PTC thermistors for overcurrent protection in telecom applications

Leaded disks

Series/Type:

Date: December 2010

Applications

- Overcurrent protection for telecom applications
- Suitable for line card applications e.g. POTS, access networks, customer premises equipment (CPE) or integrated voice data (IVD)

Features

- Compliant with ITU-T standards
  - basic-level lightning surges (10/700 µs)
  - basic-level power induction (600 V, 1 A, 0.2 s)
  - power contact criteria A/B (230 V, 15 min.)
- Suitable for continuous connection to mains voltages of 110/230 V AC in tripped (high-ohmic) condition
- Matching available with narrow resistance tolerance
- Tight resistance matching maintained after switching
- Negligible resistance drift after soldering or switching
- Marked with manufacturer's logo, type designation and date code
- RoHS-compatible

Options

- Alternative tolerances and resistances on request

Delivery mode

- Cardboard tape, 360-mm reel, taping to IEC 60286-2 or untaped on cardboard strips

General technical data

Max. operating voltage		V_{max}	245	V AC
Operating temperature range	(V = 0)	T_{op}	−20/+125	°C
Operating temperature range	(V = 230 V)	T_{op}	0/+70	°C

Electrical specifications and ordering codes

Type	R_R	ΔR_R	$R_{25,match}$ (per packing unit) $\lvert R_1 - R_2 \rvert_{max}$	I_R @ 25°C	I_R @ 70°C	I_S @ 25°C	I_{Smax} @ 230 V AC	Ordering code
	Ω	%	Ω	mA	mA	mA	A	
C1805	4.75	+15/−20	0.25	160	70	370	1.0	B59805C1080A151
B1048	6	±15	0.8	140	65	300	2.5	B59048B1080B151
C1098	6	±17	No	185	110	440	1.0	B59098C1100B051
B1010	9	±20	No	150	100	370	3.0	B59010B1120A070
S1022	10	±15	No	160	110	375	2.5	B59022S1120A051
B1042	10	±15	1.0	150	100	350	1.0	B59042B1120B151
B1070	10	±20	1.0	135	90	340	5.0	B59070B1105B151
B1076	10	±20	1.0	140	95	340	1.0	B59076B1120B151
B1076	10	±20	1.0	140	95	340	1.0	B59076B1120B153
B1012	12	±15	No	90	35	210	1.0	B59012B1080B070
S1071	17.5	±20	2.0	150	100	250	1.5	B59071S1120B151
B1084	20	+10/−20	0.5	100	65	240	3.0	B59084B1120A151
B1008	25	±15	1.0	100	70	240	3.0	B59008B1130A051
S1023	25	±15	No	95	65	225	2.8	B59023S1120A070
B1045	25	±15	1.0	90	60	210	3.0	B59045B1120B151
B1069	25	±20	No	60	25	150	0.9	B59069B1080B051
B1069	25	±20	1.0	60	25	150	0.9	B59069B1080B151
B1069	25	±15	No	85	55	200	0.9	B59069B1120A051
B1603	25	±20	0.6	100	65	200	1.5	B59603B1120B157
S1024	35	±15	2.0	70	45	170	1.0	B59024S1120A151
C1154	50	±15	1.0	65	45	150	2.5	B59154C1130A151
C1154	50	±10	1.0	65	45	150	2.5	B59154C1130B151
U1154[1)]	50	±15	1.0	90	60	190	2.5	B59154U1135B151
B1184	50	±15	1.0	60	40	140	2.5	B59184B1120A151
C1184	50	±15	1.0	65	45	150	4.0	B59184C1120B153
C1184[1)]	50	±15	1.0	100	60	210	2.5	B59184C1130A151
C1173[1)]	55	±15	3.0	90	60	210	2.5	B59173C1130A151

