RENESAS

BIG IDEAS FOR EVERY SPACE

INTERSIL SPACE PRODUCTS

FPGA Power Solutions, Switching Regulators, LDOs, CAN Transceivers, Multiplexers, Temperature Sensors, Voltage References, Radiation-Tolerant Plastic ICs

2018.06

intersil™

WHEN FAILURE IS NOT AN OPTION™

INTERSIL SPACE ICs

Highly reliable, efficient and accurate radiation-hardened ICs for space applications and other radiation environments.

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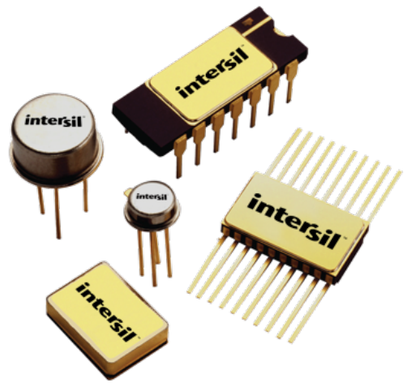


Seven Decades of Flight Experience

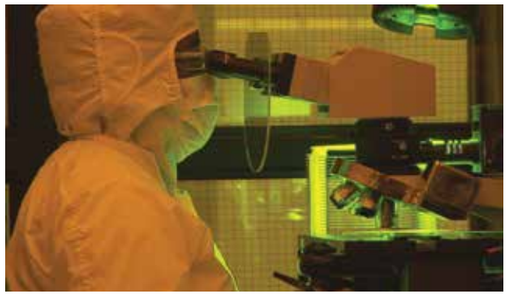
Intersil (now Renesas) history and experience in the space and defense industries spans almost seven decades beginning with the founding of Radiation, Inc. in 1950. Today, we continue to support and release new SMD-based, Class-V/Q radiation hardened (rad hard) products for Hi-Reliability, and Space marketplaces.

The low dose rate ionizing dose response of semiconductors has become a key issue in space applications. We are addressing this changed market by wafer-by-wafer low dose rate acceptance testing as a complement to current high dose rate acceptance testing.

All of our SMD products are MIL-PRF-38535/QML compliant and are 100% burned in.

By leveraging our latest technology for the consumer marketplace, Intersil space products group is releasing Class V/Q products that are revolutionizing the Hi-Reliability and Space marketplaces.

Intersil Space IC Benefits



Reliable, Proven Supply Chain

Proven proprietary processes and package technologies, shipping over 1 billion ICs per year.

- Strong technology development
  - Proprietary process and package technologies
- Multi-sourcing strategy
  - Sourcing from multiple leading-edge semiconductor foundries & assembly/test partners ensures a steady product supply and reduced risk
- Industry-leading quality & reliability metrics
  - Billion+ ICs shipped every year
  - Less than 1.0 DPPM (defective parts per million) and improving
  - Decades of experience handling military/space products and delivering world-class quality and reliability metrics
  - ISO/TS16949 and AEC-Q100
  - MIL-PRF-38535 compliant and 100% burned in

Highest Standards

As a major supplier to the military and aerospace industries, our Intersil product development methodologies reflect experience designing products to meet the highest standards for reliability and performance in challenging environments. Intersil products can be found in virtually every satellite shipped into space.

- All products are MIL-PRF-38535/QML compliant
- All products are 100% burned in
- Consistent design and manufacturing in our MIL-PRF-38535-qualified facility in Palm Bay, Florida
- We are one of only a few RHA Defense Logistics Agency (Land and Maritime) QML suppliers
- All products are fully Class V (space level) compliant
- All products are on individual DLA SMD drawings

Assured Product Supply

Long life cycles ensure steady flow of product. We still support customer programs with products in production for over 40 years.

Our Approach to Radiation Environments in Space

TID (Total Ionizing Dose)

TID is the progressive, long-term ionizing radiation damage caused by protons, electrons and other sources. Total ionizing dose testing of semiconductor components has historically been performed at 'qualification' dose rates in the 50–300rad(Si)/s. Modern sub-micron technologies tend to be more resistant to total dose effects.

Our approach: TID hardness is tested and guaranteed on a wafer-by-wafer basis to MIL-STD-883 Method 1019 using an in-house Gammacell 220™ ^{60}Co irradiator. This testing is done at both high dose rates (50rad(si)/s) and low dose rates (0.01rad(Si)/s).

SEE (Single-Event Effects)

The intense heavy ion environment encountered in space applications can cause a variety of effects in electronic circuitry, including Single-Event Transient (SET), Single-Event Latchup (SEL) and Single-Event Burnout (SEB). These Single-Event Effects (SEE) can lead to system-level performance issues including disruption, degradation and destruction.

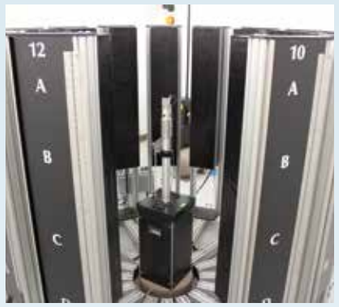
Our approach: SEE characterizations are performed at Texas A&M. To view our complete ELDRS and SEE test reports, go to: www.intersil.com

ELDRS (Enhanced Low Dose Rate Sensitivity) Program

We are performing wafer-by-wafer production testing qualification at both low and high dose rate under biased and unbiased conditions.

Many industry-standard devices show severe degradation of key parameters when irradiated at very low dose rates. The de facto standard for low dose rate is 0.01 rad(Si)/s, which is now included in MIL-STD-883 Method 1019.

