

Georgia Tech ERC Pioneered System-on-a-Package Concept

More than 160 companies have taken parts of the System-on-a-Package (SOP) technology pioneered by the Microelectronics Packaging Research Center (PRC) at Georgia Tech—an Engineering Research Center (ERC) that graduated from NSF funding in 2006—and applied them to their automotive, computer, consumer, military, and wireless applications. The PRC has also built a number of test packages for different companies focused on integrating different combinations of analog, digital, RF, optical, and sensor components in a single package.

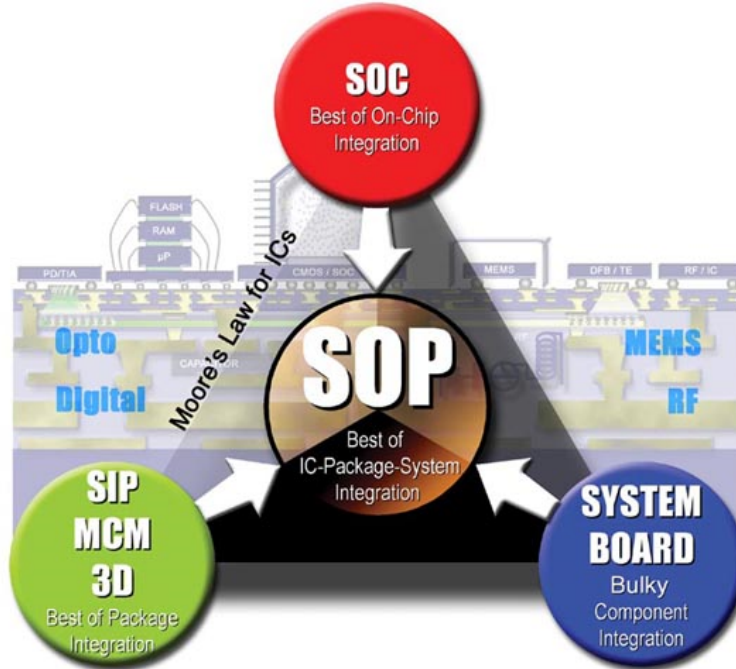
SOP is an emerging system technology that goes beyond System-On-a-Chip (SOC) and System-In-a-Package (SIP) to form the basis of all emerging digital convergent electronic and bio-electronic systems. Unlike SOC, which integrates and miniaturizes 10 percent of a system, SOP miniaturizes the entire system. It does this by package integration with embedded components at microscale in the short term and nanoscale in the long term.

Motorola, as one example, was one of the PRC's founding industrial partners and used parts of SOP technology in two models of its GSM/General Packet Radio Service quad-band cellphones to gain about a 40 percent reduction in board area. The module contains all the critical cellphone functions: RF processing, base-band signal processing, power management, and audio and memory sections. Not only does the module free up space for new features; but it is also the base around which new cellphones with different shapes and features (camera or Bluetooth, for instance) can be rapidly designed. Motorola calls its package a system-on-module (SOM), for which it developed its own custom embedded-capacitor technology. The company reports it has shipped tens of millions of SOM-based phones as of 2009.

The SOP concept requires a “holistic” approach to design and manufacturing of electronic systems—with integrated circuits, packages, system boards, and complete systems all designed and developed for fabrication at the same time. This spurred a major change in the prevailing manufacturing model, in which all these complements are designed and built separately and then assembled together. A number of different manufacturing techniques for SOPs have emerged, including an SOP-like package with thin-film deposition on silicon wafers by Philips; organic boards by Shinko, Ibiden, and Matsushita; and ceramic boards by Murata and TDK. Companies that have adopted SOP as their strategy include IBM, Intel, Samsung, Sony, Panasonic, TI, Motorola, and Amkor.

The PRC believes that the market for multifunctional products and the advantages of designing chips and system packages concurrently are so compelling that companies throughout most industries involving microelectronics will soon be driven by the market to design and fabricate everything together.

SOC & SIP: Moore's Law for ICs



SOP: Moore's Law for System Integration

The System-on-a-Package (SOP) technology pioneered by the PRC integrates the best of package integration, chip integration, and component integration into a single package system.