PHOTOVOLTAICS: THE FUTURE FOR GAN?
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Photovoltaics: The Future For GaN?

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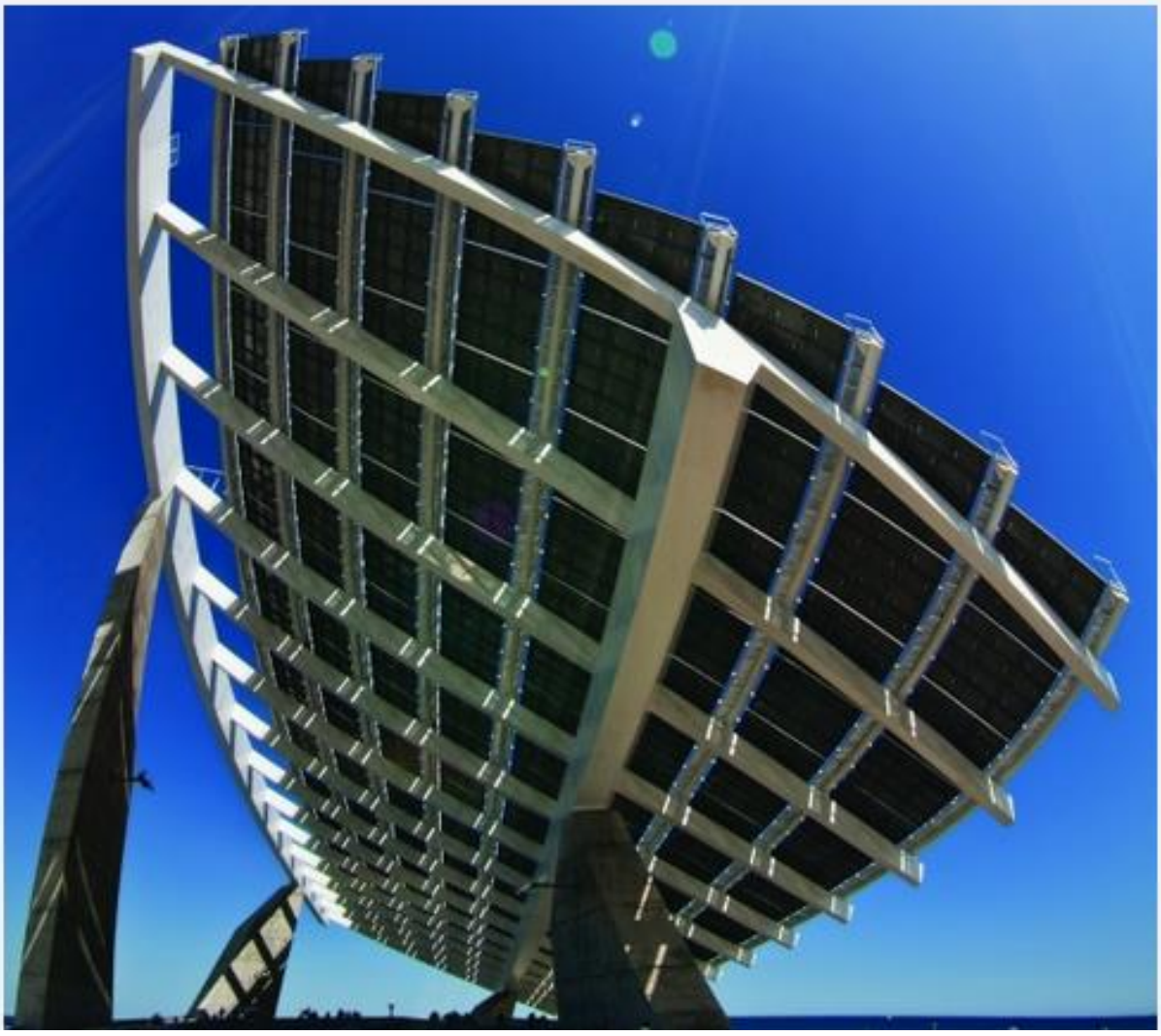
Transphorm ramps up GaN-on-silicon device production as photovoltaic inverter markets drive growth. *Compound Semiconductor* reports.



