Silicon Carbide (SiC) Power Processing Unit (PPU) for Hall Effect Thrusters

A high-efficiency, radiation-hardened power supply

Arkansas Power Electronics International (APEI), Inc., is developing a high-efficiency, radiation-hardened 3.8-kW SiC power supply for the PPU of Hall effect thrusters. This project specifically targets the design of a PPU for the high-voltage Hall accelerator (HiVHAC) thruster, with target specifications of 80- to 160-V input, 200- to 700-V/5A output, efficiency greater than 96 percent, and peak power density in excess of 2.5 kW/kg. The PPU under development uses SiC junction field-effect transistor power switches, components that APEI, Inc., has irradiated under total ionizing dose conditions to greater than 3 MRad with little to no change in device performance.

Applications

NASA

- Satellite and spacecraft power management systems
- Satellite and spacecraft motors and actuators:
  - Opening and rotating solar array panels, controlling robotic arms, aligning communications arrays, pointing cameras and instruments, etc.
- Extreme environment exploratory vehicles

Commercial

- High-voltage hybrid electric vehicle battery packs
- Photovoltaic energy systems
- Energy exploration
- Industrial motor drives
- Electric vehicle motor drives
- Military systems

Phase II Objectives

- Determine the overall system requirements for the PPU power converter
- Develop the electrical design of the radiation-hardened SiC-based PPU power supply
- Fabricate and test PPU power supply prototype

Benefits

- More efficient than silicon
- Lower weight and volume
- Operates in high-temperature environments

Firm Contact

APEI, Inc.
Bradley Reese
breese@apei.net
535 W. Research Center Blvd.
Fayetteville, AR 72701–7175
Phone: 479–443–5759 ext. 8250

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