PTC thermistors for overcurrent protection in telecom applications

Single SMDs

Series/Type: **B590****

Date: November 2009

EPCOS

Overcurrent protection for telecom

Single SMDs

SMD

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
- UL approval for Gamma I version to UL 1434 (file number E69802)
- Matching available with narrow resistance tolerance
- Tight resistance matching maintained after switching
- Negligible resistance drift after reflow soldering or switching
- Marked with type designation and date code
- RoHS-compatible

Options

- Alternative tolerances and resistances on request

Delivery mode

- Blister tape, 330-mm reel with 16-mm (Gamma I) or 24-mm tape (Gamma L), taping to IEC 60286-3

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

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Electrical specifications and ordering codes

Type	R_R Ω	ΔR_R %	$R_{25,match}$ (per packing unit) $\lvert R_1 - R_2 \rvert_{max}$ Ω	I_R @ 25°C mA	I_R @ 70°C mA	I_S @ 25°C mA	I_{Smax} @ 230 V AC A	Ordering code
Gamma I								
G1081	9	±20	0.5	180	120	400	1.0	B59081G1120A161
G1085	10	±20	1.0	180	120	400	1.0	B59085G1120A161
G1083	16	±20	0.5	150	100	300	1.5	B59083G1120A161
G1080	25	±20	1.0	130	85	270	2.8	B59080G1120B262
G1086	29	±20	1.0	125	80	260	2.8	B59086G1120B262
G1084	50	±15	1.0	90	60	190	2.5	B59084G1120A161
Gamma L								
G1040	25	±20	1.0	120	80	250	4.0	B59040G1120B161
G1012	35	+15/−20	1.0	100	65	250	4.6	B59012G1120A161

Switching times and ordering codes

Type	R_R Ω	t_S (typ.) @ I_{Smax}, 230 V AC s	t_S (typ.) @ 1 A, 230 V AC s	t_S (typ.) @ 500 mA, 230 V AC s	Ordering code
Gamma I					
G1081	9	4.4	4.4	23.0	B59081G1120A161
G1085	10	3.9	3.9	19.0	B59085G1120A161
G1083	16	1.0	2.4	11.0	B59083G1120A161
G1080	25	0.2	1.5	6.5	B59080G1120B262
G1086	29	0.18	1.3	5.5	B59086G1120B262
G1084	50	0.13	0.8	3.1	B59084G1120A161
Gamma L					
G1040	25	0.08	1.1	5.0	B59040G1120B161
G1012	35	0.05	0.8	3.5	B59012G1120A161

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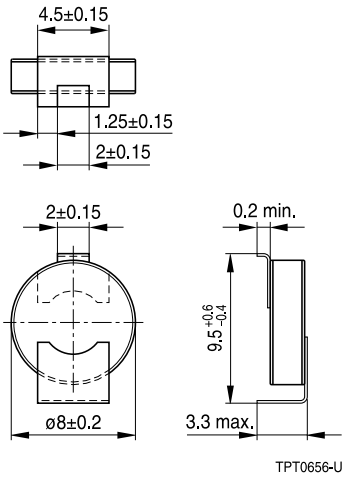
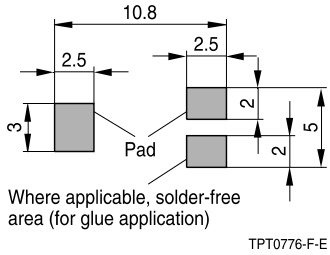
Dimensional drawings for Gamma I

Dimensions in mm

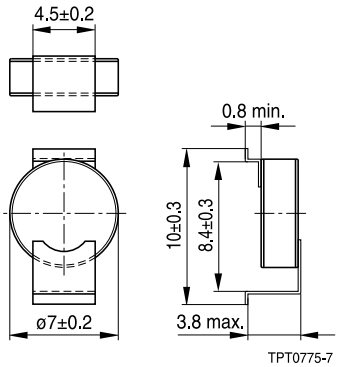


Solder pad

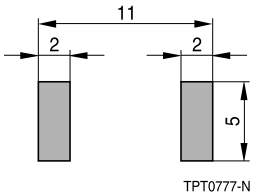


Dimensional drawings for Gamma L

Dimensions in mm



Solder pad



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Packaging

Type	Packaging
Gamma I	
G1080	16-mm tape
G1081	16-mm tape
G1083	16-mm tape
G1084	16-mm tape
G1085	16-mm tape
G1086	16-mm tape
Gamma L	
G1012	24-mm tape
G1040	24-mm tape

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/s² 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%

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ITU performance overview and test conditions

	Test no.	ITU K20		ITU K21		ITU K45	
		Basic test level	Enhanced test level	Basic test level	Enhanced test level	Basic test level	Enhanced test level
Power induction	1	A	A	A	A	A	A
	2	B	C	B	C	B	C
Power contact	3	D	E	D	E	D	E
Lightning surge	4	F	G	G	G	G	G
	5	H	H	H	I	H	H

Power induction	A	600 V AC, R = 600 Ω, t = 0.2 s, criteria A
	B	600 V AC, R = 600 Ω, t = 1.0 s, with GDT, criteria A
	C	1500 V AC, R = 200 Ω, t = 2.0 s, with GDT, criteria A
Power contact	D	230 V AC, t = 15 min, R = 10 ... 1000 Ω, criteria B
	E	230 V AC, t = 15 min, R = 10, 20, 40, 80, 1000 Ω, criteria B, R = 160, 300, 600 Ω, criteria A
Lightning surge	F	$U_{c(max)}$ = 1.0 kV, R = 25 Ω, t = 10/700 µs, without GDT, criteria A
	G	$U_{c(max)}$ = 1.5 kV, R = 25 Ω, t = 10/700 µs, without GDT, criteria A
	H	$U_{c(max)}$ = 4.0 kV, R = 25 Ω, t = 10/700 µs, with GDT, criteria A
	I	$U_{c(max)}$ = 6.0 kV, R = 25 Ω, t = 10/700 µs, with GDT, criteria A

Criteria A: no damage, function must be fulfilled.
Criteria B: no fire hazard.

Electrical requirements according to GR1089 standard for AC power contact

AC voltage: 120 V, 50 Hz, short circuit current 25 A, time 15 min, criteria A.

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_{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
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.
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