Power Matters.™

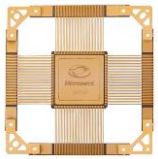
Mixed Signal ICs for Space

Microsemi Space Forum 2015

Dorian Johnson
Product Marketing Manager – High Reliability ICs

Microsemi
SPACE FORUM

Mixed Signal ICs for Space

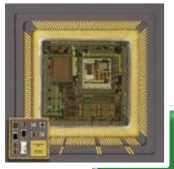


New Products

- SSM
  - Telemetry
  - Power Drive/Motor Control
- High Side Drivers
- Diode Array

Legacy

- 30+ yrs
- PWM Controllers
- Regulators
- Drivers
- QML listed



Custom

- 15+ years
- Drivers
- Controllers
- Amplifiers
- Relays
- Telemetry
- Sensor Interface
- Motor Control

Microsemi Mixed Signal Space Heritage

- Microsemi Space heritage
  - Broad space portfolio since 1957
  - First Mixed Signal ICs screened for space in 1985
  - First Mixed Signal ICs specifically designed & manufactured for space applications in 1995
  - Our custom ICs reside in Spacecraft Control Electronics units that are installed in at least 36 spacecraft that are already in space
  - Examples are:

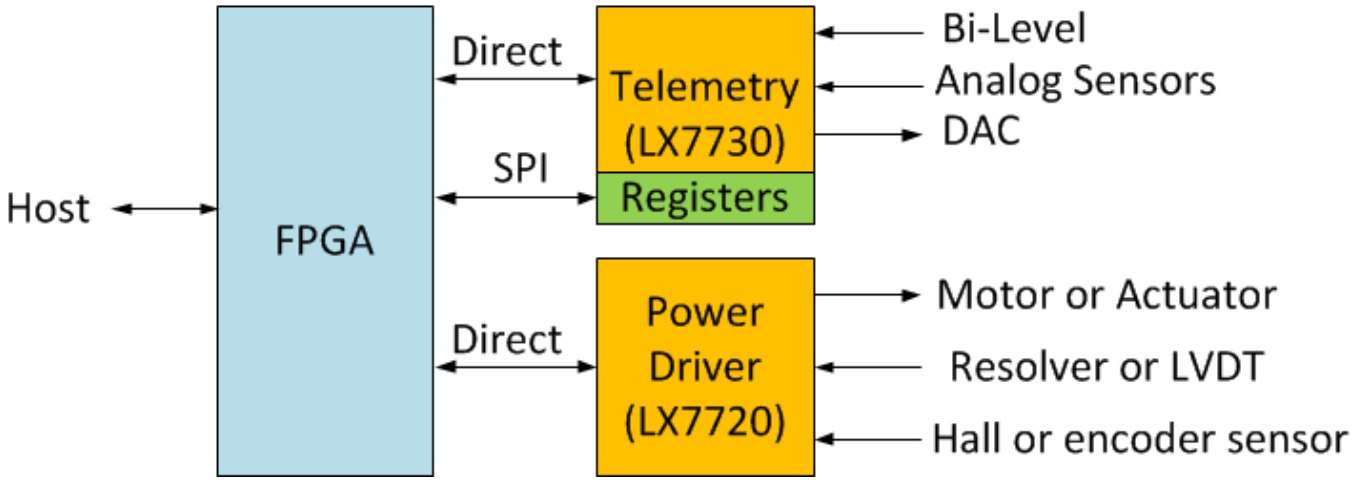
New Products

- Space System Managers –LX7730 and LX7720
- AAHS298B High Side Driver
- LX7710 Diode Array