Our approach: Starting in 2011, we perform wafer-by-wafer production testing qualification at both low and high dose rate under biased and unbiased conditions. We constructed a vault-type low dose rate irradiator specifically to support this activity. Baseline ELDRS testing continues, and complete reports can be found on the Intersil website. Intersil parts released on this new low dose flow have an EH designation (vs. RH).



View of 'pop-up' source (center) and surrounding test racks.

RAD-HARD QML SMD

STANDARD DATA PACKAGE	Class Q	Class V			
Nomenclature, Example	RH Packaged Part	RH Packaged Part	EH Packaged Part	RH Die - Authorized Die Processors Only	EH Die - Authorized Die Processors Only
Part Types	"RH-8" "RHQ" XXXXRH-8 in the part #	"MSR" "NSR" "RHV" "RH-Q" XXXXRH-Q in the part #	"EHV" "EH-Q" XXXXEH-Q in the part #	HS0-XXXXRH-Q IS0-XXXXRH-Q ISL7XXXXRHVX "HSR" or "HMSR" in the part #	HS0-XXXXEH-Q IS0-XXXXEH-Q ISL7XXXXEHVX in the part #
Shipper/Pack Slip	X	X	X	X	X
P.O. Number	X	X	X	X	X
Customer Part Number, Rev (as applicable on the P.O.)	X	X	X	X	X
Intersil Part Number	X	X	X	X	X
Lot Date Code / Trace Code	X	X	X		
Lot Number	X	X	X	X	X
Quantity	X	X	X	X	X
Certificate of Conformance	X	X	X	X	X
Screening Attributes Data		X	X	X	X
Post seal thru end of 100% screening operations		X	X		
Test Operations		X	X		
Test Methods		X	X		
Quantity of units in/out by operation		X	X		
Date of each test		X	X		
PDA as applicable		X	X		
Visual Inspection		X	X	X	X
Document Review		X	X	X	X
Screening Variables & Delta Data - Variables data for all read/record and/or delta operations pre/post burn-in @25C are provided on electronic media.		X	X		
Group A Attributes (located in Screening Attribute Data if performed)		X	X		
Group B Attributes Summary		X	X		
Group C Attributes Summary		X	X		
Group C Variables & Delta Data - Variables data for all read/record and/or delta operations pre/post life test are provided on electronic media.			X		
Group D Attributes Summary		X	X		
Group E Variables Data for HDR & LDR - Variables data for all read/record operations pre/post rad are provided on electronic media.			X		X
SEM C of C & Photos (if performed)		X	X	X	X
Radiation C of C (High Dose Rate and/or Low Dose Rate)	HDR	HDR	HDR & LDR	HDR	HDR & LDR
X-Ray Report (Film kept on file and available on request. Request must be documented on P.O.)		X	X		

★ All EH product shipments will now come with Group C and E variables data in the data package.

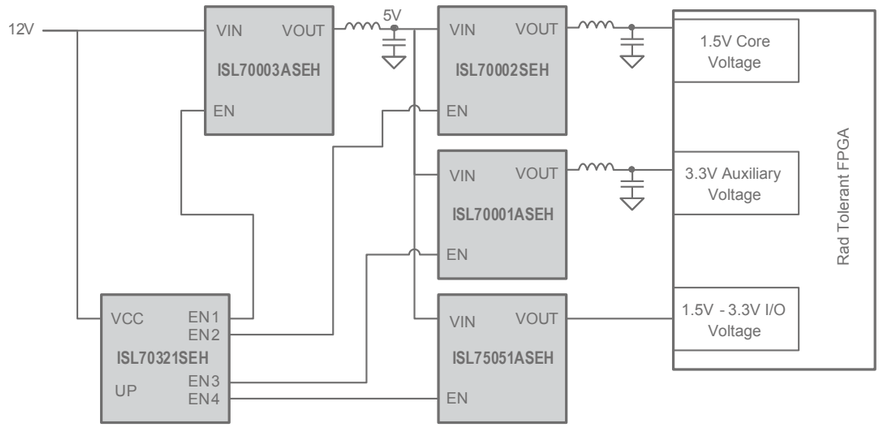
RAD-HARD FPGA POWER SOLUTIONS

Complete Solutions for Powering Rad-Hard FPGAs

Due to its flexibility in design and cost effectiveness compared to ASICs, FPGA based systems have become increasingly common in space applications as the requirement to do more on board processing is increasing.

Equally important is the power solution of these multi-rail digital loads. The power supply must be stable and efficient even in the harsh environments of space which includes total ionizing dose and single event effects. Couple-in the need for a smaller, light-weight power solution and you will find us at the forefront developing leading edge point-of-load (POL) regulators that meet the demands to power these high performance FPGA's.

For more information see an application note **AN1947** "Intersil's Radiation Hardened Low Power FPGA Power Solutions" and **AN1707** "Intersil's Radiation Hardened FPGA Power Solutions".



Device	Description	Class	DLA SMD	High Dose Rate (HDR) krad(Si)	Low Dose Rate ELDRS krad(Si)	Qualification Level	Single Event Latchup (MeV/mg/cm²)	Package
SWITCHING REGULATORS								
ISL70001ASEH	SEE Hardened 6A Synchronous Buck Regulator	V, /PROTO	5962-09225	100	50	QML Class V	86.4	48 Ld CQFP
ISL70002SEH	SEE Hardened 12A Synchronous Buck Regulator with Current Sharing	V, /PROTO	5962-12202	100	50	QML Class V	86.4	64 Ld CQFP
ISL70003ASEH	SEE Tolerant 3V to 13.2V, 9A Buck Regulator	V, /PROTO	5962-14203	100	50	QML Class V	86.4	64 Ld CQFP
POWER SEQUENCING								
ISL73321SEH	Quad Power Supply Sequencer	V, /PROTO	5962-17225	100	75	QML Class V	86	18 Ld CFP
ISL70321SEH	Quad Power Supply Sequencer	V, /PROTO	5962-17225	100	75	QML Class V	86	18 Ld CFP
LDO								
ISL75051ASEH	3A, Radiation Hardened, Positive, Ultra-Low Dropout Regulator	V, /PROTO	5962-11212	100	50	QML Class V	86.3	18 Ld CFP

