Power Matters

Analog Mixed Signal Space Product Update

Microsemi Space Forum Russia – November 2013

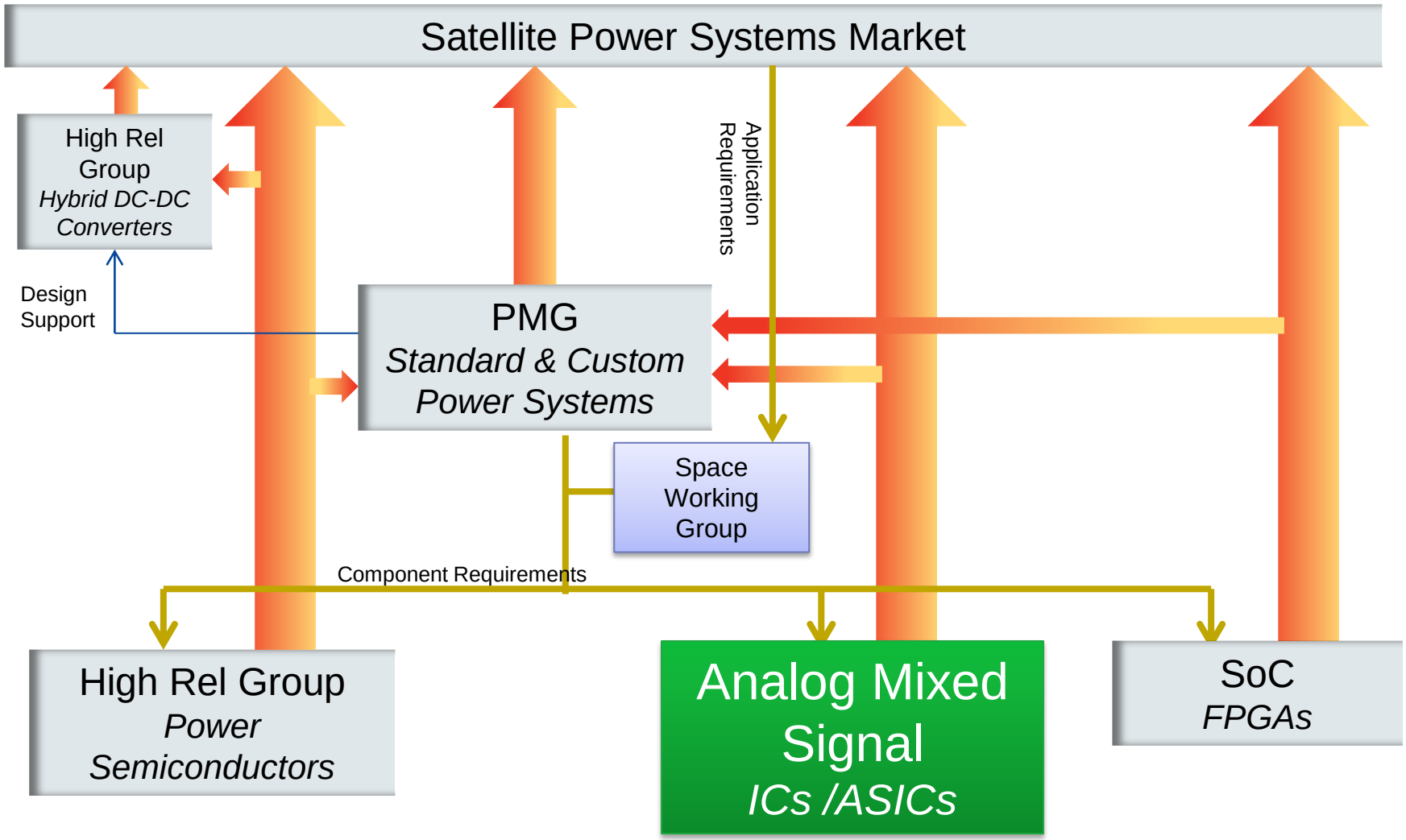
Dorian Johnson
Senior Product Marketing Engineer, Analog Mixed Signal Group

Agenda

- HiRel ICs Overview
- Industry Standard Analog Integrated Circuits
- Space System Manager
- Custom Integrated Circuits

Hi-Rel ICs Overview

The Analog-Mixed Signal Hi-Rel ICs



AMSG-HiReL – Who We Are

- Microsemi is a leading supplier of high reliability Analog and Mixed-Signal integrated circuits
  - 30 years of standard products offering
  - 15 years of custom products design
- We develop analog mixed signal integrated circuits primarily for the Military, Space and Aerospace markets
- We are focused on markets and products operating in harsh environments and requiring rigorous testing and long product availability
- Our group is built upon developed expertise in sensor interface and driver products

Industry Standard Integrated Circuits

Industry Standard Integrated Circuits

- Our industry standard ICs have been a trusted solution for over 35 years in Military and Aerospace and have a long heritage

- Over 80 different products including
  - PWM Controllers
  - Linear Voltage Regulators
  - Driver Arrays
  - Transistor Arrays
  - Op Amps

- A policy of non-obsolescence

Hi-Rel Industry Standard ICs - Overview

Linear Voltage Regulators

SG109	Positive, Fixed
SG117/SG117A	Positive, Adjustable
SGR117/SGR117A	Positive, Adjustable, Rad Hard
SG120/SG120A	Negative, Fixed
SG137/SG137A	Negative, Adjustable
SG140/SG140A	Positive, Fixed
SG723	Precision, Positive or Negative Adjustable
SG1532	Precision, Positive or Negative Adjustable
SG78xx/SG78xxA	Positive, Fixed
SG79xx/SG79xxA	Negative, Fixed

PWM Controllers

SG1524/SG1524B	Voltage Mode
SG1525A	Voltage Mode, Dual Sink/Source
SG1526/SG1526B	Voltage Mode, Dual Sink/Source
SG1527	Voltage Mode, Regulating, Dual Sink/Source
SG1529	Voltage Mode, Regulating
SG1731	DC Motor Controller
SG1825C	High Speed, Current Mode
SG1842	Off-line, Current Mode, 16V UVLO, 100% Max Duty Cycle
SG1843	Off-line, Current Mode, 8V UVLO, 100% Max Duty Cycle
SG1844	Off-line, Current Mode, 16V UVLO, 50% Max Duty Cycle
SG1845	Off-line, Current Mode, 8V UVLO, 50% Max Duty Cycle
SG1846	Current Mode, Dual Sink/Source

Linear Circuits

Interface

SG2000 Series	Driver Array - 7 NPN
SG2800 Series	Driver Array - 8 NPN

MOSFET Drivers

SG1626	Dual High-Speed, Inverting
SG1644	Dual High-Speed, Non-inverting

Op Amps

SG143	High-Voltage, Low-Current
SG1436	High-Voltage, Low-Current
SG1536	High-Voltage, Low-Current, Low-Offset
SG2101	Dual, Compensated

Voltage Reference

SG1503	Precision 2.5V Reference

Supervisory

SG1543	Power Supply Output Control Circuit
SG1544	Low-Voltage Power Supply Output Control Circuit
SG1548	Quad Power Fault Monitor
SG1549	Current Sense Latch, 100mV Input Threshold, 180nS delay

Hi-Rel Standard Portfolio – 1/3

(DESC Cross Reference Available)

				Available Hi-Reliability Features			
Linear Voltage Regulators		I_{OUT}	V_{OUT}	Mil-Std-883	DESC/SMD	Mil-M38510 (JAN)	Rad-hard / TID Passed *
SG109	Positive, Fixed	1A	5V	●		●	
SG117/SG117A	Positive, Adjustable	1.5A		●	●	●	
SGR117/SGR117A	Positive, Adjustable, Rad Hard	1.5A		●	●		1000 krad TID (spec)
SG120/SG120A	Negative, Fixed	1.5A	-5,-12,-15V	●			
SG137/SG137A	Negative, Adjustable	1.5A	-1.2 to -37V	●	●		
SG140/SG140A	Positive, Fixed	1.5A	5, 12 ,15V	●			
SG723	Precision, Positive or Negative Adjustable	1.5A	2 to 37V	●		●	
SG1532	Precision, Positive or Negative Adjustable	150mA	2 to 38V	●	●		
SG78xx/SG78xxA	Positive, Fixed	1.5A	5, 12 ,15V	●	●	●	
SG79xx/SG79xxA	Negative, Fixed	1.5A	-5,-12,-15V	●	●	●	

Class S (Space Level) Screening is available for all devices and is specified by the customer SCD

Hi-Rel Standard Portfolio – 2/3

(DESC Cross Reference Available)

Linear Circuits				Mil-Std-883	DESC/SMD	Mil-M38510 (JAN)	Rad-hard Test Results
	Interface	$I_{CE(MAX)}$	$V_{CE(MAX)}$				
SG2000 Series	Driver Array - 7 NPN	up to 600mA	50 to 95V	•	•	•	
SG2800 Series	Driver Array - 8 NPN	up to 600mA	50 to 95V	•	•	•	
	MOSFET Drivers	Freq	V_{CC}				
SG1626	Dual High-Speed, Inverting	DC to 1.5MHz	4.5 to 20V	•	•		
SG1644	Dual High-Speed, Non-inverting	DC to 1.5MHz	4.5 to 20V	•	•		
	Op Amps	$V_{INPUT\ OFFSET}$	V_{SUPPLY}				
SG143	High-Voltage, Low-Current	2mV	28V	•	•		
SG1436	High-Voltage, Low-Current	5mV	15V	•			
SG1536	High-Voltage, Low-Current, Low-Offset	2mV	28V	•	•		
SG2101	Dual, Compensated	3mV	5 to 20V	•		•	
	Voltage Reference	V_{IN}	V_{OUT}				
SG1503	Precision 2.5V Reference	4.5 to 40V	2.5V	•	•		
	Supervisory	V_{IN}	V_{OUT}				
SG1543	Power Supply Output Control Circuit	4.7 to 40V	2.5V	•	•		
SG1544	Low-Voltage Power Supply Output Control Circuit	4.7 to 40V	2.5V	•	•		
SG1548	Quad Power Fault Monitor	4.5 to 40V	2.5V	•	•		
SG1549	Current Sense Latch, 100mV Input Threshold, 180nS delay			•	•		

Class S (Space Level) Screening is available for all devices and is specified by the customer SCD

Hi-Rel Standard Portfolio – 3/3

(DESC Cross Reference Available)

