

Embedded Semiconductor Memory for SoC

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Abstract

The demand for high-speed, high-density and low-power semiconductor memory is rising to increase the performance of System-on-Chip (SoC). Several alternative embedded memories replacing SRAMs, DRAMs, or NOR Flash are under development aimed at strong applications because of their advantageous characteristics (Figure 1).

Technology

- **FRAM (Ferroelectric Random Access Memory)**

FRAM is for the ultralow-power and non-volatile memory. It uses the polarization of the ferroelectric crystals (Figure 2). Wide range of low-power, mobile applications like smart cards and RFID tags are expected.

- **Spin-Torque-Transferred (STT) MRAM (Magnetoresistive Random Access Memory)**

STT-MRAM is for the high-speed, high-density, and non-volatile memory. It uses the change in the magnetoresistance of a magnetic tunnel junction upon the magnetic field direction (Figure 3). It utilizes the read head technology of the hard disk drive.

- **ReRAM (Resistive Random Access Memory)**

ReRAM is for the low operation voltage, high-speed, low cost, and non-volatile memory. It uses the change in the resistance of Metal/Insulator/Metal junction (Figure 4). Replacement for NOR Flash in MicroControllerUnit is expected.

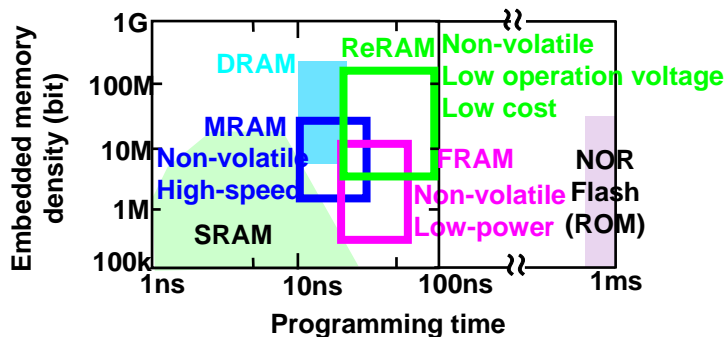


Figure 1. Properties of embedded memories

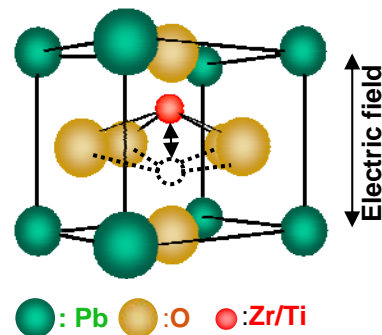


Figure 2. Ferroelectric crystal structure of FRAMs

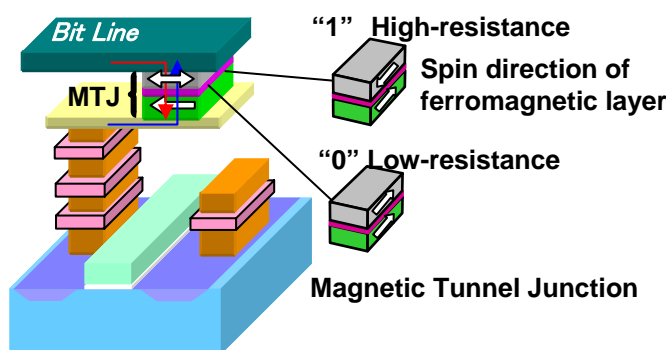


Figure 3. Cell structure of MRAM

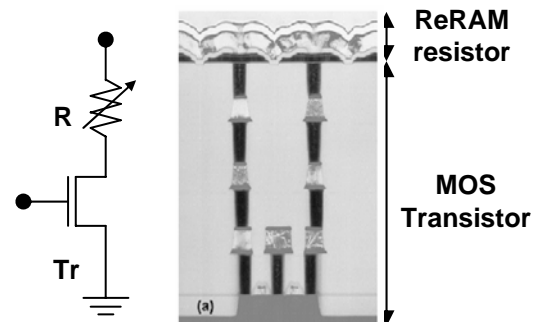


Figure 4. Cross-sectional image of ReRAM Cell structure