

1990s

Evolution of SoCs

~ Integrated Circuit ~

SoC (System-On-a-Chip) is an LSI that appeared with the development of LSI technology. In the 1970s, at the time of the introduction of a microprocessor in which the CPU function was integrated on one chip, the memory, the input/output circuit and the like were mounted in separate packages, respectively, and when composing the computer system, they were assembled on a substrate and connected with each other.

From the beginning of the 1980s, due to the advancement of semiconductor manufacturing technology, it became possible to integrate these individual LSIs into one LSI and it was called a microcontroller. In addition, high value-added products called ASIC (Application Specific Integrated Circuit) and custom IC appeared for applications requiring higher processing capability or special performance, with a high-performance single microprocessor or dedicated circuits suitable for the purpose being added. However, as the target fields diversified, it became necessary to develop a wide variety of ASICs despite the low production volume, and the cost disadvantage became prominent.

Therefore, since the mid-1990s when the integration technology advanced further, LSI with memory, various buses, graphics, and other controllers all mounted with the CPU on one chip was made, which was called SoC, in which necessary functions are selected according to the purpose. The cost advantage of SoC due to mass production of limited number of product types was recognized, and it developed rapidly after 2000. This development was supported by the improvement of design efficiency by the design method using EDA tools using the hardware description language, as well as the progress of the integration technology by the miniaturization described above. The design at the level close to the semiconductor process and the design at the function level were effectively separated, and basic circuit IPs spread widely, which had not been open to the public before.

Advantages of installing advanced system functions on one chip are 1) size reduction of the system by reducing occupied area, 2) no signal delay caused by impedance of lead wires, pads, etc. 3) low power of total system due to size reduction, 4) cost reduction due to the reduction in the number of parts, and omission of assembly/testing steps, and the like. Considering that various functional devices such as sensors will be taken in the SoC from now on, it is an issue to be discussed which is more advantageous whether SiP (System In Package) in which these functional devices are assembled as discrete components on one substrate by advanced assembly technology, or SoC in which all these functions are integrated on one chip.

Products targeted by SoC range from cell phone, digital TV, digital camera, DVD recorder, digital audio/video, and so on. In this sense, it can be said that SoC will be a key device in the coming age of digital consumer products. Also, system LSI is used as a word having almost the same meaning as SoC.