Design and Development of Smart Power Junction Box for Passenger Vehicles

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Abstract:

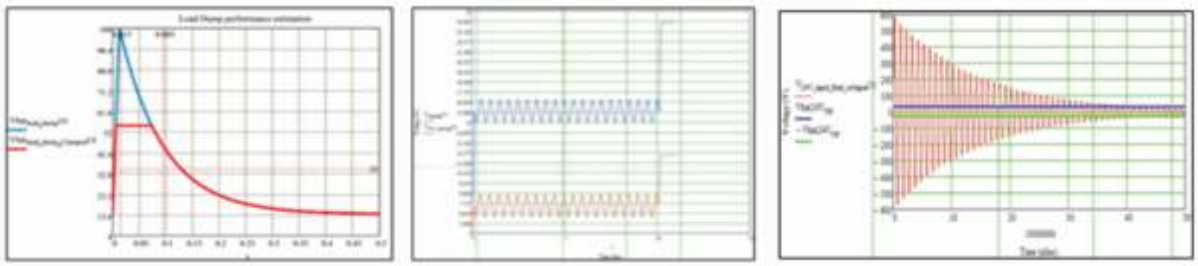
The use of semiconductor devices in automotive domain is increasing exponentially. The electrical power distribution is one of the upcoming areas. The electrical power distribution system in a vehicle has lots of challenges in the vehicle. There are various concerns and the problems faced by the electrical power distribution system in the field. These make the electrical system vulnerable to failures. Thus a system is needed to overcome these challenges. This system will add on to the system level reliability, improved safety and several other advantages.

In this work a SJB is designed and developed. This SJB is the need of automotive industry as a robust, reliable and a safe electrical power distribution system. The current practise is to distribute the electrical power to vehicle aggregates is with wires, fuses and relays. This way of power distribution is conventional and not so safe. In order to attain high level of reliability and safety, this project is taken up. This project encompasses the design and development of Smart Power Junction Box - SJB. To achieve this, the literature survey, and review of various tier-ones products, specialising in this area is done. To name few of these are the Lear Corporation, Sumitomo, Siemens-VDO. A study is carried out to find out the best available semiconductor devices to meet the SJB requirements. The search ended with the Renesas semiconductors. Renesas semiconductors have proven microcontrollers along with the power devices that are required to design the SJB. The prototypes are developed with this design. The software is developed with the Renesas Cube-Suit. The scope of this project is to design and develop the SJB prototypes and test these for the performances as per the requirements.

The prototypes are tested as per the test plan. The steady state and the dynamic performance of the SJB are carried out. The various sub-circuits within the SJB are tested and the performances are recorded. Thermal performances are also recorded so as to ensure the elevated temperature performance. SJB technology and the architecture will become the backbone of a robust electrical power distribution system in a vehicle as a future work.

Smart power junction box

SJB prototype



MathCAD simulation