PWM Controllers		Freq	V_{IN}	V_{OUT}	Available Hi-Reliability Features			
					Mil-Std-883	DESC/SMD	Mil-M38510 (JAN)	Rad-hard Screen Results *
SG1524/SG1524B	Voltage Mode	100-400kHz		5V	●	●	●	SG1524B TID 100k krad(si)
SG1525A	Voltage Mode, Dual Sink/Source	100-500kHz		5.1V	●	●	●	
SG1526/SG1526B	Voltage Mode, Dual Sink/Source	1-500kHz		5V	●	●	●	TID 50k krad(si)
SG1527	Voltage Mode, Regulating, Dual Sink/Source	100-500kHz		5.1V	●	●	●	
SG1529	Voltage Mode, Regulating	100-400kHz		5V	●			
SG1731	DC Motor Controller	5k-350kHz		-	●			
SG1825C	High Speed, Current Mode	1.5MHz		10 to 30V	●	●		
SG1842	Off-line, Current Mode, 16V UVLO, 100% Max Duty Cycle	500kHz		30V	●	●		
SG1843	Off-line, Current Mode, 8V UVLO, 100% Max Duty Cycle	500kHz		30V	●	●		
SG1844	Off-line, Current Mode, 16V UVLO, 50% Max Duty Cycle	500kHz		30V	●	●		
SG1845	Off-line, Current Mode, 8V UVLO, 50% Max Duty Cycle	500kHz		30V	●	●		
SG1846	Current Mode, Dual Sink/Source	500kHz		8 to 40V	●	●		TID 80k krad(si) ELDR 50k

Class S (Space Level) Screening is available for all devices and is specified by the customer SCD

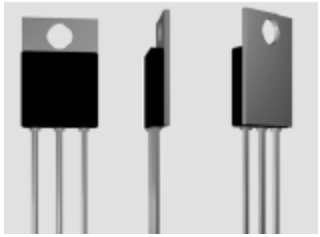
Hi-Rel Industry Standard ICs - Packages

Metal Case with Mounting Tab

TO-257, 3 pin

IG = Microsemi designator for insulated case

G = Microsemi designator for non-insulated case



Metal Cans

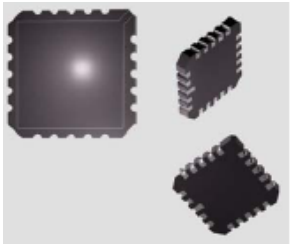
Low Current (500mA)

TO-39, 3 pin, T = Microsemi designator

TO-99, 8 pin, T = Microsemi designator

High Current (>1.5A)

TO-3, 3 pin, K = Microsemi designator



Ceramic Leadless Chip Carrier

LCC, 20 pin, L = Microsemi designator

Ceramic Dual In-Line

DIP, 8 pin, Y = Microsemi designator

DIP, 14, 16, 18 pin, L = Microsemi designator

The New SGR Product Line

To address the growing requirement for both Extended Low Dose Radiation (ELDR) and Total Ionization Dose (TID) guaranteed performance, the new SGR product line features

- 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
- QML-V certified and listed
  - EV = Equivalent QML-V flow offered prior to full certification
- Fit-Form-Function (FFF) equivalent of SG product
  - Process change ONLY
  - No design change
- No changes to SG product line. Still fully supported

Process Comparison

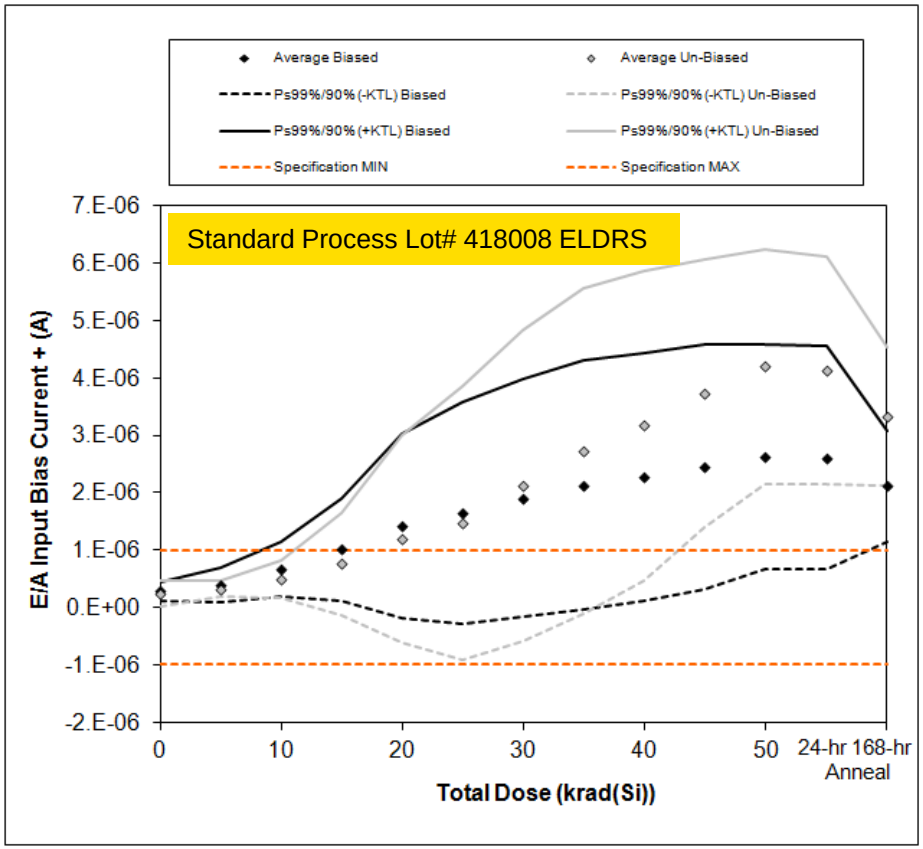
- STANDARD SG PARTS

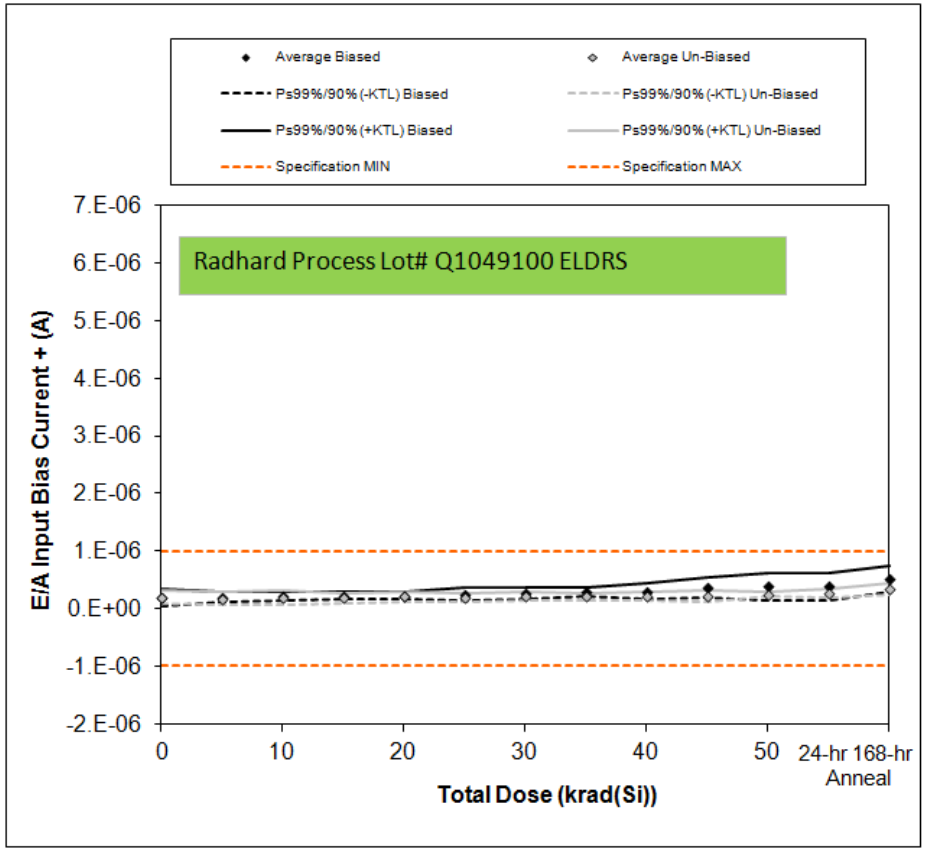
- 20V, 40V, or 60V Bipolar Processes with vertical NPN, lateral PNP, Diffused resistor, and Oxide capacitor
- Thermal Oxide passivation and Silicon Nitride overglass
- Some parts performed well to TID but failed ELDRS at 5-10 krad(Si)

- NEW SGR PARTS

- Same processes with the same electrical characteristics on all active devices
- Radhard oxide passivation and Silicon Nitride overglass. Radhard oxide was successfully used in CMOS processes from Hughes Aircraft and Honeywell to create radhard processes in the 80s
- Target 100K-300Krad TID and 50Krad ELDRS

