

FPGAs

Mixed Signal ICs

DC-DC Converters

Discrete Power Components

Timing and Frequency

Microcircuit Assemblies

RF Components

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Leading Space Innovation for More Than a Half Century

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



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 product and technology introductions.

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 long standing commitment to the space market.

Launchers

- Navigation and Guidance System
- Electrical Power System
- TT&C/C&DH System
- Propulsion Control System



Broad Solutions Portfolio

With one of the industry's most comprehensive portfolios of space products, 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 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.

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





**Orbcomm
Gen 2
2014**



**Cygnus
2012**



LEADING SPACE INNOVATION SINCE 1957

Microsemi technology has been used in major U.S. space initiatives since 1957, as well as important international space programs.

**Apollo Program
1971**



**Int'l. Space Station
1998**



**Mars Rovers
2003**



**Mars Science Lab
2011**

**Surveyor
1966**



**Centaur
1962**



**Mercury
1962**



**Poseidon
1961**



**Atlas
1957**



**Titan
1959**



**Delta
1959**



**Agena
1960**



**Polaris
1960**

International Space Heritage

Japanese space missions

ALOS 2 (DAICHI-2)	2014
Himawari 8	2014
ASNARO	2014
HAYABUSA 2	2014
GCOM-W (SHIZUKU)	2012
Quasi-Zenith Michibiki	2010
GOSAT/IBUKI	2009
SDS-1	2009
WINDS / Kizuna	2009
ASTRO EII (Suzaku)	2008
SELENE	2007
ASTRO-F/AKARI	2006
ALOS	2006
Hayabusa	2003

European space missions

Galileo	2015
Sentinel	2014
GAIA	2013
ATV	2012, 2011, 2008
Metop	2012, 2006
Terrasar + Tandem X	2010, 2007
Columbus	2008
Venus Express	2005
Rosetta	2004
Mars Express	2003
Envisat	2002

India space missions

IRNSS series	2015
MANGALYAAN	2013
Chandrayaan I	2008



Space System Solutions

Radiation-Tolerant FPGAs



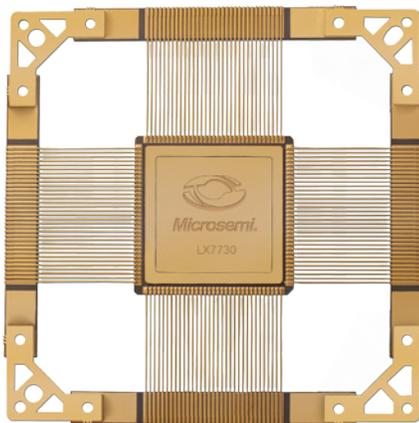
RTG4™ Radiation-Tolerant FPGA

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, 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-by-design 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, 5Mbit SRAM, 462 Multipliers
- Up to 840 I/O and 24 x 3.125 Gb/sec SERDES
- Reprogrammable flash or permanently programmed anti-fuse interconnects

