FABS and LABS

Qorvo's SHIP Assembly and Test Center: A Trusted Source for Heterogeneous RF Packaging

The pandemic proved the warning the U.S. Department of Defense (DoD) has voiced for decades: supply chains spread around the globe can be unexpectedly interrupted. Add the growing regional tensions and it becomes obvious the U.S. needs its critical technologies and industries within the country. Yet the U.S. share of global semiconductor wafer capacity has declined—to 12.5 percent in 2019—and virtually all high volume semiconductor packaging is done in Asia.

Unlike the silicon used for processing, memory and other digital functions, the U.S. has maintained leadership in the high performance RF semiconductor technologies so critical for defense systems, primarily GaAs and GaN. The gap is in multi-chip module packaging, the ability to integrate digital and RF semiconductor circuits with passive components and interconnects to create a system in a package (SiP)—what Gordon Moore envisioned as the logical extension of the single IC, now called heterogeneous integration.

To address these supply chain and technology challenges, last fall the DoD awarded Qorvo a contract to develop an RF production and prototype center where customers use Qorvo's processes to design a SiP using RF, mixed-signal and digital ICs. The 4-year initiative, worth up to $75 million, is called SHIP (State-of-the-art Heterogeneous Integrated Packaging) for RF or SHIP-RF. The DoD awarded a similar program for advancing digital packaging to Intel.

The focus of SHIP-RF will be adding new process capabilities and manufacturing capacity to Qorvo's Advanced Microwave Module Assembly (AMMA) facility in Richardson, Texas, in conjunction with end-to-end "quantifiable assurance." *Microwave Journal* profiled the first generation of AMMA in a December 2015 Fabs and Labs. The SHIP-RF effort comprises three tasks: 1) onshore some of Qorvo's critical commercial assembly processes used for smartphone front-end modules, 2) develop new capabilities for heterogeneous packaging of silicon and RF die and 3) increase automation and capacity to support SHIP-RF.

To enable customers to use the capabilities of SHIP-RF, Qorvo will also form a design center with simulation, layout and verification tools, including a library of proven design blocks. These process and assembly design kits will reduce development time and risk and provide confidence that a new design will be producible with high yields.

To validate the SHIP-RF capabilities, Qorvo will build three demonstration products, which are being defined by defense partners, Qorvo and the DoD. These demonstrators will help Qorvo define the needed packaging and process technologies and ensure they support both defense and commercial needs once the project completes in 2024. At that time, Qorvo will offer packaging and test services for defense and commercial customers, just as it offers GaAs and GaN foundry services.

Qorvo's GaAs and GaN MMICs are at the heart of many of the latest generation U.S. radar and electronic warfare sensors. Qorvo is also a DoD trusted supplier for the foundry and AMMA packaging processes located in its Richardson facility. This trusted certification will be extended to the SHIP-RF Assembly and Test Center, offering defense primes more options for improving system capabilities while reducing size, weight, power and cost. A trusted, turnkey supplier within the U.S., one able to cost-effectively manufacture highly integrated, high performance RF SiPs and offer quantifiable assurance will reduce a critical risk within the defense industrial base and help the U.S. maintain technology leadership.

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