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2001

Release of LSI with embedded FeRAM for IC cards (Fujitsu and Matsushita)

~ Integrated Circuit ~

Compared to EEPROM (Electrically Erasable Programmable ROM), the ferroelectric memory (FeRAM: Ferroelectric RAM) has many advantages such as a rewrite speed of 1000 times faster (about 100nsec), power consumption is 1/10, and read/write endurance of more than five digits (10^5-10^7). In addition, since the dielectric film can be formed at a relatively low temperature of 550°C, it is also compatible with CMOS process. As a result, commercialization progressed from early on, and it is expected to expand in the future as embedded memory of system LSI, while being adopted in large quantities in contactless IC cards.

ROHM has first established the mass production technology of FeRAM. In 1993, it collaborated with Ramtron in the US and started manufacturing of 64K and 256K bit memories, and non-contact tag LSI for baggage, using materials of PZT ($Pb(Zr_x,Ti_{1-X})O_3$) and STN ($Sr_2(Ta_{1-X},Nbx)_2O_7$).

In 2001, Fujitsu announced the manufacture and sale of IC card LSI (Photo 1, 2) with embedded FeRAM based upon 0.35μm process. The LSI incorporates a 32-bit RISC microprocessor, 64 Kbytes of FeRAM, 96 Kbytes of mask ROM, 4 Kbytes of SRAM, for use in multi-purpose IC cards for contact/non-contact types. It adopted PZT for ferroelectric material and 2 transistor / 2 capacitor (2T2C) type cell configuration.

Matsushita Electronics (Panasonic) also developed and produces 8-bit microcontroller with built-in FeRAM, 64 Kbit FeRAM, etc. using metal oxide with bismuth layered perovskite structure called Y-1.

Meanwhile, Toshiba announced FeRAM in February 2009 with FeRAM with maximum capacity of 128Mbits and maximum transfer rate of 1.6 GB/sec (Photo 3), with its unique cell arrangement based on chain structure. As capacity increases and higher data transfer speed is realized in this manner, it is expected to be used as a main memory for mobile terminal equipment and cache memory for mobile terminal equipment in the future.
The issues to be resolved are deterioration by writing, deterioration of high-temperature retention characteristics, processing of ferroelectric materials and so on, but easy implementation as a post process of CMOS logic makes it easy to combine with various system LSIs. As the result, FeRAM not only serves as a discrete memory device, but gathers great expectations for future growth toward realization of various system LSIs.

Photo 1: FeRAM embedded IC card by Fujitsu

Photo 2: FeRAM embedded LSI for IC card from Fujitsu

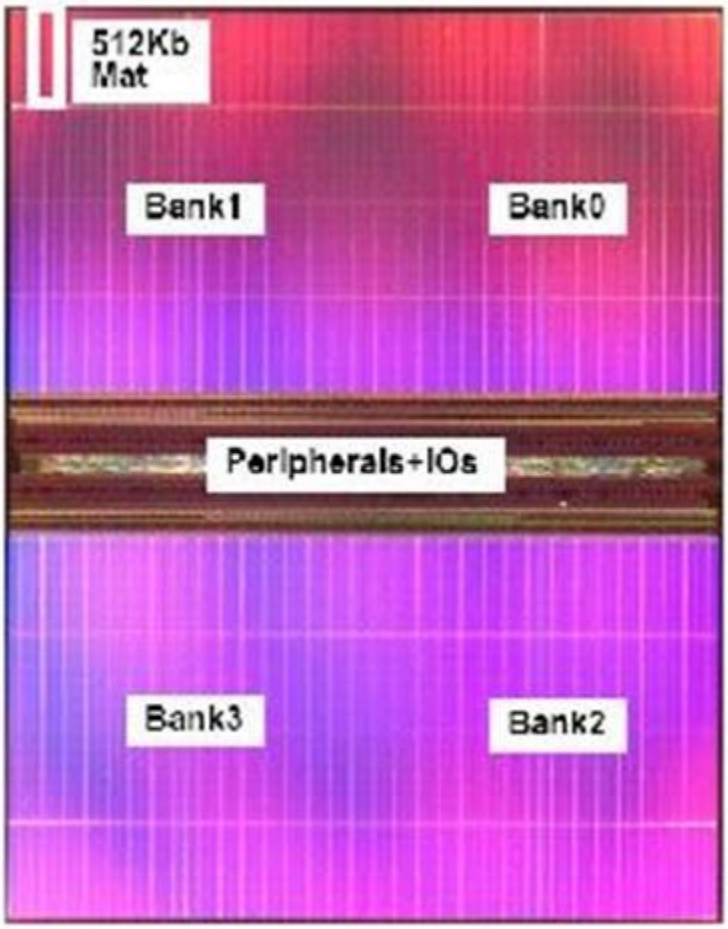

Photo 3: 128Mbit FeRAM from Toshiba

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