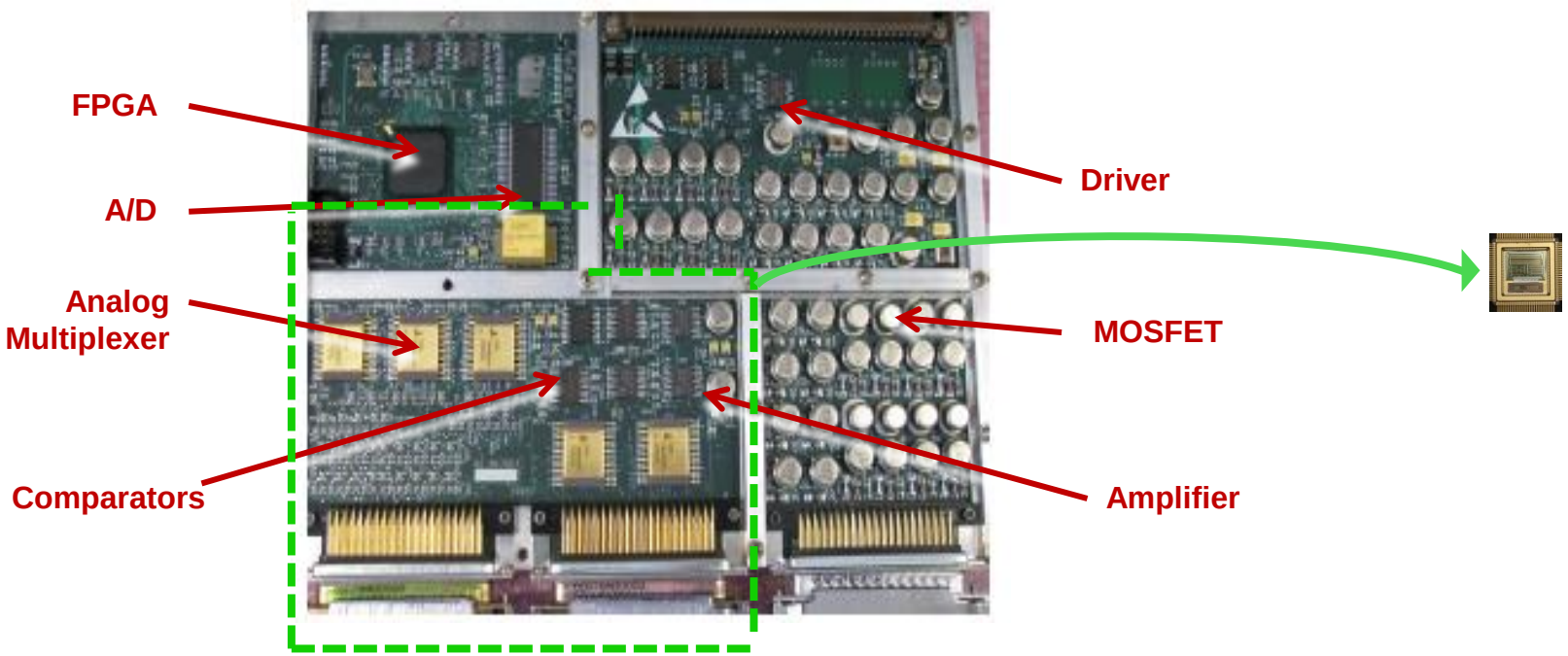
Space System Managers

Space System Manager Concept

- The Space System Manager (SSM) is a special purpose, off-the-shelf, analog mixed signal IC that is used with a FPGA
- The solution reduces part count resulting in smaller size and weight and increased reliability
- The SSM ICs add power and mixed signal capability to supplement the digital functionality and flexibility of the FPGA
- SSMs provide a higher level of integration than basic devices by specifically focusing on common spacecraft interfaces
- Through FPGA programmability, the SSM can be adjusted to particular settings by changing the internal command registers



Space System Manager vs. Discrete Components

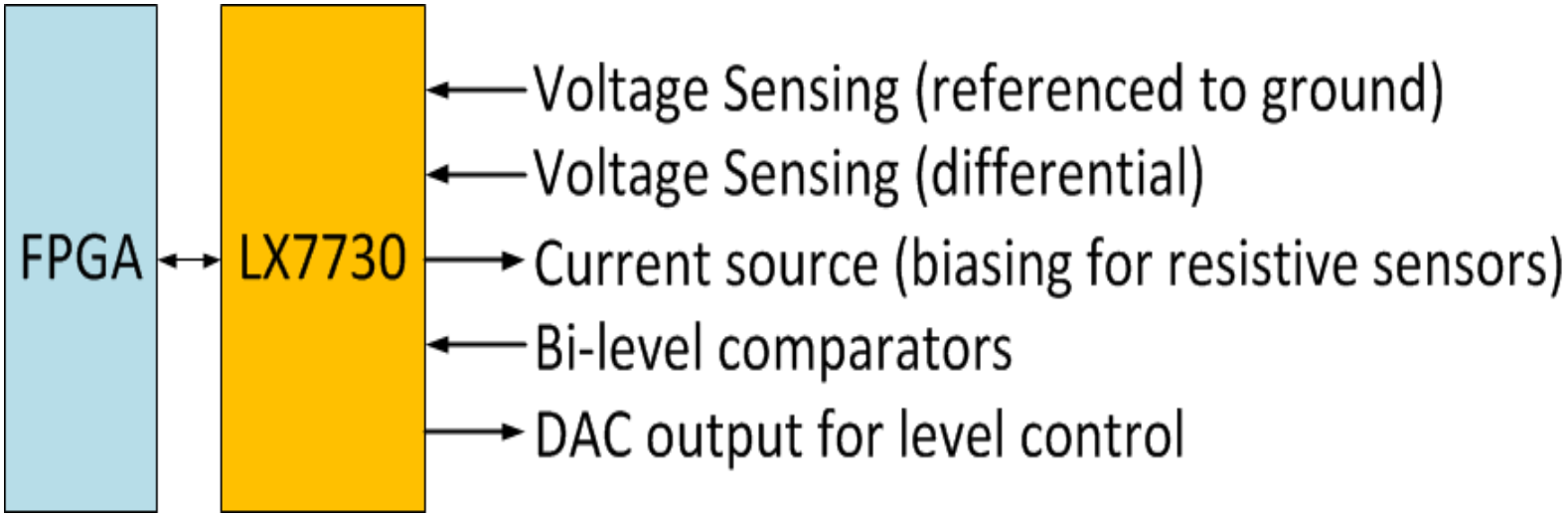


- A typical circuit uses an FPGA with analog interface functions implemented with many single function ICs and discrete components.
- SSM integrates commonly used functions into one package to reduce circuit board area and weight.
- Although utilization may not be 100% for the space system manger, it is still likely to be a more compact solution.