www.microsemi.com/products/fpga-soc/radtolerant-fpgas/rtg4

Radiation-Tolerant Integrated Circuits



LX7730 - Radiation-Tolerant Telemetry Controller

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

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

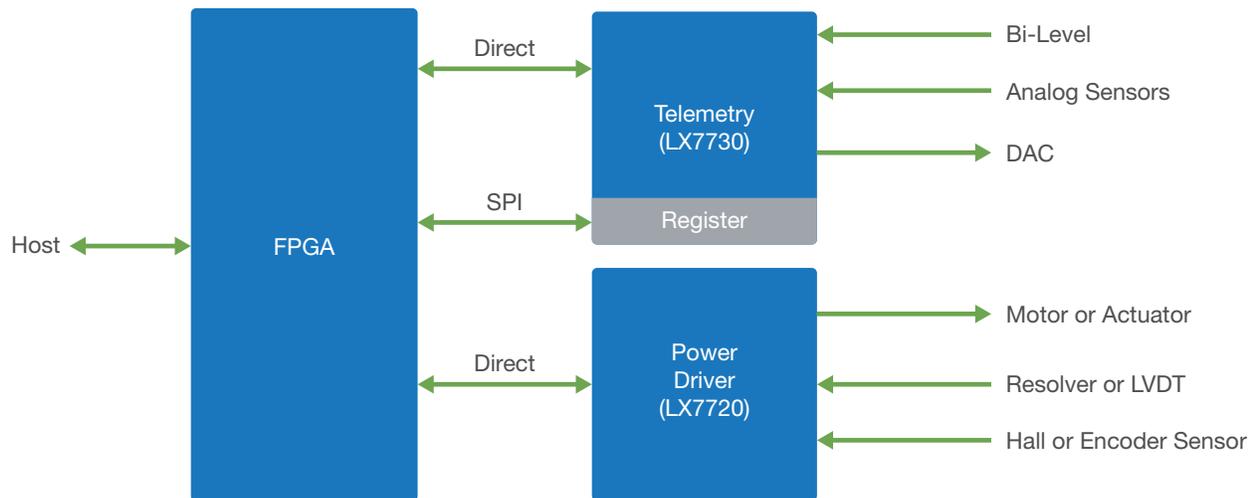
Our access to several process technologies and expertise in radiation-tolerant circuit design has enabled us to offer custom solutions for embedded satellite functions. These ICs provide space-saving solutions with voltages ranging up to 120V and deliver vital integrated functions such as high-side drivers, motor control and telemetry.

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

Space System Manager Integrated Circuits

Microsemi continues to build on this history 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: 100krad TID, 50krad ELDRS, single event immunity
- 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



Precise Timing and Frequency Solutions



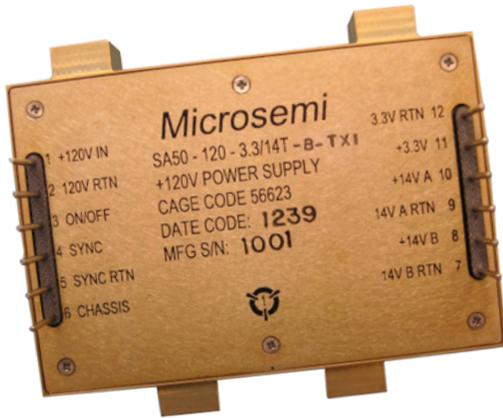
Microsemi has a long history of supplying space-qualified oscillators and cesium clocks for both domestic and international space applications.

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

Space Grade DC to DC Converters



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

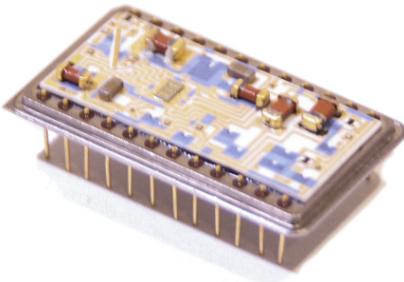
Microsemi has delivered thousands of highly reliable standard and custom radiation-hardened DC-DC power supplies to support space missions, military and commercial aviation system development programs. We offer:

- Standard modules: 30W and 50W, 28V or 120V input, single, dual and triple outputs
- Full custom design of power supply and power distribution systems
- DC-DC power conversion (typical inputs: 28V, 70V, 100V, and 120V)
- Outputs of 1.2V, 1.5V, 3.3V, 5V, 12V, 15V, 28V, or to custom specification
- Power outputs capabilities from 5W to over 10 kW
- Radiation hardness 300 kRad TID, 82 MeV SEE

Microsemi has been delivering Space Grade Relays since the space race began in 1957. We have products on the Voyager Program that continue to operate reliably after 37 years in space. We offer:

