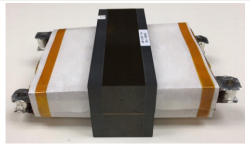
Virginia Tech - CPES Academic member

Project Title: High Density Bidirectional SiC/GaN based Soft-switched Dc-Dc Charger for All-Electric Transportation Refrigeration Unit

Objectives: Demonstrate an air-cooled 20 kW bi-directional soft-switched dc-dc battery charger using SiC/GaN switches with >98.8% pk efficiency, >100 W/in^3 density.

Major Milestones: high-density converter and high-frequency high current transformer

Deliverables: 20 kW dc-dc battery charger unit



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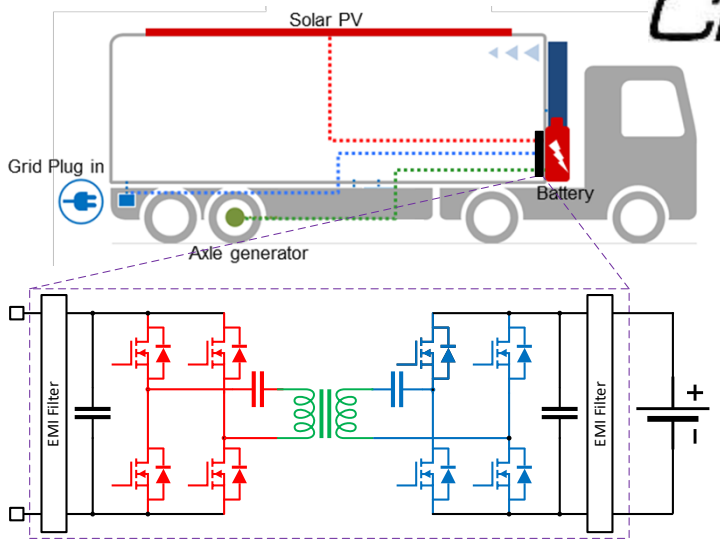

WBG Technology Impact

1. Significant size reduction of power transformer and loss saving by using WBG devices.
2. Application sector: Transportation Refrigeration unit (LRU)
3. Timeframe for commercialization: 36 months
4. State-of-art Si based dc-dc charger converter suffers large switching losses with limited options of >1kV switching devices. High power transformer (>10kW) operation frequency is limited within < 100 kHz. WBG-based solution push the switching frequency > 400 khz with >700 dc-link voltage.

Additional impacts

1. Less magnetics components due to lower flux-density enabled by high-frequency switching of WBG devices. Higher efficiency and higher density reduce cooling cost and system integration effort.

2. The proposed technology will boost the adoption of electrification and battery usage in large vehicles like trucks, creating new jobs in related industry as well as WGB industry.

3. Graduate and undergradue students will be trained in the use of both 1.2 kV SiC MOSFETs and 650 V GaN E-mode FETs

4. The US semiconductor and power electronics industry will be strengthened in EV applications