

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.

Toll-free: 800-713-4113

sales.support@microsemi.com

www.microsemi.com



FPGAs

Mixed-Signal ICs

Space System Manager ICs

Precise Timing and Frequency Solutions

DC-DC Converters and Relays

Discrete Power Components

RF Integrated Solutions



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Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center 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; enterprise storage and communication solutions, 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, California and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

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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.

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.

A Partner for the Long Run

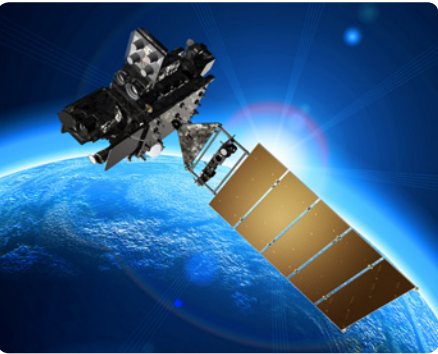
Microsemi's high-reliability products and solutions have been used in applications that require high levels of radiation-hardness for trips to the moon, Mars, and beyond. Microsemi has always responded to the specific needs of space applications and has a longstanding commitment to the space market.

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.

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-



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



LEADING SPACE INNOVATION SINCE 1957

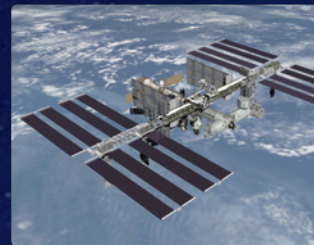
Microsemi technology has been used in many major U.S. and international space initiatives since 1957. A selection of programs that have chosen Microsemi products is presented here.



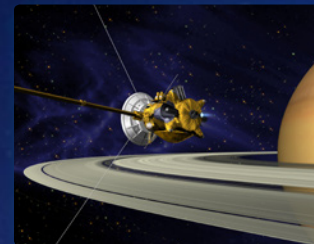
Atlas
NASA




Mars Science Lab
NASA



International
Space Station
NASA



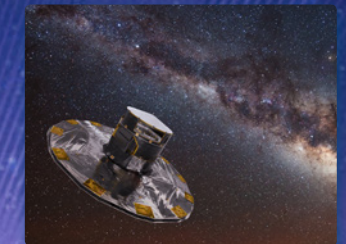
Cassini-Huygens
NASA



Cygnus
NASA



Mars Rovers



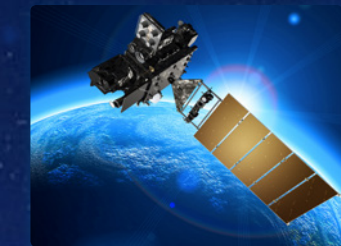
Gaia
ESA



Mars Recon. Orbiter
NASA



GOCE
ESA



GOES-R
NASA

| | | | | | | | | | |
|-------------------|----------------|-----------------------------|-------------------------|----------------|----------------------|------------------|-------------------|------------------|---------------------|
| Apollo | FLTSATCOM | Cassini | CloudSat | MESSENGER | AEHF | MetOp | ALOS 2 (DAICHI-2) | GOES-R | Orbcomm Gen 2 |
| Atlas | GPS I & II/IIA | Envisat | Envisat | MUOS | ALOS | MUOS FS3-5 | ASNARO | Hayabusa 2 | PAN 2 |
| Centaur | Landsat-D | GPS Block IIF | GOCE | Rosetta | Astro-F (IRIS/Akari) | New Horizons | ATV | Himawari 8 | SBIRS 5 & 6 |
| Delta | Leasat | Intelsat 8 | Hayabusa | SAOCOM 1A & 1B | CHIRP | PAN | Chandrayaan I | Iridium Next | Sentinel 1, 2, 3, 4 |
| Mercury | Mission 34 | International Space Station | Lunar Recon. Orbiter | SAR-2000 | Columbus | SBIRS HIGH 3 & 4 | CLIO (PAN II) | IRNSS Series | Skyfox |
| NST-2 Termination | Telstar 4 | ORBCOMM | Mars Exploration Rovers | SBIRS | Cosmo IV | SDS-1 | Cygnus | Juno | Terrasar & Tandem X |
| Polaris | | QuickBird 1 & 2 | Mars Express | STEREO | GOSAT/IBUKI | SELENE | DSAC | JPSS-1 | WorldView III |
| Poseidon | | SBIRS HIGH | Mars Recon. Orbiter | Venus Express | GPS III | WINDS/KIZUNA | Gaia | Mangalyaan | |
| Surveyor | | SBIRS LOW | | | INTELSAT | WorldView II | Galileo | Mars Science Lab | |
| Titan | | | | | KOMPSAT | | GCOM-W (SHIZUKU) | MetOp SG | |

