Silicon carbide solutions to solar challenges revealed

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STMicroelectronics is revealing innovations in silicon carbide devices at Solar Power International (SPI) 2012 that enable systems producers to build ultra-efficient electronics for converting raw solar energy into grid-quality power.

Featuring on the ST booth at SPI, the Company's 1200V silicon carbide

diodes replace ordinary silicon diodes in the DC-DC boost converter and DC-AC inverter that convert the photovoltaic module's low-voltage output into high-quality AC power at the correct line voltage.

As a base material for diodes targeting solar-power conversion applications, silicon carbide is superior to ordinary silicon bipolar technology. Silicon carbide diodes can switch rapidly between conducting and non-conducting states without suffering the reverse recovery current that occurs when switching bipolar diodes. Eliminating this unwanted effect saves up to 70% of energy normally lost, maintains high efficiency over a wide temperature range, and enhances freedom for designers to optimize the system operating frequency.

ST's trials using 1200V silicon carbide diodes have shown a 2% increase in overall inverter yield, even when operating at high load and high frequency. Over the intended lifetime of inverters used in installations such as residential photovoltaic systems and high-power solar farms, this improvement can effectively save many Megawatt-hours of valuable energy.

At SPI 2012, ST will also reveal progress in its silicon carbide MOSFET program. These will be among the world's first commercial silicon carbide MOSFETs; an advanced class of devices predicted to offer an alternative to high-voltage silicon IGBTs (Insulated Gate Bipolar Transistor) in solar inverters, delivering a number of advantages. In addition to saving at least 50% of IGBT energy losses, silicon carbide MOSFETs require no special drive circuitry and can operate at higher frequencies. This enables designers to miniaturize other components in the power supply thereby reducing cost and size as well as enhancing energy efficiency.

Further applications for silicon carbide MOSFETs and diodes include bulk power supplies used in energy-hungry computer rooms and data

centers, and motor-drive electronics in electric vehicles.

Source: STMicroelectronics