- 1 Amp to 30 Amp Relays
- Latching and non-latching
- SPST to 4PDT configuration
- Multiple mounting and lead configurations
- Extensive in-house shock and vibration testing capability

Hybrids for Space Applications



www.microsemi.com/product-directory/transistors/3274-bit-bipolar-junction-transistor

Microsemi designs and manufactures high-reliability micro-circuits qualified to MIL-PRF-38534 performance requirements. We produce standard and custom power conversion products including linear regulators and switching converters that are qualified for use in harsh radiation environments. We offer customers the following capabilities:

- Space qualified products to Class H and K, MIL-PRF-38534
- Radiation qualifications to 300 kRad TID
- 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

Rad-Hard Bipolar Transistors and Diodes, and Solar Diodes



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

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. We were the first diode manufacturer selected by the U.S. military services as a source of supply to qualify product to the highest specified reliability level. We have expanded our offering to include a growing range of space solutions and capabilities including:

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

Radiation-Hardened MOSFETs

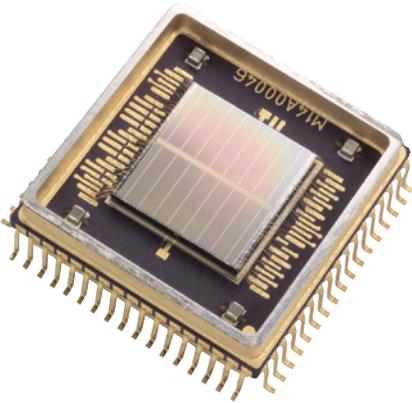


Microsemi currently offers nearly 30 radiation-hardened MOSFETs qualified to Defense Logistics Agency (DLA) slash sheets 601, 603, 614, 615 and 630. We offer numerous customer benefits including:

- Single event effect (SEE) testing performed at Texas A and M University to 85.4MeV using Au ions
- JAN class S qualified product to 300 kRad (TID)
- Surface-mount and through-hole packages
- Voltage range from 60V to 200V
- A new radiation-hardened MOSFET platform, I²MOS™, is in development and will initially cover 100V to 250V devices. The process brings the potential of improved system efficiencies and robustness

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

Integrated Custom Products

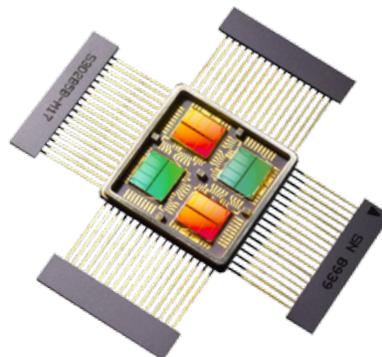
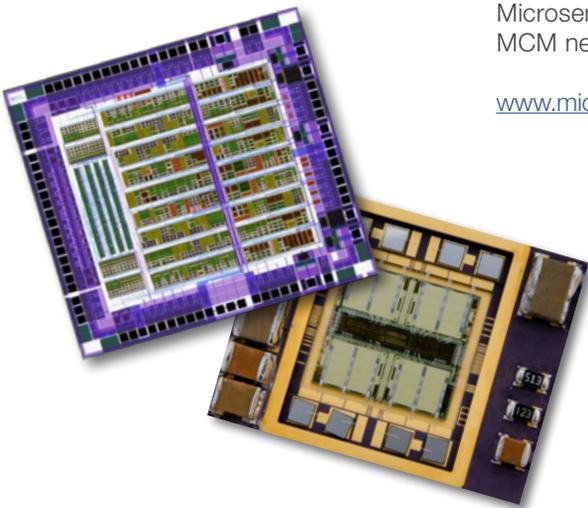


Microsemi's integrated custom products can be used in a broad array of space systems including satellite payloads and sub-orbital rockets. Leveraging our extensive expertise in MIL-PRF-38534 class K multichip system-in-package technology, these devices can combine radiation-tolerant and radiation-hardened silicon into space-saving, reduced-weight, class K-compliant sub-systems. Typical products include solutions with multiple organizations of memories, gate arrays and processors in various hermetically-sealed ceramic packages. Capabilities include:

- Flip-chip and wire-bond processes
- Standard and custom hermetic products
- Industrial and military temperature ranges
- Multi-chip and monolithic packaging

Microsemi's facility in Phoenix, Arizona, is a trusted partner for your space MCM needs.

www.microsemi.com/design-support/semi-custom-hi-reliability-ics



RF Integrated Solutions



Microsemi has a long history of supplying 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. Key features include:

- Proven reliability silicon and gallium arsenide diodes covering a broad frequency range up to Ka band
- Space flight reliable silicon bipolar junction transistors covering UHF, VHF, L-Band, and S-Band frequency bands
- Components deployed in GPS, Galileo and TerraSAR satellites performing a wide variety of clock, navigation, telemetry, power amplification and signal control functions
- 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, enhancing system performance and reliability. These innovative devices allow manufacturers to reduce component count, achieve smaller transmitter footprints with less weight and improved power density and efficiency. GaN on SiC HEMT's offer higher band gap energy, higher breakdown voltage, higher thermal conductivity and enhanced carrier mobility, and are able to operate at higher junction temperatures with better MTTF compared to Si BJT transistors. Microsemi pulsed and CW GaN transistors are available in frequency bands between 50MHz to X-band.

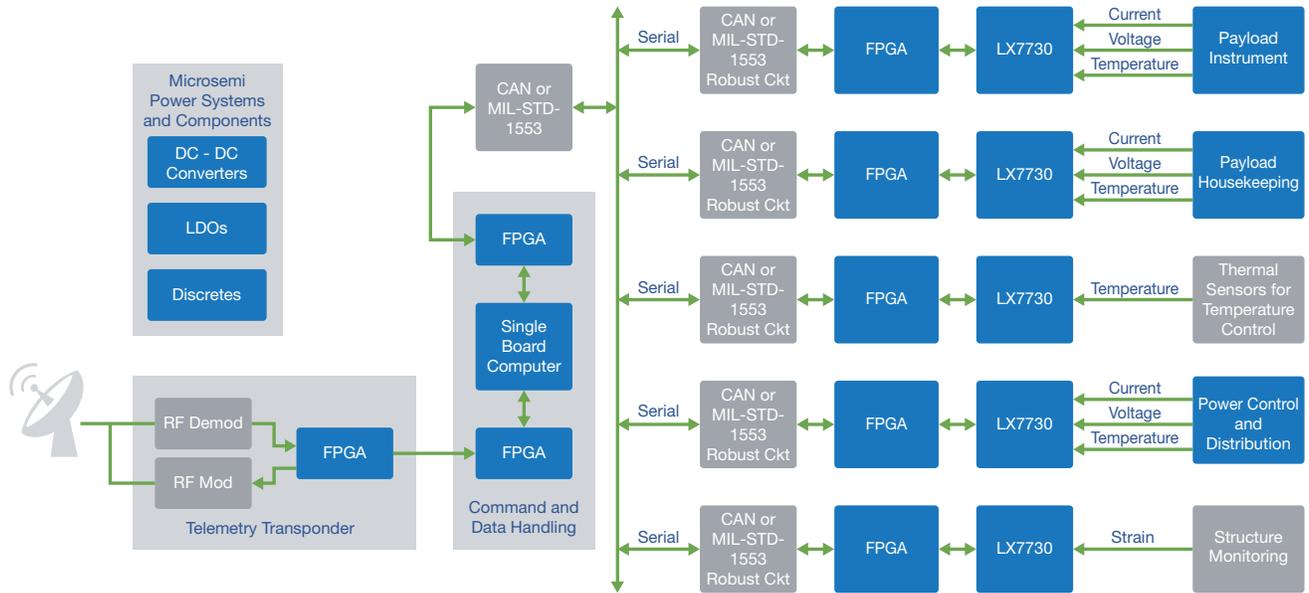
www.microsemi.com/product-directory/transistors/3390-migan-ganfet