1) Please note - additional tests and test conditions

Switching times and ordering codes

Type	R_R	t_S (typ.) @ I_{Smax}, 230 V AC	t_S (typ.) @ 1 A, 230 V AC	t_S (typ.) @ 500 mA, 230 V AC	Ordering code
	Ω	s	s	s	
C1805	4.75	4.0	4.0	20.0	B59805C1080A151
B1048	6	0.5	3.3	15.0	B59048B1080B151
C1098	6	14.0	14.0	70.0	B59098C1100B051
B1010	9	0.7	6.5	30.0	B59010B1120A070
S1022	10	1.0	6.0	28.0	B59022S1120A051
B1042	10	3.8	3.8	17.0	B59042B1120B151
B1070	10	0.2	5.0	22.0	B59070B1105B151
B1076	10	1.8	1.8	8.0	B59076B1120B151
B1076	10	1.8	1.8	8.0	B59076B1120B153
B1012	12	1.0	1.0	3.8	B59012B1080B070
S1071	17.5	1.0	2.2	9.0	B59071S1120B151
B1084	20	0.1	0.9	3.8	B59084B1120A151
B1008	25	0.2	1.7	7.0	B59008B1130A051
S1023	25	0.2	1.5	6.3	B59023S1120A070
B1045	25	0.08	0.7	3.0	B59045B1120B151
B1069	25	0.25	--	0.8	B59069B1080B051
B1069	25	0.25	--	0.8	B59069B1080B151
B1069	25	0.4	--	1.4	B59069B1120A051
B1603	25	1.5	3.5	14.0	B59603B1120B157
S1024	35	1.4	1.4	5.5	B59024S1120A151
C1154	50	0.05	0.3	1.1	B59154C1130A151
C1154	50	0.05	0.3	1.1	B59154C1130B151
U1154[1)]	50	0.05	0.4	1.3	B59154U1135B151
B1184	50	0.1	0.8	3.0	B59184B1120A151
C1184	50	0.06	0.8	3.1	B59184C1120B153
C1184[1)]	50	0.08	1.1	4.0	B59184C1130A151
C1173[1)]	55	0.09	1.3	5.0	B59173C1130A151

1) Please note - additional tests and test conditions

Dimensional drawings [1)]

Figure 1
Kinked leads, uncoated

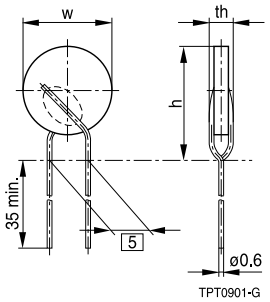


Figure 2
Straight leads, uncoated

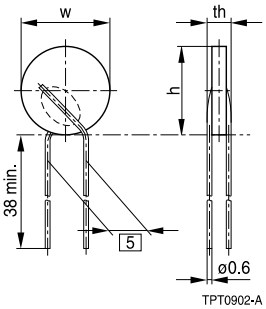


Figure 3
Kinked leads, coated

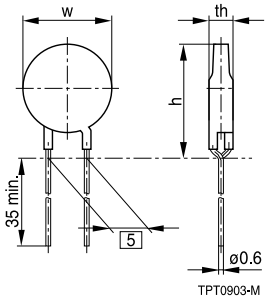
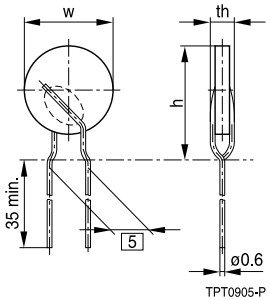


Figure 4
Kinked leads, uncoated



1) The lead length stated in the dimensional drawing refers to the untaped version. For dimensions of the taped version, see chapter "Taping and packing".

