VISHAY INTERTECHNOLOGY, INC.

INTERACTIVE
data book

PTC THERMISTORS
VISHAY

VSE-DB0061-1010

Notes:

1. To navigate:
   a) Click on the Vishay logo on any datasheet to go to the Contents page for that section. Click on the Vishay logo on any Contents page to go to the main Table of Contents page.
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VISHAY INTERTECHNOLOGY, INC.

PTC THERMISTORS

www.vishay.com

SEMICONDUCTORS

RECTIFIERS

- Schottky (single, dual)
- Standard, Fast and Ultra-Fast Recovery (single, dual)
- Bridge
- Superectifier®
- Sinterglass Avalanche Diodes

HIGH-POWER DIODES AND THYRISTORS

- High-Power Fast-Recovery Diodes
- Phase-Control Thyristors
- Fast Thyristors

SMALL-SIGNAL DIODES

- Schottky and Switching (single, dual)
- Tuner/Capacitance (single, dual)
- Bandswitching
- PIN

ZENER AND SUPPRESSOR DIODES

- Zener (single, dual)
- TVS (TRANSZORB®, Automotive, ESD, Arrays)

FETs

- Low-Voltage TrenchFET® Power MOSFETs
- High-Voltage TrenchFET® Power MOSFETs
- High-Voltage Planar MOSFETs
- JFETs

OPTOELECTRONICS

- IR Emitters and Detectors, and IR Receiver Modules
- Optocouplers and Solid-State Relays
- Optical Sensors
- LEDs and 7-Segment Displays
- Infrared Data Transceiver Modules
- Custom Products

ICs

- Power ICs
- Analog Switches

MODULES

- Power Modules (contain power diodes, thyristors, MOSFETs, IGBTs)

PASSIVE COMPONENTS

RESISTIVE PRODUCTS

- Film Resistors
  - Metal Film Resistors
  - Thin Film Resistors
  - Thick Film Resistors
  - Metal Oxide Film Resistors
  - Carbon Film Resistors
- Wirewound Resistors
- Power Metal Strip® Resistors
- Chip Fuses
- Variable Resistors
  - Cermet Variable Resistors
  - Wirewound Variable Resistors
  - Conductive Plastic Variable Resistors
- Networks/Arrays
- Non-Linear Resistors
  - NTC Thermistors
  - PTC Thermistors
  - Varistors

MAGNETICS

- Inductors
- Transformers

CAPACITORS

- Tantalum Capacitors
  - Molded Chip Tantalum Capacitors
  - Coated Chip Tantalum Capacitors
  - Solid Through-Hole Tantalum Capacitors
  - Wet Tantalum Capacitors
- Ceramic Capacitors
  - Multilayer Chip Capacitors
  - Disc Capacitors
- Film Capacitors
- Power Capacitors
- Heavy-Current Capacitors
- Aluminum Capacitors

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PTC Thermistors

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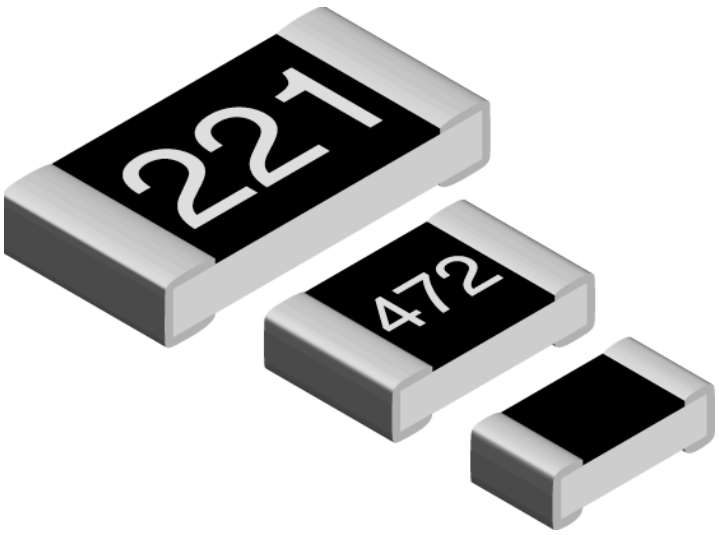
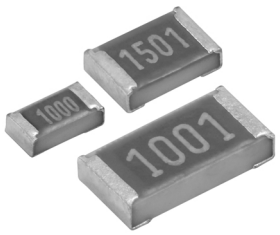
PTC Thermistors

PTC Temperature Sensing

Contents



SMD PTC - Nickel Thin Film Linear Thermistors



FEATURES

- Alumina substrate base with nickel based PTC thin film element
- 0603, 0805 and 1206 sizes available
- Available in tape and reel packaging
- Standard R_{25} tolerances: ± 0.5 %, ± 1 %, ± 5 %
- Operation range - 55 °C to + 125 °C (+ 150 °C)
- Compliant to RoHS directive 2002/95/EC

e3
RoHS
COMPLIANT

STANDARD ELECTRICAL SPECIFICATIONS

TCR AT ROOM TEMPERATURE (25 °C) SEE TYPICAL CURVE FOR TCR AT OTHER TEMPS.	TCR [1] TOLERANCE ppm/K	R_{25} VALUE RANGE in Ω (0.5 %, 1 %, 5 % TOLERANCE) [2]					
		0603		0805		1206	
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
4110 ppm/K	± 400	100	to 1K	100	to 5K	100	to 10K

Notes
[1] Contact Vishay if closer TCR lot tolerance is desired
[2] Other R_{25} values and tolerances are available upon request

STANDARD RESISTANCE VALUES at 25 °C in Ω

100	270	680	1.8K	4.7K
120	330	820	2.2K	5.6K
150	390	1K	2.7K	6.8K
180	470	1.2K	3.3K	8.2K
220	560	1.5K	3.9K	10.0K

STANDARD TECHNICAL SPECIFICATIONS

PART NUMBER	P_{70} MAXIMUM POWER at 70 °C	MAXIMUM WORKING VOLTAGE RCWV [3]
TFPT 0603	75 mW	30 V_{DC}
TFPT 0805	100 mW	40 V_{DC}
TFPT 1206	125 mW	50 V_{DC}

Note
[3] Rated continuous working voltage is maximum working voltage or square root of the power rating times resistance value, whichever is less

GLOBAL PART NUMBER INFORMATION

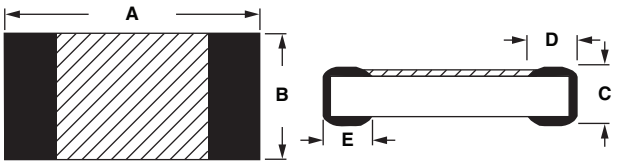
Global Part Numbering: TFPT1206L1002FM (preferred part number format)

T	F	P	T	1	2	0	6	L	1	0	0	2	F	M

GLOBAL MODEL	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING
TFPT0603 **TFPT0805** **TFPT1206**	**L** = Linear	**1002** = 10K	**D** = ± 0.5 % **F** = ± 1 % **J** = ± 5 %	**F** = Lead (Pb)-free, bulk **M** = Lead (Pb)-free, T/R (5000 pieces) **V** = Lead (Pb)-free, T/R (1000 pieces) **P** = Tin/lead, bulk **Z** = Tin/lead, T/R (5000 pieces) **Y** = Tin/lead, T/R (1000 pieces)

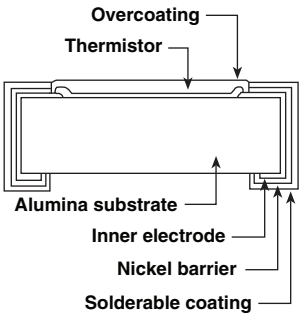
For technical questions, contact: nlr@vishay.com
Document Number: 33017
Revision: 21-Jun-10

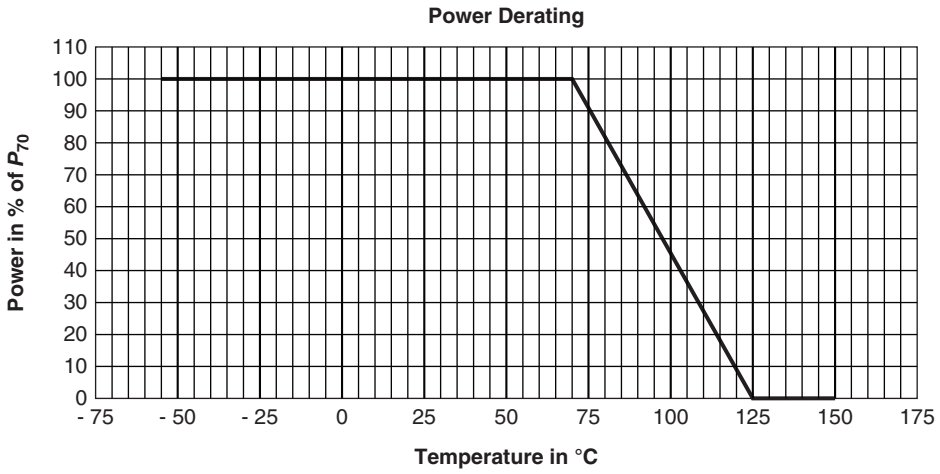
DIMENSIONS in millimeters



PART NUMBER	A	B	C	D	E
TFPT 0603	1.60 ± 0.10	0.85 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
TFPT 0805	2.00 ± 0.15	1.25 ± 0.15	0.45 ± 0.10	0.40 ± 0.20	0.40 ± 0.20
TFPT 1206	3.20 ± 0.15	1.60 ± 0.15	0.55 ± 0.10	0.50 ± 0.25	0.50 ± 0.25

CONSTRUCTION





PERFORMANCE (1)	
TEST	MAXIMUM $\Delta R/R_{25}$ (2)
High temperature exposure (100 h at 125 °C)	0.25 %
Effects of bonding (10 s solder dip at 260 °C)	0.25 %
Thermal shock (30 min at - 55 °C, 30 min at 125 °C, 5 cycles)	0.25 %
Low temperature operation (maximum rated power for 2 h at - 55 °C)	0.25 %
Short time overload (2.5 x RCWV for 5 s)	0.25 %
Load life (1000 h 70 °C, maximum rated power 1.5 h “ON”, 0.5 h “OFF”	0.25 %
Solderability (95 % coverage P/F)	P
Leaching (physical damage P/F)	P

Notes

(1) Environmental performance specifications use test procedures as outlined in MIL-R-23648D and MIL-STD-202

(2) TFPTs are ESD sensitive

AVERAGE RATIO R/R_{25} TFPT ALL SIZES AND VALUES											
TEMP.	R/R_{25}	TEMP.	R/R_{25}	TEMP.	R/R_{25}	TEMP.	R/R_{25}	TEMP.	R/R_{25}	TEMP.	R/R_{25}
		- 20	0.825	20	0.980	60	1.150	100	1.337	140	1.541
		- 19	0.828	21	0.984	61	1.155	101	1.342	141	1.547
		- 18	0.832	22	0.988	62	1.159	102	1.347	142	1.552
		- 17	0.836	23	0.992	63	1.164	103	1.352	143	1.557
		- 16	0.839	24	0.996	64	1.168	104	1.357	144	1.563
- 55	0.702	- 15	0.843	**25**	**1.000**	65	1.173	105	1.362	145	1.568
- 54	0.705	- 14	0.847	26	1.004	66	1.177	106	1.367	146	1.574
- 53	0.708	- 13	0.851	27	1.008	67	1.182	107	1.372	147	1.579
- 52	0.712	- 12	0.854	28	1.012	68	1.186	108	1.377	148	1.584
- 51	0.715	- 11	0.858	29	1.017	69	1.191	109	1.382	149	1.590
- 50	0.719	- 10	0.862	30	1.021	70	1.196	110	1.387	150	1.595
- 49	0.722	- 9	0.866	31	1.025	71	1.200	111	1.392		
- 48	0.725	- 8	0.869	32	1.029	72	1.205	112	1.397		
- 47	0.729	- 7	0.873	33	1.033	73	1.209	113	1.402		
- 46	0.732	- 6	0.877	34	1.037	74	1.214	114	1.407		
- 45	0.736	- 5	0.881	35	1.042	75	1.219	115	1.412		
- 44	0.739	- 4	0.885	36	1.046	76	1.223	116	1.417		
- 43	0.743	- 3	0.889	37	1.050	77	1.228	117	1.422		
- 42	0.746	- 2	0.892	38	1.054	78	1.232	118	1.427		
- 41	0.749	- 1	0.896	39	1.059	79	1.237	119	1.432		
- 40	0.753	0	0.900	40	1.063	80	1.242	120	1.437		
- 39	0.756	1	0.904	41	1.067	81	1.246	121	1.442		
- 38	0.760	2	0.908	42	1.071	82	1.251	122	1.448		
- 37	0.763	3	0.912	43	1.076	83	1.256	123	1.453		
- 36	0.767	4	0.916	44	1.080	84	1.261	124	1.458		
- 35	0.771	5	0.920	45	1.084	85	1.265	125	1.463		
- 34	0.774	6	0.924	46	1.089	86	1.270	126	1.468		
- 33	0.778	7	0.927	47	1.093	87	1.275	127	1.473		
- 32	0.781	8	0.931	48	1.097	88	1.280	128	1.478		
- 31	0.785	9	0.935	49	1.102	89	1.284	129	1.484		
- 30	0.788	10	0.939	50	1.106	90	1.289	130	1.489		
- 29	0.792	11	0.943	51	1.110	91	1.294	131	1.494		
- 28	0.796	12	0.947	52	1.115	92	1.299	132	1.499		
- 27	0.799	13	0.951	53	1.119	93	1.303	133	1.505		
- 26	0.803	14	0.955	54	1.124	94	1.308	134	1.510		
- 25	0.806	15	0.959	55	1.128	95	1.313	135	1.515		
- 24	0.810	16	0.963	56	1.133	96	1.318	136	1.520		
- 23	0.814	17	0.967	57	1.137	97	1.323	137	1.526		
- 22	0.817	18	0.971	58	1.141	98	1.328	138	1.531		
- 21	0.821	19	0.975	59	1.146	99	1.333	139	1.536		

RATIO FORMULA

$R_T = R_{25}$ x (9.0014 x 10^{-1} + 3.87235 x 10^{-3} (°C)$^{-1}$ x T + 4.86825 x 10^{-6} (°C)$^{-2}$ x T^2 + 1.37559 x 10^{-9} (°C)$^{-3}$ x T^3)

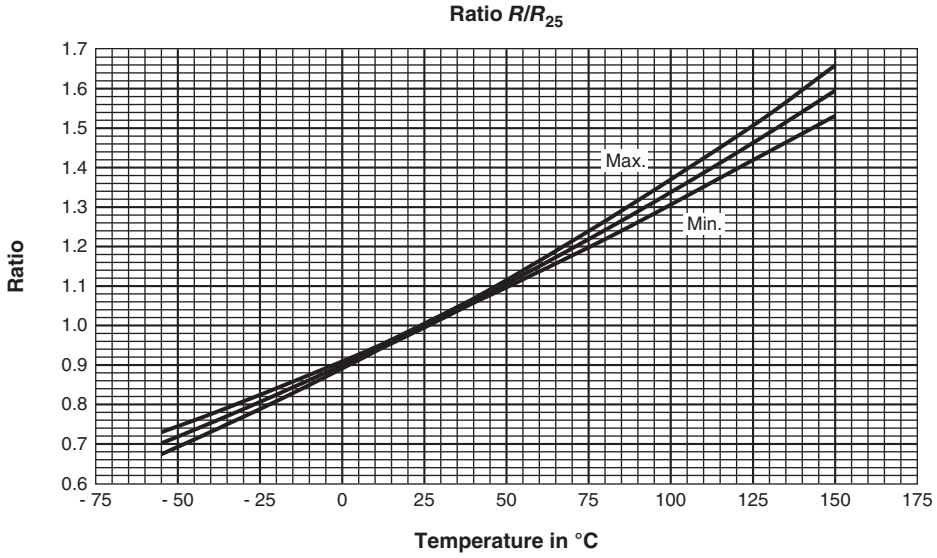
$T_{(°C)}$ = 28.54 x $(R_T/R_{25})^3$ - 158.5 x $(R_T/R_{25})^2$ + 474.8 x (R_T/R_{25}) - 319.85)

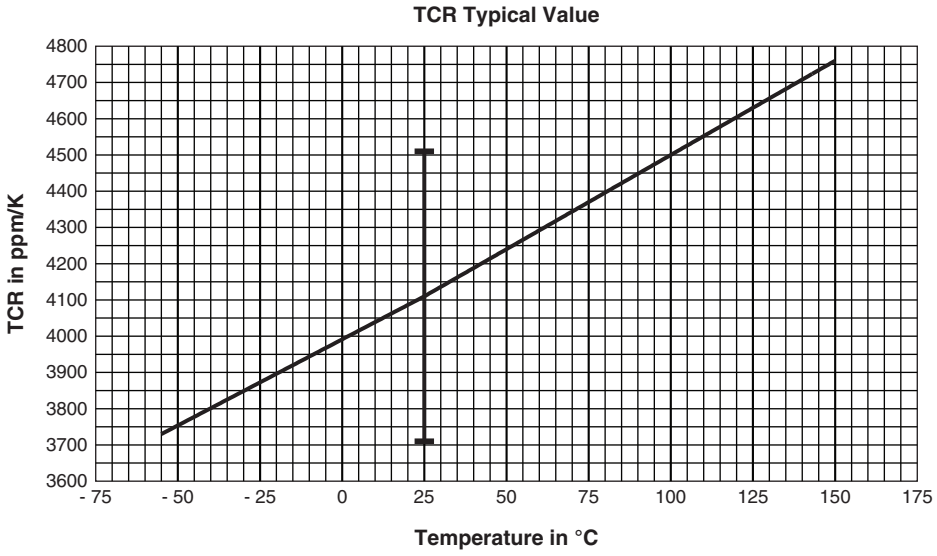
RATIO TOLERANCES		
LOW TEMP.	HIGH TEMP.	TOL.
- 55 °C	+ 150 °C	± 4 %
- 40 °C	+ 125 °C	± 3 %
- 20 °C	+ 85 °C	± 2 %
0 °C	+ 55 °C	± 1 %
+ 12 °C	+ 40 °C	± 0.5 %

Ratio Tolerance Examples:

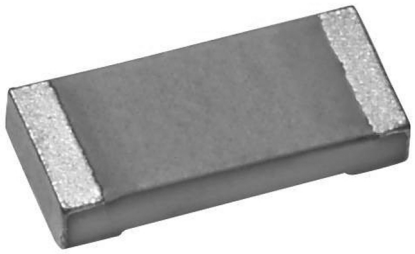
At 40 °C, ratio = 1.063 ± 0.5 % (0.005)
so, ratio = 1.058 to 1.068

At 125 °C, ratio = 1.460 ± 3 % (0.044)
so, ratio = 1.416 to 1.504


Ratio R/R_{25}
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
Ratio
Max.
Min.
- 75
- 50
- 25
0
25
50
75
100
125
150
175
Temperature in °C


TCR Typical Value
4800
4700
4600
4500
4400
4300
4200
4100
4000
3900
3800
3700
3600
TCR in ppm/K
- 75
- 50
- 25
0
25
50
75
100
125
150
175
Temperature in °C

Platinum SMD Flat Chip Temperature Sensor



PTS SMD Flat Chip Temperature sensors are the perfect choice for temperature control of electronics operating under varying environmental conditions. The highly controlled platinum thin film manufacturing process guarantees an outstanding stability of temperature characteristics which ensures reliable operation even under harsh conditions. Typical applications include automotive, aviation and industrial electronics.

FEATURES

- Standardized characteristics according to IEC 60751
- Advanced thin film technology
- Short reaction times down to $t_{0.9} \leq 2$ s (in air)
- Outstanding stability of temperature characteristic
- Standard SMD sizes
- Supports lead (Pb)-free soldering
- AEC-Q200 qualified
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

APPLICATIONS

Temperature measurement in

- Automotive electronics
- Aviation electronics
- Industrial electronics

TECHNICAL SPECIFICATIONS

DESCRIPTION		PTS 0603	PTS 0805	PTS 1206
Resistance values R_0 at 0 °C		100 Ω	100 Ω, 500 Ω	100 Ω, 500 Ω, 1000 Ω
Temperature coefficient (0 °C ... + 100 °C)		+ 3850 ppm/K		
Tolerance classes		F0.3, F0.6		
Operating temperature range		- 55 °C to + 155 °C		
Long term stability $\Delta R_0/R_0$; R_0 change after 1000 h at + 155 °C		< ± 0.04 %		
Insulation resistance		> 10 MΩ		
Measurement current $I_{meas.}$ (DC) (2)	100 Ω	0.1 mA to 0.50 mA	0.1 mA to 1.0 mA	0.1 mA to 1.0 mA
	500 Ω	-	0.1 mA to 0.40 mA	0.1 mA to 0.40 mA
	1000 Ω	-	-	0.1 mA to 0.25 mA
Self-heating (1)	Still air (v = 0 m/s)	≤ 0.9 K/mW	≤ 0.8 K/mW	≤ 0.7 K/mW
Thermal response time (1)	Flowing water (v = 0.4 m/s)	$t_{0.5} \leq 0.1$ s	$t_{0.5} \leq 0.2$ s	$t_{0.5} \leq 0.3$ s
		$t_{0.9} \leq 0.2$ s	$t_{0.9} \leq 0.3$ s	$t_{0.9} \leq 0.4$ s
	Flowing air (v = 3.0 m/s)	$t_{0.5} \leq 1.0$ s	$t_{0.5} \leq 1.5$ s	$t_{0.5} \leq 2.0$ s
		$t_{0.9} \leq 2.0$ s	$t_{0.9} \leq 3.0$ s	$t_{0.9} \leq 5.0$ s

Notes

(1) Valid for sensor element only

(2) Indicated measurement currents can be applied continuously with self-heating effect of less then 0.1 °C

For technical questions, contact: nlr@vishay.com

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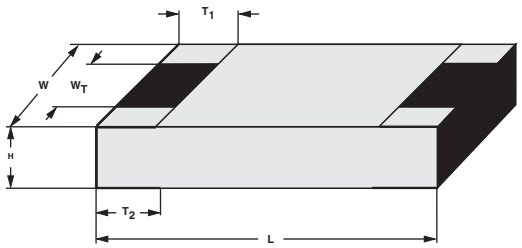
Revision: 15-Jul-10

DIMENSIONS in millimeters



DIMENSIONS - PTS sensor types, mass and relevant physical dimensions							
TYPE	**H**	**L**	**W**	**W_T**	**T_1**	**T_2**	**MASS (mg)**
PTS 0603	0.45 + 0.1/- 0.05	1.55 ± 0.05	0.85 ± 0.1	> 75 % of W	0.3 + 0.15/- 0.2	0.3 + 0.15/- 0.2	1.9
PTS 0805	0.45 + 0.1/- 0.05	2.0 ± 0.1	1.25 ± 0.15	> 75 % of W	0.4 + 0.1/- 0.2	0.4 + 0.1/- 0.2	4.6
PTS 1206	0.55 ± 0.1	3.2 + 0.1/- 0.2	1.6 ± 0.15	> 75 % of W	0.5 ± 0.25	0.5 ± 0.25	9.2

PRODUCTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of platinum is deposited on a high grade ceramic body (96 % Al_2O_3). The sensor-elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure tin on nickel plating.

QUALITY

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual sensors. Only accepted products are laid directly into the paper tape in accordance with **IEC 60286-3**.

STORAGE

Solderability is specified for 2 years after production or re-qualification. The permitted storage time is 2 years.

ASSEMBLY

The Pt-sensors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The Pt-sensors are RoHS compliant, the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing.

All products comply with the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances.

This includes full compatibility with the following directives:

- 2000/53/EC End of Vehicle life Directive (ELV)
- 2000/53/EC Annex II to End of Vehicle Life Directive (ELV II)
- 2002/95/EC Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

The Pt-sensors are tested in accordance with **IEC 60751** and **IEC 60068** series.

PART NUMBER AND PRODUCT DESCRIPTION (1)

PART NUMBER (2): PTS060301B100RP100

P	T	S	0	6	0	3	0	1	B	1	0	0	R	P	1	0	0

TYPE	SIZE CODE	SPECIAL CHARACTER	TOLERANCE CLASS	RESISTANCE VALUE	PACKAGING (3)	SPECIAL
3 digits	4 digits	1 digit	2 digits	4 digits	2 digits	2 digits
PTS = Platinum Temperature Sensor SMD	**0603** **0805** **1206**	**0** = Neutral	**1B** = Class F0.3 **2B** = Class F0.6	**100R** = 100 Ω **500R** = 500 Ω **1K00** = 1000 Ω	**PU** **P1**	**00** = Standard

PRODUCT DESCRIPTION (4): PTS 0603-B P1 100R

PTS	0603	-B	P1	100R
TYPE	SIZE CODE	TOLERANCE CLASS	PACKAGING (3)	RESISTANCE VALUE
PTS = Platinum Temperature Sensor SMD	**0603** **0805** **1206**	**B** = Class F0.3 **2B** = Class F0.6	**PU** **P1**	**100R** = 100 Ω **500R** = 500 Ω **1K** = 1000 Ω

Notes

(1) Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION

(2) The part number is shown to facilitate the introduction of a unified part numbering system

(2) Please refer to table PACKAGING

(4) We recommend that the Production Description is used to minimize the possibility of errors in order handling

PACKAGING

MODEL	DIAMETER	PIECES	CODE	BOX/REEL
PTS 0603	114 mm	100	PU	BOX
	180 mm/7"	1000	P1	REEL
PTS 0805	114 mm	100	PU	BOX
	180 mm/7"	1000	P1	REEL
PTS 1206	114 mm	100	PU	BOX
	180 mm/7"	1000	P1	REEL

FUNCTIONAL PERFORMANCE

The temperature resistance relationships of the PTS series follow different equations:

For the temperature range of - 55 °C up to 0 °C:

$$R_T = R_0 \times (1 + A \times T + B \times T^2 + C \times (T - 100\ °C) \times T^3)$$

And for the temperature range of 0 °C up to + 155 °C:

$$R_T = R_0 \times (1 + A \times T + B \times T^2)$$

R_T: Resistance as a function of temperature
R_0: Nominal resistance value at 0 °C
T: Temperature in °C

Coefficients according to IEC 60751:

$A = 3.9083 \times 10^{-3}\ °C^{-1}$
$B = -5.775 \times 10^{-7}\ °C^{-2}$
$C = -4.183 \times 10^{-12}\ °C^{-4}$

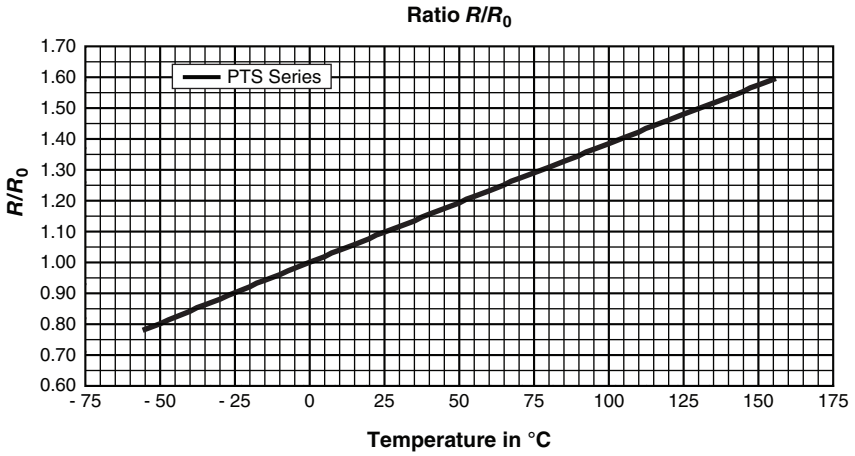
The tolerances values of the PTS series are classified by the following equations as specified by IEC 60751:

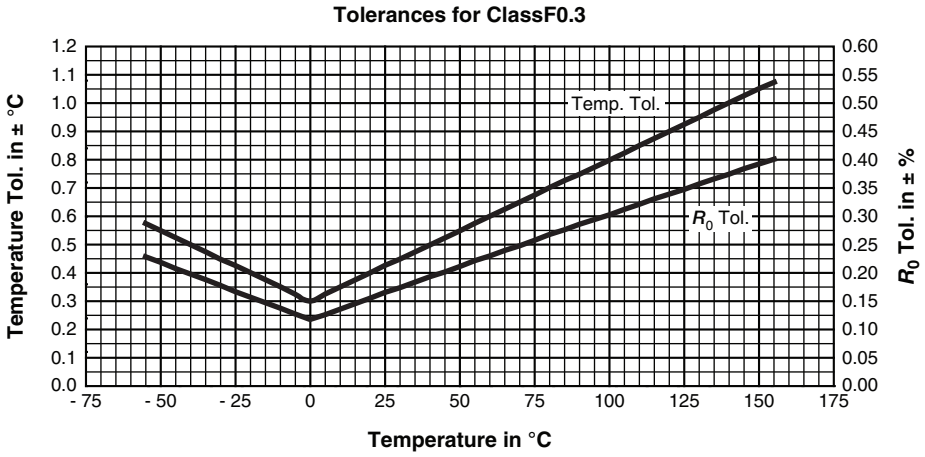
Class F0.3: $\Delta T_{F0.3} = \pm (0.30 + 0.005 \times |T|)$

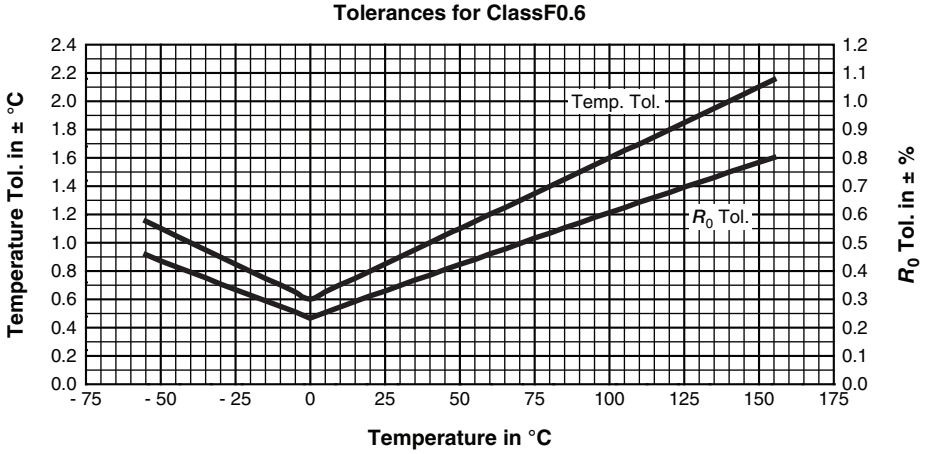
Class F0.6: $\Delta T_{F0.6} = \pm (0.60 + 0.010 \times |T|)$

NOMINAL RESISTANCE VALUE

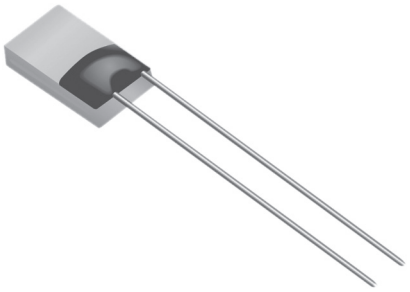
TEMPERATURE	R/R_0 RATIO	NOMINAL RESISTANCE VALUES			CLASS F0.3	CLASS F0.6
		R_0 100 Ω	R_0 500 Ω	R_0 1000 Ω	$T_{Tol.}$	$T_{Tol.}$
(°C)		(Ω)	(Ω)	(Ω)	(°C)	(°C)
- 55	0.78319	78.32	391.59	783.19	± 0.58	± 1.15
- 50	0.80306	80.31	401.53	803.06	± 0.55	± 1.10
- 45	0.82290	82.29	411.45	822.90	± 0.53	± 1.05
- 40	0.84271	84.27	421.35	842.71	± 0.50	± 1.00
- 35	0.86248	86.25	431.24	862.48	± 0.48	± 0.95
- 30	0.88222	88.22	441.11	882.22	± 0.45	± 0.90
- 25	0.90192	90.19	450.96	901.92	± 0.43	± 0.85
- 20	0.92160	92.16	460.80	921.60	± 0.40	± 0.80
- 15	0.94124	94.12	470.62	941.24	± 0.38	± 0.75
- 10	0.96086	96.09	480.43	960.86	± 0.35	± 0.70
- 5	0.98044	98.04	490.22	980.44	± 0.33	± 0.65
0	**1.00000**	**100.00**	**500.00**	**1000.00**	**± 0.30**	**± 0.60**
5	1.01953	101.95	509.76	1019.53	± 0.33	± 0.65
10	1.03903	103.90	519.51	1039.03	± 0.35	± 0.70
15	1.05849	105.85	529.25	1058.49	± 0.38	± 0.75
20	1.07794	107.79	538.97	1077.94	± 0.40	± 0.80
25	1.09735	109.73	548.67	1097.35	± 0.43	± 0.85
30	1.11673	111.67	558.36	1116.73	± 0.45	± 0.90
35	1.13608	113.61	568.04	1136.08	± 0.48	± 0.95
40	1.15541	115.54	577.70	1155.41	± 0.50	± 1.00
45	1.17470	117.47	587.35	1174.70	± 0.53	± 1.05
50	1.19397	119.40	596.99	1193.97	± 0.55	± 1.10
55	1.21321	121.32	606.60	1213.21	± 0.58	± 1.15
60	1.23242	123.24	616.21	1232.42	± 0.60	± 1.20
65	1.25160	125.16	625.80	1251.60	± 0.63	± 1.25
70	1.27075	127.08	635.38	1270.75	± 0.65	± 1.30
75	1.28987	128.99	644.94	1289.87	± 0.68	± 1.35
80	1.30897	130.90	654.48	1308.97	± 0.70	± 1.40
85	1.32803	132.80	664.02	1328.03	± 0.73	± 1.45
90	1.34707	134.71	673.53	1347.07	± 0.75	± 1.50
95	1.36608	136.61	683.04	1366.08	± 0.78	± 1.55
100	1.38506	138.51	692.53	1385.06	± 0.80	± 1.60
105	1.40400	140.40	702.00	1404.00	± 0.83	± 1.65
110	1.42293	142.29	711.46	1422.93	± 0.85	± 1.70
115	1.44182	144.18	720.91	1441.82	± 0.88	± 1.75
120	1.46068	146.07	730.34	1460.68	± 0.90	± 1.80
125	1.47951	147.95	739.76	1479.51	± 0.93	± 1.85
130	1.49832	149.83	749.16	1498.32	± 0.95	± 1.90
135	1.51710	151.71	758.55	1517.10	± 0.98	± 1.95
140	1.53584	153.58	767.92	1535.84	± 1.00	± 2.00
145	1.55456	155.46	777.28	1554.56	± 1.03	± 2.05
150	1.57325	157.33	786.63	1573.25	± 1.05	± 2.10
155	1.59191	159.19	795.96	1591.91	± 1.08	± 2.15


Ratio R/R_0
PTS Series
R/R_0
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
- 75
- 50
- 25
0
25
50
75
100
125
150
175
Temperature in °C


Tolerances for ClassF0.3
Temperature Tol. in ± °C
R_0 Tol. in ± %
Temp. Tol.
R_0 Tol.
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
- 75
- 50
- 25
0
25
50
75
100
125
150
175
Temperature in °C


Tolerances for ClassF0.6
Temperature Tol. in ± °C
R_0 Tol. in ± %
Temp. Tol.
R_0 Tol.
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
- 75
- 50
- 25
0
25
50
75
100
125
150
175
Temperature in °C

Leaded Platinum Temperature Sensor



PTL Temperature Sensors are the perfect choice for the most fields of modern electronics. The highly controlled platinum thin film manufacturing process guarantees an outstanding stability of temperature characteristics. Typical applications include temperature measurement in process controls in industrial electronics, and precise temperature measurement in medical equipment.