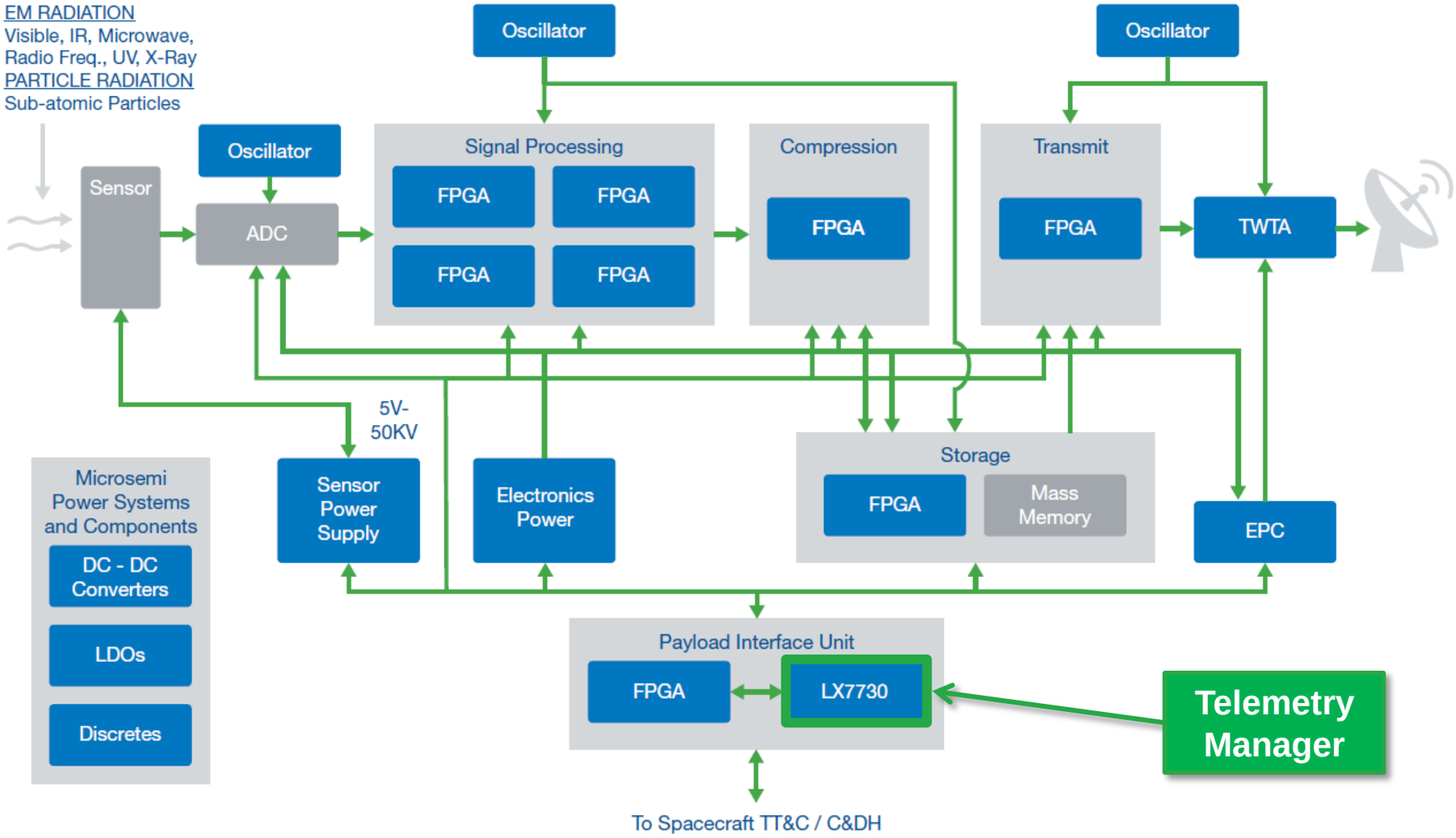
The LX7730 Telemetry Controller SSM

The LX7730 is a Telemetry Controller is the first SSM.

- 64 channel MUX
- Break-before-make switching
- 25kSPS 12 bit ADC
- 2% Precision Adjustable Current Source
- 1% Precision 5.00V Source
- Parallel or Dual SPI Interface
- Threshold Monitoring
- 8 x Bi-level Logic
- 10 bit DAC
- Radiation Tolerant
  - 100krad TID, 50kad ELDR