Microsemi's Quality and Space Related Certifications

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

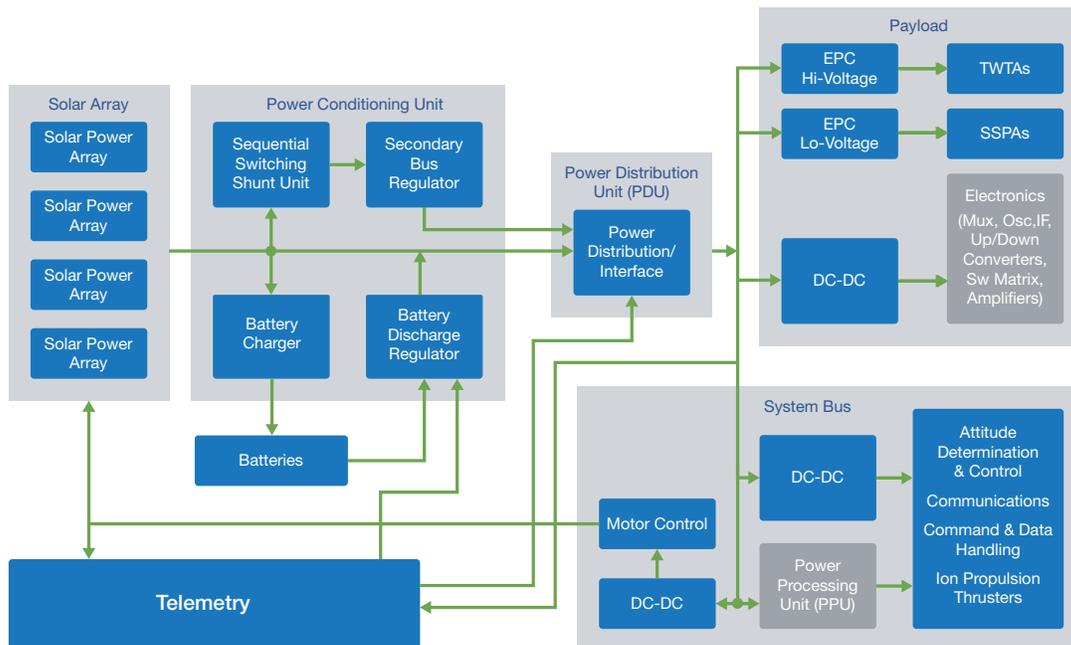
Leading-Edge Solutions for Space Applications

