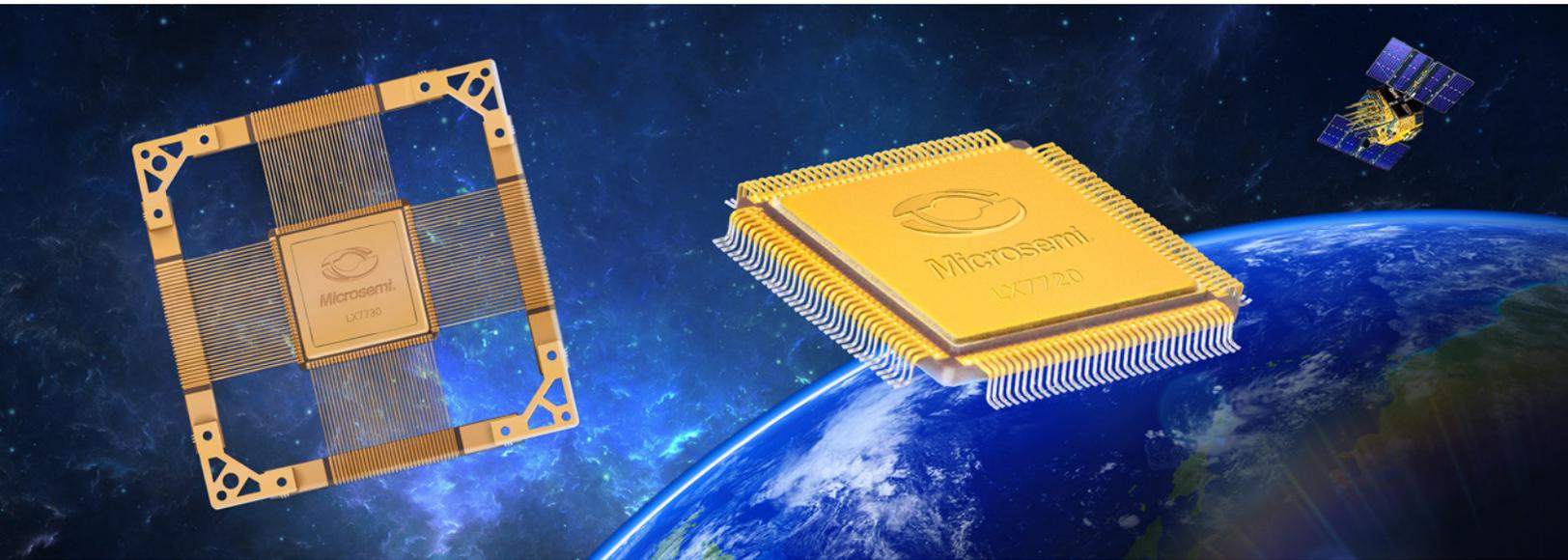


Microsemi Mixed Signal Solutions for Space



Leading Space Innovation for Sixty Years

Space System Manager ICs

Development Tools

Radiation-Tolerant Source Drivers and Diode Arrays

Radiation-Tolerant Voltage Regulators and PWM Controllers

Custom Solutions for Space

Microsemi Space Forum and Space Brief eNewsletter

Leading Space Innovation for Sixty Years

Extensive Space Heritage

Microsemi has been developing space solutions for almost six decades and has played an important role in a wide variety of space programs globally. The company has a proven track record for innovation, quality, and reliability, and continues to build on that legacy with an impressive portfolio of industry-leading new products and technology innovations.

A Partner for the Long Run

Microsemi's high-reliability products and solutions have been used in applications that require high levels of radiation-hardness for trips to the moon, Mars, and beyond. Microsemi has always responded to the specific needs of space applications and has a longstanding commitment to the space market.

