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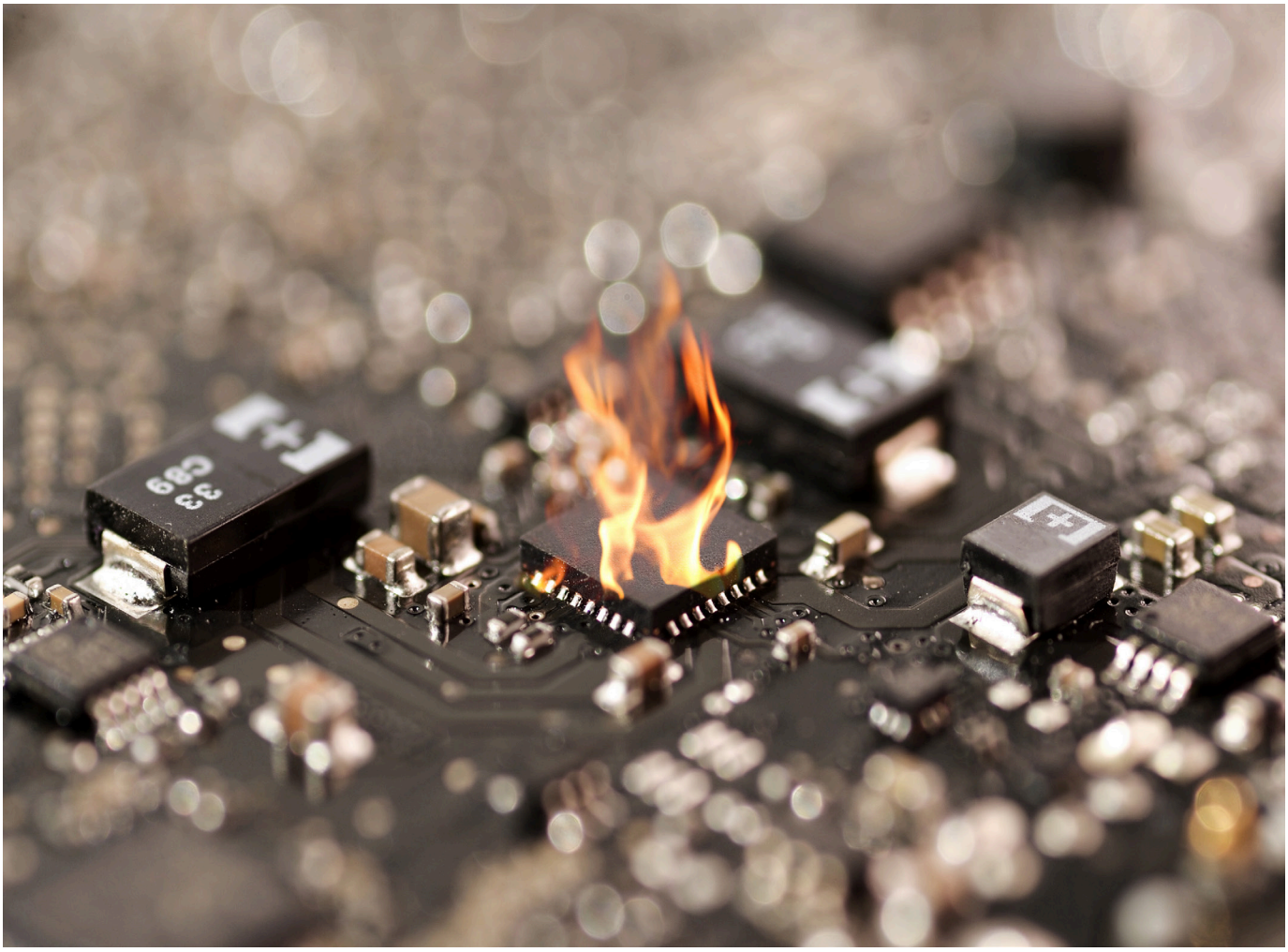
Protection against thermal runaway

A thermal runaway is an increasing threat to electronic devices where more and more power is packed in ever smaller spaces; it is a threat that is poorly dealt with using traditional means. SMD thermal fuses offer a solution that can be reflow-soldered at 260°C and still open at 210°C.



What is meant by a thermal runaway or the thermal damage of power semiconductors: A thermal runaway refers to the overheating of a technical apparatus due to a self-reinforcing process that generates heat. This damage usually causes the destruction of the apparatus and often leads to a fire or explosion.

Causes

The causes of a thermal runaway are varied and often random in nature. However, the ever-higher power density in electronic wiring and the trend towards miniaturization are without a doubt of particular importance. More and more functions are packed in compact modules, which then also have a correspondingly high power consumption.

Even slightly excessive currents in power electronics with only a little power loss lead to elevated temperatures of approximately 200°C.

The possible consequences: damage or disconnection of surrounding components, damage to the printed circuit board structure or, in the worst case, the triggering of a fire.

Build up

With a power semiconductor (e.g. MOSFET) the drain-source transmission resistance increases with rising temperatures, when connected, which results in an increasing loss of power in the barrier layer. If the elements are not sufficiently cooled - the high power density permits cooling - the power loss output in the form of heat can no longer be sufficiently dissipated, which also increases the transmission resistance. This process escalates and ultimately leads to destruction of the component.

