

# Ridgetop Group Inc

## Radiation Hardening Capabilities Overview

### Radiation-Hardened (Rad-Hard) Electronics Capabilities

#### Hardening Microelectronics to Radiation

Since its formation in 2000, Ridgetop has designed effective radiation-hardening tools, test structure libraries and mixed-signal IP cores for demanding applications. Ridgetop also provides independent engineering assessments of radiation vulnerability of critical systems in space satellites, and foundry capabilities. Ridgetop maintains a DSS-approved facility and is certified as a Trusted Supplier of Design Services by the Defense Microelectronics Activity (DMEA). Ridgetop has been chosen to help design critical systems for NASA, NAVAIR, the Air Force, Department of Energy, and U.S. government prime contractors. Ridgetop maintains AS9100C- and ISO9001:2008-compliant quality management systems.

#### General Rad-Hard Design Methods

Electronics, when exposed to radiation, will degrade and eventually fail, but methods can be adopted to extend their life. ICs can also be subjected to sudden changes due to single-event particle strikes in radiation environments. These hazards, whether temporary or permanent, require corrective actions.

There are typically three methods of reducing the vulnerability of electronics to radiation damage:

- Rad-Hard by Design (RHBD)
- Rad-Hard by Shielding (RHBS)
- Rad-Hard by Process (RHBP)

Many effective RHBD techniques exist for microelectronic circuits. These can be grouped as total ionizing dose (TID) RHBD techniques such as enclosed gate layout techniques, guard ring techniques, and adaptive biasing techniques; and single-event effect mitigation techniques such as triple modular redundancy, guard gates, dual-interlocked storage cells (DICE), etc.

Ridgetop has designed and built the following rad-hard design libraries of analog and mixed-signal building blocks that can be incorporated into critical designs.

#### InstaCell™ Analog Mixed-Signal Library

- Rad-hard analog-to-digital converters (ADCs)
- Rad-hard bandgap references
- Rad-hard op amps and comparator cells

#### InstaBIST™ Built-in Test Library

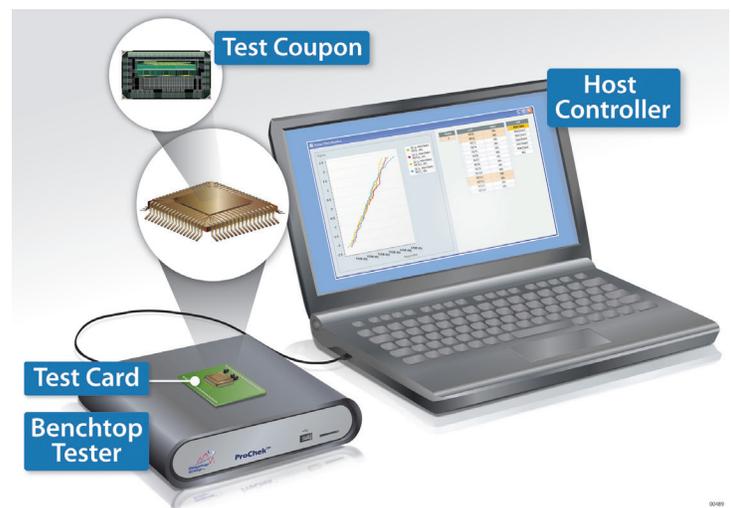
- ADC BIST

#### Sentinel Silicon™ Prognostic Cores

- RadCell Fox (field oxide edge leakage) from radiation
- RadCell Vr (threshold voltage shift) from radiation

#### ProChek™ Semiconductor Characterization System

ProChek is Ridgetop's innovative system to characterize and qualify the performance and intrinsic reliability of deep submicron nanotechnology CMOS processes for microelectronics applications. ProChek uses a test coupon



ProChek characterization of enclosed gate transistors





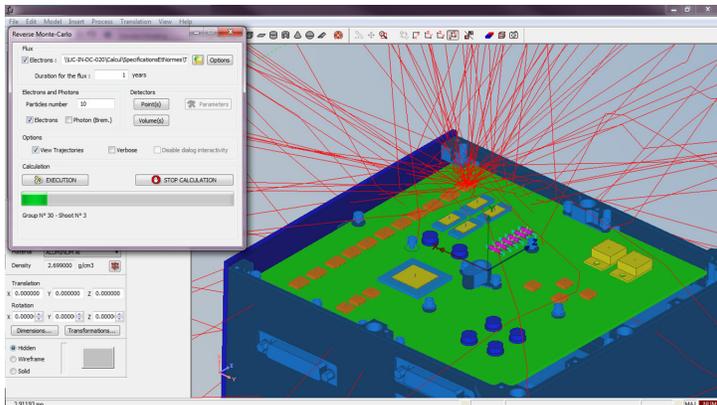
that is fabricated to expedite the characterization process. Process reliability characterization is performed using measurement and data collection circuits on a benchtop tester with a test card providing the interface to the test coupon. The benchtop tester is controlled by the host controller, which includes a graphical user interface application on a PC.

### RadChek™ 3D Radiation Design and Shielding Analysis

Ridgetop now offers RadChek, a 3D software tool that supports the design and analysis of shielding for PCBs and electromechanical assemblies that are exposed to radiation.

RadChek was developed for radiation engineers who need a user-friendly interface that can:

- Create a radiation 3D model of the system
- Calculate the received doses
- Perform optimum shielding analysis



RadChek 3D shielding analysis screen shot

### Rad-Hard by Process (RHBP)

For rad-hard design requirements, Ridgetop utilizes advanced semiconductor processes that can help reduce vulnerability of critical systems. These process methods include the use of Silicon on Insulator (SOI) and Silicon on Sapphire (SOS) processes for single-event effect mitigation. Small-geometry CMOS processes can provide inherent hardness to TID effects. Ridgetop maintains a full EDA tool suite that supports the use of RHBP methods. Often RHBP is combined with RHBD methods to achieve a specific tolerance target. Ridgetop is familiar with various semiconductor processes and is well-suited to meet demanding design requirements.

### Summary

Ridgetop can provide advanced methods to meet a desired level of radiation tolerance, including design, process and shielding methods. To reach a specific level of hardness, the tradeoffs on performance, weight, processing speed, and other factors need to be considered. The variables are complex, but Ridgetop maintains a staff of experienced personnel to handle the most demanding applications. Call Ridgetop for more information.

*Ridgetop is AS9100C/  
ISO9001:2008-compliant  
and has Trusted Supplier  
of Design Services  
accreditation from U.S.  
Defense Microelectronics  
Activity (DMEA)*



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