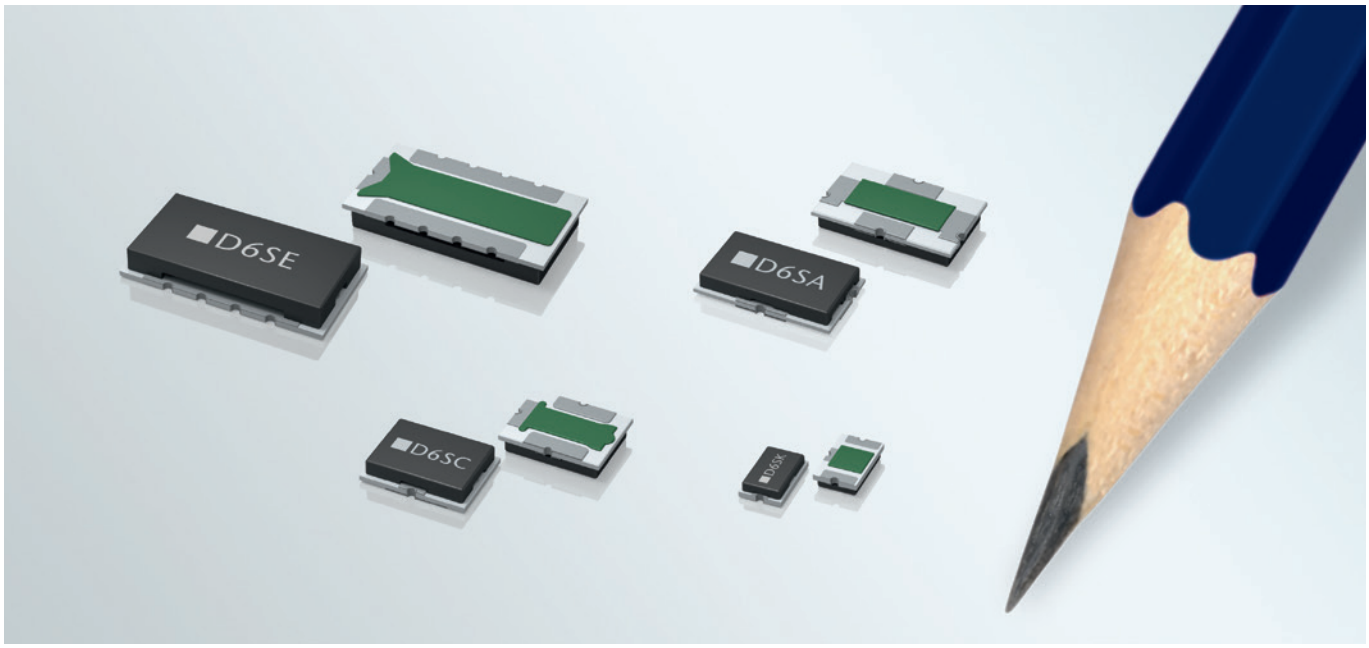

TOP TIPS

SELECTING BATTERY FUSES FOR LITHIUM BATTERY PACKS

Battery fuses are designed to protect Lithium-ion (Li-ion) batteries from potentially damaging and dangerous overcurrent and overcharging events. The devices safeguard components, equipment, and people from risk of fire and electric shock.

Overcurrent protection can be achieved by using current fuses or battery fuses. Current fuses protect against overcurrent. On the other hand, a battery fuse is used in a Battery Management System (BMS) as a secondary protection element. In case overcurrent occurs while using the device, the fuse element will open and cut off the circuit. In case of overcharging, an external field effect transistor (FET) can be activated by the secondary protection IC and trigger the heater element to disable the fuse element.

1 Set your priorities.

Safety is the top priority for electronic devices, battery-powered tools, and vehicles. This has led to increased demand for highly reliable battery fuses. These components are designed to protect Li-ion batteries from potentially damaging and dangerous overcurrent and overcharging circumstances. At the same time, surface-mount design is required in terms of workability.

