



SPACE BRIEF

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Welcome to Microsemi's quarterly *Space Brief* newsletter, Edition 17.

This edition includes news about Microsemi's collaboration with STAR-Dundee as well as our radiation-tolerant analog mixed signal ICs for telemetry and motor control. Also featured are the space events Microsemi has participated in this past quarter and upcoming events.

We hope you find our newsletter useful, and we encourage you to pass this edition on to your colleagues or click the archive link to explore past editions. Instructions for registering to receive this quarterly *Space Brief* are included at the end of the newsletter.

Recent Product News

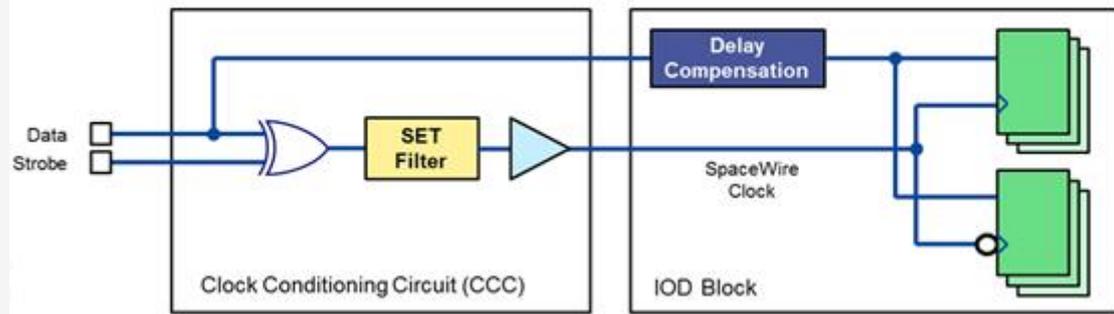
STAR-Dundee and Microsemi Collaborate on High-Speed Data Networking for Space Applications

STAR-Dundee and Microsemi have announced their collaboration to provide SpaceWire and SpaceFibre network technology using Microsemi's RTG4™ high-speed signal processing radiation-tolerant FPGAs. STAR-Dundee has demonstrated its SpaceWire and SpaceFibre intellectual property (IP) cores using Microsemi's RTG4 Development Kit, with SpaceWire IP running at over 200 Mbits per second, and its next-generation SpaceFibre IP running at 2.5 Gbits per second. For more information, see <http://investor.microsemi.com/2016-03-03-Microsemi-and-STAR-Dundee-Collaborate-to-Provide-Flexible-High-Speed-Data-Networking-for-Space-Applications>

STAR-Dundee specializes in supporting users and developers of SpaceWire and SpaceFibre, data-handling networks for use onboard satellites and spacecraft. SpaceWire connects instruments, mass-memory, processors, downlink telemetry, and other onboard subsystems. SpaceWire is currently used in a variety of mission types on hundreds of spacecraft by agencies, research organizations, and the space industry worldwide, including the European Space Agency (ESA), NASA, and Japan Aerospace eXploration Agency (JAXA). SpaceFibre, developed by STAR-Dundee in collaboration with the University of Dundee and ESA, is an emerging standard that provides a high-speed serial data link for high data-rate payloads. It is able to fulfill a wide range of spacecraft onboard communications applications because of its inbuilt quality of service (QoS) and fault detection, isolation, and recovery (FDIR) capabilities. SpaceFibre complements the speed, simplicity, flexibility, and interoperability capabilities of the widely used SpaceWire, and is backward compatible with existing SpaceWire equipment at the packet level.

Microsemi's RTG4 FPGAs are the only devices of their kind to feature embedded SpaceWire clock recovery circuits. These circuits allow designers to achieve SpaceWire clock and data recovery at data rates up to 400 Mbits per second. RTG4 also offers high-speed Serializer/Deserializer (SerDes) transceiver capabilities to enable SpaceFibre to operate at data transfer rates beyond 2.5 Gbits per second.

RTG4 SpaceWire Clock and Data Recovery Circuit



A short video showing a 2.5 Gbits per second SpaceFibre connection between two RTG4 FPGAs is posted on the Microsemi web site at : <http://www.microsemi.com/products/fpga-soc/design-resources/partners/star-dundee#demo-video>

For more information on RTG4 FPGAs, please contact ken.oneill@microsemi.com or minh.u.nguyen@microsemi.com

RT ProASIC3 FPGAs Heading To Mars

The first of two ExoMars missions to Mars has been launched with Microsemi RT ProASIC3 FPGAs on board the spacecraft. The Trace Gas Orbiter and the Schiaparelli entry, descent, and landing demonstrator lifted off on March 14, 2016. When the spacecraft reaches Mars in October 2016, it will be the first RT ProASIC3 in Mars orbit (RT ProASIC3 already has flight heritage in earth-orbiting satellites and also in the LADEE lunar orbiter). The second ExoMars mission, comprising a rover and stationary surface science platform, is scheduled to launch in May 2018 and will arrive at its destination in early 2019. This mission also has a variety of Microsemi FPGAs and other components in its instruments and flight systems.



