INTRODUCTION

The potential dangers of lithium-ion batteries have become headline news in recent times. Battery problems in some smart phones, hoverboards and notebooks have highlighted that even the largest of companies may see problems with lithium-ion batteries. Lithium-ion based batteries hold many advantages over competing technologies, with cost being one of the primary advantages. As lithium-ion batteries continue to grow in popularity, they will enjoy further cost reductions because of the economies of scale as they are used in more large applications such as electric vehicles and stationary storage systems. However, the need for protection circuits to maintain the voltage and current within safe limits is one of the primary limitations of the lithium-ion battery.

One of the latest approaches for providing a safety circuit to lithium-ion battery packs is the use of the Bourns® Mini-breaker, which is a resettable Thermal Cutoff (TCO) device designed to provide accurate and repeatable overcurrent and overtemperature protection.

The Bourns® Mini-breaker is a combination of two common circuit protection technologies; a PTC and a bimetal switch, providing several advantages over either technology on its own. The skills developed by Bourns over 70 years in precision metal stamping, plastic injection molding and high-end assembly turn these ubiquitous technologies into a market-leading circuit protection solution. The figure below provides a simple schematic of how the mini-breaker is constructed. The two terminals (arm terminal and base terminal), are connected in a normally closed position to allow current to flow through the device. Naturally, the contact point between both terminals provides a critical function and a testament to the high precision of the Bourns® Mini-breaker is that the contact resistance is as low as 2 mΩ (max.) in some model families.

TYPICAL PART MARKING

- Series Designator
- Trip Temperature (±5 °C)
- Arm Material
  - A = Cu Alloy High Current Type
  - C = Cu Alloy Low Current Type
- Terminal Type
  - 1 = With Projection
  - B = Without Projection
- Manufacturer’s Internal Code

In the normal condition, current flows through the arm terminal, down through the very low resistance contact point and out through the base terminal. The key to any battery application is low resistance; hence, the contact resistance between the arm terminal and base terminal is a feature advantage that Bourns has integrated into all of our mini-breaker products.
The mini-breaker can be triggered by either an increase in the environmental temperature or by excessive current flow. Once the trip temperature has been reached, the bimetal disc heats and flexes, causing the arm to open. If the mini-breaker only used a bimetal disc for its protection, the arm would quickly close as the temperature cooled. However, key to the mini-breaker’s design is the PTC that operates in parallel with the arm terminal. When the bimetal disc causes the arm to open, current flows through the bimetal disc and into the PTC. This current causes the PTC to act like a current limiting heater, which provides sufficient heat to keep the bimetal disc flexed and the arm open. The combination of the bimetal disc and the PTC prevents oscillating opening and closing of the mini-breaker arm. Instead, this design allows the arm to remain open until a lower and safer temperature level of between 40 °C and 10 °C below the lower specification limit of the mini-breaker is reached, at which point the arm will reset. As part of UL 60730 testing, Bourns® mini-breakers are tested up to 6000 cycles of this opening and closing mechanism.
MINI-BREAKER EVOLUTION

Mini-breaker TCO devices come in two distinct formats:

- Axial leaded packaging
- Surface mount packaging

The axial leaded models are the most common mini-breaker TCOs on the market. They are almost exclusively used in lithium-ion battery packs and are welded into place using secondary nickel tabs. The Bourns® Model HC Series is one of the most popular models of this type on the market.

Bourns offers three evolutionary Mini-Breaker Series types:

1. **Higher Currents** – As higher current density batteries grow in popularity, whether for electric vehicles, home energy storage or electric bicycles, mini-breakers are being tasked to handle higher currents. This trend has led to the Bourns® Model AC series, which can operate up to 18 A at 60 °C with future devices in development featuring even higher current-handling capabilities.

2. **Smaller Footprints** – Portable electronics continue to shrink in footprint and thickness. Electronics have become wearable and are now in intimate contact with the human body. This has led to a need for greater levels of safety and smaller sizes. Bourns introduced the Model NR series, one of the smallest mini-breakers on the market. This is an ongoing trend, and Bourns will continue to develop smaller-size mini-breaker models without sacrificing performance.

3. **Surface Mount** – Mini-breakers are traditionally resistance welded into the battery pack. However, this has limited its uses in other applications. The Bourns® Model SA Series is the industry’s first surface mount mini-breaker. This TCO series expands usage into markets such as USB cables, automotive and consumer board electronics. The demand for these surface mount devices is a result of the combination of the higher current and smaller footprint trends mentioned above where they will need to hold greater levels of current and shrink in size.
APPLICATIONS FOR MINI-BREAKERS

Mini-breakers typically come in an axial leaded format to allow the device to be welded to the terminals of the battery cells. The battery cell terminals are made from aluminum tabs and the mini-breakers are usually welded to nickel tabs before those nickel tabs are welded to the battery cell terminals. The advantage of welding the mini-breakers close to the battery tabs is that the mini-breakers can be situated in intimate contact with the individual battery cells and can react quickly to any unusual rises in cell temperature.

