

NSREC Highlights Latest Rad Hard Power Components For Space

by David G. Morrison, Editor, How2Power.com

At this year's IEEE Nuclear and Space Radiation Effects Conference (NSREC 2017), which is being held from July 17-21 in New Orleans, several IC and module vendors will showcase the latest power supply ICs and modules for space applications. Among these rad-hard or rad-tolerant devices are several point-of-load regulators (POLs). But perhaps most notable is the demo of a soon-to-be-released GaN FET Driver with GaN FET, highlighting the emergence of the GaN power semiconductors in the high-rel world of spacecraft and satellites.

Among the new products that Cobham¹ will be showing and demo'ing at NSREC are its Power Distribution Modules (PDMs), which are said to offer the industry's best end-to-end efficiency from the satellite bus (22 to 100 V) down to the point of load. The PDMs are a two-stage solution that leverage resonant-mode control, zero-voltage/zero-current switching, chip-on board manufacturing, planar magnetics, proprietary FETs, controllers and drivers to provide greater than 50 W of power at 83%+ end-to-end efficiency to the customer's FPGA or ASIC. All of this is accomplished in a very small footprint of ~4 in².

These modules are also radiation hardened to meet TID immunity of 50 krad(Si) and SEL immunity up to 80 MeV-cm²/mg. The PDMs are a family of input regulator modules (IRMs) and isolated point-of-load modules (iPOLs) that together make up a power conversion system. The IRM provides a regulated intermediate voltage to the iPOL which can be set to adjust to load condition by using the adaptive loop feature between the IRM and iPOL. The iPOLs are isolated, unregulated, dc-dc converters that divide down the intermediate bus voltage, provided by the IRM, by a constant k-factor. These PDMs can generate an adjustable output voltage as low as 0.65 V to meet the core voltage requirements of the latest FPGAs and ASICs.

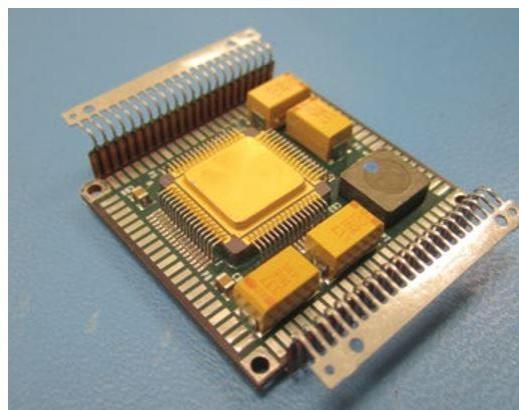
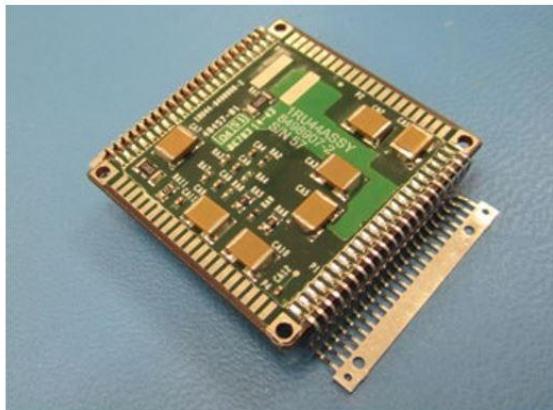
Also, these modules are specified to operate from -40°C to +125°C and QML Class L MIL-PRF-38534 qualification is pending. For more information on the PDMs, email the company at info-ams@cobham.com.

After making power supply products for internal use for many years, BAE Systems has released its first external product offering—a point of load converter (POL), the RAD POLX-14.

Actually, there are two versions of this POL, a 'P and an 'S model. The RAD-POLX-14P is designed for paralleling two POLs to increase current handling capacity up to 22 A. The RAD-POLX-14S is for standalone applications up to 14 A and is physically smaller (1.3 inches x 1.5 inches x 0.35 inches for the '14S vs. 1.5 inches x 1.5 inches x 0.35 inches for the '14P).



Cobham's rad hard Power Distribution Modules.



BAE Systems' RAD POLX-14P/S converters.

Both the RAD POLX-14P and RAD POLX-14S converters are fully integrated building blocks for today's digital space electronic modules. They minimize non-recurring engineering and maximize space and routing channels for other electronic devices on the hosting motherboard module. These products enable efficient processing to meet the onboard requirements of the spacecraft environment. Integrated power switches, magnetics, and stable power enables controlled circuitry.

