PTC Thermistors, Overload Protection for Telecommunication

**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
- Material categorization: for definitions of compliance please see 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**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum voltage (RMS or DC)</td>
<td>220 to 600</td>
<td>V_{RMS}</td>
</tr>
<tr>
<td>Maximum holding current ($I_{th}$)</td>
<td>100 to 175</td>
<td>mA</td>
</tr>
<tr>
<td>Resistance at 25 °C ($R_{25}$)</td>
<td>8 to 50</td>
<td>Ω</td>
</tr>
<tr>
<td>Tolerance on $R_{25}$ value</td>
<td>15 to 25</td>
<td>%</td>
</tr>
<tr>
<td>Maximum overload current $I_{ol}$</td>
<td>0.6 to 10.0</td>
<td>A</td>
</tr>
<tr>
<td>Tripping time at 1 A</td>
<td>1 to 40</td>
<td>s</td>
</tr>
<tr>
<td>Operating temperature range at max. voltage</td>
<td>0 to 70 (95)</td>
<td>°C</td>
</tr>
</tbody>
</table>

**ELECTRICAL DATA AND ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>RESISTANCE ($R_{25}$)</th>
<th>TOLE. (Ω)</th>
<th>V_{max.} (V_{RMS})</th>
<th>MAX. CURRENT</th>
<th>TRIP CURRENT</th>
<th>MAX. TRIP TIME at 1 A</th>
<th>I_{max.} AT V_{max.} (A)</th>
<th>APPLICATION AREA (2)</th>
<th>ORDERING PART NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 ± 20</td>
<td>1.0</td>
<td>220</td>
<td>200</td>
<td>2.5</td>
<td>4.0</td>
<td>C.O.</td>
<td>PTCTL4MR250GTE</td>
<td></td>
</tr>
<tr>
<td>10 ± 20</td>
<td>1.0</td>
<td>230</td>
<td>250</td>
<td>3.0</td>
<td>2.0</td>
<td>MDF; ISDN</td>
<td>PTCTL3MR100GTE</td>
<td></td>
</tr>
<tr>
<td>25 ± 15</td>
<td>no</td>
<td>245</td>
<td>200</td>
<td>5.0</td>
<td>2.6</td>
<td>C.O.</td>
<td>PTCTL4MR250GTE</td>
<td></td>
</tr>
<tr>
<td>16 ± 20</td>
<td>no</td>
<td>245</td>
<td>175</td>
<td>8.0</td>
<td>1.6</td>
<td>T.E.</td>
<td>PTCTL6MR160GTE</td>
<td></td>
</tr>
<tr>
<td>10 ± 20</td>
<td>no</td>
<td>245</td>
<td>140</td>
<td>8.0</td>
<td>2.0</td>
<td>T.E.</td>
<td>PTCTL6MR100GTE</td>
<td></td>
</tr>
<tr>
<td>25 ± 20</td>
<td>1.0</td>
<td>250</td>
<td>175</td>
<td>1.3</td>
<td>3.2</td>
<td>MDF; C.O.</td>
<td>PTCTL3MR250HTE</td>
<td></td>
</tr>
<tr>
<td>10 ± 20</td>
<td>no</td>
<td>250</td>
<td>100</td>
<td>4.0</td>
<td>10.0</td>
<td>T.E.</td>
<td>PTCL6MR100HBE</td>
<td></td>
</tr>
<tr>
<td>8 ± 25</td>
<td>0.5</td>
<td>285</td>
<td>95</td>
<td>6.0</td>
<td>0.6</td>
<td>MDF; ISDN</td>
<td>PTCTL4MR080JBE</td>
<td></td>
</tr>
<tr>
<td>16 ± 25</td>
<td>no</td>
<td>300</td>
<td>100</td>
<td>4.0</td>
<td>1.0</td>
<td>M.DF; T.E.</td>
<td>PTCTL3MR160KTE</td>
<td></td>
</tr>
<tr>
<td>10 ± 20</td>
<td>no</td>
<td>350</td>
<td>70</td>
<td>4.0</td>
<td>1.0</td>
<td>T.E.; S.B.</td>
<td>PTCTL4MR100LBE</td>
<td></td>
</tr>
<tr>
<td>10 ± 20</td>
<td>1.0</td>
<td>350</td>
<td>70</td>
<td>4.0</td>
<td>1.0</td>
<td>C.O.</td>
<td>PTCTL4MR100LBE</td>
<td></td>
</tr>
<tr>
<td>50 ± 20</td>
<td>1.0</td>
<td>600</td>
<td>70</td>
<td>5.0</td>
<td>1.0</td>
<td>C.O.</td>
<td>PTCTL4MR500SBE</td>
<td></td>
</tr>
<tr>
<td>35 ± 20</td>
<td>3.0</td>
<td>600</td>
<td>70</td>
<td>3.0</td>
<td>1.0</td>
<td>C.O.</td>
<td>PTCTL4MR350SBE</td>
<td></td>
</tr>
<tr>
<td>25 ± 20</td>
<td>0.5</td>
<td>600</td>
<td>70</td>
<td>2.5</td>
<td>2.0</td>
<td>C.O.</td>
<td>PTCTL4MR250STE</td>
<td></td>
</tr>
<tr>
<td>25 ± 20</td>
<td>0.5</td>
<td>600</td>
<td>70</td>
<td>5.0</td>
<td>2.0</td>
<td>C.O.</td>
<td>PTCTL6MR250STE</td>
<td></td>
</tr>
<tr>
<td>10 ± 20</td>
<td>0.5</td>
<td>600</td>
<td>175</td>
<td>7.0</td>
<td>1.0</td>
<td>C.O.</td>
<td>PTCTL7MR100SBE (1)</td>
<td></td>
</tr>
<tr>
<td>10 ± 20</td>
<td>no</td>
<td>600</td>
<td>175</td>
<td>7.0</td>
<td>1.0</td>
<td>T.E.; S.B.</td>
<td>PTCTL7MR100SBE (1)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**
- All types pass ITU-T K20-21-45 telecommunication protection recommendation
- UL 1434 approved types and compatible with UL1459 and GR1089

