

A Simplified Overtemperature Protection Solution for Wireless Charging Coils

WHITE PAPER



Bourns® SW Series Mini-breakers

INTRODUCTION

In our homes, cars, or even at our local coffee house, the ease and simplicity of wireless charging is a welcome convenience. Removing the need to constantly have a selection of different charging cables on hand makes wireless charging a convenient and increasingly popular way to power our devices. Unfortunately, wireless charging coils can overheat if they are not properly protected.

For all of its convenience, wireless charging is not a very efficient way to transfer energy. The energy loss with this charging method gets converted to heat, and if that heat is not properly managed, there is the potential for dangerous or destructive consequences. Devices that utilize wireless charging such as smartphones, fitness trackers, watches, True Wireless Stereo (TWS) headphones and earphones are all susceptible to overheating if their wireless charging coils malfunction. Such overheating can impact the internal lithium-ion battery cells in these devices in the form of a thermal runaway condition that can lead to catastrophic failure.

This white paper introduces a simplified solution to protect wireless charging coils. It will outline the benefits of incorporating Mini-breaker Thermal Cutoff (TCO) devices into these designs and provide a brief overview of their construction and protection functionality.

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EFFECTIVE WIRELESS CHARGING COIL PROTECTION

Wireless charging coils do not usually have direct overtemperature protection. Instead, some devices use temperature monitoring. This monitoring comes in the form of a temperature sensor such as an NTC thermistor. These solutions can be slow, inaccurate and depend on ancillary electronics to control the circuit.

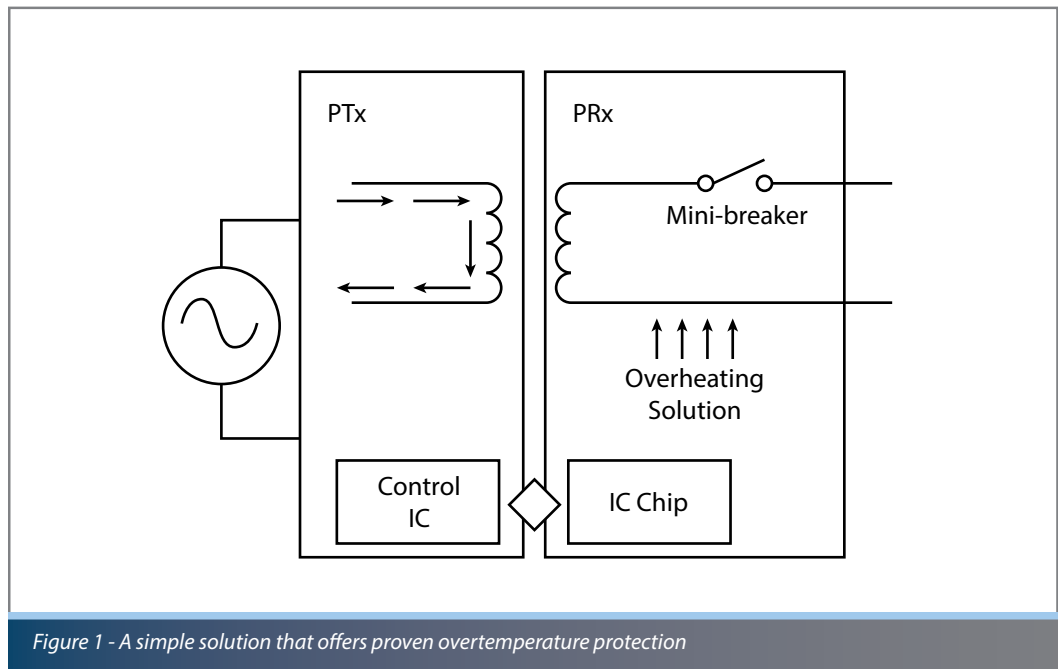


Figure 1 - A simple solution that offers proven overtemperature protection

A simple solution that offers proven overtemperature protection is the use of a Mini-breaker device. A Mini-breaker is a small, inexpensive device that can be mounted in very close proximity to the wireless charging coil and is designed to quickly react to an overheating situation.

A Mini-breaker is a type of circuit breaker that works by interrupting the flow of electricity if the temperature exceeds a certain level. The Mini-breaker can be triggered from either an increase in the environmental temperature or from excessive current flow. Once the trip temperature has been reached, the Mini-breaker's internal bimetal mechanism triggers at a precise temperature value. This helps to prevent the wireless charging coils from generating excessive heat.

Immediately cutting the power within the charging coils results in rapid cooling which helps to greatly reduce the risk of heat spreading to the vulnerable lithium-ion battery cell.

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MINI-BREAKER PROTECTION BENEFITS

Mini-breaker overtemperature devices offer a range of benefits when used to protect wireless charging coils:

- **Overheating:** A Mini-breaker can help to prevent wireless charging coils from overheating by interrupting the flow of electricity if the temperature exceeds a certain level. This can help to prevent damage to the coils and can also prevent the contagion effect of overheating the lithium-ion cells.
- **Coil Lifespan:** Overheating can shorten the lifespan of wireless charging coils. By using a Mini-breaker to help prevent overheating, this also contributes to extending coil life.
- **Brand Value:** Improving the reliability of the charging coils also influences a company's overall brand quality as warranty returns are reduced.

SURFACE MOUNT SPACE AND ASSEMBLY GAINS

Reducing the number of parts that require special handling can positively influence assembly steps in the manufacturing of any application. Selecting smaller, surface mount components can deliver significant space and weight savings of 50 - 66 percent. Not only does this save space, it also reduces the parasitics and electronic noise introduced by the package, which solves a key issue in compact designs such as in wireless charging coils.

Bourns® Model SW Mini-breaker

Bourns recently announced its smallest surface mount Mini-breaker TCO device. Ultra-compact, it has a 4.7 mm x 2.8 mm footprint with a height of just 0.94 mm. Designed to control abnormal, excessive current virtually instantaneously up to rated limits, Bourns® Mini-breakers are proven overtemperature protection solutions, and the miniature size and features of the Model SW Mini-breaker make it ideal for wireless charging coils as well as other lower current applications. The use of a small, independently triggered Mini-breaker devices helps users to safely enjoy the convenience of wireless charging devices.

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