Space System Managers in Remote Sensing Payload

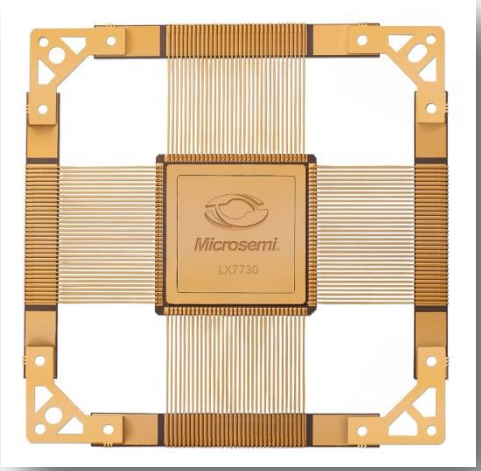


The LX7730 complements other Microsemi space products

LX7730 Product Availability

LX7730 availability

- NOT ITAR - EAR 9A515.e.
- Engineering Samples LX7730-ES: ***NOW***
- Evaluation Board LX7730-EVB: ***NOW***
- Class S built Samples Q3 2015
- Qualification Testing Complete Q1 2016
- QML Class V certification: Targeting mid-2016



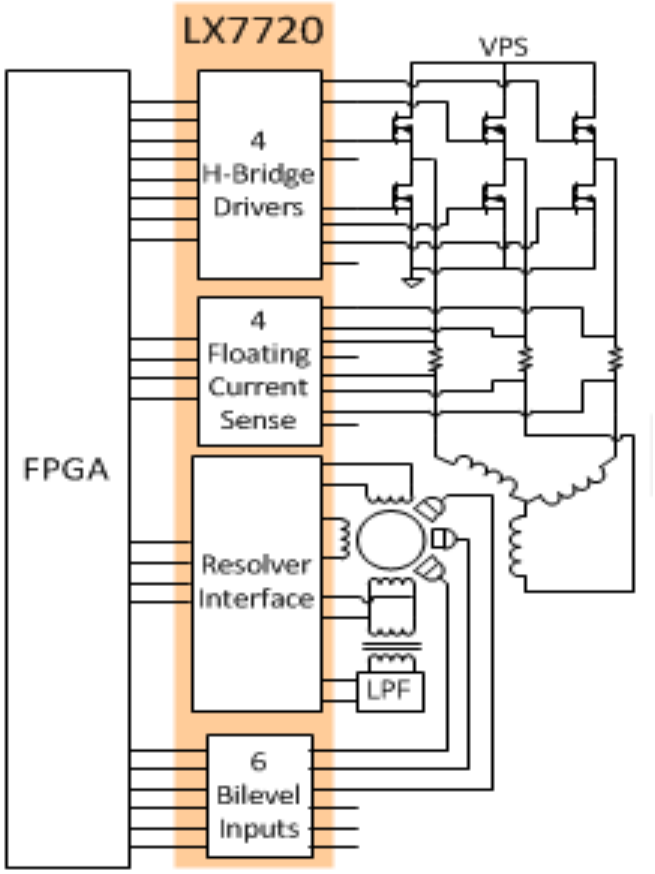
132 pin ceramic quad flat pack

LX7720 Power Driver / Motor Controller

The LX7720 Power Driver with Position Feedback is the second SSM

Features

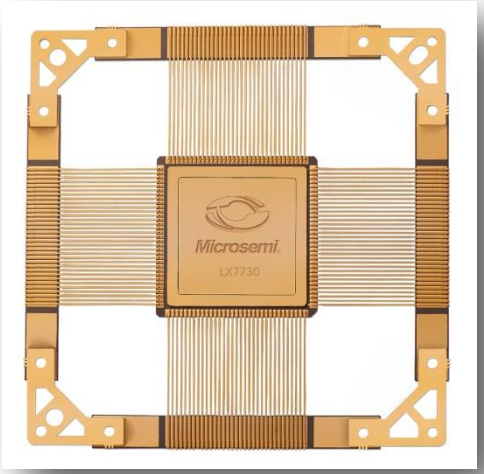
- 4 half-bridge Nch MOSFET drivers
- 4 floating differential current sensors
- Sigma-delta resolver transformer driver
- 3 differential resolver sense inputs
- 6 bi-level logic inputs
- Fault detection
- Provides motor control for:
  - Stepper, Brushless DC, PMSM motor driver



LX7720 Product Availability

LX7720 availability

- NOT ITAR - EAR 9A515.e.
- Engineering Samples LX7720-ES – Q4 2015
- Evaluation Board LX7730-EVB – Q4 2015
- Class S built Samples Q2 2016
- Qualification Testing Complete Q4 2016
- QML Class V certification: Targeting mid-2017



132 pin ceramic quad flat pack

Visit our website for more information on our SSMs:

SSM page:
http://www.microsemi.com/product-directory/radiation-hardened-devices/3574-space-system-managers

LX7730 page:
http://www.microsemi.com/product-directory/space-system-managers/3575-telemetry-controller-ic

