

FAB S and LAB S

NHanced Semiconductors: Making the Impossible Possible



NHanced Semiconductors has its headquarters in Illinois, an R&D and prototyping fab in North Carolina and a recently opened advanced package assembly facility in Indiana. The company's evolution and growing importance in packaging and heterogeneous integration are a testament to its expertise. Founded in 2016 by current CEO and owner Bob Patti, NHanced Semiconductors emerged as a spin-out of Tezzaron Semiconductor, which evolved from ASIC Designs. ASIC Designs was an R&D company specializing in high performance systems and ASICs and was Bob Patti's first start-up endeavor. Tezzaron Semiconductor established itself as a leader in 3D-IC technology, developing its first working 3D ICs in 2004. The development lineage and expertise of NHanced Semiconductors have deep roots in these packaging and integration start-ups.

Since its inception, NHanced Semiconductors has been advancing and developing 2.5D/3D technologies, chiplet integration, smart interposers, die and wafer stacking and other advanced packaging techniques. The company prides itself on turning what they call "bleeding edge designs" into state-of-the-art 3D ICs and 2.5D assemblies. They call this manufacturing model "Foundry 2.0™."

The Foundry 2.0 concept is based on sourcing building blocks from high volume semiconductor foundries. NHanced combines these building blocks into different combinations using packaging technologies like through-silicon vias (TSVs), hybrid bonding and glass or silicon interposers. With this technique, the company works with state-of-the-art foundries as a third-party integrator to provide sophisticated, highly differentiated, heterogeneously integrated products to meet customer needs and requirements. NHanced Semiconductor takes pride in being the only U.S.-based foundry that can support this manufacturing model.

The Foundry 2.0 model has been a success. The NHanced footprint in its three current facilities is already

well over 55,000 sq. ft., including 12,000 sq. ft. of Class 100 cleanroom. Rapid growth has been necessary to meet the market demand facing NHanced as the semiconductor industry increases its focus on innovation and specialty production.

The Foundry 2.0 model encompasses the entire process, from the original concept to full production. To accomplish this, the NHanced design team will support customers with project management, system-level designs, software development, hardware front-end designs, physical/back-end designs and support to get designs into prototyping and production. Once a design goes into the NHanced fab, the company takes care of all the necessary wafer processing, interconnection and manufacturing steps. From here, the devices go into packaging, assembly and test.

In these final steps, the company differentiates from most outsourced semiconductor assembly and test (OSAT) providers by serving customers needing low volume to medium volume complex device runs. In their production environment, NHanced targets engineering-heavy advanced package assemblies with extremely flexible manufacturing lines tuned for lower-volume production. Once the products are assembled, NHanced completes its end-to-end manufacturing cycle with in-house thermal cycling, HAST and probe testing. These capabilities are augmented by outside resources for a broad range of component testing and screening to ensure the highest yields for their end customers.

Utilizing this production model, NHanced targets opportunities in heterogeneous integration, additive silicon manufacturing, photonics, microfluidics and III-V compound semiconductors. These support large-scale electrification, 5G wireless communications and the widespread deployment of artificial intelligence in aerospace and defense, medical and industrial markets. The Foundry 2.0 model is helping NHanced Semiconductors make the impossible possible.

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