FEATURES

- Specification according to IEC 60751
- Advanced thin film technology
- Short reaction times down to $t_{0.9} \leq 8$ s
- Outstanding stability of temperature characteristics
- Small ceramic body
- Radial terminations

APPLICATIONS

Temperature measurement and control in

- Industrial electronics
- Medical electronics

TECHNICAL SPECIFICATIONS

DESCRIPTION		PTL 1112	PTL 1222	PTL 1252
Resistance values R_0 at 0 °C (1)		100 Ω, 500 Ω, 1000 Ω	100 Ω, 500 Ω, 1000 Ω, 10 000 Ω	100 Ω, 500 Ω, 1000 Ω, 10 000 Ω
Temperature coefficient (0 °C to + 100 °C)		+ 3850 ppm/K		
Tolerance class		F0.15, F0.3		
Temperature range		- 55 °C up to + 550 °C (1)		
Long term stability $\Delta R_0/R_0$		< ± 0.2 %		
Insulation resistance		> 10 MΩ		
Measurement current $I_{mea.}$ (DC) (3)		Up to 1.0 mA for 100 Ω Up to 0.4 mA for 500 Ω Up to 0.3 mA for 1 kΩ Up to 0.1 mA for 10 kΩ		
Self-heating (2)	Flowing air (v = 3.0 m/s)	≤ 0.25 K/mW	≤ 0.2 K/mW	≤ 0.17 K/mW
	Still air (v = 1.0 m/s)	≈ 0.6 K/mW	≈ 0.4 K/mW	≈ 0.35 K/mW
Thermal response time (2)	Flowing air (v = 3.0 m/s)	$t_{0.5} \leq 2.5$ s	$t_{0.5} \leq 3$ s	$t_{0.5} \leq 5$ s
		$t_{0.9} \leq 8$ s	$t_{0.9} \leq 10$ s	$t_{0.9} \leq 15$ s
Material of leads		Platinum clad Ni (1)		
Length of leads		10 mm (1)		
Diameter of leads		0.2 mm (1)		

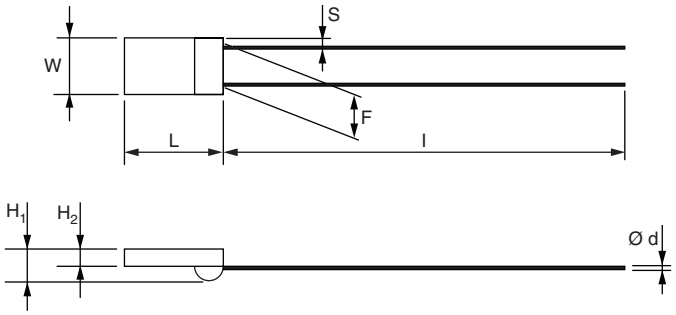
Notes

(1) Customized solutions on request, temperature class F0.15 up to 300 °C

(2) Valid for sensor element only

(3) Indicated measurement currents can be applied continuously with self-heating effect of less than 0.1 °C at 0 °C in still air

DIMENSIONS in millimeters



DIMENSIONS - PTL sensor type, relevant physical dimensions									
TYPE	**H_1**	**H_2**	**L**	**W**	**Ø d**	**l**	**F**	**S**	**MASS (mg)**
PTL 1112	1.0 ± 0.25	0.4 ± 0.05	1.6 ± 0.2	1.25 ± 0.2	0.2 ± 0.02	10.0 ± 1.0	0.55	0.35	16
PTL 1222	1.0 ± 0.25	0.4 ± 0.05	2.3 ± 0.2	2.0 ± 0.3	0.2 ± 0.02	10.0 ± 1.0	0.90	0.55	24
PTL 1252	1.0 ± 0.25	0.4 ± 0.05	5.0 ± 0.2	2.0 ± 0.3	0.2 ± 0.02	10.0 ± 1.0	0.90	0.55	36

PRODUCTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of platinum is deposited on a high grade ceramic body (96 % Al_2O_3). The sensor-elements are covered by a protective coating designed for electrical, mechanical and climatic protection.

QUALITY

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual sensors. Only accepted products are laid directly into the waffle trays. The resistance values and tolerances according to DIN EN 60751 are given for the device including the standard leads. Any additional wiring will change resistance values for the total setup.

ASSEMBLY

The Pt-sensors are suitable for all standard assembly processes like crimping, soldering, brazing and welding (LASER- or resistive welding).

The parameters of the assembly process should be chosen in accordance with the used wire material. It is recommended to verify the parameters by pre-testing.

The assembly process of the sensor should be in compliance with the following guidelines and recommendations:

- Fixation of only one lead during assembly
- Tensile forces parallel to the leads < 5 N
- Avoiding of large temperature gradients between the welding region and the sensor during assembly, e.g. by using a cooled clamp with a good thermal conductivity
- Radius of curvature of the leads > 0.3 mm
- Curvature or torsion strain > 3 mm away form the sensor element
- After assembly we recommend to fix the leads in the welded region with a strain relief

ENVIRONMENTAL CONDITIONS

Unprotected sensor-elements are usable under dry environmental conditions only. Platinum-plated nickel leads enable the usage in applications with ambient temperatures up to 550 °C. The environment of the sensor application should be without any corrosive substances (e.g. potassium hydroxide or hydrogen fluoride) or other contaminants which could affect the sensor, especially shifting the temperature coefficient of the sensor. This has also to be considered during the assembly process.

DIRECTIVES

All products comply with the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances.

This includes full compatibility with the following directives:

- 2000/53/EC End of Vehicle Life Directive (ELV)
- 2000/53/EC Annex II to End of Vehicle Life Directive (ELV II)
- 2002/95/EC Restriction of the use of Hazardous Substances Directive (RoHS)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

The Pt-sensors are tested in accordance with **IEC 60751/ DIN EN 60751**.

PART NUMBER AND PRODUCT DESCRIPTION (1)

PART NUMBER (2): PTL122201B1K00KU00

P	T	L	1	2	2	2	0	1	B	1	K	0	0	K	U	0	0

TYPE	TYPE CODE	SPECIAL CHARACTER	TOLERANCE CLASS	RESISTANCE VALUE	PACKAGING (3)	SPECIAL
3 digits	4 digits	1 digit	2 digits	4 digits	2 digits	2 digits
PTL = Platinum Temperature Sensor Leaded	**1112** **1222** **1252**	**0** = Neutral	**1A** = Class F0.15 **1B** = Class F0.3	**100R** = 100 Ω **500R** = 500 Ω **1K00** = 1000 Ω **10K0** = 10 kΩ	Waffles in a box **KU** **K1**	**00** = Standard

PRODUCT DESCRIPTION (4): PTL 1222 -B KU 1K0

PTL	1222	-B	KU	1K0
TYPE	**TYPE CODE**	**TOLERANCE CLASS**	**PACKAGING (3)**	**RESISTANCE VALUE**
PTL = Platinum Temperature Sensor Leaded	**1112** **1222** **1252**	**A** = Class F0.15 **B** = Class F0.3	Waffles in a box **KU** **K1**	**100R** = 100 Ω **500R** = 500 Ω **1K0** = 1000 Ω **10K0** = 10 000 Ω

Notes

(1) Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION

(2) The part number is shown to facilitate the introduction of unified part numbering system

(3) Please refer to table PACKAGING

(4) We recommend that the production description is used to minimize the possibility of errors in order handling

PACKAGING

MODEL	WAFFLE PACK	
	PIECES/WAFFLES IN A BOX	CODE
PTL	100	KU
	1000	K1

FUNCTIONAL PERFORMANCE

The temperature resistance relationships of the PTL series follow different equations:

for the temperature range from - 55 °C up to 0 °C:

$$R_T = R_0 \times (1 + A \times T + B \times T^2 + C \times (T - 100\ °C) \times T^3)$$

and for the temperature range from 0 °C up to + 550 °C:

$$R_T = R_0 \times (1 + A \times T + B \times T^2)$$

R_T: Resistance as a function of temperature
R_0: Nominal resistance value at 0 °C
T: Temperature in °C

According to IEC 60751/DIN EN 60751 the values of the coefficients are:

$$A = 3.9083 \times 10^{-3}\ °C^{-1}$$
$$B = -5.775 \times 10^{-7}\ °C^{-2}$$
$$C = -4.183 \times 10^{-12}\ °C^{-4}$$

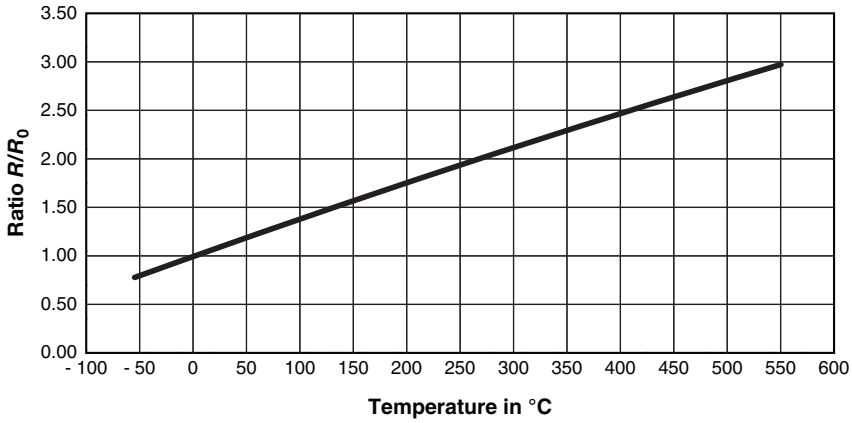
The temperature tolerances values of the PTL series are classified by the following equation:

Class F0.15: $\Delta T_{F0.15} = \pm (0.15 + 0.002 \times |T|)$
(valid from - 55 °C to 300 °C)

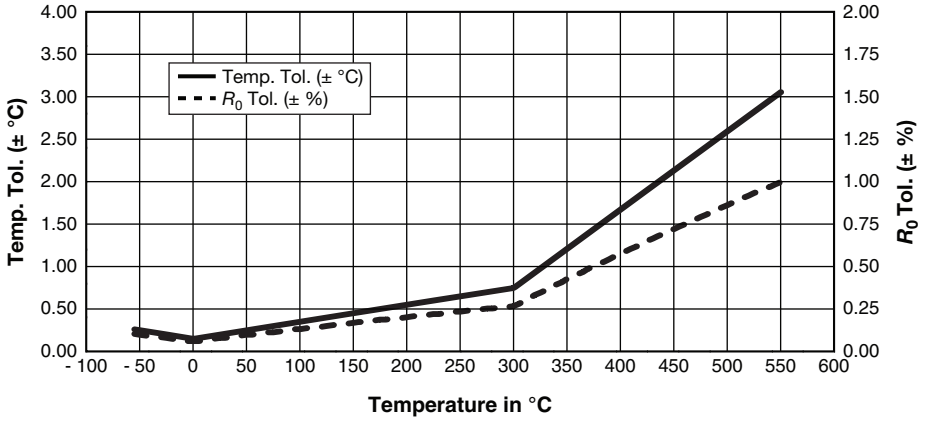
Class F0.3: $\Delta T_{F0.30} = \pm (0.30 + 0.005 \times |T|)$
(valid from - 55 °C to 550 °C)

NOMINAL RESISTANCE VALUE

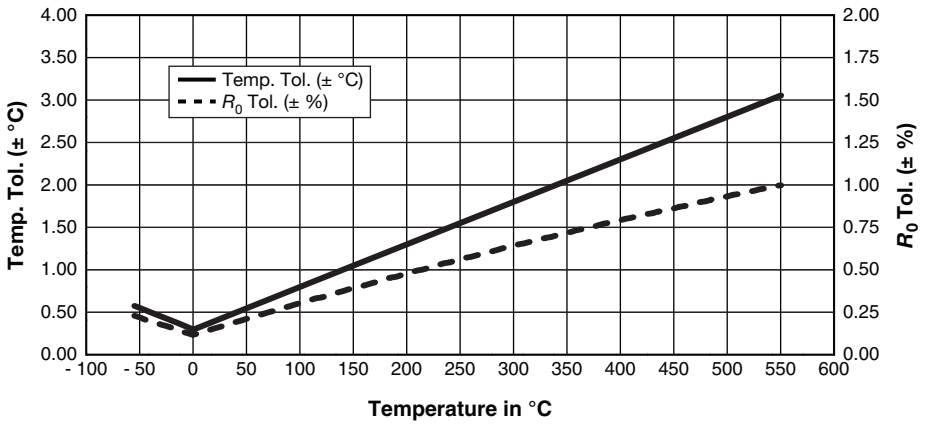
TEMPERATURE (°C)	R_0 = 100 Ω	R_0 = 500 Ω	R_0 = 1000 Ω	R_0 = 10 000 Ω	CLASS F0.15	CLASS F0.30
	NOMINAL RESISTANCE (Ω)	NOMINAL RESISTANCE (Ω)	NOMINAL RESISTANCE (Ω)	NOMINAL RESISTANCE (Ω)	TOLERANCE (K)	TOLERANCE (K)
- 55	78.319	391.59	783.19	7831.9	± 0.26	± 0.58
- 50	80.306	401.53	803.06	8030.6	± 0.25	± 0.55
- 25	90.192	450.96	901.92	9019.2	± 0.20	± 0.43
0	**100**	**500**	**1000**	**10 000**	**± 0.15**	**± 0.30**
25	109.73	548.67	1097.3	10 973	± 0.20	± 0.43
50	119.40	596.99	1194.0	11 940	± 0.25	± 0.55
75	128.99	644.94	1289.9	12 899	± 0.30	± 0.68
100	138.51	692.53	1385.1	13 851	± 0.35	± 0.80
125	147.95	739.76	1479.5	14 795	± 0.40	± 0.93
150	157.33	786.63	1573.3	15 733	± 0.45	± 1.05
175	166.63	833.13	1666.3	16 663	± 0.50	± 1.18
200	175.86	879.28	1758.6	17 586	± 0.55	± 1.30
225	185.01	925.07	1850.1	18 501	± 0.60	± 1.43
250	194.10	970.49	1941.0	19 410	± 0.65	± 1.55
275	203.11	1015.6	2031.1	20 311	± 0.70	± 1.68
300	212.05	1060.3	2120.5	21 205	± 0.75	± 1.80
325	220.92	1104.6	2209.2	22 092		± 1.93
350	229.72	1148.6	2297.2	22 972		± 2.05
375	238.44	1192.2	2384.4	23 844		± 2.18
400	247.09	1235.5	2470.9	24 709		± 2.30
425	255.67	1278.4	2556.7	25 567		± 2.43
450	264.18	1320.9	2641.8	26 418		± 2.55
475	272.61	1363.1	2726.1	27 261		± 2.68
500	280.98	1404.9	2809.8	28 098		± 2.80
525	289.27	1446.3	2892.7	28 927		± 2.93
550	297.49	1487.4	2974.9	29 749		± 3.05



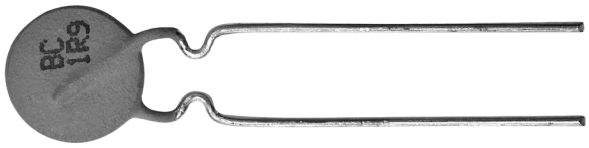
Tolerance for Class F0.15



Tolerance for Class F0.3

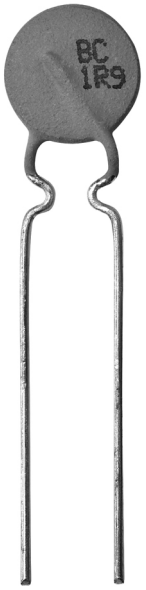


PTC Overload Protection Applications



Contents

30 V to 60 V PTC Thermistors For Overload Protection



FEATURES

- Wide range of trip and non-trip currents: From 94 mA up to 2 A for the trip current
- Small ratio between trip and non-trip currents (I_t/I_{nt} = 1.5 at 25 °C)
- High maximum overload current (up to 23 A)
- Leaded parts withstand mechanical stresses and vibration
- UL file E148885 according to XGPU standard UL1434
- UL approved PTCs are guaranteed to withstand severe test programs
  - Long-life cycle tests (over 5000 trip cycles)
  - Long-life storage tests (3000 h at 250 °C)
  - Electrical cycle tests at low ambient temperatures (- 40 °C or 0 °C)
  - Damp-heat and water immersion tests
  - Overvoltage tests at up to 200 % of rated voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

APPLICATIONS

Over-temperature/over-load protection:

- Telecommunications
- Automotive systems
- Industrial electronics
- Consumer electronics
- Electronic data processing

QUICK REFERENCE DATA		
PARAMETER	**VALUE**	**UNIT**
Maximum voltage (DC or AC)	30 to 60	V
Holding current	0.094 to 2	A
Resistance at 25 °C (R_{25})	0.3 to 50	Ω
$I_{max.}$	0.8 to 23	A
Switch temperature	140	°C
Operating temperature range at max. voltage	- 40 to + 85	°C
Climatic category	40/125/56	

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for overload protection. They consist of a naked disc with two tinned brass or copper clad steel leads and are coated with a high temperature silicone UL 94 V-0 coating. Leadless discs and leaded disks without coating are available on request.

MOUNTING

The PTC Thermistors are suitable for processing on automatic insertion equipment.

Typical soldering
235 °C; duration: 5 s (Lead (Pb)-bearing)
245 °C, duration: 5 s (Lead (Pb)-free)

Resistance to soldering heat
260 °C, duration: 10 s max.

MARKING

Only the grey lacquered thermistors with a diameter of 8.5 mm to 20.5 mm are marked with BC, R_{25} value (example 1R9) on one side and I_{nt}, $V_{max.}$ on the other side.

ELECTRICAL DATA AND ORDERING INFORMATION for 2381 66. 5...1; max. voltage = 30 V to 60 V (AC or DC) (1)									
I_{nt} MAX. at 25 °C (mA)	I_t MIN. at 25 °C (mA)	R_{25} ± 20 % (Ω)	V MAX. (V)	I (2) MAX. at 25 °C (mA)	I_{res} MAX. at V MAX. and 25 °C (mA)	DISSIP. FACTOR (mW/K)	Ø D MAX. (mm)	CATALOG NUMBERS	
								BULK	TAPE ON REEL
94	145	50	60	800	22	6.9	5	2381 660 59491	2381 660 69491
130	195	25	60	1200	25	6.9	5	2381 660 51311	2381 660 61311
180	270	13	30	1700	45	6.9	5	2381 660 51811	2381 660 61811
270	405	6	30	2500	60	6.9	5	2381 660 52711	2381 660 62711
320	480	5	30	3500	62	7.8	7	2381 661 53211	2381 661 63211
410	615	3	30	4500	65	7.8	7	2381 661 54111	2381 661 64111
470	705	2.5	30	5000	70	8.8	8.5	2381 661 54711	2322 661 64711
540	810	1.9	30	6000	75	8.8	8.5	2381 661 55411	2381 661 65411
610	915	1.7	30	7000	80	9.9	10.5	2381 662 56111	2381 662 66111
700	1050	1.3	30	8000	90	9.9	10.5	2381 662 57011	2381 662 67011
830	1245	1.1	30	10 000	100	11.5	12.5	2381 662 58311	2381 662 68311
920	1380	0.9	30	11 000	105	11.5	12.5	2381 662 59211	2381 662 69211
1170	1755	0.7	30	13 500	140	14.5	16.5	2381 663 51121	-
1390	2085	0.5	30	16 000	170	14.5	16.5	2381 663 51321	-
1770	2655	0.4	30	20 000	200	18.7	20.5	2381 664 51721	-
2050	3075	0.3	30	23 000	220	18.7	20.5	2381 664 52021	-

Notes

(1) The thermistors are clamped at the seating plane

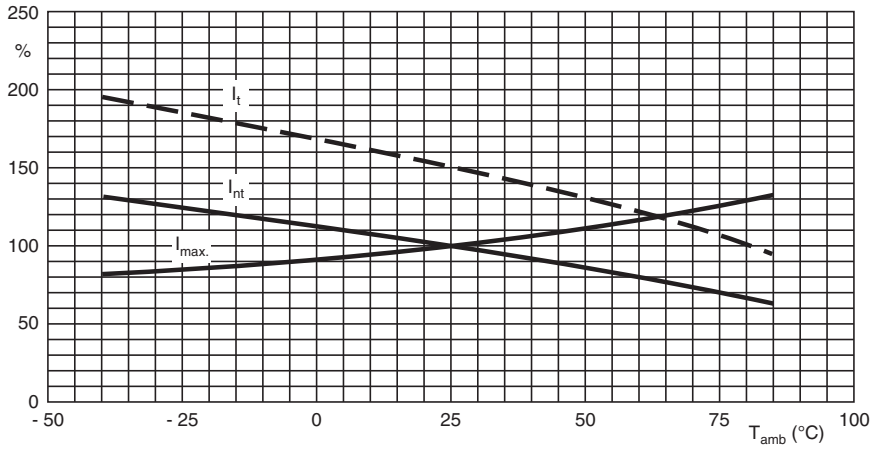
(2) $I_{max.}$ is the maximum overload current that may flow through the PTC when it passes from the low ohmic to the high ohmic state. UL approval: $I_{max.}$ x 0.85

SAP AND 12NC PART NUMBERS			
12NC	SAP CODING	12NC	SAP CODING
2381 660 x9491	PTCCL05H940EyE	2381 662 x6111	PTCCL11H611DyE
2381 660 x1311	PTCCL05H131EyE	2381 662 x7011	PTCCL11H701DyE
2381 660 x1811	PTCCL05H181DyE	2381 662 x8311	PTCCL13H831DyE
2381 660 x2711	PTCCL05H271DyE	2381 662 x9211	PTCCL13H921DyE
2381 661 x3211	PTCCL07H321DyE	2381 663 51121	PTCCL17H112DBE
2381 661 x4111	PTCCL07H411DyE	2381 663 51321	PTCCL17H132DBE
2381 661 x4711	PTCCL09H471DyE	2381 664 51721	PTCCL21H172DBE
2381 661 x5411	PTCCL09H541DyE	2381 664 52021	PTCCL21H202DBE

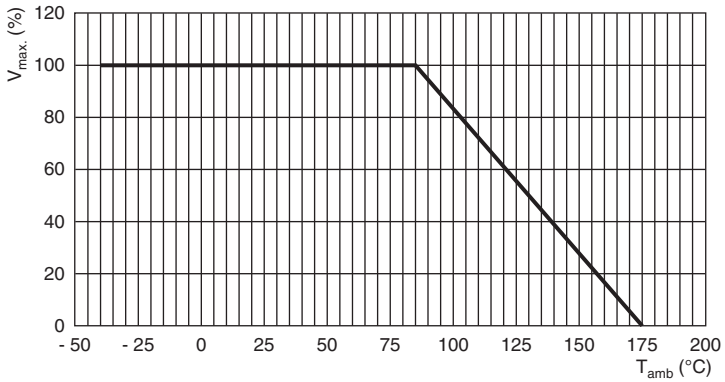
Notes

- For bulk parts replace x by “5” and y by “B”
- For taped on reel parts replace it x by “6” and y by “T”

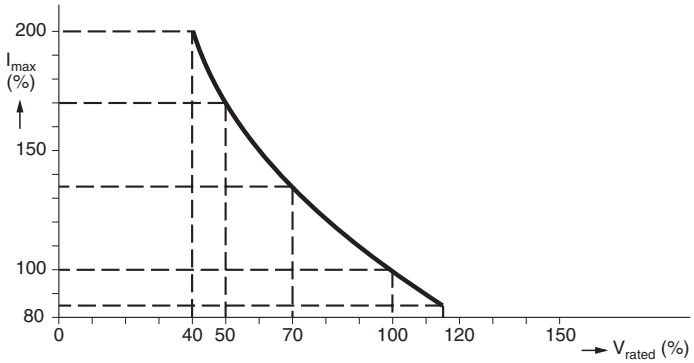
CURRENT DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



VOLTAGE DERATING AS A FUNCTION OF AMBIENT TEMPERATURE



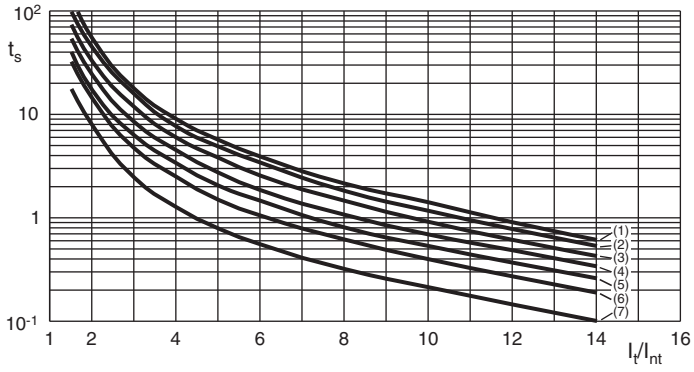
ELECTRICAL CHARACTERISTICS $I_{max.}$ AS A FUNCTION OF VOLTAGE



$I_{max.}$ as stated in the electrical data and ordering information tables, is the maximum overload current that may flow through the PTC when passing from the low ohmic to high ohmic state at rated voltage.

When other voltages are present after tripping, the $I_{max.}$ value can be derived from the above $I_{max.}$ as a function of voltage graph. Voltages below V_{rated} will allow higher overload currents to pass the PTC.

TYPICAL TRIP-TIME AS A FUNCTION OF TRIP CURRENT RATIO



Curve 1: Ø $D_{max.}$ = 20.5 mm
Curve 2: Ø $D_{max.}$ = 16.5 mm
Curve 3: Ø $D_{max.}$ = 12.5 mm
Curve 4: Ø $D_{max.}$ = 10.5 mm
Curve 5: Ø $D_{max.}$ = 8.5 mm
Curve 6: Ø $D_{max.}$ = 7.0 mm
Curve 7: Ø $D_{max.}$ = 5.0 mm

Measured in accordance with *"IEC 60738"*.

Trip-time or switching time (t_s)

To check the trip-time for a specific PTC, refer to the Electrical Data and Ordering Information tables for the value I_{nt}. Divide the overload or trip current by this I_{nt} and you realize the factor I_t/I_{nt}. This rule is valid for any ambient temperature between 0 °C and 70 °C. Adapt the correct non-trip current with the appropriate curve in the Current Deviation as a Function of the Ambient Temperature graph. The relationship between the I_t/I_{nt} factor and the switching time is a function of the PTC diameter; see the above graphs.

Example

What will be the trip-time at I_{ol} = 3 A and T_{amb} = 0 °C of a thermistor type 2381 661 54711; 2.5 Ω; Ø $D_{max.}$ = 8.5 mm:

I_{nt} from the table: 470 mA at 25 °C

I_{nt}: 470 x 1.12 = 526 mA (at 0 °C).

Overload current = 3 A; factor I_t/I_{nt}: $^3/_{0.526}$ = 5.70. In the typical trip-time as a function of trip current ratio graph, at the 8.5 mm line and I_t/I_{nt} = 5.70, the typical trip-time is 1.7 s.

COMPONENTS OUTLINE			
CODE NUMBER 2381		SPQ	OUTLINE
660	5...1	500	Fig. 1a
	6...1	1500	Fig. 1b
661	5...1	250	Fig. 1a
	6...1	1500	Fig. 1b
662	5...1	250	Fig. 1a
	66111 to 67011	1500	Fig. 1b
	68311 to 69211	750	Fig. 1b
663	5...1	200	Fig. 1a
664	5...1	100	Fig. 1a

PTC THERMISTORS IN BULK

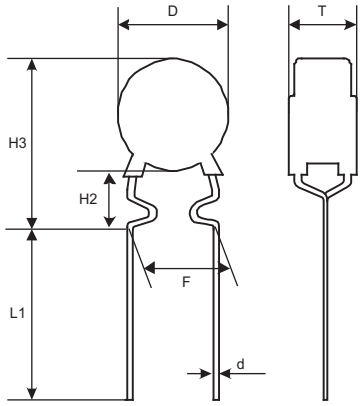


Fig. 1a

DIMENSIONS OF BULK TYPE PTC'S in mm	
D	See table
d	0.6 ± 10 %
T	4.0 max.
H2	4.0 ± 1.0
H3	D + 5 max.
L1	20 min.
F	5.0

PTC THERMISTORS ON TAPE ON REEL

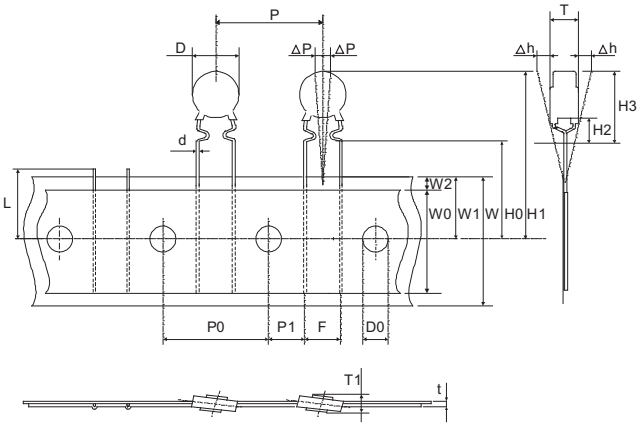
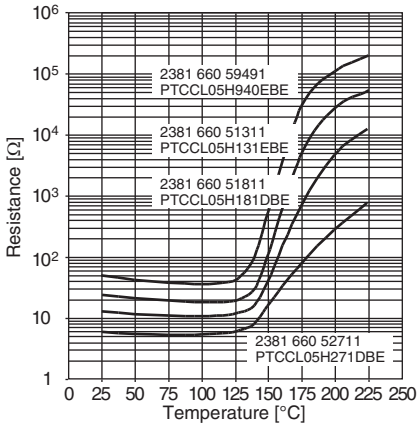


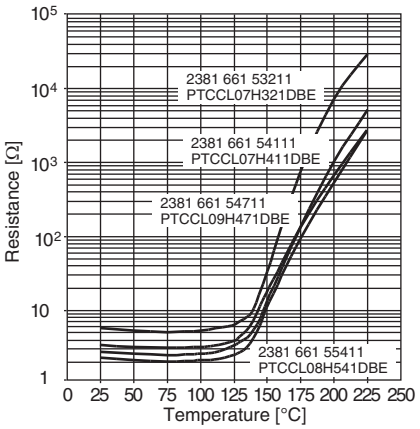
Fig. 1b

TAPE AND REEL ACCORDING TO IEC 60286-2 DIMENSIONS in millimeters			
SYMBOL	PARAMETER	DIMENSIONS	TOLERANCE
D	Body diameter	See table	Max.
d	Lead diameter	0.6	± 10 %
P	Pitch of components Diameter < 12 mm Diameter ≥ 12 mm	 12.7 25.4	 ± 1.0 ± 2.0
P_0	Feedhole pitch	12.7	± 0.3
F	Leadcenter to leadcenter distance (between component and tape)	5.0	+ 0.6 - 0.1
H0	Lead wire clinch height	16.0	± 0.5
H2	Component bottom to seating plane	4.0	± 1.0
H3	Component top to seating plane	D + 5	Max.
T	Total thinkness	4.0	Max.