For Lead Customer Program inquiries, please contact:
SSM_LCP@Microsemi.com

AAHS298B High Side Driver
LX7710 Diode Array

AAHS298B – Rad Tolerant 8 Channel Source Driver

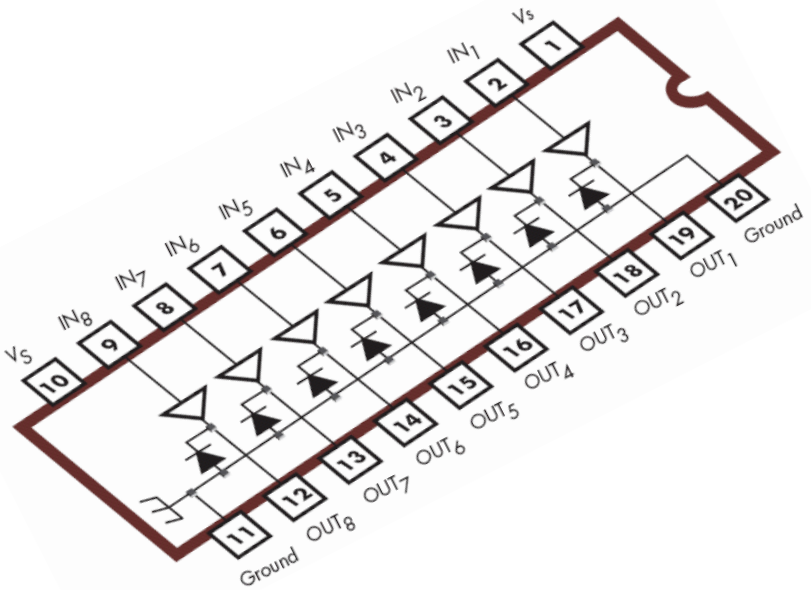
Features

- 700mA per output source current
- Fully isolated channels with DI process
- 100krad TID, SEL immune
- 80V minimum output breakdown
- Low quiescent current consumption
- Internal ground clamp diodes
- Internal thermal shutdown
- TTL, 5V, and 12V logic compatible

Applications

- Aerospace satellite manufacturers
  - Military power electronics control

- **In Production**
- **Samples available now**



LX7710 – Rad Tolerant Octal Diode Array with Redundancy

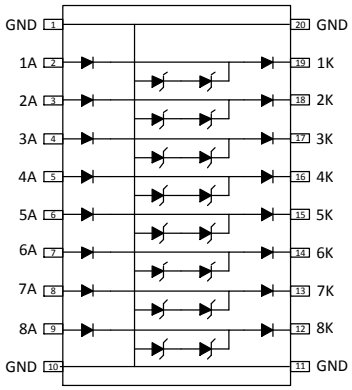
Features

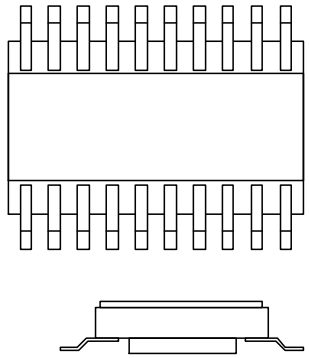
- 125V min breakdown voltage
- 1A current rating/diode
- 2800mA combined rating
- Redundancy if one diode fails
- Discharge path for inductive kick
- -55°C to 125°C ambient
- 20 lead ceramic SOIC

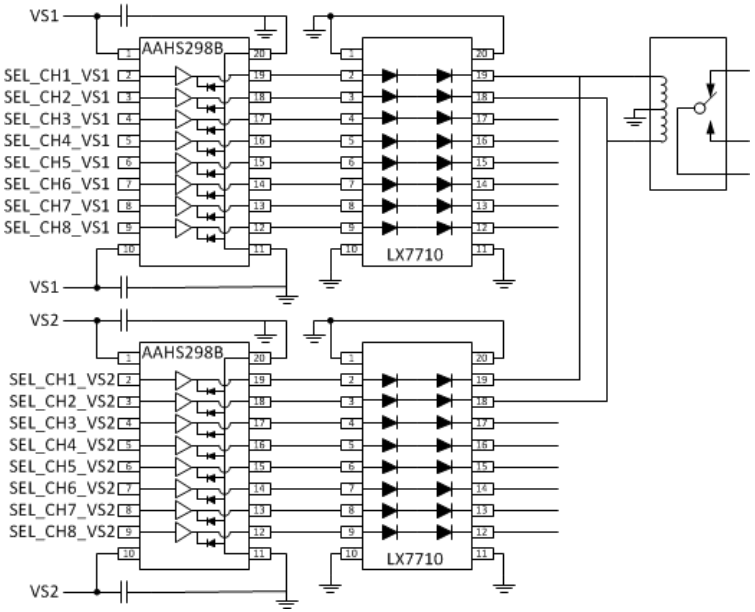
Applications

- Relay Driver
- Uninterruptable power
- Redundant power sourcing
- Prevents channel backflow

- **In Development**
- **Samples available now**
- **Production Q1 calendar 2016**