Radiation Hardened

RAD-HARD POWER

GaN FET Drivers

Space Industry's First Radiation-Hardened 100V and 200V GaN FET Power Supply Solutions

The ISL70040SEH low side Gallium Nitride (GaN) field effect transistor (FET) driver and ISL70023SEH and ISL70024SEH GaN FETs enable primary and secondary DC/DC converter power supplies in launch vehicles and satellites, as well as downhole drilling and high reliability industrial applications. These devices power ferrite switch drivers, motor control driver circuits, heater control modules, embedded command modules, 100V and 28V power conditioning, and redundancy switching systems.

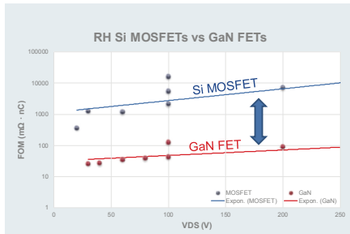
Key Features of ISL70023SEH and ISL70024SEH GaN FETs

- Very low R_{DSON} at 5mΩ (typ) - ISL70023SEH; and 45mΩ (typ) - ISL70024SEH
- Ultra-low total gate charge 14nC (typ) - ISL70023SEH; and 2.5nC (typ) - ISL70024SEH
- SEE hardness at LET 86MeV•cm²/mg
  - ISL70023SEH, V_{DS} = 100V, VGS = 0V
  - ISL70024SEH, V_{DS} = 160V, VGS = 0V
- Full military temperature range operation
  - T_A = -55°C to +125°C
  - T_J = -55°C to +150°C

Key Features of ISL70040SEH GaN FET Driver

- Wide operating voltage range from 4.5V to 13.2V
- Up to 14.7V logic inputs (regardless of V_{DD} level), inverting and non-inverting inputs
- Full military temperature range operation
  - T_A = -55°C to +125°C
  - T_J = -55°C to +150°C
- Radiation hardness assurance (wafer-by-wafer):
  - High Dose Rate (HDR) (50-300rad(Si)/s):100krad(Si)
  - Low Lose Rate (LDR) (0.01rad(Si)/s): 75krad(Si)
- SEE hardness at LET = 86MeV•cm²/mg:
  - no SEB/SEL, V_{DD} = 16.5V
  - no static input SET, V_{DD} = 4.5V and V_{DD} = 13.2V
- Electrically screened to DLA SMD 5962-17233

Benefits of GaN Power Transistors



- Intersil products offer an order of magnitude better performance.

GaN FET Drivers

Product	Class	High Dose (HDR) krad(Si)	Low Dose (ELDRS) krad(Si)	SEL (MeV/mg/cm²)	Package
ISL70040SEH	V, /PROTO	100krad(Si)	75krad(Si)	86	CLCC8
ISL73040SEH	V, /PROTO	-	75krad(Si)	86	CLCC8

GaN FETs

Product	Class	High Dose (HDR) krad(Si)	Low Dose (ELDRS) krad(Si)	Breakdown Voltage	Package
ISL70023SEH, ISL73023SEH	Mod-Class V, /PROTO	100krad(Si)	75krad(Si)	100V	CLCC4
ISL70024SEH, ISL73024SEH	Mod-Class V, /PROTO	100krad(Si)	75krad(Si)	200V	CLCC4

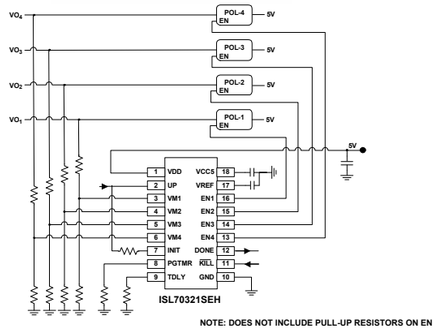
Sequencers

Radiation-Hardened Quad Power Supply Sequencers

The ISL70321SEH and ISL73321SEH quad power supply sequencers are designed to drive point-of load (POL) regulators that power high performance FPGAs and complex, multi-rail power systems. Highly scalable, up to four power supplies can be fully sequenced by a single device or multiple devices can be easily cascaded to sequence an unlimited number of power supplies.

The highly integrated sequencers provide critical reliability features, and reduce bill of materials cost by replacing discrete solutions that employ several comparators, resistors, and capacitors.

- Wide operating voltage range, 3V to 13.2V
- Single resistor sets the rising and falling delay
- Power-off POLs in reverse order or simultaneously
- Precision voltage monitoring
  - 600mV ±1.5% threshold voltage over temperature and radiation
- Full military temperature range operation
  - T_A = -55°C to +125°C
  - T_J = -55°C to +150°C



NOTE: DOES NOT INCLUDE PULL-UP RESISTORS ON EN

Typical Application Schematic

Source Drivers

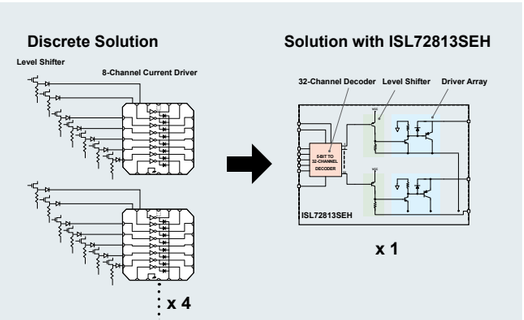
Single-Chip Rad-Hard Driver with Integrated Decoder

The ISL72813SEH rad hard 32-channel driver reduces the size, weight and power of satellite command and telemetry systems. The device integrates the decoder, level shifter and driver array in a single monolithic IC, allowing satellite manufacturers to significantly increase system capacity and reduce solution size by 50%.

