

## WOLFSPEED GaN: RUGGED ENOUGH FOR TRACKING SPACE JUNK, RUGGED ENOUGH FOR 5G

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GaN RF devices are used throughout the world on projects in a broad range of applications such as surveillance and weather radar, first responder communications, and improvised explosive device (IED) protection systems, where downtime is not an option. But are they rugged and reliable enough to tackle the harshest environments the telecom market can hand out, especially as it relates to 5G small cells?

As 5G deployments gather momentum, small cell antennas and base stations will need to be deployed in a wide variety of locations — street lights, utility poles, sides of buildings — while delivering ultra-high reliability to support applications for which always-on connectivity is required. Every piece needs to be rugged in form factor to withstand harsh environmental conditions such as high heat, high humidity, dust and other factors. However, the semiconductor materials used also need to be able to withstand fluctuations in power and temperature with minimal degradation of performance or issues that might require costly maintenance on the base station equipment.

So is GaN on SiC ready for prime time in 5G? A look at a case study incorporating GaN on SiC technology from Wolfspeed may help put things in perspective. Lockheed Martin has partnered with Wolfspeed to provide GaN on SiC-based high-power amplifiers (HPAs) for the U.S. Air Force's Space Fence system. Space Fence is a ground-based system designed to detect, track, and catalog the innumerable number of objects in space, a.k.a., space junk. Space Fence replaces the Air Force Space Surveillance System, which has been used since the early 1960s.

Space Fence, which is located on the Kwajalein Atoll in the Marshall Islands, accurately tracks an estimated 500,000 objects, including spent rocket boosters, stray hardware, decommissioned satellites and other debris, that are floating in the same orbit as modern-day communications satellites.

### **Wolfspeed in Action**

The Space Fence system tracks objects in space and precisely determines their projected orbit. Operators can use the data collected to reconstruct recent events, such as collisions and satellite breakups, and accurately predict future issues. Space Fence incorporates a scalable, solid-state S-Band radar with a much higher frequency that is capable of detecting much smaller objects than the previous system, and will thus improve accuracy, quicken response time, and expand surveillance coverage.

Lockheed Martin uses the latest MMIC technology, GaN on SiC, as it provides significant advantages for active phased array radar systems, including higher power density, greater efficiency and improved reliability over other technologies. Early on in the process, Lockheed Martin conducted more than 5,000 hours (or nearly seven months) of accelerated stress testing, and demonstrated with greater than 99% confidence that Wolfspeed's GaN HPAs would meet the long-term reliability goals for the Space Fence program, which is integral to meeting the project's efficiency and availability goals.

"These test results represent the culmination of more than a decade of shared investment in GaN technology," Steve Bruce, vice president, Advanced Systems at Lockheed Martin Mission Systems and Training, said when announcing the successful reliability testing of Wolfspeed's GaN HPAs. "GaN HPAs provide significant advantages for active phased-array radar systems like Space Fence, including higher power density, greater efficiency, and improved reliability over previous technologies," he added.

### **5G Readiness**

S-Band radar systems, such as those used in Space Fence, work at similar frequencies as those being developed for sub 6 GHz 5G systems. Although the technology is similar, radar applications are actually driven harder for saturated power, and are stressed more, than is expected in 5G systems. In addition to Space Fence, Wolfspeed also works with other demanding military applications such as radar, jammers and communication systems critical to homeland defense.

"[Wolfspeed parent company] Cree is a US government trusted foundry, and if it's rugged enough for their most critical applications, Wolfspeed's GaN on SiC is rugged enough for 5G," says John Palmour, co-founder and CTO of Wolfspeed. "None of these environments can afford to fail, and that's why they choose solutions from Wolfspeed."

In fact, Wolfspeed maintains a failure-in-time (FIT) rate of 5-per-billion device hours, illustrating the industry-leading reliability and performance of Wolfspeed's GaN-on-SiC devices.

"Our high-performance commercial GaN products have been fielded for many years in a variety of military and commercial applications, and has matured enough to support the mission-critical 24/7/365 coverage required by the Space Fence system and other mission-critical applications like 5G," says Jim Milligan, senior director of Wolfspeed's Foundry, Aerospace and Defense Business Unit.

**Is Wolfspeed's GaN on SiC prepared for everything the 5G market can throw at it?  
Indeed, all systems are a go for launch.**