1957–1970

1971–1990

1991–2000

2001–2005

2006–2010

2011–2020

Radiation-Tolerant FPGAs

Microsemi's space-proven, radiation-tolerant FPGAs provide a wide range of gate counts, hardwired multiply-accumulate blocks for fast, efficient digital signal processing, and high-speed serial interfaces such as SERDES. They also feature QML qualification to classes Q and V, and are available in a variety of package types and sizes. Our FPGAs have survived more than 33 million device-hours of reliability data from flight and commercially equivalent units, and performed flight-critical functions in space systems orbiting around the Earth, the moon, Venus, and the sun. They also have been used on missions to the surface of Mars, and into the furthest reaches of the solar system. Microsemi's innovations include radiation-hardening techniques that protect against single event upset (SEU) radiation effects, novel packaging technologies to enable integration of FPGAs into hybrids and multi-chip modules, and high-density ceramic column grid array packaging. Product family specifications include:

- Up to 300 kRad (Si) functional TID
- Up to 150K LEs, 5 Mbits SRAM, 462 multipliers
- Up to 840 I/Os and 24 × 3.125 Gbps SERDES
- Reprogrammable flash or permanently programmed anti-fuse interconnects

www.microsemi.com/products/fpga-soc/rad-tolerant-fpgas



RTG4™ Radiation-Tolerant FPGA

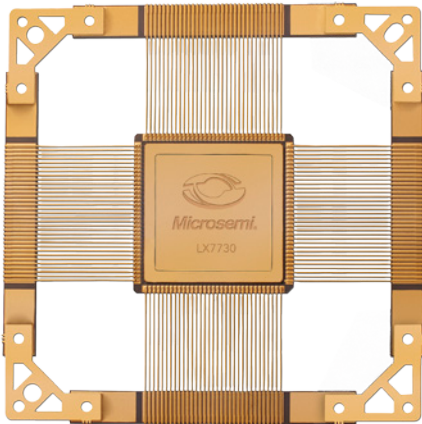
Radiation-Tolerant Mixed-Signal Integrated Circuits

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

- Space system managers
- High-side drivers
- Diode arrays
- Voltage regulators and reference ICs
- PWM controllers
- Operational amplifiers
- Driver arrays

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 high-side drivers, motor control, and telemetry.

www.microsemi.com/product-directory/space-system-managers/3575-telemetry-controller-ic

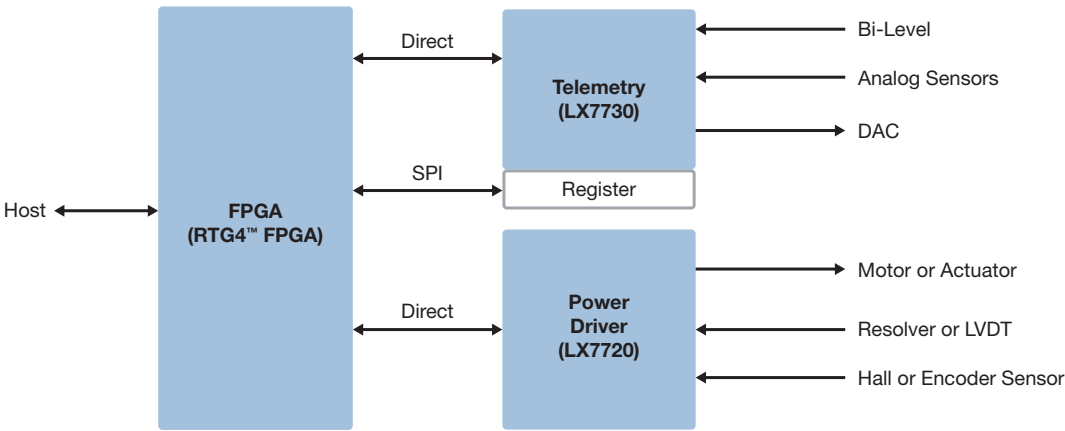


LX7730 Radiation-Tolerant Telemetry Controller

Space System Manager Integrated Circuits

Microsemi continues to build on its history with groundbreaking 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, SEU
- 132-pin, ceramic quad flat pack
- MIL-PRF-38535 Class V and Class Q processing
- LX7730: 64-channel telemetry controller
- LX7720: power driver/motor controller



www.microsemi.com/product-directory/radiation-tolerant-devices/3574-space-system-managers

Precise Timing and Frequency Solutions

Microsemi has a long history of supplying space-qualified oscillators and cesium clocks for both domestic and international space applications.

Small size, low power consumption, fast warm-up, excellent stability, and superior spectral purity make our products ideal for satellite timing, navigation, metrology, and communication functions.