The ISL72813SEH offers a 4x higher density channel count compared to the nearest competitor, and the integrated level shifter eliminates several peripheral components.

- Acceptance tested to 50krad(Si) LDR, wafer-by-wafer; HDR radiation tolerance of 100krad(Si)
- Integrated 5-bit to 32-channel decoder and level shifting circuit
- High collector current outputs to 600mA
- Low V_{CE} saturation of 1.5V with IC of 530mA
- High voltage outputs up to -40V
- V_{CC} supply range of 3V to 5.5V

Reduce Solution Size by 50%



Device	Number of Channels	Maximum V_{CE}	Maximum I_{CE}	V_{CE} (SAT)	I_{CEX} (Leakage Current)	Level Shifter	Integrated Decoder	Parallel Drive Capability	Package
ISL72813SEH	32	42V	530mA	1.5V @ 530mA	40nA	Yes	Yes, (5:32 Decoder)	No	44 Ld CLCC

Radiation Hardened

RAD-HARD ANALOG

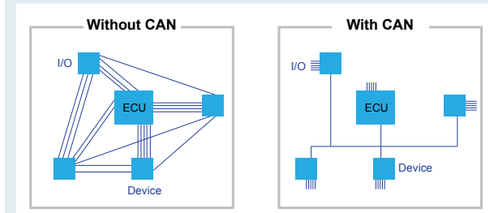
CAN Transceivers

Industry's First Rad Tolerant 3.3V CAN Transceivers for Satellite Communications

The ISL7202xSEH CAN transceivers provide reliable serial data transmission between a CAN controller and CAN bus at speeds up to 1Mbps. Up to 120 ISL7202xSEH ICs can be connected to a single CAN bus to reduce cabling/harness size, weight and power (SWAP) costs, allowing system engineers to increase satellite functionality and eliminate the extra cabling and tradeoffs associated with current point-to-point interface solutions.

- ISL72026SEH
  - Loopback feature which provides a node diagnostic mode
- ISL72027SEH
  - Split mode feature which helps improve EMI/EMC
- ISL72028SEH
  - Low power shutdown mode

CAN Network Significantly Reduce Wiring



Can Transceivers

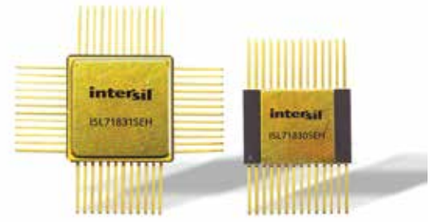
Product	Loopback Feature	V_{REF} Output	Listen Mode	Shutdown Mode	VTHRLM	VTHFLM	VHYSLM	Supply Current, Listen Mode	Supply Current, Shutdown Mode	V_{REF} Leakage Current	Package
ISL72026SEH	Yes	No	Yes	No	1150mV (Max)	525mV (Min)	50mV (Min)	2mA (Max)	N/A	±25µA (Max)	8 Ld CFP
ISL72027SEH	No	Yes	Yes	No	1150mV (Max)	525mV (Min)	50mV (Min)	2mA (Max)	N/A	±25µA (Max)	8 Ld CFP
ISL72028SEH	No	Yes	No	Yes	N/A	N/A	N/A	N/A	50µA (Max)	±25µA (Max)	8 Ld CFP

Multiplexers

Rad Tolerant 5V Multiplexers that Deliver Best-in-Class Performance for Space Flight Systems

The ISL71830/31SEH 5V rad hard multiplexers provide data acquisition systems with the industry's best ESD protection, and deliver lower R_{ON} and input leakage for reduced power consumption and higher signal integrity.

The 16-channel ISL71830SEH and 32-channel ISL71831SEH multiplexers provide a "cold spare" redundant capability, allowing the connection of 2-3 additional unpowered multiplexers to a common data bus.



Rad-Hard Multiplexers Product Highlights

Device	Channels	Supply Voltage	R_{ON} (typ)	Off Switch Leakage (max)	Package
ISL71840SEH	16	30V	<500Ω	100nA	28 LD CDFP
ISL71841SEH	32	30V	<500Ω	100nA	48 Ld CQFP
ISL71830SEH	16	5V	<120Ω	120nA	28 LD CDFP
ISL71831SEH	32	5V	<120Ω	120nA	48 Ld CQFP

Instrumentation Amplifiers

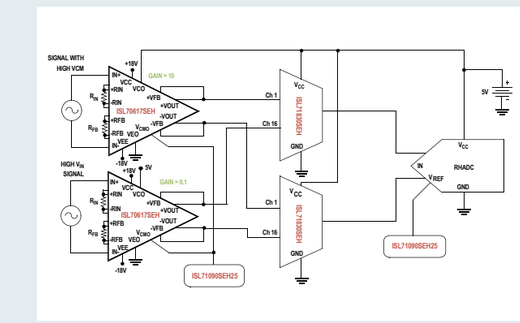
36V In-Amp with Integrated ADC Driver

The ISL70617SEH rad hard in-amp integrates a rail-to-rail output differential ADC driver to provide the industry's highest sensor signal processing performance for communication satellites. Its high integration and best-in-class performance reduces system size, weight and power (SWAP) costs, and speeds time to market.

The ISL70517SEH joins the ISL70617SEH, and offers similar features but implements a differential input and rail-to-rail single-ended output.