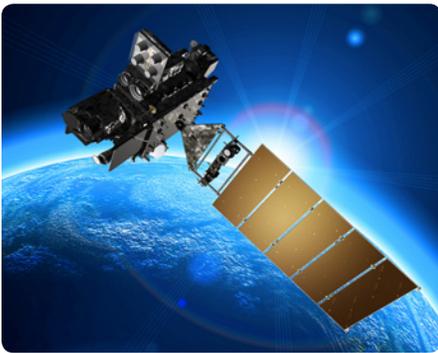
Broad Solutions Portfolio

With one of the industry's most comprehensive space products portfolios, Microsemi provides radiation-hardened and radiation-tolerant solutions including high-performance FPGAs, precise frequency and timing solutions with space-grade oscillators, mixed-signal ICs, isolated DC-DC converter

modules, custom power supplies, hybrid solutions, MOSFETs, diodes, transistors, RF components, and custom solutions. We are committed to supporting our products throughout the lifetime of our customer's programs.

Continuous Innovation

We continue to innovate in areas such as semiconductor materials, advanced packaging technologies, and high-density integrated circuits. Our products are qualified to the highest government, DLA, NASA, and ESA standards, and their reliability has been independently verified by multiple agencies. As your supply partner for electronic systems in space, Microsemi can solve problems at all stages of design and implementation, including power conversion and distribution, radio and radar signal processing, system telemetry and control, digital logic integration, and semiconductor packaging. We invite you to explore Microsemi's solutions and engage with us to help solve your most difficult space system design challenges.



Satellites

- Attitude and orbit control system
- Electrical power system
- TT&C/C&DH system
- Communications payload
- Remote sensing payload
- Solar array and power conditioning
- Active and passive image payload
- Solid state recorder



Launchers

- Navigation and guidance system
- Electrical power system
- TT&C/C&DH system
- Propulsion control system



Landers

- Navigation and guidance system
- Electrical power system
- TT&C/C&DH system
- Science experiment payloads
- RF communications subsystems
- Cameras and imagers
- Motor control systems

Space System Manager ICs

Microsemi Mixed Signal Solutions for Space

Microsemi has a long history of providing successful and reliable industry standard, radiation-tolerant integrated circuits including:

- Space System Managers
 - LX7720 position sensing motor controller
 - LX7730 telemetry controller
- Source Drivers
 - LX7798 (AAHS298) eight-channel source driver
- Diode Arrays
 - LX7710 eight-pair diode array
- Voltage Regulators and PWM Controllers
 - SGR117
 - SGR137
 - SGR1845
 - SGR1846

We also offer special screening and manufacturing flows for our non-space high-reliability products that include voltage regulators and reference ICs, PWM controllers, op amps, and driver arrays. These are done through customer generated Source Control Drawings (SCD) and associated Microsemi generated SPS documents.

Our access to several process technologies and expertise in radiation-tolerant circuit design has enabled us to offer custom solutions for embedded satellite functions. These ICs provide

space-saving solutions with voltages ranging up to 120 V, and deliver vital integrated functions such as source drivers, motor control, and telemetry.

Space System Manager Integrated Circuits

Microsemi continues to build on this experience with breakthrough additions to our radiation-tolerant IC portfolio. Our new Space System Manager (SSM) family integrates commonly used mixed-signal satellite functions into a single space-saving IC. The SSM IC interfaces with an FPGA to offer a complete application-specific solution that allows our customers to achieve aggressive weight and space requirements. Key features of the SSM family are:

- Radiation-tolerance: 100 krad TID, 50 krad ELDRS, single event immunity
- 132-pin ceramic quad flat pack
- MIL-PRF-38535 Class V and Class Q processing
- 64 channel telemetry controller (LX7730)
- Power driver/motor controller (LX7720)