PWM Controllers
Linear Regulators

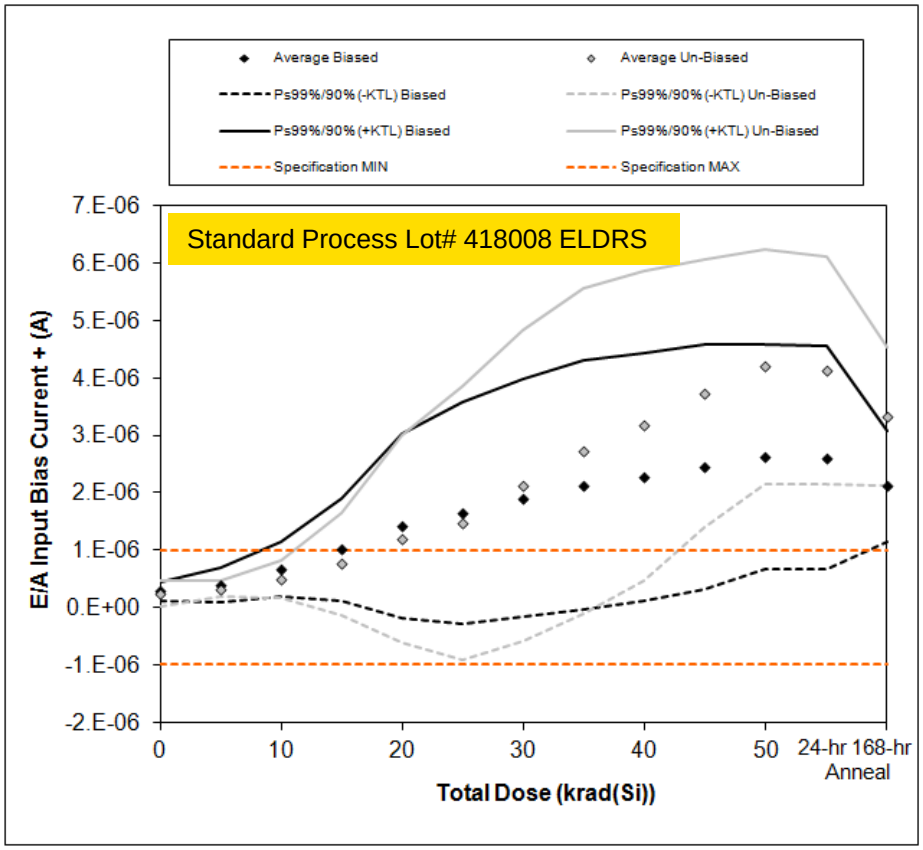
SGR Product Offering

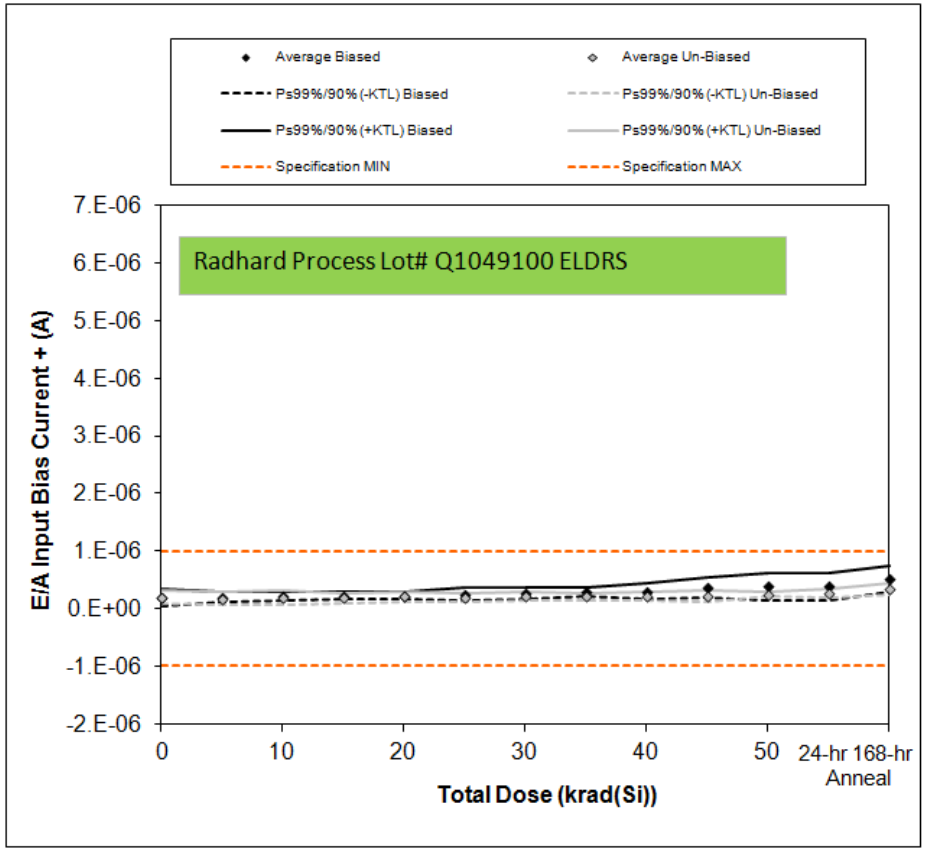
Microsemi offers new radiation tolerant enhancements to our popular Industry Standard products.

- PWM Controllers SGR1846 and SGR1845
- Linear Voltage Regulators SGR117 (positive) and SGR137 (negative)
- Guaranteed Radiation Tolerance performance - (Test data available)
  - TID to a minimum of 100krad(Si)
  - ELDRS to a minimum of 50krad(Si)
  - SEL immunity to a minimum of 87MeV cm^2/mg
- Fit-Form-Function (FFF) equivalent of Industry Standard SG product
  - Process change ONLY* and No design change*
- Currently sampling and in production.

