

SBIR Topic Number:
AF05-018

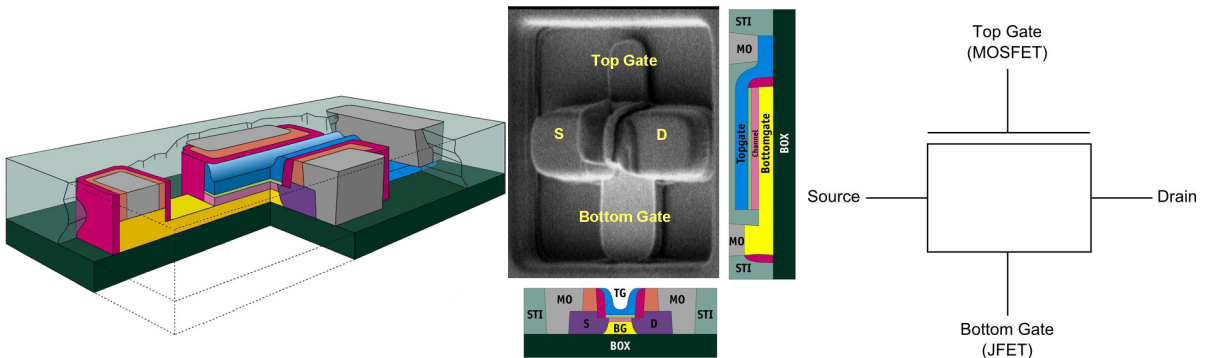
SBIR Title:
Radiation-Hardened
by Design Techniques
for Total Dose and
Single Event Upset

Contract Number:
FA9453-06-C-0043

SBIR Company Name:
American Semiconductor,
Inc., Boise, ID

Technical Project Office:
AFRL Space Vehicles
Directorate, Kirtland AFB,
NM

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.



Left: 3D Flexfet Cross Section. Middle: Flexfet Cross Section. Right: Flexfet Symbol

Commercial Rad-Hard Advanced Digital Library (CRADL)

- The Air Force needs advanced Complementary Metal Oxide Semiconductor (CMOS) technology that is inherently radiation-hard, dynamically tunable for speed and power, and commercially available with standard cell libraries
- CRADL libraries are designed on American Semiconductor's Flexfet™ advanced CMOS technology
- The Commercial Rad-Hard Advanced Digital Library (CRADL) enables advanced satellite and spacecraft requirements for high chip density, low power, high speed, and inherent radiation tolerance
- Flexfet CMOS and CRADL circuits enable the next generation of satellite and spacecraft requirements to be met

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Air Force Requirement

Current Complementary Metal Oxide Semiconductor (CMOS) technology is not well suited for satellite and spacecraft applications. Today's designs must make trade offs between speed and power, and must incorporate radiation hardness through external means that often include redundancy and increased chip area. Future satellite and spacecraft mission requirements demand high chip density, low power, high speed, and inherent radiation tolerance that exceed the limits of current technology.

The Air Force needs advanced CMOS technology that is inherently radiation-hard, dynamically tunable for speed and power, and commercially available with standard cell libraries.

SBIR Technology

The Commercial Rad-Hard Advanced Digital Library (CRADL) delivers a standard digital cell library that enables advanced satellite and spacecraft requirements for high chip density, low power, high speed, and inherent radiation tolerance. CRADL libraries are designed on American Semiconductor's Flexfet™ advanced CMOS technology.

Flexfet is a commercially available, independently double gated (IDG), silicon-on-insulator (SOI) technology that provides inherent radiation tolerance and is dynamically tunable for speed and power. CRADL circuits are the most complex circuits ever built with IDG transistors, demonstrating Flexfet as a commercially manufacturable alternative to technologies such as FinFET.

Potential Air Force Application

CRADL enables the development of digital logic cells that provide integrated circuit (IC) designers with a platform for rapid development of rad-hard designs that incorporate dynamic, threshold-voltage scaling. This provides on-the-fly reconfigurable optimization of performance and power consumption, and enables satellite and spacecraft designers a degree of flexibility that they have never had before.

The ability to dynamically tune between power and performance can be used to design ICs that can be high speed one moment, but ultra low power the next, enabling high performance electronics without the need for larger batteries and power systems. CRADL circuits, based on Flexfet, are also inherently rad-hard which further reduces size,

weight, and power drain by reducing circuit, IC, and system redundancies. Flexfet CMOS and CRADL circuits enable the next generation of satellite and spacecraft requirements to be met.

Company Impact

Flexfet is a unique and novel transistor device technology that American Semiconductor originated as a viable multi-gate structure. The CRADL project provided the opportunity to utilize the Systematic Hierarchical Approach to Radiation-Hardened Electronics (SHARE) Process Development Kit and develop a core cell library which is the fundamental building block for the foundry application. The projects generated outstanding technology readiness level (TRL) progress for Flexfet CMOS.

"American Semiconductor has enjoyed working on CRADL," said Doug Hackler, President and Chief Executive Officer. "CRADL has been an important program for us and enabled the development of an advanced, low power, dynamically tunable digital cell library that can directly benefit the Air Force Research Laboratory's rad-hard space programs and support additional foundry customers in applying the benefits of new multi-gate transistor technology."



SBIR/STTR

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