SG1846 ELDRS vs. SGR1846

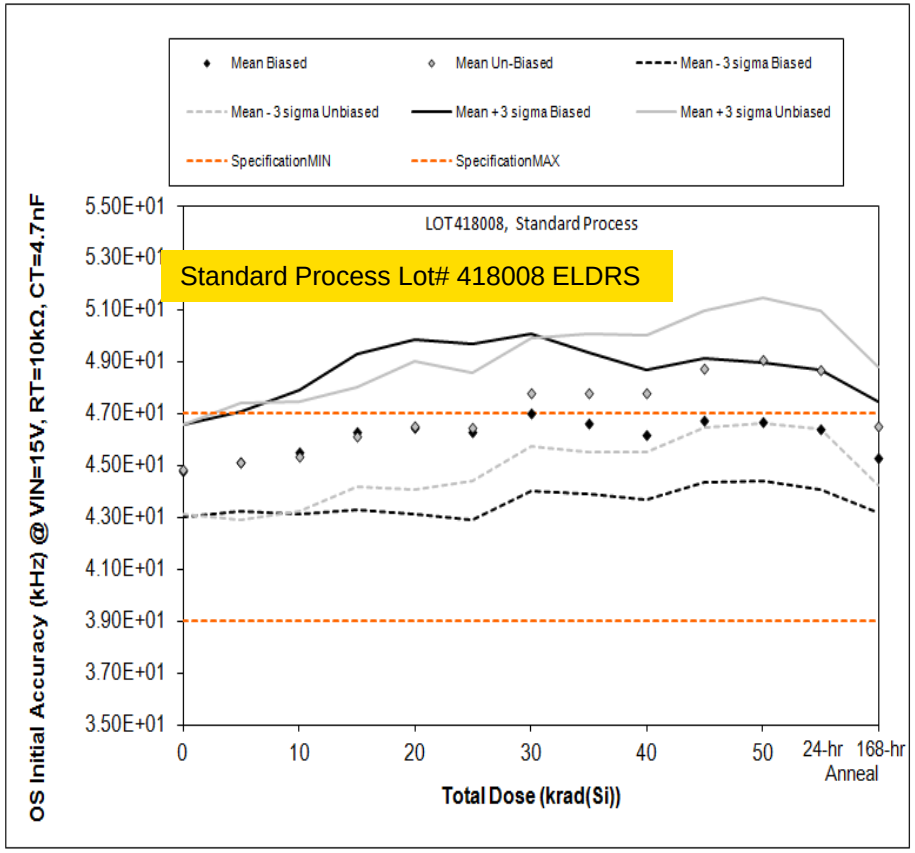


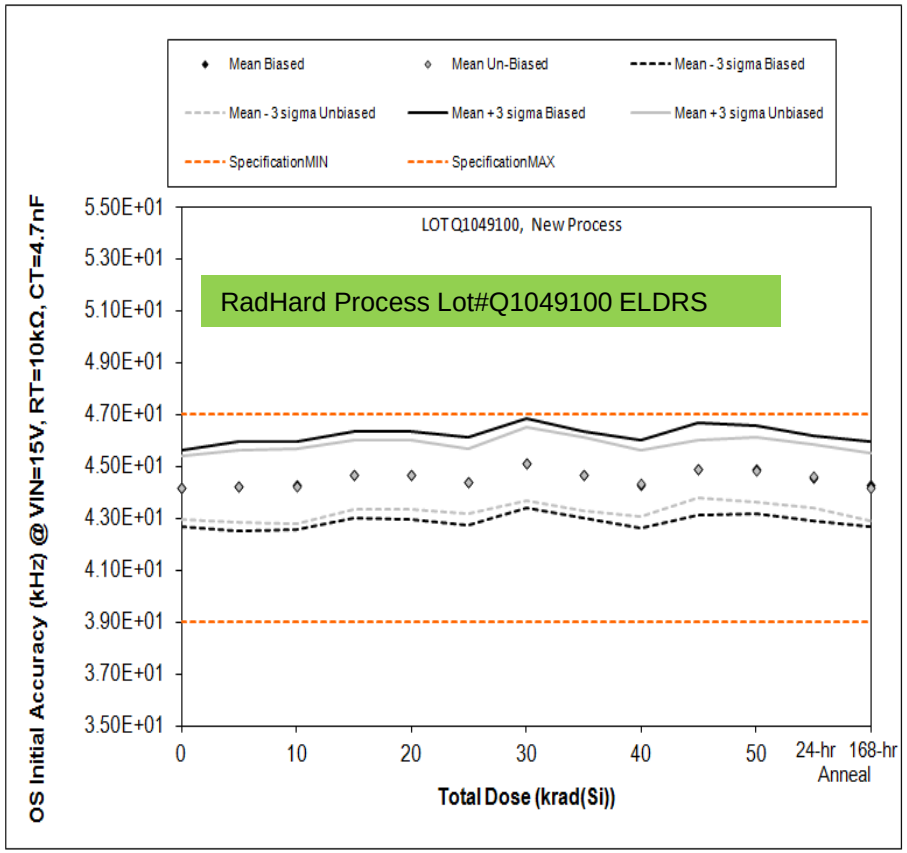


- STD process failed 10 Krad

- New process passed 50 Krad

SG1846 ELDRS vs. SGR1846





- STD process failed 10 Krad

- New process passed 50 Krad

SGR1846 - Rad Hard PWM Controller

- Current Mode PWM Controller
- Buck, Flyback, Forward, SEPIC topologies
- Vin: 8V to 40V
- Low Cost Application
  - <50% Duty cycle, no need for slope compensation while lowering External MOSFET Voltage
  - Built-in Error Amplifier, Voltage Reference and Soft Start
- Built-in Protection
  - Shutdown with automatic restart
- Optimize design for size, efficiency or to avoid EMI issues
  - 1KHz to 500KHz
- Rad-Tolerance: (Test data available)
  - TID to a minimum of 100krad(Si)
  - ELDRS to a minimum of 50krad(Si)
  - SEL immunity to a minimum of 87MeV mm2/mg
- Samples available now
- Production calendar Q3 2013

Samples Available Now

SGR1845 - Rad Hard PWM Controller

- Current Mode PWM Controller
- Vin: 30V
- Optimized for Off-Line Control
- Low Start-Up Current (<1mA) with Pulse-By-Pulse Current Limiting
- Automatic Feed Forward Compensation
- High-Current Totem-Pole Output
- Trimmed Oscillator and Internally Trimmed Bandgap Reference
- 500kHz Operation
- Under-voltage Lockout 8.4 Volts
- Low Shoot-through Current <75mA Over Temperature
- Rad-tolerance: (Test data available)
  - TID to a minimum of 100krad(Si)
  - ELDRS to a minimum of 50krad(Si)
  - SEL immunity to a minimum of 87MeV mm2/mg
- Samples available now
- Production calendar Q3 2013

Samples Available Now

SGR117- Rad Hard 1.5A Three Terminal Adjustable Voltage Regulator

- Positive adjustable voltage regulator
- Supports Input-to-Output Voltage Differential up to 40V
- Low current limit option (500mA)
  - TO-39, CLCC and CerDIP packages
  - High current limit option (1.5A)
  - TO-3 and TO-257 packages
- Rad-tolerance: (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
  - $5x10^{12}$ N/cm^2 neutron fluence

SGR Product Release Map

P/N	Description	Samples	RTP	QML-V
SGR1846	Current Mode PWM Controller, 500KHz, 40Vin, 7.7V UVLO, <50% D.C.	Now!	CY13Q4	CY14Q2
SGR1845	Current Mode PWM Controller, 500KHz, 30Vin, 8.4V UVLO, <50% D.C.	Now!	CY13Q4	CY14Q2
SGR1825C	Current Mode PWM Controller, 2MHz, 30Vin, 9.2V UVLO, <85% D.C.	Now!	CY14Q1	CY14Q2
SGR137	1.5A, Negative Adjustable Linear Regulator, 40Vin, -1.25Vref	Now!	CY14Q1	CY14Q2
SGR1524B	PWM Controller, 40V	CY14Q1	CY14Q3	CY14Q3
SGR117HV	.5A or 1.5A, Positive Adjustable Voltage Regulator, 60Vin	CY14Q1	CY14Q3	CY14Q3
SGR28xx	High Voltage Transistor Array, 50Vce, 600mA Ic, High Output TTL input	CY14Q1	CY14Q3	CY14Q3
SGR1843	Current Mode PWM Controller, 500KHz, 30Vin, 8.4V UVLO, <100% D.C.	CY14Q1	CY14Q4	CY14Q4
SGR78xx	1.5A, Positive Adjustable Linear Regulator, 35Vin, 5Vout ±4%	CY14Q1	CY14Q4	CY14Q4
SGR7815A	1.5A, Negative Fixed Voltage Regulator	CY14Q1	CY14Q4	CY14Q4
SGR1644	Dual MOSFET Driver, 3A Ipeak, 22Vin, Trise/Tfall<25ns	CY14Q1	CY15Q1	CY15Q1
SGR1503	Voltage Reference, 2.5V ±1%, 4.5V to 40Vin, T.C. 10ppm/°C, 1.5mA Iq	CY14Q1	CY15Q1	CY15Q1
SGR1525	PWM Controller, 35V	CY14Q1	CY15Q1	CY15Q1
SGR1526B	Regulating PWM Modulator, 8-35V	CY14Q1	CY15Q1	CY15Q1
SGR1536	Op Amp, ±12V to ±36Vin	CY14Q1	CY15Q1	CY15Q1

Screening Options Plan

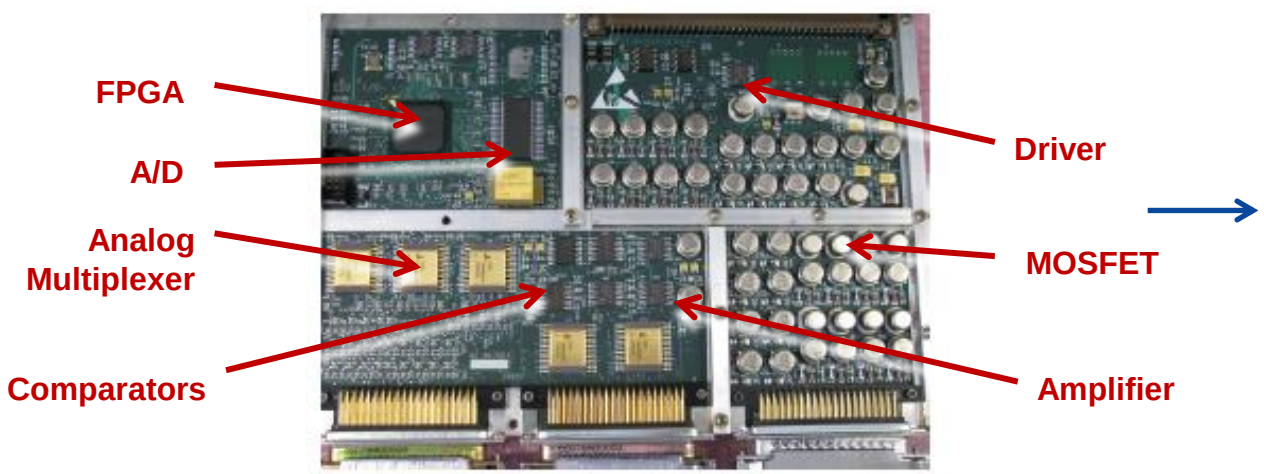
	SG (non-Radiation guaranteed)	SGR Prototypes	SGR QML-V	SGR QML-V Extended
Part Suffix	NA	-P	-EV/-V	-EVX/-VX
TID	None	-	Per lot	Per Wafer
ELDR	None	-	Qualification	Per Wafer
SEE	None	-	Qualification	Qualification

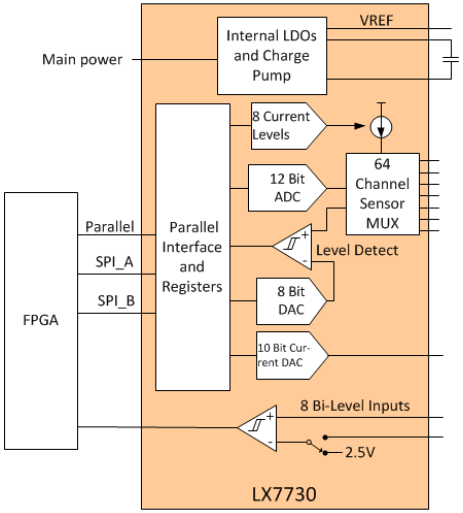
Space System Manager

Space System Manager Concept

- Space System Manager (SSM) is a combination of an FPGA with a special purpose analog or power companion IC
- The Companion IC integrates circuits that control or monitor typical application oriented interfaces but has minimal hard coded internal logic
- Using VHDL modules the FPGA can be configured to customize the SSM for specific applications
- The Companion IC is a standard part that is space qualified and immediately available
- The SSM solution is scalable by selecting one or more companion ICs for an application and selecting an FPGA model number with a sufficient number of gates

The Discrete Component Solution





- A typical circuit uses an FPGA with commonly-used analog interface functions implemented with many single function ICs and discrete components. IC compatibility often requires buffering circuitry
- The discrete solution tends to result in large circuit cards and more weight than would be possible with a more highly integrated solution
- In general, the more components, the lower the level of reliability.

