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

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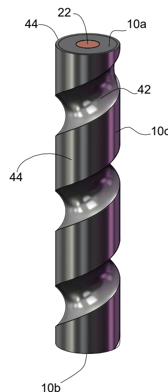
PART IV OF THE SUMMER 2020 MEPTEC REPORT titled "Call to Action" addressed the need to strengthen the gaps in the diminishing supply base that collectively threatens America's leadership position as a producer of Field Programmable Gate Array (FPGA) devices for the aerospace and defense industries.

Defense Grade FPGA Require Solder Columns

Heritage hardware used in the aerospace and defense (A&D) industry are built on a platform of Field Programmable Gate Array (FPGA) devices with solder columns instead of solder balls. Column Grid Array (CGA) FPGA packages engaged in mission critical black box systems are more reliable than Ball Grid Array (BGA) packages. FPGA BGA packages with solder balls prematurely fail due to huge stresses caused by differentials inherent in material mismatches between the FPGA package and Printed Circuit boards (PCB). In a nutshell, ceramic BGA devices experience an unacceptable level of failures; whereas, column CGA devices endure significantly longer.

Risk of Continuation of Supply of Solder Columns

Today, Original Device Makers (ODM) of ceramic FPGA devices rely on just one subcontractor (Six Sigma, Milpitas California) to attach copper wrapped solder columns for the entire aerospace and defense industry. To understand the risk of relying on a monopoly supplier, one needs only to ponder a simple question: Can the aerospace and defense industry be assured of a consistent supply of solder column attachment services 10, 20 or 30 years from now? A sudden shortage of mission critical FPGA devices could cause market distortions that are not in the defense industry's best interest, resulting in warfighters not flying and rockets not launching. To strengthen the resiliency of supply, VPT Components and Micross Components (recently acquired by Corfin Industries, financially backed by equity investor, Behrman Capital) are at various stages of attaining Qualified Manufacturers List (QML) approval to offer copper wrap column attachment services on FPGA devices. Other microelectronics subcontractors are also showing interest in offering column attachment services. That said, as of the date of this publication major ODM device makers, who control over 80% of all FPGA devices for aerospace and defense, have not taken steps to qualify a second source as a contingency back up. The principal reason cited for such inaction is the lack of a budget to qualify alternative subcontractors to attach copper wrap columns.



Lead Free Solder Column. *U.S. Patent Pending*

Emerging Technologies Need Columns

New markets for massive A.I. computing, silicon antennas and super-sized devices for 5G towers and satellites under development require solder columns to reduce stress caused by Coefficient of Thermal Expansion (CTE) mismatch in materials. The need for solder columns in such commercial applications will grow more than 25x over the next 10 years. These burgeoning applications require tens of thousands of solder column terminals per device. Ramping demand will quickly swamp the capacity of today's subcontractors to attach solder columns. A risk exists in the current supply chain for column attachment services should the need for columns in the defense market suddenly surge.

Pending RoHS Requirements for Lead Free Columns

Historically, the aerospace and defense industry has largely been exempt from meeting the requirements of the European Union (EU) Restrictions of Hazardous Substances (RoHS) directive which regulate the use of lead (Pb) in solder columns. It is widely speculated that one day in the future, RoHS will stop renewing its exemption which currently allows high Pb content solder balls and solder columns. This event could trigger unintentional consequences by forcing ODMs to convert to fully lead-free FPGA products. This could force individual end-users to independently seek lead (Pb) bearing column attachment services. Such a cascade of events could most likely exceed the production capacity of the current monopoly column attachment subcontractor. To meet future needs for lead-free columns, TopLine has applied for patents on Pb-free solder columns.

Conclusion

By the end of 2021, it is anticipated that more than five subcontractors in the USA will be proficient at providing column attachment services to the aerospace and defense industry. Presumably, the Defense Logistics Agency (DLA) current travel ban will be lifted after the Corona Virus dissipates, allowing the DLA to resume on-site auditing to certify additional QML suppliers of column attachment services. Establishing strength in this critical area will enhance readiness, provide greater security of supply, and cause fewer program delays by the potential inability to deliver FPGA components in a timely manner. ◆