

High-voltage Semiconductor Junction Block

Under development

Scheduled to be installed in 2030

A high-voltage junction block (J/B) featuring advanced power distribution with integrated precharge and fuse functions, and achieving a compact and lightweight design by replacing the mechanical relays with semiconductors for higher-voltage and higher-current BEVs.

Background or Assignment

- With higher voltage and current in BEVs, the size and weight of conventional mechanical relays have obviously increased.
- With the BEV design considering aerodynamics, the demand for smaller and lower-profile components is growing.
- Higher functional integration and advanced control are required to fit within limited mounting space.

Solutions to Challenges

- 1 Greatly reduces the overall size and weight of high-voltage J/Bs by replacing conventional mechanical relays with semiconductor relays, with the relay volume reduced by approx. 60%.
- 2 By using power semiconductor devices such as Sic, it can support higher withstand voltage and higher current, enabling further increases in power output in automotive electrical systems
- 3 By switching to semiconductors, advanced functional integration utilizing various features is achieved, contributing to downsizing from the viewpoint of overall optimization for in-vehicle systems.
- 4 As heat countermeasures for increased density, thermal management technologies such as low thermal resistance design, high thermal dissipation structure, and water cooling were studied.

Main performance, specifications, and structure

Voltage	Max 1,000V
Current	Max 1,000A
Leak current	100uA or less
Control voltage range	8V to 16V
Maximum operating temperature	175°C or higher
Functions	Bidirectional current cutoff Semiconductor fuse Semiconductor failure detection Precharge function

High-voltage semiconductor J/B circuit diagram