The NASA/JPL Mars Insight lander, currently scheduled for launch in 2018, also makes extensive use of RT ProASIC3 FPGAs.

For more information on RT FPGAs, please contact ken.oneill@microsemi.com or minh.u.nguyen@microsemi.com

Ken O'Neill,
Director of Marketing, Space and Aviation, SoC Products Group



Product Updates and Notifications

RTG4 FPGAs Featured in IEEE Aerospace Conference

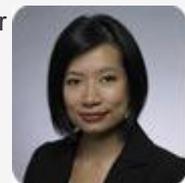
Microsemi's latest RT FPGA, RTG4, was featured in several papers presented last week at the IEEE Aerospace Conference, which took place in Big Sky, MT, from March 5 through March 12, 2016. Los Alamos National Laboratory presented a new compact single-board computer using the ruggedized MicroTCA form factor, enabled in part by the high density, low power consumption, and high performance of RTG4.



STAR-Dundee presented details of the SpaceWire and SpaceFibre networking standards and demonstrated high-speed SpaceFibre data-networking between two RTG4 development kits.

For more information on RT FPGAs, please contact ken.oneill@microsemi.com or minh.u.nguyen@microsemi.com

Minh U. Nguyen
Marketing Manager, Space FPGAs, SoC Products Group



Space System Manager Update

Microsemi's radiation-tolerant IC product portfolio features the newly launched Space System Manager family. These mixed-signal ICs integrate commonly used functions in spacecraft and work together with an FPGA to provide one of the best integrated solutions available to satellite manufacturers today. For more information, see <http://www.microsemi.com/product-directory/radiation-hardened-devices/3574-space-system-managers>

LX7730 Radiation-Tolerant Telemetry Controller

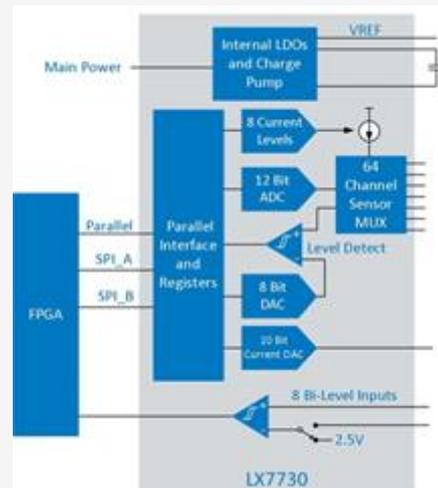
The first member of the Space System Manager family is the LX7730 Telemetry Controller. This IC has been sampling for over a year with growing design-in activity in the space community. We now offer production silicon, and we are beginning qualification and group testing. Samples built per Q and V flow requirements will be available this quarter with fully qualified material available in accordance with the following schedule.

Part Number	Silicon	Availability
LX7730-ES & EVB	Engineering Samples using production version silicon	Now
LX7730MFQ-EQ	Pre-production Q flow Production. Qual complete	CQ2 2016 CQ4 2016
LX7730MFQ-EV	Pre-production V flow Production. Qual complete	CQ2 2016 CQ4 2016



For the latest documentation (including datasheet, app notes, radiation test results, and white papers), please visit the product webpage at

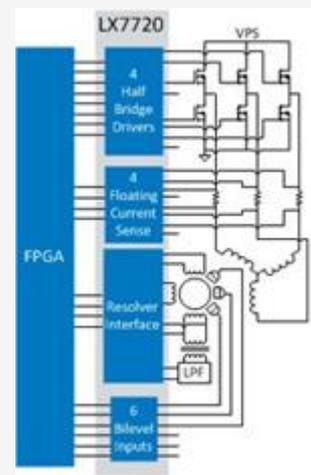
<http://www.microsemi.com/product-directory/space-system-managers/3575-telemetry-controller-ic>



LX7720 Radiation-Tolerant Motor Control/Power Driver

The second member of the Space System Manager family is our LX7720 Motor Control/Power Driver IC with Rotation and Position Sensing. We have completed the design phase of the LX7720, and plan to begin sampling in Q3 2016. A product brief is available on the product webpage <http://www.microsemi.com/product-directory/space-system-managers/3708-position-motor-controller-ic>. More detailed product information can be obtained by joining our Lead Customer Program via email at SSM_LCP@Microsemi.com.

For additional information about Microsemi's Space System Managers, please contact Dorian.Johnson@microsemi.com.



