

**Reliable SiP/SoP Technologies:
A Physics of Failure Perspective**

ABSTRACT

A. Dasgupta and D. Farley

CALCE – EPSC, University of Maryland, USA

J. Caers and K. Zhang

Philips Applied Technologies, Netherlands

3D multi-technology system-integration concepts, such as a SiP (System-in-Package) or MCM (Multi-Chip-Module) or SoP (System-on-Package), have emerged as the leading methods of miniaturization beyond what is possible with SoC (System-on-Chip). For this reason, this technology is sometimes referred to as MtM (“More than Moore”), rather than “more Moore”. These packages can be found wherever miniaturization is needed for multi-functional applications, such as portable electronics, “smart” biomechanical implants, and even home appliance electronic controls.

In SiP/SoP technologies, system integration allows the incorporation of a multitude of devices and subsystems to be brought together in one package. Each subsystem may employ a different technology such as RF, magnetics, optics, MEMS, bio-chemical sensing, nanoelectronics, etc. There is a growing body of literature on this topic, focusing either on position papers that speculate on the advantages of this technology, or research roadmaps that discuss anticipated challenges, concept papers that provide ideas for systems integration or example papers that demonstrate the implementation of a specific SiP/SoP concept.

The literature review reveals that there is a noticeable lack of studies that have focused on the reliability challenges introduced by SiP/SoP technologies. CALCE’s objective is to identify new reliability issues that are unique to SiP products; to perform systematic and system level PoF (physics of failure) reliability investigations on SiP test articles; and to develop lifetime prediction methods for these multitechnology packages. The integration of diverse technologies onto a single platform can introduce new interactions of failure modes that can only be solved with better vertical integration of the supply chain. While reliability assurance is a more complex task for these multi-technology platforms, the good news is that a systematic PoF approach can provide valuable insights into this problem. Simple PoF studies have already been undertaken by CALCE and Philips researchers, for a candidate RF-SiP product.