Today, mini-breakers are commonly used to protect the battery cells of notebook PCs, tablet computers, smart phones and digital cameras. As each battery pack is customized to fit the limited space within the portable electronic device, the mini-breaker is welded to nickel tabs of various sizes and formats.

BATTERY PROTECTION FOR:

- Notebook Computers
- PCs
- Tablet Computers
- Smart Phones
- Portable Electronics
- Digital Cameras
### FEATURES
- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options

### APPLICATIONS
- Battery cell protection for:
  - Notebook PCs
  - Tablet PCs
  - Smart Phones

### AA Series – Very High Current Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA72AB0</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
<tr>
<td>AA77AB0</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
<tr>
<td>AA82AB0</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
<tr>
<td>AA85AB0</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
</tbody>
</table>

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips.

High Current Series

FEATURES
• High current capacity, low impedance
• Overtemperature and overcurrent protection for lithium polymer and prismatic cells
• Controls abnormal, excessive current virtually instantaneously, up to rated limits
• Wide range of temperature options

APPLICATIONS
Battery cell protection for:
• Notebook PCs
• Gaming PCs
• Tablet PCs
• Smart Phones

AC Series – Very High Current Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC72ABD</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A,100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
<tr>
<td>AC77ABD</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
<tr>
<td>AC82ABD</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
<tr>
<td>AC85ABD</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
<tr>
<td>AC90ABD</td>
<td>90 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A, 100 cycles</td>
<td>DC28 V / 35 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>2 milliohms max.</td>
</tr>
</tbody>
</table>

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips.

**FEATURES**
- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options

**APPLICATIONS**
Battery cell protection for:
- Notebook PCs
- Tablet PCs
- Smart Phones

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**CB Series – Miniature Package/High Current Series**

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB72ABB</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 50 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>CB72A1B</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>CB77ABB</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 50 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>CB77A1B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CB82ABB</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 50 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>CB82A1B</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CB85ABB</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 50 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
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<tr>
<td>CB85A1B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


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**Ambient Temperature Impact on Mini-breaker Operating Currents**

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips.
**LITHIUM-ION CELL FUNCTIONALITY**

The basic function of the lithium-ion cell is to transform chemical energy into electricity. The individual lithium-ion cell is comprised of an intercalating lithium compound cathode, a carbon based (typically graphite) anode, as well as a liquated or gel type electrolyte with lithium salts through which ions travel, and a polymer separator to act as an internal insulator to the electrons.

The use of the two intercalation electrodes has led to the lithium-ion batteries being called “rocking-chair” batteries as ions shuttle back and forth between the electrodes and through the electrolyte in a lithiation/delithiation process. The separator plays a critical role in cell safety by ensuring there is no physical contact between the cathode and anode.

**POTENTIAL LITHIUM-ION CELL HAZARDS**

While separators have evolved from simple single layer sheets to multilayer sheets with shutdown features, they alone cannot ensure complete cell safety. The lithium-ion cell is constructed with materials that are flammable and degradable and mechanical and electrical shocks can lead to thermal runaway. The lithium-ion cell materials that are stable at lower temperatures start to breakdown when the temperature exceeds 130 °C.

If a cell starts to enter thermal runaway, the results can be catastrophic as seen in various news reports in recent years. Thermal runaway in a lithium-ion cell is a highly exothermic, self-propagating process that results in the venting of toxic and highly flammable gases and releases significant energy in the form of heat greater than 1000 °C. Some of the newest smartphones on the market now use multiple cells so the risk becomes even greater as the failure can potentially daisy chain from one cell failure to the next.

**LITHIUM-ION CELL SAFETY**

In light of such obvious hazards, cell designers take a multi-layer approach to protecting against various potential hazards. Individual cells require mechanical, electrical and thermal protection and this becomes more complicated when cells get networked into various battery pack arrangements. There are numerous standards that help govern battery pack safety but for rechargeable batteries in smartphones, the IEEE 1725 standard (IEEE Standard for Rechargeable Batteries for Cellular Telephones) is a solid starting point.

