

RFMD Leverages RF GaN Capability To Build Power HEMTs

by Ashok Bindra, Technology Writer, Technika

In my last column, I talked about the growing list of suppliers of gallium nitride (GaN) technology based power devices, both transistors and diodes. We saw that research firm Yole Developpement had identified at least six new device players—Transphorm, STMicroelectronics, Fuji, Infineon, LG, and Samsung—entering the GaN power arena to join the pioneers International Rectifier (IR) and Efficient Power Conversion (EPC).

Because GaN power has the potential to grow, it has begun to attract more new players. Consequently, we now have one more addition. Early this month at PCIM Europe in Nuremberg, Germany, RF Micro Devices (RFMD) announced its entry into the GaN power market. The RF semiconductor supplier unwrapped its newest GaN process technology called rGaN-HV, optimized for high-voltage, high-power devices for power conversion applications.

According to RFMD's director of marketing and sales, Dan Schwob, rGaN-HV technology is capable of delivering device breakdown voltages up to 900 V with high peak-current capability and ultra-fast switching times for both GaN-on-SiC based power transistors and diodes. In fact, stated Schwob, "the rGaN-HV leverages the huge GaN fabrication capability in Greensboro, NC, as well as the packaging capability in Asia."

Per company release, the new rGaN-HV technology complements RFMD's GaN 1 process, which is optimized for high-power RF applications and delivers high breakdown voltage over 400 V, and GaN 2 process, which is optimized for high-linearity applications and delivers high breakdown voltage over 300 V.

Schwob said that RFMD will fabricate discrete power devices at its GaN facility in Greensboro, NC, and provide access to rGaN-HV technology to foundry customers for their customized power device solutions.

Bob Bruggeworth, president and chief executive officer of RFMD, commented, "The global demand for energy savings through improved power conversion efficiency is creating a tremendous opportunity for high-performance power devices based on RFMD's GaN power process technologies. We expect our newest GaN power process will expand our opportunities in the high-voltage power semiconductor market, and we are pleased to provide access to rGaN-HV to our external foundry customers to support their success in the high-performance power device market."

GaN-on-SiC HEMTs

Based on the rGaN-HV platform, the company will initially produce two 650-V normally-off power switches utilizing an n-channel high electron mobility transistor (HEMT) structure. These source-switched FETs (SSFETs) will be housed in standard TO-247 packages (see the figure). These devices will provide immediate efficiency improvements as drop-in replacements for super junction transistors or IGBTs in a broad range of applications.

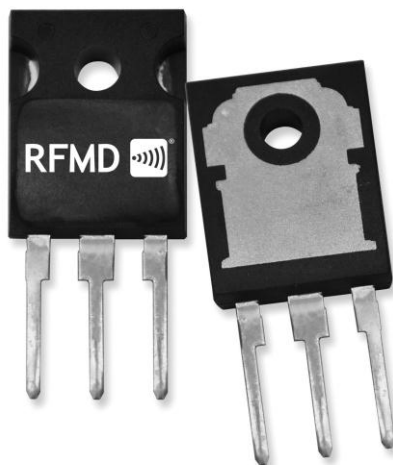


Figure. RFMD's 650-V GaN-on-SiC HEMTs are encased in TO-247 packages as drop-in replacements for super junction transistors and IGBTs in a broad range of applications.

While a 30-A, 650 V GaN part will offer 40 mΩ on-resistance at 25°C, a 15 -A version will spec 80 mΩ on-resistance at 25°C (see the table). Besides offering very good thermal characteristics in comparison to silicon devices, the GaN-on-SiC based HEMTs also offer high switching speeds with low Eon/Eoff. The turn-on/off is 5 ns for the 30-A part with a very short delay time of less than 10 ns. The output capacitance is <50 pF.

Table: Key specs for RFMD's 650-V GaN-on-SiC power HEMTs.

Part #	BV _{DSS}	I _{D(100°C)}	R _{DS(on)}	Eon/Eoff	Package
RFJS1506F	650 V	15 A	80 mΩ	50/25 μJ	3L TO-247
RFJS3006F	650 V	30 A	40 mΩ	100/50 μJ	3L TO-247

"Since the switching losses have been significantly reduced, these devices are capable of delivering very high power conversion efficiencies," noted Schwob, adding, "We will be demonstrating a greater than 98% conversion efficiency in a 1-kW battery charger reference design in the near future."

The company plans to start sampling the 650-V GaN-on-SiC based power devices to select customers in the July-August time frame, with general sampling in September. Target applications for these transistors include IT/Telecom ac-dc power supplies, solar inverters, UPS inverters, battery chargers and high-frequency dc-dc converters.

Meanwhile, research firm Yole Developpement expects there to be mass production of GaN power devices, starting this year. These devices will mostly be for IT and telecom segments (high-end power supplies), but they will be followed by the qualification of 600-V devices for photovoltaic inverters.

About The Author



Ashok Bindra is a veteran writer and editor with more than 25 years of editorial experience covering RF/wireless technologies, semiconductors and power electronics. He has written, both for print and the web, for leading electronics trade publications in the U.S, including Electronics, EETimes, Electronic Design and RF Design. Presently, he has his own technical writing company called Technika through which he does writing projects for different trade publications and vendors. Prior to becoming an editor, Bindra worked in industry as an electronics engineer. He holds an M.S. degree from the Department of Electrical and Computer Engineering, Clarkson College of Technology (now Clarkson University) in Potsdam, NY, and an M.Sc (Physics) from the University of Bombay, India. He can be reached by email at bindra1[at]verizon.net.