

# PTC Thermistors, Overload Protection for Telecommunication


**RoHS**  
COMPLIANT

## FEATURES

- Wide resistance range in telecom area from 4  $\Omega$  to 70  $\Omega$
- 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  $\leq$  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
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

## 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 gray coated body  
BC and  $R_{25}$  value

| QUICK REFERENCE DATA                        |              |           |
|---|--------------|-----------|
| PARAMETER                                   | VALUE        | UNIT      |
| Maximum voltage (RMS or DC)                 | 220 to 600   | $V_{RMS}$ |
| Maximum holding current ( $I_{nt}$ )        | 100 to 175   | mA        |
| Resistance at 25 °C ( $R_{25}$ )            | 8 to 50      | $\Omega$  |
| Tolerance on $R_{25}$ value                 | 15 to 25     | %         |
| Maximum overload current $I_{ol}$           | 0.6 to 10.0  | A         |
| Tripping time at 1 A                        | 1 to 40      | s         |
| Operating temperature range at max. voltage | 0 to 70 (95) | °C        |

| ELECTRICAL DATA AND ORDERING INFORMATION |          |                       |                          |                  |           |              |           |                       |                          |                      |                       |
|--|----------|-----------------------|--------------------------|------------------|-----------|--------------|-----------|-----------------------|--------------------------|----------------------|-----------------------|
| RESISTANCE                               |          | MATCHING ( $\Omega$ ) | $V_{max.}$ ( $V_{RMS}$ ) | NON-TRIP CURRENT |           | TRIP CURRENT |           | MAX. TRIP TIME at 1 A | $I_{max.}$ AT $V_{max.}$ | APPLICATION AREA (2) | ORDERING PART NUMBERS |
| $R_{25}$ ( $\Omega$ )                    | TOL. (%) |                       |                          | $I_{nt}$ (mA)    | at T (°C) | $I_t$ (mA)   | at T (°C) | $t_{max.}$ (S)        | $I_{max.}$ (A)           |                      |                       |
| 25                                       | $\pm$ 20 | 1.0                   | 220                      | 70               | 70        | 200          | 25        | 2.5                   | 4.0                      | C.O.                 | PTCTL4MR250GTE        |
| 10                                       | $\pm$ 20 | 1.0                   | 230                      | 100              | 70        | 250          | 25        | 3.0                   | 2.0                      | MDF; ISDN            | PTCTL3MR100GTE        |
| 25                                       | $\pm$ 15 | no                    | 245                      | 70               | 70        | 200          | 25        | 5.0                   | 2.6                      | C.O.                 | PTCTL4NR250GTE        |
| 16                                       | $\pm$ 20 | no                    | 245                      | 140              | 55        | 270          | 25        | 8.0                   | 1.6                      | T.E.                 | PTCTL6NR160GTE        |
| 10                                       | $\pm$ 20 | no                    | 245                      | 140              | 55        | 270          | 25        | 8.0                   | 2.0                      | T.E.                 | PTCTL6NR100GTE        |
| 25                                       | $\pm$ 20 | 1.0                   | 250                      | 70               | 70        | 175          | 25        | 1.3                   | 3.2                      | MDF; C.O.            | PTCTL3MR250HTE        |
| 10                                       | $\pm$ 20 | no                    | 250                      | 100              | 70        | 450          | 0         | 40.0                  | 10.0                     | T.E.                 | PTCTL8NR100HBE        |
| 8  | $\pm$ 25 | 0.5                   | 285                      | 135              | 95        | 400          | 25        | 6.0                   | 0.6                      | MDF; ISDN            | PTCTL4MR080JBE        |
| 16                                       | $\pm$ 25 | no                    | 300                      | 100              | 70        | 250          | 25        | 2.0                   | 2.6                      | MDF; T.E.            | PTCTL3NR160KTE        |
| 10                                       | $\pm$ 20 | no                    | 350                      | 100              | 70        | 270          | 25        | 4.0                   | 1.0                      | T.E.; S.B.           | PTCTL4NR100LBE        |
| 10                                       | $\pm$ 20 | 1.0                   | 350                      | 100              | 70        | 270          | 25        | 4.0                   | 1.0                      | C.O.                 | PTCTL4MR100LTE        |
| 50                                       | $\pm$ 20 | 1.0                   | 600                      | 50               | 70        | 140          | 25        | 1.0                   | 1.0                      | C.O.                 | PTCTL4MR500SBE        |
| 35                                       | $\pm$ 20 | 3.0                   | 600                      | 70               | 70        | 600          | 0         | 3.0                   | 1.0                      | C.O.                 | PTCTL4MR350STE        |
| 25                                       | $\pm$ 20 | 0.5                   | 600                      | 70               | 70        | 170          | 25        | 2.5                   | 2.0                      | C.O.                 | PTCTL4MR250STE        |
| 25                                       | $\pm$ 20 | 0.5                   | 600                      | 70               | 70        | 170          | 25        | 5.0                   | 2.0                      | C.O.                 | PTCTL6MR250STE        |
| 10                                       | $\pm$ 20 | 0.5                   | 600                      | 175              | 25        | 400          | 25        | 7.0                   | 1.0                      | C.O.                 | PTCTL7MR100SBE (1)    |
| 10                                       | $\pm$ 20 | no                    | 600                      | 175              | 25        | 400          | 25        | 7.0                   | 1.0                      | T.E.; S.B.           | PTCTL7NR100SBE (1)    |