We maintain ISO 9001-2000 and MIL-STD certifications to assure the highest-quality design, manufacturing, and test facilities available in the industry today. We are also AS9100 registered, and our workmanship standards include NASA and J-STD-001DS. Capabilities include:

- Ovenized quartz oscillators
- Hybrid voltage-controlled and temperature-compensated crystal oscillators
- Cesium clocks
- Custom build-to-print capabilities

www.microsemi.com/products/timing-synchronization-systems/time-frequency-references/high-reliability-ruggedized-oscillators#space-xos



Space System Solutions

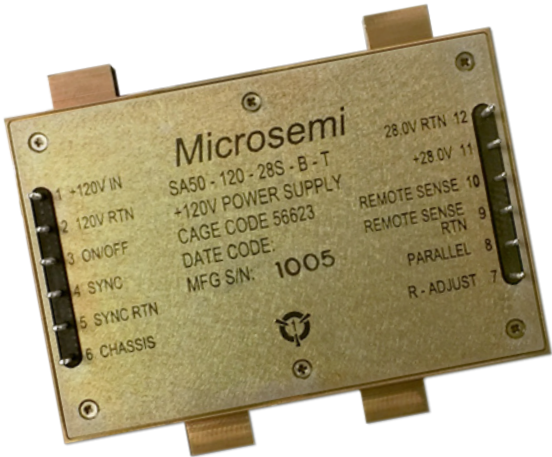
Space-Grade DC to DC Converters

Microsemi has delivered thousands of highly-reliable standard and custom radiation-hardened DC-DC power supplies to support space missions as well as military and commercial aviation system development programs. We offer:

- Standard modules: 30 W and 50 W; 28 V or 120 V inputs; single, dual, and triple outputs
- Full custom design of power supply and power distribution systems
- DC-DC power conversion (typical inputs: 28 V, 50 V, 70 V, 100 V, and 120 V)
- Outputs of 1.2 V, 1.5 V, 3.3 V, 5 V, 12 V, 15 V, 28 V, or a custom specification

www.microsemi.com/product-directory/modules-a-hybrids/1450-dc-to-dc-converters#overview

- Power outputs capabilities from 5 W to over 10 kW
- Radiation hardness to TID= 100 krad (Si) and SEE immune to 82 MeV



Space-Grade Relays

Microsemi has been delivering space-grade relays since the space race began in 1957. We have products on NASA's Voyager program that continue to operate reliably after 37 years. Voyager is now in interstellar space, over 11.6 billion miles from Earth, and takes over 17 hours to communicate back. We offer:

- 1 Amp to 30 Amp relays, up to 6,000 V isolation
- Latching and non-latching
- SPST to 4PDT configuration
- Multiple mounting and lead configurations
- Extensive in-house shock and vibration testing capabilities

www.microsemi.com/product-directory/relays-a-contactors/969-relays



Space System Solutions

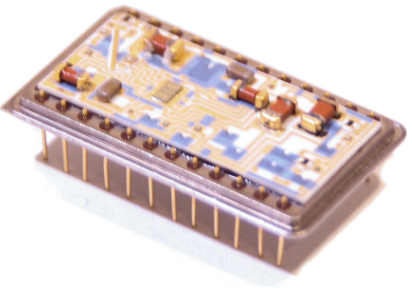
Point-of-Load Space Hybrids

Microsemi designs and manufactures high-reliability micro-circuits qualified to MIL-PRF-3853, Class H or K. The portfolio includes standard and custom power conversion products including linear regulators and switching converters that offer the following capabilities:

- Space-qualified products to Class H and K, MIL-PRF-38534
- Radiation qualifications up to 300 krad (Si) TID

Rad-Hard Non-Isolated Switching Regulators—
www.microsemi.com/product-directory/switching-regulators/1773-non-isolated

Rad-Hard Voltage Regulators (non-LDO)—
www.microsemi.com/product-directory/rad-hard-hybrid-regulators/680-rad-hard-hybrid-regulators



- Single-event-rated products up to LET= 82 MeV
- Custom build-to-print capabilities
- DBC, thick, and thin film technologies
- Assemblies with low thermal resistance

Radiation-Hardened Bipolar Transistors, Diodes, Zeners, TVS, Solar Diodes, and Rectifiers

Microsemi's discrete solutions are qualified to MIL-PRF-19500, and the company has more DLA slash sheet qualifications than any other manufacturer of space-level discrete products (over 60% of the QPL/QML). We were the first diode manufacturer selected by the U.S. military services as a source of supply to qualify products to the highest specified reliability level. We have expanded our offerings to include a growing range of space solutions and capabilities including:

- Radiation-hardened bipolar transistors, diodes, rectifiers, zeners, transient voltage suppressors (TVS), and solar diodes
- JAN, JANTX, JANTV, and JANS-qualified products

Radiation-Hardened Bipolar Transistors—
www.microsemi.com/product-directory/transistors/3274-bjt-bipolar-junction-transistor