**The SGR117 is a design change from the SG117 and has extensive space heritage.*

SG1846 ELDRS vs. SGR1846





- STD process failed 10 Krad

- New process passed 50 Krad

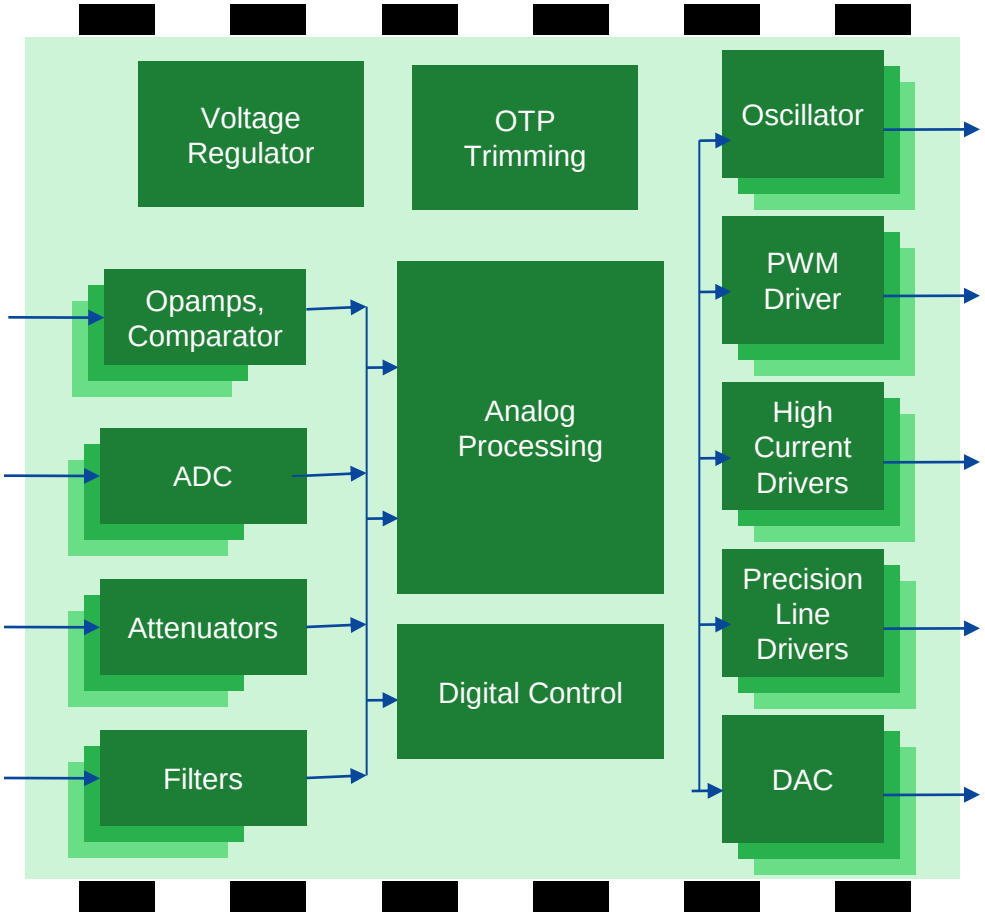
Custom Capabilities

Custom ASIC Solutions

- 15 years of custom ASIC development
  - Design team in San Jose, CA
- Full custom designs, from specification to production
  - System integration
  - Second sourcing to replace obsolete parts
  - Customization of standard product
- Mixed-signal solutions integrating complex analog functions with up to 100k gates
- Challenging operating conditions
  - Extreme temperature environment (225°C)
  - Radiation tolerance by design for 100kRad TID minimum
  - SEL/SEU immunity, SETI mitigation
  - Cold-sparing on I/Os for redundant applications
- 10 year minimum process life guarantee and obsolescence management
- Screening to MIL-PRF-38535 Class B and Class S/V

A typical Mixed-Signal ASIC

Typical design: 10 analog functions, 5k-100k digital gates, 12 man-months of engineering



