PTC thermistors for overcurrent protection

Leaded disks, coated, 230 V

Series/Type: **B598****

Date: February 2012

Applications

- Overcurrent protection
- Short circuit protection

Features

- Lead-free terminals
- Marking: Type, manufacturer's logo, reference temperature in °C and date code YYWW (except B59880C0130* and B59890C*)
- Short response times
- UL approval for T_{ref} = 130 °C to UL 1434 with V_{max} = 220 V and V_R = 220 V (file number E69802)
- UL approval for T_{ref} = 120 °C to UL 1434 with V_{max} = 230 V and V_R = 220 V (file number E69802)
- UL approval for T_{ref} = 80 °C to UL 1434 with V_{max} = 165 V and V_R = 145 V (file number E69802)
- VDE approval for selected types (license number 104843 E)
- RoHS-compatible

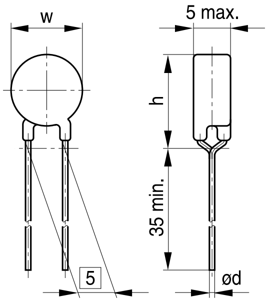
Options

- Leadless disks and leaded disks without coating available on request
- Thermistors with diameter w ≤11.0 mm are also available on tape (to IEC 60286-2)

Delivery mode

- Cardboard strips (standard)
- Cardboard tape reeled or in Ammo pack on request

Dimensional drawing



TPT0648-4

Dimensions (mm)

Type	T_{ref} °C	w_{max}	h_{max}	∅d
C810	130	22.0	25.5	0.8
C830	80	22.0	25.5	0.6
C830	120	22.0	25.5	0.6
C830	130	17.5	21.0	0.8
C840	80	17.5	21.0	0.6
C840	120	17.5	21.0	0.6
C840	130	13.5	17.0	0.6
C850	80	13.5	17.0	0.6
C850	120	13.5	17.0	0.6
C850	130	11.0	14.5	0.6
C860	80	11.0	14.5	0.6
C860	120	11.0	14.5	0.6
C860	130	9.0	12.5	0.6
C870	80	9.0	12.5	0.6
C870	120	9.0	12.5	0.6
C870	130	6.5	10.0	0.6
C872	120	9.0	12.5	0.6
C873	120	9.0	12.5	0.6
C874	120	9.0	12.5	0.6
C875	120	9.0	12.5	0.6
C880	80	6.5	10.0	0.6
C880	120	6.5	10.0	0.6
C880	130	4.0	7.5	0.6
C883	120	6.5	10.0	0.6
C890	80	4.0	7.5	0.5
C890	120	4.0	7.5	0.5

General technical data

Max. operating voltage	(T_A = 60 °C)	V_{max}	265	V DC or V AC
Rated voltage		V_R	230	V DC or V AC
Switching cycles		N	100	
Tolerance of R_R	(T_{ref} = 80 °C or 120 °C)	ΔR_R	±25	%
Tolerance of R_R	(T_{ref} = 130 °C)	ΔR_R	±20	%
Operating temperature range	(V = 0)	T_{op}	−40/+125	°C
Operating temperature range	(V = V_{max})	T_{op}	0/+60	°C

