Evaluation of Data Retention Characteristics for Ferroelectric Random Access Memories (FRAMs)

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Abstract. Data retention and fatigue characteristics of 64 Kb PZT-based FRAM microcircuits manufactured by Ramtron were examined over temperature range from -85°C to +310 °C for ceramic packaged parts and from -85°C to +175 °C for plastic parts, during retention periods up to several thousand hours. Intrinsic failures, which were caused by a thermal degradation of the ferroelectric cells, occurred in ceramic parts after tens or hundreds of hours of aging at temperatures above 200 °C. The activation energy of the retention test failures was 1.05 eV and the extrapolated mean-time-to-failure (MTTF) at room temperature was estimated to be more than 280 years. Multiple write-read cycling (up to $3x10^7$) during the fatigue testing of plastic and ceramic parts did not result in any parametric or functional failures. However, operational currents linearly decreased with the logarithm of number of cycles thus indicating fatigue process in PZT films. Plastic parts, that had a more recent date code as compared to ceramic parts, appeared to be using die with improved process technology and showed significantly smaller changes in operational currents and data access times.

This paper will be presented at NVMTS2001 Conference, San-Diego, CA in November 2001.