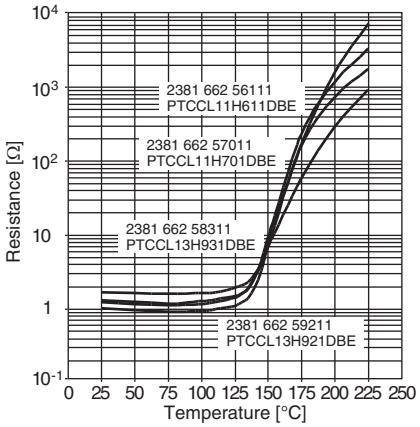
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



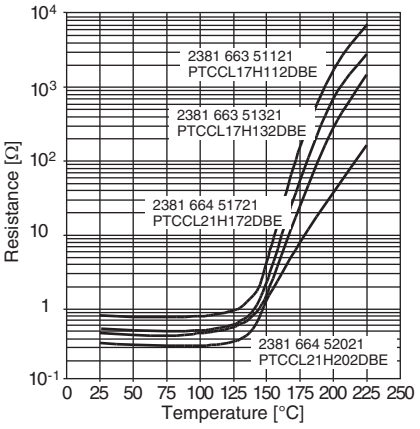
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



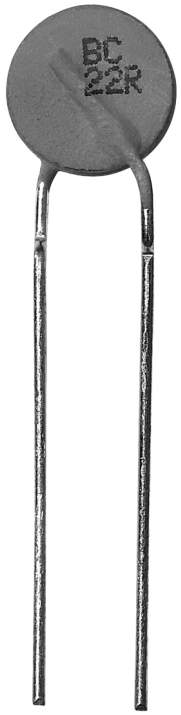
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



145 V PTC Thermistors for Overload Protection



FEATURES

- Wide range of trip and non-trip currents: From 47 mA up to 1 A for the non-trip current
- Small ratio between trip and non-trip currents (I_t/I_{nt} = 1.5 at 25 °C)
- High maximum inrush current (up to 13 A)
- Leaded parts withstand mechanical stresses and vibration
- UL file E148885 according to XGPU standard UL1434
- UL approved PTCs are guaranteed to withstand severe test programs
  - Long-life cycle tests (over 5000 trip cycles)
  - Long-life storage tests (3000 h at 250 °C)
  - Electrical cycle tests at low ambient temperatures (- 40 °C or 0 °C)
  - Damp-heat and water immersion tests
  - Overvoltage tests at up to 200 % of rated voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

APPLICATIONS

Over-temperature/over-load protection:

- Telecommunications
- Automotive systems
- Industrial electronics
- Consumer electronics
- Electronic data processing

QUICK REFERENCE DATA		
PARAMETER	**VALUE**	**UNIT**
Maximum voltage (RMS or DC)	145	V
Holding current	0.047 to 1	A
Resistance at 25 °C (R_{25})	1.3 to 240	Ω
$I_{max.}$	0.2 to 13	A
Switch temperature	140	°C
Operating temperature range at max. voltage	0 to 70	°C
Climatic category	25/125/56	

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for overload protection. They consist of a naked disc with two tinned brass or copper clad steel leads and are coated with a high temperature silicone UL 94 V-0 coating. Leadless discs and leaded disks without coating are available on request.

MOUNTING

The PTC Thermistors are suitable for processing on automatic insertion equipment.

Typical soldering

235 °C; duration: 5 s (Lead (Pb)-bearing)
245 °C, duration: 5 s (Lead (Pb)-free)

Resistance to soldering heat

260 °C, duration: 10 s max.

MARKING

Only the grey lacquered thermistors with a diameter of 8.5 mm to 20.5 mm are marked with BC, R_{25} value (example 1R9) on one side and I_{nt}, $V_{max.}$ on the other side.

ELECTRICAL DATA AND ORDERING INFORMATION for 2381 66. 5...2; max. voltage = 145 V (AC or DC) (1)

I_{nt} MAX. at 25 °C (mA)	I_t MIN. at 25 °C (mA)	R_{25} ± 20 % (Ω)	I (2) MAX. at 25 °C (mA)	I_{res} MAX. at V MAX. and 25 °C (mA)	DISSIP. FACTOR (mW/K)	Ø D MAX. (mm)	CATALOG NUMBERS	
							BULK	TAPE ON REEL
47	70	240	200	9	7.3	5	2381 660 54792	2381 660 64792
65	100	115	300	11	7.3	5	2381 660 56592	2381 660 66592
93	140	55	450	13	7.3	5	2381 660 59392	2381 660 69392
110	165	40	500	13	7.3	5	2381 660 51112	2381 660 61112
130	195	28	600	13	7.3	5	2381 660 51312	2381 660 61312
170	255	19	1000	15	8.3	7	2381 661 51712	2381 661 61712
210	315	12	1400	15	8.3	7	2381 661 52112	2381 661 62112
250	375	9.4	2000	16.5	9	8.5	2381 661 52512	2381 661 62512
270	405	8	2200	16.5	9	8.5	2381 661 52712	2381 661 62712
320	480	6.7	3000	19	10.5	10.5	2381 662 53212	2381 662 63212
360	540	5.3	3500	19	10.5	10.5	2381 662 53612	2381 662 63612
410	615	4.6	4500	22.5	11.7	12.5	2381 662 54112	2381 662 64112
450	675	3.8	5000	22.5	11.7	12.5	2381 662 54512	2381 662 64512
600	900	2.9	7200	28.5	15.5	16.5	2381 663 56012	-
710	1065	2.1	8500	28.5	15.5	16.5	2381 663 57112	-
880	1320	1.7	11 000	37.5	19.8	20.5	2381 664 58812	-
1000	1500	1.3	13 000	37.5	19.8	20.5	2381 664 51022	-

Notes

(1) The thermistors are clamped at the seating plane

(2) $I_{max.}$ is the maximum overload current that may flow through the PTC when it passes from the low ohmic to the high ohmic state. UL approval: $I_{max.}$ x 0.8

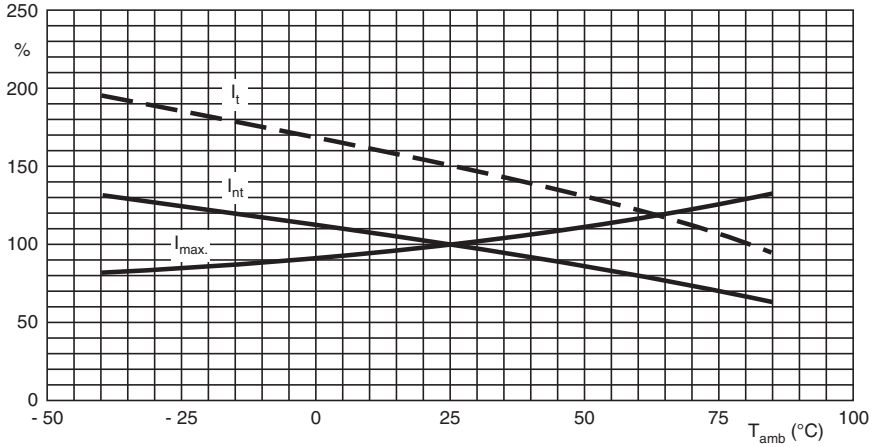
SAP AND 12NC PART NUMBERS

12NC	SAP CODING	12NC	SAP CODING
2381 660 x4792	PTCCL05H470FyE	2381 662 x3212	PTCCL11H321FyE
2381 660 x6592	PTCCL05H650FyE	2381 662 x3612	PTCCL11H361FyE
2381 660 x9392	PTCCL05H930FyE	2381 662 x4112	PTCCL13H411FyE
2381 660 x1112	PTCCL05H111FyE	2381 662 x4512	PTCCL13H451FyE
2381 660 x1312	PTCCL05H131FyE	2381 663 56012	PTCCL17H601FBE
2381 661 x1712	PTCCL07H171FyE	2381 663 57112	PTCCL17H711FBE
2381 661 x2112	PTCCL07H211FyE	2381 664 58812	PTCCL21H881FBE
2381 661 x2512	PTCCL09H251FyE	2381 664 51022	PTCCL21H102FBE
2381 661 x2712	PTCCL09H271FyE		

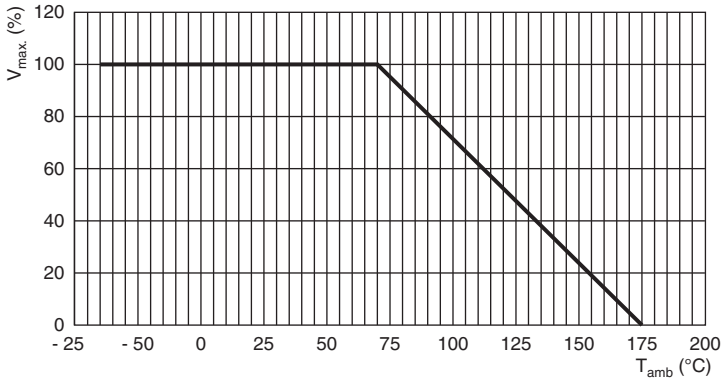
Notes

- For bulk parts replace x by “5” and y by “B”
- For taped on reel parts replace x by “6” and y by “T”

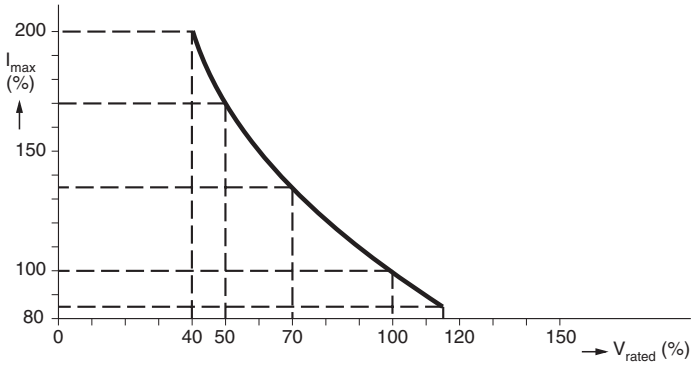
CURRENT DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



VOLTAGE DERATING AS A FUNCTION OF AMBIENT TEMPERATURE

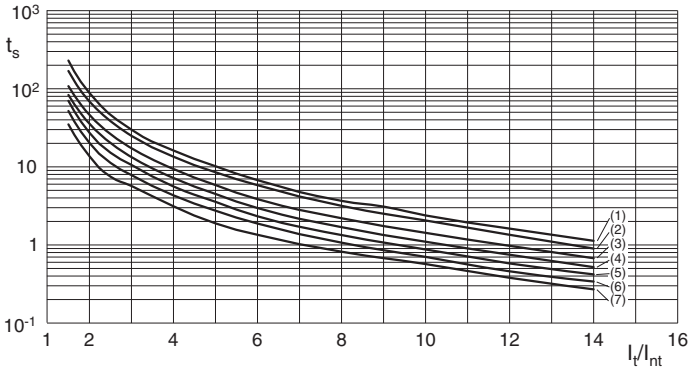


ELECTRICAL CHARACTERISTICS $I_{max.}$ AS A FUNCTION OF VOLTAGE



$I_{max.}$ as stated in the electrical data and ordering information tables, is the maximum overload current that may flow through the PTC when passing from the low ohmic to high ohmic state at rated voltage.
When other voltages are present after tripping, the $I_{max.}$ value can be derived from the above $I_{max.}$ as a function of voltage graph. Voltages below V_{rated} will allow higher overload currents to pass the PTC.

TYPICAL TRIP-TIME AS A FUNCTION OF TRIP CURRENT RATIO



Curve 1: Ø $D_{max.}$ = 20.5 mm
Curve 2: Ø $D_{max.}$ = 16.5 mm
Curve 3: Ø $D_{max.}$ = 12.5 mm
Curve 4: Ø $D_{max.}$ = 10.5 mm
Curve 5: Ø $D_{max.}$ = 8.5 mm
Curve 6: Ø $D_{max.}$ = 7.0 mm
Curve 7: Ø $D_{max.}$ = 5.0 mm
Measured in accordance with *"IEC 60738"*.

Trip-time or switching time (t_s)
To check the trip-time for a specific PTC, refer to the Electrical Data and Ordering Information tables for the value I_{nt}. Divide the overload or trip current by this I_{nt} and you realize the factor I_t/I_{nt}. This rule is valid for any ambient temperature between 0 °C and 70 °C. Adapt the correct non-trip current with the appropriate curve in the Current Deviation as a Function of the Ambient Temperature graph. The relationship between the I_t/I_{nt} factor and the switching time is a function of the PTC diameter; see the above graphs.

Example
What will be the trip-time at I_{ol} = 0.8 A and T_{amb} = 0 °C of a thermistor type 2381 661 52112; 12 Ω; Ø $D_{max.}$ = 7.0 mm:
I_{nt} from the table: 210 mA at 25 °C
I_{nt}: 210 x 1.12 = 235 mA (at 0 °C).
Overload current = 0.8 A; factor I_t/I_{nt}: $^{0.8}/_{0.235}$ = 3.40. In the typical trip-time as a function of trip current ratio graph, at the 7.0 mm line and I_t/I_{nt} = 3.40, the typical trip-time is 6.0 s.

COMPONENTS OUTLINE			
CODE NUMBER 2381		SPQ	OUTLINE
660	5...2	500	Fig. 1a
	6...2	1500	Fig. 1b
661	5...2	250	Fig. 1a
	6...2	1500	Fig. 1b
662	5...2	200	Fig. 1a
	63212 - 63612	1500	Fig. 1b
	64112 - 64512	750	Fig. 1b
663	5...2	100	Fig. 1a
664	5...2	100	Fig. 1a

PTC THERMISTORS IN BULK

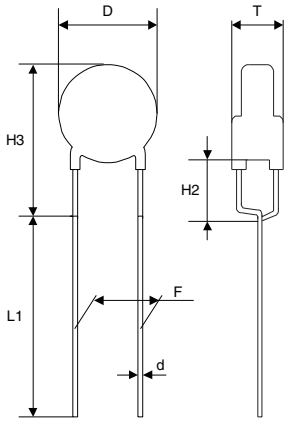


Fig. 1a

DIMENSIONS OF BULK TYPE PTC'S in mm	
D	See table
d	0.6 ± 10 %
T	5.0 max.
H2	4.0 ± 1.0
H3	D + 5 max.
L1	20 min.
F	5.0

PTC THERMISTORS ON TAPE ON REEL

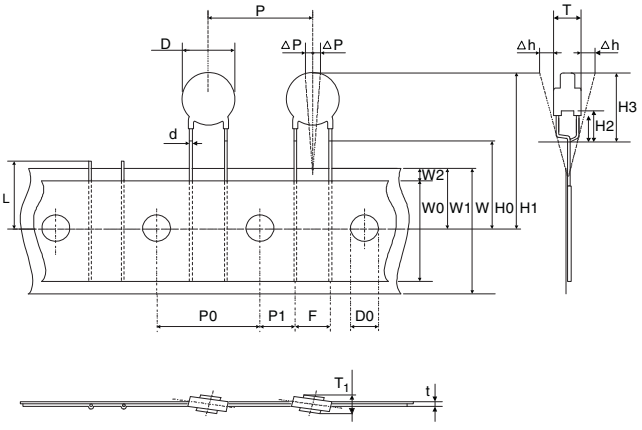
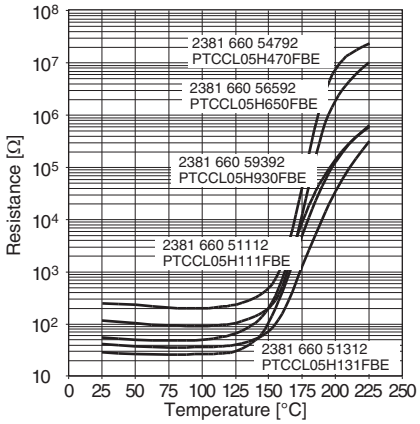


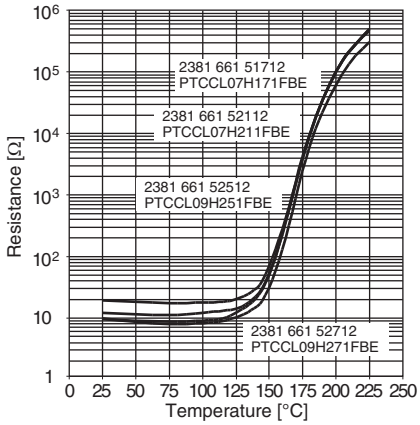
Fig. 1b

TAPE AND REEL ACCORDING TO IEC 60286-2 DIMENSIONS in millimeters			
SYMBOL	PARAMETER	DIMENSIONS	TOLERANCE
D	Body diameter	See table	Max.
d	Lead diameter	0.6	± 10 %
P	Pitch of components Diameter < 12 mm Diameter ≥ 12 mm	 12.7 25.4	 ± 1.0 ± 2.0
P_0	Feedhole pitch	12.7	± 0.3
F	Leadcenter to leadcenter distance (between component and tape)	5.0	+ 0.6 - 0.1
H0	Lead wire clinch height	16.0	± 0.5
H2	Component bottom to seating plane	4.0	± 1.0
H3	Component top to seating plane	D + 5	Max.
H4	Seating plane difference (left-right lead)	0	± 0.2
T	Total thinkness	5.0	Max.

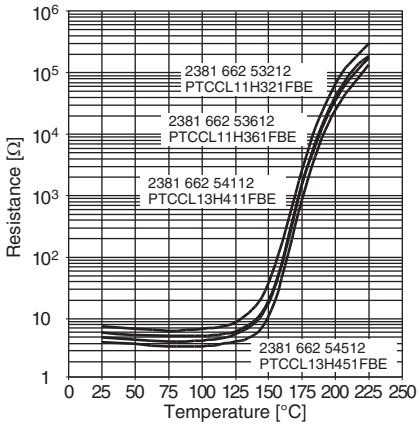
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



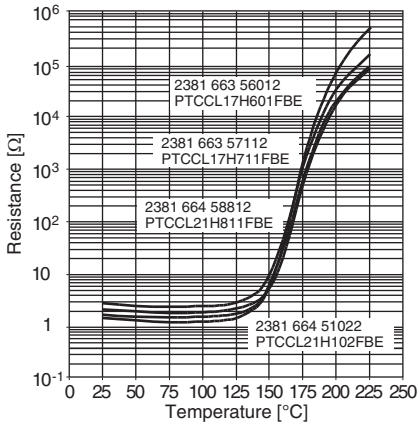
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



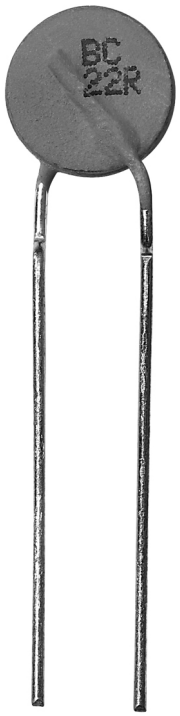
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



265 V PTC Thermistors for Overload Protection



FEATURES

- Wide range of trip and non-trip currents: From 11 mA up to 800 mA
- Small ratio between trip and non-trip currents (I_t/I_{nt} = 1.5 at 25 °C)
- High maximum inrush current (up to 5.5 A)
- Leaded parts withstand mechanical stresses and vibration
- UL file E148885 according to XGPU standard UL1434
- UL approved PTCs are guaranteed to withstand severe test programs
  - Long-life cycle tests (over 5000 trip cycles)
  - Long-life storage tests (3000 h at 250 °C)
  - Electrical cycle tests at low ambient temperatures (- 40 °C or 0 °C)
  - Damp-heat and water immersion tests
  - Overvoltage tests at up to 200 % of rated voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

APPLICATIONS

Over-temperature/over-load protection:

- Telecommunications
- Automotive systems
- Industrial electronics
- Consumer electronics
- Electronic data processing

QUICK REFERENCE DATA		
PARAMETER	**VALUE**	**UNIT**
Holding current	0.011 to 0.8	A
Resistance at 25 °C (R_{25})	2.1 to 3000	Ω
$I_{max.}$	0.8 to 5.5	A
Switch temperature	140	°C
Maximum voltage (RMS or DC)	265	V
Operating temperature range at max. voltage	0 to 70	°C
Climatic category	25/125/56	

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for overload protection. They consist of a metallized ceramic disc with two tinned brass or copper clad steel leads reflow soldered to it and coated with a high temperature silicone lacquer. Leadless disks and leaded disks without coating are available on request.

MOUNTING

The PTC Thermistors are suitable for processing on automatic insertion equipment.

Typical soldering

235 °C; duration: 5 s (Lead (Pb)-bearing)
245 °C, duration: 5 s (Lead (Pb)-free)

Resistance to soldering heat

260 °C, duration: 10 s max.

MARKING

Only the grey lacquered thermistors with a diameter of 8.5 mm to 20.5 mm are marked with BC, R_{25} value (example 1R9) on one side and I_{nt}, $V_{max.}$ on the other side.

ELECTRICAL DATA AND ORDERING INFORMATION for 2381 66. 5...3; max. voltage = 265 V (AC or DC) (1)								
I_{nt} MAX. at 25 °C (mA)	I_t MIN. at 25 °C (mA)	R_{25} ± 20 % (Ω)	I (2) MAX. at 25 °C (mA)	I_{res} MAX. at V MAX. and 25 °C (mA)	DISSIP. FACTOR (mW/K)	Ø D MAX. (mm)	CATALOG NUMBERS	
							BULK	TAPE ON REEL
11	17	3000	80	6.5	7.3	5	2381 660 51193	2381 660 61193
15	23	1900	110	6.5	7.3	5	2381 660 51593	2381 660 61593
19	29	1200	140	6.5	7.3	5	2381 660 51993	2381 660 61993
28	42	500	200	6.8	7.3	5	2381 660 52893	2381 660 62893
39	59	260	300	6.8	7.3	5	2381 660 53993	2381 660 63993
63	95	120	450	7	7.3	5	2381 660 56393	2381 660 66393
76	115	85	550	7	7.3	5	2381 660 57693	2381 660 67693
95	143	56	600	7	7.3	5	2381 660 59593	2381 660 69593
110	165	48	650	7.5	8.3	7	2381 661 51113	2381 661 61113
140	210	29	800	8	8.3	7	2381 661 51413	2381 661 61413
170	255	22	900	9	9	8.5	2381 661 51713	2381 661 61713
190	285	18	1000	9.5	9	8.5	2381 661 51913	2381 661 61913
210	315	17	1300	10	10.5	10.5	2381 662 52113	2381 662 62113
250	375	12	1500	11	10.5	10.5	2381 662 52513	2381 662 62513
280	420	11	1800	12	11.7	12.5	2381 662 52813	2381 662 62813
320	480	8.4	2200	13	11.7	12.5	2381 662 53213	2381 662 63213
400	600	6.6	3000	15	15.5	16.5	2381 663 54013	-
490	735	4.4	3500	16	15.5	16.5	2381 663 54913	-
590	855	4	4500	19.5	19.8	20.5	2381 664 55913	-
700	1050	2.8	5500	21	19.8	20.5	2381 664 57013	-
800	1200	2.1	5500	22.5	19.8	20.5	2381 664 58013 (3)	-

Notes

(1) The thermistors are clamped at the seating plane

(2) $I_{max.}$ is the maximum overload current that may flow through the PTC when it passes from the low ohmic to the high ohmic state.
UL approval: $I_{max.}$ x 0.75

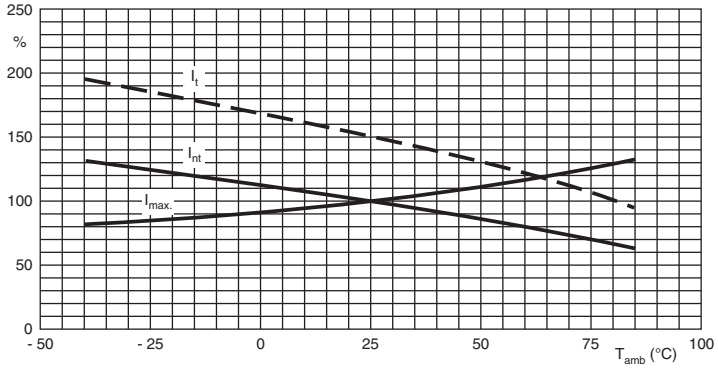
(3) Not UL approved

SAP AND 12NC PART NUMBERS			
12NC	SAP CODING	12NC	SAP CODING
2381 660 x1193	PTCCL05H110HyE	2381 661 x1913	PTCCL09H191HyE
2381 660 x1593	PTCCL05H150HyE	2381 662 x2113	PTCCL11H211HyE
2381 660 x1993	PTCCL05H190HyE	2381 662 x2513	PTCCL11H251HyE
2381 660 x2893	PTCCL05H280HyE	2381 662 x2813	PTCCL13H281HyE
2381 660 x3993	PTCCL05H390HyE	2381 662 x3213	PTCCL13H321HyE
2381 660 x6393	PTCCL05H630HyE	2381 663 54013	PTCCL17H401HBE
2381 660 x7693	PTCCL05H760HyE	2381 663 54913	PTCCL17H491HBE
2381 660 x9593	PTCCL05H950HyE	2381 664 55913	PTCCL21H591HBE
2381 661 x1113	PTCCL07H111HyE	2381 664 57013	PTCCL21H701HBE
2381 661 x1413	PTCCL07H141HyE	2381 664 58013	PTCCL21H801HBE
2381 661 x1713	PTCCL09H171HyE		

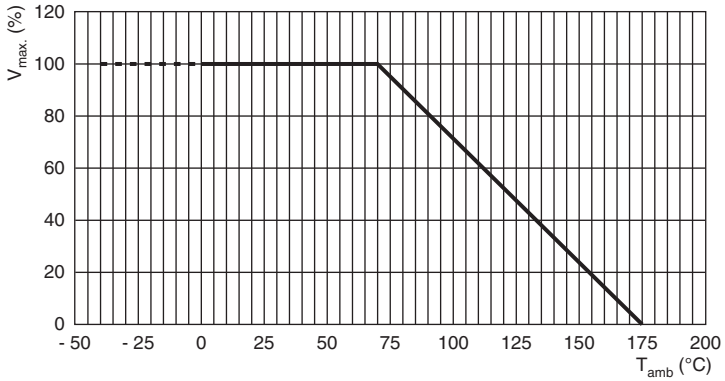
Notes

- For bulk parts replace x by “5” and y by “B”
- For taped on reel parts replace x by “6” and y by “T”

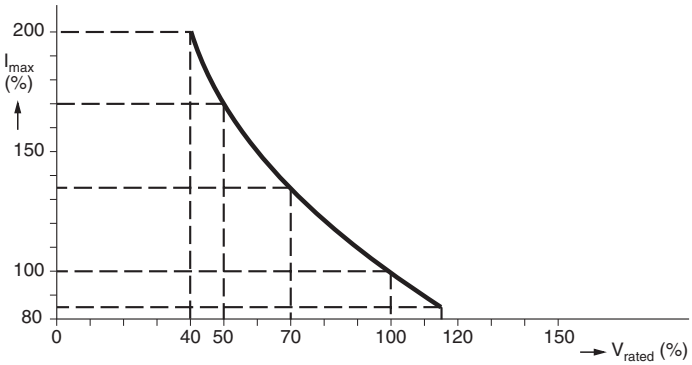
CURRENT DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE



VOLTAGE DERATING AS A FUNCTION OF AMBIENT TEMPERATURE



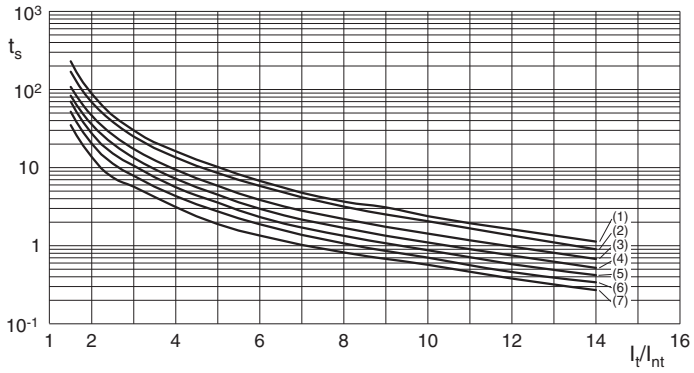
ELECTRICAL CHARACTERISTICS $I_{max.}$ AS A FUNCTION OF VOLTAGE



$I_{max.}$ as stated in the electrical data and ordering information tables, is the maximum overload current that may flow through the PTC when passing from the low ohmic to high ohmic state at rated voltage.

When other voltages are present after tripping, the $I_{max.}$ value can be derived from the above $I_{max.}$ as a function of voltage graph. Voltages below V_{rated} will allow higher overload currents to pass the PTC.

TYPICAL TRIP-TIME AS A FUNCTION OF TRIP CURRENT RATIO



Curve 1: Ø $D_{max.}$ = 20.5 mm
Curve 2: Ø $D_{max.}$ = 16.5 mm
Curve 3: Ø $D_{max.}$ = 12.5 mm
Curve 4: Ø $D_{max.}$ = 10.5 mm
Curve 5: Ø $D_{max.}$ = 8.5 mm
Curve 6: Ø $D_{max.}$ = 7.0 mm
Curve 7: Ø $D_{max.}$ = 5.0 mm

Measured in accordance with *"IEC 60738"*.

Trip-time or switching time (t_s)

To check the trip-time for a specific PTC, refer to the Electrical Data and Ordering Information tables for the value Int. Divide the overload or trip current by this Int and you realize the factor It/Int. This rule is valid for any ambient temperature between 0 °C and 70 °C. Adapt the correct non-trip current with the appropriate curve in the Current Deviation as a Function of the Ambient Temperature graph. The relationship between the It/Int factor and the switching time is a function of the PTC diameter; see the above graphs.

Example

What will be the trip-time at I_{ol} = 0.8 A and T_{amb} = 50 °C of a thermistor type 2381 661 51713; 22 Ω; Ø $D_{max.}$ = 8.5 mm:

I_{nt} from the table: 170 mA at 25 °C

I_{nt}: 170 x 0.87 = 148 mA (at 50 °C).

Overload current = 0.8 A; factor I_t/I_{nt}: $^{0.8}/_{0.148}$ = 5.40. In the typical trip-time as a function of trip current ratio graph, at the 8.5 mm line and I_t/I_{nt} = 5.40, the typical trip-time is 3.0 s.

COMPONENTS OUTLINE

CODE NUMBER 2381		SPQ	OUTLINE
660	5...3	500	Fig. 1a
	6...3	1500	Fig. 1b
661	5...3	250	Fig. 1a
	6...3	1500	Fig. 1b
662	5...3	200	Fig. 1a
	62113 - 62513	1500	Fig. 1b
	62813 - 63213	750	Fig. 1c
663	5...3	100	Fig. 1a
664	5...3	50	Fig. 1a

PTC THERMISTORS IN BULK

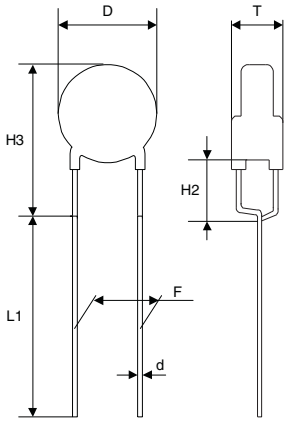


Fig. 1a

DIMENSIONS OF BULK TYPE PTC'S in mm	
D	See table
d	0.6 ± 10 %
T	5.5 max.
H2	4.0 ± 1.0
H3	D + 5 max.
L1	20 min.
F	5.0

PTC THERMISTORS ON TAPE ON REEL

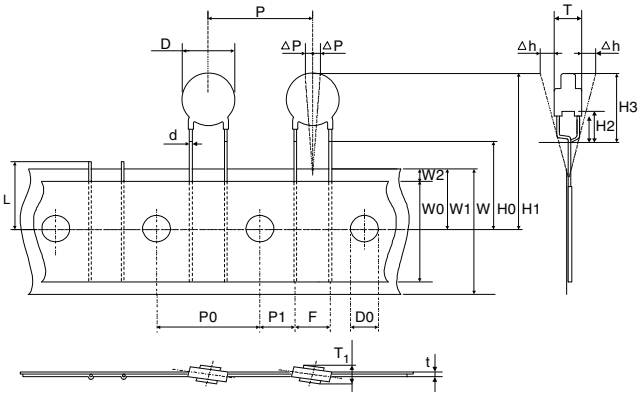


Fig. 1b

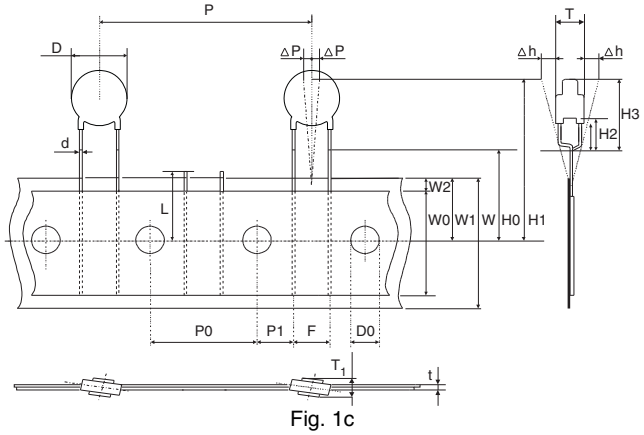
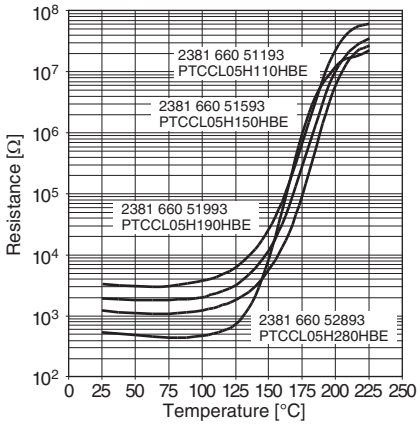


Fig. 1c

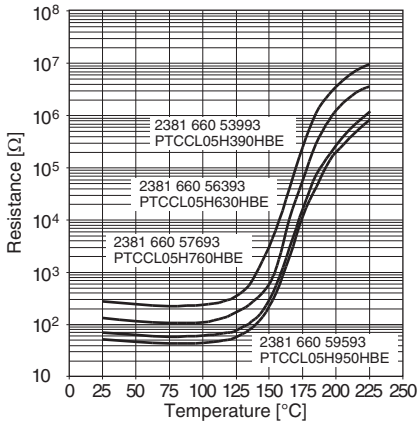
TAPE AND REEL ACCORDING TO IEC 60286-2 DIMENSIONS in millimeters

SYMBOL	PARAMETER	DIMENSIONS	TOLERANCE
D	Body diameter	See table	Max.
d	Lead diameter	0.6	± 10 %
P	Pitch of components Diameter < 12 mm Diameter ≥ 12 mm	 12.7 25.4	 ± 1.0 ± 2.0
F	Leadcenter to leadcenter distance (between component and tape)	5.0	+ 0.6 - 0.1
H0	Lead wire clinch height	16.0	± 0.5
H2	Component bottom to seating plane	4.0	± 1.0
H3	Component top to seating plane	D + 5	Max.
H4	Seating plane difference (left-right lead)	0	± 0.2
T	Total thinkness	5.5	Max.