Diodes—www.microsemi.com/product-directory/discretes/607-diodes

Zeners—www.microsemi.com/product-directory/diodes/630-zener

- Radiation-qualified products (TID, ELDRS, SEE)
- Solar cell blocking and bypass diodes
- Radiation testing services
- Customized devices



Transient Voltage Suppressors (TVS)—
www.microsemi.com/product-directory/discretes/682-transient-voltage-suppressors

Solar Diodes—www.microsemi.com/product-directory/diodes/622-solar-array-diode

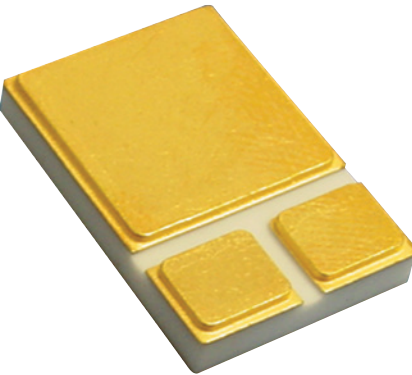
Rectifiers—www.microsemi.com/product-directory/diodes/666-rectifier-diodes

Radiation-Hardened MOSFETs

Microsemi currently offers nearly 30 radiation-hardened MOSFETs qualified to Defense Logistics Agency (DLA) slash sheets 601, 603, 614, 615, and 630. We offer numerous customer benefits including:

- Single event effect (SEE) testing performed at Texas A&M University to 85.4 MeV using Au ions
- JAN Class S-qualified product up to TID 300 krad (Si)
- Surface-mount and through-hole packages
- Voltage range from 60 V to 200 V

www.microsemi.com/product-directory/transistors/3275-mosfet



RF Integrated Solutions

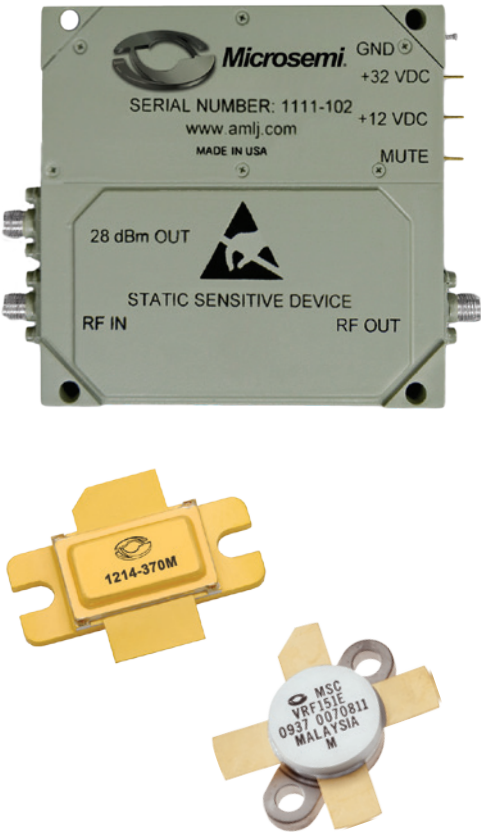
Microsemi has a long history of supplying custom RF and microwave diodes, transistors, and control devices for domestic and international space applications. We offer dedicated service and provide the necessary performance, packaging, and testing that is required for these demanding applications. Our components have been deployed in GPS, Galileo, and TerraSAR satellites, performing a wide variety of clock, navigation, telemetry, power amplification, and signal control functions.

Key features include:

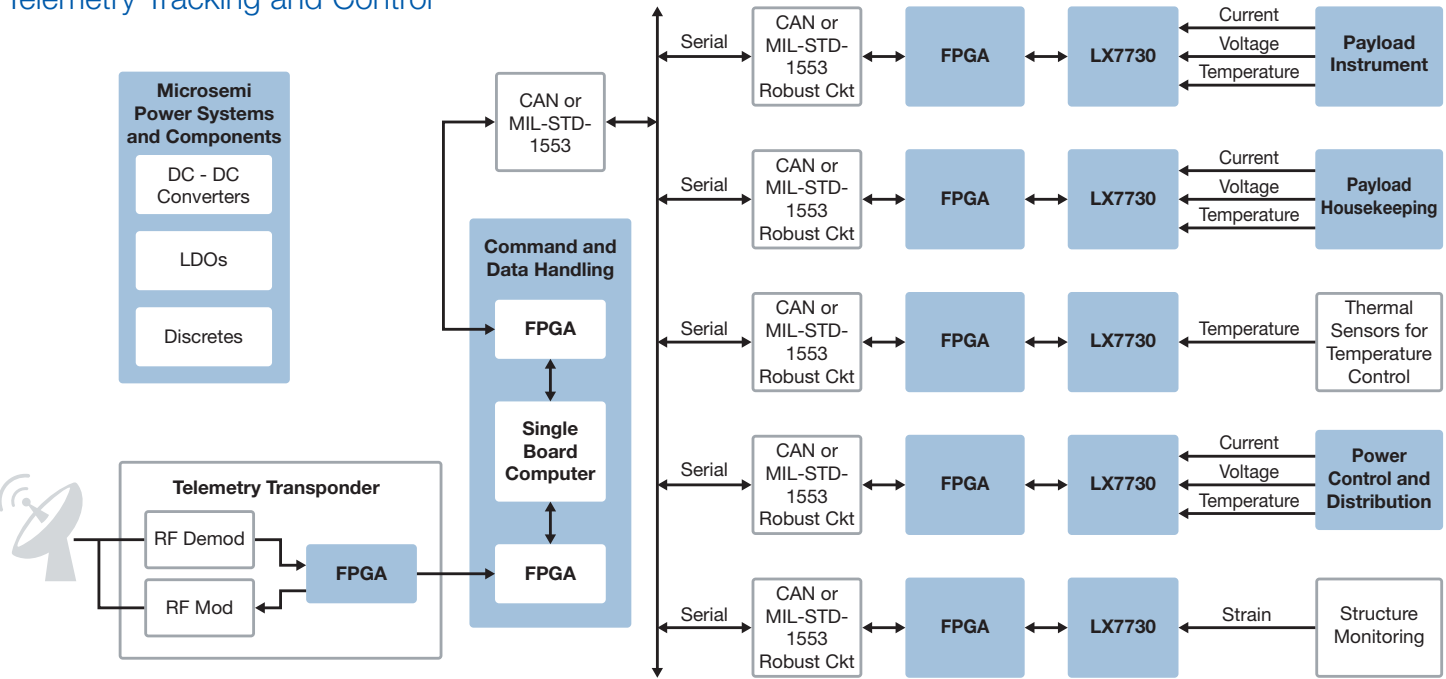
- Proven silicon and gallium arsenide diodes covering a broad frequency range (up to Ka band)
- Silicon bipolar junction transistors covering UHF, VHF, L-Band, and S-Band frequency bands
- Product screening to JAN Class S requirements per MIL-PRF-19500, MIL-PRF-38534, ESA ESCC 5010
- Tailored screening flows to individual customer specifications are available

Our latest generation of RF microwave transistors is based on gallium nitride (GaN) wide band gap material. These innovative devices allow manufacturers to reduce component count and achieve smaller transmitter footprints with less weight and improved power density and efficiency. Microsemi pulsed and CW GaN transistors are available in frequency bands between 50 MHz to X-band, making them ideal for satellite applications.

