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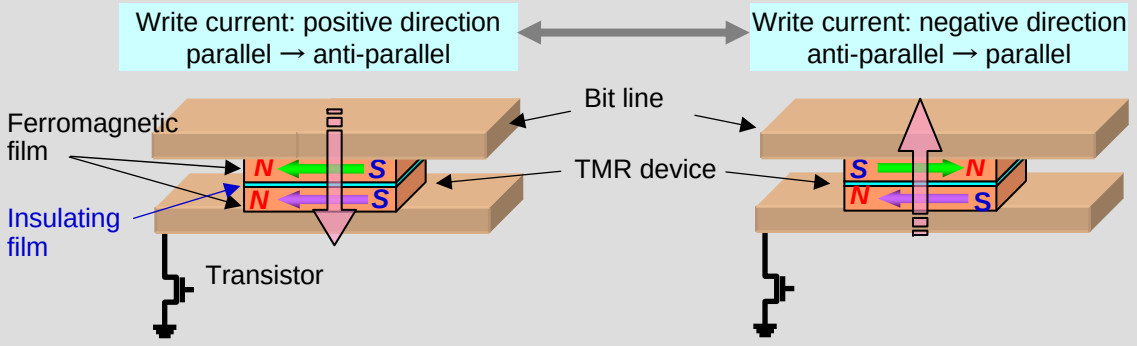
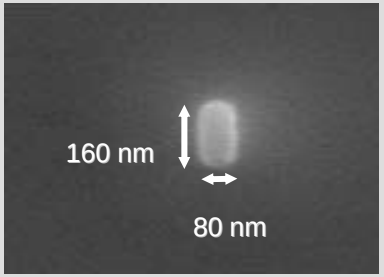
Low-current driven magnetization reversal achieved at room temperature using high output TMR device

Further opening the way to achieving next-generation large capacity MRAM



"0" and "1" are determined by the parallel or antiparallel magnetization configuration, respectively, of the upper and lower ferromagnetic film

Principle of write operation using current driven magnetization reversal



1 nanometer (nm) = 10^{-9} meter

SEM image of the TMR device prototype

Professor Hideo OHNO at the Research Institute of Electrical Communications (RIEC) of Tohoku University, in cooperation with the Advanced Research Laboratory of Hitachi, Ltd., have successfully achieved room temperature low-current driven magnetization reversal(*1) using a current density of approximately 10^5A/cm^2, the lowest reported to date, with a metallic-base tunnel magneto-resistance (TMR) device.(*2) This technology finds application in MRAM (Magnetoresistive Random Access Memory), by significantly reducing the power required to write magnetic data, as well as enabling high output read of the data. This research result is expected to open the way for future high-density high-speed low-power gigabit-level MRAM.

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*1: Current driven magnetization reversal: Changing the direction of magnetization by passing current through the magnetic device

*2: A TMR device is composed of two ferromagnetic layers separated by an extremely thin insulating layer of a few nanometers. The TMR device shows the TMR effect, that is, a large change in electrical resistance when the direction of magnetization, controlled by the magnetic field, of one ferromagnetic layer is opposite to that of the other layer.