- Low input offset of 30µV, and low input bias current of 0.2nA
- Programmable gain from 0.1 to 10,000 via two external resistors
- Excellent CMRR and PSRR of 120dB typical for attenuating, gaining and filtering sensor signals to improve signal quality
- Wide operating range from ±4V to ±18V
- Low dose rate (0.01rad(Si)/s) radiation tolerance of 75krad(Si)

COMPLETE SPACE GRADE ANALOG SIGNAL CHAIN



Radiation Tolerant

RADIATION-TOLERANT PLASTIC-PACKAGE ICs

Cost Effective Solutions for Short Duration Low Earth Orbit (LEO) Mission Profiles

The ISL71xxxM family of radiation-tolerant plastic-package ICs is designed to support the emerging field of small satellites that will provide solutions such as high-speed Internet connections to hundreds of millions of users in communities, governments, and businesses worldwide. Fleets of hundreds of small satellites will create mega-constellation networks to deliver broadband Internet links from low Earth orbit (LEO) to every corner of the globe, including rural areas without wireless connectivity access.

Our rad-tolerant plastic packaging flow leverages the company's more than 60 years of spaceflight experience developing rad hard (>75krad) and rad-tolerant (<75krad) products for extremely harsh environments. The upfront radiation effects characterization and AEC-Q100 automotive-like qualification gives customers the utmost confidence to design Intersil radiation-tolerant plastic parts into cost-sensitive small satellites for LEO mission profiles up to five-years. The ISL71xxxM are also well suited for high altitude (>40km) avionic systems, launch vehicles that are prone to heavy ions, and medical equipment where radiation is a concern.

Rad-Tolerant Power

6A Synchronous Buck Regulator with Integrated MOSFETs

The ISL71001M rad-tolerant 6A synchronous buck regulator with integrated MOSFETs delivers high peak efficiency up to 95%, and steps down 5V and 3.3V primary rails to POL inputs as low as 0.8V for FPGAs, CPLDs, DSPs, CPUs and peripheral I/Os.

KEY SPECIFICATIONS

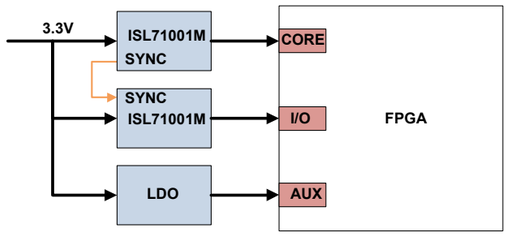
- V_{IN} range: 3V to 5.5V
- V_{OUT} range: 0.6V to 85% of V_{IN}
- Up to 94% efficiency
- 1% output voltage accuracy
- Input UVLO, output UVLO, and OCP protection

PACKAGE

- 10mm x 10mm, 64-lead QFP with e-pad

BENEFITS

- Radiation-tolerant to 30krad(Si) and SEE characterized
- Redundant control loop for class leading SET performance
- Ease of use: Integrated MOSFETs and compensation
- 1MHz switching frequency for reduced filter size



Typical Application Schematic

Rad-Tolerant Analog

CAN BUS TRANSCEIVER

The ISL71026M radiation-tolerant 3.3V CAN transceiver provides serial data transmission at speeds up to 1Mbps. Up to 120 transceivers can be connected to a single CAN bus to reduce cabling/harness size, weight and power (SWAP) costs for satellite command and telemetry systems.

Device	Description	Low Dose Rate (ELDRS) krad(Si)	SEL (MeV/mg/cm²)	Package Type	Temp Range (°C)
ISL71026M	3.3V CAN Transceiver, 1Mbps, Listen Mode, Loopback	30	43	TSSOP14	-55 to 125

OPERATIONAL AMPLIFIERS

The ISL71444M is ideal for applications requiring both high DC accuracy and AC performance, and the ISL71218M is ideal for single-supply applications where input operation at ground is important.

Device	Description	# Channels	Bandwidth (MHz)	V_S Range (V)	Low Dose Rate (ELDRS) krad(Si)	SEL (MeV/mg/cm²)
ISL71444M	19MHz 40V Quad Rail-to-Rail Input-Output, Low-Power Op Amp	4	19	2.7 to 40	30	43
ISL71218M	Dual 36V Precision Single-Supply, Rail-to-Rail Output, Low-Power Op Amp	2	4	3 to 36	30	43

VOLTAGE REFERENCES

The ultra low noise rad-tolerant ISL71010B50 and ISL71010B25 precision voltage references are ideal for high-end instrumentation, data acquisition, and processing applications requiring high DC precision where low noise performance is critical.

Device	Description	V_{OUT} Option (V)	Accuracy (%)	Temp Coefficient (ppm/°C)	Low Dose Rate (ELDRS) krad(Si)	SEL (MeV/mg/cm²)
ISL71010B50	Ultra Low Noise, 2.5V Precision Voltage Reference	5.0	±0.05	10	30	43
ISL71010B25	Ultra Low Noise, 5V Precision Voltage Reference	2.5	±0.05	10	30	43

PRODUCTS SELECTION TABLE

For a complete list of Intersil Space & Harsh Environment products, visit www.intersil.com/space