www.microsemi.com/product-directory/973-rf-microwave-a-millimeter-wave



Telemetry Tracking and Control

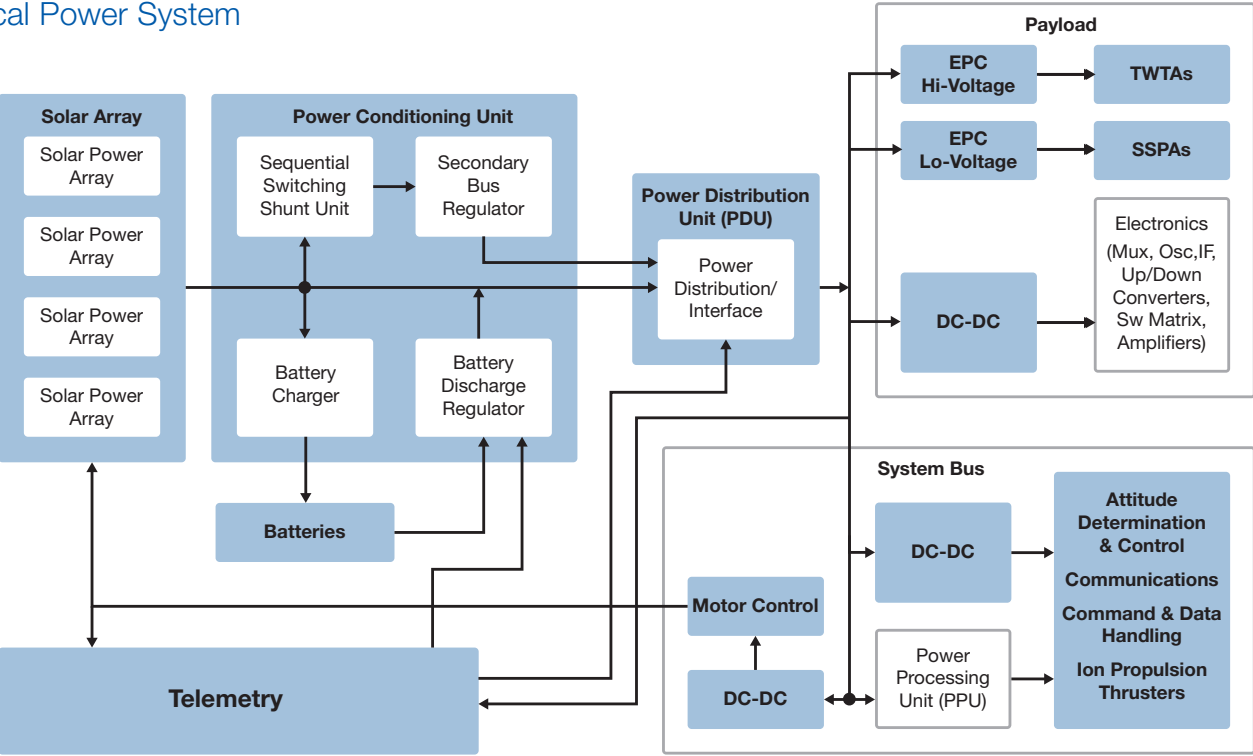


www.microsemi.com/applications/launchers/telemetry-tracking-control

Microsemi's Quality and Space Related Certifications

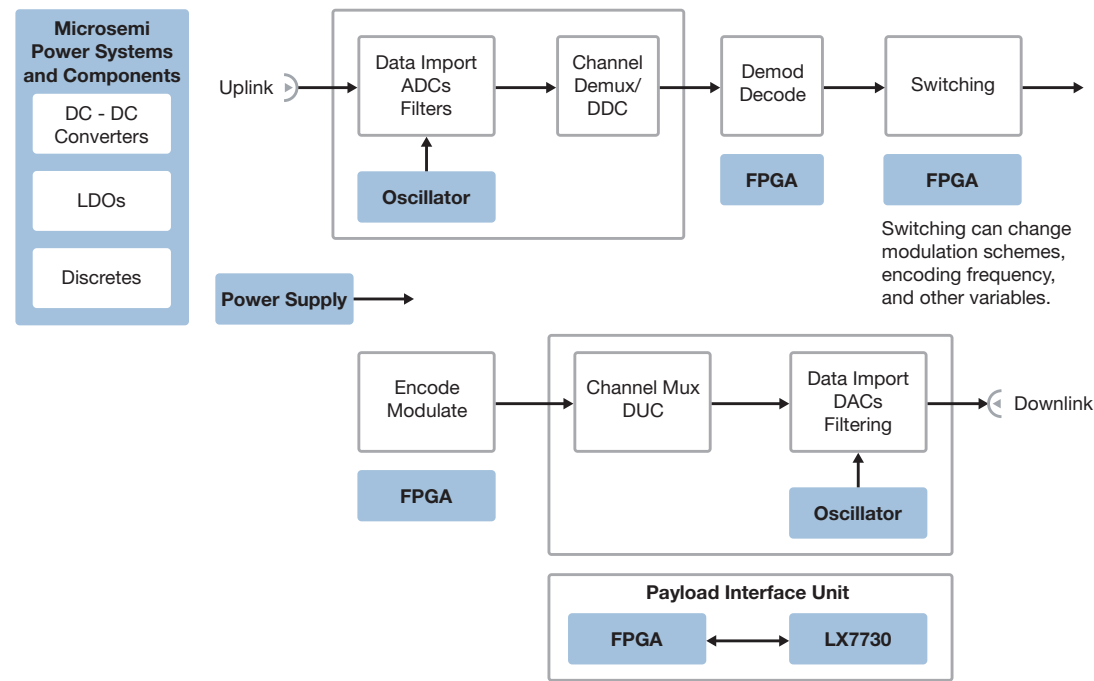
- AS9100:2009 Rev B and C Certificate
- MIL-PRF-19500, MIL-PRF-38534, and QML MIL-PRF-38535
- DOD Trusted Source
- STACK International Supplier Certification
- Laboratory Suitability MIL-STD-883
- ISO 9001-2008
- DSCC-VQ Letter
- SONY Green Partner Certification
- ISO14001
- DMEA Accredited
- PURE Certificate