Reducing Risk While Maximizing Integration

	Discrete Solution	Space System Manager	Custom ASIC Solution
NRE	Low	Low	High
Development Time	Months	Months	Years
Qualification	Fast	Fast	Long
Risk	Small	Small	High
Flexibility	High	High	None
Power	Worst	Good	Best
Reliability	Average	Excellent	Excellent
Size and Weight	Poor	Good	Best

The Companion IC Protection Features

- The companion IC uses a special Dielectric Isolated (DI) process that is **fault tolerant** such that if any channel within the IC becomes compromised, the remaining IC circuitry continues to function normally

- An isolated ESD structure for each Companion IC pin along with design techniques considering low leakage with power removed allows the companion IC to be **cold spared** (becomes a high impedance with the power removed)

- **Radiation Tolerance**
  - Minimum Total Ionization Dose (TID) tolerance of 100kRad
  - Minimum Extended Low Dose Radiation (ELDR) tolerance of 50kRad
  - Single Event Latch-up (SEL) immunity

The Companion IC Family

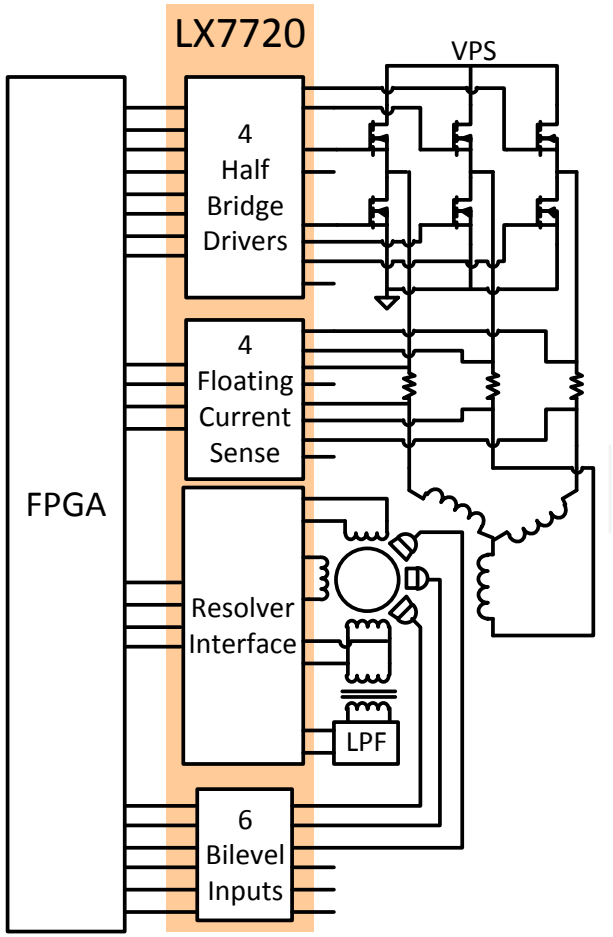
- In Development
  - LX7720: Power Driver with Rotation and Position Feedback
  - LX7730: 64 Input Analog Telemetry Controller

- Concept
  - LX7740: Multi-rail Power Controller

LX7720 Power Driver w Position Feedback

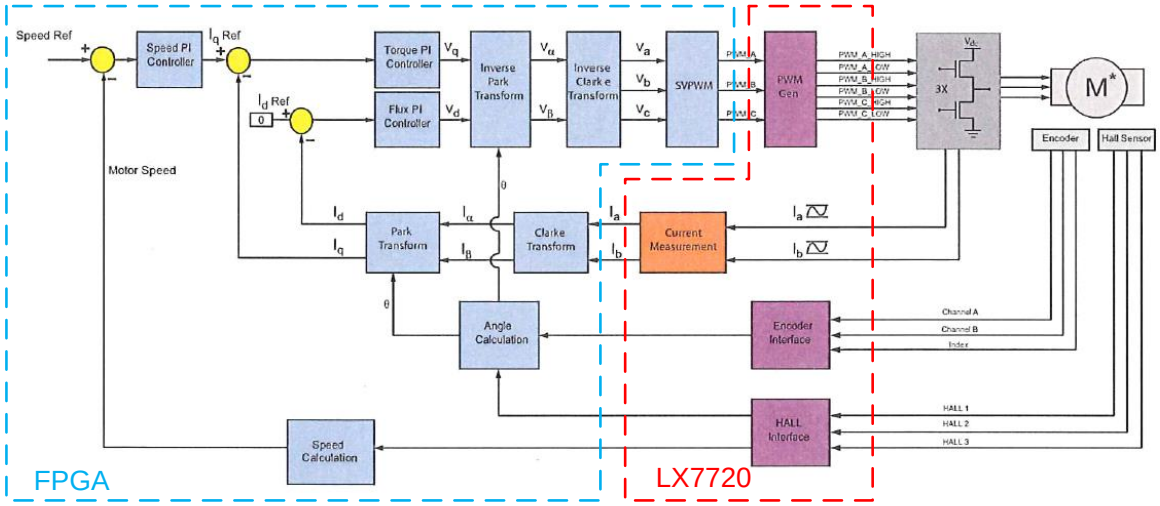
- Facilitates digital loop servo control of a complete power systems such as a brushless DC motor, stepper motor or solenoid driver

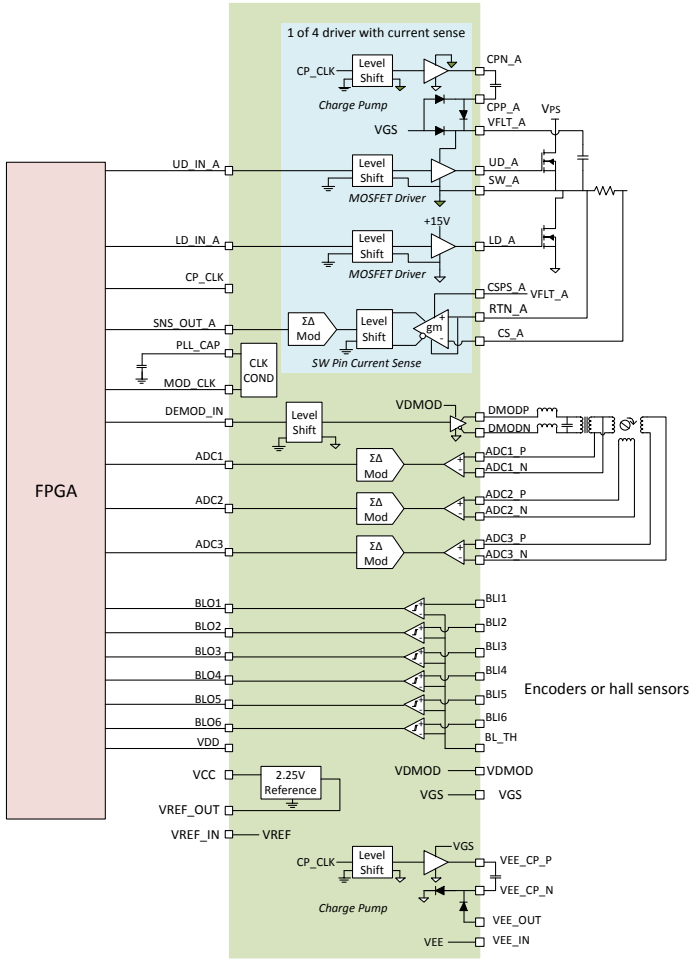
- LX7720 Features
  - Four half bridge all Nch MOSFET drivers
  - Four floating differential current sense.
  - Separate motor and signal grounds
  - Resolver or LVDT drive and receivers
  - Six Bi-level inputs
- FPGA provides
  - Average coil current and torque control
  - PWM control (stepper or BLDC)
  - Precision speed and positioning



LX7720 Application: PMSM

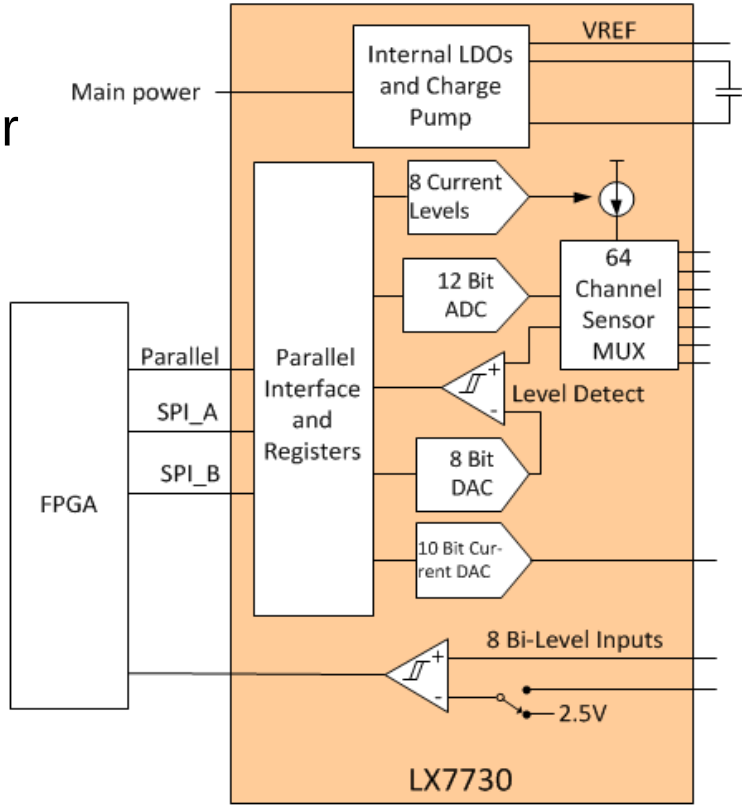
- LX7720 provides
  - MOSFET drivers
  - Current Sense inputs
  - Rotation position and speed inputs
- FPGA provides:
  - Field coordinate transformation
  - Control loop
  - Space Vector PWM driver