Rad-Hard Analog EH Products

Device	Description	Class	DLA SMD	High Dose Rate (HDR) krad(Si)	Low Dose Rate ELDRS krad(Si)	Qualification Level	Single Event Latchup (MeV/mg/cm²)
COMPARATORS							
HS-139EH	Quad Voltage Comparator	V, /PROTO	5962-98613	300	50	QML Class V	SEL free
IS-139ASEH	Single Event Quad Voltage Comparators	V, Q, /PROTO	5962-01510	300	Report Available	QML Class V	SEL free
ISL7119EH	High Speed Dual Voltage Comparator	V, /PROTO	5962-07215	300	50	QML Class V	SEL free
SWITCH/MUX							
HS-1840AEH	16 Channel CMOS Analog Multiplexer with High-Z Analog Input Protection	V, /PROTO	5962-95630	300	50	QML Class V	SEL free
HS-1840BEH	16 Channel BiCMOS Analog Multiplexer with High-Z Analog Input Protection	V, /PROTO	5962-95630	300	50	QML Class V	SEL free
HS-201HSEH	High Speed, Quad SPST, CMOS Analog Switch	V, /PROTO	5962-99618	300	50	QML Class V	SEL free
HS-303AEH	CMOS Dual SPDT Analog Switch	V, Q, /PROTO	5962-95813	300	50	QML Class V	SEL free
HS-303BEH	CMOS Dual SPDT Analog Switch	V, Q, /PROTO	5962-95813	300	50	QML Class V	SEL free
HS-303CEH	BiCMOS Dual SPDT Analog Switch	V, Q, /PROTO	5962-95813	100	50	QML Class V	SEL free
HS-508BEH	8 Channel CMOS Analog Multiplexer with Overvoltage Protection	V, /PROTO	5962-96742	300	50	QML Class V	SEL free
ISL71830SEH	5V 16-Channel Analog Multiplexer	V, /PROTO	5962-15247		75	QML Class V	60
ISL71831SEH	5V 32-Channel Analog Multiplexer	V, /PROTO	5962-15248		75	QML Class V	60
ISL71840SEH	30V 16-Channel Analog Multiplexer	V, /PROTO	5962-15219	100	50	QML Class V	86.4
ISL71841SEH	30V 32-Channel Analog Multiplexer	V, /PROTO	5962-15220	100	50	QML Class V	86.4
SAMPLE AND HOLD							
HS-2420EH	Fast Sample and Hold	V, /PROTO	5962-95669	100	50	QML Class V	SEL free
INTERFACE							
HS-26C31EH	Quad Differential Line Driver	V, /PROTO	5962-96663	300	50	QML Class V	100
HS-26C32EH	Quad Differential Line Receiver	V, /PROTO	5962-95689	300	50	QML Class V	100
HS-26CLV31EH	3.3V Quad Differential Line Drivers	V, /PROTO	5962-96663	300	50	QML Class V	100
HS-26CLV32EH	3.3V Quad Differential Line Receiver	V, /PROTO	5962-95689	300	50	QML Class V	100
HS-26CT31EH	Quad Differential Line Drivers	V, /PROTO	5962-95632	300	50	QML Class V	100
HS-26CT32EH	Quad Differential Line Receivers	V, Q, /PROTO	5962-95631	300	50	QML Class V	100
ISL72026SEH	3.3V CAN Transceiver, 1Mbps, Listen Mode, Loopback	Q, /PROTO	5962-15228	75	75	QML Class V	60
ISL72027SEH	3.3V CAN Transceiver, 1Mbps, Listen Mode, Split Termination Output	Q, /PROTO	5962-15228	75	75	QML Class Q (military)	60
ISL72028SEH	3.3V CAN Transceiver, 1Mbps, Low Power Shutdown, Split Termination Output	Q, /PROTO	5962-15228	75	75	QML Class Q (military)	60

Rad-Hard Analog EH Products (continued)

Device	Description	Class	DLA SMD	High Dose Rate (HDR) krad(Si)	Low Dose Rate ELDRS krad(Si)	Qualification Level	Single Event Latchup (MeV/mg/cm²)
OP AMPs							
HS-3530AEH	Programmable Low Power Op Amps	V, /PROTO	5962-95687	300	50	QML Class V	SEL free
HS-5104AEH	Low Noise Quad Operational Amplifiers	V, /PROTO	5962-95690	100	50	QML Class V	SEL free
HS-OP470AEH	Very Low Noise Quad Operational Amplifier	V	5962-98533	100	50	QML Class V	SEL free
ISL70218SEH	Enhanced Dual 36V Precision Single-Supply, Rail-to-Rail Output, Low-Power Op Amp	V, /PROTO	5962-12222	100	50	QML Class V	SEL free
ISL70219ASEH	40V and SET Enhanced Precision Low Power Operational Amplifier	V, /PROTO	5962-14226	300	50	QML Class V	SEL free
ISL70227SEH	36V Dual Precision Operational Amplifier	V, /PROTO	5962-12223	100	50	QML Class V	SEL free
ISL70244SEH	19MHz 40V Dual Rail-to-Rail Input-Output, Low-Power Operational Amplifier	V, /PROTO	5962-13248	300	50	QML Class V	86.4
ISL70417SEH	40V Quad Precision Low Power Operational Amplifiers	V, /PROTO	5962-12228	300	50	QML Class V	SEL free
ISL70419SEH	36V Quad Precision Low Power Operational Amplifier With Enhanced SET Performance	V, /PROTO	5962-14226	300	50	QML Class V	SEL Free
ISL70444SEH	19MHz 40V Quad Rail-to-rail Input-output, Low-power Operational Amplifiers	V, /PROTO	5962-13214	100	50	QML Class V	86.4
ISL7124SEH	Single Supply Quad Operational Amplifier	V, /PROTO	5962-02542	300	50	QML Class V	SEL free
INSTRUMENTATION AMPLIFIERS							
ISL70517SEH	36V Radiation Tolerant Precision Instrumentation Amplifier with Rail-to-Rail Output ADC Driver	V, /PROTO	5962-15246	-	75	QML Class V	SEL Free
ISL70617SEH	36V Radiation Tolerant Precision Instrumentation Amp with Rail-to-Rail Output Differential ADC Driver	V, /PROTO	5962-15246	-	75	QML Class V	SEL Free
CONVERTER							
HS-565BEH	High Speed, Monolithic Digital-To-Analog Converter	V, /PROTO	5962-96755	100	50	QML Class V	SEL free
VOLTAGE REFERENCE							
IS-1009EH	2.5V Reference	V, Q, /PROTO	5962-00523	300	50	QML Class V	SEL free
ISL71090SEH12	Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-13211	100	50	QML Class V	86
ISL71090SEH25	Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-13211	100	50	QML Class V	86
ISL71090SEH50	Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-13211	100	50	QML Class V	86
ISL71090SEH75	Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-13211	100	50	QML Class V	86
ISL71091SEH10	10V Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-14208	100	50	QML Class V	86
ISL71091SEH20	2.048V Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-14208	100	50	QML Class V	86
ISL71091SEH33	3.3V Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-14208	100	50	QML Class V	86
ISL71091SEH40	4.096V Ultra Low Noise, Precision Voltage Reference	V, /PROTO	5962-14208	100	50	QML Class V	86
TEMP SENSOR							
ISL71590SEH	Radiation Hardened, 2-Terminal Temperature Transducer	V, /PROTO	5962-13215	300	50	QML Class V	86.4
TRANSISTOR ARRAY							
ISL73096EH	Ultra High Frequency NPN/PNP Transistor Arrays	V, Q	5962-07218	300	50	QML Class V	SEL free
ISL73127EH	Ultra High Frequency NPN/PNP Transistor Arrays	V, Q	5962-07218	300	50	QML Class V	SEL free
ISL73128EH	Ultra High Frequency NPN/PNP Transistor Arrays	V, Q	5962-07218	300	50	QML Class V	SEL free

