

Bulk Current Sensor to Detect Single-Event Transients

Our Solution

This invention is about to detect the single event transients induced by energetic particles in microelectronics. This is the first reported solution which is verified by experiments. It can detect the single event in real time and also reveal the physical locations of the event. It can be used in microprocessors or FPGAs to improve the reliability of the microelectronics.

Single-Event-Transients (SETs) is an interaction caused by ion-induced electron-hole pairs generated by heavy ions or high-energy proton.

These electron-hole pairs lead to current spikes striking to a sensitive node in a microelectronic device. The interferences in the device may result in significant transient errors at circuit output nodes, and thus cause system failures, which are especially more severe in aerospace electronic systems. Furthermore, this disruption becomes even worse in the down-scaled devices.

A number of research works were published in this field. Generally SET-tolerant circuits and systems are achieved by using redundancy or other methods to directly mitigate the SET effects. The examples are shown by the SETs CMOS device modeling, and SETs-tolerant circuits such as RF CMOS Voltage-Controlled Oscillator, Phase-Locked Loops, CMOS comparators, DICE latches, and error-correcting coding, etc.

A novel current sensing approach to detect SETs is introduced which can greatly reduce the area overhead and increase the sensitivity of the sensor. It is verified by inverters and a 4-bit multiplier with TSMC 90 nm CMOS technology using Cadence simulation tools. The designs are submitted to MOSIS for fabrication. Experimental results are expected once the chips are shipped back.

Advantages over existing technology

This is the first working solution to detect single event transient in real time. The sensor uses very little area and power. It can be systematically placed in the layout of microelectronics to detect the single event transients.

Applications

It can be used for Microelectronics for space and ground-level applications.

Patent status

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