Space System Manager ICs

LX7720: Radiation-Tolerant Position Sensing and Motor Controller

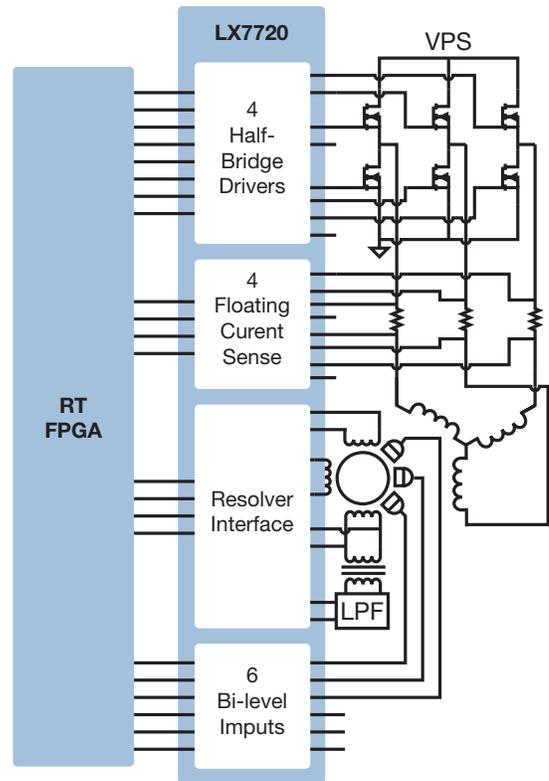
As the industry's first highly integrated radiation-tolerant motor control integrated circuit, the LX7720 significantly reduces weight and board space relative to conventional discrete motor control circuits, offering a unique solution for satellite manufacturers sensitive to area and weight challenges.

Features

- Four half-bridge n-channel MOSFET drivers
- Four floating differential current sensors
- Pulse modulated resolver transformer driver
- Three differential resolver sense inputs
- Six bi-level logic inputs
- Fault detection
- Radiation tolerant: 100 krad TID, 50 krad ELDRS, single event effects

Applications

- Motor driver servo control
- Linear actuator servo control
- Stepper, BLDC, PMSM motor driver



Part Number	Description
LX7720MFQ-ES	Engineering samples.
LX7720MFQ-EQ	Built per QML-Q flow. This will convert to LX7720MFQ-Q once QML certification is achieved and parts will also be orderable by SMD number.
LX7720MFQ-EV	Built per QML-V flow. This will convert to LX7720MFQ-V once QML certification is achieved and parts will also be orderable by SMD number.
LX7720-DB	Daughterboard available to work with company's RTG4™ FPGA Development Kit.

Space System Manager ICs

LX7730: Radiation-Tolerant Telemetry Controller IC

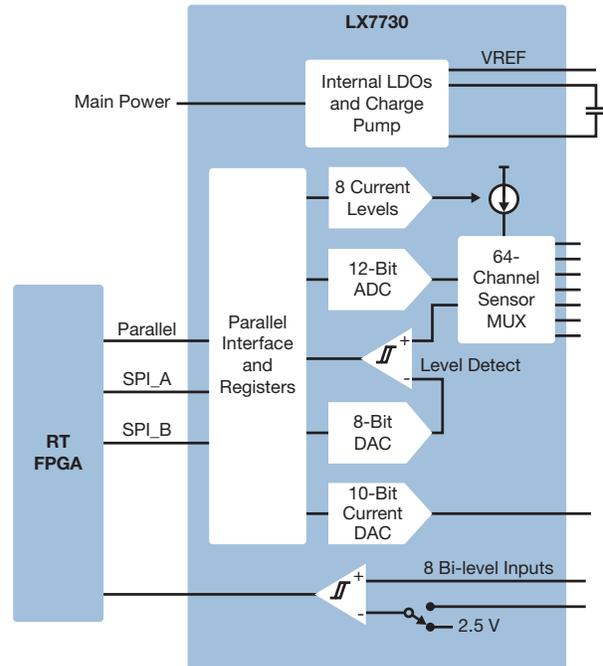
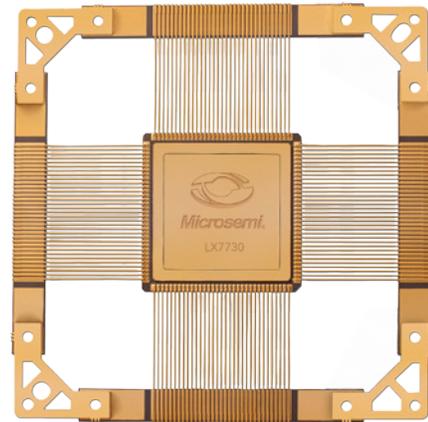
Microsemi's LX7730 offers space system architects and designers the highest level of integration for telemetry applications available today to address their increasing needs and requirements. The LX7730 integrates the required functions in satellite telemetry systems such as sensor monitoring, attitude, and payload control, and interfaces with radiation-tolerant FPGAs such as those offered in Microsemi's portfolio of FPGA solutions.