Electrical specifications and ordering codes

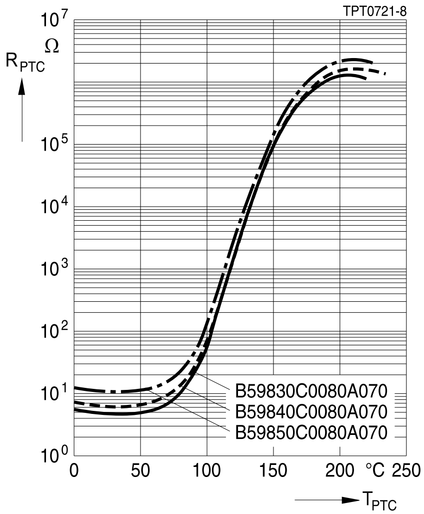
Type	I_R	I_S	I_{Smax} (V = V_{max})	I_r (typ.) (V = V_{max})	T_{ref} (typ.)	R_R	R_{min}	Approvals		Ordering code
	mA	mA	A	mA	°C	Ω	Ω			
C810	650	980	7.0	20	130	3.5	2.3	X	–	B59810C0130A070
C830	460	920	7.0	20	120	3.7	2.4	X	–	B59830C0120A070
C830	450	680	4.1	15	130	5	3.3	X	–	B59830C0130A070
C840	330	660	4.1	15	120	6	3.8	X	–	B59840C0120A070
C840	330	500	2.2	13	130	9	5.9	X	–	B59840C0130A070
C830	250	510	7.0	15	80	3.7	2.2	X	–	B59830C0080A070
C850	200	400	2.2	13	120	10	6.4	X	–	B59850C0120A070
C850	200	320	1.5	10	130	13	8.6	X	–	B59850C0130A070
C840	170	350	4.1	10	80	6	3.6	X	X	B59840C0080A070
C860	140	280	1.5	10	120	15	9	X	–	B59860C0120A070
C860	140	230	1.0	9	130	25	16.5	X	–	B59860C0130A070
C850	110	230	2.2	8	80	10	6	X	X	B59850C0080A070
C870	100	200	1.0	9	120	25	15	X	–	B59870C0120A070
C870	100	150	0.4	6	130	50	33	X	X	B59870C0130A070
C860	90	180	1.5	6	80	15	7.8	X	X	B59860C0080A070
C872	80	160	1.0	9	120	35	21	X	–	B59872C0120A070
C873	70	140	1.0	9	120	45	27	X	–	B59873C0120A070
C870	60	130	1.0	5	80	25	13	X	X	B59870C0080A070
C874	60	125	1.0	9	120	55	31	X	–	B59874C0120A070
C875	55	110	1.0	9	120	65	36	X	–	B59875C0120A070
C880	55	110	0.4	6	120	70	39	X	X	B59880C0120A070
C880	55	90	0.2	5	130	160	106	X	X	B59880C0130A070
C883	35	70	0.4	5	120	120	67	X	X	B59883C0120A070
C880	30	70	0.4	4	80	70	36.7	X	X	B59880C0080A070
C890	30	60	0.2	5	120	150	84	X	X	B59890C0120A070
C890	15	40	0.2	3	80	150	78.7	X	X	B59890C0080A070

Reliability data

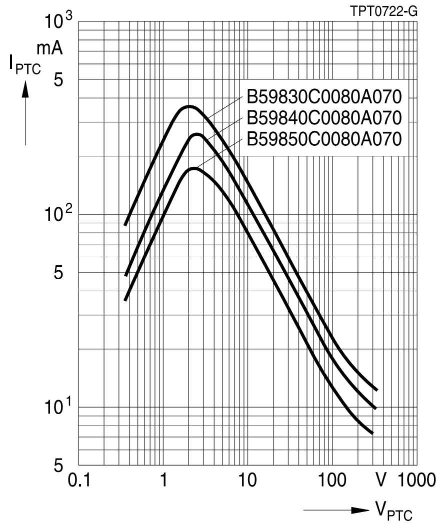
Test	Standard	Test conditions	$\|\Delta R_{25}/R_{25}\|$
Electrical endurance, cycling	IEC 60738-1	Room temperature, I_{Smax}; V_{max} Number of cycles: 100	< 25%
Electrical endurance, constant	IEC 60738-1	Storage at V_{max} /$T_{op,max}$ (V_{max}) Test duration: 1000 h	< 25%
Damp heat	IEC 60738-1	Temperature 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%

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

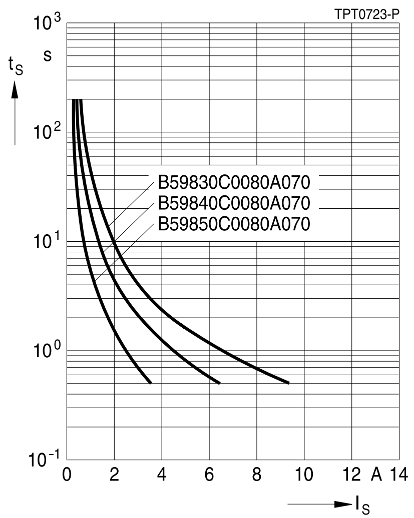
PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage)



