

## 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)
- Leadless parts withstand mechanical stresses and vibration
- UL file E148885 according to XGPU standard UL1434
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

Overload (current, voltage, temperature) protection in:

- Industrial electronics
- Consumer electronics
- Electronic data processing

### DESCRIPTION

These directly heated ceramic-based thermistors have a positive temperature coefficient and are primarily intended for overload protection. They consist of a ceramic pellet soldered between two tinned CCS wires and coated with a UL 94 V-0 high temperature hard silicone lacquer.

Bare metalized pellets are available on request.

### MOUNTING

PTC thermistors can be mounted by wave, reflow, or hand-soldering. Current levels have been determined according IEC 60738 conditions. Different ways of mounting or connecting the thermistors can influence their thermal and electrical behavior. Standard operation is in air, any potting or encapsulation of PTC thermistors is not recommended and will change its operating characteristics.

#### 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 gray 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.

### QUICK REFERENCE DATA

| PARAMETER                                   | VALUE       | UNIT     |
|---------------------------------------------|-------------|----------|
| Maximum voltage (DC or AC)                  | 30 to 60    | V        |
| Maximum holding current ( $I_{nt}$ )        | 0.094 to 2  | A        |
| Resistance at 25 °C ( $R_{25}$ )            | 0.3 to 50   | $\Omega$ |
| Tolerance on $R_{25}$ value                 | 20          | %        |
| Maximum overload current $I_{ol}$           | 0.8 to 23   | A        |
| Switching temperature                       | 135 to 145  | °C       |
| Operating temperature range at max. voltage | -40 to +85  | °C       |
| Storage temperature                         | -40 to +150 | °C       |

### QUALITY

UL approved PTCs are guaranteed to withstand severe test programs and have factory audited follow-up programs. Major UL qualification tests are long-life (6000 cycles) electrical cycle tests at trip-current, long-life stability storage tests (3000 h at 250 °C), damp heat and water immersion tests and over-voltage tests up to 200 % of rated voltage.

UL approved PTCs are guaranteed to withstand severe test programs

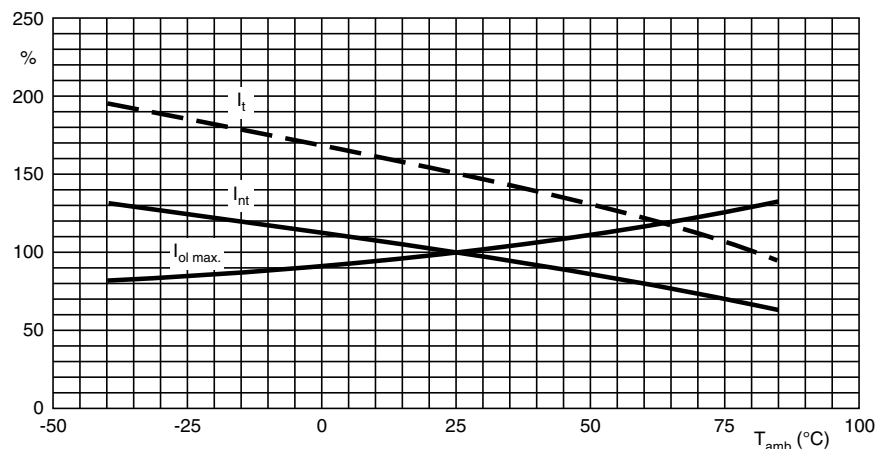
- Long-life cycle tests (over 5000 trip cycles)
- Long-life storage tests (3000 h at 250 °C)
- Electrical cycle tests at low ambient temperatures (-40 °C or 0 °C)
- Damp-heat and water immersion tests
- Overvoltage tests at up to 200 % of rated voltage

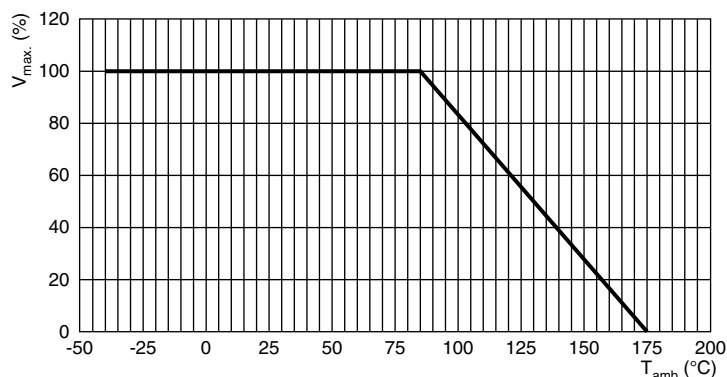
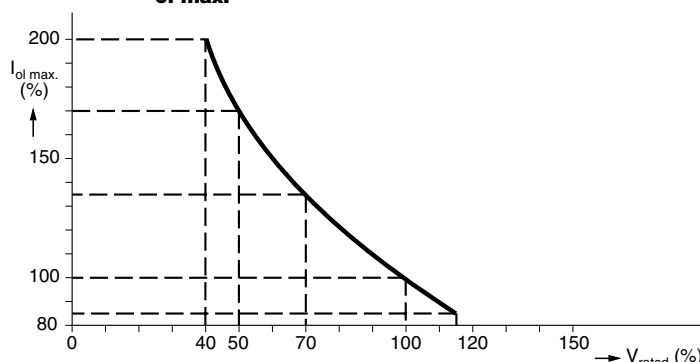
**ELECTRICAL DATA AND ORDERING INFORMATION**