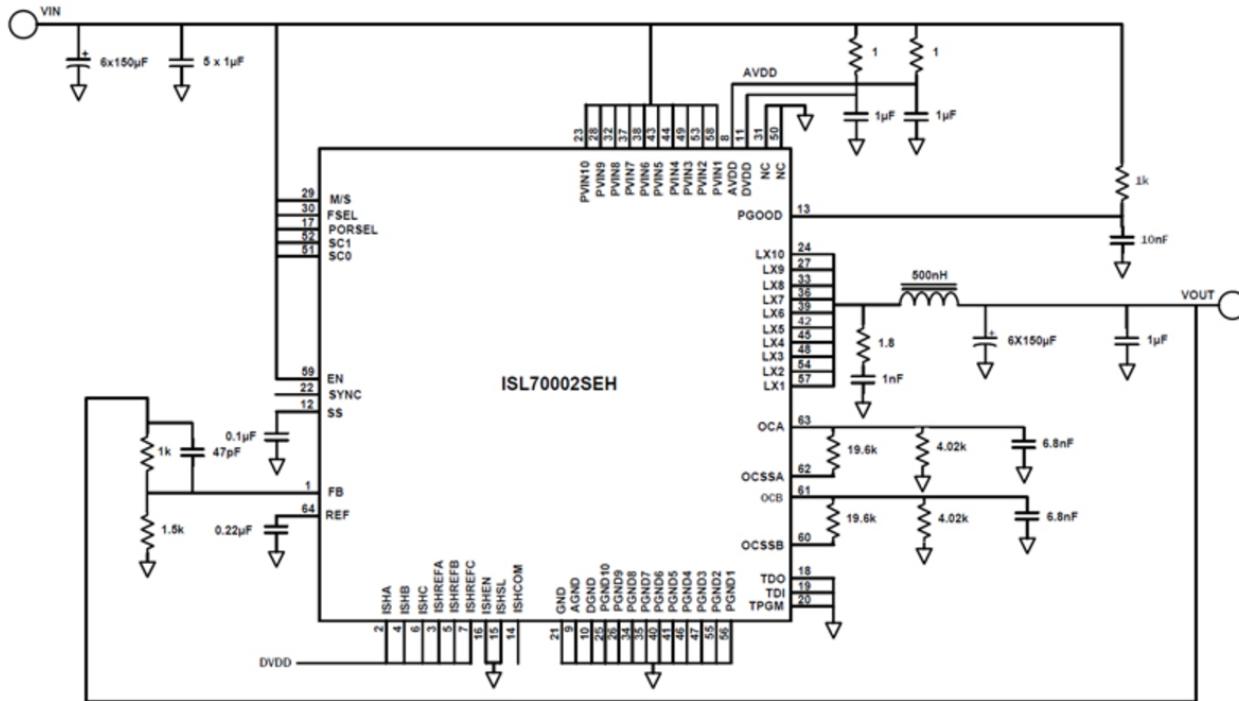
These POLs are housed on eight-layer, two-ounce printed wiring board, minimizing voltage drop to maintain tight output voltage regulation. Input undervoltage lockout and overcurrent protection promotes efficient transient response. Top and bottom thermal paths have been optimized for maximum efficiency for low power and thermal dissipation. The RAD-POLX-14P/S are subjected to acceptance tests that include full functionality and temperature cycling, allowing worst case analysis and component stress analysis. Integrated space class 3a printed wiring board ensures ruggedness and quality construction

For additional information about the company's space technology and radiation-hardened electronics catalog, visit BAE Systems Space Products and Processing [page](#) and also the Radiation hardened electronic products literature [page](#). On the latter page, scroll all the way down to the bottom where you'll see the link for Low voltage power products, "RAD POLYX-14P/S point of load DC/DC converters."

In booth 201 at NSREC, Intersil will showcase demos of numerous products. Highly notable is the company's demo of its soon-to-be-released Low-Side (LS) GaN FET Driver with GaN FET. The demo displays fast switching speed with the input and gate connected to an oscilloscope. These GaN FET devices address primary and secondary power supplies for launch vehicles, spacecraft command modules and satellite subsystems.

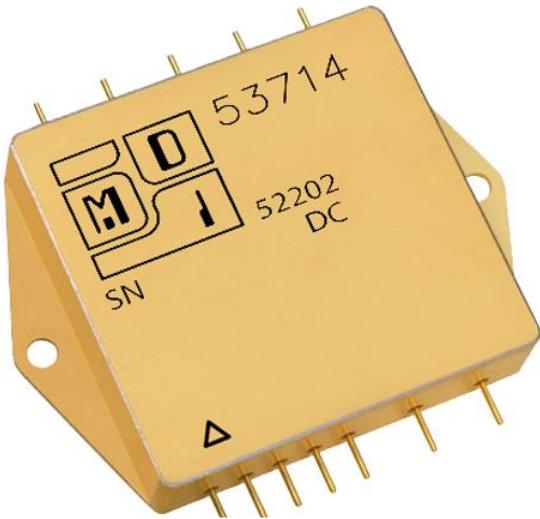
The company will also show its FPGA power solution using Intersil's POL switching regulators. This demonstration shows Intersil's [ISL70001ASEH](#), [ISL70002SEH](#), [ISL70003ASEH](#) rad hard switching regulators providing point-of-load power supply rails to an FPGA that can be used to manage a communication satellite's flight computer.