Microsemi Enhances Radiation-Tolerant Space Product Portfolio with New LX7710 Diode Array and Recent QML Certifications for its Source Driver Device

Microsemi issued a press release on April 19, 2016, to announce key product milestones pertaining to our analog mixed-signal ICs for space. These milestones include the production availability of our LX7710 Radiation-Tolerant Diode Array and the QML V and Q certifications of our AAHS298B Radiation-Tolerant Source Driver.

Click [here](#) to view the press release.

For more information or if you have any questions, please contact Dorian.Johnson@microsemi.com

Dorian Johnson

Product Marketing Manager, Analog Mixed-Signal High Reliability ICs



Space News

Space Budget News

Since the start of the new year, there has been a lot of news regarding budgets for the established space players (namely the United States, Europe, India, and Japan). Governments will remain the largest customers of the satellite and launch service industries in the next ten years, and the dominance of the established space powers is the result of large government spending in order to replenish and maintain existing satellite capabilities and to develop new ones with the corresponding launch autonomy. In general, we are seeing a rise in predicted space spending during 2016–2017.



In January, the European Space Agency (ESA) announced its 2016 budget of €5.25 billion (\$5.7 billion), an increase of 18.4% compared to 2015. This growth results from the strength of higher contributions by several member governments and substantially increased investment by the European Commission. The biggest increase went to rockets (that represent 20% of the overall 2016 budget), but Earth observation still commands the biggest slice of ESA's budget at 30.5%

In February, the US President submitted his final budget requests to Congress for fiscal year 2017. The total budget request for NASA is \$19 billion, with \$3.3 billion reserved for space exploration, \$5.6 billion for space-related science, \$5.1 billion for space operations, \$827 million for space technology, \$1.31 billion for space launch systems (SLS), and \$1.12 billion for the Orion crew vehicle. This controversial budget request is less than the \$19.3 billion approved by Congress for 2016, and contains very few new programs or other major changes. The question now is whether or not space policy will get the attention it deserves from Congress during an election year.

The total budget request for the US Department of Defense (DoD) is \$583 billion. This represents significant growth for research and development investments in new technologies such as precision-guided munitions, stealth technologies, and cyber activities. This budget includes over \$22 billion specifically for the protection of US national security, space assets, and infrastructure. The Air Force accounts for the largest share of the Defense Department's space portfolio, building satellites and launching rockets. That budget is estimated at \$8.9 billion for 2017. The NRO classified budget is estimated to be \$10.3 billion, leaving approximately \$3 billion for non-NRO classified space programs. The Defense Department has recently indicated the Pentagon would spend about \$200 billion on space in the next 10 years (about \$20 billion per year). When the Pentagon's major satellite programs (WGS, MUOS, AEHF, and SBIRS) come to the end of their production run, funding for new protected communication and missile warning programs (a new generation of GPS 3 satellites and ground system) will begin in 2018 and will spike around 2021. These requests must be reviewed and approved by Congress, but it is unlikely that a formal FY17 budget will be approved by October 1, 2016, and another Continuing Resolution may be required (at least initially) to fund these activities.

The recently announced Union budget 2016–2017 allocated Rs 7509 crore (US \$1.12 billion) to the Indian Department of Space (DoS), a significant increase over the 2015–2016 budget of US \$1.05 billion. Of the \$1.12 billion budget allocation, \$227 million has been earmarked for specific projects such as Chandrayaan 2 and GSLV Mark III. This year, Space Technology will receive 62% of the space budget (with a heavy emphasis on launch vehicle technology and support), followed by INSAT at 18%, and Space Applications technology at 13%. ISRO (Indian Space Research Organisation) is the only science-related department or ministry that has seen an increase in its budget for this financial year.

In the 2016 Japanese government budget report (issued in February 2016), the budget allocation to support Japanese space policy was 289.9 billion yen (\$2.51 billion), which represents an increase of 4.1% from 2015. If we include the "Supplementary Budget" carried over from 2015, the total funding available for space will be 332.3 billion yen (US \$2.89 billion): a 19.3% increase from 2015.

The main emphasis will be on establishing space national security, promoting utilization of space technologies for commercial industry, and maintaining and strengthening the foundation of space industries' scientific technologies.



Siobhan Dolan Clancy
Vice President & General Manager
Discrete Product Group

Microsemi's Commitment to Space

ELDRS Testing on Qualified BiPolar Junction Transistors

Microsemi has been a leader in radiation testing and characterization of bipolar transistors. In the past ten years, we have qualified over twenty-five low-dose radiation-hardened slash sheet products. These products were qualified using a Co-60 Gamma source and MIL-ST-750, Method

1015. We have total ionizing dose ratings from 100 Krad to 1 Mrad on more than ninety part numbers.

At our Lawrence, MA, facility, we have an additional capability to provide low-dose radiation data on the same bipolar products portfolio. Our equipment is capable of irradiation rates of 10 millirads per second and 100 millirads per second using our Co-60 source. Low-dose testing has become the new standard when rating semiconductors for radiation tolerance. We have had many requests for low-dose data on our standard JANSR product lines. Therefore, going forward, we will be adding low-dose testing to our standard slash sheet products.

