

AUTOMOTIVE CASE STUDY HIGH VOLTAGE POWER ELECTRONICS



Designing electronic hardware and software solutions to integrate seamlessly with thermal and mechanical designs when used in a variety of passenger vehicle applications.

CHALLENGE

South Korea headquartered LS Automotive Technologies ('LsAT'), a leading manufacturer of automotive electronic components, needed to grow its capabilities in the design of high voltage power electronics for a variety of applications.

APPROACH

Through a collaborative approach a Ricardo team of engineers, worked alongside client engineers, to design electronic hardware and software solutions, that would integrate seamlessly with thermal and mechanical designs when used in a variety of passenger vehicle applications. This resulted in the development of a cutting-edge high voltage DC-DC converter to power auxiliary electric buses of the future.

The DC-DC converter takes energy from the high voltage battery that powers the propulsion of an electric vehicle and converts it for use by the low voltage power bus,

powering lights, fans, pumps, wipers, and electronic control units.

Ricardo pushed the boundaries of power density achieving 1.2kW/L and 1.1kW/l for an isolated DC-DC converter. This was incredibly challenging as the unit needed to incorporate bulky magnetic components to filter electromagnetic noise and provide the isolation barrier between the high and low voltage sides.

Incorporating all the power and digital electronics components into a single printed circuit board also presented a challenge, marrying different technologies.

Mounting all the components in a single board helps with production and keeps manufacturing costs down.

Another challenge was the fine tuning of the digital control and the configuration of the microcontroller to execute the current control strategy.

Ricardo engineers applied Model-in-the-Loop and Hardware-in-the-Loop techniques before executing the software in the target microcontroller. Although it worked first time, fine turning was required to configure the General Timer Module in the microcontroller to get the required performance.

RESULTS

Ricardo completed a cutting-edge project on behalf of LS Automotive Technologies to power low voltage networks in electric passenger vehicles. The power conversion performs at a peak efficiency of 97% to ensure that the equipment remains cool whilst occupying a small space in the vehicle.

The technology created is transferrable to all electric vehicles as the architecture is scalable based on input and output voltages and power levels.

We developed experience and know-how in the design of high voltage and high-power systems and in the latest design, we used cutting-edge silicon carbide semiconductors and gate drivers that increased the efficiency of the unit. We also developed digital control techniques that are widely transferable to other power electronic application.

By transferring know-how and technology during the project, by the end, the customer was testing the unit in their own laboratories and is now capable of taking it to the next phase of production.

RECOMMENDATIONS

The design and engineering expertise involved in this project is fully scalable and transferable to other applications. Ricardo continues to work with LsAT on other project work.

- Fully scalable technology to a variety of vehicles
- Cutting-edge high voltage DC-DC converter
- Peak efficiency of power conversion at 97%
- Compact design

FIND OUT MORE

Email: info@ricardo.com
Tel: +44 (0)1273 455611
www.ricardo.com