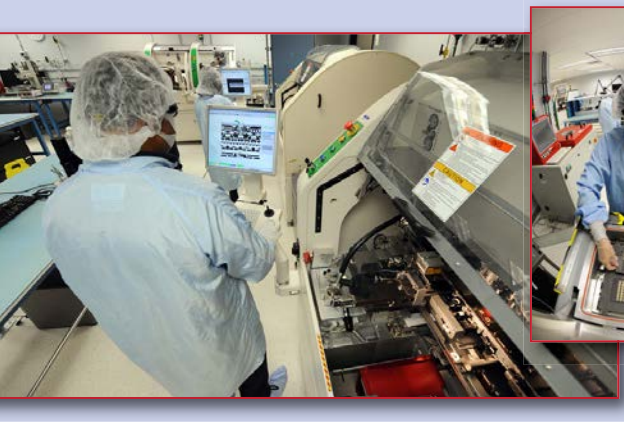
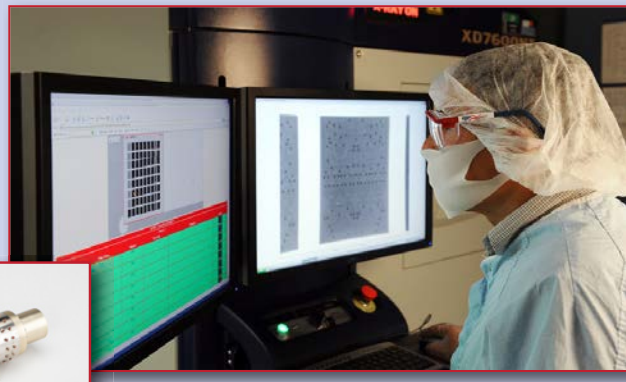
Qorvo's Advanced Microwave Modules Assembly: Speed, Quality, Performance





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This is the story of a problem needing a solution, a solution that fixes the problem and becomes a much bigger strategic advantage. When TriQuint (now Qorvo) began shipping GaN die, some customers reported device failures in their assemblies. Poor die attach was the root cause. The high power density of GaN requires a void-free eutectic bond between the die and package to transfer the heat from the transistor channel — otherwise the device will fail prematurely. The criticality and sophistication of the die attach process led TriQuint to offer GaN die eutectically mounted on thermal spreaders, assuring their customers the quality of the most critical thermal interface.

That vacuum reflow process expanded into a complete assembly and test capability that serves Qorvo's own need for rapid prototypes and a production source for moderate volume and high performance products. Called AMMA (Advanced Microwave Modules Assembly), the 9,000 square foot facility is housed with Qorvo's GaN, GaAs and BAW wafer fabs in Richardson, Texas. The paperless factory, where all key performance data is online in real-time, shares the wafer fabs' commitment to automation, lean manufacturing and statistical process control.

From that first eutectic die attach process, AMMA's processes now include epoxy attach, ball bonding, Cu bump flip-chip, surface-mount assembly, solder and seam sealing for hermetic packages, plastic overmolding and mechanical integration of complex assemblies. X-ray and acoustic microscopy (CSAM) are available as QC steps to help assure the critical die attach process. For commercial applications demanding low cost plastic packaging, AMMA developed a highly reliable process to attach GaN on SiC power die to Cu lead frames. Despite the CTE mismatch between SiC and Cu, assemblies pass 1,000 temperature cycles without delamination. Once the products are assembled, AMMA also performs the RF acceptance testing, assuring a tight feedback loop between assembly and test.

AMMA's assembly and test capabilities have been accredited as a "trusted source" by the U.S. Defense Microelectronics Activity (DMEA), an important endorsement for the defense industry. The success of the operation is reflected in the broad portfolio of Qorvo products that AMMA produces: die on tab and packaged devices for defense and aerospace programs, Spatium™ spatially-combined PAs, GaN PAs for base stations, modulator drivers for transport and metro optical networks, and millimeter wave amplifiers for point-to-point radio — virtually everything in the catalog except for the highest volume and lowest cost.

Qorvo's investment in AMMA provides many returns. Product development moves from prototype to production in the same facility, co-located with many of the designers. Time to market is faster, with no expensive and time-consuming trips to offshore subcontractors. AMMA yields are higher, especially for high performance and high frequency products. With an internal assembly capability, designers and process engineers can collaborate on new, non-standard packaging approaches that better meet RF requirements — rather than being constrained by the industry standards set for lower frequency silicon.

AMMA enables a vertical integration strategy that differentiates Qorvo's infrastructure and defense products. It's an example that moving semiconductor assembly back to the U.S. can be a competitive advantage, even in a global market.

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