This standard and the standards it references has helped guide designers into taking a layered approach to battery protection with multiple levels of redundancy being built into a pack. An integral part of maximizing battery pack efficiency and safe operation is the Battery Management System (BMS) that uses various primary and secondary protection devices as well as software and hardware elements to manage the state of charge, current, voltage and ambient battery temperatures. Mini-breaker Thermal Cutoff (TCO) devices are key elements in the protection architecture that is being increasingly used in lithium-ion battery cell arrangements.

**LITHIUM-ION POUCH TYPE CELLS**

While lithium-ion pouch cells boast many desirable features such as low cost, ease of large scale manufacturing, lighter non-universal sizes and high-energy densities, the technology still has the same limitations of other types of lithium-ion cells. The requirement for protection circuits to maintain the voltage and current within safe limits is one of the primary limitations of a lithium-ion battery. The soft foil cell design also adds a further disadvantage, causing the cells to visibly inflate (sometimes called pillowing) during over-charge because of internal delamination.

One of the latest approaches for providing a safety circuit to lithium-ion battery packs is the use of the miniature resetting Thermal Cutoff devices (TCOs). TCO devices are designed to provide accurate and repeatable overcurrent and overtemperature protection.
High Current Series

**FEATURES**
- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options

**APPLICATIONS**
Battery cell protection for:
- Notebook PCs
- Tablet PCs
- Smart Phones
- Mobile Phones

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**HC Series – Standard Package / High Current Series**

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC72AY-1</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 80 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>HC77AY-1</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 80 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>HC82AY-1</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 80 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>HC85AY-1</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 80 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>HC90AY-1</td>
<td>90 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 80 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
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</tbody>
</table>

**Ambient Temperature Impact on Mini-breaker Operating Currents**

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips.

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High Current Series

**FEATURES**
- High current capacity, low impedance
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options

**APPLICATIONS**
Battery cell protection for:
- Notebook PCs
- Tablet PCs
- Smart Phones

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**NRxxA Series – Miniature Package / High Current Series**

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR72AB0</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DCS V / 60 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>NR77AB0</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DCS V / 60 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>NR82AB0</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DCS V / 60 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
<tr>
<td>NR85AB0</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DCS V / 60 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
</tr>
</tbody>
</table>

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**Dimensions**

Low Current Series

**FEATURES**
- Low current capacity type
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options

**APPLICATIONS**
- Battery cell protection for:
  - Notebook PCs
  - Tablet PCs
  - Smart Phones
  - Mobile Phones

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### LC Series – Standard Package / Low Current Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC72AY-1</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 40 A, 100 cycles</td>
<td>DC28 V / 5 A, 100 cycles</td>
<td>150 mA max. @ 25 °C</td>
<td>10 ± 5 milliohms max.</td>
</tr>
<tr>
<td>LC77AY-1</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 40 A, 100 cycles</td>
<td>DC28 V / 5 A, 100 cycles</td>
<td>150 mA max. @ 25 °C</td>
<td>10 ± 5 milliohms max.</td>
</tr>
<tr>
<td>LC82AY-1</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 40 A, 100 cycles</td>
<td>DC28 V / 5 A, 100 cycles</td>
<td>150 mA max. @ 25 °C</td>
<td>10 ± 5 milliohms max.</td>
</tr>
<tr>
<td>LC85AY-1</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 40 A, 100 cycles</td>
<td>DC28 V / 5 A, 100 cycles</td>
<td>150 mA max. @ 25 °C</td>
<td>10 ± 5 milliohms max.</td>
</tr>
</tbody>
</table>

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**Ambient Temperature Impact on Mini-breaker Operating Currents**

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips.

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**Dimensions**

- Dimensions (inches): 0.15 ± 0.004

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Low Current Series

FEATURES
- Low current capacity type
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options

APPLICATIONS
Battery cell protection for:
- Notebook PCs
- Tablet PCs
- Smart Phones

NRxxC Series – Miniature Package / Low Current Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
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<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 30 A, 100 cycles</td>
<td>DC28 V / 12 A, 100 cycles</td>
<td>150 mA max. @ 25 °C</td>
<td>15 milliohms max.</td>
</tr>
<tr>
<td>NR77CB0</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 30 A, 100 cycles</td>
<td>DC28 V / 12 A, 100 cycles</td>
<td>150 mA max. @ 25 °C</td>
<td>15 milliohms max.</td>
</tr>
<tr>
<td>NR82CB0</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 30 A, 100 cycles</td>
<td>DC28 V / 12 A, 100 cycles</td>
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<tr>
<td>NR85CB0</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 30 A, 100 cycles</td>
<td>DC28 V / 12 A, 100 cycles</td>
<td>150 mA max. @ 25 °C</td>
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</tr>
</tbody>
</table>