For GaN device manufacturer,Transphorm, 2015 is already shaping up very nicely. Mass production of power devices kicked off at Fujitsu Semiconductor's CMOS-compatible 150mm wafer fab in Fukushima in late January.

And now, Japan-based Yaskawa Electric has revealed it is using these very same GaN power modules in its PV inverters, currently under mass production for Japanese markets.

As Primit Parikh, president and co-founder of Transphorm tells *Compound Semiconductor:* "Fujitsu's fabrication line has been qualified for automotive-grade wafers in the past, and while our products have always been reliable, the scale of a large mass production foundry such as this is unmatched."

"Mass production here assures our customers they are getting the highest quality product at an affordable price, and they don't have to worry about scaling in the future," he adds.

Parikh will not be drawn into actual production numbers, but as he points out, Yaskawa intends to produce 34,000 systems every year, with each system containing several GaN devices and modules.

"Volumes are beginning to ramp and we are ready to supply and scale up," he says.

Surprisingly for Parikh, and many in the industry, the PV inverter market is proving to be very lucrative for GaN-based devices. The PV inverters market segment has already widely adopted SiC Schottky switching diodes from the likes of Cree, Infineon and Rohm.

And while industry pundits have speculated GaN transistors could make in-roads into this market, questions over qualification have been raised. Not any more, says Parikh.

"Traditionally, the photovoltaic industry has been associated with 25 years of reliability so many doubted the technology would be adopted here," he asserts.

But as the company chairman points out, Transphorm has spent several years sampling and selling 600V qualified devices to PV manufacturers, including Yaskawa and India-based Tata Power Solar, with real results.

"Our customers were not married to any technology so they looked at GaN devices from us and our competitors, as well as SiC devices from leading vendors," he explains. "They chose our technology based on performance, cost and reliability. We beat SiC hands down."

Critically, for this industry, Transphorm's GaN-on-silicon diodes and transistors were JEDEC qualified in 2013 and the company has since demonstrated a high voltage off-state lifetime of more than 10 million hours, at 600V, with these chips.

"This is a first for the GaN industry," highlights Parikh. "Cree has introduced the data for SiC MOSFETs and now we have done it for GaN. Nobody else in the wide bandgap industry has shown this true intrinsic lifetime via systematic reliability testing."

Cost-wise, Parikh points out that device to device, GaN-on-silicon is obviously more expensive than silicon, but adds: "SiC is even more expensive." And as he highlights, his company's GaN platform is diode-free as its GaN transistor serves the function of the anti-parallel or fly-back diode used in conventional approaches, bringing cost, space and energy savings.

"Instead of using two high performance components, such as a SiC MOSFET and SiC diode, the GaN customer can use just one," says Parikh. "So we deliver half the components, half the size and half the cost."

Beyond PV

Packaging higher voltage semiconductors has also raised concerns across the industry, But again, Parikh highlights how his company has developed protective enclosures, such as its so-called Quiet Tab, based on standard packages, such as TO220, TO247 and PQFN, that 'work well'.

Beyond PV

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"New packaging will be important but we've patented some simple ways to use standard packaging in a configuration that allows high speed operation while minimising the electrical parasitic effects," he says. "We don't have to wait for advanced packaging to be developed to take advantage of today's GaN products."

So where next of Transphorm? Parikh reckons the India-based PV inverter market is going to be huge for Transphorm but points out how the company's discrete and module products have also been designed into kW class 99% Totem-Pole PFC circuits and multi-hundred Watt all-in-one computer compact power supplies.

Transphorm Japan is also collaborating with Japan-based auto-makers and OEMs on the use of GaN devices in electric vehicles. Key applications include inverters in drive trains as well as DC to DC converters in, for example, air conditioning units.

"Using GaN in these applications is more near-term that one would think," says Parikh. "I am hopeful for Transphorm and the entire GaN power industry that we will solve real problems and make a tangible dent to energy use."