Design of Bulk Built-In Current Sensors to Detect Single Event Effects and Laser-Induced Fault Injection Attempts

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Bulk Built-In Current Sensors (BBICS) are fault detection mechanisms embedded in integrated systems. BBICS are able to monitor anomalous transient currents like the so-called single event effects induced by radiation or even malicious injection sources. This work reviews BBICS principles and introduce new sensor architectures that improve the transient-fault detection sensitivity. In addition, a test chip is presented for the validation of the sensor concept under the laser-induced effects.

Mitigation of transient faults by using CED schemes based on Bulk Built-In Current Sensors (BBICS):

**Analysis of laser-induced currents in NMOS and PMOS transistors:**

Test chip composed of single NMOS and PMOS transistors designed with classic and triple-well 90-nm CMOS technology.

**Improving the transient-fault detection sensitivity of BBICS by using triple-well CMOS technology:**

**Conclusions and Perspectives:**

- Laser-based experiments revealed:
  1. Classic PMOS transistors drive bulk currents much higher than drain currents, limiting efficient transient-fault detection sensitivity of PMOS-BBICS.
  2. Structural weakness in classic NMOS transistors that precludes NMOS-BBICS efficiently identifying anomalous bulk currents.
  3. Use of triple-well CMOS technology allows a distinction of the bulk current and improves the transient-fault detection sensitivity of NMOS-BBICS.

- A 65-nm CMOS test chip is being tested to validate BBICS approach in such a technology.

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