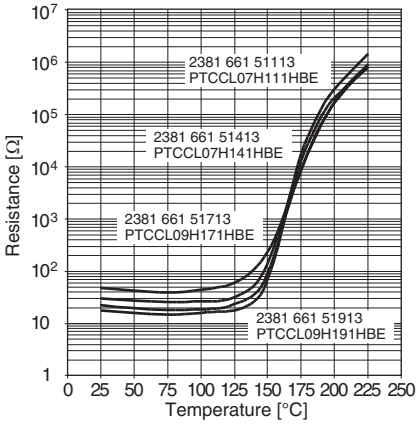
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



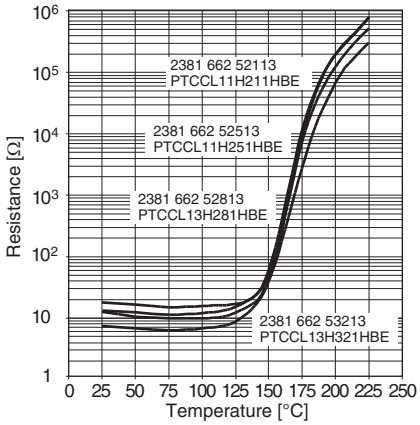
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



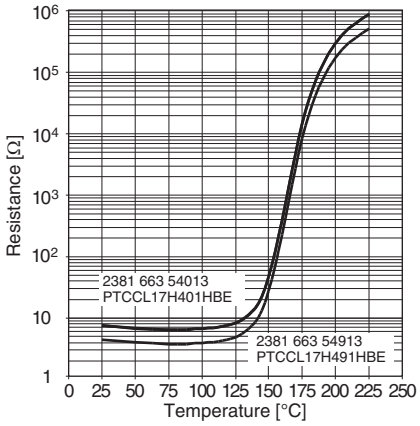
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



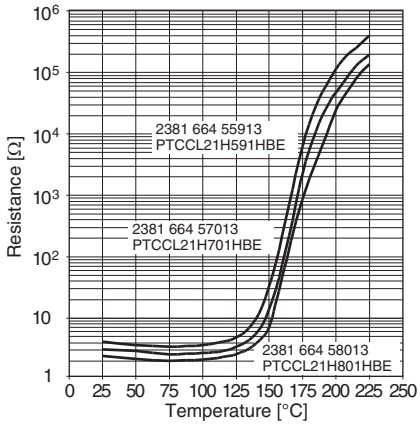
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC



600 V PTC Thermistors for Overload Protection

FEATURES AND BENEFITS

- Fast response time for rapid protection
- Automatic resetting once overload is removed
- Operates on DC or AC voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- UL approved (E148885)

APPLICATIONS

- Over-temperature/over-load protection for metering, low current signal protection, digital signal protection against over-voltage

DESCRIPTION

Test and measuring instruments, such as oscilloscopes and digital multimeters, can be easily damaged if excessive voltages are applied across their input terminals.

Simple and effective overload protection can be provided by connecting a high-voltage PTC thermistor in series with the instrument; see Typical Connection of the PTC Thermistor for Digital Multimeter Protection drawing. Under normal conditions, the resistance of the PTC thermistor is low, so the test voltage will be measured by the instrument. Under an overload condition, the PTC thermistor will switch to its high-resistance state, absorbing the overload current and protecting the instrument. When the overload is removed, the PTC thermistor will return to its low-resistance state, ready to resume its protective function.

ELECTRICAL DATA AND ORDERING INFORMATION

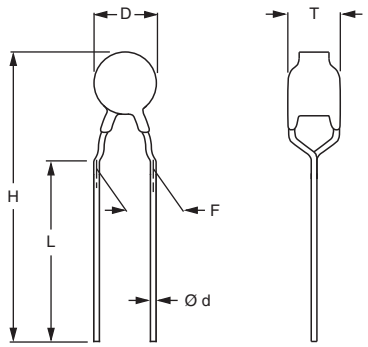
I_{nt} MAX. at 25 °C (mA)	I_t MIN. at 25 °C (mA)	R_{25} (2)	MAXIMUM (1) VOLTAGE (V)	INSULATION VOLTAGE (V)	CATALOG NUMBER	
					12NC	SAP CODING
10	20	1600 ± 300	600	-	2381 660 93034	PTCCL05H100SBE
10	50	400 ± 100	600	> 1000	2381 661 93113	PTCCL10H010SBE

Note

(1) These PTCs can handle maximum voltage without series resistance

(2) Other resistance values and voltage levels on request

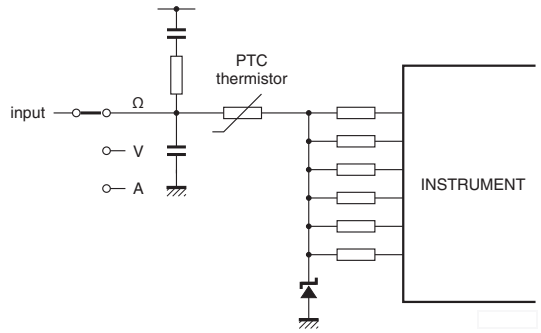
PTC THERMISTORS IN BULK



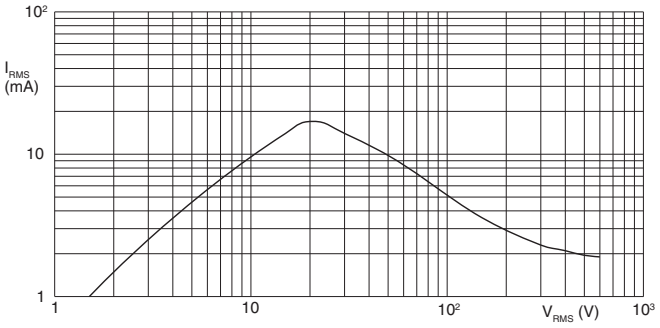
COMPONENT DIMENSIONS in millimeters

H	L	D MAX.	T MAX.	F	Ø d	MASS (g)	SPQ	CATALOG NUMBER	
								12NC	SAP CODING
30 ± 3	20 ± 3	5	4.5	5.08	0.6	± 0.47	500	2381 660 93034	PTCCL05H100SBE
15.5 ± 1.5	3.1 ± 0.5	10	6.5	8.12	0.8	± 1.82	500	2381 661 93113	PTCCL10H010SBE

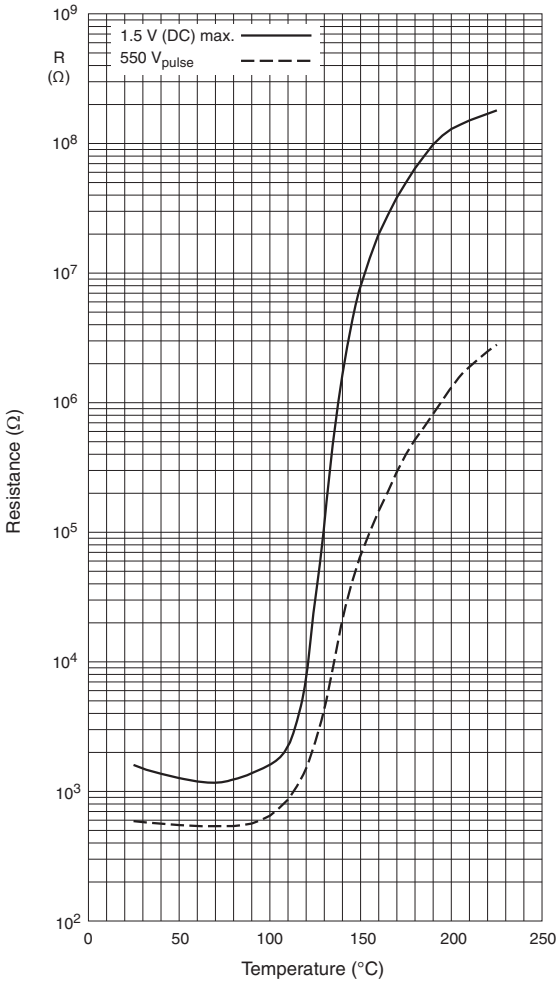
TYPICAL CONNECTION OF THE PTC THERMISTOR FOR DIGITAL MULTIMETER PROTECTION.



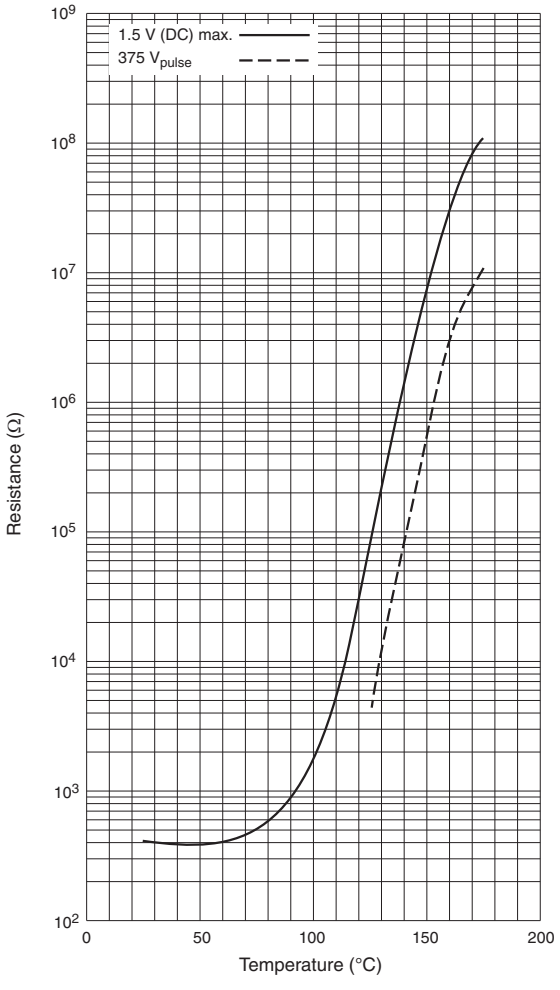
TYPICAL CURRENT/VOLTAGE CHARACTERISTIC for 2381 660 93034/PTCCL05H100SBE



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC for 2381 660 93034/PTCCL05H100SBE



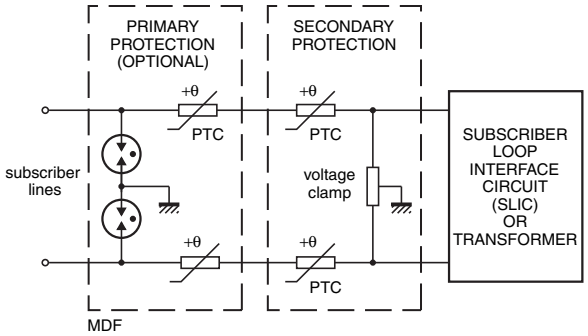
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC for 2381 661 93113/PTCCL10H010SBE



PTC for Telecommunication Applications

Contents

PTC Thermistors, Overload Protection for Telecommunication



Typical telephone line showing where PTC thermistors can be used for overcurrent protection.

FEATURES

- Wide resistance range in telecom area from 4 Ω to 70 Ω
- Fast protection against power contact faults
- Withstand high overload currents of up to 10 A
- High voltage withstanding capabilities for the larger sized thermistors (up to 600 V)
- Good tracking over a wide temperature range for all matched or binned thermistors (matching at 85 °C ≤ 2 x matching at 25 °C)
- UL1434 approved types available (XGPU2)
- All telecom PTCs are coated with a high temperature silicon lacquer (UL 94 V-0) to protect them from any harsh environments and to improve their lifetime
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

DESCRIPTION

Advanced developments in telephone equipment in recent years have radically altered the protection requirements for both exchange and subscriber equipment. The Vishay BCcomponents range of Positive Temperature Coefficient (PTC) thermistors includes devices specially designed to provide overcurrent protection in specific telecom applications.

APPLICATIONS

Over-temperature/over-load protection:

- Main Distribution Frame (MDF)
- Central Office Switching (C.O.)
- Subscriber Terminal Equipment (T.E.)
- Set-top Box (S.B.)

MARKING

Clear marking on a grey coated body
BC and R_{25} value

ELECTRICAL DATA AND ORDERING INFORMATION

RESISTANCE		MATCHING (Ω)	$V_{max.}$ (V_{RMS})	NON-TRIP CURRENT		TRIP CURRENT		MAX. TRIP TIME at 1 A	$I_{max.}$ at $V_{max.}$	APPLICATION AREA (4)	CATALOG NUMBER	
R_{25} (Ω)	TOL. (%)			I_{nt} (mA)	at T (°C)	I_t (mA)	at T (°C)	$t_{max.}$ (s)	$I_{max.}$ (A)		12NC	SAP CODING
25	± 20	1.0	220	70	70	200	25	2.5	4.0	C.O.	2381 661 93048 (1)	PTCTL4MR250GTE (1)
10	± 20	1.0	230	100	70	250	25	3.0	2.0	MDF; ISDN	2381 661 93147 (1)	PTCTL3MR100GTE (1)
33	± 20	1.5	245	75	70	150	10	1.2	1.0	C.O.	2381 661 93037	PTCTL3MR330GTE
25	± 15	no	245	70	70	200	25	5.0	2.6	C.O.	2381 661 93175 (1) (3)	PTCTL4NR250GTE (1) (3)
16	± 20	no	245	140	55	270	25	8.0	1.6	T.E.	2381 662 93081 (1) (3)	PTCTL6NR160GTE (1) (3)
10	± 20	no	245	140	55	270	25	8.0	2.0	T.E.	2381 662 93074 (1) (3)	PTCTL6NR100GTE (1) (3)
25	± 20	1.0	250	70	70	175	25	1.3	3.2	MDF; C.O.	2381 661 93148 (1)	PTCTL3MR250HTE (1)
10	± 20	no	250	100	70	450	0	40.0	10.0	T.E.	2381 663 93025 (1)	PTCTL8NR100HBE (1)
8	± 25	0.5	285	135	95	400	25	6.0	0.6	MDF; ISDN	2381 661 93078 (1)	PTCTL4MR080JBE (1)
16	± 25	no	300	100	70	250	25	2.0	2.6	MDF; T.E.	2381 661 93121 (1)	PTCTL3NR160KTE (1)
10	± 20	no	350	100	70	270	25	4.0	1.0	T.E.; S.B.	2381 661 93124 (1)	PTCTL4NR100LBE (1)
10	± 20	1.0	350	100	70	270	25	4.0	1.0	C.O.	2381 661 93146 (1)	PTCTL4MR100LTE (1)
50	± 20	1.0	600	50	70	140	25	1.0	1.0	C.O.	2381 661 93135 (1)	PTCTL4MR500SBE (1)
35	± 20	3.0	600	70	70	600	0	3.0	1.0	C.O.	2381 661 93056 (1)	PTCTL4MR350STE (1)
25	± 20	0.5	600	70	70	170	25	2.5	2.0	C.O.	2381 661 93139 (1)	PTCTL4MR250STE (1)
25	± 20	0.5	600	70	70	170	25	5.0	2.0	C.O.	2381 662 93129 (1)	PTCTL6MR250STE (1)
10	± 20	0.5	600	175	25	400	25	7.0	1.0	C.O.	2381 662 93114 (2)	PTCTL7MR100SBE (2)
10	± 20	no	600	175	25	400	25	7.0	1.0	T.E.; S.B.	2381 662 93131 (2)	PTCTL7NR100SBE (2)

Notes

(1) These types pass ITU-T K20-21-45 edition 2003 telecommunication protection recommendation
(2) UL 1434 approved types and compatible with UL1459 and GR1089
(3) These types are compatible with FTCSE 131
(4) MDF: Main Distribution Frame; C.O.: Central Office Switching; T.E.: Subscriber Terminal Equipment; S.B.: Set-top Box

OVERCURRENT PROTECTION OF TELECOMMUNICATION LINES

The PTC thermistor must protect the telephone line circuit against overcurrent which may be caused by the following examples:

- Surges due to lightning strikes on or near to the line plant.
- Short-term induction of alternating voltages from adjacent power lines or railway systems, usually caused when these lines or systems develop faults.
- Direct contact between telephone lines and power lines.

To provide good protection under such conditions a PTC thermistor is connected in series with each line, usually as secondary protection; see Typical Telephone Line drawing on page 1. However, even with primary line protection (usually a gas discharge tube), the PTC thermistor must fulfil severe requirements.

Surge pulses of up to 2 kV can occur and in order to withstand short-term power induction the PTC thermistor must withstand high voltages. If the line has primary protection a 220 V to 300 V PTC thermistor is adequate. Without primary protection, however, a 600 V PTC device is necessary. Vishay BCcomponents manufacturers a range of PTC thermistors (see Electrical Data and Ordering Information Table) covering both requirements.

In the case of direct contact between the telephone line and a power line, the PTC thermistor must withstand very high inrush power at normal mains voltage. Under such conditions, overload currents of up to 10 A on a 230 V mains could occur for up to several hours. To handle this power, the resistance/temperature characteristic of the thermistor must have a very steep slope and the ceramic must be extremely homogeneous.

In case of overcurrent due to short-term induction of alternating voltages, currents of several AMPs with voltages as high as 650 V_{RMS} can be present for several seconds

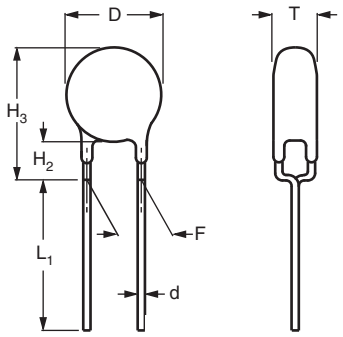
For standard high voltage applications, resistance values from 25 Ω to 50 Ω are available. However, ISDN networks which carry high-frequency sound and vision, need lower line impedance.

Telecommunication designers are therefore demanding high voltage thermistors with much lower R_{25} values, which places even greater demands on the manufacture of PTC thermistors. For these applications PTC thermistors which have a R_{25} value of 10 Ω with voltages in the 300 V_{RMS} to 600 V_{RMS} range are available.

In a typical telephone line application, two PTC thermistors are used, one each for the tip and ring (or A and B) wire together with their series resistors. For good line balance it is important that the thermistor and resistor pairs are matched.

On request, Vishay BCcomponents can supply matched or binned PTC thermistors with R_{25} values matched to as close as 0.5 Ω.

PTC THERMISTORS IN BULK



COMPONENT DIMENSIONS in millimeters

D MAX.	T MAX.	H_2	L_1	H_3 MAX.	H_0	PACKAGING (1)(2)		CATALOG NUMBER	
						TYPE	SPQ	12NC	SAP CODING
8.5	5.0	1.5 to 3.0	-	11.5	16	Taped on reel	1500	2381 661 93048	PTCTL4MR250GTE
7.0	4.0	2.0 ± 0.5	-	9.8	18	Taped on reel	1500	2381 661 93147	PTCTL3MR100GTE
7.0	5.0	1.5 to 3	-	10.0	16	Taped on reel	1500	2381 661 93037	PTCTL3MR330GTE
8.3	4.0	1.5 to 3.0	-	11.0	18	Taped on reel	1500	2381 661 93175 (3)	PTCTL4NR250GTE (3)
11	4.5	4.0 ± 1.0	-	15.5	16	Taped on reel	1500	2381 662 93081	PTCTL6NR160GTE
11	4.5	4.0 ± 1.0	-	15.5	16	Taped on reel	1500	2381 662 93074 (3)	PTCTL6NR100GTE (3)
7.0	4.0	2.0 ± 0.5	-	9.8	18	Taped on reel	1500	2381 661 93148	PTCTL3MR250HTE
13.6	6.0	4.0 ± 1.0	20 ± 4.0	18.6	-	Bulk	200	2381 663 93025 (3)	PTCTL8NR100HBE (3)
8.3	5.0	1.5 ± 0.5	20 ± 3.0	10.3	-	Bulk	250	2381 661 93078	PTCTL4MR080JBE
7.0	4.0	2.5 ± 0.5	-	10.0	16	Taped on reel	1500	2381 661 93121	PTCTL3NR160KTE
8.5	4.0	2.5 ± 0.5	4.1 ± 0.5	11.5	-	Bulk	500	2381 661 93124	PTCTL4NR100LBE

COMPONENT DIMENSIONS in millimeters									
D MAX.	T MAX.	H_2	L_1	H_3 MAX.	H_0	PACKAGING (1)(2)		CATALOG NUMBER	
						TYPE	SPQ	12NC	SAP CODING
8.5	4.0	2.5 ± 0.5	-	11.5	16	Taped on reel	1500	2381 661 93146	PTCTL4MR100LTE
8.5	4.0	2.5 ± 0.5	4.1 ± 0.5	11.5	-	Bulk	500	2381 661 93135	PTCTL4MR500SBE
8.0	5.0	2.5 ± 0.5	-	11.0	16	Taped on reel	1500	2381 661 93056	PTCTL4MR350STE
8.5	4.0	2.0 ± 0.5	-	11.0	16	Taped on reel	1500	2381 661 93139	PTCTL4MR250STE
10.5	5.0	2.0 ± 0.5	-	12.6	16	Taped on reel	1500	2381 662 93129	PTCTL6MR250STE
13	5.5	4.0 ± 1.0	20 min.	18.0	-	Bulk	200	2381 662 93114	PTCTL7MR100SBE
13	5.5	4.0 ± 1.0	20 min.	18.0	-	Bulk	200	2381 662 93131	PTCTL7NR100SBE

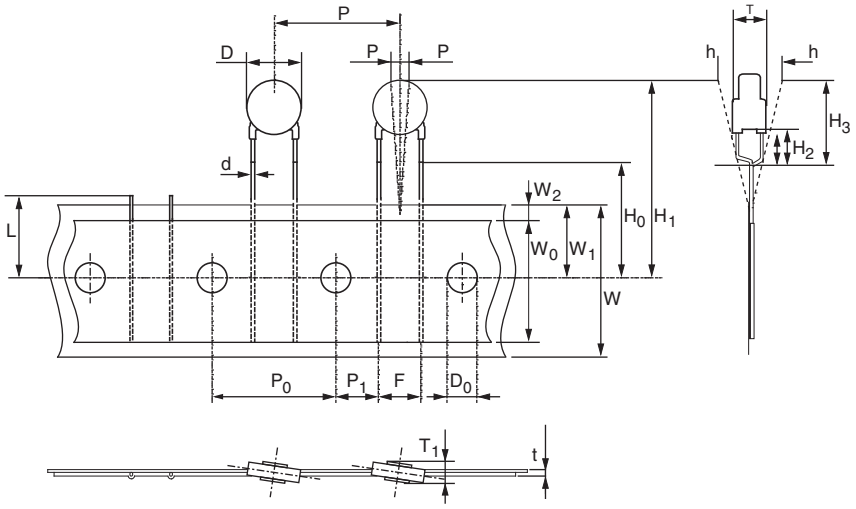
Notes

(1) Taped in accordance with IEC 60286-2

(2) Naked disc ceramic for substrate mounting, available on request

(3) Insulated version is also available

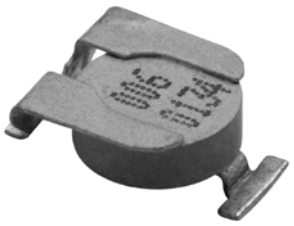
PTC THERMISTORS TAPE ON REEL ACCORDING IEC 60286-2



Dimensions of the reel

TAPE AND REEL ACCORDING TO IEC 60286-2 DIMENSIONS in millimeters				
SYMBOL	PARAMETER	DIMENSIONS	TOLERANCE	REMARKS
d	Lead diameter	0.6	± 10 %	
P	Pitch between thermistors	12.7	± 1	
F	Lead to lead distance	5	+ 0.6 to - 0.1	Guaranteed between component and tape
H2	Component body to seating plane	4	± 1	
H_0	Lead-wire clinch height	See table	± 0.5	

SMD PTC Thermistors for Overload Protection



FEATURES

RoHS COMPLIANT

- Ideal for pick-and-place circuit assembly
- Low mounting height
- Suitable for reflow soldering
- Small ceramic diameter for faster response
- Low heat transfer to substrate
- Flat terminations for stable positioning and good solderability
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

APPLICATIONS

Over-temperature/over-load protection:

- Telecom
  - Central Office Switching (C.O.)
  - Subscriber Terminal Equipment (T.E.)
  - Set-top Box (S.B.)
  - Modems
  - Cable TV communications
- General industry and automotive
  - Low power supplies overload protection
  - Data bus protection

DESCRIPTION

The component consists of a high-performance PTC ceramic disc mounted in a lead-frame for direct soldering onto a printed-circuit board (PCB) or substrate.

The ceramic is soldered to the leadframe by a local reflow process, during which the solder layer is melted to the metallized ceramic surface using a low residue flux.

MARKING

- All SMD PTCs are marked with the last 3-digits of the type number (XXX) and a date code (YYWW)

QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	STANDARD TYPES (1)(2)	TELECOM TYPES (1)(2)
Nominal R_{25}	2 Ω to 500 Ω	10 Ω to 70 Ω
Resistance tolerance	± 10 %; ± 15 %; ± 20 %	
Maximum overload current (voltage dependent)	2 A to 10 A	
Non-trip current	50 mA to 500 mA at 25 °C	50 mA to 100 mA at 70 °C
Maximum voltage	16 V_{RMS} to 400 V_{RMS}	220 V_{RMS} to 600 V_{RMS}
Response time at 25 °C and 20 W overload power	< 1 s	
Matching	-	Down to 0.5 Ω
Maximum continuous power at 25 °C	2 W	

Notes

(1) Customized products are available on request

(2) Coated and/or reinforced types are available on request

ELECTRICAL DATA AND ORDERING INFORMATION

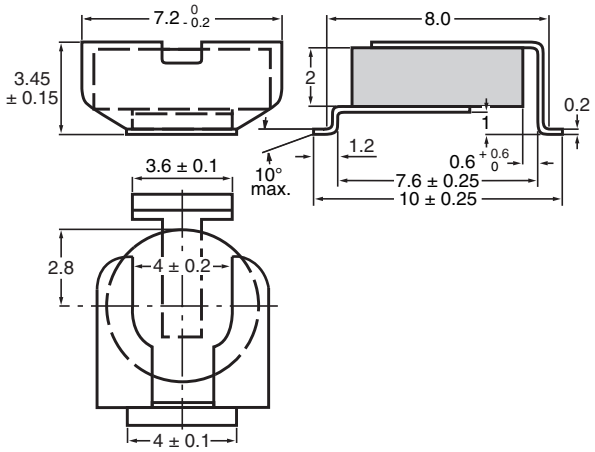
RESISTANCE		MATCHING Ω	V MAX. (V)	I_{nt} at		I_t at	MAX. TRIP-TIME at 1 A (s)	I MAX. at V MAX. (A)	CATALOG NUMBER	
R_{25} (Ω)	TOL. (%)			25 °C (mA)	70 °C (mA)	25 °C (mA)			12NC	SAP CODING
Telecommunication Types										
10	20	no	245	165	100	270	3.0	2.0	2381 661 97012 (3)	PTCTZ3NR100GTE (3)
10	20	0.5	245	165	100	270	3.0	2.0	2381 661 97016 (3)	PTCTZ3MR100GTE (3)
40	25	no	265	80	50	130	0.8	2.0	2381 661 97002	PTCTZ3NR400HTE
25	20	1	265	120	70	220	1.3	2.0	2381 661 97005 (3)	PTCTZ3MR250HTE (3)
15 to 20	-	no	300	150	100	250	1.5	1.5	2381 661 97004 (3)	PTCTZ3NR150KTE (3)
15 to 20	-	0.5	300	150	100	250	1.5	2.0	2381 661 97003 (3)	PTCTZ3MR150KTE (3)
20	20	0.5	300	120	70	250	1.4	1.5	2381 661 97018 (3)	PTCTZ3MR200KTE (3)
35	+ 15/- 20	1	425	110	70	175	1.0	0.7	2381 661 97009 (3)	PTCTZ3MR350MTE (3)
50	20	1	425	90	60	150	0.8	0.7	2381 661 97019	PTCTZ3MR500MTE
General Industrial Types										
3.3	25	-	24	400	-	650	6.0	8.0	2381 661 97013 (3)	PTCTZ3NR339CTE (3)
9.4	25	-	60	150	100	300	1.8	3.0	2381 661 97011 (3)	PTCTZ3NR949ETE (3)

Note

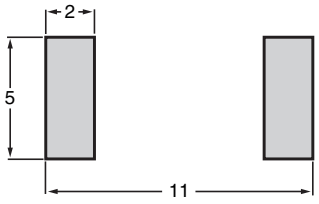
(3) These types pass ITU-K20-21-45 edition 2003 telecommunication protection recommendation

PTC OUTLINES

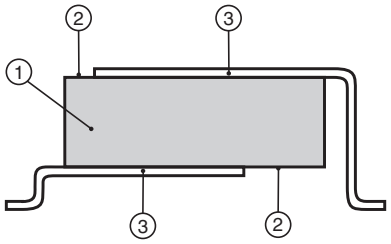
PTC SMD ceramic size: 6.5 mm



DIMENSIONS OF SOLDER LANDS in millimeters



DIMENSIONS in millimeters



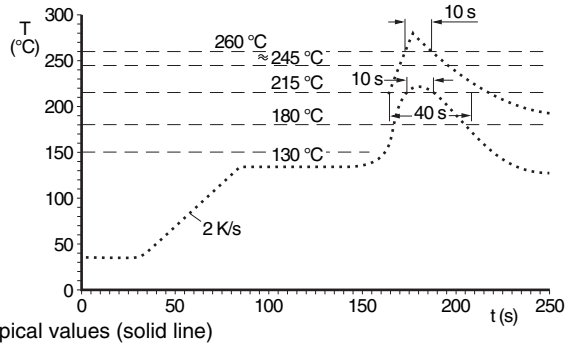
MATERIAL INFORMATION		
REF.	**DESCRIPTION**	**MATERIAL AND REMARKS**
1	Ceramic	BaTiO3 doped
2	Metallization	NiCr Ag layer (vacuum deposition)
3	Leadframe	Ni plated phosphor bronze material covered by PbSn8 solder layer

SOLDERING CONDITIONS

This SMD thermistor is only suitable for reflow soldering, in accordance with JEDEC J-STD-020D. Soldering processes which can be used are reflow (infrared and convection heating) and vapour phase. The maximum temperature of 260 °C during 10 s should not be exceeded and no liquid flux should be allowed to reach the ceramic body.

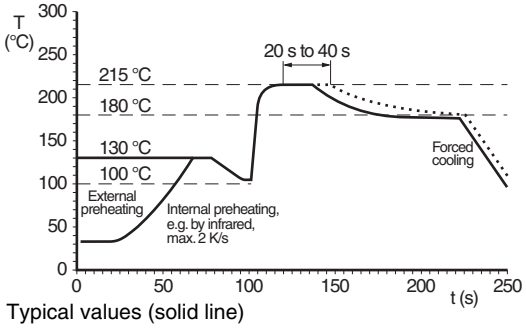
Typical examples of a soldering processes that will provide reliable joints without damage, are shown below.

Reflow soldering



Typical values (solid line)
Process limits (dotted lines)

Vapour phase soldering



Typical values (solid line)
Process limits (dotted lines)

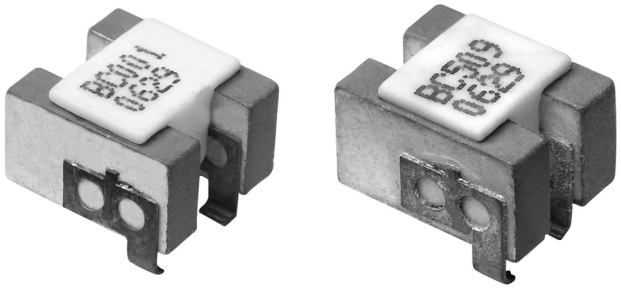
HANDLING PRECAUTIONS

The special leadframe construction and the applied processes do not allow high handling forces on the component.
Because of the nature of PTC ceramic material the component should not be touched with bare hands, as the residue of perspiration can influence component behaviour at high temperatures.

Handling forces vertically applied to the centre of the component should be limited to 5 N in the non-soldered condition and to 10 N in the soldered. These forces should not be exceeded during the handling, transportation and packaging of the soldered product.

For those applications where higher handling forces can be present, a reinforced version is available on request.