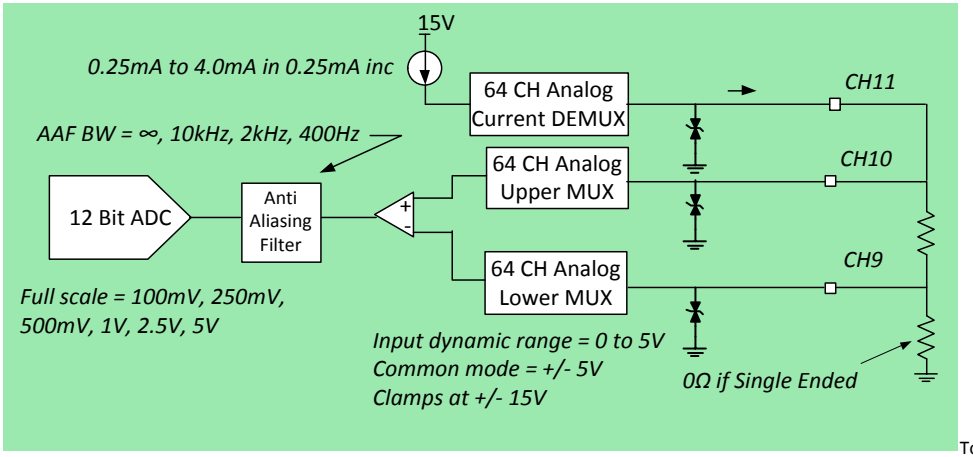
LX7730 Telemetry Manager

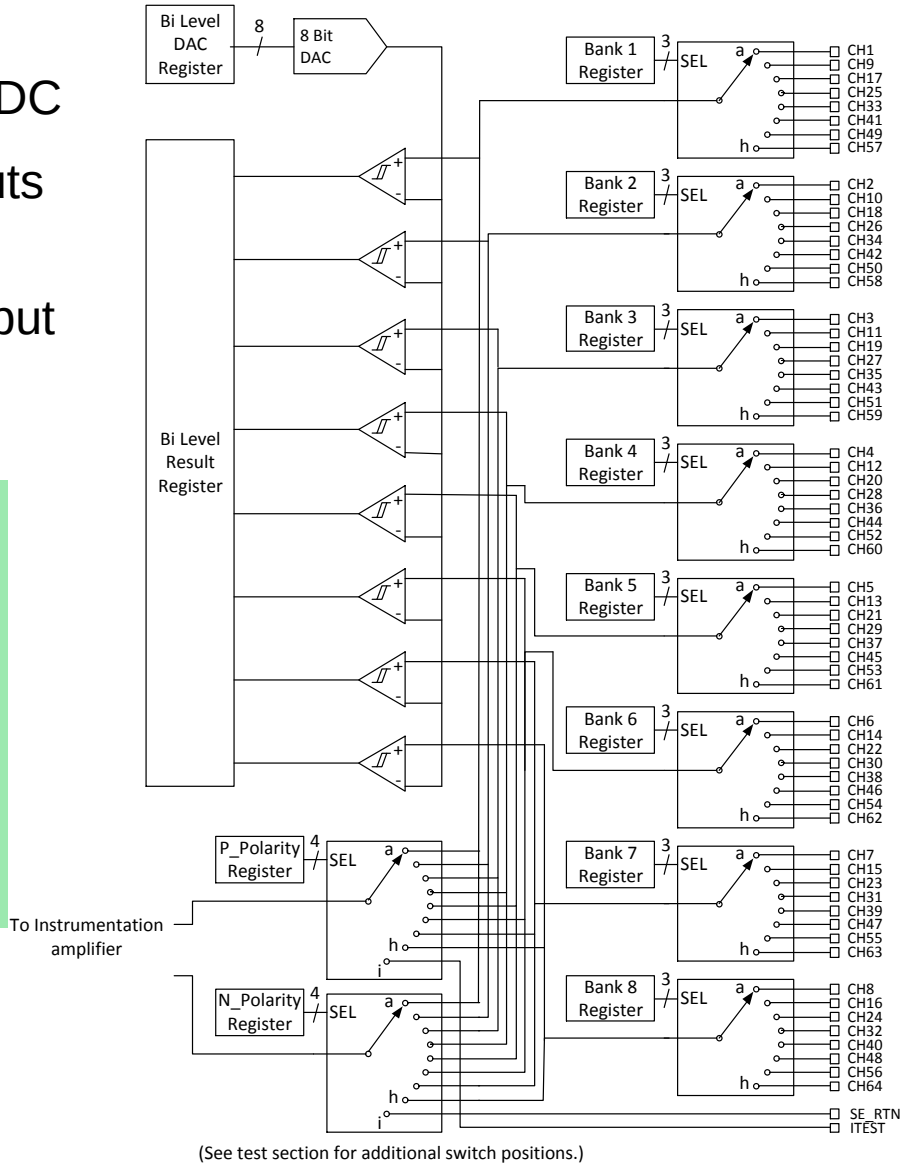
- Facilitates sensor monitoring, attitude control, payload control
- LX7730 features
  - 64 SE or 32 diff ch MUX with 12bit ADC
  - 8x8 input simultaneous threshold monitor
  - Voltage & de-mux current references
  - 8 x bi-level logic
  - 10 bit DAC
  - Parallel or Dual SPI interface
  - Rad Hard: 100krad TID, 50krad ELDRS
- FPGA provides
  - Data logging routines
  - Threshold monitoring
  - Communication
  - Calibration



LX7730 Multiplexer

- Multiplexer routes a single analog differential or single ended input to the ADC
- Can also monitor eight single ended inputs simultaneously
- A current demux can be routed to any input for exciting passive sensors





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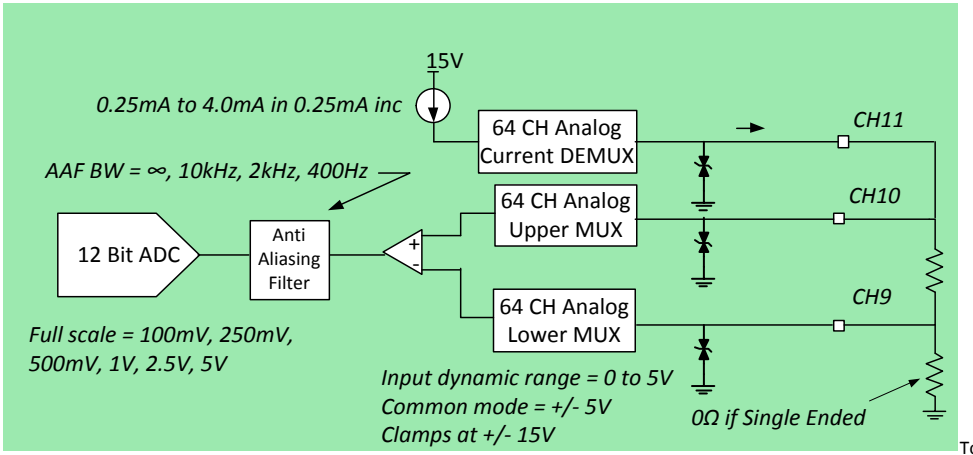
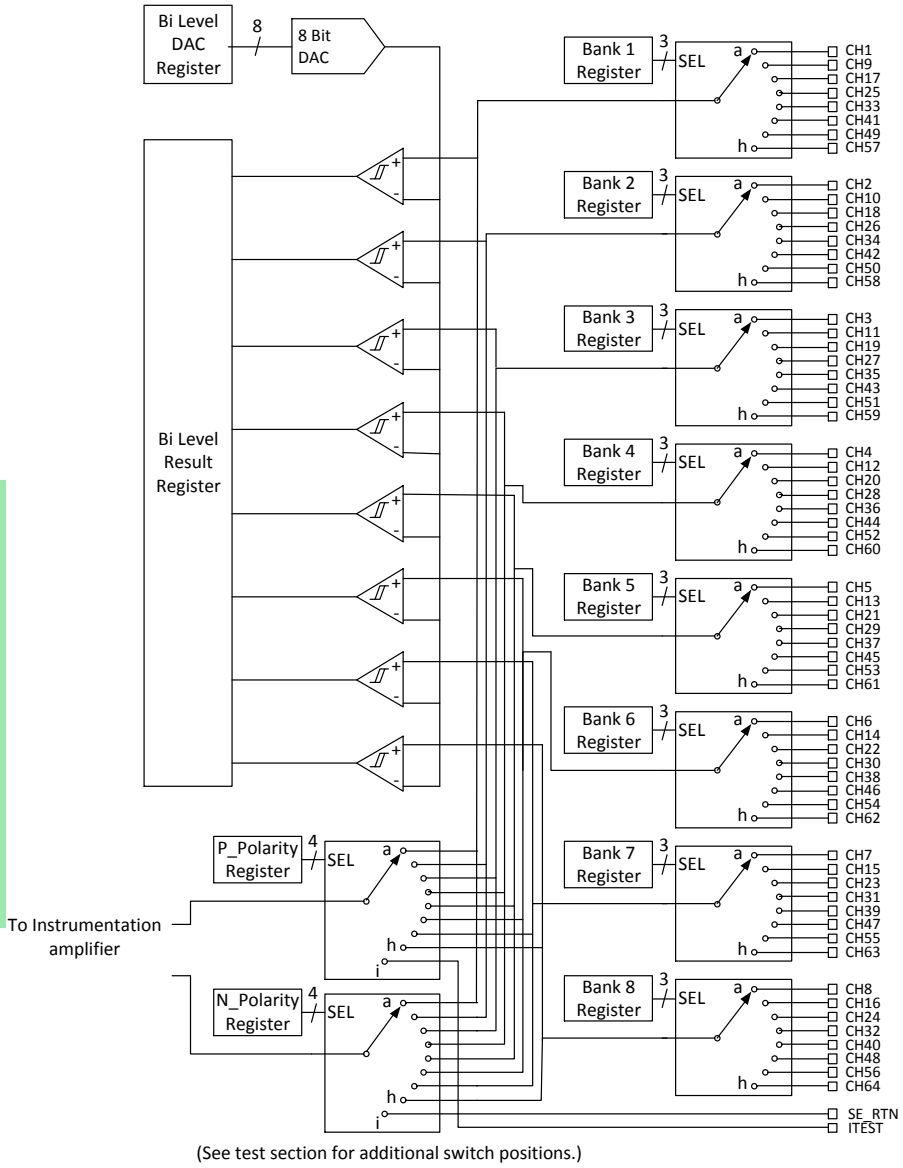
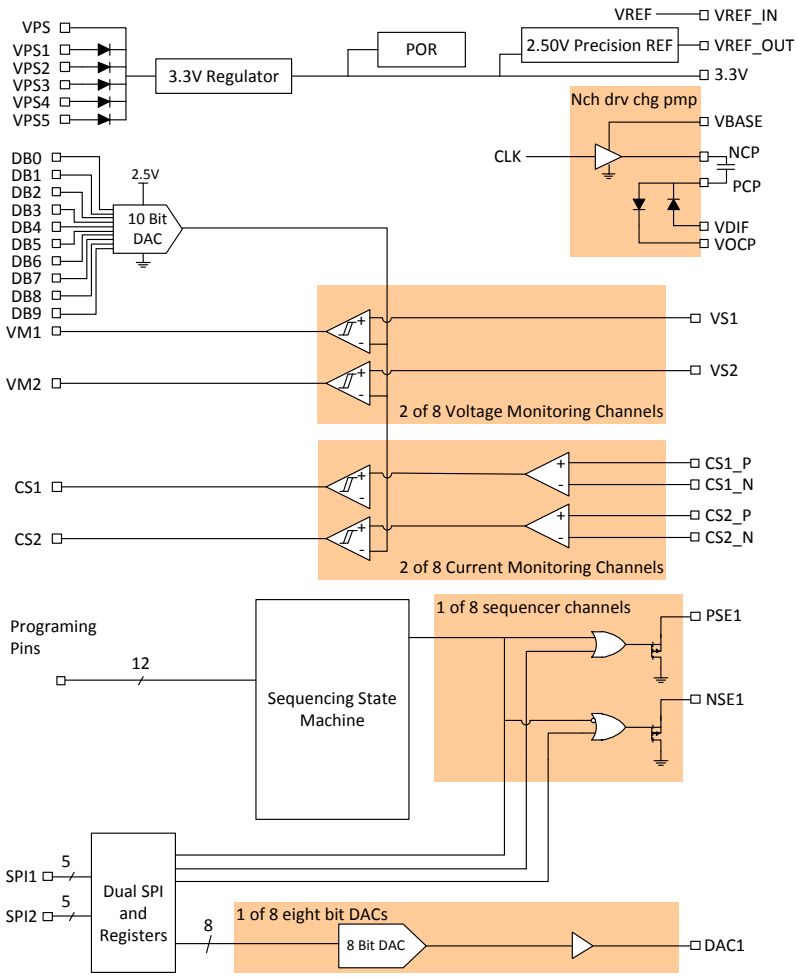




