Scaling and Power Properties of Thermally Written MRAM

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ABSTRACT

Most nonvolatile RAM technologies currently being developed use a transistor as a part of the memory cell. As photo lithography becomes smaller and smaller, this transistor becomes a significant part of the cell size. To keep this device small, on the order of the lithography, it is important to reduce the current through the cell. In addition, as elements are made smaller, the thermal excitation of the elements becomes progressively more important as a design consideration. To make the elements adequately stable, generally the anisotropy must be increased. Increased anisotropy means larger drive fields are required to switch the elements. Larger drive fields in turn require larger current densities in the conductors and this causes an increase in the accompanying heating. Thermal writing or thermally assisted writing exploit the heating that occurs and can be exploited to substantially reduce the drive currents which are required to write a memory element. This paper will compare scaling, writing, writing temperature and stability of the MRAM toggle bit, thermal write bits, and the Chalcogenide bits.