| $I_{nt}$ MAX.<br>at 25 °C<br>(mA) <sup>(1)</sup> | $I_t$ MIN.<br>at 25 °C<br>(mA) <sup>(1)</sup> | $R_{25}$<br>± 20 %<br>(Ω) | $V$<br>MAX.<br>(V) | $I_{ol}$ MAX.<br>at 25 °C<br>(mA) <sup>(2)</sup> | $I_{res}$ MAX. at<br>$V_{max}$ and<br>25 °C (mA) <sup>(1)</sup> | DISSIP.<br>FACTOR<br>(mW/K) <sup>(1)</sup> | Ø D<br>MAX.<br>(mm) | ORDERING PART NUMBERS |                |
|--------------------------------------------------|-----------------------------------------------|---------------------------|--------------------|--------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------|---------------------|-----------------------|----------------|
|                                                  |                                               |                           |                    |                                                  |                                                                 |                                            |                     | BULK                  | TAPE ON REEL   |
| 94                                               | 145                                           | 50                        | 60                 | 800                                              | 22                                                              | 6.9                                        | 5                   | PTCCL05H940EBE        | PTCCL05H940ETE |
| 130                                              | 195                                           | 25                        | 60                 | 1200                                             | 25                                                              | 6.9                                        | 5                   | PTCCL05H131EBE        | PTCCL05H131ETE |
| 180                                              | 270                                           | 13                        | 30                 | 1700                                             | 45                                                              | 6.9                                        | 5                   | PTCCL05H181DBE        | PTCCL05H181DTE |
| 270                                              | 405                                           | 6                         | 30                 | 2500                                             | 60                                                              | 6.9                                        | 5                   | PTCCL05H271DBE        | PTCCL05H271DTE |
| 320                                              | 480                                           | 5                         | 30                 | 3500                                             | 62                                                              | 7.8                                        | 7                   | PTCCL07H321DBE        | PTCCL07H321DTE |
| 410                                              | 615                                           | 3                         | 30                 | 4500                                             | 65                                                              | 7.8                                        | 7                   | PTCCL07H411DBE        | PTCCL07H411DTE |
| 470                                              | 705                                           | 2.5                       | 30                 | 5000                                             | 70                                                              | 8.8                                        | 8.5                 | PTCCL09H471DBE        | PTCCL09H471DTE |
| 540                                              | 810                                           | 1.9                       | 30                 | 6000                                             | 75                                                              | 8.8                                        | 8.5                 | PTCCL09H541DBE        | PTCCL09H541DTE |
| 610                                              | 915                                           | 1.7                       | 30                 | 7000                                             | 80                                                              | 9.9                                        | 10.5                | PTCCL11H611DBE        | PTCCL11H611DTE |
| 700                                              | 1050                                          | 1.3                       | 30                 | 8000                                             | 90                                                              | 9.9                                        | 10.5                | PTCCL11H701DBE        | PTCCL11H701DTE |
| 830                                              | 1245                                          | 1.1                       | 30                 | 10 000                                           | 100                                                             | 11.5                                       | 12.5                | PTCCL13H831DBE        | PTCCL13H831DTE |
| 920                                              | 1380                                          | 0.9                       | 30                 | 11 000                                           | 105                                                             | 11.5                                       | 12.5                | PTCCL13H921DBE        | PTCCL13H921DTE |
| 1170                                             | 1755                                          | 0.7                       | 30                 | 13 500                                           | 140                                                             | 14.5                                       | 16.5                | PTCCL17H112DBE        | -              |
| 1390                                             | 2085                                          | 0.5                       | 30                 | 16 000                                           | 170                                                             | 14.5                                       | 16.5                | PTCCL17H132DBE        | -              |
| 1770                                             | 2655                                          | 0.4                       | 30                 | 20 000                                           | 200                                                             | 18.7                                       | 20.5                | PTCCL21H172DBE        | -              |
| 2050                                             | 3075                                          | 0.3                       | 30                 | 23 000                                           | 220                                                             | 18.7                                       | 20.5                | PTCCL21H202DBE        | -              |