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2 Know your application.

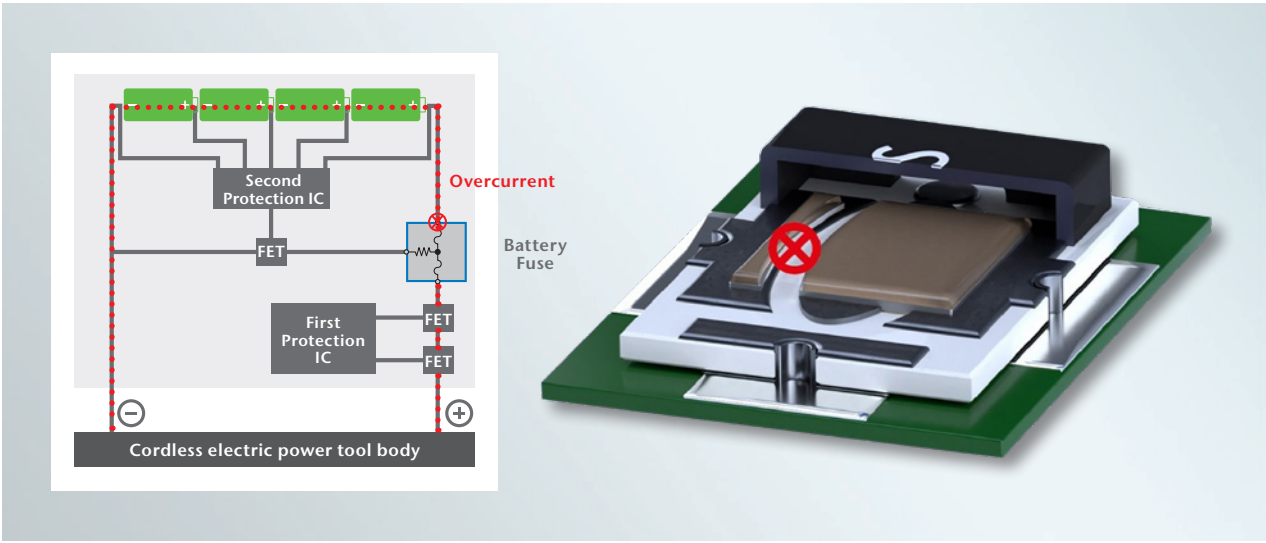
Different applications require different degrees of protection. Lithium batteries, in particular, need special protection. Control circuits keep them within their voltage, current, and temperature operating limits. For example, in the rechargeable power/garden tool industry, the battery packs involve high current, which must be considered.

Li-ion battery packs typically consist of the battery cells and a BMS. State-of-the-art BMSs include primary and secondary protection circuitry and a battery protection fuse.

The primary protection IC measures the voltage on the cells and the current going in and out of the battery. If any of these metrics are outside the prescribed range, the first protection IC will send a signal to the FETs to turn the circuit off. In case the first battery protection IC doesn't function properly, a secondary protection device, such as a battery fuse, receives a signal of overcharge from a second battery protection IC or opens the circuit in case of an overcurrent event.

The design and functionality of the battery fuse protect Li-ion batteries from potentially damaging and dangerous overcurrent and overcharging circumstances. In case overcurrent occurs while using the device, the fuse element will open and cut off the circuit. In case of overcharging, an FET is activated, and the heater element disables the fuse element, resulting in the circuit being cut off.

3 Protect against overcurrent.



Battery fuses, such as the SCHOTT SEFUSE® battery fuse, incorporate a fuse element that opens and cuts off the circuit in case overcurrent occurs.

The most fundamental requirement in any electrical system is proper overcurrent protection of conductors and equipment. An overcurrent protection device safeguards the circuit by opening the device when the current reaches a value that will cause an excessive or dangerous temperature rise in conductors.