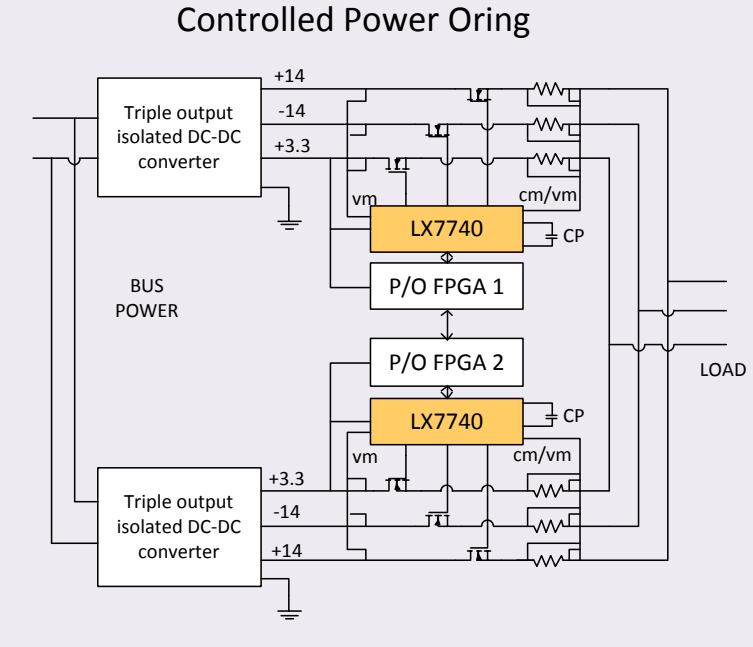
LX7740 Power Control

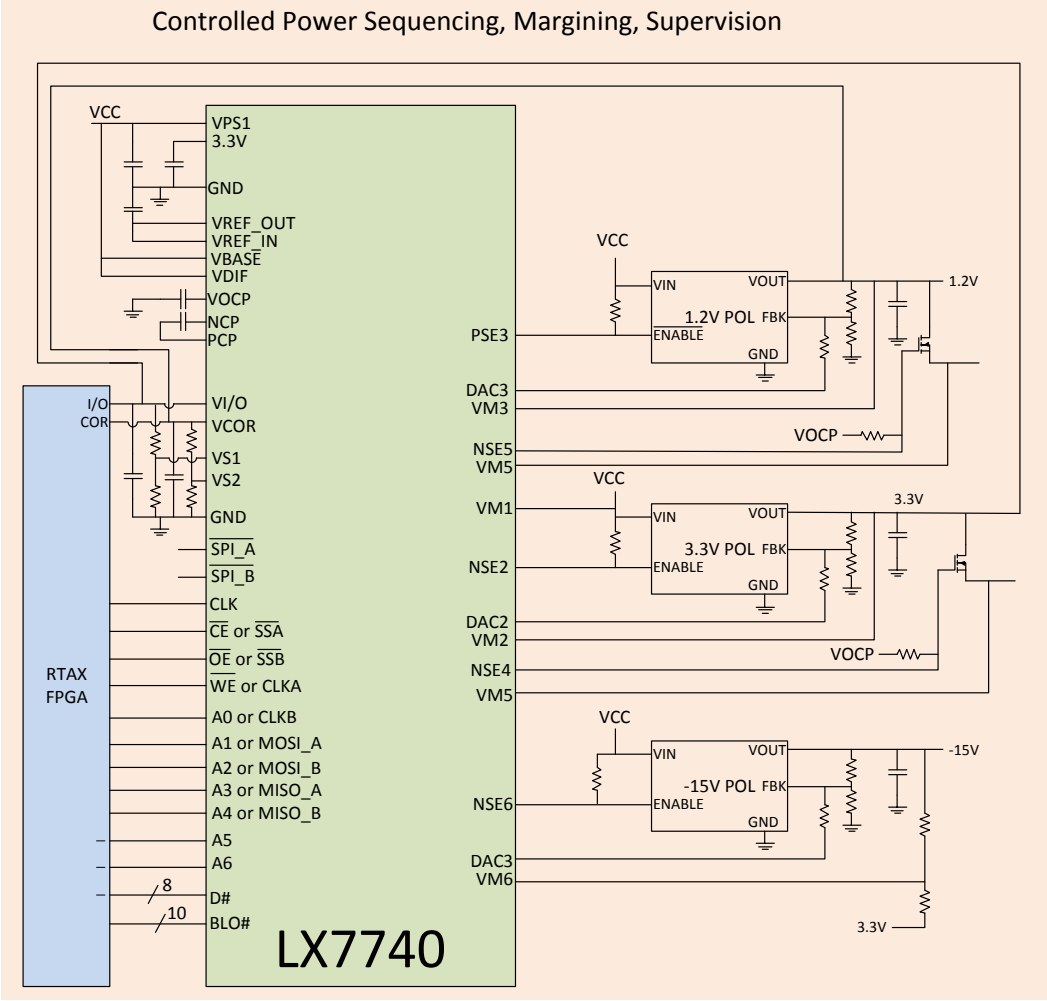
- Supervisor, redundant power switch, current limit, load isolator, voltage margining (when used with voltage programming pin)
- LX7740 features:
  - 8 Voltage monitors
  - 8 differential current monitors
  - 16 N-ch switch/enable outputs
  - 8 DACs
  - Dual SPI interface
  - Radiation Tolerant: 100krad TID, 50krad ELDRS
- FPGA provides:
  - Power sequencing/load isolation
  - Power oring
  - Fault detection and management
  - Voltage margining
  - Communication



LX7740 Power Control Applications

- Supervisor, redundant power switch, current limit, load isolator, voltage margining (when used with voltage programming pin)





SSM - Roadmap

Device	Description	2012	2013	2014	2015	2016
AAHS298B	Octal 8-channel 700mA High-Side Driver	★				
LX7710	Octal Diode Array			▲ ★		
LX7720	Power Driver with Rotation and Position Feedback				▲	★
LX7730	64-Channel Telemetry Manager			▲	★	