Electrical Power System



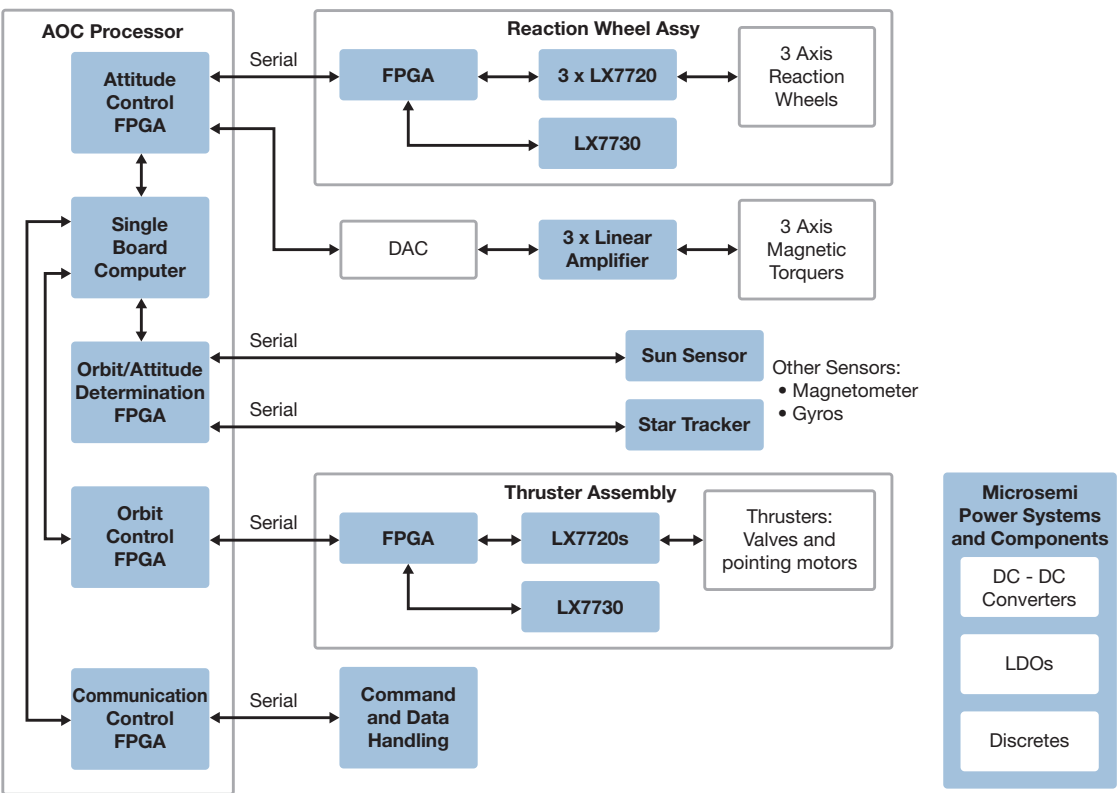
www.microsemi.com/applications/satellite-bus-platform/power-distribution-control

Digital Communications Payload



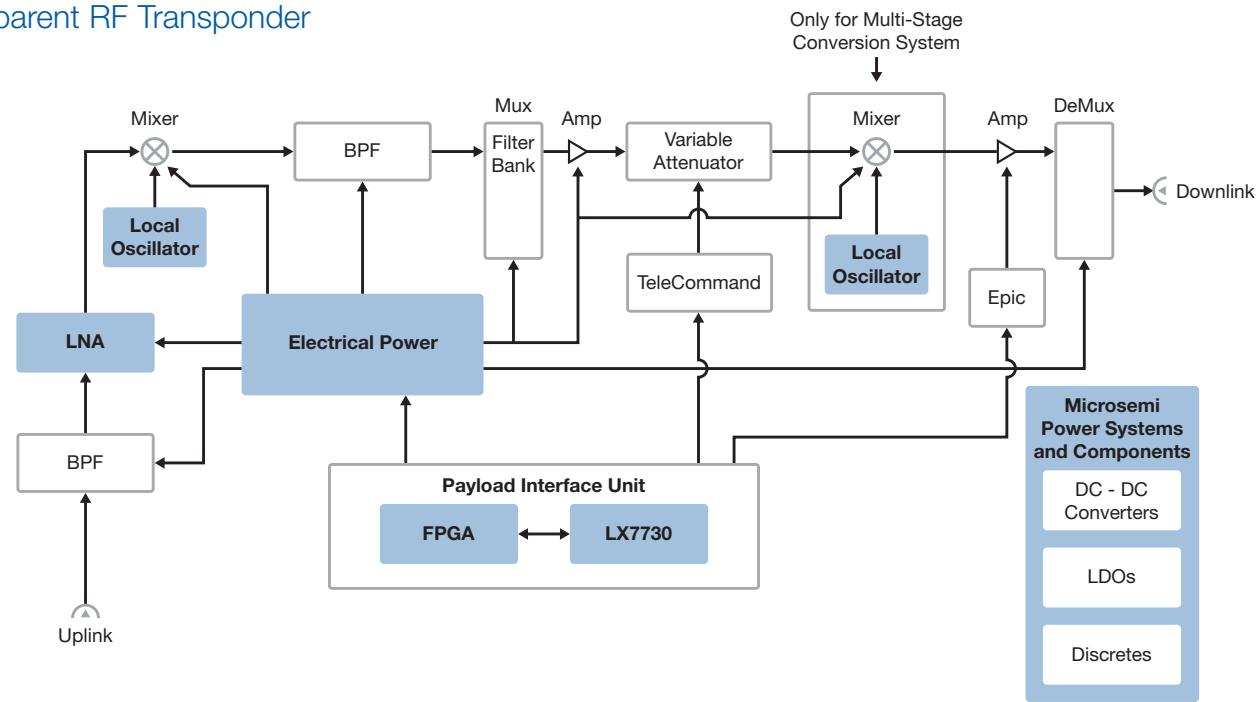
www.microsemi.com/applications/satellite-payloads/digital-communications-payload

