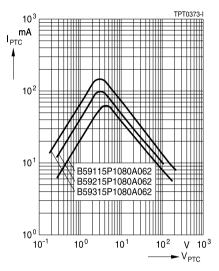
SMD

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

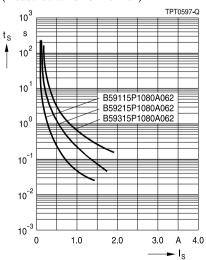
PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage)



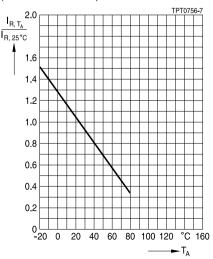
PTC current I_{PTC} versus PTC voltage V_{PTC} (measured at 25 °C in still air)



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)



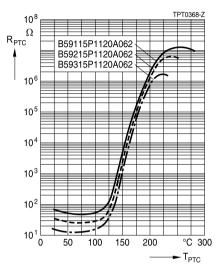


SMDs, EIA sizes 3225 and 4032, 63 V

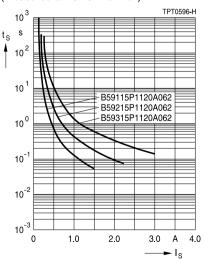
SMD

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

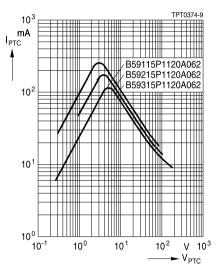
PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage)



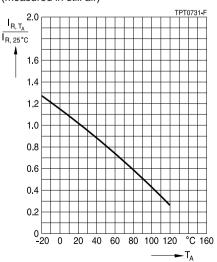
Switching time t_{S} versus switching current I_{S} (measured at 25 °C in still air)



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



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





SMDs, EIA sizes 3225 and 4032, 63 V

SMD

Cautions and warnings

General

- EPCOS 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 EPCOS 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 before storage.
- 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 0402, 0603, 0805 and 1210: 12 months

Handling

- PTCs must not be dropped. Chip-offs must not be caused during handling of PTCs.
- 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.



SMDs, EIA sizes 3225 and 4032, 63 V

SMD

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 of the clamping contacts pressing against the PTC must be 10 N.
- 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 EPCOS AG.

Display of ordering codes for EPCOS products

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



SMDs, EIA sizes 3225 and 4032, 63 V

SMD

Symbols and terms

Symbol	Term
A	Area
С	Capacitance
C_{th}	Heat capacity
f	Frequency
1	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
Is	Switching current
I _{Smax}	Maximum switching current
LCT	Lower category temperature
N	Number (integer)
N _c	Operating cycles at V _{max} , charging of capacitor
$N_{\rm f}$	Switching cycles at V _{max} , failure mode
Р	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
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
T	Temperature
t _	Time
T _A	Ambient temperature



SMDs, EIA sizes 3225 and 4032, 63 V

SMD

 $\begin{array}{ll} t_a & & \text{Thermal threshold time} \\ T_C & & \text{Ferroelectric Curie temperature} \\ t_E & & \text{Settling time (for level sensors)} \end{array}$

 $\begin{array}{lll} T_{\text{R}} & & \text{Rated temperature} \\ T_{\text{sense}} & & \text{Sensing temperature} \\ T_{\text{op}} & & \text{Operating temperature} \\ T_{\text{PTC}} & & \text{PTC temperature} \\ t_{\text{R}} & & \text{Response time} \end{array}$

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_{E,max} Maximum voltage applied at fault conditions in protection mode

V_{RMS} Root-mean-square value of voltage

 $\begin{array}{lll} V_{BD} & & Breakdown \ voltage \\ V_{ins} & & Insulation \ test \ voltage \\ V_{link,max} & & Maximum \ link \ voltage \\ V_{max} & & Maximum \ operating \ voltage \end{array}$

V_{max.dvn} 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 Dissipation factor

τ_{th} 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, 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.
- 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, Alu-X, CeraDiode, CeraLink, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FilterCap, FormFit, MiniBlue, MiniCell, MKD, MKK, MLSC, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, 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.