SYNOPSIS V1.0:

Heavy Ion Latch-up Test Results for the Maxim MAX4617 CMOS Analog Multiplexer

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TEST DATE: November 17, 2000 REPORT DATE: November 21, 2000

I. INTRODUCTION

This study was undertaken to determine the radiation-induced latch-up sensitivity of the Maxim MAX4617 CMOS analog multiplexer. The testing was done at Brookhaven National Laboratory's Single Event Upset Test Facility. The power supply current was monitored for large increases, and the device's functionality was verified after each single event latchup (SEL).

II. DEVICES TESTED

The MAX4617 is an eight-channel CMOS analog multiplexer that operates with power supply voltages in the range 2.0 V<Vcc< 5.5 V, and logic levels from 0.8 V to 2.4 V.

More detailed process information is not available for these devices at this time.

Two samples of the device were tested for SEL only.

III. TEST FACILITY

Facility: Brookhaven National Laboratory Single Event Upset Test Facility.
Flux Range: $2x10^2$ to $1.3x10^5$ particles/cm^2/s.
Particles: linear energy transfer (LET)

Ion	LET ($MeVcm^2/mg$)
Cl	11.4
Ni	26.6
Br	37.4
I	59.8

IV. TEST METHODS

Temperature: ambient temperature

Test Hardware: A VXI-based custom test set was used to supply nominal input levels to the DUTs and monitor the bias supply current for changes resulting from the radiation exposure. Files were generated for each DUT to track changes in the supply current with a measurement accuracy 100 pA. The current was measured and recorded at 10 ms intervals throughout the exposure. An oscilloscope was used to monitor the DUT functionality during the irradiation.

Software: Customized LABVIEW® software provided a user interface to control signals to the DUT. The software also automatically monitored supply currents and generated a file history. In the event that the supply current exceeded a predefined value, called the limiting current (I_L), the software automatically turned off the DUT power supply.

Test Techniques: Tests were performed to screen for susceptibility to latch-up and measure latch-up sensitivity as a function of particle LET. The devices were tested at their nominal application supply voltage of 3.6 V and at ambient temperature. An equivalent normal-incidence fluence of at least $1x10^7$ ions/cm^2 was used at each test condition unless an SEL occurred. A beam flux range of $1x10^2$ to $1.3x10^5$ particles/cm^2/s resulted in individual exposures between 10 second and 10 minutes.

Device functionality was monitored by toggling the input to the chip and verifying that the output also changed. If the device current experienced a sudden increase larger than I_L, the power was cycled and the DUT was checked for functionality; we called this an SEL. The DUT functionality information was not saved to a file, but was recorded in the run log.

V. RESULTS

The MAX4617 exhibited no SEL events for effective LETs up to 119.8 MeVcm^2/mg and for and particle fluences up to 1.0E7 particles per cm^2. Effective LETs were obtained by varying the angle of incidence of the particle beam relative to the die surface's normal, thus allowing testing at LET values other those given in the table in section III.

VI. COMMENTS AND RECOMMENDATIONS

In general, the REA group does not recommend the use of devices in space flight applications that experience an SEL at an LET less than or equal to 37 MeV cm^2 / mg. Significant error mitigation approaches capable of detecting an increase in current and responding to rapidly cycle power would be required if these devices are used in a space flight application. The extent of degradation of device lifetime and reliability due to an SEL are unknown.
Although the switches did not exhibit SEL or any other hard failure mechanism, they may be susceptible to single-event transient upsets. If these are a concern in the application, additional testing may be required.