### Notes

- All types pass ITU-T K20-21-45 telecommunication protection recommendation
- (1) UL 1434 approved types and compatible with UL1459 and GR1089
- (2) 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 events:

- 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 fig. 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 manufactures 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 amperes with voltages as high as 650 V<sub>RMS</sub> 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<sub>25</sub> values, which places even greater demands on the manufacture of PTC thermistors. For these applications PTC thermistors which have a R<sub>25</sub> value of 10 Ω with voltages in the 300 V<sub>RMS</sub> to 600 V<sub>RMS</sub> 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.

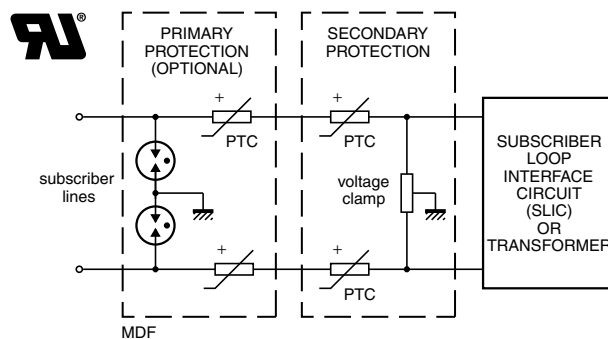
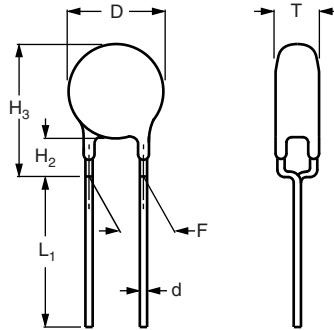


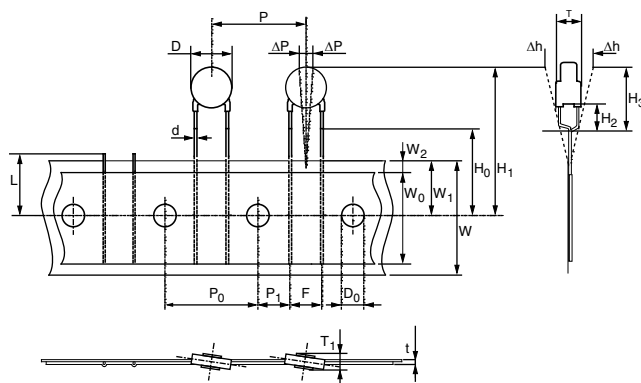
Fig. 1 - Typical telephone line showing where PTC thermistors can be used for overcurrent protection.