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Surface Mount Series

FEATURES
- Surface mount
- Overtemperature and overcurrent protection for lithium polymer and prismatic cells
- Controls abnormal, excessive current virtually instantaneously, up to rated limits
- Wide range of temperature options

APPLICATIONS
- Battery cell protection for:
  - Notebook PCs
  - Tablet PCs
  - Smart Phones
  - USB Cable Protection for Smart Phones

SA Series – Surface Mount

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA72SB0</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A,100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>7 milliohms max.</td>
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<tr>
<td>SA77SB0</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A,100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>7 milliohms max.</td>
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<tr>
<td>SA82SB0</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A,100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>7 milliohms max.</td>
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<tr>
<td>SA85SB0</td>
<td>85 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 60 A,100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>7 milliohms max.</td>
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<tr>
<td>SA72CB0</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DC5 V / 30 A,100 cycles</td>
<td>DC28 V / 12 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>15 milliohms max.</td>
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<td>DC5 V / 30 A,100 cycles</td>
<td>DC28 V / 12 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
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</tbody>
</table>

Product Structure

Dimensions

Ambient Temperature Impact on Mini-breaker Operating Currents

The above curves were derived from placing test samples in an oven at 25 °C, 40 °C, 60 °C and 70 °C, increasing current flow through the sample at a rate of 0.1 A/minute and recording the current value when the sample trips.

Surface Mount Series

FEATURES
• Surface mount
• Overtemperature and overcurrent protection for lithium polymer and prismatic cells
• Controls abnormal, excessive current virtually instantaneously, up to rated limits
• Wide range of temperature options

APPLICATIONS
Battery cell protection for:
• Notebook PCs
• Tablet PCs
• Smart Phones
• USB Cable Protection for Smart Phones

SC Series – Surface Mount / High Current Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Trip Temperature</th>
<th>Reset Temperature</th>
<th>Maximum Breaking Current</th>
<th>Maximum Voltage</th>
<th>Maximum Leakage Current</th>
<th>Resistance</th>
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<tbody>
<tr>
<td>SC72AAA</td>
<td>72 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DCS V / 50 A, 100 cycles</td>
<td>DC28 V / 25 A, 100 cycles</td>
<td>200 mA max. @ 25 °C</td>
<td>5 milliohms max.</td>
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<tr>
<td>SC72AAB</td>
<td>SC77AAA</td>
<td>77 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DCS V / 50 A, 100 cycles</td>
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<td>SC77AAB</td>
<td>82 °C ± 5 °C</td>
<td>40 °C min.</td>
<td>DCS V / 50 A, 100 cycles</td>
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Ambient Temperature Impact on Mini-breaker Operating Currents

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Worldwide Sales Offices

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Phone</th>
<th>Email</th>
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<tbody>
<tr>
<td>Americas</td>
<td>+1-951-781-5500</td>
<td><a href="mailto:americus@bourns.com">americus@bourns.com</a></td>
</tr>
<tr>
<td>Brazil</td>
<td>+55 11 5505 0601</td>
<td><a href="mailto:americus@bourns.com">americus@bourns.com</a></td>
</tr>
<tr>
<td>China</td>
<td>+86 21 64821250</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Europe, Middle East, Africa</td>
<td>+36 88 520 390</td>
<td><a href="mailto:eurocus@bourns.com">eurocus@bourns.com</a></td>
</tr>
<tr>
<td>Japan</td>
<td>+81 49 269 3204</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Korea</td>
<td>+82 70 4036 7730</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Singapore</td>
<td>+65 6348 7227</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Taiwan</td>
<td>+886 2 25624117</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
</tr>
<tr>
<td>Other Asia-Pacific Countries</td>
<td>+886 2 25624117</td>
<td><a href="mailto:asiacus@bourns.com">asiacus@bourns.com</a></td>
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<table>
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<td>+886 2 25624117</td>
<td><a href="mailto:techweb@bourns.com">techweb@bourns.com</a></td>
</tr>
<tr>
<td>Europe, Middle East, Africa</td>
<td>+36 88 520 390</td>
<td><a href="mailto:eurotech@bourns.com">eurotech@bourns.com</a></td>
</tr>
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<td>Americas</td>
<td>+1-951-781-5500</td>
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</tr>
<tr>
<td>BOURNS KK</td>
<td>+816 4790 8211</td>
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Specifications subject to change without notice. Actual performance in specific customer applications may differ due to the influence of other variables. Customers should verify actual device performance in their specific applications.