TWIN Vertical SMD PTC Thermistors for Telcom Overload Protection



FEATURES

RoHS COMPLIANT

- Very small footprint, allowing to increase the number of lines per PCB
- Matched pairs in one component, significantly reducing the assembly time
- Narrow tracking between the 2 PTC's over a wide temperature range (matching at 85 °C: ≤ 2 x matching at 25 °C)
- Limited height and weight, used on high speed pick-and-place circuit assembly
- Flat pick-up ceramic area for easy placement
- Small ceramics for faster response time
- Thermal coupled PTC's for enhanced protection
- Coated versions available on request
- Four spaced terminations for heat flow regulation and improved mechanical stability
- Small and large pitch available
- Compliant with the enhanced level requirements of ITU - K20-21-45 edition 2003
- Suitable for lead (Pb)-bearing and lead (Pb)-free reflow soldering
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

QUICK REFERENCE DATA		
PARAMETER	VALUE	UNIT
Maximum voltage (RMS)	240	V
Temperature range	- 40 to + 85	°C
Climatic category	40/125/56	
Weight	~ 1.3	g

DESCRIPTION

The component consists of a high-performance PTC ceramic disc mounted in a lead-frame for direct soldering onto a printed-circuit board (PCB) or substrate.

The ceramic is soldered to the leadframe by a local reflow process, during which the solder layer is melted to the metallized ceramic surface using a low residue flux.

MARKING

- All TWIN Vertical SMD PTC's are marked with the last 3-digits of the type number (BCxxx) and a date code (YYWW)

APPLICATIONS

Over-temperature/over-load protection:

- Telecom
  - Telecommunications infrastructure
  - PABX
  - Set-top Box (S.B.)

MOUNTING

With a flat pick-up area = 30 mm^2 the PTC thermistors are suitable for processing on high speed automatic insertion equipment.

Typical soldering

235 °C, duration: 5 s (Lead (Pb)-bearing)

245 °C, duration: 5 s (Lead (Pb)-free)

Resistance to soldering heat

260 °C, duration: 10 s max.

ELECTRICAL DATA

R_{25} ± 20 % (Ω)	MATCHING (Ω)	V MAX. (V_{RMS})	I_{nt} at 25 °C (mA)	I_{nt} at 70 °C (mA)	I_{nt} at 85 °C (mA)	I_t (mA)	MAX. TRIP-TIME at 1 A (s)	I MAX. at V MAX. (A)	I_{res} (2 PIECES POWERED) at V MAX. (mA)
10	0.5	240	140	85	55	300	4.0	4.0	12.0
20	0.5	240	90	60	40	200	2.0	8.0	12.0
25	0.5	240	100	60	40	200	2.0	4.0	12.0
35	1.0	240	100	60	40	200	1.5	4.0	12.0
50	1.0	240	90	50	35	190	1.2	2.5	12.0

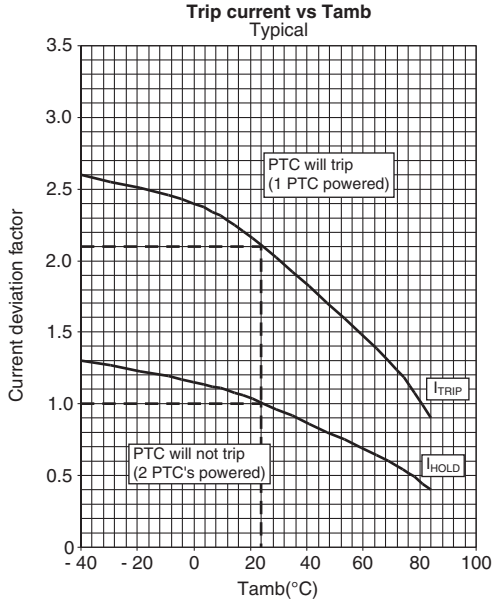
Note

(1) All data is measured at 25 °C unless otherwise specified

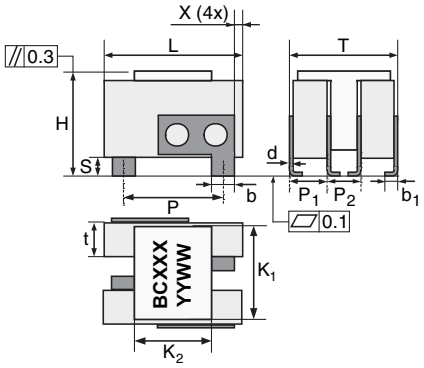
ORDERING INFORMATION

R_{25} ± 20 % (Ω)	12NC		SAP CODING	
	SMALL PITCH	LARGE PITCH	SMALL PITCH	LARGE PITCH
10	2381 673 61109	2381 673 62109	PTCTT95R100GTE	PTCTT95R100GTELAR
20	2381 673 61209	2381 673 62209	PTCTT95R200GTE	PTCTT95R200GTELAR
25	2381 673 61259	2381 673 62259	PTCTT95R250GTE	PTCTT95R250GTELAR
35	2381 673 61359	2381 673 62359	PTCTT95R350GTE	PTCTT95R350GTELAR
50	2381 673 61509	2381 673 62509	PTCTT95R500GTE	PTCTT95R500GTELAR

ELECTRICAL CHARACTERISTICS

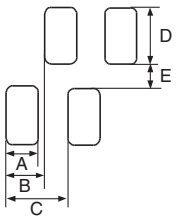


PTC OUTLINES



DIMENSIONS in millimeters		
	SMALL PITCH	LARGE PITCH
L	9.0 ± 0.1	9.0 ± 0.1
T	7.2 ± 0.25	8.4 ± 0.25
H	6.9 ± 0.25	6.9 ± 0.25
b	1.5 ± 0.1	1.5 ± 0.1
b_1	0.9 ± 0.15	0.9 ± 0.15
S	1.25 ± 0.15	1.25 ± 0.15
d	0.22 ± 0.025	0.22 ± 0.025
t	2.3 ± 0.1	2.3 ± 0.1
P	6.5 ± 0.5	6.5 ± 0.5
P_1	2.55 ± 0.15	2.55 ± 0.15
P_2	2.2 ± 0.1	3.45 ± 0.15
X	0.5 ± 0.2	0.5 ± 0.2
K_1	6.0 ± 0.5	7.2 ± 0.5
K_2	5.0 ± 0.5	5.0 ± 0.5

FOOTPRINT



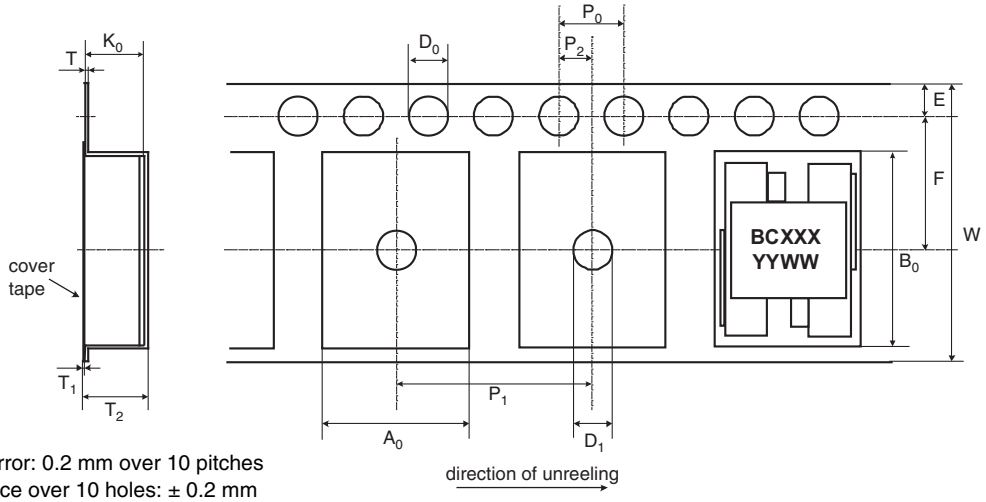
RECOMMENDED FOOTPRINT in millimeters		
	SMALL PITCH	LARGE PITCH
A	2.0	2.0
B	2.4	2.4
C	3.8	5.0
D	3.8	4.0
E	2.7	1.4

PACKAGING

Tape specifications

All tape and reel specifications are in accordance with IEC 60286-3. Carrier tape material is non-conductive polystyrene or polycarbonate.

Blister tape

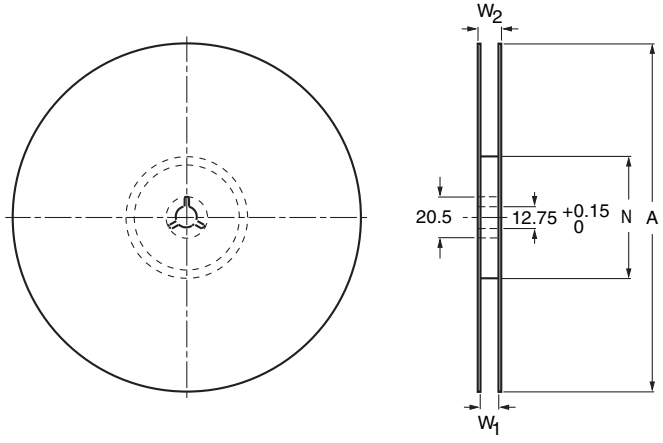


Cumulative pitch error: 0.2 mm over 10 pitches
Cumulative tolerance over 10 holes: ± 0.2 mm

DIMENSIONS OF BLISTER TAPE in millimeters					
	SMALL PITCH	**LARGE PITCH**		**SMALL PITCH**	**LARGE PITCH**
A_0	7.2 ± 0.1	8.4 ± 0.1	D_1	1.5 + 0.1	1.5 + 0.1
B_0	9.3 ± 0.1	9.3 ± 0.1	P_0	4.0 ± 0.1	4.0 ± 0.1
K_0	7.2 ± 0.1	7.2 ± 0.1	P_1	12.0 ± 0.1	12.0 ± 0.1
W	16.0 ± 0.3	16.0 ± 0.3	P_2	2.0 ± 0.1	2.0 ± 0.1
E	1.75 ± 0.1	1.75 ± 0.1	T	0.5 ± 0.05	0.5 ± 0.05
F	7.5 ± 0.1	7.5 ± 0.1	T_1	0.05	0.05
D_0	1.5 + 0.1	1.5 + 0.1	T_2	7.8 max.	7.8 max.

REEL SPECIFICATIONS in millimeters

Reel



REEL DIMENSIONS in millimeters					
UNITS PER REEL	**TAPE WIDTH**	**A**	**N**	**W_1**	**W_2 MAX.**
1000	16	380	64	16.4	20.4

Note

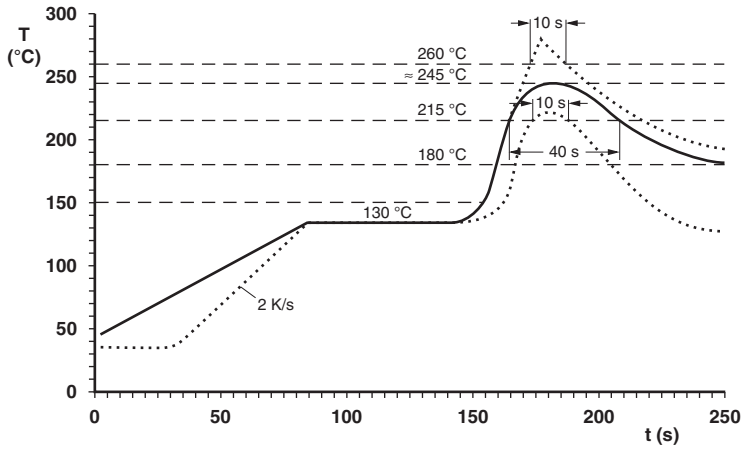
- Reels are packed in sealed plastic bags for protection against high humidity and corrosive atmospheres

SOLDERING CONDITIONS

This SMD thermistor is only suitable for reflow soldering, in accordance with JEDEC J-STD-020. Soldering processes which can be used are reflow (infrared and convection heating) and vapour phase. The maximum temperature of 260 °C during 10 s should not be exceeded and no liquid flux should be allowed to reach the ceramic body.

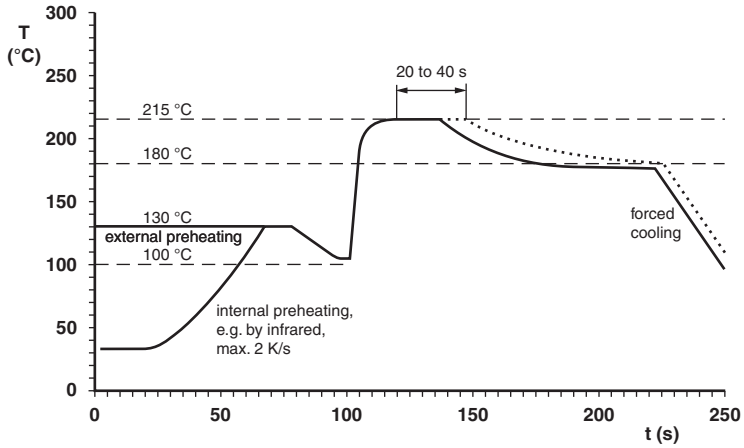
Typical examples of soldering processes that will provide reliable joints without damage, are shown below.

Reflow soldering



Typical values (solid line)
Process limits (dotted lines)

Vapour phase soldering



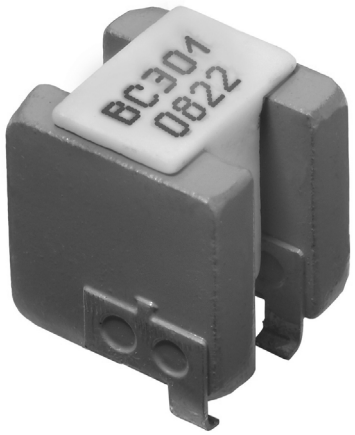
Typical values (solid line)
Process limits (dotted line)

HANDLING PRECAUTIONS

Because of the nature of PTC ceramic material the component should not be touched with bare hands, as the residue of perspiration can influence component behaviour at high temperatures.

Handling forces applied to the centre of the component should be limited to 20 N vertically and 5 N horizontally in non-soldered condition. These forces should not be exceeded during the handling, transportation and packaging of the soldered product.

TWIN Vertical SMD 600 V PTC Thermistors for Telcom Overload Protection



RoHS COMPLIANT

FEATURES

- Very small footprint, allowing to increase the number of lines per PCB
- Matched pairs in one component, significantly reducing the assembly time
- Narrow tracking between the 2 PTC's over a wide temperature range (matching at 85 °C: ≤ 2 x matching at 25 °C)
- High interrupt voltage handling capabilities up to 600 V
- Limited height and weight, used on high speed pick-and-place circuit assembly
- Flat pick-up ceramic area for easy placement
- Fully coated parts
- Four spaced terminations for heat flow regulation and improved mechanical stability
- Compliant with the enhanced level requirements of ITU - K20-21-45 edition 2003
- Compliant with GR1089
- Suitable for lead (Pb)-bearing and lead (Pb)-free reflow soldering
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

QUICK REFERENCE DATA		
PARAMETER	VALUE	UNIT
Maximum continuous voltage (RMS)	240	V
Maximum interrupting voltage (RMS)	600	V
Temperature range	- 40 to + 85	°C
Climatic category	40/125/56	
Weight	± 1.6	g

DESCRIPTION

The component consists of a high-performance PTC ceramic disc mounted in a lead-frame for direct soldering onto a printed-circuit board (PCB) or substrate.

The ceramic is soldered to the leadframe by a local reflow process, during which the solder layer is melted to the metallized ceramic surface using a low residue flux.

MARKING

- All TWIN Vertical SMD PTC's are marked with the last 3-digits of the type number (BCxxx) and a date code (YYWW)

APPLICATIONS

Over-temperature/over-load protection:

- Telecom
  - Telecommunications infrastructure
  - PABX
  - Set-top Box (S.B.)

MOUNTING

With a flat pick-up area = 30 mm^2 the PTC thermistors are suitable for processing on high speed automatic insertion equipment.

Typical soldering

235 °C, duration: 5 s (Lead (Pb)-bearing)

245 °C, duration: 5 s (Lead (Pb)-free)

Resistance to soldering heat

260 °C, duration: 10 s max.

ELECTRICAL DATA

R_{25} ± 20 % (Ω)	MATCHING (Ω)	V MAX. (V_{RMS})	I_{nt} at			I_t (mA)	MAX. TRIP-TIME at 1 A (s)	I MAX. at V MAX. (A)	I_{res} (2 PIECES POWERED) at V MAX. (mA)
			25 °C (mA)	70 °C (mA)	85 °C (mA)				
60	1.0	240	80	45	35	200	1.5	5.5	12.0

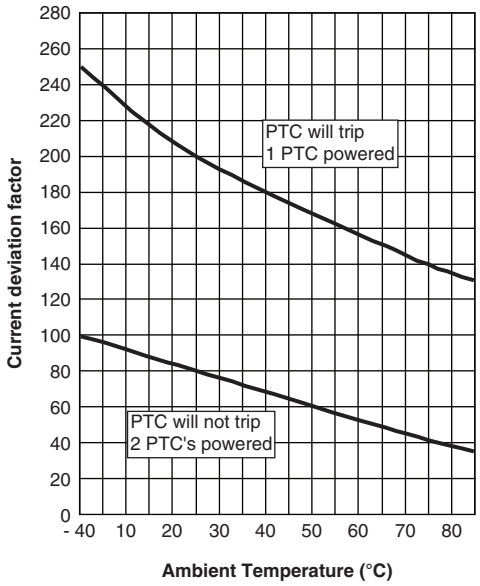
Notes

- All data is measured at 25 °C unless otherwise specified
- Other values on request

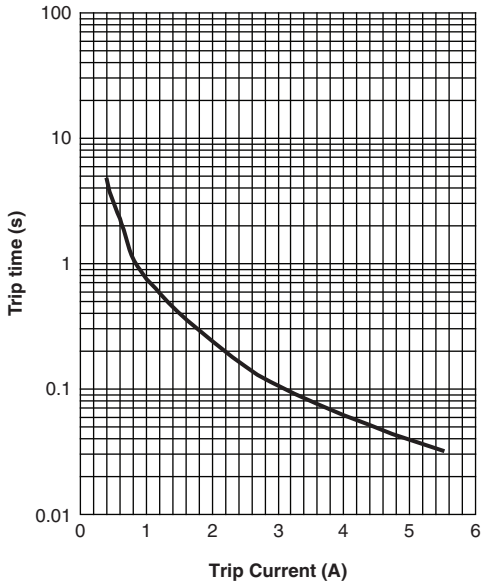
ORDERING INFORMATION		
R_{25} ± 20 % (Ω)	12NC	SAP
60	2381 673 97301	PTCTT99R600GTE301

ELECTRICAL CHARACTERISTICS

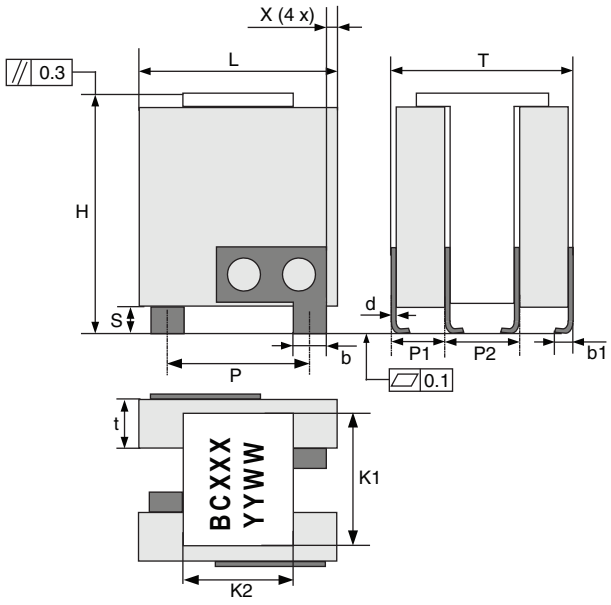
Trip Current vs. T_{amb}
Typical



Trip Time vs. Trip Current
Typical

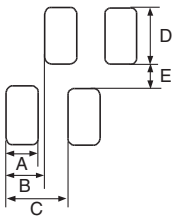


PTC OUTLINES



DIMENSIONS in millimeters	
L	9.0 ± 0.1
T	8.4 ± 0.25
H	10.9 ± 0.25
b	1.5 ± 0.1
b_1	0.9 ± 0.15
S	1.25 ± 0.15
d	0.22 ± 0.025
t	2.3 ± 0.1
P	6.5 ± 0.5
P_1	2.55 ± 0.15
P_2	3.4 ± 0.15
X	0.5 ± 0.2
K_1	7.2 ± 0.5
K_2	5.0 ± 0.5

FOOTPRINT



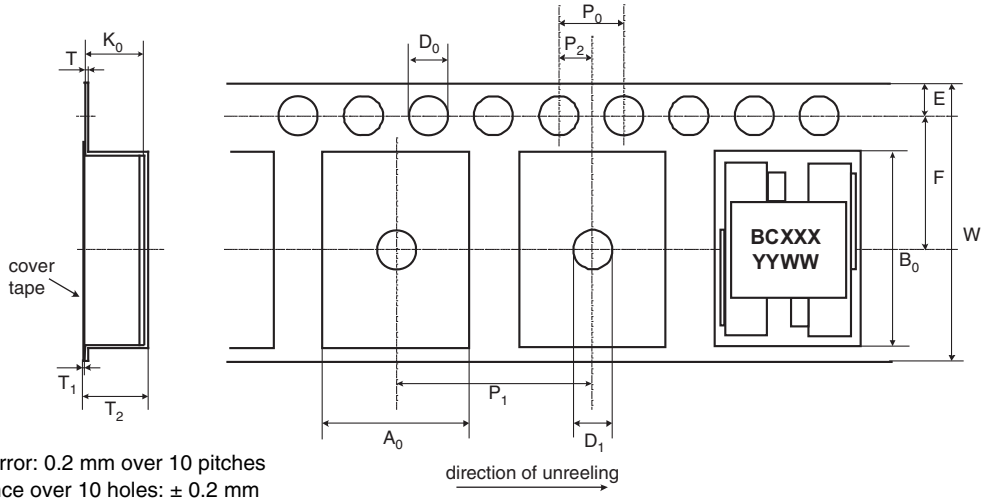
RECOMMENDED FOOTPRINT in millimeters	
A	2.0
B	2.4
C	5.0
D	4.0
E	1.4

PACKAGING

Tape specifications

All tape and reel specifications are in accordance with IEC 60286-3. Carrier tape material is non-conductive polystyrene or polycarbonate.

Blister tape

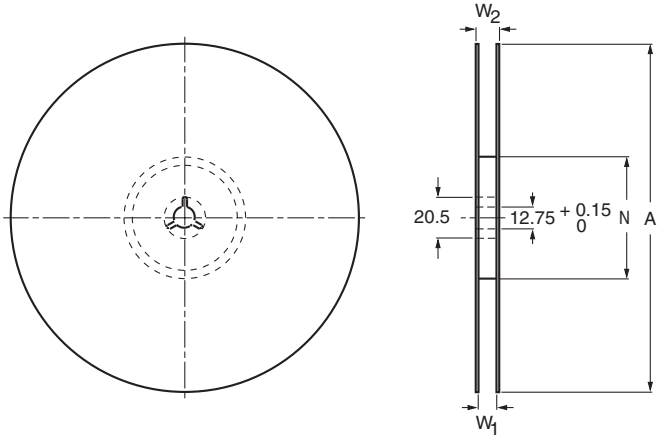


Cumulative pitch error: 0.2 mm over 10 pitches
Cumulative tolerance over 10 holes: ± 0.2 mm

DIMENSIONS OF BLISTER TAPE in millimeters			
A_0	8.85 ± 0.1	D_1	1.5 + 0.1
B_0	9.3 ± 0.1	P_0	4.0 ± 0.1
K_0	11.25 ± 0.1	P_1	16.0 ± 0.1
W	24.0 ± 0.3	P_2	2.0 ± 0.1
E	1.75 ± 0.1	T	0.5 ± 0.05
F	11.5 ± 0.1	T_1	0.05
D_0	1.5 + 0.1	T_2	12.0 max.

REEL SPECIFICATIONS in millimeters

Reel



REEL DIMENSIONS in millimeters					
UNITS PER REEL	**TAPE WIDTH**	**A**	**N**	**W_1**	**W_2 MAX.**
500	24	380	64	24.4	30.4

Note

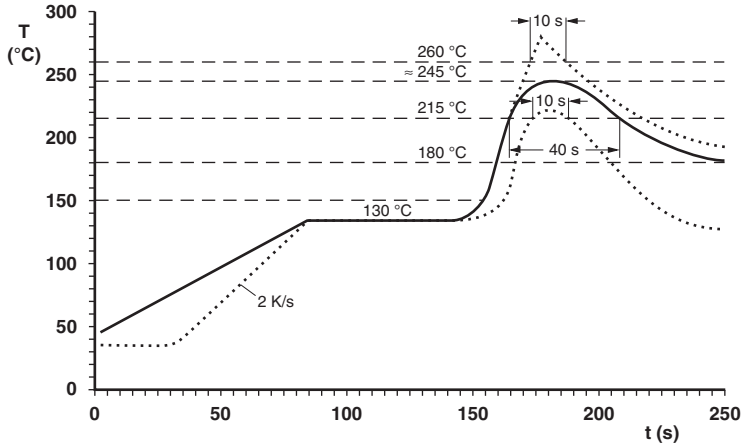
• Reels are packed in sealed plastic bags for protection against high humidity and corrosive atmospheres

SOLDERING CONDITIONS

This SMD thermistor is only suitable for reflow soldering. Soldering processes which can be used are reflow (infrared and convection heating) and vapour phase. The maximum temperature of 260 °C during 10 s should not be exceeded and no liquid flux should be allowed to reach the ceramic body.

Typical examples of soldering processes that will provide reliable joints without damage, are shown below.

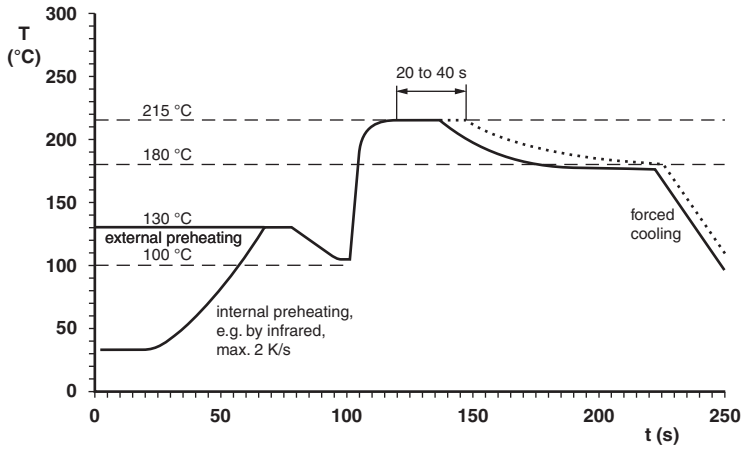
Reflow soldering



Typical values (solid line)

Process limits (dotted lines)

Vapour phase soldering



Typical values (solid line)

Process limits (dotted line)

HANDLING PRECAUTIONS

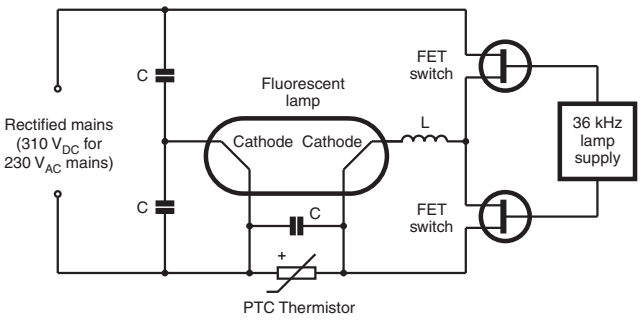
Because of the nature of PTC ceramic material the component should not be touched with bare hands, as the residue of perspiration can influence component behaviour at high temperatures.

Handling forces applied to the centre of the component should be limited to 10 N vertically and 5 N horizontally in non-soldered condition. These forces should not be exceeded during the handling, transportation and packaging of the soldered product.

PTC for Lighting Applications

Contents

PTC Thermistors, Radial Leaded for Lighting Ballasts



Typical electronic ballast circuit.

DESCRIPTION

Positive Temperature Coefficient (PTC) thermistors for overload protection have proved to be the ideal electronic ballast component for increased lamp life-time.

When the rectified mains is first applied, the PTC thermistor is cold, so its resistance is low. The lamp voltage will be below the necessary ignition value, so the current will flow through the cathodes, heating them to their emission temperature. At the same time, the PTC thermistor will heat up to its switch temperature, whereupon its resistance will rise rapidly, allowing the lamp voltage to reach its ignition value and light the lamp.

Once the lamp is lit, the cathodes are fed by a high-frequency (36 kHz) lamp supply, to avoid flicker, via two power FET switches. The PTC thermistor plays no further part until the lamp is switched off, whereupon it is ready to resume its smooth-starting function.

We supply a range of lighting PTC thermistors for this application offering a wide choice of voltage and switch times.

FEATURES

- Reliable lamp starting, due to well defined inrush-current generated time delay
- Accurate resistance for ease of circuit design
- Small size and durable
- Available bulk-packed or taped-on-reel
- Long life: More than 20 000 starts for a 20 W CFL lamp
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

APPLICATIONS

Fluorescent lighting and lighting ballasts for:

- CFL 5 to 25 W range
- TL HF-ballasts

MOUNTING

The leads are suitable for soldering in any position. The lacquer may cover the leads up to 1.0 mm from the seating plane.

PACKAGING

All tape and reel specifications are in accordance with IEC 60286-3.

ELECTRICAL DATA AND ORDERING INFORMATION

R_{25} (Ω)		SWITCH TEMPERATURE (°C)	MAXIMUM VOLTAGE (PEAK VALUE) (V)	TYPICAL (1) TRIP TIME at 25 °C		CATALOG NUMBER	
MIN.	MAX.			t_{trip} (s)	at I_t (mA)	12NC	SAP CODING
500	750	≈ 110	700	0.4	200	2381 660 93049 (2)	PTCLL05P131TBE (2)
185	300	≈ 120	700	0.5	300	2381 660 93055 (2)	PTCLL05P211TTE (2)
75	125	≈ 80	700	0.7	300	2381 660 93066 (2)	PTCLL05P251TTE (2)
225	375	≈ 105	900	0.75	300	2381 661 93102 (3)	PTCLL07P261VTE (3)
75	125	≈ 105	1000	0.85	500	2381 661 93114 (3)	PTCLL07P421WTE (3)

Notes

(1) Ignition time of the lamp approximately equals the tripping time

(2) Specific for CFL lamp electronic starter

(3) Specific for HF-TL ballast

DIMENSIONS in millimeters

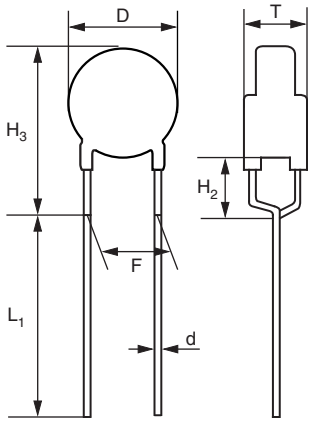


Fig. 1a

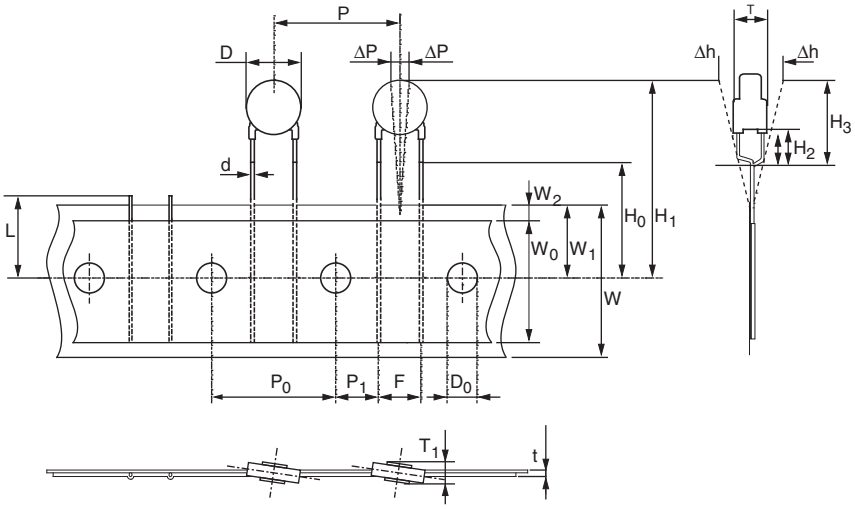
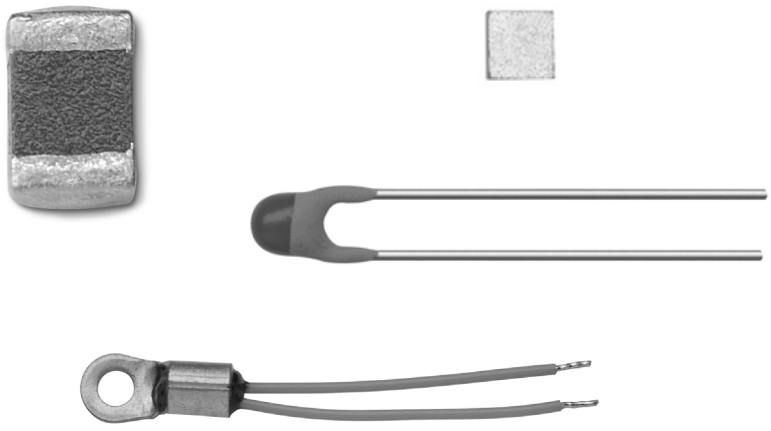


Fig. 1b

COMPONENT DIMENSIONS in millimeters								
$D_{max.}$	$T_{max.}$	H_3	WEIGHT (g)	FIGURES	PACKAGING	SPQ	CATALOG NUMBER	
							12NC	SAP CODING
5.4	4.5	10	≈ 0.33	Fig. 1a	Bulk	500	2381 660 93049	PTCLL05P131TBE
5.4	4.5	9	≈ 0.45	Fig. 1b	On tape	1500	2381 660 93055	PTCLL05P211TTE
5.4	4.5	10	≈ 0.45	Fig. 1b	On tape	1500	2381 660 93066	PTCLL05P251TTE
7.0	5.0	12	≈ 0.66	Fig. 1b	On tape	1500	2381 661 93102	PTCLL07P261VTE
7.0	5.0	12	≈ 0.66	Fig. 1b	On tape	1500	2381 661 93114	PTCLL07P421WTE

TAPE AND OTHER DEVICE DIMENSIONS in millimeters				
SYMBOL	PARAMETER	DIMENSIONS	TOLERANCE	REMARKS
d	Lead diameter	0.6	± 10 %	
P	Pitch between thermistors	12.7	± 1	
F	Lead to lead distance	5	+ 0.6/- 0.1	Guaranteed between component and tape
H_2	Component body to seating plane	4	± 1	
H_0	Lead-wire clinch height	16	± 0.5	

PTC for Temperature Protection



Contents

PTC Thermistors, Mini Chips for Over-Temperature Protection

FEATURES

- Well-defined protection temperature levels
- Fast reaction time (< 6 s in still air)
- Accurate resistance for ease of circuit design
- Excellent long term behavior (< 1 °C or 5 % after 1000 h at T_n + 15 °C)
- Wide range of protection temperatures (70 °C to 170 °C)
- No need to reset supply after overtemperature switch
- Small size and rugged
- Coated leaded and naked devices available
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

APPLICATIONS

Over-temperature protection and control in:

- Industrial electronics
- Power supplies
- Electronic data processing
- Motor protection

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for sensing.