Features

- 64-channel MUX
- Break-before-make switching
- 13 ksps 12-bit ADC
- 3% precision adjustable current source
- 1% precision 5.00 V source
- Threshold monitoring
- 8x bi-level logic
- 10-bit DAC
- Supports parallel or dual SPI interface
- Radiation tolerant: 100 krad TID, 50 krad ELDRS, single event effects

Applications

- Spacecraft health monitoring
- Attitude control
- Payload equipment



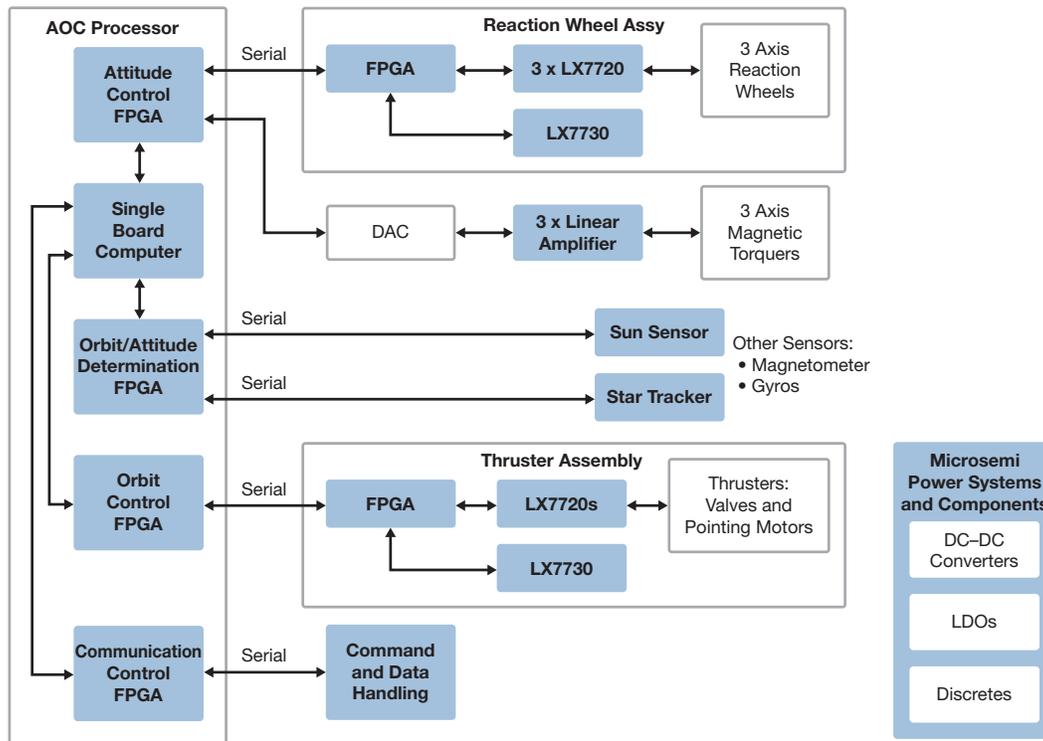
Part Number	Description
LX7730MFQ-ES	Engineering samples (using production silicon).
LX7730MFQ-EQ	Built per QML-Q flow. This will convert to LX7730MFQ-Q once QML certification is achieved and parts will also be orderable by SMD number.
LX7730MFQ-EV	Built per QML-V flow. This will convert to LX7730MFQ-V once QML certification is achieved and parts will also be orderable by SMD number.
LX7730-EVB	Evaluation board: allows user to exercise LX7730 features when coupled with USB to serial interface. Application software provided. Includes cable assembly.
LX7730-DB	Daughterboard available to work with company's RTG4™ FPGA Development Kit.

