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Chipmaker Adds Rad-Hard GaN Transistors Including JANS-Certified Device

Infineon Technologies has announced its first family of radiation-hardened gallium nitride (GaN) transistors, fabricated at Infineon's own foundry, and based on the company's CoolGan technology. Designed to operate in harsh space environments, this family is said to offer the first *in-house manufactured* GaN transistor to earn the highest quality certification of reliability assigned by the United States Defense Logistics Agency (DLA) to the Joint Army Navy Space (JANS) specification MIL-PRF-19500/794. At least one other *fabless* GaN device supplier has announced JANS certification for its facilities and pending devices.

The rad-hard GaN HEMT devices are engineered for mission-critical applications required in on-orbit space vehicles, manned space exploration, and deep space probes. Combining the robust performance of GaN HEMTs with Infineon 50+ years of experience in high-reliability applications, the power transistors are said to deliver best-in-class efficiency, thermal management and power density for smaller, lighter, and more reliable space designs (see Figs. 1, 2 and 3). The devices complement Infineon's legacy rad-hard silicon MOSFET portfolio.

"The Infineon team continues to push the limits of power design with our new GaN transistor line," said Chris Opoczynski, senior vice president and general manager HiRel, at Infineon. "This milestone brings the next-generation of high reliability power solutions for mission-critical defense and space applications that utilize the superior material properties of wide-bandgap semiconductors to customers serving the growing aerospace market."

The first three product variations in the rad-hard GaN transistor line are 100-V, 52-A devices featuring what's described as an industry leading $R_{DS(ON)}$ of 4 mΩ (typical) and a total gate charge (Q_g) of 8.8 nC (typical). Encased in hermetically sealed ceramic surface-mount packages, the transistors are single event effect (SEE) hardened up to a LET (GaN) of 70 MeV.cm^2/mg (Au ion) (see Fig. 4).

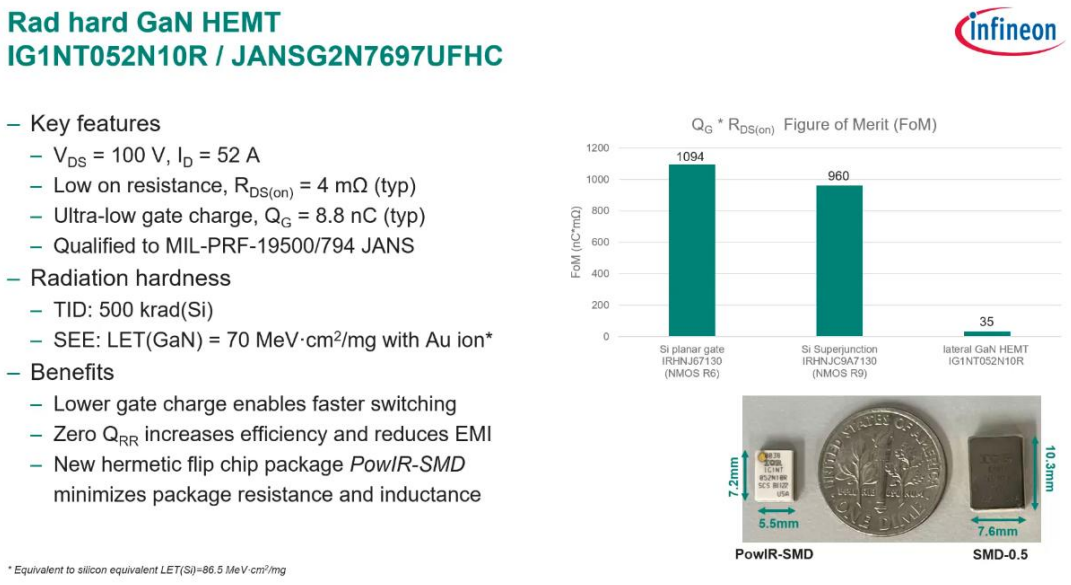
Two devices, which are not JANS certified, are screened to a total ionizing dose (TID) of 100 krad and 500 krad. The third device, screened to 500-krad TID, is qualified to the rigorous JANS Specification MIL-PRF-19500/794. The two COTS models (IG1NT052N10R, IG1NT052N10G) and the JANS model (JANSG2N7697UFHC) are offered in the company's PowIR-SMD package (see the table).