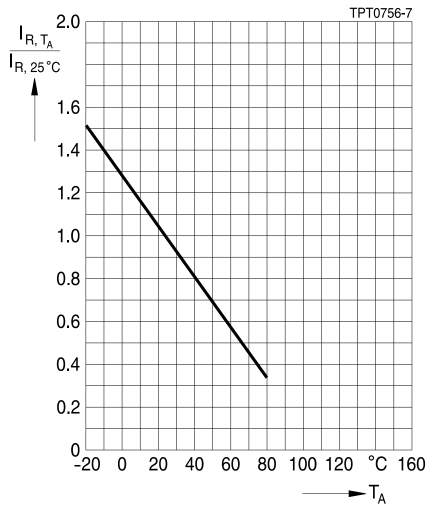
PTC current I_{PTC} versus PTC voltage V_{PTC} (measured at 25 °C in still air)



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

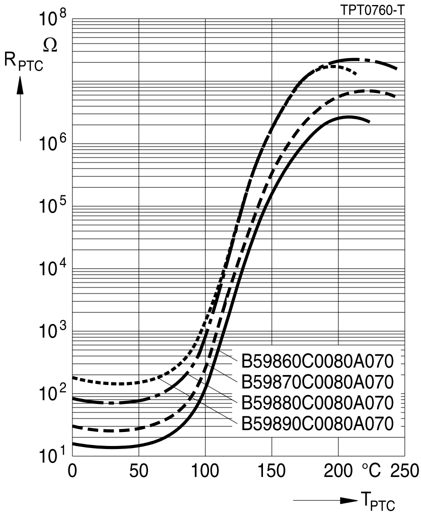


Rated current I_R versus ambient temperature T_A (measured in still air)

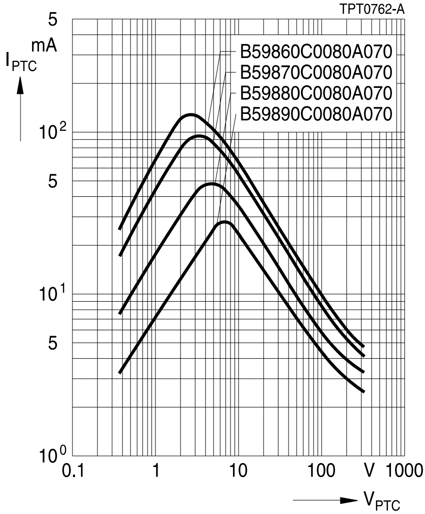


Characteristics (typical) for T_{ref} = 80 °C

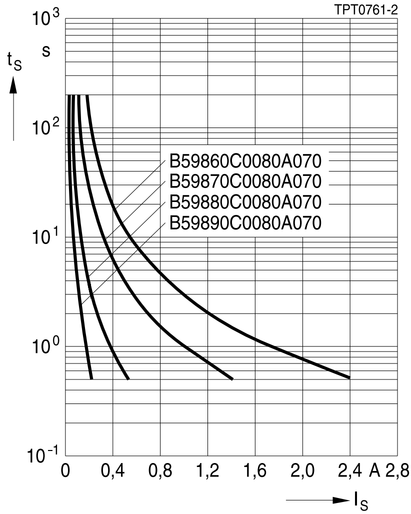
PTC resistance R_{PTC} versus PTC temperature T_{PTC}
(measured at low signal voltage)



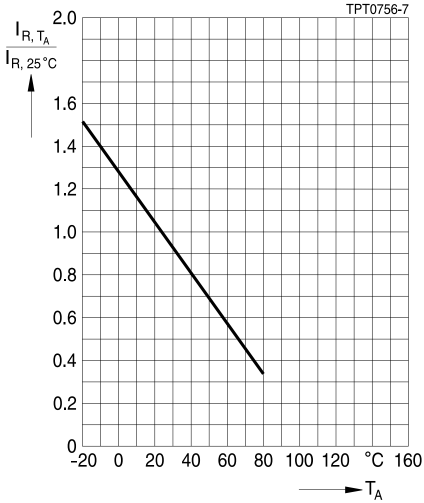
PTC current I_{PTC} versus PTC voltage V_{PTC}
(measured at 25 °C in still air)