Attitude and Orbit Control



www.microsemi.com/applications/satellite-bus-platform/attitude-orbit-control

Transparent RF Transponder

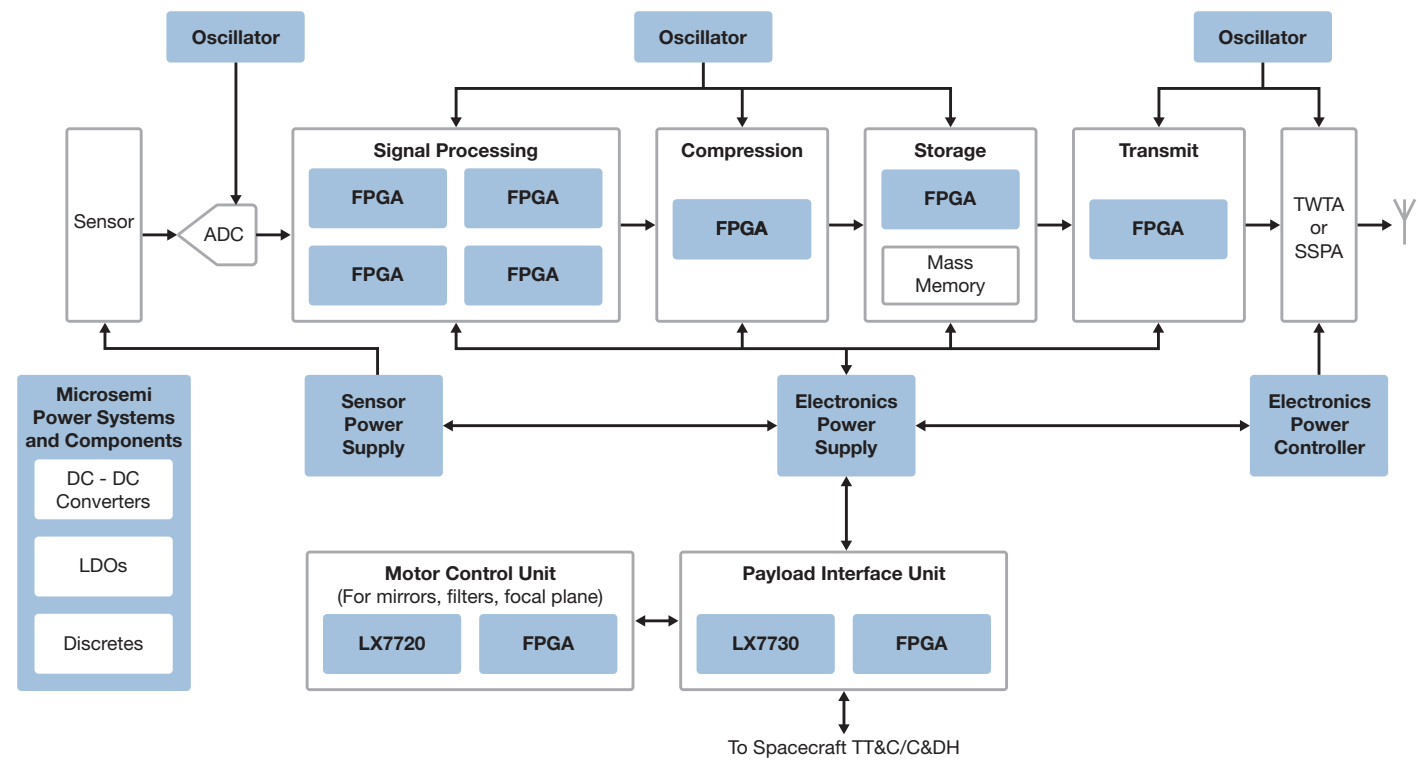


www.microsemi.com/applications/satellite-payloads/rf-repeater-payload

Remote Sensing Payload

Microsemi FPGAs have achieved flight heritage on many programs in command and control applications that require limited amounts of logic and modest performance levels. RTG4™ has much greater logic density and much higher performance, which combined give a >10 times improvement in signal processing throughput. Now, designers of high-

speed data paths in space payloads can use RTG4 to take advantage of the flexibility and ease-of-use of programmable logic. This is particularly important for remote sensing payload instruments, which are required to perform rapidly increasing amounts of on-board processing, as sensor resolution is increasing faster than downlink bandwidth.



www.microsemi.com/applications/landers/instrument-payload

Microsemi
SPACE FORUM

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Stay updated on future Microsemi Space Forum events by visiting www.microsemi.com/spaceforum

Microsemi
Power Matters.™

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