Testing will be performed at the 100 millirads per second (0.1 rad(s)/sec) rate. These new product characterizations will help to eliminate costly manpower, documentation, and test verification while ensuring enhanced low-dose rate validation on bipolar devices not currently mandated within MIL-PRF-19500 Group D, Subgroup 2 inspection criteria.

We are planning to have these low-dose products available by the end of 2016, with the following tests performed in-house:

1. TID per MIL-STD-750, Method 1019
2. Low-dose data at 0.1 rads per second, up to 100 Krad total

Please contact Al.ortega@microsemi.com with any questions.

Al Ortega

Business Development Manager, Power Discretes and Modules Group



Making a Square Peg Fit into a Round Hole

The only way to get a “perfect power supply” is to have a custom supply designed. The Space and Power Management group at Microsemi has spent decades doing just that: designing and developing a supply to exactly meet your needs. Unfortunately, not all projects have the time or the funding to develop a custom supply.

As system designers go about their trade study, they often find there is no DC-to-DC converter that exactly meets their needs. To get the right output voltage, front-end circuitry can be used to adapt a “standard product” to fit your application. However, the extra circuitry is more expensive, has more mass, and requires greater board space, resulting in lower reliability.

There is a middle ground between these two options. The SA50-120, SA50-28, and the SB30-100 families of DC-to-DC converters are relatively easy to modify to meet your needs. Modifying the input voltage range means changing the turns ratio of the input transformer as well as the input caps. Modifying the output voltage requires a similar transformer ratio change as well as a resistor divider, Zener diode, and output cap. Qualification is by similarity, so there are no expensive WCA, radiation, stress, or thermal analysis reports to generate. NRE is minimal. It adds only four weeks to the lead time (24 weeks total).

By rounding off the corners, you really can make a square peg fit a round hole!

Use these as a starting point: <http://www.microsemi.com/product-directory/modules-a-hybrids/1450-dc-to-dc-converters>

Please contact Kent.Brooten@microsemi.com with any questions.

Kent Brooten

National Sales Manager, Power Module Group



Appearances and Events

Satellite Conference

Microsemi participated in the Satellite Conference and Exhibition in Maryland from March 7–10, 2016. Thousands of professionals from the satellite community participated to explore next-generation products and technology, and to discuss solutions for today's challenges with experts, thought leaders, and veterans from the field.

Space Parts Working Group



DoubleTree by Hilton Torrance-South Bay, Torrance, CA

April 19–20, 2016

The Space Parts Working Group event was held April 19–20 in Torrance, California. This event is an unclassified, international forum for providing information to the aerospace industry and for resolving problems with high-reliability electronic piece parts for space applications. It was well-attended by space professionals eager to hear how they might remain competitive in today's turbulent market. With nearly thirty component suppliers presenting product line updates, as well as industry experts addressing issues such as export control regulations, hermeticity, and counterfeiting, there were topics of interest for almost everyone in the space industry. Ken O'Neill, Director of Marketing, Space, and Aviation – Microsemi's key speaker at the event– gave an update on RTG4 Radiation-Tolerant FPGAs with complementary power solutions, the LX7730 Telemetry Controller, and our overall space solutions. We would like to take this opportunity to thank those of you who also attended our sponsored luncheon during the Space Parts Working Group event.

To view the Microsemi paper presented at the SPWG conference, please visit:

<http://www.cvent.com/events/2016-space-parts-working-group/event-summary-0f62197c9e1b4353b0497b47513f43c6.aspx>

32nd Space Symposium

Microsemi attended the 32nd Space Symposium held at the Broadmoor Hotel in Colorado Springs with an attendance of over 9,000 participants. Microsemi presented a paper titled "Precision Commercial Off-the-Shelf (COTS) Oscillators for Space Applications." If you have any questions, please contact Peter Cash at Peter.Cash@microsemi.com.

Upcoming Appearances and Events

- SEE/MAPLD
- Sandia Fault-Tolerant Spaceborne Workshop
- 6th AMICSA
- NSREC - Nuclear and Space Radiation Effects Conference
- RADECs
- ESPC Power Conference

Register to Receive the Microsemi *Space Brief*

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For more information about how Microsemi is serving the space market, access our brochure at [Microsemi Space Solutions Brochure](#) and our space webpage at <http://www.microsemi.com/applications/space>.

If you have any feedback or content suggestions for the *Space Brief* Newsletter, send an email to SpaceBrief@microsemi.com or click the "Feedback" link. Thank you for your assistance in ensuring the *Space Brief* continues to serve the space market and all employees.

Sylvia Keane
Marketing Executive,
Aerospace and (*Space Brief* Editor-in-Chief)

