

Polyolithic Integration of True Single Chip Radio using Quartz-on-Silicon Wafer

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Monolithic integrated circuit fabrication technology is the most advanced mass production technology ever invented, reducing transistor cost by billion times during last 4 decades. Modern electronic systems, however, are composed of many different crystals, each of which is an optimized material for each application. Notable examples are electro-acoustic resonators/filters made by quartz in wireless system, semiconductor laser diode made by direct gap compound semiconductor in optical communication system, and so forth. These heterogeneous systems cannot be integrated using conventional monolithic IC technology, making final cost and size determined more often by the packaging and wiring various devices on a printed circuit board not by the device itself.

We propose PLIC (Polyolithic Integrated Circuit) technology which allows us to fabricate heterogeneous system on a single wafer. In PLIC, various crystals are stacked vertically and different devices having optimum performance on each crystal, are fabricated then connected on a same wafer, all using IC fabrication technology. Then complete system is finally obtained as a single chip after dicing. Thus drastic reduction in cost and size and great improvement in performance and reliability are expected. In this presentation, PLIC using QoS (Quartz-on-Silicon) is taken as an example to demonstrate the feasibility of a true single chip radio, where RF and digital circuits, antenna, and electro-acoustic filters are integrated on a same wafer.



Kwyro Lee received the B.S. Degree in Electronics Engineering from Seoul National University in 1976 and the M.S. and Ph.D. degrees from the University of Minnesota, Minneapolis in 1979 and 1983 respectively, where he did many pioneering works for modeling Heterojunction Field Effect Transistor. After graduation, he worked as an Engineering General Manager in GoldStar Semiconductor Inc. Korea, from 1983 to 1986, responsible for development of first polysilicon CMOS products in Korea. He joined KAIST in 1987 in the Department of Electrical Engineering, where he is now a Professor. His research interests are focused on RF device and circuit and polyolithic integration of heterogeneous system on a single chip. He led the development of AIM-Spice and is the principal author of the book titled, "Semiconductor Device Modeling for VLSI", 1993, Prentice Hall. He is a Senior Member of IEEE and a Life Member of IEEE. He served as the Chairman of IEEE Korea Electron Device Chapter and is currently serving as the elected member of IEEE EDS AdCom. He has also been working as the Director of MICROS (Micro Information and communication Remote-object Oriented Systems) Research center, since 1997.