Telemetry Tracking and Control



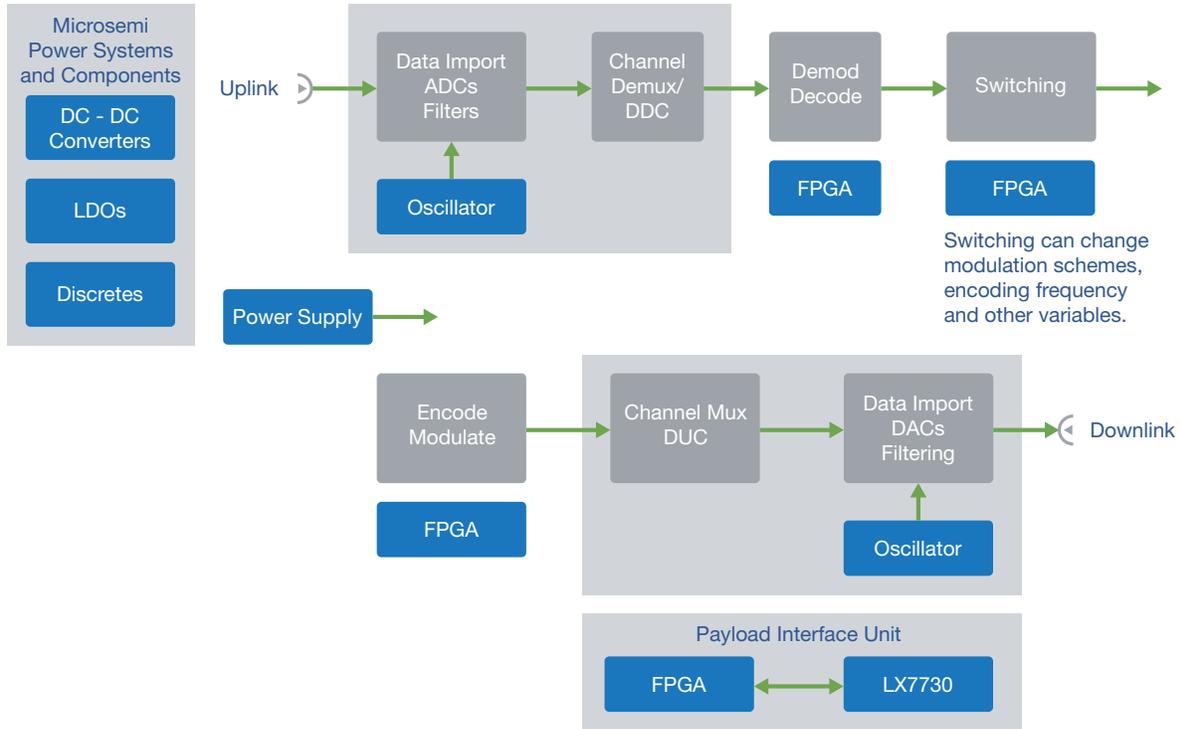
www.microsemi.com/applications/launchers/telemetry-tracking-control

Electrical Power System



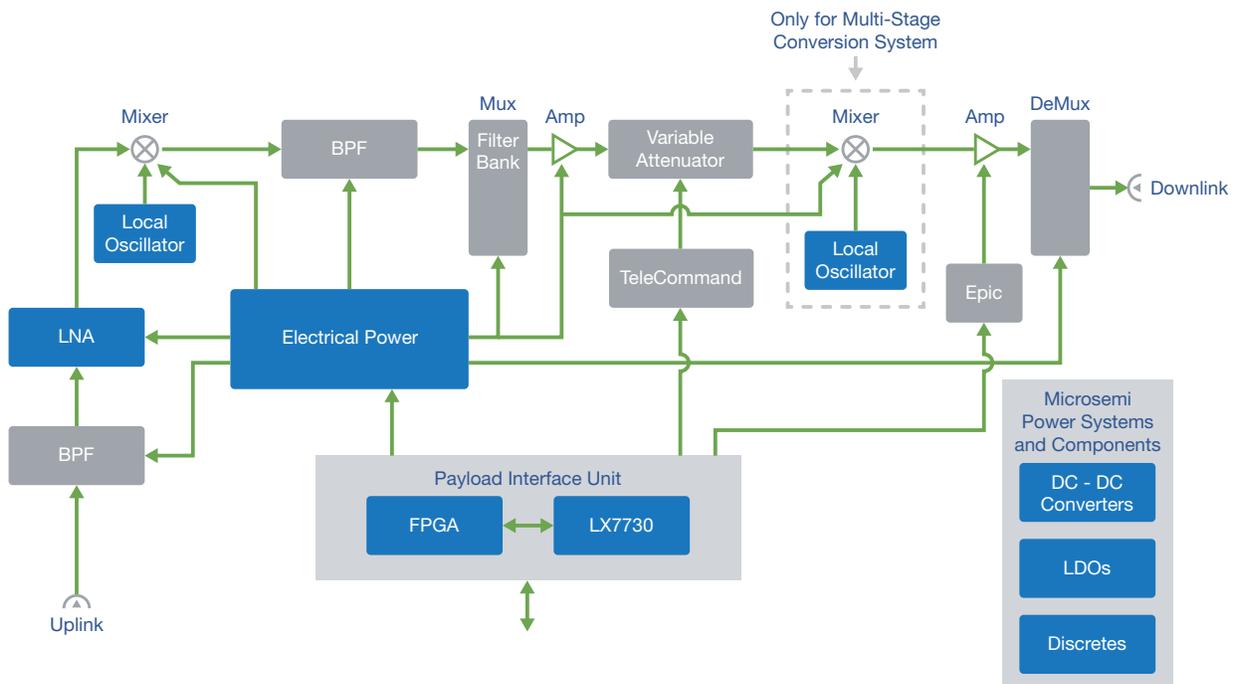
www.microsemi.com/applications/satellite-bus-platform/power-distribution-control