DLA JANS certification requires rigorous levels of screening and Quality of Service Class Identifiers to ensure the performance, quality, and reliability required for space flight applications. Infineon is also running multiple lots prior to full JANS production release to ensure long-term manufacturing reliability.

In December, EPC Space, a fabless supplier specializing in rad-hard GaN devices, announced that it had received JANS certification for its Andover, Massachusetts facility and its wafer fabrication facility in Taiwan under the JANS MIL-PRF-19500 standard. At that time, it also indicated its plans to launch 18 JANS-certified rad-hard GaN HEMT parts, ranging from 40 V to 300 V throughout 2025.

Engineering samples and evaluation boards for Infineon's rad-hard GaN transistors are available immediately with the final JANS device being released in the summer of 2025. Additional JANS parts are launching soon, expanding available voltages and currents. For more information, visit www.infineon.com/radhardgan

Fig. 1. Infineon's GaN HEMT devices include what's described as the first in-house manufactured GaN transistor to earn JANS certification. This is a 100-V HEMT with an on-resistance of 4 mΩ typ. and total gate charge of 8.8 nC, and which is screened to 500-krad TID. The company also offers two COTS versions screened to either 100 or 500 krad TID. All three parts are offered in the company's hermetic, surface-mount PowIR-SMD package.



(a)

Parameter	Si Planar MOSFET	Si Superjunction MOSFET	IG1NT052N10R
V_{DS} max	100 V	100 V	100 V (120 V transient)
$R_{DS(on)}$ typ	40 mΩ	25 mΩ	**4 mΩ**
V_{GS} max	20 V	20 V	5.0 V (5.5 V transient)
$V_{GS(th)}$ typ	3.0 V	3.0 V	1.5 V
C_{oss} Q_{rr}	340 pF 2,016 nC	440 pF 820 nC	510 pF 0 nC
C_{iss} Q_G	1,730 pF 28 nC	1,800 pF 33 nC	820 pF **8.8 nC**
Q_{GD}	20 nC (max)	9 nC (max)	1.1 nC
Q_{GS}	15 nC (max)	25 nC (max)	3.1 nC
Q_{GD}/Q_{GS}	**1.33**	0.36	0.35
V_{SD}	1.2 V (max)	1.2 V (max)	**> 2.0 V**
FoM ($Q_g \times R_{DS(on)}$)	**1,120**	**825**	**35.2**
Package size	**7.5 mm x 10.3 mm**	**7.5 mm x 10.3 mm**	**5.3 mm x 7.1 mm**

(b)

Fig. 2. Comparing the Q_G x $R_{DS(ON)}$ FOM of the IG1NT052N10R, IG1NT052N10G, and JANSG2N7697UFHC 100-V rad-hard GaN HEMTs with the company's rad-hard silicon planar and silicon superjunction MOSFETs (graph in upper right of slide (a)). Note that the 'G model (not listed in this slide) specifies 100-krad TID. The table in (b) shows a more detailed comparison of the rad-hard GaN part with its rad-hard silicon counterparts.