▲ : Engineering Models available

★ : Flight Models available

AAHS298B – 8 Channel Source Driver

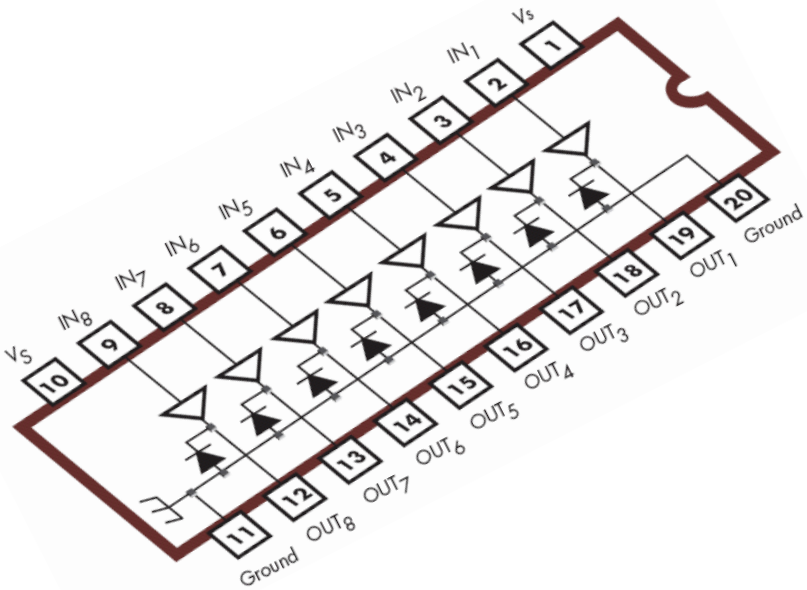
Available Now

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

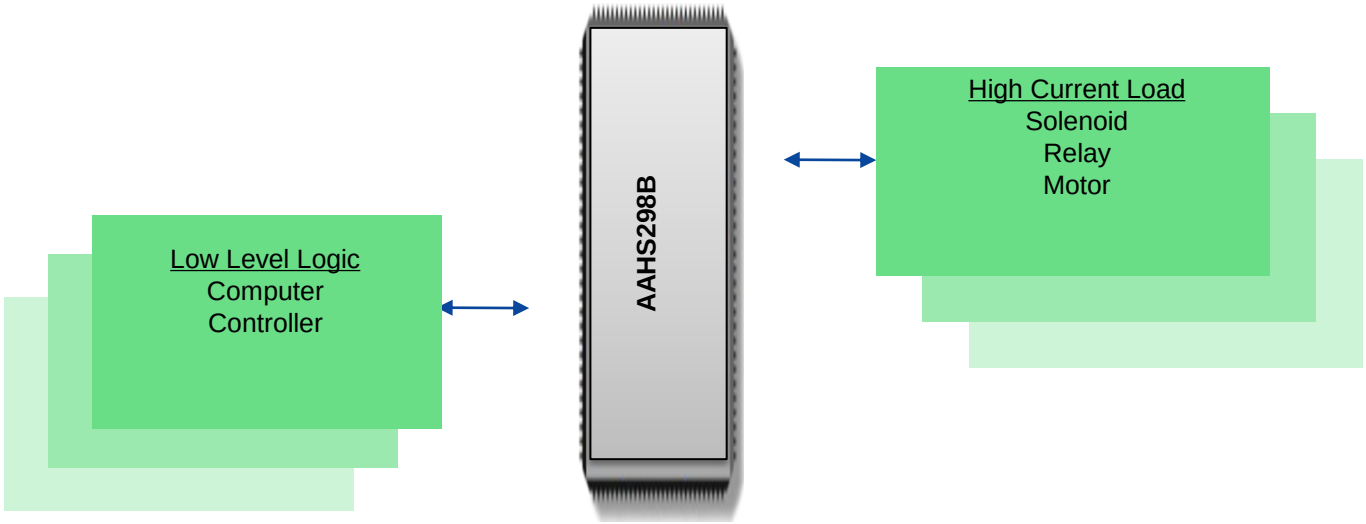
Target Markets

- Aerospace satellite manufacturers
  - Military power electronics control



AAHS298B – Applications

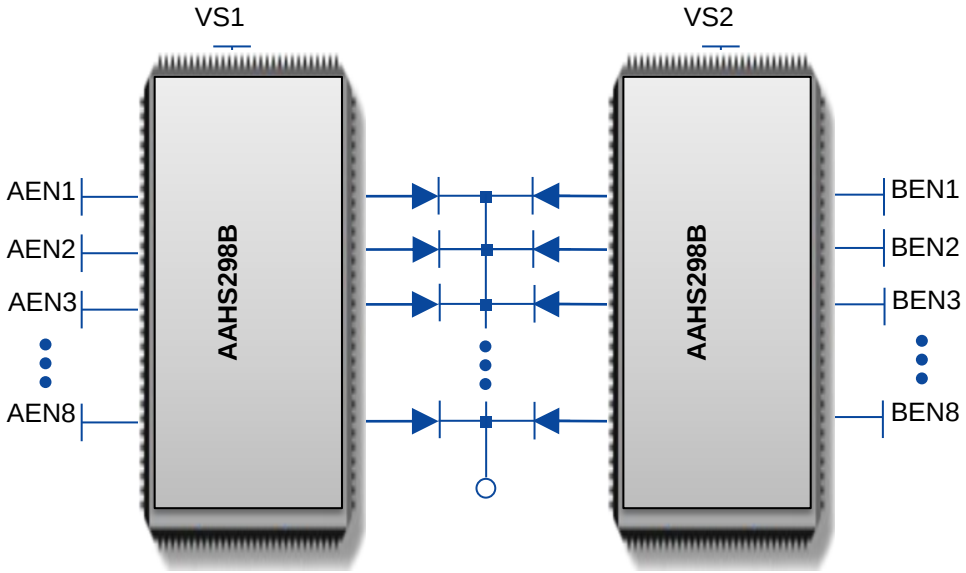
- Can be used as high-voltage drivers for lamps, relays, solenoids and motors
- Recommended for high-side switching applications that benefit from separate logic and load grounds
- Reliable replacement of discrete solutions
- Interfacing between low-level logic and high-current loads



Driving High Current Loads

AAHS298B – Applications

- For high reliability application, it can be used for redundant power distribution
- Application - Satellite Bus systems



Redundant Power Distribution

AAHS298B – Competitive Analysis

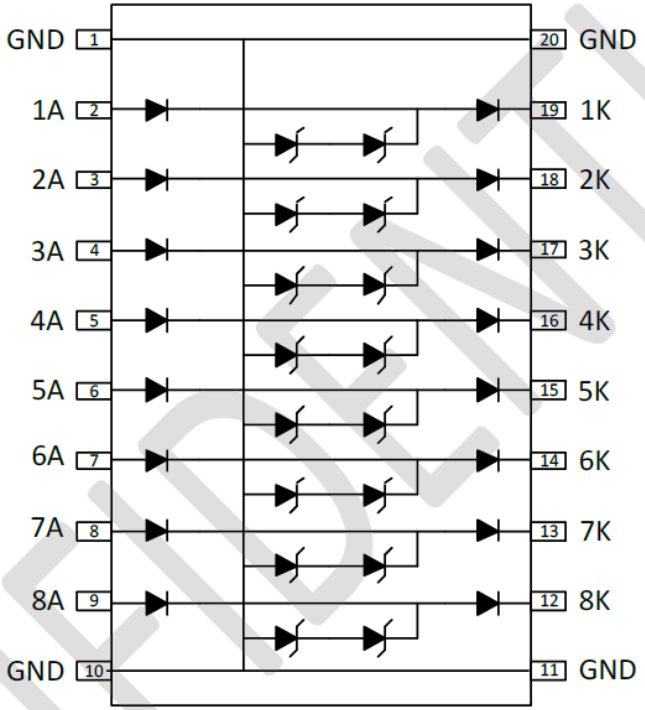
Parameter	AAHS298B	A2982	IS-2981RH
Supply Breakdown, Vs	80V	50V	80V
Continuous Output Current	**700mA**	500mA	200mA
Radiation Tolerance	100krad	-	100krad
Process	Dielectric Isolated	Junction Isolation	Dielectric Isolated
Operating Temp	-55C to +125C	-20C to +85C	-55C to +125C

- 3.5X the current of the IS-2981RH so no need to parallel outputs for higher current capability
- For Military applications that do not require radiation tolerance, better voltage breakdown and current capability than the Allegro A2982
- AAHS298A with Over-current protection will be available in Q3 2014

LX7710 – 125V Octal Series Diode Pairs Array

Features

- Redundant diode pair
- 125V working voltage per diode
- Forward current
- Low leakage current
- Internal ESD protection
- Zener supports inductive kickback



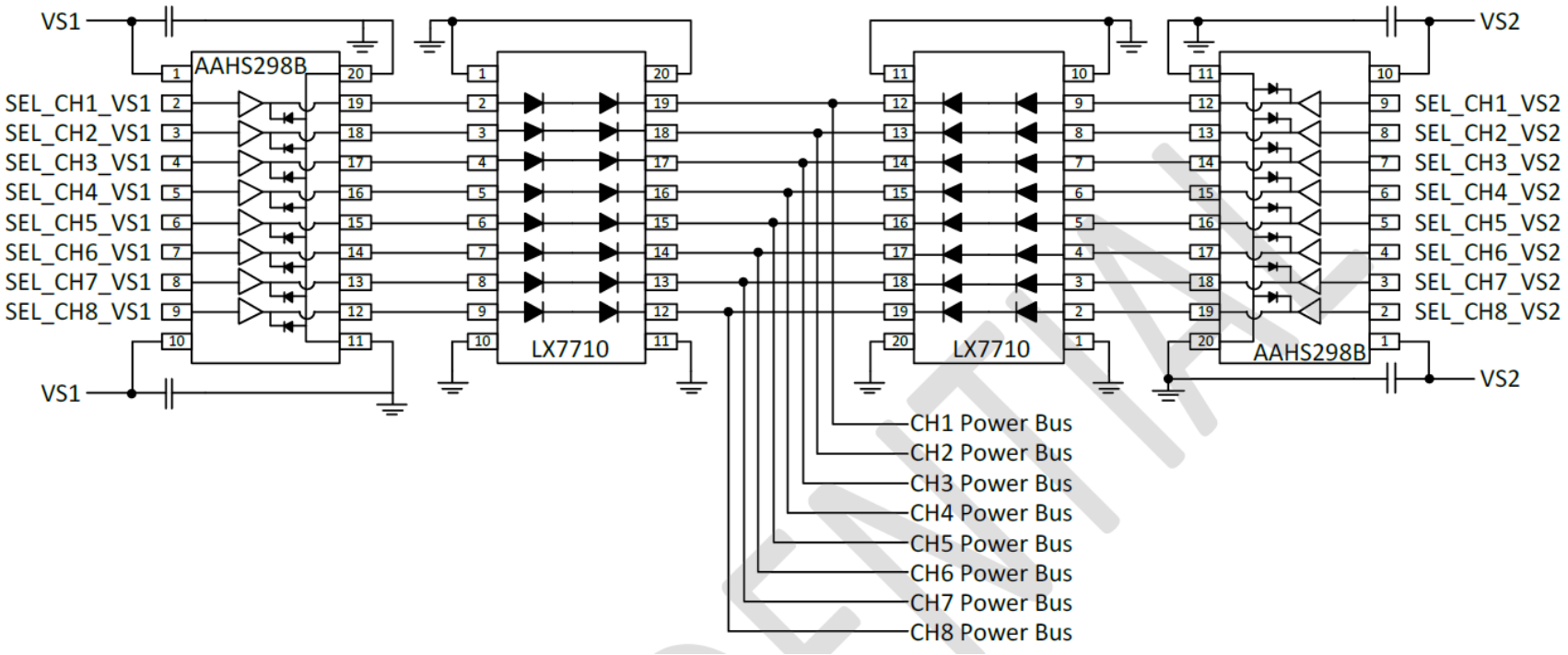
Target Markets

- Power Oring
- Redundant power sourcing
- Aerospace satellite manufacturers
- Military power electronics control