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

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For technical questions, contact: nlr@vishay.com

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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 fulfill 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 amperes with voltages as high as $650 \text{ V}_{\text{RMS}}$ can be present for several seconds.

For standard high voltage applications, resistance values from 25 $\Omega$ to 50 $\Omega$ 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 $\Omega$ with voltages in the 300 $V_{\text{RMS}}$ to 600 $V_{\text{RMS}}$ 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.

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

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 IEC 60286-2 (in mm)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>DIMENSIONS</th>
<th>TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Body diameter</td>
<td>see table max.</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Lead diameter</td>
<td>0.6</td>
<td>± 0.05</td>
</tr>
<tr>
<td>P</td>
<td>Pitch between thermistors</td>
<td>12.7</td>
<td>± 1</td>
</tr>
<tr>
<td>P₀</td>
<td>Feedhole pitch</td>
<td>12.7</td>
<td>± 0.3</td>
</tr>
<tr>
<td>F</td>
<td>Leadcenter to leadcenter distance (between component and tape)</td>
<td>5</td>
<td>± 0.5 / - 0.2</td>
</tr>
<tr>
<td>H₀</td>
<td>Lead wire clinch height</td>
<td>see table</td>
<td>± 0.5</td>
</tr>
<tr>
<td>H₂</td>
<td>Component bottom to seating plane</td>
<td>see table</td>
<td>see table</td>
</tr>
<tr>
<td>H₃</td>
<td>Component top to seating plane</td>
<td>see table</td>
<td>max.</td>
</tr>
<tr>
<td>T</td>
<td>Total thinkness</td>
<td>see table</td>
<td>max.</td>
</tr>
</tbody>
</table>
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