**Notes**

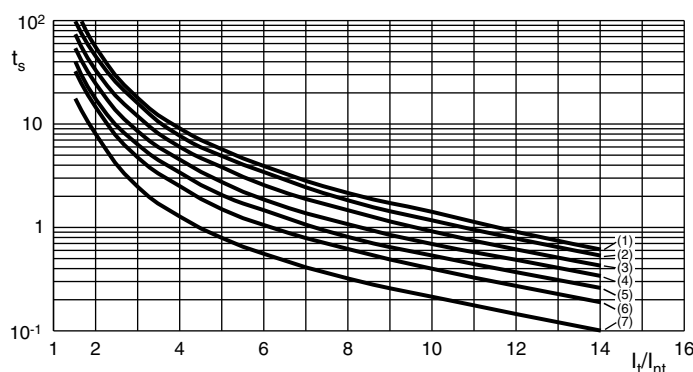
- (1) The indicated current levels are guaranteed according IEC 60738 mounting conditions. For different mounting conditions the indicated current levels can change and should be evaluated in the application.
- (2)  $I_{ol}$  max. is the maximum overload current that may flow through the PTC when it passes from the low ohmic to the high ohmic state.  
UL approval:  $I_{ol}$  max. x 0.85

**CURRENT DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE**

**VOLTAGE DERATING AS A FUNCTION OF AMBIENT TEMPERATURE**

**MAXIMUM OVERLOAD CURRENT  $I_{ol\ max.}$  DERATING 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 PTC voltages are present after tripping, the  $I_{max.}$  value can be derived from the above  $I_{ol\ max.}$  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:  $\varnothing D_{max.} = 20.5\ mm$   
 Curve 2:  $\varnothing D_{max.} = 16.5\ mm$   
 Curve 3:  $\varnothing D_{max.} = 12.5\ mm$   
 Curve 4:  $\varnothing D_{max.} = 10.5\ mm$   
 Curve 5:  $\varnothing D_{max.} = 8.5\ mm$   
 Curve 6:  $\varnothing D_{max.} = 7.0\ mm$   
 Curve 7:  $\varnothing D_{max.} = 5.0\ mm$   
 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 85 °C. Adapt the correct non-trip current with the appropriate curve in the Current Derating 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  $T_{amb} = 0\ ^\circ C$  of a thermistor type PTCCL09H471DBE;  $2.5\ \Omega$ ;  $\varnothing D_{max.} = 8.5\ mm$ :

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

$I_{nt}$ :  $470 \times 1.12 = 526\ mA$  (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 PACKING INFORMATION**

| SAP ORDERING PART NUMBER |                | SPQ  | PACKING OUTLINE |
|--------------------------|----------------|------|-----------------|
| PTCCL05H....BE           |                | 500  | Bulk            |
| PTCCL05H....TE           |                | 1500 | Tape and reel   |
| PTCCL07H....BE           | PTCCL09H....BE | 250  | Bulk            |
| PTCCL07H....TE           | PTCCL09H....TE | 1500 | Tape and reel   |
| PTCCL11H....BE           | PTCCL13H....BE | 250  | Bulk            |
| PTCCL11H....TE           |                | 1500 | Tape and reel   |
| PTCCL13H....TE           |                | 750  | Tape and reel   |
| PTCCL17H....BE           |                | 200  | Bulk            |
| PTCCL21H....BE           |                | 100  | Bulk            |

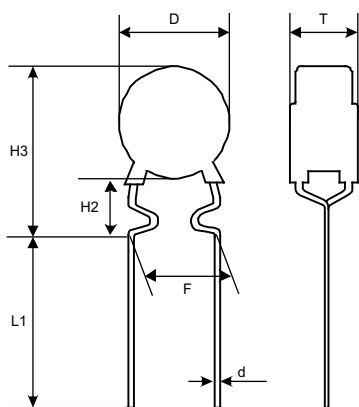
**PTC THERMISTORS IN BULK**


Fig. 1

**DIMENSIONS OF BULK TYPE PTCs (in mm)**

|    |            |
|----|------------|
| D  | See table  |
| d  | 0.6 ± 0.05 |
| T  | 4.0 max.   |
| H2 | 4.0 ± 1.0  |
| H3 | D + 5 max. |
| L1 | 20 min.    |
| F  | 5.0        |

