



GaN for Photovoltaics

GaN/Si micro-inverter reduces cost per watt of solar power

What is GaN for Photovoltaics?

Regular silicon-based micro-inverters—the most critical components to take advantages of solar panel performance—have reached their limits. CEA-Leti researchers are now offering 650V & 100V GaN/Si power transistors to reduce the cost and size of solar inverters while increasing compactness:

- high power density: 1.1kW/l (GaN)
- high yield: 97% (GaN) vs. 95% (Si)
- lower parasitic inductance

GaN/Si are power components made of Gallium Nitride on a low cost 8" Silicon substrate. Such components are already in volume production. An improved transistor architecture, called "MIS-gate" has been developed by CEA-Leti and will reach volume production in the coming months.

Applications

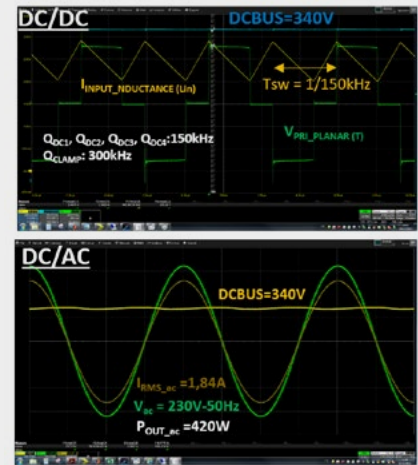
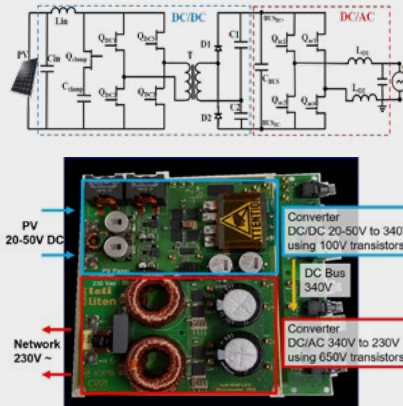
- Building-integrated photovoltaics (BIPV)
- Off-grid power supply systems

What's new?

The integration of a micro-inverter directly into solar panels enable paralleling, making it a strategic component. This micro-inverter helps efficiently convert the 72-cell PV module's electrical energy into the 230V~50Hz. In fact, CEA-Leti's GaN/Si power components (MIS-Gate: *Metal Insulator Semiconductor*) helps deliver superior returns and a built-in MPPT (Maximum Power Point Tracker) maximizes power conversion regardless of the solar irradiation.

Schematic of circuit, micro-inverter picture and measured signals of two stages conversion

- First stage conversion DC (40V)/DC (340V) (top right in blue square): input current (orange curve) in inductance (L_{in}) and BusDC output voltage 340V (blue curve).
- Second stage conversion DC (340V)/AC (~230V) (bottom right in red square): input DC voltage (yellow curve) and output AC voltage 230V-50Hz (green curve).



Publications

- A.Bier, V-S.Nguyen, S.Catellani, J.Martin "Control of a single-phase grid-tied GaN based solar micro-inverter" EPE 2020 / ECCE, Sept. 2020
- V-S.Nguyen, S.Catellani, J.Martin, H.Zara, J.Aime "A compact high efficiency GaN based 400W solar micro inverter in ZVS operation" PCIM 2020, July 2020
- C. Le Royer and al." Normally-OFF 650V GaN-on-Si MOSc-HEMT Transistor: Benefits of the Fully Recessed Gate Architecture" ISPSD 2022, May 2022

What's next?

This technology will reach the market in 2025-27. Meanwhile, CEA-Leti and CEA-Liten researchers will improve the technology and develop a built-in digital control system. The team will unveil new prototypes in the coming years.

Interested in this technology?

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