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

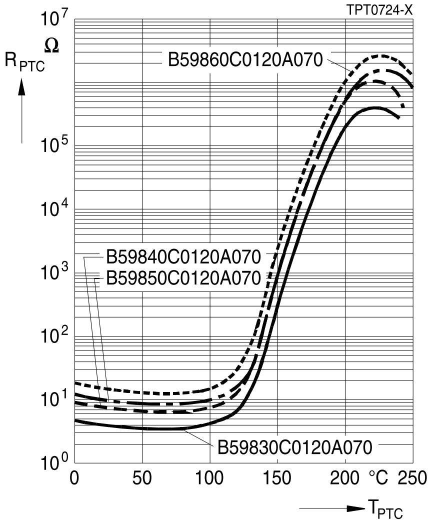


Rated current I_R versus ambient temperature T_A
(measured in still air)

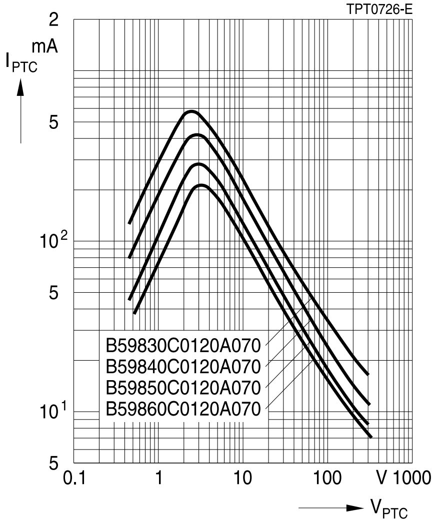


Characteristics (typical) for T_{ref} = 120 °C

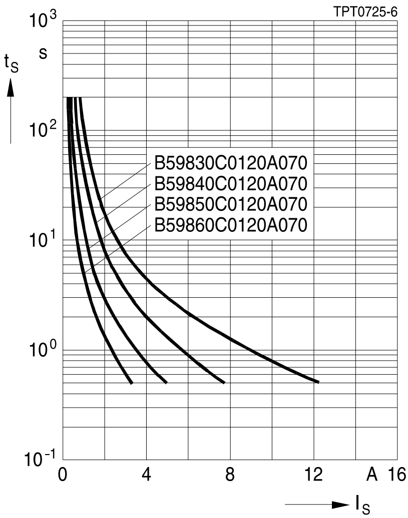
PTC resistance R_{PTC} versus
PTC temperature T_{PTC}
(measured at low signal voltage)



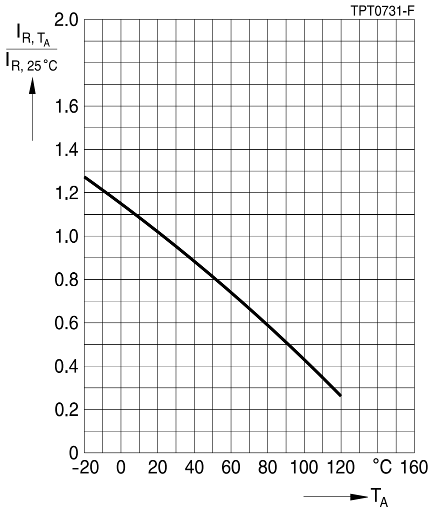
PTC current I_{PTC} versus PTC voltage V_{PTC}
(measured at 25 °C in still air)



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

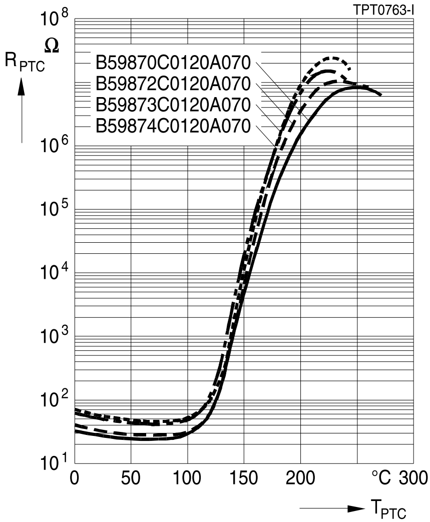


Rated current I_R versus ambient temperature T_A
(measured in still air)