Dimensions in mm

Type	R_R Ω	w_{max} mm	h_{max} mm	th_{max} mm	Figure	Packaging	Ordering code
C1805	4.75	9.0	12.5	4.5	Figure 3	Taped on reel	B59805C1080A151
B1048	6	8.0	12.0	5.0	Figure 1	Taped on reel	B59048B1080B151
C1098	6	13.0	17.0	5.0	Figure 3	Taped on reel	B59098C1100B051
B1010	9	10.1	10.1	4.2	Figure 2	Cardboard strips	B59010B1120A070
S1022	10	10.5	14.5	4.2	Figure 4	Taped on reel	B59022S1120A051
B1042	10	8.2	12.1	4.0	Figure 1	Taped on reel	B59042B1120B151
B1070	10	10.2	14.0	4.5	Figure 4	Taped on reel	B59070B1105B151
B1076	10	6.6	8.0	4.0	Figure 1	Taped on reel	B59076B1120B151
B1076	10	6.6	7.5	4.0	Figure 2	Taped on reel	B59076B1120B153
B1012	12	6.0	10.0	4.0	Figure 1	Cardboard strips	B59012B1080B070
S1071	17.5	8.2	8.2	4.0	Figure 4	Taped on reel	B59071S1120B151
B1084	20	6.6	7.5	4.0	Figure 2	Taped on reel	B59084B1120A151
B1008	25	8.2	10.5	4.0	Figure 4	Taped on reel	B59008B1130A051
S1023	25	8.2	10.5	4.0	Figure 4	Cardboard strips	B59023S1120A070
B1045	25	6.6	9.5	4.0	Figure 4	Taped on reel	B59045B1120B151
B1069	25	5.2	5.2	3.5	Figure 2	Taped on reel	B59069B1080B051
B1069	25	5.2	5.2	3.5	Figure 2	Taped on reel	B59069B1080B151
B1069	25	5.2	5.2	3.5	Figure 2	Taped on reel	B59069B1120A051
B1603	25	10.2	12.6	5.0	Figure 1	Taped on reel	B59603B1120B157
S1024	35	8.2	12.1	4.5	Figure 1	Taped on reel	B59024S1120A151
C1154	50	6.0	10.0	4.5	Figure 3	Taped on reel	B59154C1130A151
C1154	50	6.0	10.0	4.5	Figure 3	Taped on reel	B59154C1130B151
U1154[1)]	50	6.0	10.0	4.0	Figure 3	Taped on reel	B59154U1135B151
B1184	50	8.2	12.1	4.0	Figure 1	Taped on reel	B59184B1120A151
C1184	50	9.0	12.5	4.5	Figure 3	Taped on reel	B59184C1120B153
C1184[1)]	50	9.0	13.0	4.5	Figure 3	Taped on reel	B59184C1130A151
C1173[1)]	55	8.0	11.0	5.5	Figure 3	Taped on reel	B59173C1130A151

Figure 1: Kinked leads, uncoated
Figure 2: Straight leads, uncoadted
Figure 3: Kinked leads, coated
Figure 4: Kinked leads, uncoated

For further details see "Dimensional drawings".

1) Please note - additional tests and test conditions

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: 10	< 20%
Electrical endurance, constant	IEC 60738-1	Storage at V_{max} /$T_{op,max}$ (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%
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%
Shock	IEC 60738-1	Acceleration: 390 m/s^2 Pulse duration: 6 ms; 6 × 4000 pulses	< 5%
Climatic sequence	IEC 60738-1	Dry heat: T = $T_{op,max}$ (0 V) Test duration: 16 h Damp heat first cycle Cold: T = $T_{op,min}$ (0 V) Test duration: 2 h Damp heat 5 cycles Tests performed according to IEC 60068-2-30	< 10%

Additional tests and test conditions

For type U1154:

GR1089 Second level intra building AC power fault	120 V_{AC} (50 Hz), short circuit current 25 A, t = 15 min, criteria A (no damage, function must be fulfilled)
Enhanced test condition to GR1089 first level intra building lightning surge for multi-pair ports	$V_{c(max)}$ = ±2.25 kV (each polarity 1 application), t = 2/10 µs, R_G = 2 Ω, R = 12 Ω, criteria A (no damage, function must be fulfilled)

For type C1184 (only B59184C1130A151):

Enhanced test condition to K.20 power induction	600 V_{AC}, R = 600 Ω, t = 1.0 s, without GDT, criteria A (no damage, function must be fulfilled)
Enhanced test condition to K.20 main power contact	230 V_{AC}, t = 15 min, R = 10 ... 1000 Ω, criteria A (no damage, function must be fulfilled)

For type C1173:

Enhanced test condition to K.20 power induction	600 V_{AC}, R = 600 Ω, t = 0.5 s, without GDT, criteria A (no damage, function must be fulfilled)
Enhanced test condition to K.20 single port, lightning	$V_{c(max)}$ = 4 kV, t = 10/700 µs, R = 40 Ω, without GDT, criteria A (no damage, function must be fulfilled)

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.

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).

Symbols and terms

A	Area
C_{th}	Heat capacity
f	Frequency
I	Current
I_{max}	Maximum current
I_R	Rated 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
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
t_a	Thermal threshold time
T_C	Ferroelectric Curie temperature

t_E	Settling time (for level sensors)
T_R	Rated temperature
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_{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
$\boxed{e}$	Lead spacing (in mm)

Abbreviations / Notes

SMD Surface-mount devices

* To be replaced by a number in ordering codes, type designations etc.

+ To be replaced by a letter

All dimensions are given in mm.

The commas used in numerical values denote decimal points.

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.
6. 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, BAOKE, Alu-X, CeraDiode, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FormFit, MiniBlue, MiniCell, MKK, MKD, MLSC, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, 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.