In case overcurrent occurs while using the device, the fuse element will open and cut off the circuit. There are two types of overcurrent events--overload, which is drawing excessive current beyond the designed capacity of the circuit, and short-circuit.

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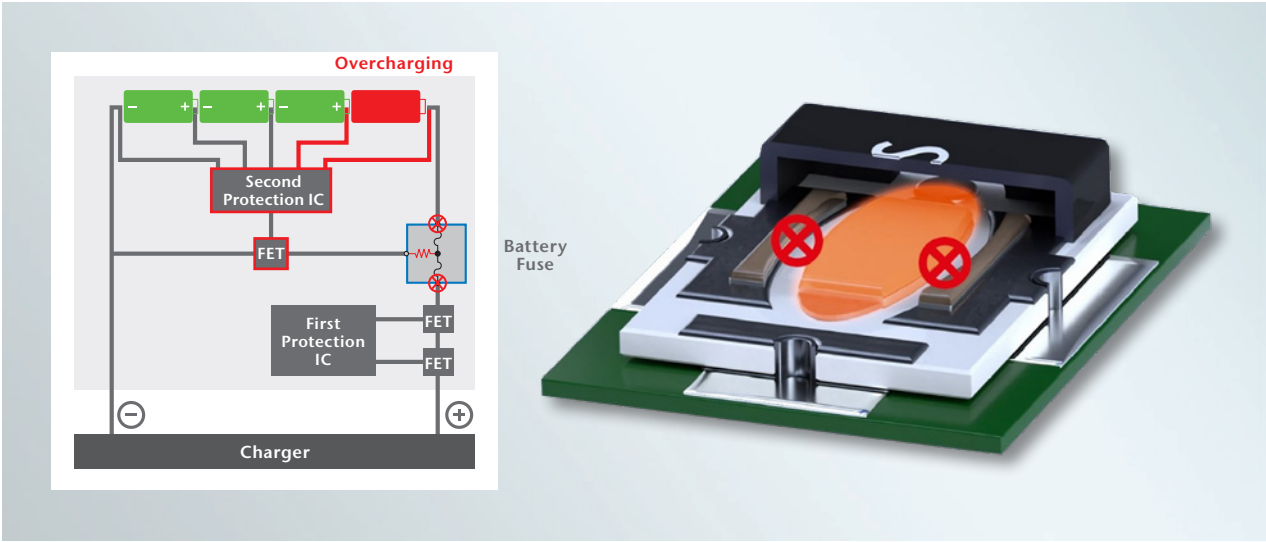
4 Consider the issue of overcharging.



In the event of overcharging, an FET is activated, and the heater element disables the fuse element, subsequently cutting off the circuit.

Overcharging severely reduces battery life and is potentially dangerous. This causes overheating, potentially leading to an explosion due to outgassing of the electrolyte. As a result, battery makers need suitable safety systems to prevent this.

Overcharge protection in a fuse device prevents overcharging of batteries by disconnecting it from the power source. In case of overcharging, the secondary protection IC detects the voltage increase of the affected cell and activates an external FET. This FET turns on the heater element, which will subsequently trigger the fuse and cut off the circuit.

5 Understand safety standards.

The circuit designer must consider that meeting various safety standards for Li-ion batteries may be required. For example, the IEC standard for Li-ion batteries requires an external short-circuit test with one protective device disabled (single fault conditions). In addition, the IEC standard for rechargeable power tools requires the charging system to be permanently disabled if the cell voltage does not meet the required specifications during Li-ion battery charging tests under abnormal conditions. In both cases, the addition of a secondary protection device can satisfy these requirements, with battery fuses being the ideal choice to fulfill them.

6 Keep up to date on battery cell advancements.

Researchers continue to investigate the fundamentals of Li-ion battery technology with the goal of achieving both safe and more energy-dense cells. Recent developments have significantly improved the latest Li-ion cells, allowing the use of a higher charging current without raising the internal temperature. However, there is still a risk in overcharging, and secondary protection devices, such as battery fuses, are required.

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