QUICK REFERENCE DATA		
PARAMETER	**VALUE**	**UNIT**
Maximum resistance at 25 °C	100	Ω
Minimum resistance at (T_n + 15) °C	4000	Ω
Maximum (DC) voltage	30	V
Temperature range	- 20 to (T_n + 15)	°C
Weight	≈ 0.006	g
Climatic category	25/125/56	

NOMINAL WORKING TEMPERATURES AND ORDERING INFORMATION				
NOMINAL WORKING TEMPERATURE				CATALOG NUMBER 2381 671 .....
T_n (°C)	RESISTANCE from - 20 °C to T_n - 20 °C (Ω)	RESISTANCE at T_n - 5 °C (Ω)	RESISTANCE at T_n + 5 °C (kΩ)	NAKED CHIP [1] 1.7 x 1.7 (mm)
70	30 to 250	50 to 570	0.57 to 50	91002
80	30 to 250	50 to 550	1.33 to 50	91003
90	30 to 250	50 to 550	1.33 to 50	91004
100	30 to 250	50 to 550	1.33 to 50	91005
110	30 to 250	50 to 550	1.33 to 50	91006
120	30 to 250	50 to 550	1.33 to 50	91007
130	30 to 250	50 to 550	1.33 to 50	91009
140	30 to 250	50 to 550	1.33 to 50	91012
150	30 to 250	50 to 550	1.33 to 50	91014
155	30 to 250	50 to 550	1.33 to 50	91015
160	30 to 250	50 to 550	1.33 to 50	91016
170	30 to 250	50 to 550	1.33 to 50	91017

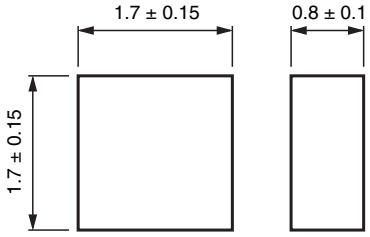
Note

[1] Naked chips are packed in a hermetically-sealed alu-plastic bag

ELECTRICAL CHARACTERISTICS	
PARAMETER	**VALUES**
Maximum resistance at 25 °C	100 Ω
Maximum resistance at (T_n - 5) °C	See Nominal Working Temperatures and Ordering Information table
Minimum resistance at (T_n + 15) °C	4000 Ω
Minimum resistance at (T_n + 5) °C	See Nominal Working Temperatures and Ordering Information table
Maximum voltage	30 V (AC or DC)

CATALOG NUMBERS AND PACKAGING		
12NC	**SAP**	**SPQ**
2381 671 91002	PTCSC17T071DBE	5000
2381 671 91003	PTCSC17T081DBE	5000
2381 671 91004	PTCSC17T091DBE	5000
2381 671 91005	PTCSC17T101DBE	5000
2381 671 91006	PTCSC17T111DBE	5000
2381 671 91007	PTCSC17T121DBE	5000
2381 671 91009	PTCSC17T131DBE	5000
2381 671 91012	PTCSC17T141DBE	5000
2381 671 91014	PTCSC17T151DBE	5000
2381 671 91015	PTCSC17T155DBE	5000
2381 671 91016	PTCSC17T161DBE	5000
2381 671 91017	PTCSC17T171DBE	5000

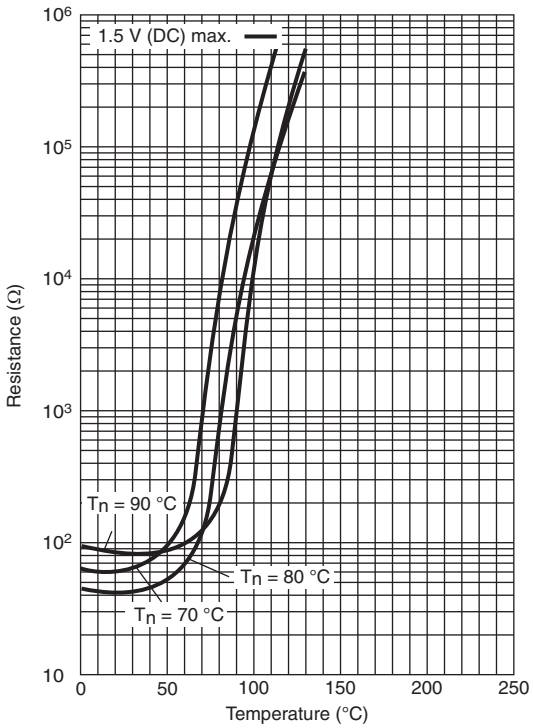
COMPONENT OUTLINES DIMENSIONS in millimeters



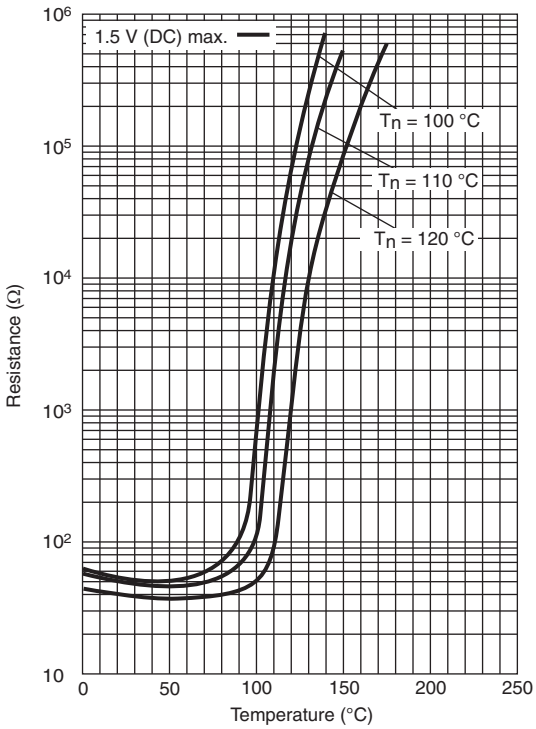
Component outline for 91002 to 91017

For clamping, reflow or hand soldering. Not intended for either wave or ultrasonic soldering and not for spot welding.
All standard solder alloys with low activated halogene-free fluxes are acceptable, for example: 62Sn/36Pb/2Ag.

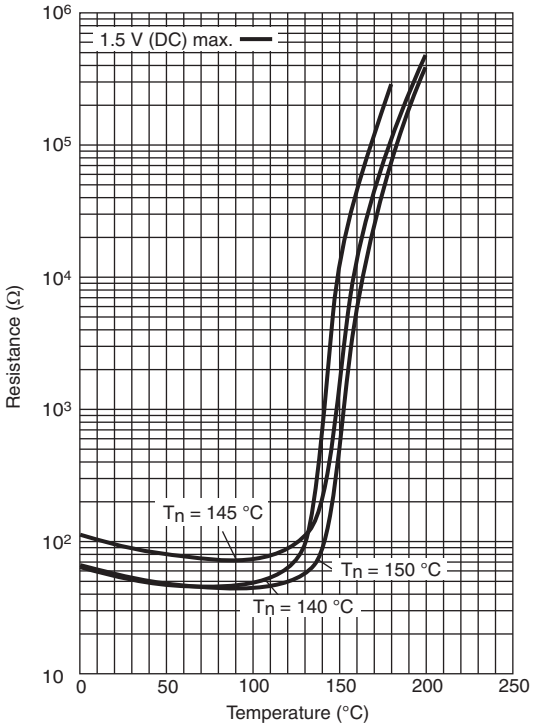
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC FOR 2381 671 91002, 2381 671 91003 and 2381 671 91004



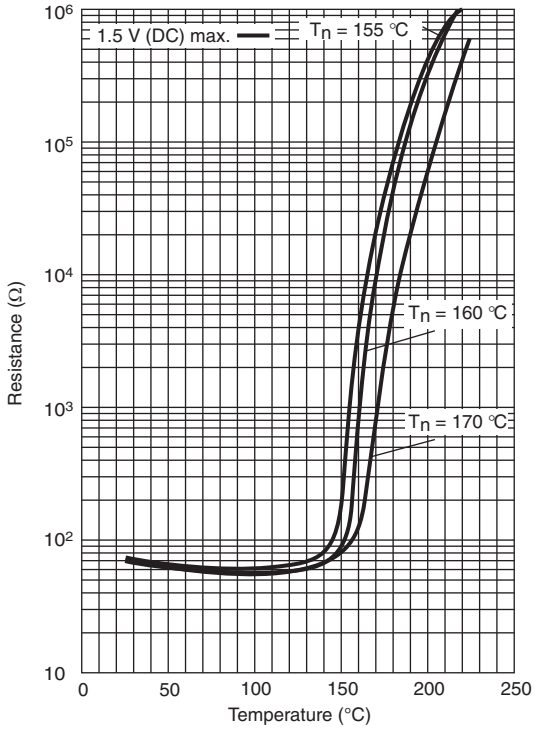
TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC FOR 2381 671 91005, 2381 671 91006 and 2381 671 91007



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC FOR 2381 671 91009, 2381 671 91012 and 2381 671 91014



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC FOR 2381 671 91015, 2381 671 91016 and 2381 671 91017



APPLICATION SPECIFIC DATA

Negative Temperature Coefficient (NTC) thermistors are well known for temperature sensing. What is not well known, however, is that Positive Temperature Coefficient (PTC) thermistors can be used for thermal protection. Although their operating principles are similar, the applications are very different; whereas NTC thermistors sense and measure temperature over a defined range, PTC thermistors switch at one particular temperature.
Just like thermostats they protect such equipment and components as motors, transformers, power transistors and thyristors against overtemperature. A PTC thermistor is less expensive than a thermostat, and its switch temperature can be more accurately specified. It is also smaller and easier to design-in to electronic circuitry.

The PTC thermistor is mounted in thermal contact with the equipment to be protected, and connected into the bridge arm of a comparator circuit, such as shown in Fig. 1. At normal temperature, the PTC thermistor resistance (R_p) is lower than R_s (see Fig. 2), so the comparator's output voltage V_0 will be low. If an equipment overtemperature occurs, the PTC thermistor will quickly heat up to its trigger or nominal reference temperature T_n, whereupon its resistance will increase to a value much higher than R_s, causing V_0 to switch to a high level sufficient to activate an alarm, relay or power shutdown circuit.

APPLICATION EXAMPLES

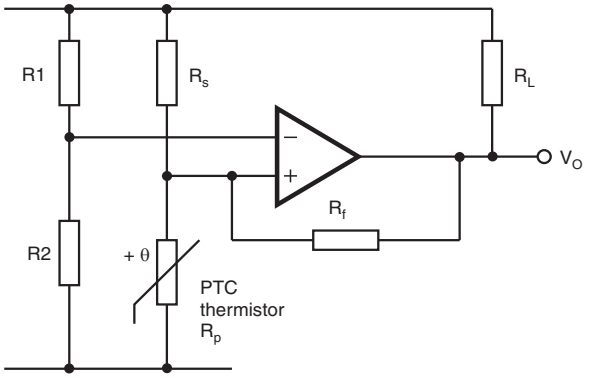


Fig. 1 Typical comparator circuit

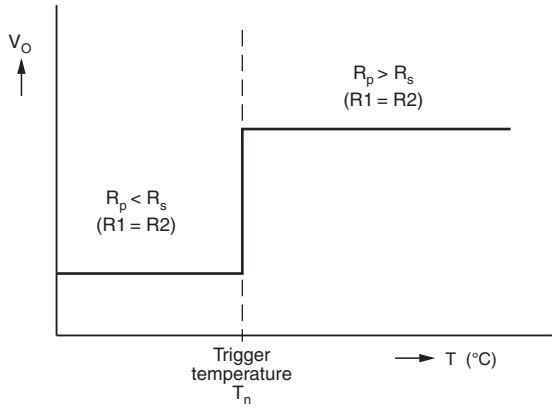
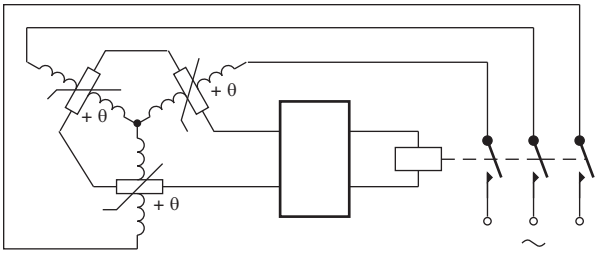


Fig. 2 Typical switch characteristic



As soon as one or more of the windings becomes too hot, the motor is switched off.

Fig. 3 Temperature protection of electric motors

PTC Thermistors, Mini Radial Leaded for Over-Temperature Protection

FEATURES

- Well-defined protection temperature levels
- Fast reaction time (< 15 s in still air)
- Accurate resistance for ease of circuit design
- Excellent long term behavior (< 1 °C or 5 % after 1000 h at T_n + 15 °C)
- Wide range of protection temperatures (70 °C to 150 °C)
- No need to reset supply after overtemperature switch
- Small size and rugged
- Coated leaded and naked devices available
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

APPLICATIONS

Over-temperature protection and control in:

- Industrial electronics
- Power supplies
- Electronic data processing
- Motor protection

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for sensing.

QUICK REFERENCE DATA		
PARAMETER	**VALUE**	**UNIT**
Maximum resistance at 25 °C	100	Ω
Minimum resistance at (T_n + 15) °C	4000	Ω
Maximum voltage	30	V
Temperature range	- 20 to (T_n + 15)	°C
Weight:		
91102 to 91114	≈ 0.08	g
91152 to 91164	≈ 0.11	g
Climatic category	25/125/56	

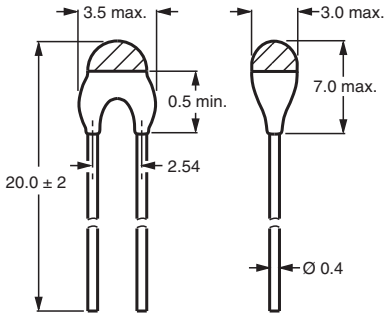
NOMINAL WORKING TEMPERATURES AND ORDERING INFORMATION

NOMINAL WORKING TEMPERATURE				CATALOG NUMBER 2381 671		
				LEADED DEVICE		
T_n (°C)	RESISTANCE from - 20 °C to T_n - 20 °C (Ω)	RESISTANCE at T_n - 5 °C (Ω)	RESISTANCE at T_n + 5 °C (kΩ)	NORMAL LEADS	LONG LEADS	COLOR CODE
70	30 to 250	50 to 570	0.570 to 50	91102	91152	Black
80	30 to 250	50 to 550	1.33 to 50	91103	91153	Brown
90	30 to 250	50 to 550	1.33 to 50	91104	91154	Red
100	30 to 250	50 to 550	1.33 to 50	91105	91155	Orange
110	30 to 250	50 to 550	1.33 to 50	91106	91156	Yellow
120	30 to 250	50 to 550	1.33 to 50	91107	91157	Green
130	30 to 250	50 to 550	1.33 to 50	91109	91159	Blue
140	30 to 250	50 to 550	1.33 to 50	91112	91162	Violet
150	30 to 250	50 to 550	1.33 to 50	91114	91164	Grey

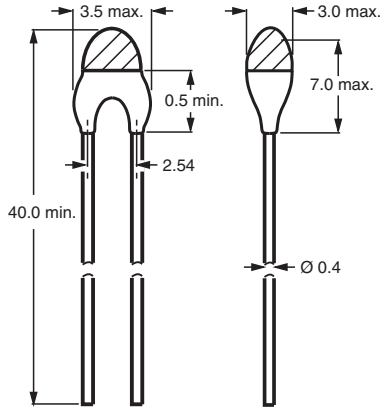
ELECTRICAL CHARACTERISTICS	
PARAMETER	**VALUES**
Maximum resistance at 25 °C	100 Ω
Maximum resistance at (T_n - 5) °C	See Nominal Working Temperatures and Ordering Information table
Minimum resistance at (T_n + 15) °C	4000 Ω
Minimum resistance at (T_n + 5) °C	See Nominal Working Temperatures and Ordering Information table
Maximum voltage	30 V (AC or DC)

CATALOG NUMBERS AND PACKAGING				
12NC	**SAP**	**12NC**	**SAP**	**SPQ**
2381 671 91102	PTCSL20T071DBE	2381 671 91152	PTCSL40T071DBE	500
2381 671 91103	PTCSL20T081DBE	2381 671 91153	PTCSL40T081DBE	500
2381 671 91104	PTCSL20T091DBE	2381 671 91154	PTCSL40T091DBE	500
2381 671 91105	PTCSL20T101DBE	2381 671 91155	PTCSL40T101DBE	500
2381 671 91106	PTCSL20T111DBE	2381 671 91156	PTCSL40T111DBE	500
2381 671 91107	PTCSL20T121DBE	2381 671 91157	PTCSL40T121DBE	500
2381 671 91109	PTCSL20T131DBE	2381 671 91159	PTCSL40T131DBE	500
2381 671 91112	PTCSL20T141DBE	2381 671 91162	PTCSL40T141DBE	500
2381 671 91114	PTCSL20T151DBE	2381 671 91164	PTCSL40T151DBE	500

COMPONENT OUTLINES DIMENSIONS in millimeters

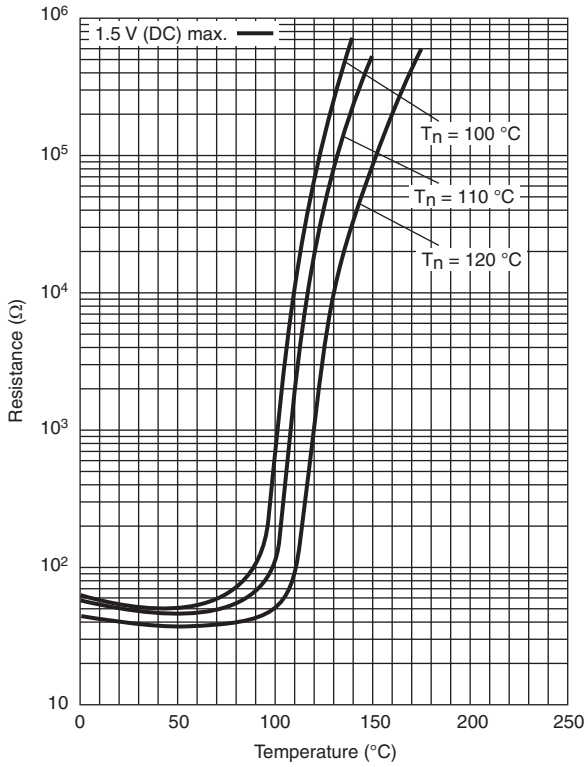


Component outline for 91102 to 91114

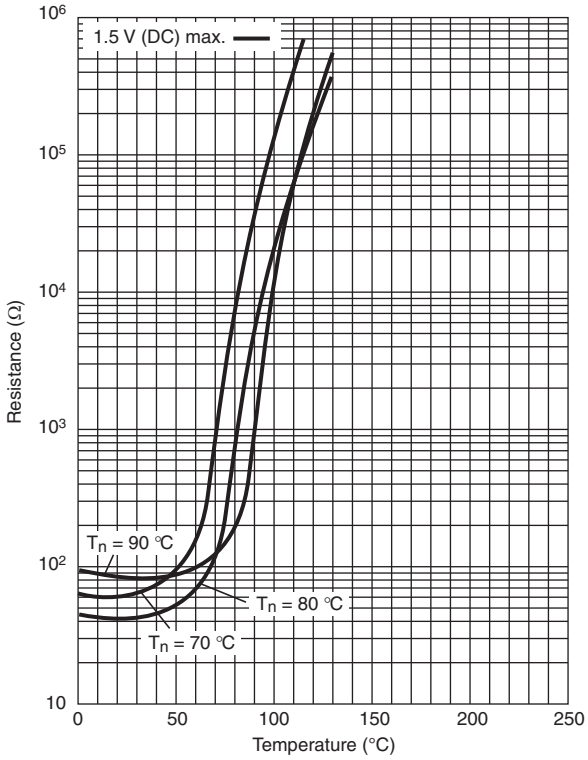


Component outline for 91152 to 91164

TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC FOR 2381 671 91105/ 2381 671 91106 and 2381 671 91107



TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC FOR 2381 671 91102/ 2381 671 91103 and 2381 671 91104



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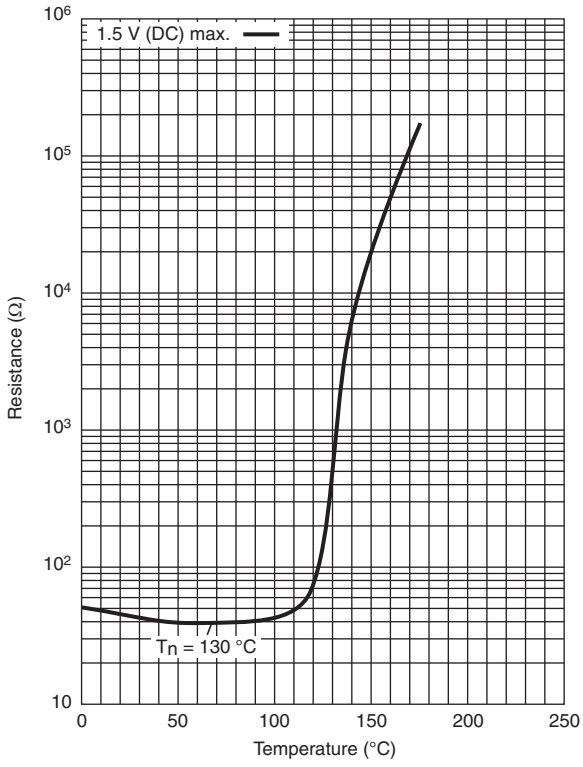
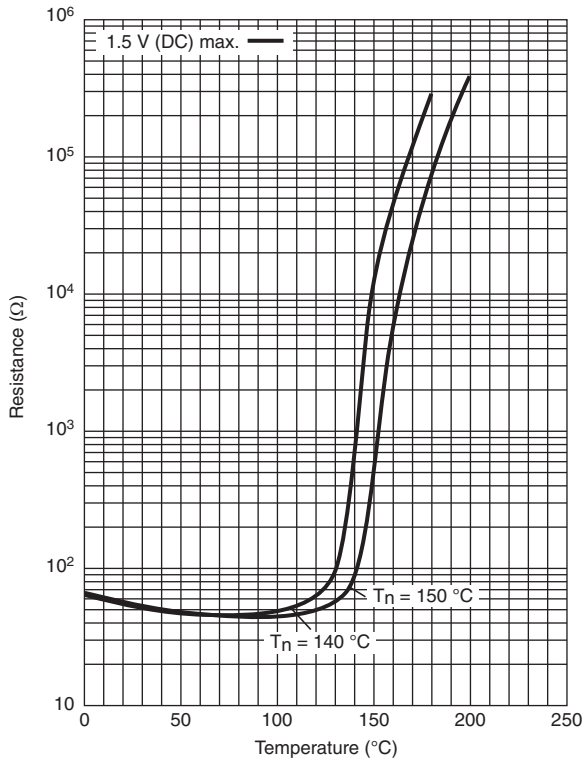


TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC FOR 2381 671 91112 and 91114



APPLICATION SPECIFIC DATA

Negative Temperature Coefficient (NTC) thermistors are well known for temperature sensing. What is not well known, however, is that Positive Temperature Coefficient (PTC) thermistors can be used for thermal protection. Although their operating principles are similar, the applications are very different; whereas NTC thermistors sense and measure temperature over a defined range, PTC thermistors switch at one particular temperature.
Just like thermostats they protect such equipment and components as motors, transformers, power transistors and thyristors against overtemperature. A PTC thermistor is less expensive than a thermostat, and its switch temperature can be more accurately specified. It is also smaller and easier to design-in to electronic circuitry.

So how does it work? The PTC thermistor is mounted in thermal contact with the equipment to be protected, and connected into the bridge arm of a comparator circuit, such as shown in Fig. 1. At normal temperature, the PTC thermistor resistance (R_p) is lower than R_s (see Fig. 2), so the comparator's output voltage V_0 will be low. If an equipment overtemperature occurs, the PTC thermistor will quickly heat up to its trigger or nominal reference temperature T_n, whereupon its resistance will increase to a value much higher than R_s, causing V_0 to switch to a high level sufficient to activate an alarm, relay or power shutdown circuit.

APPLICATION EXAMPLES

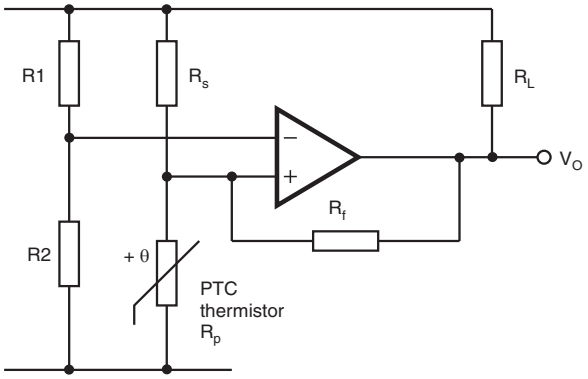


Fig. 1 Typical comparator circuit

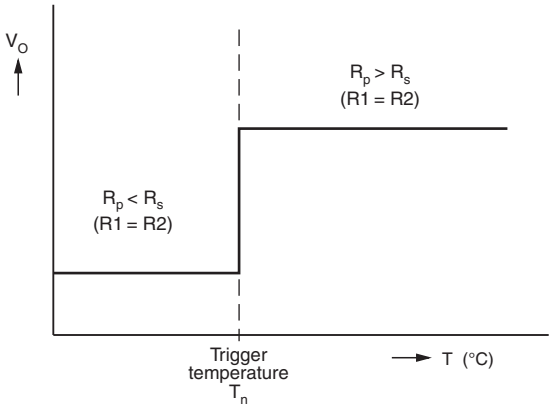
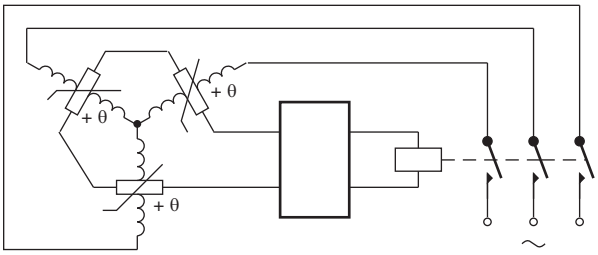


Fig. 2 Typical switch characteristic



As soon as one or more of the windings becomes too hot, the motor is switched off.

Fig. 3 Temperature protection of electric motors

PTC Thermistors, Lug Sensors for Over-Temperature Protection

FEATURES

- Well-defined protection temperature levels
- Fast reaction time (< 30 s in still air)
- Accurate resistance for ease of circuit design
- Excellent long term behavior (< 1 °C or 5 % after 1000 h at T_n + 15 °C)
- Wide range of protection temperatures (70 °C to 150 °C)
- No need to reset supply after overtemperature switch
- Small size and rugged
- Coated leaded and naked devices available
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

APPLICATIONS

Over-temperature protection and control in:

- Industrial electronics
- Power supplies
- Electronic data processing
- Motor protection

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for sensing.

QUICK REFERENCE DATA

PARAMETER	VALUE	UNIT
Maximum resistance at 25 °C	100	Ω
Minimum resistance at (T_n + 15) °C	4000	Ω
Maximum (DC) voltage	30	V
Thermal time constant	± 8.0	s
Temperature range	- 40 to (T_n + 15)	°C
Weight:	± 2.0	g
Climatic category	40/125/56	

NOMINAL WORKING TEMPERATURES AND ORDERING INFORMATION

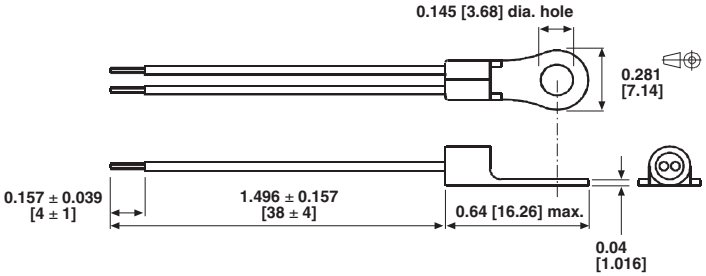
NOMINAL WORKING TEMPERATURE			CATALOG NUMBER 2381 671 .....
T_n (°C)	$R_{max.}$ at T_n - 5 °C (Ω)	$R_{min.}$ at T_n + 5 °C (Ω)	LUG DEVICE
70	570	570	91202
80	550	1330	91203
90	550	1330	91204
100	550	1330	91205
110	550	1330	91206
120	550	1330	91207
130	550	1330	91209
140	550	1330	91212
150	550	1330	91214

ELECTRICAL CHARACTERISTICS

PARAMETER	VALUES
Maximum resistance at 25 °C	100 Ω
Maximum resistance at (T_n - 5) °C	See Nominal Working Temperatures and Ordering Information table
Minimum resistance at (T_n + 5) °C	See Nominal Working Temperatures and Ordering Information table
Minimum resistance at (T_n + 15) °C	4000 Ω
Maximum voltage	30 V (AC or DC)

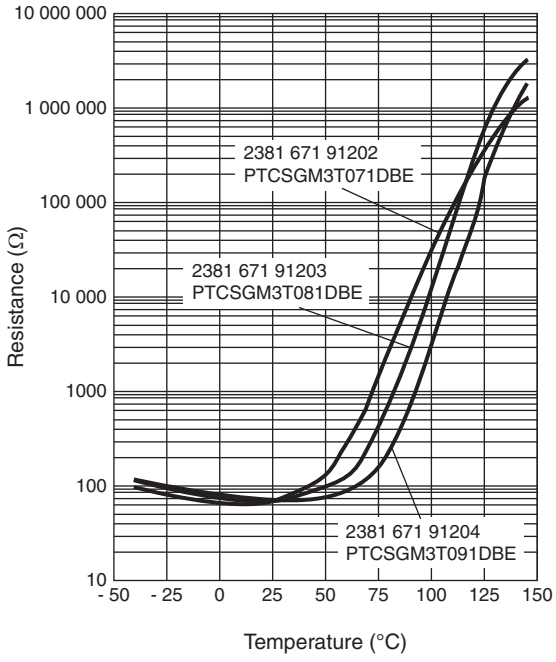
CATALOG NUMBERS AND PACKAGING		
12NC	**SAP**	**SPQ**
2381 671 91202	PTCSGM3T071DBE	200
2381 671 91203	PTCSGM3T081DBE	200
2381 671 91204	PTCSGM3T091DBE	200
2381 671 91205	PTCSGM3T101DBE	200
2381 671 91206	PTCSGM3T111DBE	200
2381 671 91207	PTCSGM3T121DBE	200
2381 671 91209	PTCSGM3T131DBE	200
2381 671 91212	PTCSGM3T141DBE	200
2381 671 91214	PTCSGM3T151DBE	200

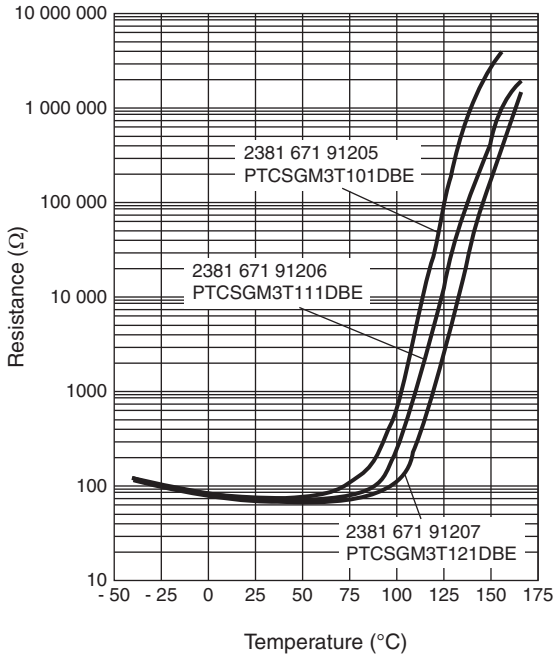
COMPONENT OUTLINES DIMENSIONS in millimeters

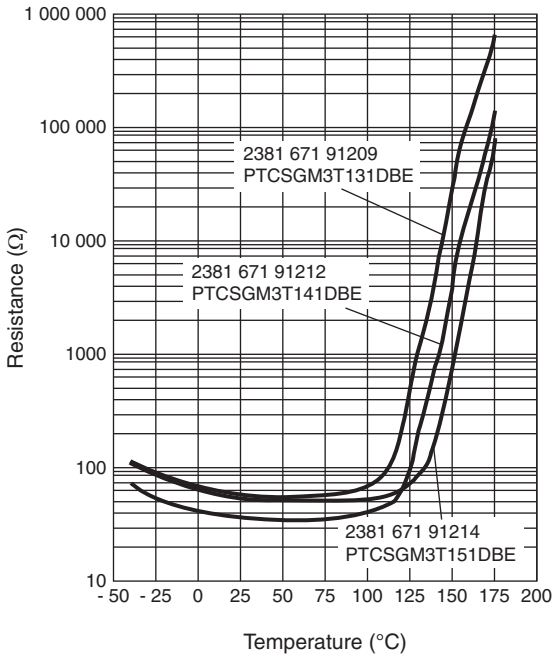


Component outline for 2381 671 91202 to 91214

TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC







APPLICATION SPECIFIC DATA

Negative Temperature Coefficient (NTC) thermistors are well known for temperature sensing. What is not well known, however, is that Positive Temperature Coefficient (PTC) thermistors can be used for thermal protection. Although their operating principles are similar, the applications are very different; whereas NTC thermistors sense and measure temperature over a defined range, PTC thermistors switch at one particular temperature.
Just like thermostats they protect such equipment and components as motors, transformers, power transistors and thyristors against overtemperature. A PTC thermistor is less expensive than a thermostat, and its switch temperature can be more accurately specified. It is also smaller and easier to design-in to electronic circuitry.