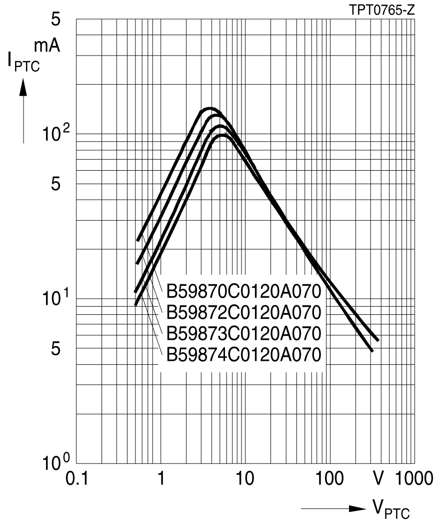


Characteristics (typical) for T_{ref} = 120 °C

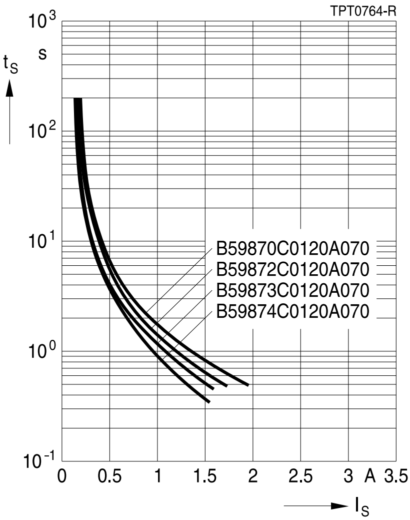
PTC resistance R_{PTC} versus
PTC temperature T_{PTC}
(measured at low signal voltage)



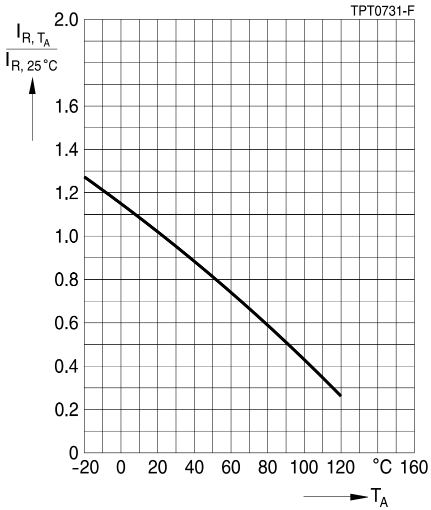
PTC current I_{PTC} versus PTC voltage V_{PTC}
(measured at 25 °C in still air)



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

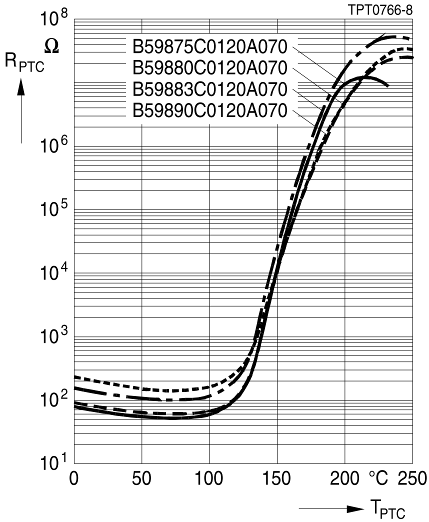


Rated current I_R versus ambient temperature T_A
(measured in still air)