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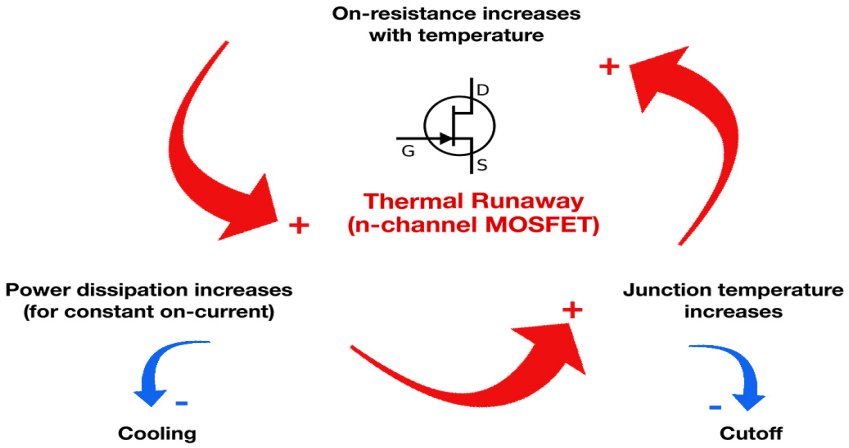

Cause diagram for thermal runaway at an n-channel MOSFET

Headquarters in Lucerne

How to protect against a short circuit?
The cooling of a system must dissipate at least as much energy as it is supplied with. The overcurrent during a thermal runaway is too low to cause a conventional fuse to trip. Thermal circuit breakers or PTCs would, in principle, be used, but the products available for the assembly of an SMD printed circuit board are too complicated or completely unsuitable

Solution
SCHURTER develops and manufactures SMD thermal fuses with the lowest possible internal resistance for power electronics of the highest packing density. They can be reflow-soldered at a maximum temperature of 260°C without opening. The temperature trigger is therefore around 210°C during operation. This corresponds to a range above normal component temperature ratings, but still below the limit to create serious consequences,The fuse opens with or without current flow depending on the temperature. Such irreversible thermal fuses are resistant to mechanical shock, vibration, thermal shock, temperature cycles and moisture. They are qualified according to AEC-Q200.

Company
SCHURTER continues to be a progressive innovator and manufacturer of electronic and electrical components worldwide. Our products ensure safe and clean supply of power, while making equipment easy to use. We offer a broad range of standard products including circuit protection, connectors, EMC products, switches and input systems, as well as electronic manufacturing services. Moreover, SCHURTER is ready to work with our customers to meet their application specific requirements, not covered in our standard range. You can rely on SCHURTER's global network of companies and partners to guarantee a high level of local service and product delivery.

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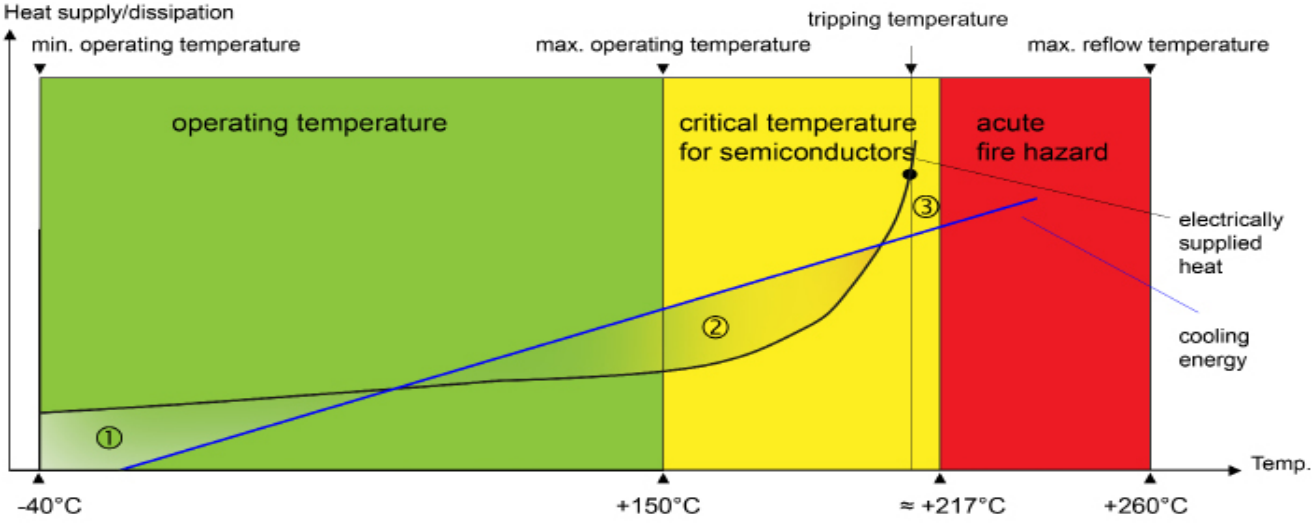

① Start heating: the electrically supplied energy increases
② Cooling capacity sufficient in the system. More energy is dissipated than supplied.
③ Thermal runaway: more energy is supplied than dissipated.

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