

1990s

Larger and faster DRAM; radical change in the DRAM business

~ Integrated Circuit ~

Even in the 1990s DRAM capacity increase speed did not slow down, and 64M was developed following the full mass production of 4M and 16M. In the capacity increase, the area reduction of memory cells did not simply follow the scaling rule, and each company devised various new technologies. The trench cell and the stacked cell technologies which started in 1MDRAM generation were improved, and NEC proposed HSG (Hemispherical Grain) as a technology to further increase cell capacitor area of stacked cell, and it was applied to 64MDRAM. Eventually, the stack type shifted to a combination of HSG and a high dielectric constant film in a cylindrical cell. The stacked cell was adopted by NEC, Hitachi, Fujitsu, and Mitsubishi etc. On the other hand, Toshiba adopted the trench cell. The trench cell technology was improved, too, and the aspect ratio of trench structure was increased. In addition, Levenson phase shift and other technologies were applied for miniaturization.

The power supply voltage also decreased due to miniaturization, the external voltage dropped from 5 V to 3.3 V, and eventually a voltage-step-down circuits were used inside the chip.

The characteristic feature of DRAM in the 1990s was that the data transfer rate was increased in response to the increase in CPU speed. Fast page mode had been a mainstream until then, but EDO (Extended Data Out) appeared, and it further evolved into synchronous DRAM. Synchronous DRAM is an architecture proposed by NEC, and NEC launched synchronous DRAM ahead of the world in 1993. In the next year, 1994, Hitachi also released synchronous DRAM. Synchronous DRAM became mainstream of DRAM after 64M generation.

After that, RDRAM (Rambus DRAM) with faster transfer speed appeared. In 1996, Intel entered into a license agreement with Rambus to introduce RDRAM as next generation PC memory, but eventually RDRAM did not become mainstream, and DDR DRAM (Double Data Rate Synchronous DRAM) became mainstream, and it further evolved to DDR 2 since around 2004.

In terms of business aspect in the 1990s, Korean manufacturers gained power. Especially in the depression after the Windows boom in 1995, Samsung Electronics made a leap forward and the position of Japanese manufacturers in DRAM declined.