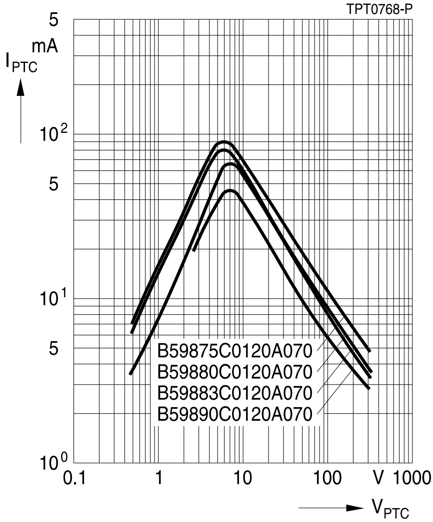


Characteristics (typical) for T_{ref} = 120 °C

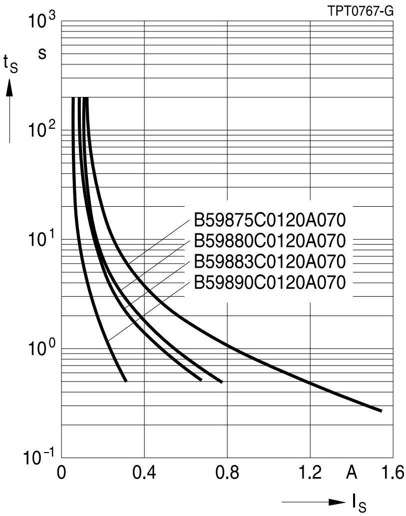
PTC resistance R_{PTC} versus
PTC temperature T_{PTC}
(measured at low signal voltage)



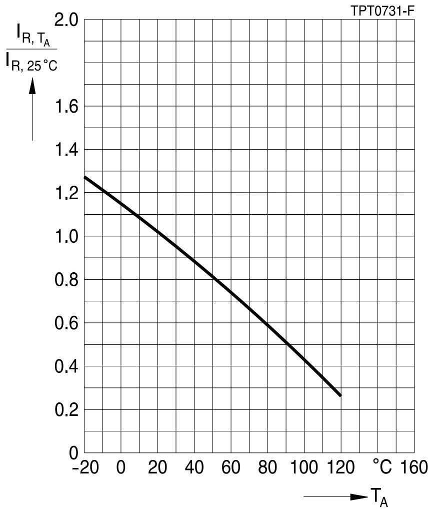
PTC current I_{PTC} versus PTC voltage V_{PTC}
(measured at 25 °C in still air)



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

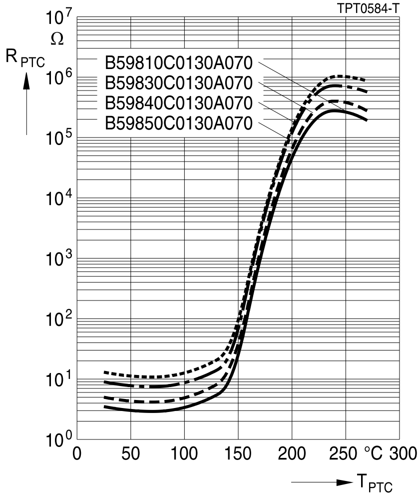


Rated current I_R versus ambient temperature T_A
(measured in still air)

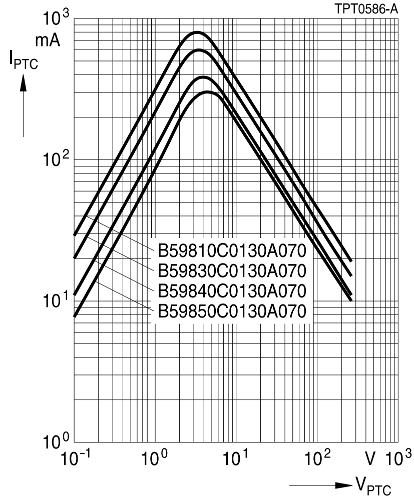


Characteristics (typical) for $T_{ref} = 130$ °C

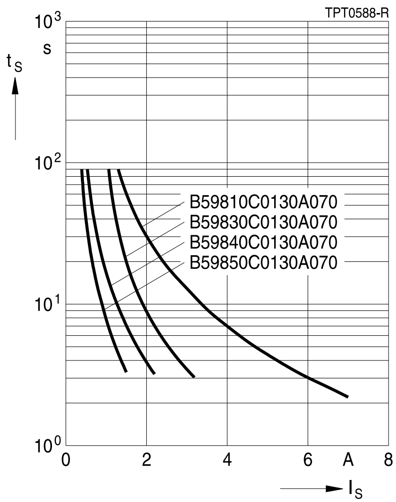
PTC resistance R_{PTC} versus
PTC temperature T_{PTC}
(measured at low signal voltage)