Rad-Hard Power EH Products

Device	Description	Class	DLA SMD	High Dose Rate (HDR) krad(Si)	Low Dose Rate ELDRS krad(Si)	Qualification Level	Single Event Latchup (MeV/mg/cm²)
LINEAR REGULATION							
HS-117EH	Adjustable Positive Voltage Regulator	V, /PROTO	5962-99547	300	50	QML Class V	SEL free
MOSFET DRIVERS							
HS-4080AEH	Full Bridge N-Channel FET Driver	V	5962-99617	300	50	QML Class V	SEL free
HS-4423BEH	Dual, Inverting Power MOSFET Drivers	V	5962-99511	300	50	QML Class V	SEL free
HS-4423EH	Dual, Inverting Power MOSFET Driver	V	5962-99511	300	50	QML Class V	SEL free
HS-4424BEH	Dual, Non-Inverting Power MOSFET Drivers	V	5962-99560	300	50	QML Class V	SEL free
HS-4424DEH	Dual, Non-Inverting Power MOSFET Drivers	V	5962-99560	300	50	QML Class V	SEL free
HS-4424EH	Dual, Non-Inverting Power MOSFET Drivers	V	5962-99560	300	50	QML Class V	SEL free
IS-2100AEH	High Frequency Half Bridge Drivers	V, /PROTO	5962-99536	300	50	QML Class V	SEL free
SWITCHING REGULATORS							
ISL70001ASEH	SEE Hardened 6A Synchronous Buck Regulator	V, /PROTO	5962-09225	100	50	QML Class V	86.4
ISL70001SEH	SEE Hardened 6A Synchronous Buck Regulator	V, /PROTO	5962-09225	100	50	QML Class V	86.4
ISL70002SEH	SEE Hardened 12A Synchronous Buck Regulator with Current Sharing	V, /PROTO	5962-12202	100	50	QML Class V	86.4
ISL70003ASEH	SEE Tolerant 3V to 13.2V, 9A Buck Regulator	V, /PROTO	5962-14203	100	50	QML Class V	86.4
SOURCE DRIVER							
IS-2981EH	8-Channel Source Driver	V, /PROTO	5962-00520	100	50	QML Class V	SEL free
ISL72813SEH	32-Channel Driver Circuit with an Integrated Decoder	V, /PROTO	5962-17208	100	50	QML Class V	86.4
SUPERVISORY							
ISL705AEH	5.0V µ-Processor Supervisory Circuits	V, /PROTO	11213	100	50	QML Class V	86
ISL705BEH	5.0V µ-Processor Supervisory Circuits	V, /PROTO	11213	100	50	QML Class V	86
ISL705CEH	5.0V µ-Processor Supervisory Circuits	V, /PROTO	11213	100	50	QML Class V	86
ISL706AEH	3.3V µ-Processor Supervisory Circuits	V, /PROTO	11213	100	50	QML Class V	86
ISL706BEH	3.3V µ-Processor Supervisory Circuits	V, /PROTO	11213	100	50	QML Class V	86
ISL706CEH	3.3V µ-Processor Supervisory Circuits	V, /PROTO	11213	100	50	QML Class V	86
POWER SEQUENCING							
ISL73321SEH	Quad Power Supply Sequencer	V, /PROTO	5962-17225	100	75	QML Class V	86
ISL70321SEH	Quad Power Supply Sequencer	V, /PROTO	5962-17225	100	75	QML Class V	86
LDO							
ISL75051ASEH	3A, Radiation Hardened, Positive, Ultra-Low Dropout Regulator	V, /PROTO	5962-11212	100	50	QML Class V	86.3
ISL75052SEH	1.5A, Positive, High Voltage LDO	V, Q, /PROTO	5962-13220	100	50	QML Class V	86
SWITCHING CONTROLLERS							
HS-1825AEH	High-Speed, Dual Output PWM	V	5962-99558	300	50	QML Class V	SEL free
ISL78840ASEH	High Performance Industry Standard Single-Ended Current Mode PWM Controller	V, /PROTO	5962-07249	100	50	QML Class V	86
ISL78841ASEH	High Performance Industry Standard Single-Ended Current Mode PWM Controller	V, /PROTO	5962-07249	100	50	QML Class V	86
ISL78843ASEH	High Performance Industry Standard Single-Ended Current Mode PWM Controller	V, /PROTO	5962-07249	100	50	QML Class V	86
ISL78845ASEH	High Performance Industry Standard Single-Ended Current Mode PWM Controller	V, /PROTO	5962-07249	100	50	QML Class V	86

