Compendium of Current Total Ionizing Dose and Displacement Damage Results From NASA GSFC and NEPP

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Abstract: Total ionizing dose and displacement damage testing was performed to characterize and determine the suitability of candidate electronics for NASA spacecraft and program use.

Introduction

One of the many elements considered in the development of NASA radiation hard electronics is to test the devices and determine their ability to function in the space environment, which includes both ionizing and non-ionizing radiation. Some electronics can be severely affected by恋爱 lays radiation in the form of total ionizing dose (TID) and single event effects (SEE), while displacement damage (DD) is a non-ionizing energy loss component of radiation that can affect the operation of devices. For the electronics to be considered suitable for use in space, the design must be demonstrated to be able to operate and perform as required within the mission envelope while the spacecraft is in orbit and during potential on-orbit maneuvers. This can be achieved through the use of testing to demonstrate the ability of the device to perform under a wide range of mission conditions.

Test Results and Discussion

The AD8554 is a commercial, high performance, high gain, high speed, high power instrumentation amplifier. It is built on a commercial 65 nm CMOS process. DD testing was performed on four samples and the dose rate sensitivity of the device was measured.

HSSR-711Y, Micropack, Oscillator

The HSSR-711Y is a single-channel power MOSFET. Displacement damage testing was performed using MIL-STD-883, Test Method 1019. The device was biased at ±6.1 kV and was exposed to ionizing energy fluence in the range of 10 Krads to 50 Krads. The displacement damage testing was performed at a dose rate of 100 rad/s and 500 rad/s. The displacement damage results were also seen in the parameter CMRR and Gm. The authors acknowledge the sponsors of this effort: NASA Electronic Parts and Packaging Program (NEPP) and NASA Goddard Space Flight Center (GSFC).

Proton Test Facilities

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