So how does it work? The PTC thermistor is mounted in thermal contact with the equipment to be protected, and connected into the bridge arm of a comparator circuit, such as shown in Fig. 1. At normal temperature, the PTC thermistor resistance (R_p) is lower than R_s (see Fig. 2), so the comparator's output voltage V_0 will be low. If an equipment overtemperature occurs, the PTC thermistor will quickly heat up to its trigger or nominal reference temperature T_n, whereupon its resistance will increase to a value much higher than R_s, causing V_0 to switch to a high level sufficient to activate an alarm, relay or power shutdown circuit.

APPLICATION EXAMPLES

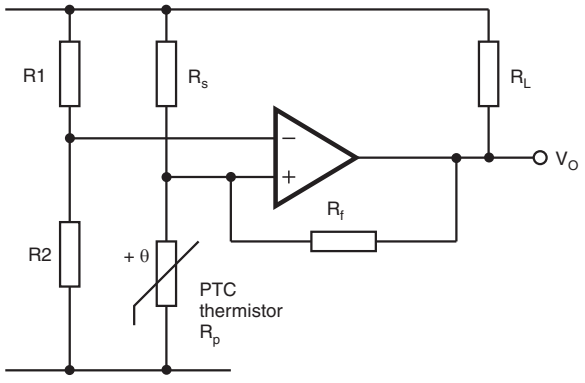


Fig. 1 Typical comparator circuit

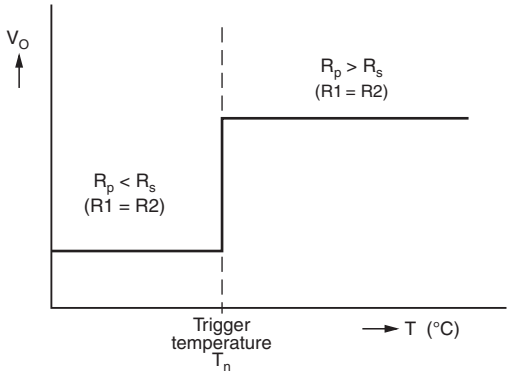
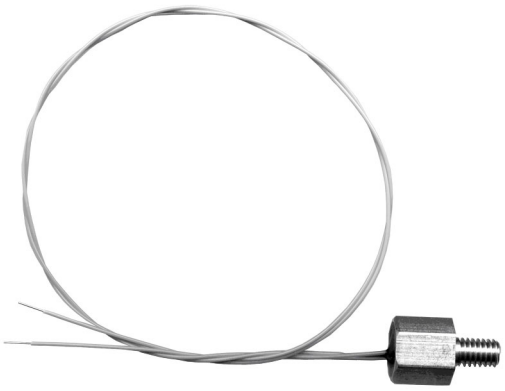


Fig. 2 Typical switch characteristic

PTC Thermistors, Screw Type for Over-Temperature Protection



FEATURES

- Well-defined protection temperature levels with low thermal gradient between thermal body and sensing temperature
- Accurate resistance for ease of circuit design
- Excellent long term behavior (< 1 °C or 5 % after 1000 h at T_n + 15 °C)
- Wide range of protection temperatures (70 °C to 150 °C)
- No need to reset supply after overtemperature switch
- Small size and rugged
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

QUICK REFERENCE DATA

PARAMETER	VALUE	UNIT
Maximum resistance at 25 °C	100	Ω
Minimum resistance at (T_n + 15) °C	4000	Ω
Maximum voltage	30	V
Thermal time constant	≈ 8.0	s
Temperature range	- 40 to (T_n + 15)	°C
Min. dielectric withstanding voltage between leads-end and screw	500	V_{AC}
Weight	± 2.0	g
Climatic category	40/155/56	

APPLICATIONS

Over-temperature protection and control in:

- Industrial electronics
- Power supplies

DESCRIPTION

These positive temperature coefficient thermistors consist of a small ceramic chip reflow-soldered between two AWG#30 wires with peek insulation and potted inside a passivated aluminum screw head.

NOMINAL WORKING TEMPERATURES AND ORDERING INFORMATION

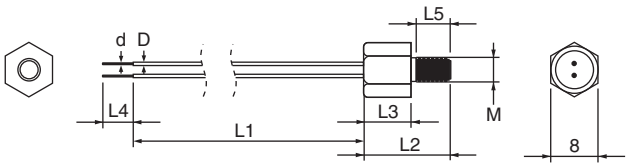
NOMINAL WORKING TEMPERATURE			CATALOG NUMBER 2381 671 .....
T_n (°C)	$R_{max.}$ at T_n - 5 °C (Ω)	$R_{min.}$ at T_n + 5 °C (Ω)	SCREW DEVICE
70	570	570	91302
80	550	1330	91303
90	550	1330	91304
100	550	1330	91305
110	550	1330	91306
120	550	1330	91207
130	550	1330	91309
140	550	1330	91312
150	550	1330	91314

ELECTRICAL CHARACTERISTICS

PARAMETER	VALUES
Maximum resistance at 25 °C	100 Ω
Maximum resistance at (T_n - 5) °C	See Nominal Working Temperatures and Ordering Information table
Minimum resistance at (T_n + 5) °C	See Nominal Working Temperatures and Ordering Information table
Minimum resistance at (T_n + 15) °C	4000 Ω
Maximum voltage	30 V (AC or DC)

CATALOG NUMBERS AND PACKAGING		
12NC	**SAP**	**SPQ**
2381 671 91302	PTCSSCWT071DBE	500
2381 671 91303	PTCSSCWT081DBE	500
2381 671 91304	PTCSSCW3T091DBE	500
2381 671 91305	PTCSSCWT101DBE	500
2381 671 91306	PTCSSCW3T111DBE	500
2381 671 91307	PTCSSCWT121DBE	500
2381 671 91309	PTCSSCWT131DBE	500
2381 671 91312	PTCSSCWT141DBE	500
2381 671 91314	PTCSSCWT151DBE	500

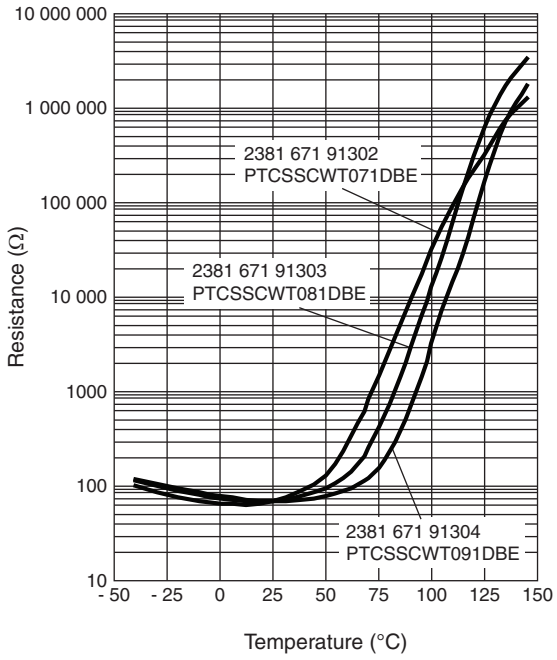
COMPONENT OUTLINES DIMENSIONS in millimeters

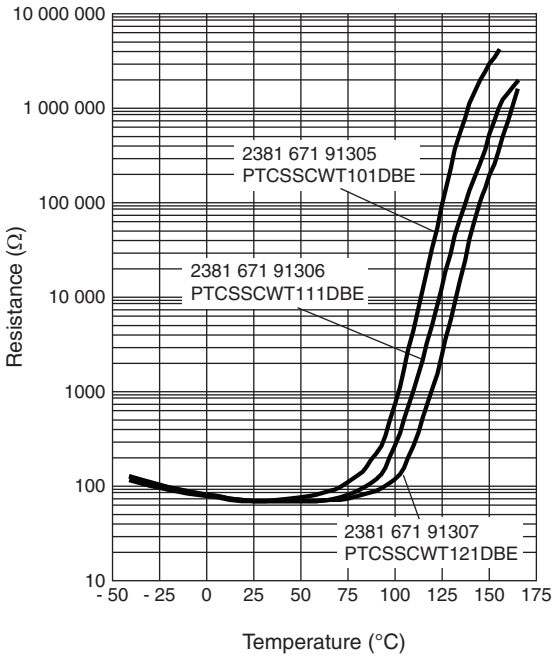


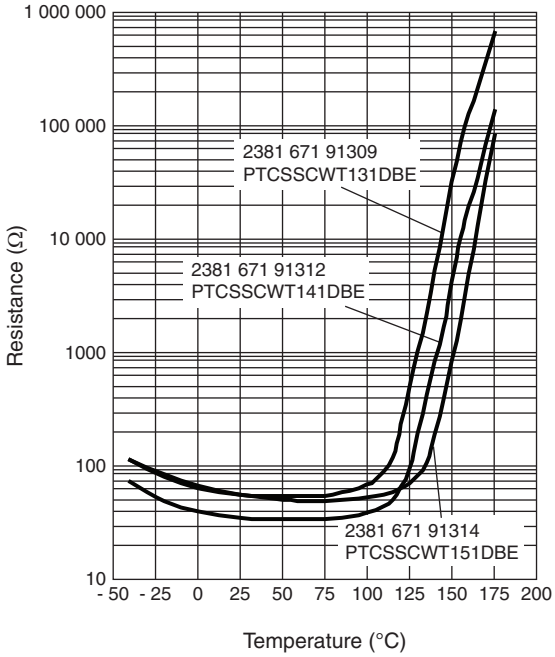
Component outline for 2381 671 91302 to 91314

L1	200 ± 20
L2	14.5
L3	8
L4	3
L5	5.5 (M4)
M	M4 - 0.70 - 6g (ISO)
d	0.254
D	0.56

TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC







APPLICATION SPECIFIC DATA

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So how does it work? The PTC thermistor is mounted in thermal contact with the equipment to be protected, and connected into the bridge arm of a comparator circuit, such as shown in Fig. 1. At normal temperature, the PTC thermistor resistance (R_p) is lower than R_s (see Fig. 2), so the comparator's output voltage V_0 will be low. If an equipment overtemperature occurs, the PTC thermistor will quickly heat up to its trigger or nominal reference temperature T_n, whereupon its resistance will increase to a value much higher than R_s, causing V_0 to switch to a high level sufficient to activate an alarm, relay or power shutdown circuit.

APPLICATION EXAMPLES

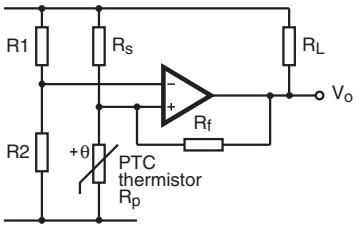


Fig. 1 Typical comparator circuit

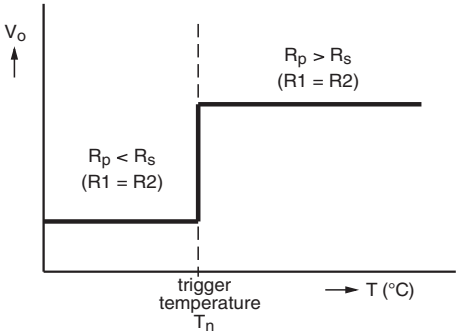


Fig. 2 Typical switch characteristic

PTC Thermistors, Sleeve Type for Over-Temperature Protection

FEATURES

- Well-defined protection temperature levels
- Accurate resistance for ease of circuit design
- Excellent long term behavior (< 1 °C or 5 % after 1000 h at T_n + 15 °C)
- Wide range of protection temperatures (70 °C to 150 °C)
- No need to reset supply after overtemperature switch
- Small size and rugged
- Also available as triple sensor
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

e4 RoHS COMPLIANT

APPLICATIONS

Over-temperature/over-load protection:

- Motor protection (thermal protection of winding)
- Industrial electronics
- Power supplies
- Electronic data processing

DESCRIPTION

These PTC thermistors consist of a small PTC ceramic chip soldered between 2 ETFE insulated silver plated copper wires, insulated by a thermal sleeve.

The are primarily intended for over-temperature sensing inside windings, coils, transformers and alike.

PACKAGING

The PTC thermistors are packed in bulk per 500 pcs.

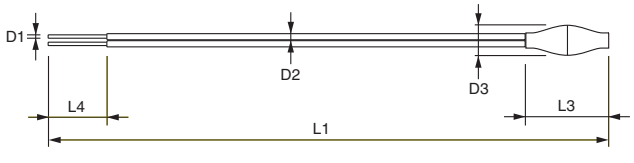
QUICK REFERENCE DATA

PARAMETER	VALUE	UNIT
Maximum resistance at 25 °C	100	Ω
Minimum resistance at (T_n + 15) °C	4000	Ω
Maximum (AC/DC) voltage	30	V
Thermal time constant	≈ 8.0	s
Temperature range	- 40 to (T_n + 15)	°C
Weight	≈ 2.0	g
Climatic category	40/125/56	- °C/+ °C/ days

NOMINAL WORKING TEMPERATURES AND ORDERING INFORMATION

NOMINAL WORKING TEMPERATURE			CATALOG AND ORDERING NUMBER	12NC REFERENCE NUMBER
T_n (°C)	$R_{max.}$ at T_n - 5 °C (Ω)	$R_{min.}$ at T_n + 5 °C (Ω)	SLEEVE DEVICE	2381 671 .....
70	570	570	PTCSSLVT071DBE	91402
80	550	1330	PTCSSLVT081DBE	91403
90	550	1330	PTCSSLVT091DBE	91404
100	550	1330	PTCSSLVT101DBE	91405
110	550	1330	PTCSSLVT111DBE	91406
120	550	1330	PTCSSLVT121DBE	91407
130	550	1330	PTCSSLVT131DBE	91409
140	550	1330	PTCSSLVT141DBE	91412
150	550	1330	PTCSSLVT151DBE	91414

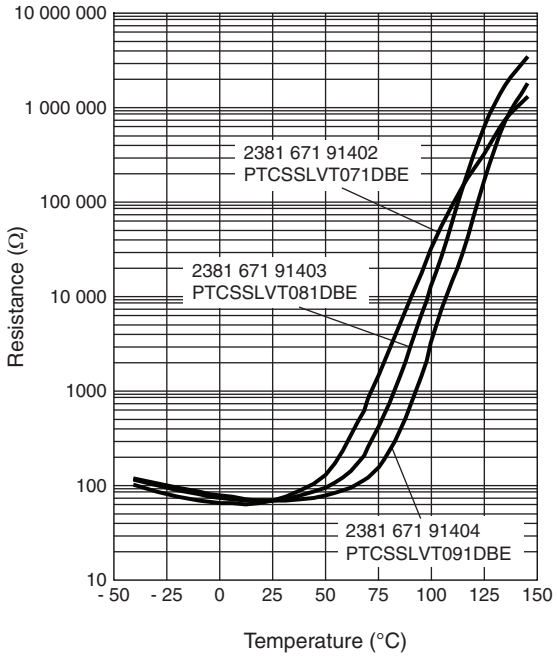
COMPONENT OUTLINES DIMENSIONS in millimeters

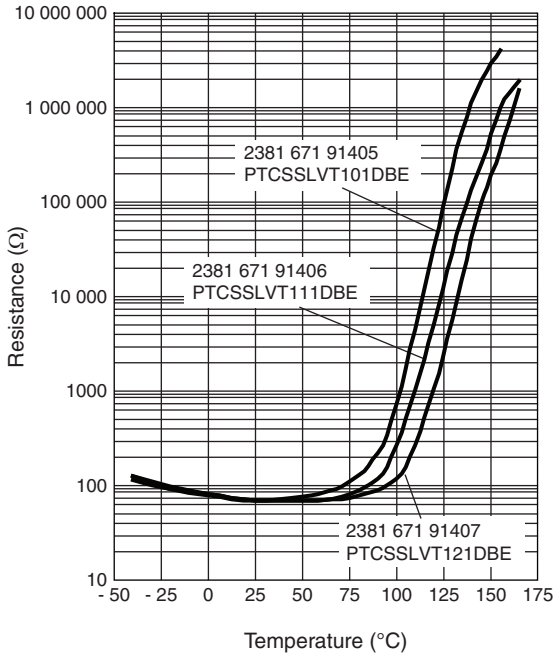


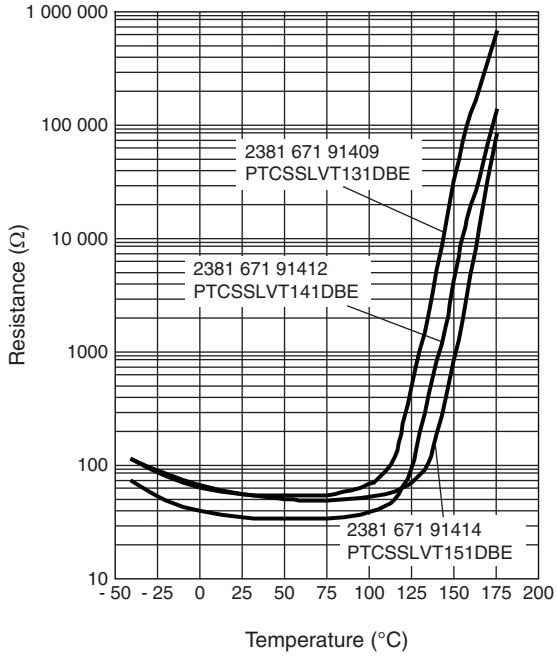
Component outline

L1	500 ± 20
L2	7 ± 2
L3	10 ± 3
D1	0.42
D2	0.7
D3	3 max.

TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC







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APPLICATION EXAMPLES

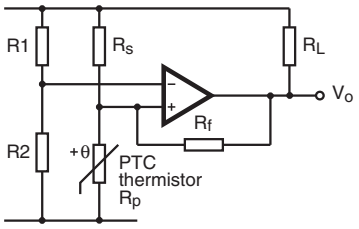


Fig. 1 Typical comparator circuit

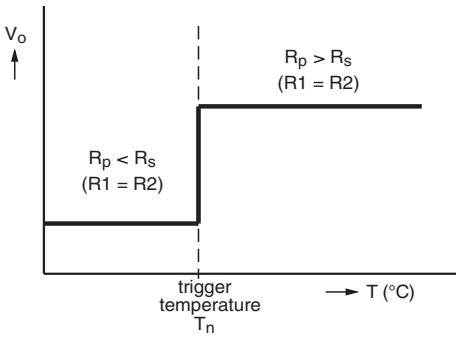
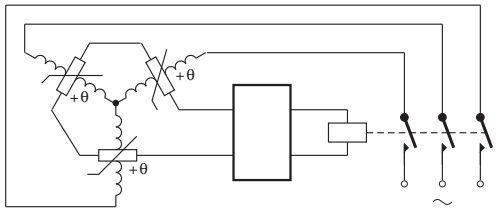


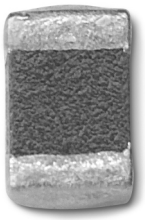
Fig. 2 Typical switch characteristic



As soon as one or more of the windings becomes too hot, the motor is switched off.

Fig. 3 Temperature protection of electric motors

SMD 0805, PTC Thermistors for Over-Temperature Protection



FEATURES

- Well-defined protection temperature levels
- Very fast reaction time
- Accurate resistance for ease of circuit design
- Excellent long term behavior
- Small size and rugged
- UL approved according standard UL1434 (file: E148885)
- PTC thermistor with lead (Pb)-free terminations
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

QUICK REFERENCE DATA

PARAMETER	VALUE	UNIT
Resistance at 25 °C	470 ± 50 %	Ω
Maximum resistance at - 40 °C	2500	Ω
Maximum resistance at (T_n - 5) °C	4700	Ω
Minimum resistance at (T_n + 5) °C	4700	Ω
Minimum resistance at (T_n + 15) °C	15 000	Ω
Maximum voltage	25	V
Dissipation factor	± 3.5	mW/K
Temperature range	- 40 to (T_n + 15)	°C
Weight	± 0.015	g
Climatic category	40/125/56	

APPLICATIONS

Over-temperature protection and control in:

- Industrial electronics
- Power supplies
- Electronic data processing
- Motor protection
- Electronic ballasts
- DC/DC convertors

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for sensing.

NOMINAL WORKING TEMPERATURES AND ORDERING INFORMATION

CODE NUMBERS 2381 675....	T_n (°C)	$R_{max.}$ at T_n - 5 °C (Ω)	$R_{min.}$ at T_n + 5 °C (Ω)	$R_{min.}$ at T_n + 15 °C (Ω)
20707	70	4700	4700	15 000
20807	80	4700	4700	15 000
20907	90	4700	4700	15 000
21007	100	4700	4700	15 000
21107	110	4700	4700	15 000
21207	120	4700	4700	15 000
21307	130	4700	4700	15 000
21407	140	4700	4700	15 000

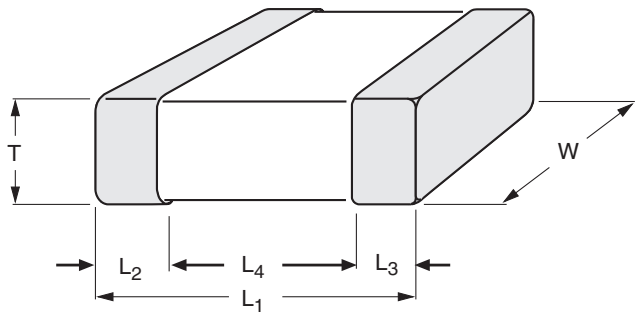
Note

• Other sizes are available on request

ELECTRICAL CHARACTERISTICS	
PARAMETER	**VALUES**
Resistance at 25 °C	470 Ω ± 50 %
Maximum resistance at - 40 °C	2500 Ω
Maximum resistance at (T_n - 5) °C	4700 Ω
Minimum resistance at (T_n + 5) °C	4700 Ω
Minimum resistance at (T_n + 15) °C	15 000 Ω
Maximum voltage	25 V (AC or DC)

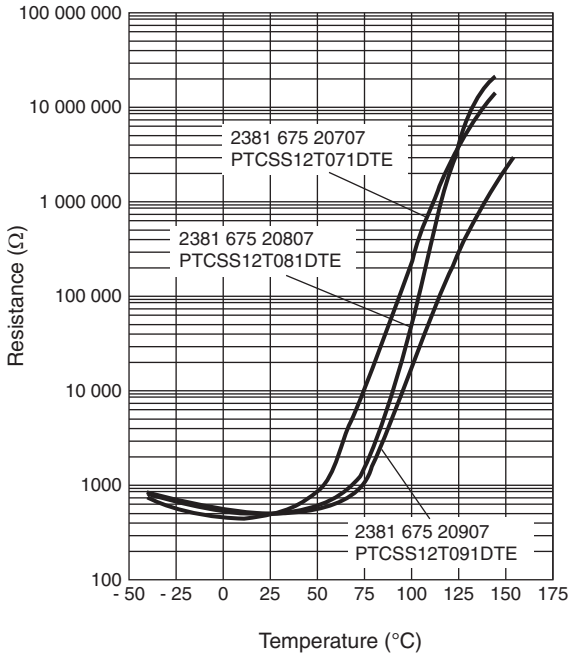
CATALOG NUMBERS AND PACKAGING		
12NC	**SAP**	**SPQ**
2381 675 20707	PTCSS12T071DTE	4000
2381 675 20807	PTCSS12T081DTE	4000
2381 675 20907	PTCSS12T091DTE	4000
2381 675 21007	PTCSS12T101DTE	4000
2381 675 21107	PTCSS12T111DTE	4000
2381 675 21207	PTCSS12T121DTE	4000
2381 675 21307	PTCSS12T131DTE	4000
2381 675 21407	PTCSS12T141DTE	4000

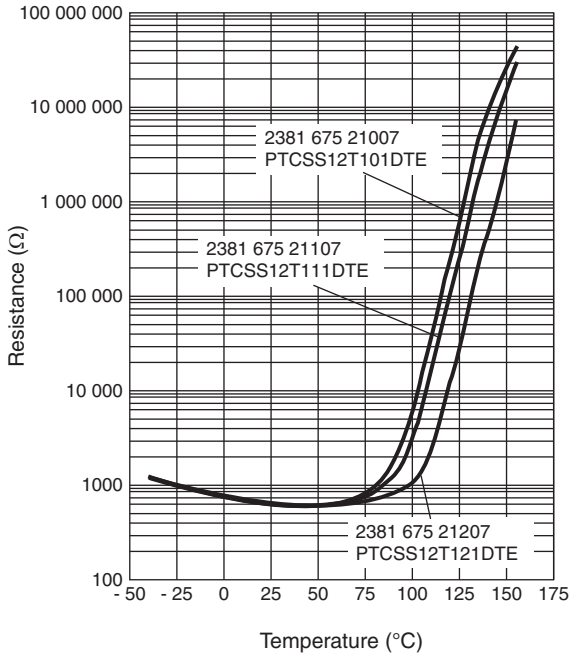
COMPONENT OUTLINE DIMENSIONS in millimeters

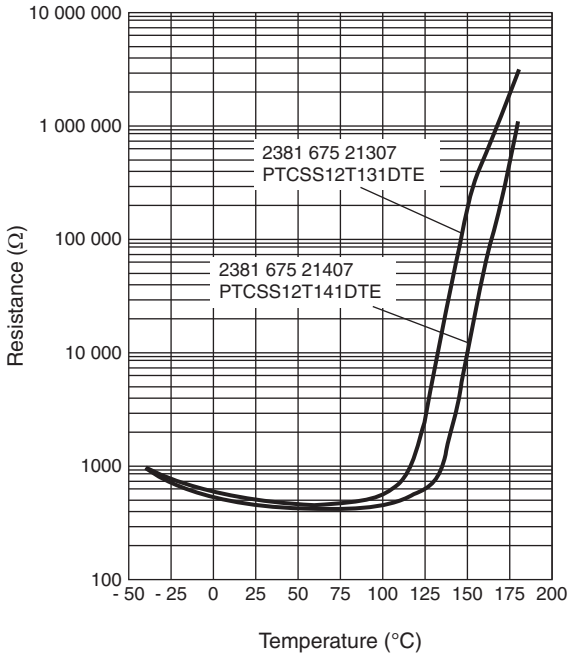


L_1	W	T	L_2 and L_3 MIN.
2.00 ± 0.2	1.25 ± 0.2	0.90 ± 0.15	0.4 ± 0.25

TYPICAL RESISTANCE/TEMPERATURE CHARACTERISTIC







PTC for Motor Start Applications

Contents

PTC Thermistors Motor Start Packages

FEATURES

RoHS COMPLIANT

- Large diameter ceramic pellets for high starting current
- Various package sizes for optimum inrush current and switching time
- Rugged mechanical construction for reliable long life operation
- UL approved packages
- Plastic case mold UL 94 V-0 approved
- Adapted accessories for easy mounting
- Compliant to RoHS directive 2002/95/EC

APPLICATIONS

- Single Phase motorstart assist in
  - Refrigerator systems
  - Airconditioning systems
  - Heat-pumps
  - Small compressors

QUICK REFERENCE DATA

PARAMETER	VALUE	UNIT
Resistance value at 25 °C	15 to 75	Ω
Tolerance on resistance value	± 30	%
Current ratings	6 to 36	A_{RMS}
Switching times (typical)	0.25 to 1.0	s
Maximum voltage rating	410, 500	V_{RMS}
Operating temperature range	- 10 to + 80	°C
Storage temperature range	- 25 to + 105	°C

PTC MOTOR START SELECTION CHART

VISHAY CERA-MITE PART NUMBER	CASE STYLE	R_{DYN} (Ω) ± 20 %	R_{25} (Ω) ± 30 %	SWITCH TIME t (s) at 230 V	CURRENT RATING (A_{RMS})	MAX. VOLTAGE RATING (V_{RMS})	COMPRESSOR RANGE (BTU 000)	COMPRESSOR RANGE (HP)
PTC305C20	C	25	35	0.25	10	410	10 to 28	0.75 to 2.0
PTC305C21	C	35	50	0.35	8	410	8 to 18	0.5 to 1.5
PTC305C22	C	50	75	0.50	6	410	5 to 12	0.25 to 1.0
PTC305C19	B	20	30	0.50	18	500	20 to 50	1.5 to 4.0
PTC305C12	B	25	40	0.60	15	500	18 to 42	1.5 to 3.5
PTC305C2	B	50	85	1.00	12	500	10 to 25	1.0 to 2.5
PTC305C9	A	10	15	0.50	36	500	28 to 68	3.0 to 7.0
PTC305C11	A	12.5	20	0.60	30	500	28 to 62	3.0 to 6.0
PTC305C1	A	25	42.5	1.00	24	500	14 to 36	1.5 to 3.5

ECONOMICAL SOLID STATE TORQUE ASSIST FOR HEAT PUMPS, ROOM AIR, COMMERCIAL AND RESIDENTIAL AIR CONDITIONING AND REFRIGERATION SYSTEMS

Positive Temperature Coefficient Themistors (PTC) have been used for many years in millions of HVAC applications to provide starting torque assistance to Permanent Split Capacitor (PSC) single phase compressor motors.

Sizes are available to cover the full range of 120 V/240 V PSC compressor motors.

Safety Agency Recognition
Vishay Cera-Mite motor start PTC thermistors are recognized by Underwriter Laboratories file E97640 in accordance with Standard for Thermistor Type Devices UL 1434; and Canadian Standards C22.2 No. 0-1991. All packages and accessories are RoHS compliant.

RELATIVE COMPARISON OF VARIOUS MOTOR STARTING METHODS

Three methods have historically been employed to generate starting torque for PSC motors. All are well-proven technologies and may be compared relative to one another based upon categories shown below.

The importance of each category is dependent upon the motor application and industry sector.
In general, if the PTC starter produces sufficient starting torque, it is considered the simplest and most economical choice.

Table 1

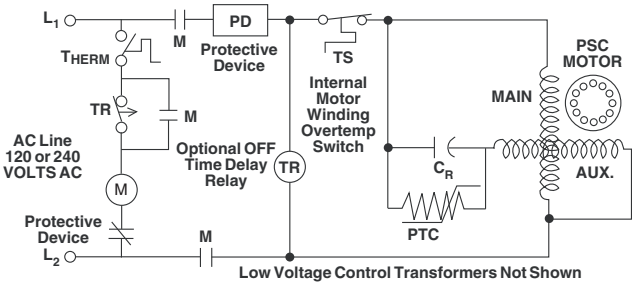
STARTING METHOD	MECHANICAL			ELECTRICAL					FINANCIAL		
	EASE OF WIRING	PANEL SPACE REQUIRED	SENSITIVE TO MOUNTING DIRECTION	ACCELERATION TORQUE PRODUCED	ACCELERATION (SWITCH) TIME	RESET TIME REQUIRED	EMI/RFI GENERATED	TECHNOLOGY	INVENTORY MIX REQUIRED	RELIABILITY	PURCHASED COST
PTC Starter	Simple 2 wire	Lowest	No	Lowest	Fixed	3 min to 5 min	No	Solid State	Lowest	Highest	Lowest
Start Cap with PTC Acting as A Current Relay	Moderate 2 wire or 3 wire	Medium	Yes	Medium	Fixed	2 min to 5 min	No	Solid State	Medium	Medium	Medium
Start Cap used With Potential or Current Relay	Difficult 4 wire or 5 wire	Highest	Yes	Highest	Variable Based on Motor Speed	None	Yes	Electro Mechanical	Highest	Lowest	Highest

SIMPLIFIED PTC STARTING DIAGRAM

Start Sequence. When starting the compressor, contactor (M) closes; the PTC, which is at low resistance, provides starting current to the motor's auxiliary winding. After time delay (t), the current passing through the PTC causes it to heat and "switch" to a very high resistance. At this point the motor is up to speed and the run capacitor (C_R) determines the current in the auxiliary winding. The PTC remains hot and at high resistance as long as voltage remains on the circuit. When contactor (M) opens, shutting off voltage to the compressor, the PTC cools to its initial low resistance and is again ready to provide torque assist on the next startup.

