Bourns® Polymeric Thermal Cutoff (P-TCO) Devices

NEW PRODUCT BRIEF

Thermal Protection for Charging Cables

INTRODUCTION
The new family of Bourns® Polymeric Thermal Cutoff (P-TCO) devices are designed to protect USB Type-C connectors and other charging cables from destructive and potentially dangerous thermal runaway events. Available in EIA 1210 and 1206 size SMD footprints (P-TCO-U and P-TCO-N series, respectively), the P-TCO product family provides effective overtemperature protection from heat generated in charging cable connectors due to unintended faults within the connector circuitry.

PRODUCT FIT
As connectors get smaller, their pin-to-pin spacing also shrinks. The USB-C connector features 24 pins in a smaller form factor than previous USB designs, yet it is capable of delivering up to 100 W of power. There are clear benefits to these enhanced features and capabilities, but a notable downside of this combination of increased power and extremely tight pin spacing is a heightened concern about safety hazards due to a greater possibility of thermal runaway events triggered by foreign debris entering the connector and causing a short. These faults can generate a tremendous amount of heat that can harm not only the charging cable and connector, but also the devices they charge or even the people using them. The new P-TCO model family from Bourns offers an ideal combination of compact, and ultra-low resistance thermal protection to guard against such thermal runaway events. Each P-TCO series has a 12 V maximum operating voltage rating, a 50 A maximum operating current rating, and comes in three different models designed to provide protection for unique temperature-current combinations.

APPLICATIONS
With the new Bourns® P-TCO-U & P-TCO-N model families, Bourns continues to expand its world class circuit protection product offering to address an increasing number of high-power charging cable applications where effective overtemperature protection and resettable functionality are essential. Typical applications include, but are not limited to:
- USB Type-C cable configurations:
  - USB-C to C cables
  - USB-C to B cables
  - USB-C to A cables
- USB 3.2, 3.1, 3.0 and 2.0 protocols
- Other charging cables

FEATURES
- Resettable thermal sensor for overtemperature & overcurrent protection
- Thermal cutoff temperatures from 75 °C to 100 °C
- Ultra-low resistance
- Up to 4.5 A $I_{\text{hold}}$ Current rating
- Up to 12 VDC / 50 A maximum rating
- EIA 1210 & 1206 surface mount footprints
- Tape & reel packaging for automated assembly
- UL & TÜV agency listed
- RoHS compliant*, halogen free**

BENEFITS
- High current, high voltage, and high breaking capacity performance in a compact space-saving design
- High power density compared to other models in similar or larger sizes
- Supported by Bourns’ world-class technical support and global supply chain
- For more information, please see the USB-C Application Note

USB TYPE-C PIN CONFIGURATION


** Bourns considers a product to be “halogen free” if (a) the Bromine (Br) content is 900 ppm or less; (b) the Chlorine (Cl) content is 900 ppm or less; and (c) the total Bromine (Br) and Chlorine (Cl) content is 1500 ppm or less.
**HOW P-TCO DEVICES WORK**

Bourns® P-TCO devices are specifically calibrated to trip and go into a highly resistive state when the application’s ambient temperature exceeds the desired upper limit.

### P-TCO RESISTANCE TEMPERATURE CURVE & TIME-TEMPERATURE-TRANSFORMATION

#### Energized method (12 V / 3 A)

<table>
<thead>
<tr>
<th>Resistance (ohms)</th>
<th>Temperature (°C)</th>
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<tbody>
<tr>
<td>1.00E+00</td>
<td>40</td>
</tr>
<tr>
<td>1.00E+01</td>
<td>80</td>
</tr>
<tr>
<td>1.00E+02</td>
<td>120</td>
</tr>
<tr>
<td>1.00E+03</td>
<td>160</td>
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<tr>
<td>1.00E+04</td>
<td>200</td>
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</tbody>
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#### Time to Trip (Seconds)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Photo</th>
<th>Marking</th>
<th>Vmax (Vdc)</th>
<th>Imax (A)</th>
<th>R1 min. (Ω)</th>
<th>R1 max. (Ω)</th>
<th>Current (A)</th>
<th>Time (Sec.)</th>
<th>at 3 A (°C)</th>
<th>at 2 A (°C)</th>
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</thead>
<tbody>
<tr>
<td>P-TCO-N350/12</td>
<td>S12</td>
<td>3.50</td>
<td>12</td>
<td>50</td>
<td>0.002</td>
<td>0.022</td>
<td>8.00</td>
<td>5.00</td>
<td>75 ± 20</td>
<td>90 ± 15</td>
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<tr>
<td>P-TCO-N400/12</td>
<td>U12</td>
<td>4.00</td>
<td>12</td>
<td>50</td>
<td>0.002</td>
<td>0.018</td>
<td>10.00</td>
<td>5.00</td>
<td>80 ± 15</td>
<td>95 ± 15</td>
</tr>
<tr>
<td>P-TCO-N450/12</td>
<td>X12</td>
<td>4.50</td>
<td>12</td>
<td>50</td>
<td>0.002</td>
<td>0.014</td>
<td>22.50</td>
<td>2.00</td>
<td>85 ± 15</td>
<td>100 ± 10</td>
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<td>12</td>
<td>50</td>
<td>0.002</td>
<td>0.022</td>
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