**PTC THERMISTORS IN BULK**


| COMPONENT DIMENSIONS (in mm) |           |                |                |                        |                |                             |      |                               |
|------------------------------|-----------|----------------|----------------|------------------------|----------------|-----------------------------|------|-------------------------------|
| D<br>MAX.                    | T<br>MAX. | H <sub>2</sub> | L <sub>1</sub> | H <sub>3</sub><br>MAX. | H <sub>0</sub> | PACKAGING <sup>(1)(2)</sup> |      | ORDERING PART<br>NUMBER       |
|                              |           |                |                |                        |                | TYPE                        | SPQ  |                               |
| 8.5                          | 5.0       | 1.5 to 3.0     | -              | 11.5                   | 16             | Taped on reel               | 1500 | PTCTL4MR250GTE                |
| 7.0                          | 4.0       | 2.0 ± 0.5      | -              | 9.8                    | 18             | Taped on reel               | 1500 | PTCTL3MR100GTE                |
| 8.3                          | 4.0       | 1.5 to 3.0     | -              | 11.0                   | 18             | Taped on reel               | 1500 | PTCTL4NR250GTE <sup>(3)</sup> |
| 11                           | 4.5       | 4.0 ± 1.0      | -              | 15.5                   | 16             | Taped on reel               | 1500 | PTCTL6NR160GTE                |
| 11                           | 4.5       | 4.0 ± 1.0      | -              | 15.5                   | 16             | Taped on reel               | 1500 | PTCTL6NR100GTE <sup>(3)</sup> |
| 7.0                          | 4.0       | 2.0 ± 0.5      | -              | 9.8                    | 18             | Taped on reel               | 1500 | PTCTL3MR250HTE                |
| 13.6                         | 6.0       | 4.0 ± 1.0      | 20 ± 4.0       | 18.6                   | -              | Bulk                        | 200  | PTCTL8NR100HBE <sup>(3)</sup> |
| 8.3                          | 5.0       | 1.5 ± 0.5      | 20 ± 3.0       | 10.3                   | -              | Bulk                        | 250  | PTCTL4MR080JBE                |
| 7.0                          | 4.0       | 2.5 ± 0.5      | -              | 10.0                   | 16             | Taped on reel               | 1500 | PTCTL3NR160KTE                |
| 8.5                          | 4.0       | 2.5 ± 0.5      | 4.1 ± 0.5      | 11.5                   | -              | Bulk                        | 500  | PTCTL4NR100LBE                |
| 8.5                          | 4.0       | 2.5 ± 0.5      | -              | 11.5                   | 16             | Taped on reel               | 1500 | PTCTL4MR100LTE                |
| 8.5                          | 4.0       | 2.5 ± 0.5      | 4.1 ± 0.5      | 11.5                   | -              | Bulk                        | 500  | PTCTL4MR500SBE                |
| 8.0                          | 5.0       | 2.5 ± 0.5      | -              | 11.0                   | 16             | Taped on reel               | 1500 | PTCTL4MR350STE                |
| 8.5                          | 4.0       | 2.0 ± 0.5      | -              | 11.0                   | 16             | Taped on reel               | 1500 | PTCTL4MR250STE                |
| 10.5                         | 5.0       | 2.0 ± 0.5      | -              | 12.6                   | 16             | Taped on reel               | 1500 | PTCTL6MR250STE                |
| 13                           | 5.5       | 4.0 ± 1.0      | 20 min.        | 18.0                   | -              | Bulk                        | 200  | PTCTL7MR100SBE                |
| 13                           | 5.5       | 4.0 ± 1.0      | 20 min.        | 18.0                   | -              | Bulk                        | 200  | PTCTL7NR100SBE                |

**Notes**

- (1) Taped in accordance with IEC 60286-2
- (2) Metallized ceramic pellet for clamping or substrate mounting, available on request
- (3) Insulated version is also available

**PTC THERMISTORS ON TAPE AND REEL**


| TAPE AND REEL ACCORDING TO<br>IEC 60286-2 (in mm) |  |            |               |
|---|--|------------|---------------|
| SYMBOL  | PARAMETER  | DIMENSIONS | TOLERANCE     |
| D   | Body diameter  | see table  | max.          |
| d   | Lead diameter  | 0.6        | ± 0.05        |
| P   | Pitch between thermistors                                      | 12.7       | ± 1           |
| P <sub>0</sub>                                    | Feedhole pitch   | 12.7       | ± 0.3         |
| F   | Leadcenter to leadcenter distance (between component and tape) | 5          | + 0.5 / - 0.2 |
| H <sub>0</sub>                                    | Lead wire clinch height  | see table  | ± 0.5         |
| H <sub>2</sub>                                    | Component bottom to seating plane                              | see table  | see table     |
| H <sub>3</sub>                                    | Component top to seating plane                                 | see table  | max.          |
| T   | Total thickness  | see table  | max.          |



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