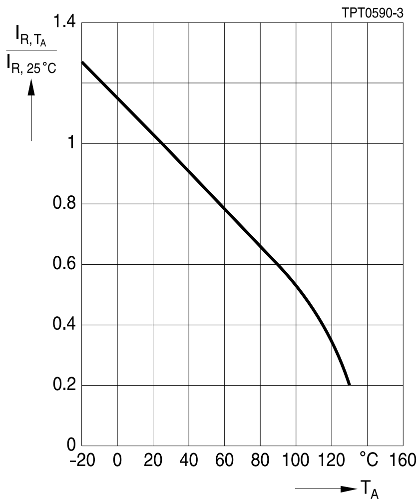
PTC current I_{PTC} versus PTC voltage V_{PTC}
(measured at 25 °C in still air)



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

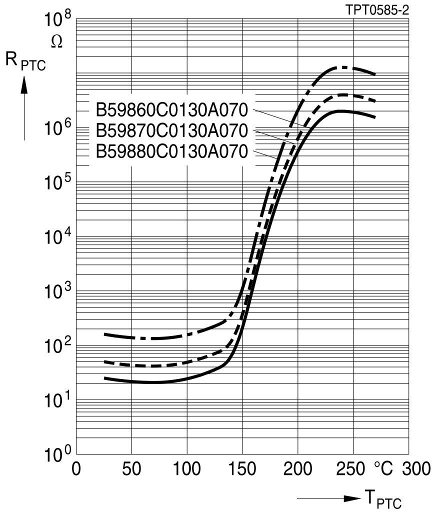


Rated current I_R versus ambient temperature T_A
(measured in still air)

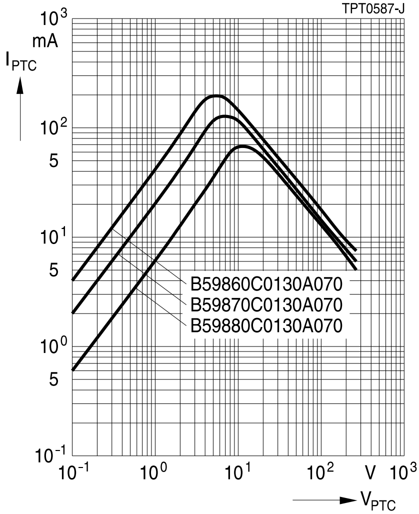


Characteristics (typical) for T_{ref} = 130 °C

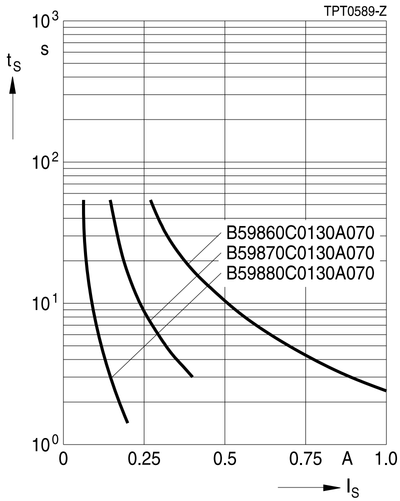
PTC resistance R_{PTC} versus
PTC temperature T_{PTC}
(measured at low signal voltage)



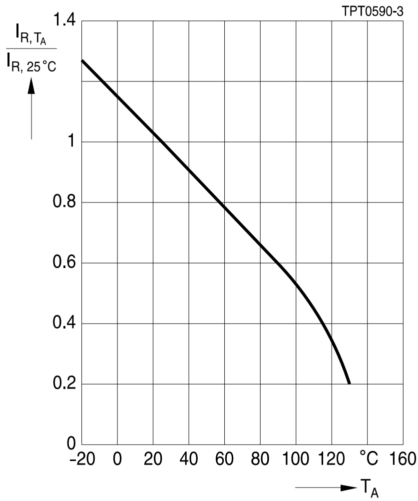
PTC current I_{PTC} versus PTC voltage V_{PTC}
(measured at 25 °C in still air)



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)



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	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
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)
$V_{c(max)}$	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
$\boxed{e}$	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.

EPCOS

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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