Space System Manager ICs

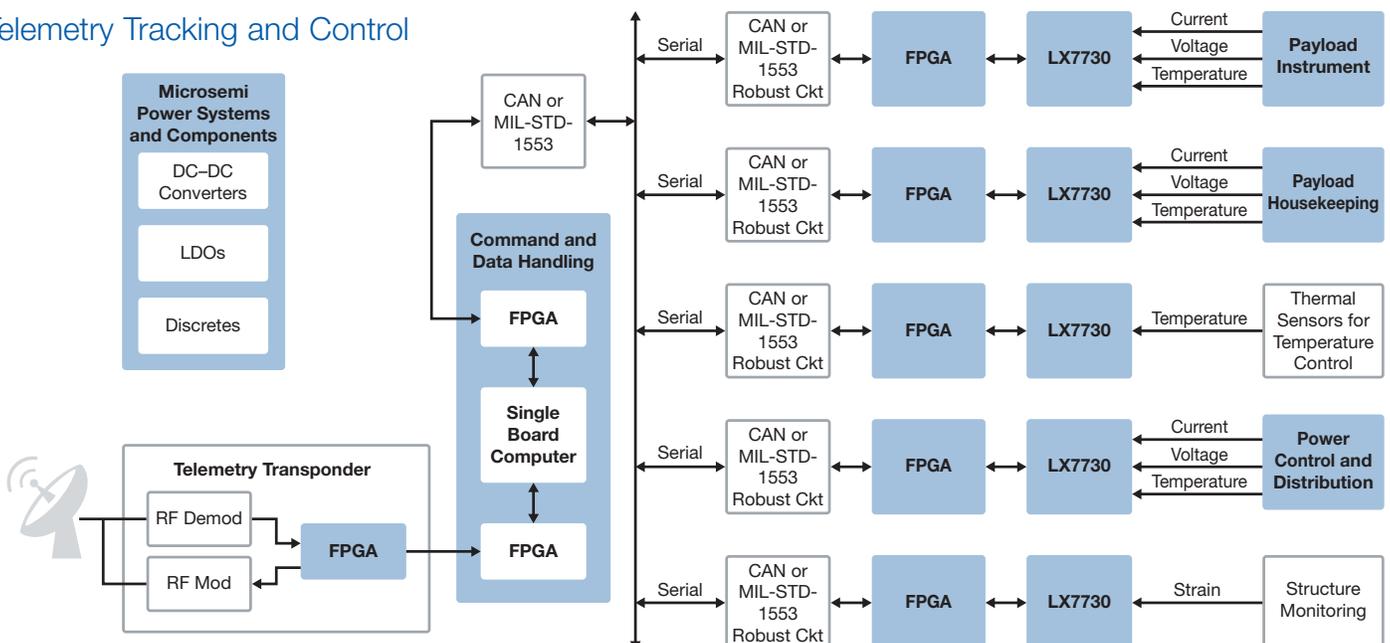
Space System Manager Applications

Our Space System Managers offer space-saving solutions in many satellite applications, including those shown.

Attitude and Orbit Control



Telemetry Tracking and Control



Development Tools

Space System Manager Development Tools

Various evaluation boards and daughterboards are available to support development using the space system manager products. Please refer to the product pages on our website for associated user guides and support material.

RTG4 Development Kit with LX7730 Daughterboard

Allows the user to connect the LX7730 to the RTG4 FPGA development kit and evaluate key functions.

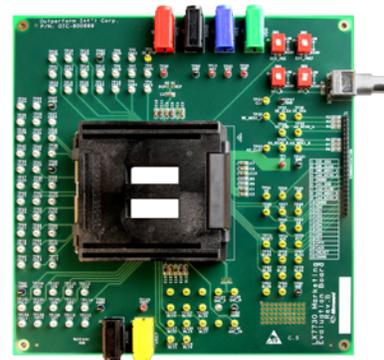


high-performance FPGAs. The development board features a RT4G150 device offering more than 150,000 logic elements in a ceramic package with 1,657 pins.