Rad-Hard Power EH Products (continued)

Device	Description	Class	DLA SMD	High Dose Rate (HDR) krad(Si)	Low Dose Rate ELDRS krad(Si)	Qualification Level	Single Event Latchup (MeV/mg/cm²)
GAN FET DRIVERS							
ISL70040SEH	Radiation Hardened Low Side GaN FET Driver	V, /PROTO	17233	100	75	QML Class V	86
ISL73040SEH	Radiation Hardened Low Side GaN FET Driver	V, /PROTO	17233	100	75	QML Class V	86
GAN POWER TRANSISTORS							
ISL70023SEH	100V, 60A Enhancement Mode GaN Power Transistor	Mod-Class V, / PROTO	-	100	75	Modified Class V	86
ISL73023SEH	100V, 60A Enhancement Mode GaN Power Transistor	Mod-Class V, / PROTO	-	100	75	Modified Class V	86
ISL70024SEH	200V, 7.5A Enhancement Mode GaN Power Transistor	Mod-Class V, / PROTO	-	100	75	Modified Class V	86
ISL73024SEH	200V, 7.5A Enhancement Mode GaN Power Transistors	Mod-Class V, / PROTO	-	100	75	Modified Class V	86

Rad-Tolerant Products

Device	Description	Low Dose Rate (ELDRS) krad(Si)	SEL (MeV/mg/cm²)	Package Type	Temp Range (°C)	
CAN BUS TRANSCEIVER						
ISL71026M	3.3V CAN Transceiver, 1Mbps, Listen Mode, Loopback	30	43	TSSOP14	-55 to 125	

Device	Description	# Channels	Bandwidth (MHz)	V_S Range (V)	Low Dose Rate (ELDRS) krad(Si)	SEL (MeV/mg/cm²)
OPERATIONAL AMPLIFIERS						
ISL71444M	19MHz 40V Quad Rail-to-Rail Input-Output, Low-Power Op Amp	4	19	2.7 to 40	30	43
ISL71218M	Dual 36V Precision Single-Supply, Rail-to-Rail Output, Low-Power Op Amp	2	4	3 to 36	30	43

Device	Description	V_{OUT} Option (V)	Accuracy (%)	Temp Coefficient (ppm/°C)	Low Dose Rate (ELDRS) krad(Si)	SEL (MeV/mg/cm²)
VOLTAGE REFERENCES						
ISL71010B50	Ultra Low Noise, 2.5V Precision Voltage Reference	5.0	±0.05	10	30	43
ISL71010B25	Ultra Low Noise, 5V Precision Voltage Reference	2.5	±0.05	10	30	43

Device	Description	# Outputs	V_{IN} Range (V)	V_{OUT} (min) (V)	Low Dose Rate (ELDRS) krad(Si)	SEL (MeV/mg/cm²)
SWITCHING REGULATOR						
ISL71001M	6A Synchronous Buck Regulator with Integrated MOSFETs	1	3 to 5.5	0.85	30	43

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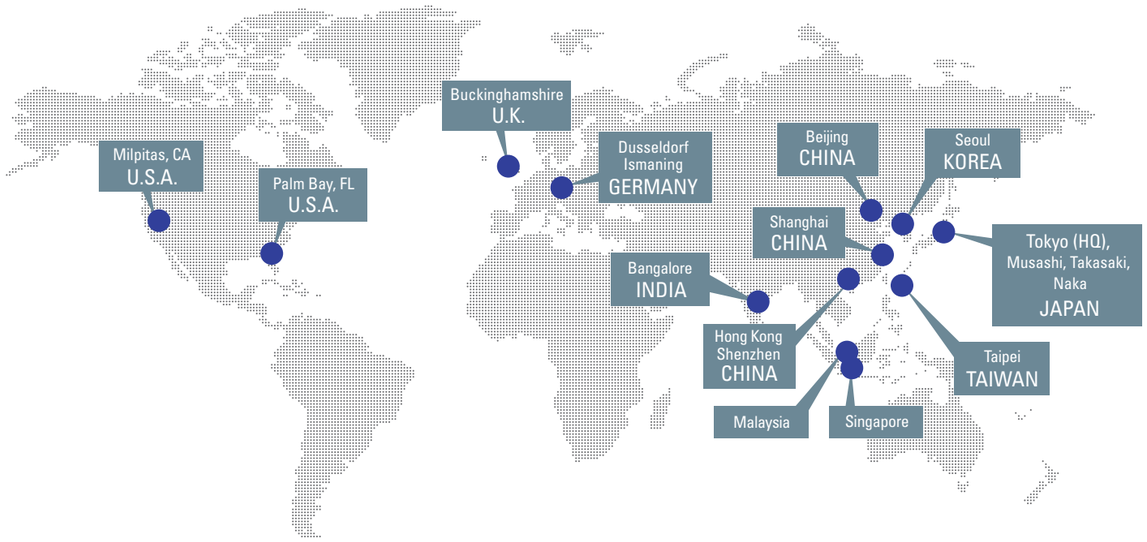

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