American National Aeronautics and Space Administration (NASA) Research in High Density Packaging Reliability

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Abstract

The reliability of greater functional density packaged in a smaller form factor is the most persistent challenge facing the microelectronics packaging research community. This paper discusses the American National Aeronautics and Space Administration (NASA) research into the reliability of high density microelectronics packaging use for aeronautic and space applications. The use of Commercial-Off-the-Shelf (COTS) components is of interest to NASA due to wide availability and cost, however the need for higher reliability and longer field life is of concern. Use of Plastic Ball Grid Array (PBGA) packages continues to cause problems. In addition to being moisture sensitive, the assembled package can have rework issues. The PBGA balls may be difficult to re-ball after collapse during rework. The PBGA package is also susceptible to warpage. Planarity defects cause the edges of the package to lift up, resulting in poor connection for the outer rows. Larger PBGA packages are more susceptible to warpage than the smaller packages. Other reliability research includes determining the origin of current collapse in nitride high electron mobility transistors and SiC metal semiconductor field effect transistor components. Power actuated switching module substrate reliability is yet another area requiring further research. There is also a need for high K, low leakage dielectrics for metal insulator semiconductor devices. The creation of light emitting devices operating in the ultraviolet portion of the electromagnetic spectrum is an attractive area of research for military, space, and commercial applications. These include secure line of sight communications, solid-state lighting, bio-detection, and remote sensing. NASA reliability research with electronic noses, System-in-a-Package and System-on-a-Chip technologies, as well as embedded passive interconnects required for extreme temperature applications will be discussed.