LX7730 Evaluation Board

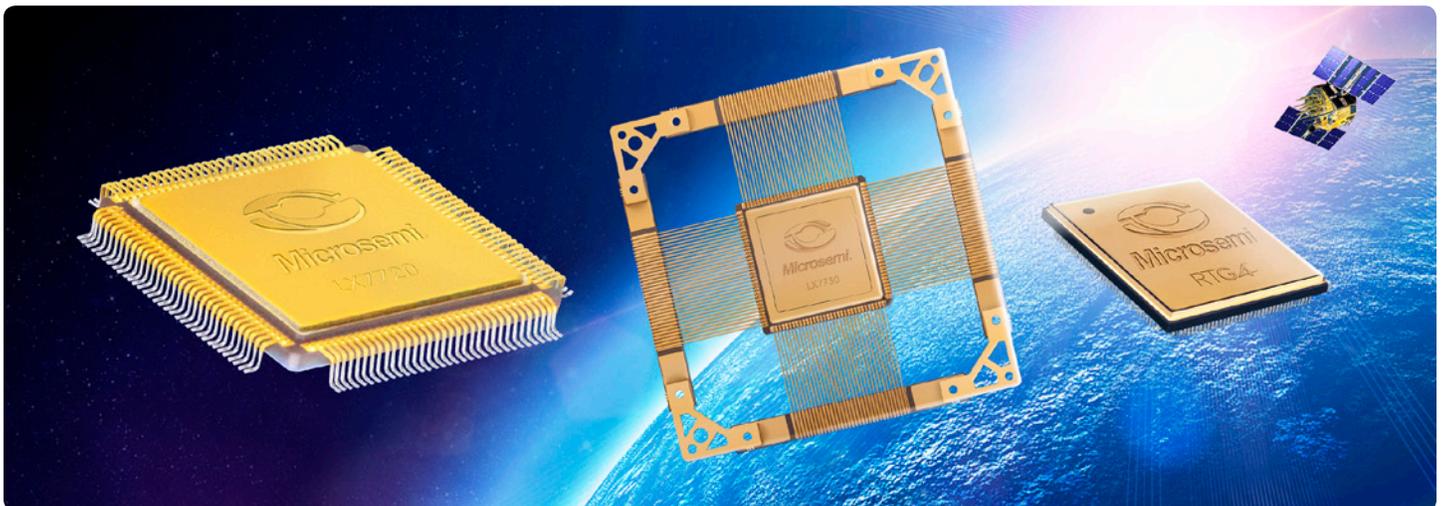
Allows the user to exercise LX7730 features when coupled with a USB-to-serial interface. Application software is provided and includes cable assembly.



RTG4 Development Kit with LX7720 Daughterboard

Allows the user to connect the LX7720 to the RTG4 FPGA development kit and evaluate key functions.

The RTG4 development kit provides space customers with an evaluation and development platform for applications such as data transmission, serial connectivity, bus interface, and high-speed designs using RTG4 radiation-tolerant high-density

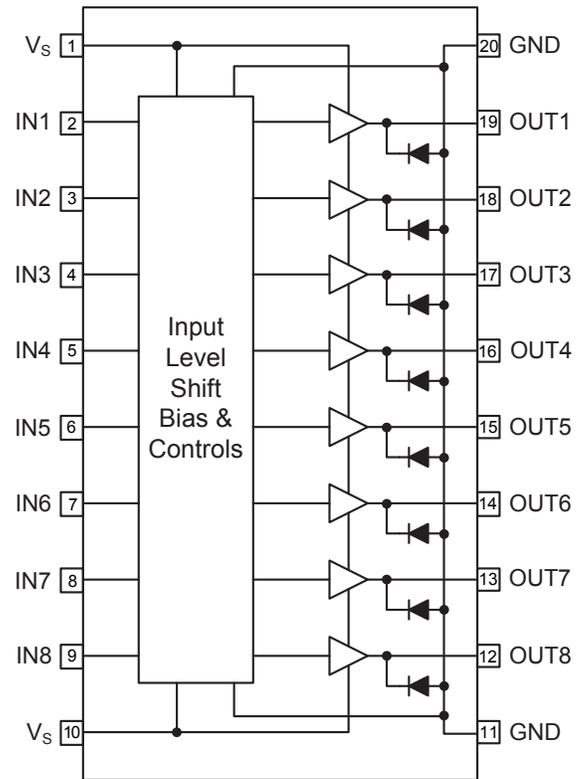


Radiation-Tolerant Source Drivers and Diode Arrays

LX7798/AAHS298B Radiation-Tolerant 8-Channel Source Driver

The AAHS298B source driver includes eight non-inverting channels and can be used to provide an interface from TTL level, 5 V, or 12 V logic systems to relays, stepper and servo motors, solenoids, and other loads. Each output is capable of sourcing 700 milliamps (mA) with a withstand voltage of 50 V across the full military operating range, allowing manufacturers to develop more compact solutions. It includes an internal thermal shutdown feature to protect against over-current and soft-start occurrences. Additional features include:

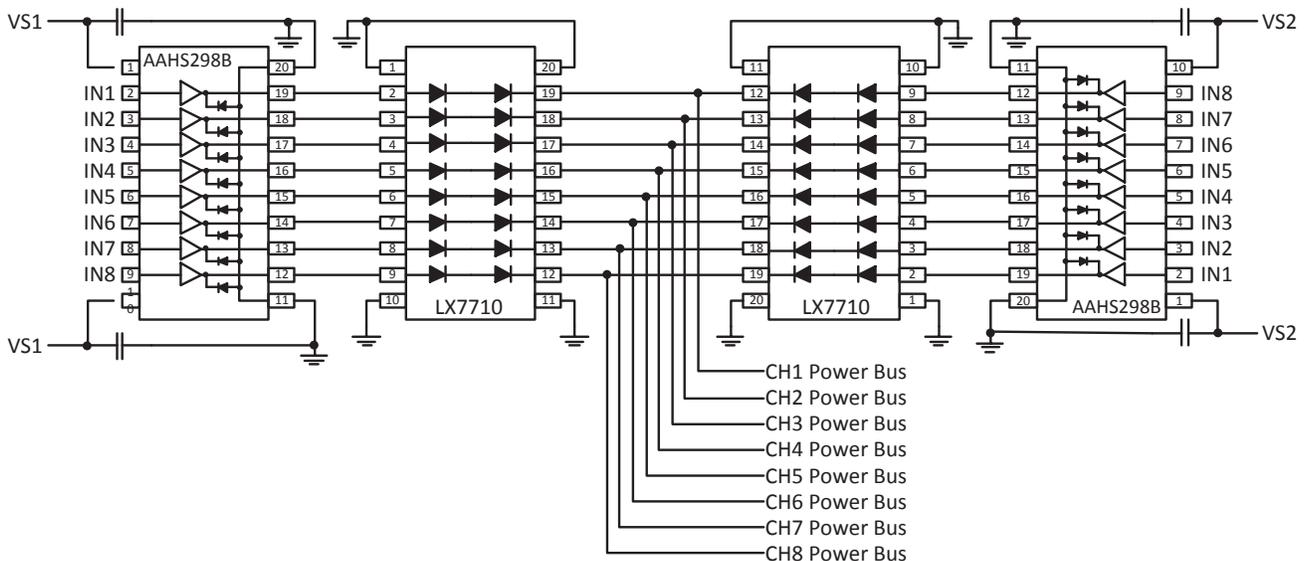
- Low quiescent current consumption
- Internal ground clamp diodes
- Output breakdown voltage of 50 V (minimum)
- Transistor-transistor logic (TTL), 5 V, and 12 V logic compatible
- QML-V and QML-Q certified
- Radiation tolerant: 100 krad TID, 50 krad ELDRS, single event effects



LX7710 Radiation-Tolerant 8-Pair Diode Array

The LX7710 offers eight series-connected diode pairs, providing redundant protection should one fail in a short circuit event, ensuring reliability even in harsh space environments. The diodes within the integrated circuit are electrostatic discharge (ESD) protected and offer a minimum of 125 V breakdown voltage and can handle up to 700 mA of continuous current. The LX7710 is designed for power OR-ing, redundant power sourcing, aerospace satellite manufacturing, and military power electronics control applications.

Both devices are packaged in a 20-pin ceramic SOIC package and are QML-V and QML-Q certified.



Radiation-Tolerant Voltage Regulators and PWM Controllers

Radiation-Tolerant Voltage Regulators

SGR117: Rad-Hard 1.5 Amp Three Terminal Adjustable Voltage Regulator

The radiation-hardened SGR117A three-terminal positive adjustable regulators have been designed to meet the most stringent space and strategic level radiation requirements while meeting the industry-standard SG117A and SG117 electrical specification.

