

Advanced, Low-Power Memory Qualification: Identification of Memory Types^{*†}

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Interest in recently available Low-Power Nonvolatile Memories concentrates presently in ferroelectric random-access memories (FRAMs) and Flash Memories. While FRAMs have a fast access time and large endurance (number of write cycles), their capacity is presently limited to 256 Kb. On the other hand, Flash Memories have a long write time and comparatively small endurance, but provide capacities up to 1 Gb. Data retention time is specified for both types as 10 years.

The following table lists the features of representatives of the two types, which are of interest to NASA deep space projects.

Parameter	Unit	FRAM	Flash
Manufacturer	-	Ramtron	Samsung
Part		FM1808	K9F2808U
Capacity	bit	256 K	128 M
Write time	s	70 n	200 μ
Read time	s	70 n	10 μ (random/page) 50 n (serial/page)
Endurance	cycles	10 G	100 k

Thus, mass data, that can be written slowly and is not changed very often, can be stored in the Flash type, while smaller amounts of data, that must be written fast or often, must be stored in FRAMs.

Presently, both types of memories have only small radiation tolerance of about 10 krad. The FRAM is limited by its CMOS sense and control circuitry¹. Radiation hardened versions have been announced by Celis Semiconductor but have not yet been brought to market. Flash memories are limited by the on-chip high write-voltage generators².

We have chosen first to perform data retention tests at elevated temperatures on the 5-V Ramtron FM1808 and the 3-V Ramtron FM18L08. Similar tests on 5-V, 64 Kb Ramtron devices exhibited early failures³, see Fig. 1, which may or may not have been removed in the new products by process and/or screening improvements.

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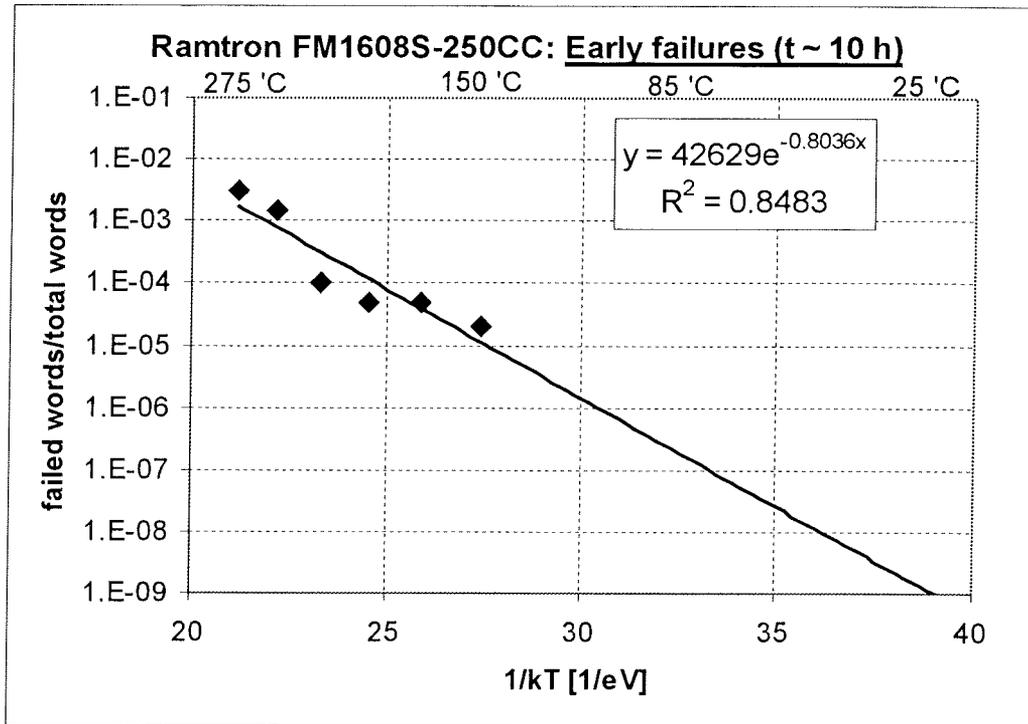


Fig. 1: Early retention failures in Ramtron 64-Kb FRAMs as function of soak temperature. Soak time was about 10 hours. From data in Ref. 3.

¹ D. N. Nguyen and L. Z. Scheick, "Radiation Response of Emerging FeRAM Technology", NVMTS 2001, paper 12

² D. N. Nguyen, private communication

³ Ashok K. Sharma and Alexander Teverovsky, "Evaluation of Data Retention Characteristics for Ferroelectric Random Access Memories (FRAMs)", NVMTS 2001, paper 11