Visitors to the Intersil booth can also view the PR40 demo with temperature sensor, mux, in-amp and current driver. This process technology poster presents Intersil's [PR40 advanced complementary bipolar process](#) on bonded-SOI substrate to achieve single-event latchup-free (SEL) performance. The poster highlights several rad hard and rad tolerant products, including the [ISL71590SEH](#) temp sensor, the [ISL71831SEH](#) 32-channel multiplexer, the [ISL70617SEH](#) in-amp, and the [ISL72813SEH](#) 32-channel driver.



Intersil's ISL70002SEH rad hard switching regulator.

Finally, the Intersil booth will feature rad-tolerant plastic parts for mega-constellation satellites. Intersil will provide static evaluation board demos of two of its soon-to-be-released plastic packaged radiation tolerant ICs, including a low-power 40-V quad precision RRIO operational amplifier, and a 6-A synchronous POL buck regulator with integrated MOSFETs.



Modular Devices' rad-hard 3714 series 18-W triple-output sequenced hybrid converter.

Modular Devices has added the 3714 series 18-W triple output sequenced hybrid converter, a proton rad hard 100K+(r) unit, to the company's extensive line of rad hard hybrid dc-dc converters. Available for operation from an input of 28, 50, 70, 100, or 120 Vdc, the model x3714 is ideally suited for mixed systems using PIN diodes or FET amplifiers where outputs are required to turn on and off in sequence so the negative gate voltage rises first and decays last with respect to the positive outputs.

The x3714 turn-on sequencing feature is controlled by precision rad hard 100K+ MOSFET switches ensuring reliable operation of the FET or PIN diode loads that are enhanced at zero voltage and uncontrolled without negative gate bias. Turn-off sequencing is achieved by pre-set RC networks, ensuring complete control of the negative gate output as the positive outputs decay first even during input power loss or brown-out conditions.

The converter's control loop is closed about the +5 and +3.3-V outputs while the -5-V output is precision post regulated. In addition, other output voltage combinations are available. For more information, see the company [website](#).

At the Freebird Semiconductor booth, representatives of the company will be on hand to discuss its series of eGaN switching power HEMTs, which have been specifically designed for critical applications in the high reliability or commercial satellite space environments.

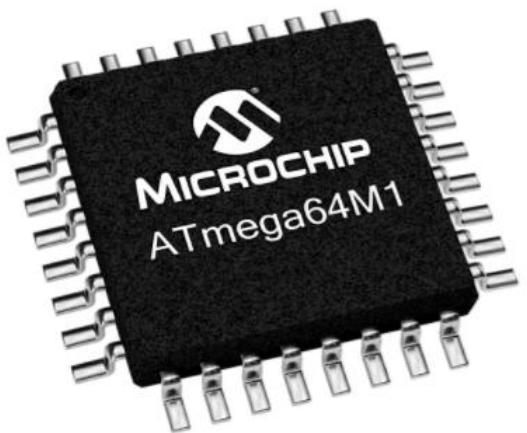
These devices have exceptionally high electron mobility and a low temperature coefficient resulting in very low R_{DS(ON)} values. The lateral structure of the die provides for very low gate charge (Q_G) and extremely fast switching times. These features enable faster power supply switching frequencies resulting in higher power densities, higher efficiencies and significantly compact circuitry.

Freebird offers packaged versions of the eGaN transistors as well as various types of multi-funtion power modules. For more information, see the company [website](#).

Microchip Technology will be showing two general-purpose microcontrollers which can be used in motor control among other applications. In fact, the company will feature one of these MCUs, the [ATMega64M1](#) general-purpose, 8-bit, 8-MHz, RISC-based microcontroller, in a Motor Control via CAN Bus demo. This will be a basic demonstration of motor control (direction and speed), using a CAN interface. The ATMega64M1 used here is available in radiation-tolerant form in a 32-pin plastic or ceramic package for use in space applications such as mechanism/motor control.

Microchip will also show the ATMegaS128 8-bit AVR. This three-layer board "sandwich" is an example of the STK600 development board being mated to the socket board of interest, via the router board. The [ATMegaS128](#) MCU is a general-purpose, 8-bit, 8 MHz, RISC-based microcontroller, available as a radiation-tolerant device for use in common space applications involving sensors and instrumentation.

For more information on rad hard power components, see How2Power's [Space Power section](#).



Microchip Technology's ATMega64M1 rad tolerant, general-purpose, 8-bit, 8-MHz, RISC-based microcontroller.