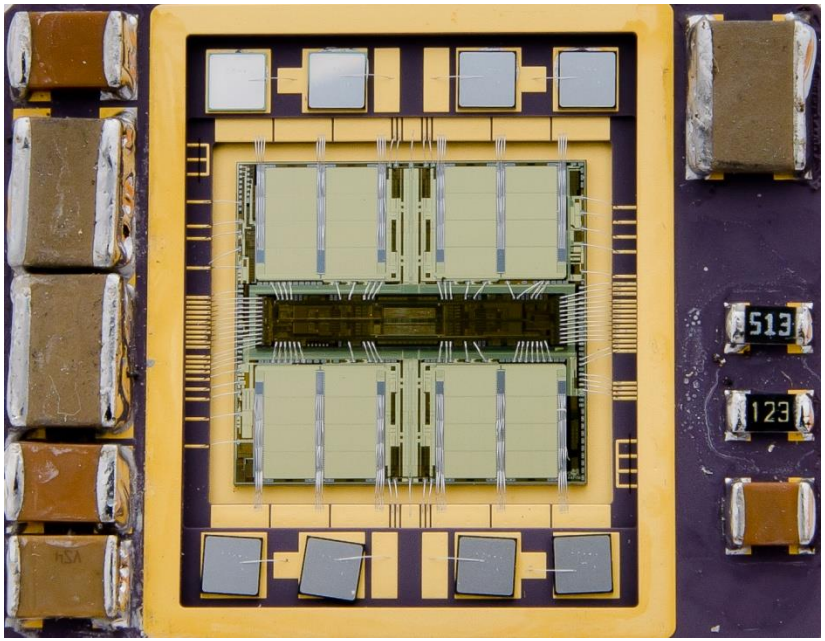
Custom ASIC Expertise

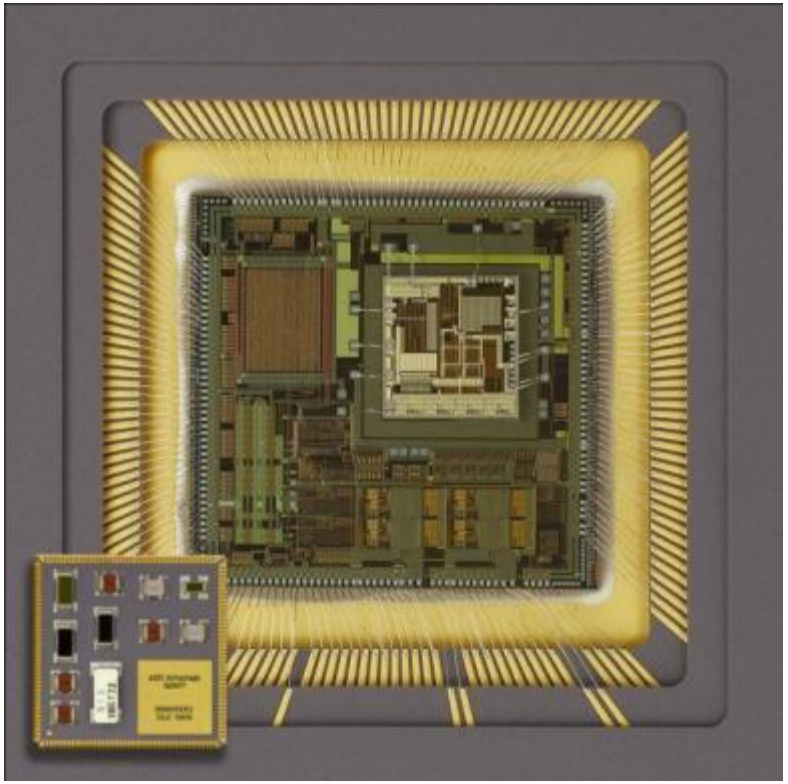
Aerospace	Other Applications
Solid State Circuit Breakers	Non-Contact Rotational Sensor
Pin-Diode Drivers	Industrial Light Proximity Sensor
Solid State Relays	Capacitive Sensor Interface
High-side drivers	Log Amplifier
RH Motor controller with 2A driver	15A SiC JFET Driver
RH RS485 Transceiver	MOSFET RF Driver
Solid State LED Drivers	55 MHz Buffer Amplifier (Extreme Temp)
ARINC 429 TX/RX/ID	5MHz Oscillator Driver (Extreme Temp)
Cockpit light dimmers	
Aircraft LVDT Controller	
Navigation Gyro Controllers	
RH Telemetry Controller	

Over 80 custom ASICs for aerospace and industrial applications

Custom Packaging

- Custom hermetic single and multi-layer ceramic packages
- Single or multi-chip (stacked or side-by-side)
- Addition of discrete components outside of the hermetic cover
- MIL-PRF-38534 assembly
- Design for low thermal resistance
- Design for high currents

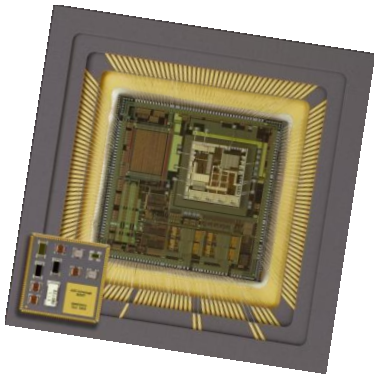




Custom Mixed-Signal for Space

Telemetry ASIC for Satellite

- Multiple analog inputs: single ended, differential, bi-level, current conditioning
- High precision analog: regulator, oscillator, 8-bit A/D, 0.5% current source
- Full digital host interface with dual RS485 transceiver
- Custom hermetic package with back-side discrete
- Cold-sparing on all pins
- 100krad(Si) total dose, ELDR, SEL immune



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Thank You

Microsemi Corporation (MSCC) offers a comprehensive portfolio of semiconductor and system solutions for communications, defense & security, aerospace and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 3,600 employees globally. Learn more at www.microsemi.com.

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