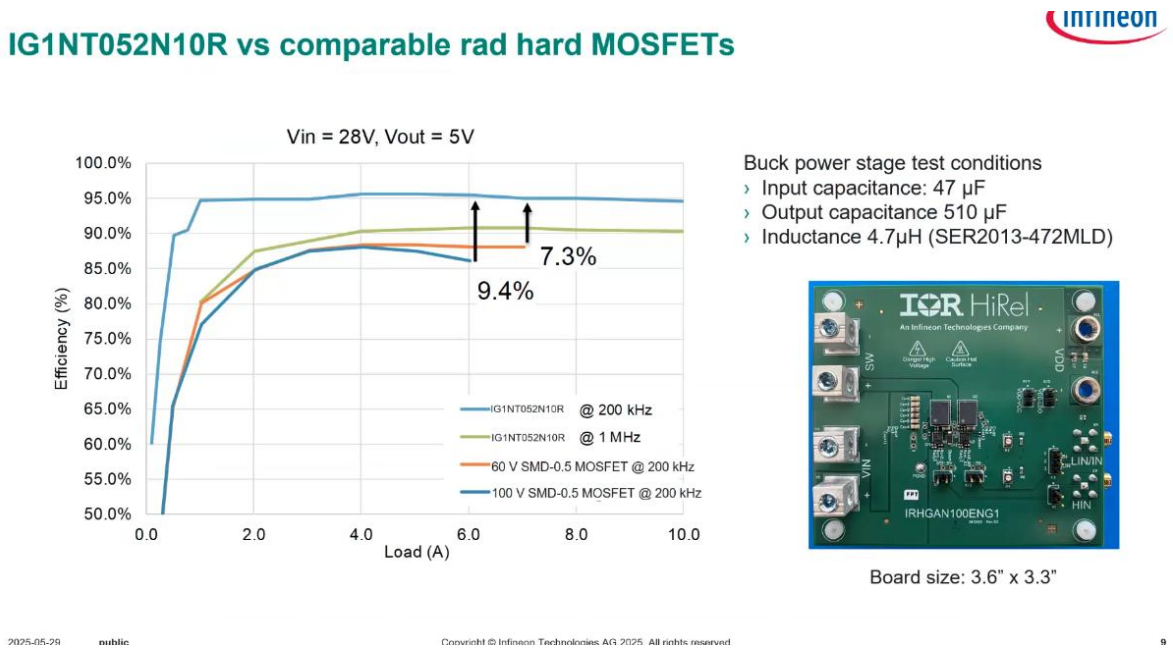


Fig. 3. A 28-V to 5-V buck converter implemented with Infineon's 100-V GaN HEMT (the 500-krad TID COTS model IG1NT052N10R) achieves higher efficiency over load even compared against lower-voltage silicon MOSFETs switching at a lower switching frequency.

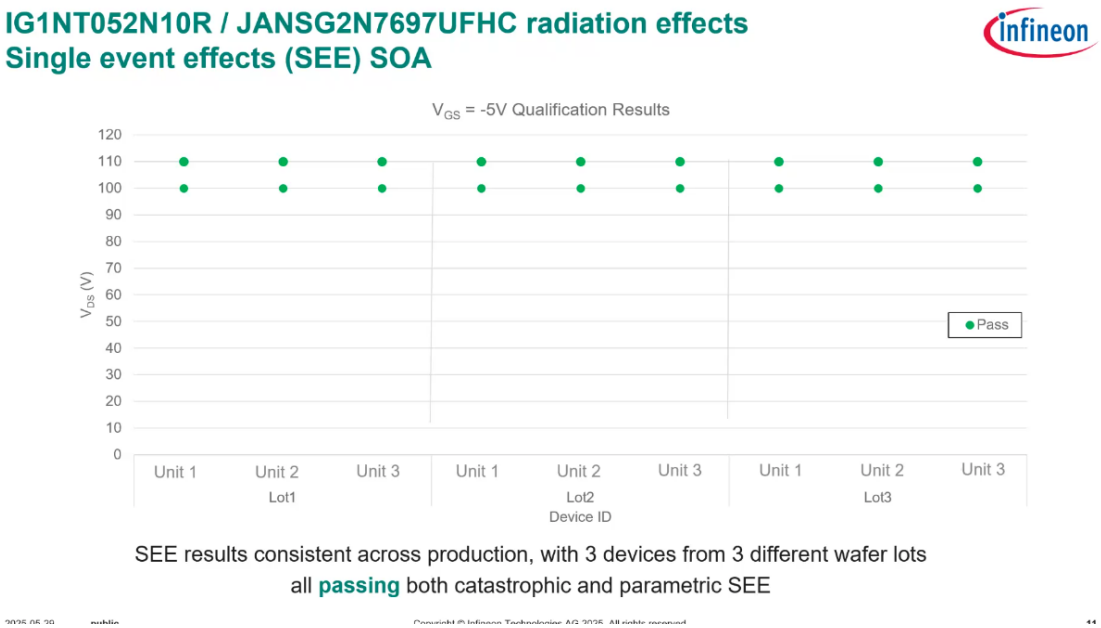


Fig. 4. SEE test results for the 500-krad COTS and JANS models. The company notes that these new devices have undergone extensive SEE testing at the Texas A&M and University of Michigan facilities.

Table. Infineon's first three rad-hard GaN HEMTs are screened to TID levels of 100 or 500 krad.

Part number	Package	Screening level	TID Level
IG1NT052N10R	PowIR-SMD	COTS	100 kRad(Si)
IG1NT052N10G	PowIR-SMD	COTS	500 kRad(Si)
JANSG2N7697UFHC	PowIR-SMD	JANS	500 kRad(Si)