

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

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