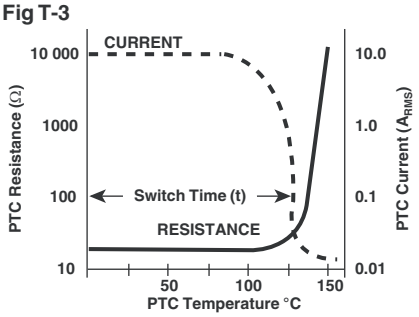
Restart. It is important to provide time between motor starts to allow the PTC to cool to near its initial temperature. This time is usually 3 min to 5 min and is determined by the thermostat (THERM) or separate time-delay relay (TR). Attempts to restart in less time may be successful depending on compressor equalization, line voltage, temperature, and other conditions. If the motor were to stall in a locked-rotor state, overload device (PD or TS) would open the line and a further time delay would occur until the motor overload is reset. Motor start PTCs are applied to compressors having means to equalize pressure during shutdown.

Fig T-2



TYPICAL PTC CHARACTERISTICS AS A MOTOR START DEVICE

Fig T-3



START AND ACCELERATION TORQUES SINGLE PHASE PSC HIGH EFFICIENCY COMPRESSORS

The use of a PTC start assist insures sufficient acceleration torque to overcome not only breakaway friction, but also parasitic asynchronous torques associated with the 5th and 7th motor harmonics or lamination slot harmonics.

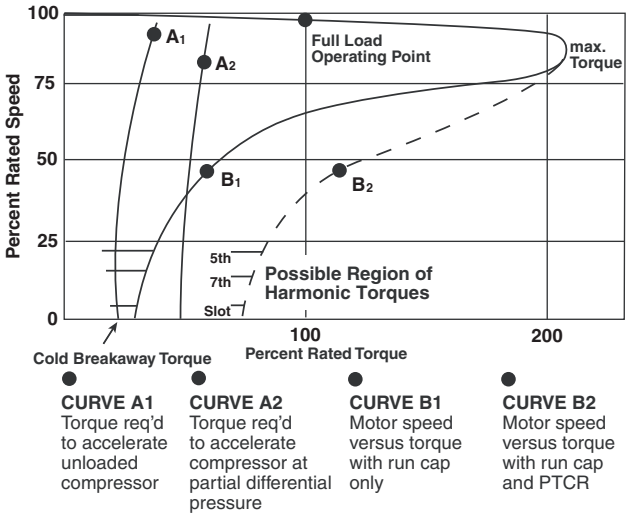
ACCELERATION TIME CONSIDERATIONS

The time to accelerate a rotating machine is:

$$\text{Accelerating time (s)} = \frac{\text{RPM} \times \text{WK}^2(\text{lb ft}^2)}{\text{Avg. torque (lb ft)} \times 308}$$

(Avg. torque = Curve B - Curve A)

1. If (Curve B - Curve A) is zero or less, the motor may stall.
2. In calculating torque available from Curve B, allowance should be made for cusps in the torque curve due to harmonics. The time needed to accelerate from rest to 1/2 speed is critical, as the average torque available in this region is limited. Select a PTC with sufficient switching time (t) to accelerate the compressor.
3. Scroll and rotary compressors may have less breakaway torque than shown.
4. A compressor with no equalization may require over 100 % starting torque and time as long as several seconds. PTC starters not recommended.



CONSIDERATIONS FOR CURRENT IN PTC APPROXIMATE EQUIVALENT CIRCUIT PSC MOTOR AT ZERO SPEED

$$I_L(\text{run}) = \frac{HP \times 746}{V_M \times pf \times eff} \quad I_L(\text{start}) \approx I_L\text{run}$$

For running conditions:

$$\text{If } V_{aux} = V_M \text{ then } I_M \text{ and } I_{aux} = \frac{I_L}{\sqrt{2}}$$

$$\text{If } (V_{aux} \neq V_M) \text{ then } I_{aux} = \frac{I_L}{\sqrt{2}} \times \frac{V_M}{V_{aux}} \text{ and } Z_{aux} = \frac{V_M}{I_{aux}}$$

For the greatest starting torque, PTC should be chosen to make:

V_M x I_M = V_{aux} x I_{aux}. In many cases the auxiliary Volt-Amperes are limited to about 50 % of the main winding Volt-Amperes to get 50 % to 70 % rated torque.

Then at start, with PTC in series: $Z'_{aux} = R_{\overline{PTC}} + Z_{\overline{aux}}$

$$I_{Rstart} \text{ through PTC} = \frac{V_M}{Z_{aux}}$$

$$I_{Cstart} \text{ through Run Cap} = \frac{V_M}{X_C}; \; X_C = \frac{1}{2\pi fC} \; \Omega$$

$$I_{aux\ start} = I_{\overline{R\ start}} + I_{\overline{C\ start}}$$

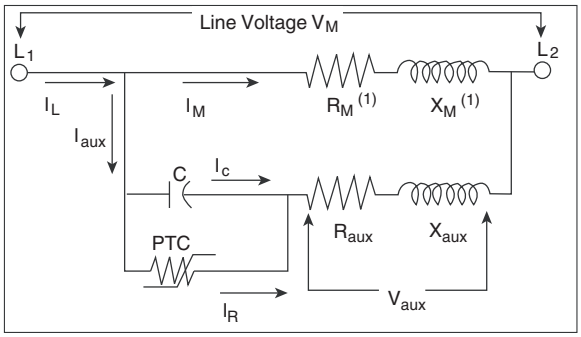
If Z_{aux} is low impedance, less than 10 % of R_{PTC}

then it can be ignored and I_{PTC} at start = $\frac{V_M}{R_{PTCR}}$

This closely approximates the condition for motors over 1/2 HP.

Fig T-5

Fig T-5



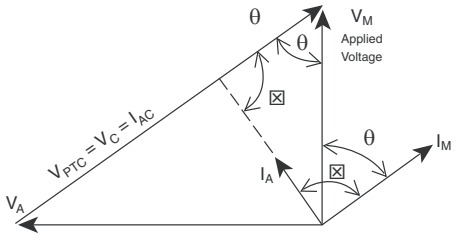
*R and X are total of stator and rotor

Fig T-6

Simplified voltage diagram of the PSC motor at operating speed.

Note

(1) I_A (auxiliary current) leads I_M (main current) by 80° to 90° when C (run capacitor) is chosen for balanced operation at 3/4 to full load. Line Power Factor = sine 2θ



EFFECT OF PTC RESISTANCE ON STARTING TORQUE OF PSC MOTORS

Table 2

MOTOR HP (TABLE 4) (NOTE 7)	LOCKED ROTOR TORQUE WITH RUN CAP ONLY % RATED TORQUE (SEE A)	STARTING TORQUE WITH RUN CAP AND PTC (% RATED TORQUE) (SEE B) RESISTANCE (R_{DYN})				
		50 Ω	25 Ω	20 Ω	12.5 Ω	10 Ω
0.5	25 % to 35 %	70 % to 100 %	80 % to 100 %	NA	NA	NA
1	25 % to 35 %	50 % to 70 %	70 % to 100 %	NA	NA	NA
2	20 % to 30 %	40 % to 60 %	60 % to 90 %	70 % to 100 %	70 % to 100 %	80 % to 100 %
3.5	20 % to 30 %	NA	40 % to 60 %	50 % to 85 %	60 % to 90 %	70 % to 100 %
5	15 % to 25 %	NA	NA	40 % to 60 %	50 % to 75 %	60 % to 90 %
6.5	15 % to 25 %	NA	NA	NA	40 % to 70 %	50 % to 80 %

A. Rated torque is the torque at full speed rated load.
It is calculated as:

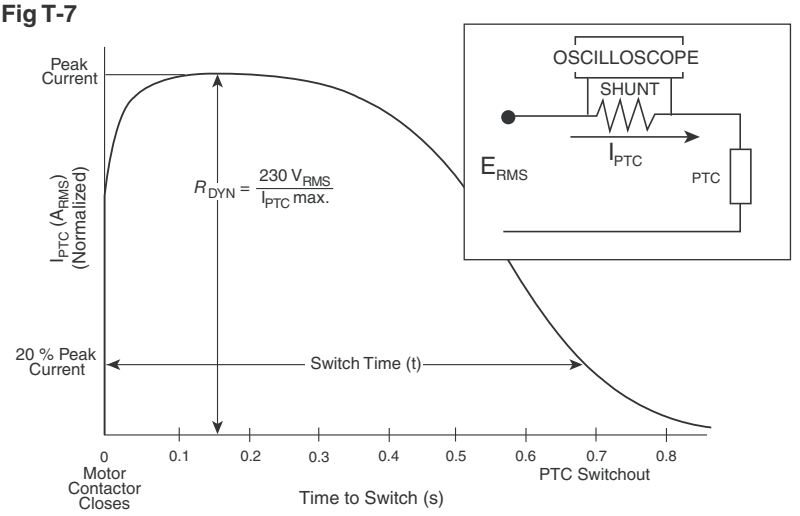
$$\text{Torque (lb-ft)} = \frac{\text{HP} \times 5250}{\text{RPM}}$$

The range shown includes both normal slip and high efficiency low slip motors. Starting torque varies as: (Line Voltage)^2

B. Figure T-4 shows effect of using PTC to increase starting torque. For reciprocating compressors, it is advised to choose a resistance value that gives at least 50 % rated torque at locked rotor. Scroll and rotary compressors may require less torque.

TYPICAL PTC CURRENT VS. TIME SHOWING DEFINITION OF R_{DYN} AND SWITCH TIME (t)

Fig T-7



$$\text{Time (t)} \approx \text{KM (130 °C - T}_0) \frac{R_{DYN}}{V^2_{PTC}}$$

M = PTC mass (g)
T_0 = PTC temp at time 0
K = 0.75 J/g/°C

START CAPACITOR REPLACEMENT

Capacitor Starting Comparison

Some PSC motors have historically been started with a capacitor and relay. To deliver the same starting current as a start capacitor, a PTC resistance is available for approximately equal ohms. Table 3 can be used for conversion.

Even though the start current may be the same, the start torques may differ depending on the motor design.The PTC has a fixed time built in. The start capacitor will stay in the circuit until a relay switches it out. The longer time provided by the capacitor and relay may be needed on applications where equalization is not present or adequate reset time is not available.

STARTING CURRENT APPROXIMATION BASED ON

$$X_C = \frac{1}{2\pi fC}$$

Table 3

START CAPACITOR	PTC VALUE
50 µF	50 Ω
75 µF	37.5 Ω
100 µF	25 Ω
125 µF	20 Ω
200 µF	12.5 Ω
250 µF	10 Ω

PTC SELECTION

- Choosing the best PTC for an application is a simple matter. See Table 4 and Table 2. Vishay Cera-Mite PTCs are available in three case sizes (A, B, and C)
- Table 4 indicates the correct case size for the application. Table 2 shows how to choose the correct resistance value
- Using a device too small or resistance too high will give inadequate starting performance. An oversize device will not harm the motor, but may not be optimum with regards to acceleration dynamics, or power dissipation
- The PTC is generally self protecting when applied within the voltage and current ratings
- All PTC305C Series starters and accessories are RoHS compliant

Table 4

PTC MOTOR START SELECTION CHART

VISHAY CERA-MITE PART NUMBER (2)	CASE STYLE (2)	RESISTANCE (Ω) (3)		SWITCH TIME (4) (t) s AT 230 V	CURRENT RATING (5) (A_{RMS})	MAX. VOLTAGE RATING (6) (V_{RMS})	AVG. POWER DISSIPATION (7) (W)	COMPRESSOR RANGE (8)	
		R_{DYN} ± 20 %	R_{25} ± 30 %					BTU (000)	HP
PTC305C20 (1)	C	25	35	0.25	10	410	3.5	10 to 28	0.75 to 2.0
PTC305C21	C	35	50	0.35	8	410	3.5	8 to 18	0.5 to 1.5
PTC305C22 (1)	C	50	75	0.50	6	410	3.5	5 to 12	0.25 to 1.0
PTC305C19 (1)	B	20	30	0.50	18	500	7	20 to 50	1.5 to 4.0
PTC305C12 (1)	B	25	40	0.60	15	500	7	18 to 42	1.5 to 3.5
PTC305C2	B	50	85	1.00	12	500	7	10 to 25	1.0 to 2.5
PTC305C9 (1)	A	10	15	0.50	36	500	9	28 to 68	3.0 to 7.0
PTC305C11	A	12.5	20	0.60	30	500	9	28 to 62	3.0 to 6.0
PTC305C1 (1)	A	25	42.5	1.00	24	500	9	14 to 36	1.5 to 3.5

UL File E97640

Notes

(1) Preferred values.

(2) Part number is stamped on the device for UL recognition. The customer part number can also include 1 or 3 character alpha-numeric suffix to designate specific customer marking and accessory furnished. The suffix is not marked on the part. Certified outline drawing and complete part number will be furnished on request for specific applications.(Example: PTC305C19K01.) Mounting brackets and other accessories can be ordered separately.

(3) R_{DYN} is nominal resistance equal to U/I when 230 V, 50 Hz/60 Hz is applied (see Fig T-7). This resistance determines current and maximum starting torque at the moment of application of voltage to the motor and can be measured with an oscilloscope.
For receiving inspection or routine trouble shooting, the DC resistance at 25 °C (R_{25}) as measured with an ohmmeter is approximately 50 % greater. For example: PTC305C20 measured with an ohmmeter would be 35 Ω ± 30 % tolerance.

(4) Resistance values are duplicated in several case sizes (i.e.: PTC305C20, C12, and C1) to provide longer switch time (t) and higher current ratings (see Fig. T-7). Larger parts may be needed for more difficult starting conditions (voltage or temperature) or may be used for accelerating fans against back pressure.

(5) Maximum current in the PTC is determined by

$$\frac{\text{Maximum Line Voltage}}{\text{Minimum } R_{DYN}}$$

Motor auxiliary winding impedance is usually small compared to PTC resistance, and does not materially affect PTC current.
Current in PTC is a percentage of the full motor inrush (locked rotor) current; usually 30 % to 50 % (see Fig T-5).

(6) In application, the maximum voltage is the voltage that appears across the run capacitor at rated speed, high line, light load. This is not the applied line voltage (see Fig T-6).
THESE DEVICES ARE INTENDED FOR APPLICATION ON 240 VOLT LINES OR SYSTEMS WITH MAXIMUM LINE VOLTAGE UP TO 265 V. The PTC305C20, 21 and 22 are also used on 120 V systems where the motor is designed to use same run capacitor and PTC as equivalent 230 V compressor.

(7) This is the power used to keep the PTC switched in a high impedance state under full load running conditions at typical ambient temperature.

(8) BTU and horsepower ranges are for reference only. PTC may be applied outside those ranges as long as maximum voltage and maximum current are not exceeded. Scroll and rotary compressors may require less starting assistance allowing use of smaller devices.

DIMENSIONS FOR PTC MOTOR START DEVICES in inches (millimeters)

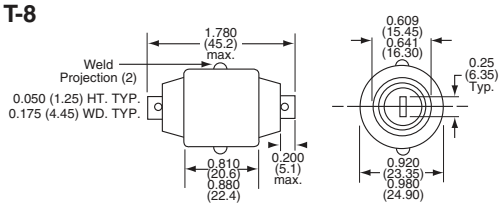
- **PACKAGED MOTOR START PTCs ARE OFFERED IN THREE DIFFERENT CASE SIZES TO ACCOMMODATE THE RANGE OF PSC COMPRESSOR MOTORS SERVED**

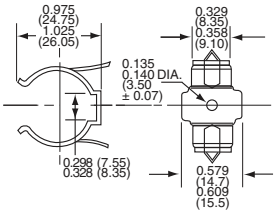
CASE STYLE C

Case Style C is a 2-terminal single pellet device with current carrying capacity up to 10 A. It is furnished with a round mounting bracket.

CASE C	MOUNTING BRACKET
PTC305C20 - Black PTC305C21 - Black PTC305C22 - Black	PTCAUX36-520M - Round

Fig T-8





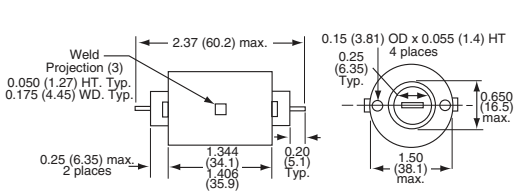
Round Bracket - Spring Steel Phosphate & Oil Finish. Accepts #6 Sheet Metal Screw

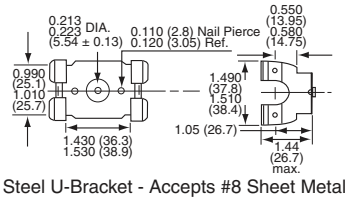
CASE STYLE B

Case Style B is a 2-terminal single pellet unit with current carrying capacity up to 18 A. Depending upon the model, either a U-shaped or round bracket is furnished.

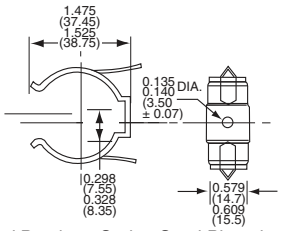
CASE B	MOUNTING BRACKET
PTC305C2 - Black PTC305C12 - Black or Blue PTC305C19 - Blue	PTCAUX7-36-5C - U-SHAPED PTCAUX36-520H - ROUND

Fig T-9





Steel U-Bracket - Accepts #8 Sheet Metal Screw



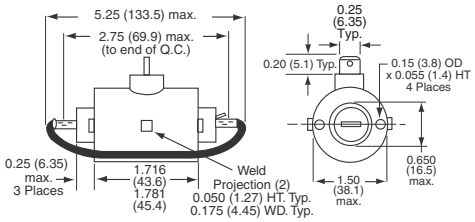
Round Bracket - Spring Steel Phosphate & Oil Finish. Accepts #6 Sheet Metal Screw

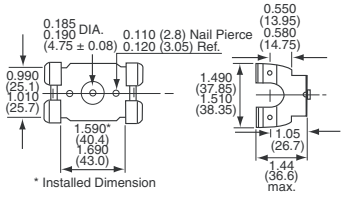
CASE STYLE A

Case Style A is a 3-terminal device that incorporates two pellets in parallel, resulting in lower resistance values and current carrying capacity up to 36 A. A jumper wire to complete the parallel connection with the two internal pellets is required.

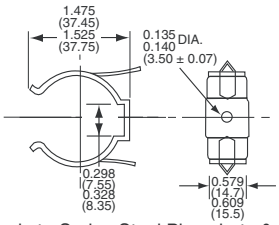
CASE A	MOUNTING BRACKET	WIRE JUMPER
PTC305C1 - Blue PTC305C9 - Tan PTC305C11 - Tan	PTCAUX7-36-4C - U-Shaped PTCAUX36-520H - Round	PTCAUX50-1278 9.75" Long 105 °C Wire

Fig T-10





Steel U-Bracket - Accepts #8 Sheet Metal Screw



Round Bracket - Spring Steel Phosphate & Oil Finish. Accepts #6 Sheet Metal Screw

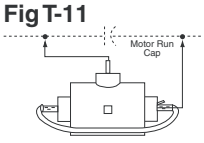
OPERATING TEMPERATURE

Under normal operation, the ceramic pellet inside the case reaches a
temperature of 150 °C. The plastic case material has been recognized by UL for operation up to this temperature. The actual temperature on the outside of the
case will be approximately 100 °C while the motor is running. An appropriate mounting location and 105 °C, 600 V wiring are recommended.

CONNECTION DIAGRAMS

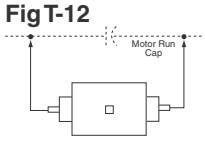
PTC Thermistors Motor Start units are connected directly across the PSC motor's "run" capacitor. Case style A is a 3-terminal device and uses an external jumper wire to connect the two internal pellets in parallel. A special "piggyback" terminal on the jumper wire provides for two connections on one side of the A-style case.

Fig T-11



A Style
3-Terminal Case

Fig T-12



B & C Style
2-Terminal Case

VISHAY CERA-MITE MOTOR START FEATURES

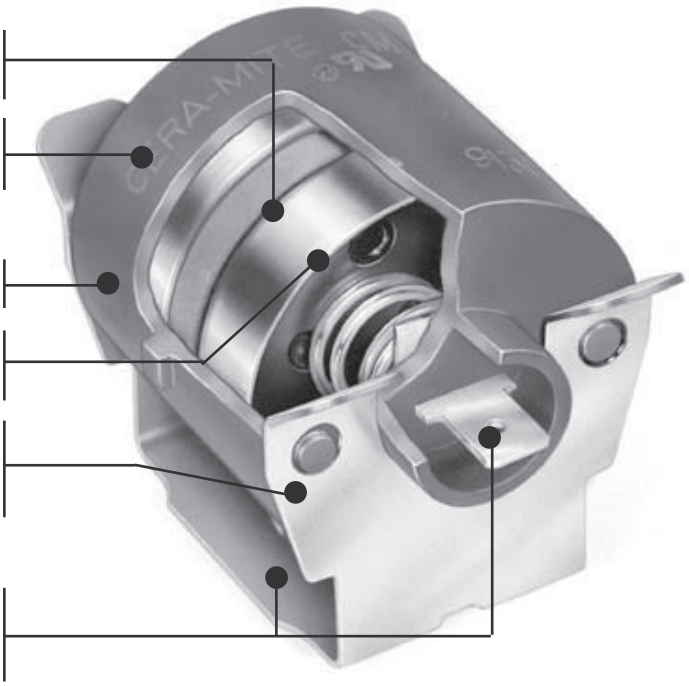
ADVANCED CERAMIC ENGINEERING FOR HVAC

Vishay Cera-Mite's capability in large diameter ceramic pellets, unique formulations tailored to motor starting, and heavy duty electrode systems, have been developed and proven with the cooperation of HVAC industry experts over a period of 25 years.

INHERENT PERFORMANCE

Large diameter pellets make possible low resistance start devices needed to match torque requirements of high efficiency compressor motors.

Various package sizes offer selection of timing intervals, providing optimum switching time without dependence on sensing speed, counter EMF, or current.



RUGGED MECHANICAL CONSTRUCTION

Vishay Cera-Mite PTC cases are molded from a UL94V0 high temperature, engineered plastic/glass composite.

Heavy duty aluminum contact plates and stainless steel force springs are scaled to the pellet sizes and current ratings to insure no internal arcing and to enhance quick reset time.

Unbreakable metal mounting brackets attach securely with a single screw. The "U" - brackets developed by Vishay Cera-Mite feature lower power consumption and greater reliability by maximizing case to ground thermal impedance.

SIMPLE AND ECONOMICAL

A solid state device requiring only 2 quick connect wires and one bracket screw to install. Compared to the alternative start capacitor and relay, PTC start devices save several wires, occupy less panel space, mount more easily, and cost less.

OUTSTANDING RELIABILITY

Over a twenty year period, with an installed base of millions of Vishay Cera-Mite PTC start devices, experience has demonstrated reliability at 1.0 FIT or less. Users have benefited from very low warranty expense.

RESTART CONSIDERATIONS

A properly sized PTC will provide adequate starting current and starting time with a cool down time of 3 min to 5 min, coordinating perfectly with standard "off delay" equalization timers restart characteristics of the three case sizes are shown.

Fig T-13

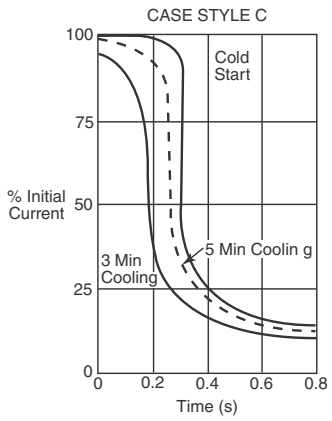


Fig T-14

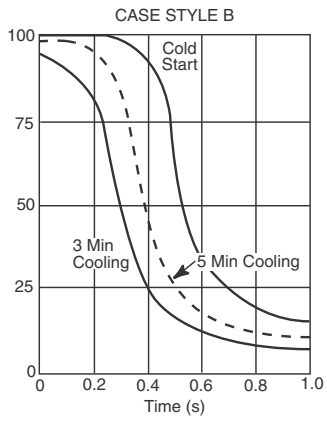
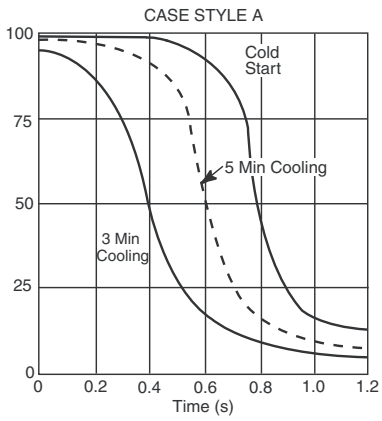


Fig T-15



PTC Thermistors Motor Start Pellets

QUICK REFERENCE DATA		
PARAMETER	**VALUE**	**UNIT**
Resistance value at 25 °C	3.3 to 75	Ω
Tolerance on resistance value	± 30	%
Current ratings	4 to 16	A_{RMS}
Switching times (typical)	0.25 to 1.0	s
Maximum voltage rating	160 to 450	V_{RMS}
Operating temperature range	- 10 to + 85	°C
Storage temperature range	- 25 to + 105	°C

FEATURES

RoHS COMPLIANT

- Rugged silver electrodes well suited for long life OEM pressure contact mounting
- Various pellet sizes for optimum inrush current and switching time
- Withstanding voltage is 2 times the maximum voltage rating
- UL approved pellets
- Compliant to RoHS directive 2002/95/EC

APPLICATIONS

- Single Phase motorstart assist in
  - Refrigerator systems
  - Airconditioning systems
  - Heat-pumps
  - Small compressors
- Inrush current generation

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended for inrush current generation. They consist of a high grade ceramic disk with two rugged pattern silver electrodes for contact pressure mounting. These ceramic pellets can be build into proprietary motor start devices for compressor, refrigerator and HVAC OEMs.

MOUNTING

The PTC thermistor pellets are suitable for pressure contact mounting in application specific housing assemblies. Examples of such assemblies can be found in the PTC305C series. Assembly housing must be appropriate for usage up to 180 °C surface temperature of the PTC pellets.
The pellets are not solderable.

MARKING

The pellets are not marked. Marking is available on request for customized parts.

SAFETY AGENCY RECOGNITION

Vishay Cera-Mite motor start PTC pellet thermistors are recognized by Underwriter Laboratories file E148885 in accordance with Standard for Thermistor Type Devices UL 1434; and Canadian Standards C22.2 No. 0-1991.

ELECTRICAL DATA AND ORDERING INFORMATION

PART NUMBER	R_{25} [1] ± 30 % (Ω)	R_{DYN} [2] (Ω)	$V_{meas.}$ R_{DYN} (V_{RMS})	MAX. VOLTAGE [3] (V_{RMS})	MAX. CURRENT (A_{RMS})	SIZE Ø x T (mm)	UL [4]	T_{switch} (°C)
PTC307C1674P	5.0	4.0	120	200	10	16 + 0.2/- 0.4 x 2.5 ± 0.25	Y	105
PTC307C1700P	6.8	5.0	120	200	10		Y	105
PTC307C1711P	10	7.2	120	200	10		Y	105
PTC307C1668P	5.0	4.0	120	180	12	17.5 ± 0.3 x 2.5 ± 0.25	Y	120
PTC307C1644P	6.8	5.0	120	200	10		Y	120
PTC307C1651P	10	7.2	120	200	10		Y	120
PTC307C1720P	20	13	120	320	8		Y	120
PTC307C1411P	3.3	2.6	120	160	12	20 + 0.2/- 0.8 x 2.5 ± 0.25	Y	120
PTC307C1484P	4.7	3.5	120	180	12		Y	120
PTC307C1544P	5.6	4.1	120	180	12		Y	120
PTC307C1399P	6.8	5.0	120	200	10		Y	120
PTC307C1489P	10	7.2	120	230	9		Y	120
PTC307C1476P	12	8.5	120	250	8.5		Y	120
PTC307C1530P	15	10.5	120	300	8		Y	120
PTC307C1531P	22	15	120	400	8		Y	120
PTC307C1282P	33	22	120	355	6		Y	120
PTC307C1533P	47	30	120	400	5		Y	120
PTC307C1292P	68	42	120	430	4		Y	120
PTC307C1487P	3.9	3.0	50	175	16	20 + 0.2/- 0.8 x 3.2 ± 0.25	Y	120
PTC307C1529P	12	10.3	100	350	8		Y	120
PTC307C1545P	14	12	100	320	8		Y	120
PTC307C1640P	30	15.9	240	380	12		Y	120
PTC307C1740P	30	15.9	240	450	7		Y	120
PTC307C1024P	38	25	240	400	9	20 + 0.2/- 0.8 x 5.0 ± 0.25	Y	120
PTC307C1409P	50	35	240	400	7.5		Y	120
PTC307C1410P	75	50	240	400	5.5		Y	120

Notes

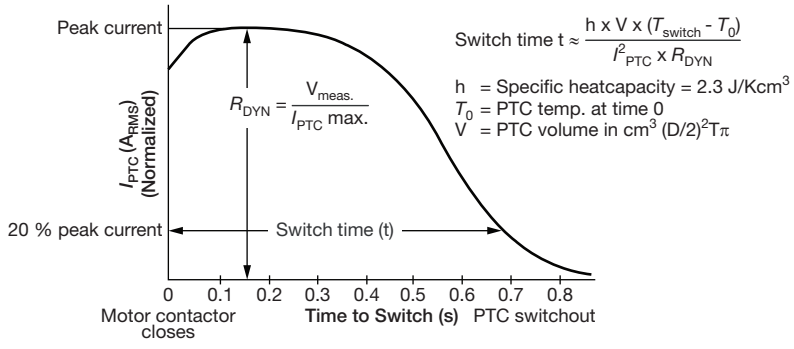
(1) R_{25} = zero power resistance measured at < 0.5 V_{DC}, standard tolerance ± 30 %, other tolerances and values on request

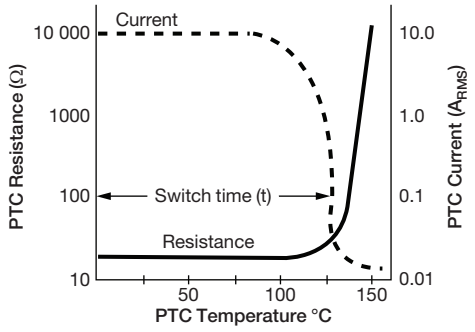
(2) R_{DYN} = nominal dynamic resistance during inrush, measured with $V_{meas.}$ applied, for information only

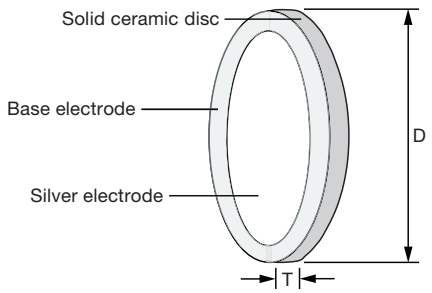
(3) The maximum voltage is the voltage that appears across the PTC in a motor start application. This is not the applied line voltage. Withstanding voltage of all UL approved types is minimum twice the specified maximum operating voltage.

(4) UL recoginition following XGPU2 category of standard UL1434, file E148885

TYPICAL PTC CURRENT VS. TIME SHOWING DEFINITION OF R_{DYN} AND SWITCH TIME (t)







PTC for Heating Applications

Contents

PTC Thermistors for Heating Application

FEATURES

- Ag-metallization suitable for clamping
- Self-regulating surface temperature at voltages from 90 V_{AC} up to 265 V_{AC}
- Self-protecting against over-heating due to PTC effect
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

RoHS COMPLIANT

QUICK REFERENCE DATA	
PARAMETER	**VALUE**
Resistance value at 25 °C	1200 Ω
Tolerance on R_{25}	± 35 %
Rated voltage	230 V_{AC}
Maximum voltage	265 V_{AC}
Operating temperature range	- 40 °C to 85 °C
Climatic category	40/155/56

DESCRIPTION

These directly heated thermistors have a positive temperature coefficient and are primarily intended as heating element.

APPLICATIONS

Home appliances (thermal actuators, warming plates, evaporators, insecticide and perfume vaporizers, fan-heaters).

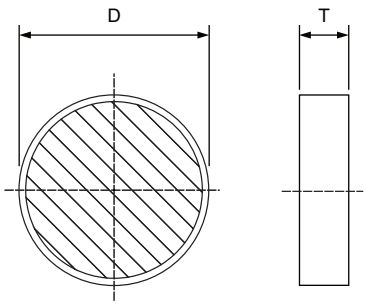
ELECTRICAL DATA AND ORDERING INFORMATION

R_{25} (Ω)	T_{switch} (°C)	T_{surf} [1] at 230 V_{AC} (°C)	12NC	SAP CODING
1200	50	100	2381 662 95051	PTCHP12S050HYE
1200	90	125	2381 662 95091	PTCHP12S090HYE
1200	110	140	2381 662 95111	PTCHP12S110HYE
1200	130	160	2381 662 95131	PTCHP12S130HYE
1200	150	180	2381 662 95151	PTCHP12S150HYE

Note

[1] Measured in a low thermal load set-up with the ceramic clamped between a 4 mm diameter stainless steel surface temperature probe on one side in the center of the metallized surface and 4 mm spring loaded round contact at the other side

DIMENSIONS in millimeters



D	T
11.8 ± 0.2	2.0 ± 0.2

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PTC THERMISTORS

DATA BOOK

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