LX7710 – 125V Octal Series Diode Pairs Array

Applications

- Provides redundant power source switching when used with AAHS298B



LX7710 – Diode Array Status/Schedule

- Product Tape–out mid-August
  - Part of a multi-device wafer run. Other device delays resulted in delay of tape-out.
- Wafer out date expected mid-November (12 week fab)
- Assembly early December (14-21 day assembly)
- Test & ship samples mid-December
- Radiation Testing and Qual (MIL-PRF-38535) V flow
  - ELDRS
  - 2000 hr Life Test
- Production March-April 2014

Custom Integrated Circuits

Custom ASIC Development

- 15 years of custom ASIC development
  - Design team in San Jose, CA

- Servicing aerospace and space customers
  - MOOG (Motor Drivers)
  - GE Aviation (FET & IGBT controllers for power systems)
  - Crane Aerospace (LVDT controllers for braking systems)
  - Space System Loral (High-side drivers, Telemetry controller, Digital ASICs)

- And our integrated product team
  - HRG (RF Gate Drivers, ETE SiC Transistor Driver, 6A Integrated POL, GaN driver)
  - SOC (Motor controller, Telemetry)

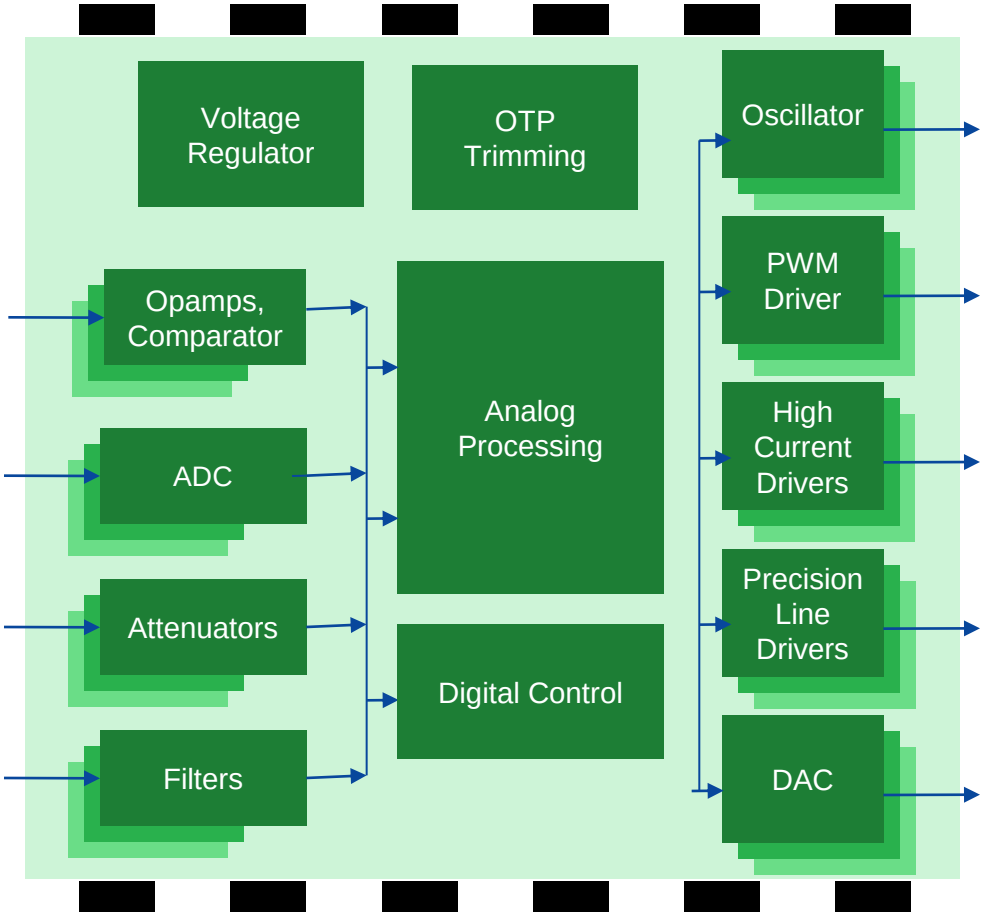
Custom ASIC Solutions

- 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 or MIL-PRF-38534 Class H and Class K

A Typical Mixed-Signal ASIC

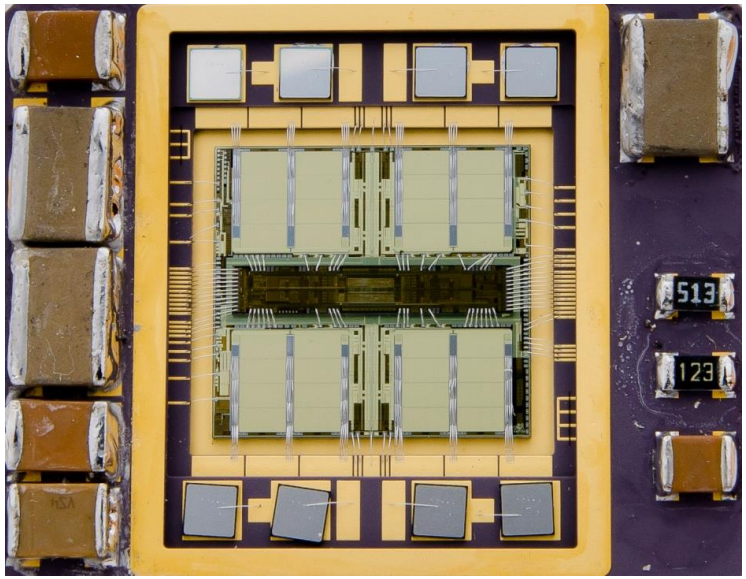
Typical design: 10 analog functions, 5k-30k digital gates, 12 man-months of engineering

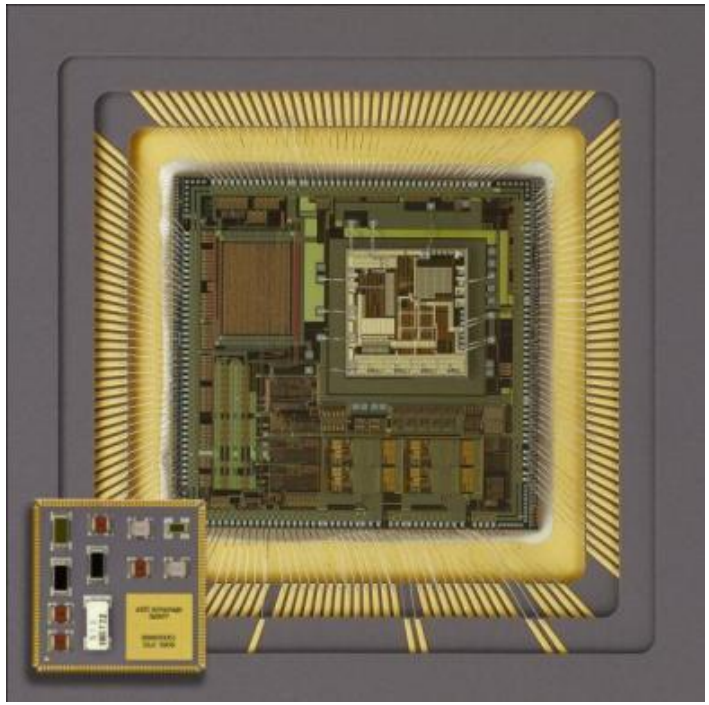
To PCB Power Rails and Temperature Sensors, Motors, Actuators, and Pyrotechnics



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 ASIC Expertise

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

Space & Aerospace Applications

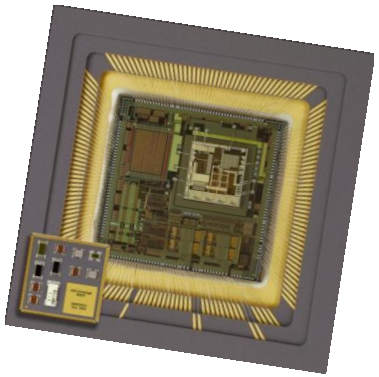
Extreme Temperature Applications

Over 80 custom ASICs for aerospace and industrial applications

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

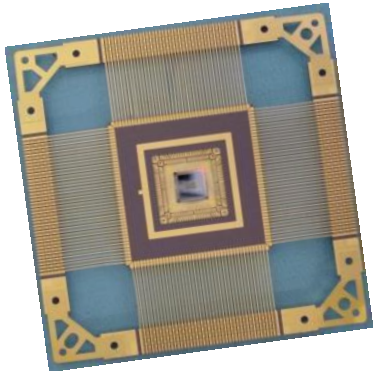


Orbiting the Earth since 2009

Custom Mixed-Signal for Space

Radiation Tolerant FPGA Conversion

- Up to 100k gates, 3.3V/5V logic
- Extend life of existing program with second-sourcing
- Pin to pin replacement of existing device
- 1 to 1 remapping of FPGA gate netlist
- 100krad(Si) total dose, SEL immune
- 17 devices qualified

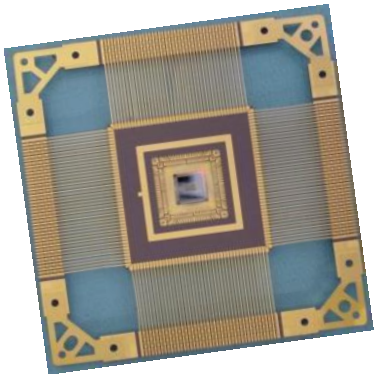


Orbiting the Earth since 2008

AAHG200A/ AAHG143A

5V Radiation Tolerant Digital Structured ASIC

- Up 25k ASIC gates with 172 I/O pads
- Optimal for hard-copy of obsolete 5V and 3.3V FPGA
- Extend life of existing programs by second-sourcing
- Pin to pin replacement of existing device
- 1 to 1 remapping from FPGA gate netlist
- 100 kRad TID, ELDR, SEL Immune
- Smaller AAHG143A available for LSI level parts



Available Now

Microsemi

Thank you