



White Paper

NEO Tech Introduces First, Commercially Available Hands-Free Manufacturing Line for Microelectronic Integrated Circuit Assemblies – Reducing Man-Made Process Variations and Cost

NEO Tech Introduces First Commercially Available Hands-Free MIC Assembly Line

Today, the reliability of gallium nitride (GaN) device technology has improved significantly, making GaN a viable technology for both military and commercial applications. Consequently, integrated circuit (IC) manufacturers generally have migrated to GaN and other advanced semiconductor compounds to address next-generation, high-power output applications. In several military radars, GaN-based devices have demonstrated five to ten times more power density than gallium arsenide (GaAs) or silicon power devices. While designers can reduce the size of a device using GaN technology, it creates new complications. The more sophisticated the device, the thinner and more fragile the air-bridged die, the higher the number of I/Os, and the smaller the pitch between interconnects. These micro-miniature structures make it more difficult to assemble rapidly, accurately, consistently, and economically. Conventional methods of handling complex IC's typically have been labor intensive, with unique process challenges in picking, placing, and wire bonding, leading to lower yields and reduced reliability.

To overcome these labor-intensive, process-dependent elements, NEO Tech has introduced its new generation of assembly automation, as well as more sophisticated levels of process characterization, enabling lower costs and enhanced reliability.

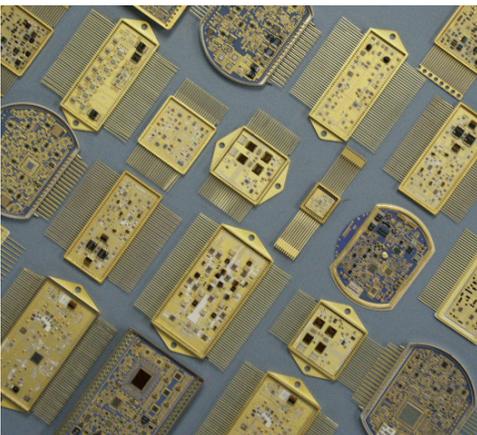
NEO Tech was one of the first US companies to bring commercially available, integrated automation to very thin and fragile semiconductor die, and the latest innovations are a significant extension of this achievement. For example, in existing manual or semi-automated lines, operators must subjectively judge the coverage under the die and visually estimate the permissible amount of material extruding from the edges, incurring the variability inherent in such methods. NEO Tech's new "Auto Line" is dedicated to performing and measuring this task more accurately, consequently producing significant gains in repeatability, quality and reliability.

For GaN and similar advanced die or ICs, truly “hands-free” automation requires an accurate, high-resolution method for dispensing the precise amount of epoxy every time. The die-bonding platform must be constantly stable, regardless of fluctuations in temperature and humidity. NEO Tech’s unique machine configuration consistently achieves high-precision epoxy dispensing.



NEO Tech partnered with leading precision assembly equipment manufacturer Palomar to develop and produce specialized die-attach systems using optically balanced breadboards, with internal dampening built into the honeycomb structure. The equipment’s resulting superior vibration dampening supports precision die attach at much higher speeds.

NEO Tech’s achievements also include the ability to reliably handle large, thin, MMIC devices. Developments include extremely accurate dispense for epoxy and a proprietary die eutectic attach process, using solder preforms. These innovations enable manufacturing of MMICs with minimum voiding under dies as thin as 0.002 inches. Originally, NEO Tech developed this system to meet the needs of high-reliability applications in defense, advanced telecommunications, and implantable medical devices. System designers using large, thin, MMIC devices in their high-frequency applications now can work confidently with this option for both prototyping and manufacturing at scale.



The industry average for thin die damage in handling prior to placement into a higher level assembly exceeded 20 percent. For odd-shaped and extremely thin die and ICs, NEO Tech’s fully automatic eutectic die-attach process performs with consistently near-zero rework. In addition to practically eliminating damage and rework, NEO Tech’s continuous, contiguous auto line guarantees planar placement of these delicate die with minimal interface voids.

For the notoriously sensitive eutectic die-attach method, the tuned handling and improved process accuracy represents significant breakthroughs in product quality, reliability, and cost.

Increasing overall process consistency by eliminating touch in areas such as epoxy dispense and eutectic attach was the critical first step. Gaining the full economic benefit, however, required integrating these and other advancements into an automated line capable of producing high-complexity devices at rates and yields supportive of today's most demanding programs. NEO Tech has accomplished this with a level of quality and cost-efficiency exceeding existing MIC assembly touch methods.

To further guarantee reliability and quality, thorough cleaning is mandatory to prevent latent defects in interface junctions during wire-bond interconnect. NEO Tech's automated process includes in-line argon plasma cleaning just prior to wire or ribbon bonding, ensuring complete residual organic removal without exposing the IC to ion or UV.

NEO Tech's hands-free, continuous, contiguous, automatic MIC assembly lines operate in a lean manufacturing environment, with high repeatability and near-zero rework. High-frequency system designers seeking domestic suppliers offering the highest quality and the most cost-effective MIC solutions are encouraged to take advantage of these next-generation capabilities.

About the Author

Jim Angeloni is Chief Operating Officer, Aerospace and Defense Operations, at NEO Tech. Jim is a recognized expert in the field of microelectronic assembly, and as an innovator in the industry for more than 30 years, and as a charter member of the International Microelectronics and Packaging Society (IMAPS).



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