Digital Communications Payload

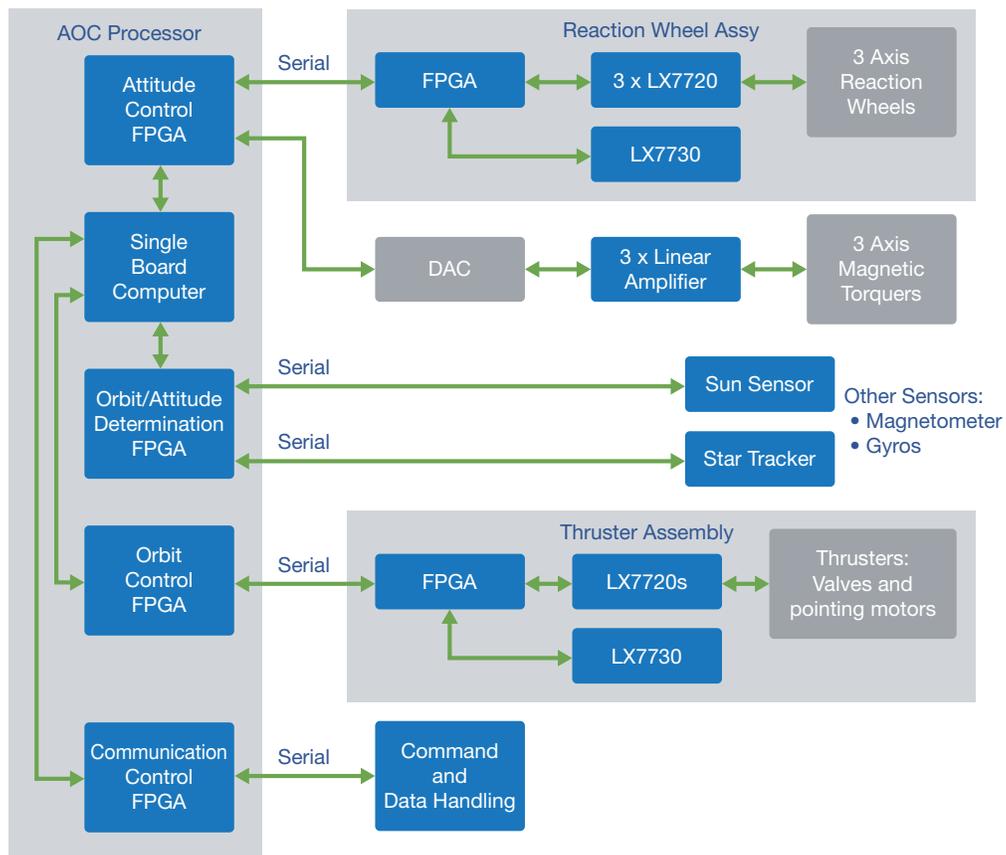


www.microsemi.com/applications/satellite-payloads/digital-communications-payload

Transparent RF Transponder



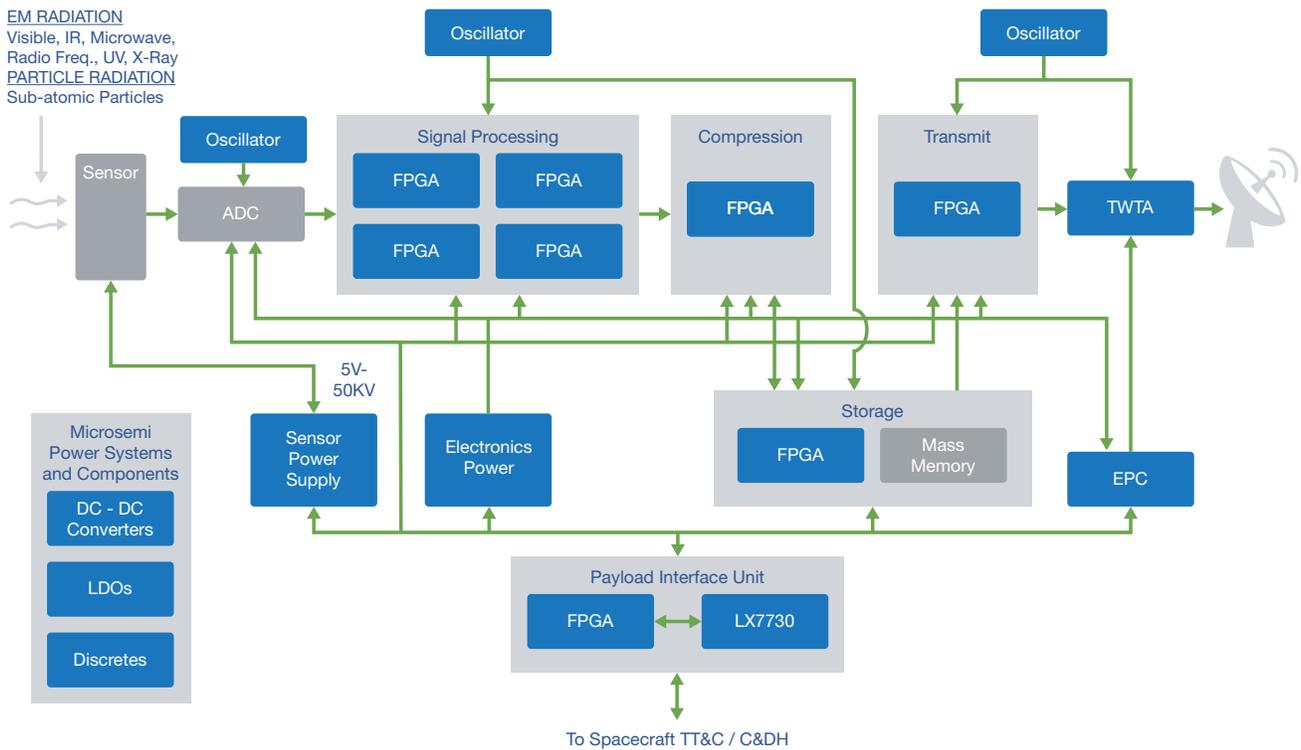
Attitude and Orbit Control



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

Remote Sensing Payload

Microsemi FPGAs have achieved flight heritage on many programs in command and control applications which require limited amounts of logic and modest performance levels. RTG4™ has much greater logic density, and much higher performance, which combined give a > 10X 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 on-board processing, as sensor resolution is increasing faster than downlink bandwidth.



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



Microsemi[®]

Power Matters.[™]



Microsemi
SPACE FORUM

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by visiting www.microsemi.com/spaceforum

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

To sign up for our quarterly Space Brief Newsletter email SpaceBrief@microsemi.com

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, email or visit our website:

Toll-free: 800-713-4113

sales.support@microsemi.com

www.microsemi.com

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

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