Does the FPGA Industry Face Peril? *Pt. III*

Martin Hart
TopLine Corporation

PART II OF THE WINTER 2019 MEPTEC REPORT titled "Call to Action" urged stakeholders to create a shared vision to ensure a robust, resilient and sustainable supply chain for production of Field Programmable Gate Arrays (FPGA) devices.

Executive Order 13806 Assessment Report

The Department of Defense published an unclassified report titled, "Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States," in fulfillment of Executive Order (EO) 13806 which describes risks that threaten America's manufacturing and defense industrial base.

The ten "risk archetypes" described in the report are as follows: 1) Sole source; 2) Single source; 3) Fragile supplier; 4) Fragile market; 5) Capacity constrained supply market; 6) Foreign dependency; 7) Diminishing manufacturing sources & material shortages (DMSMS); 8) Gap in the U.S.-based human capital; 9) Erosion of U.S.-based infrastructure; and 10) Product security.

Most of the risk archetypes described in the EO 13806 assessment report apply to FPGA manufacturing. Risk archetypes lead to a variety of impacts upon America's industrial base. These include reduced investment in new capital and R&D; reductions in the rates of modernization and technological innovation; potential bottlenecks across the many tiers of the supply chain; lower quality and higher prices resulting from reduced competition.

Sole Source Versus Single Source

A sole source risk exists when only one supplier is able to provide the required capability. Fortunately, manufacturing capability for producing copper-wrapped solder columns (shown in Figure 1) exists today in the USA. Also, multiple subcontractors who are capable of providing column attachment services for FPGA packages currently exist in America.

A single source exists when only one supplier is qualified to provide a required capability. The EO 13806 report draws a key distinction between sole source and single source. Multiple suppliers may exist, but only a single source for copper-wrapped solder columns is qualified, according to the Qualified Manufacturing List (QML-38535) published by the Defense Logistics Agency (DLA). Companies that produce FPGA devices are not required to voluntarily qualify multiple subcontractors. It could take 24 months for an alternative candidate starting from scratch to attain QML status should a single source supplier unexpectedly shut down.

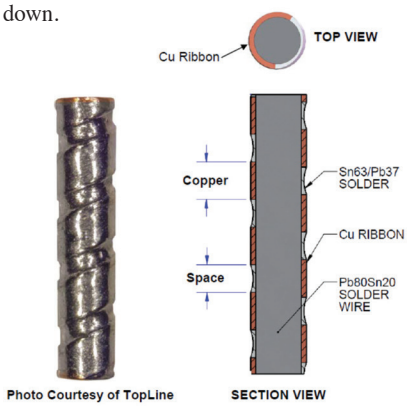

Figure 1. Construction of Copper Wrapped Solder Column.

Other Risks

A fragile supplier is an individual firm that is financially challenged or distressed, and this potentially includes most subcontractors in the U.S. microelectronics industry today.

A fragile market occurs when domestic markets have structurally challenging economics and face the potential to move toward foreign dependency.

Presently, a capacity-constrained supply market may not be thought of as problematic. However, a single source supplier may not be able to keep up with a sudden surge in market demand.

Foreign dependency on wafer foundries could become an elevated risk, especially when a domestic foundry does not produce a critical item.

Diminishing manufacturing sources and material shortages risk is often associated with obsolescence that might result when a relevant supplier issues end-of-life warnings.

Gaps in U.S.-based human capital is an ongoing concern. Think: the graying of "Silicon Valley". The industry needs to keep fresh science, technology engineering and math (STEM) talent in the pipeline especially within the microelectronics assembly base. Attaching copper wrapped solder columns to FPGA packages is fundamentally a non-automated, artisan process, which requires highly developed operator skills.

Erosion of U.S.-based infrastructure, including the loss of specialized capital equipment, is a risk since attachment of solder columns to FPGA packages requires precision tools and fixtures that are difficult to fabricate.

Lastly, product security could be of heightened concern under circumstances where FPGA packages require an assembly step overseas, opening the risk of reverse engineering or embedding trojans by hostile foreign actors.

Conclusion

Negative impacts can manifest as gaps in the industrial base, including single-points-of-failure, threatened capabilities and extinct capabilities. Fortunately, domestic manufacturing of copper wrapped solder columns is already available. Multiple American microelectronic subcontractors are ready to provide copper wrapped column attachment services for FPGA packages on the condition that funding is available to pay for QML qualification. An investment in such qualification today can mitigate that risk, rather than waiting for an unexpected disaster to strike. Such a disaster could result in diminished readiness, insecurity of supply, and program delays caused by the inability to deliver FPGA components in a timely manner. A production stoppage of critical FPGA components could possibly tip the balance of peace in the World. ◆