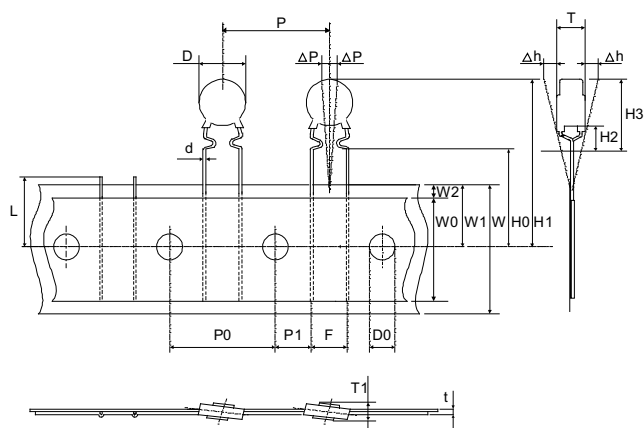
**PTC THERMISTORS ON TAPE AND REEL**


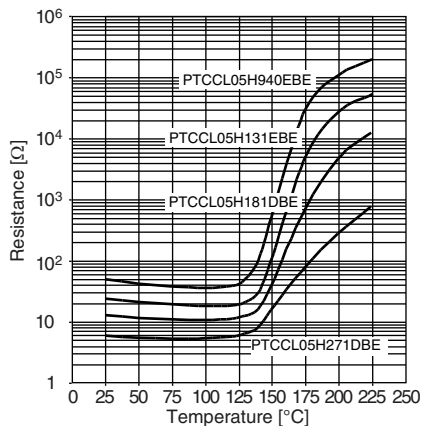
Fig. 2

**TAPE AND REEL ACCORDING TO IEC 60286-2 (in mm)**

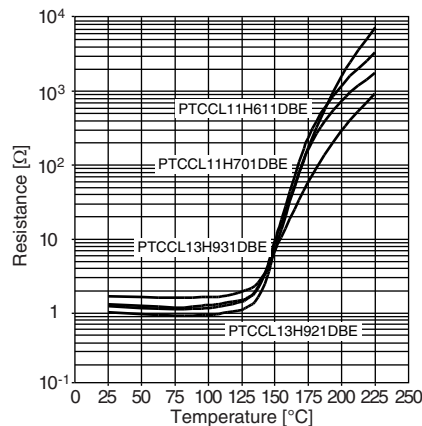
| SYMBOL         | PARAMETER                                                      | DIMENSIONS    | TOLERANCE      |
|----------------|----------------------------------------------------------------|---------------|----------------|
| D              | Body diameter                                                  | See table     | max.           |
| d              | Lead diameter                                                  | 0.6           | ± 0.05         |
| P              | Pitch of components<br>Diameter < 12 mm<br>Diameter ≥ 12 mm    | 12.7<br>25.4  | ± 1.0<br>± 2.0 |
| P <sub>0</sub> | Feedhole pitch                                                 | 12.720.385 mm | ± 0.3          |
| F              | Leadcenter to leadcenter distance (between component and tape) | 5.0           | + 0.5 / - 0.2  |
| 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 thickness                                                | 4.0           | max.           |



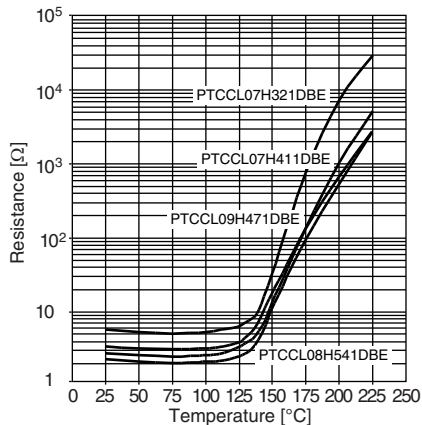
## TYPICAL RESISTANCE / TEMPERATURE CHARACTERISTIC



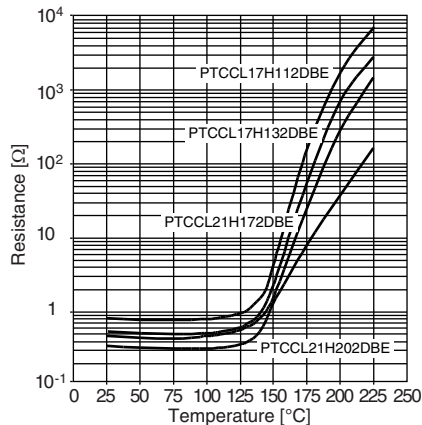
## TYPICAL RESISTANCE / TEMPERATURE CHARACTERISTIC



## TYPICAL RESISTANCE / TEMPERATURE CHARACTERISTIC



## TYPICAL RESISTANCE / TEMPERATURE CHARACTERISTIC





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