Features

- 1% output voltage tolerance
- 0.01%/V line regulation
- 0.3% load regulation
- Minimum 1.5 A output current

High Reliability Features

- Full electrical performance after radiation exposure 300 krad total dose 5x10¹² N/cm²
- Available to MIL-STD-883, 1.2.1
- Radiation data available
- MSC level “S” processing available

SGR137: 1.5 Amp Negative Adjustable Regulator

The SGR137/SGR137A is fit, form, and function compatible to the SG137/SG137A with the addition of guaranteed performance after radiation exposure. The SGR137A family of negative adjustable regulators delivers up to 1.5 A output current over an output voltage range of -1.2 V to -37 V.

Features

- 1% output voltage tolerance
- 0.01%/V line regulation
- 0.5% load regulation
- 0.02%/W thermal regulation

High Reliability Features

- Radiation data available
- TID to a minimum of 50 krad (Si)
- ELDRS to a minimum of 50 krad (Si)
- SEL immunity to a minimum of 87 MeV-cm²/mg

Radiation-Tolerant PWM Controllers

SGR1845: Radiation-Tolerant Current Mode PWM Controller

The SGR1844/SGR1845 is fit, form, and function compatible to the SG1844/SG1845 with the addition of guaranteed performance after radiation exposure. The SGR1845 provides the required features to implement off-line fixed frequency and current mode switching power supplies with a minimum number of external components.

Features

- Low start-up current (<1 mA)
- Pulse-by-pulse current limiting
- Enhanced load response
- High-current totem-pole output
- Internally trimmed bandgap reference
- 500 kHz operation

High Reliability Features

- TID to 100 krad (Si) with 150 krad overtest and 168 hours anneal
- ELDRS to 50 krad (Si)
- SEL immunity to 87 MeV-cm²/mg

SGR1846: Radiation-Tolerant Current Mode PWM Controller

The SGR1846 is fit, form, and function compatible to the SG1846 with the addition of guaranteed performance after radiation exposure. The SGR1846 control IC provides the required features to implement fixed frequency and current mode control schemes while maintaining a minimum external parts count.

Features

- Differential current sense amplifier with wide common-mode range
- 200 mA totem-pole outputs
- ±1% bandgap reference
- Under-voltage lockout
- Soft-start and shutdown capability
- 500 kHz operation

High Reliability Features

- TID to 100 krad (Si)
- ELDRS to 50 krad (Si)
- SEL immunity to 87 MeV-cm²/mg

Custom Solutions for Space

Mixed Signal Integrated Custom Space Solutions

Microsemi has 20 years of custom ASIC development experience, with expertise in space and aviation applications, and over 9 years of flight heritage for mixed signal IC custom solutions. The design team offers fully custom designs, from specification to production, including mixed-signal solutions integrating complex analog functions with limited logic circuitry (up to 100K gates), ICs designed for challenging operating conditions, radiation tolerance by design for 100 krad TID minimum, SEL/SEU immunity, with cold-sparing on I/Os for redundant applications or extreme temperature environments (225 °C), and with screening to MIL-PRF requirements (Class Q, Class V, or as specified by customer).

As your supply partner for electronic systems in space, Microsemi can solve problems at all stages of design and implementation. We invite you to explore Microsemi's solutions and engage with us to help solve your most difficult space system design challenges and develop roadmaps for standard products in the future.

Flight Heritage

Although the LX7730 and LX7720 are newly introduced standard products, they benefit from flight heritage with custom ICs that have been in production for many years. These solutions use the same fabrication processes used with the LX7730 and the same manufacturing flows and assembly facility.

Radiation Data

Our space products are subjected to the radiation exposure that can occur in satellite applications. Our standard exposures are:

- Total dose to a minimum of 100 krad
- ELDRS to a minimum of 50 krad
- Single event effects, including SEL and SEU

Radiation test results are listed on the associated product pages on our website. In some cases, we perform testing to higher tolerance levels. Please contact your local sales office for these options.





Microsemi

SPACE FORUM

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SPACE BRIEF

Microsemi's Space Brief eNewsletter

is a quarterly email that will keep you updated on the latest news about Microsemi space products and solutions.

To view, visit www.microsemi.com/spaceforum/space-brief-newsletter

To stay up to date about Microsemi's space solution products, email sales.support@microsemi.com or visit our Space Applications Website: www.microsemi.com/applications/space

Microsemi is continually adding new products to its industry-leading portfolio.

For the most recent updates to our product line and for detailed information and specifications, please call us, email, or visit our website.

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