

Rad-Hard LDOs Improve Performance And Availability

International Rectifier (IR) has redesigned its high-current, ultra-low dropout (ULDO) RAD-Hard hybrid linear voltage regulators to address availability issues, while also improving performance. The new series of devices feature improved reference voltage, output tolerance, and radiation performance. In addition, this series will offer options for a DSCC-certified SMD part number (see the figure).

Intended for space applications including satellites and launch vehicles, these space-level screened ULDOs, are designed for point-of-load and post dc-dc power conversion. They offer a low dropout voltage of only 0.4 V at full 3-A load (see the table). The adjustable regulators in this series provide output voltages as low as 0.8 V compatible with the newer FPGAs used in space equipment.

These devices feature a silicon-on-insulator (SOI) CMOS regulator IC, latch-up and SEU immunity, as well as outstanding TID and ELDRS testing in excess of 100 Krad with negligible effect on regulation tolerance. In addition, the devices provide fast transient response, timed latch-off overcurrent protection and internal thermal protection, and on/off control via shutdown pin.

According to Michael Toland, marketing manager for IR's HiRel Business Unit these new ULDOs were designed to replace a series of rad-hard ULDOs that were introduced in 2005. These new ULDOs feature the same package and output voltage options as the earlier models. However, the earlier devices used silicon supplied by outside manufacturers for which long leadtimes became an issue. Eventually, the controller chip became unavailable, which led IR to develop its own die for both the controller and the bypass transistor. Having control over the material supply enables IR to better serve its customers, says Toland. However, developing its own die also enabled the company to improve regulator performance.

"Since we were starting the design from scratch, we targeted reference voltage, output tolerance, and radiation performance as areas for improvement. The reference voltage was lowered from 1.25 V to 0.8 V. This was due to the trend of space-level components like FPGAs operating at lower and lower voltages," says Toland. "The reference voltage tolerance sets the tolerance for the output voltage. Our controller IC is trimmed to less than 1%. The initial accuracy results in an end-of-life output tolerance that is better than our previous product offering. The older version was no better than a 5% accuracy, while our newer version we will be able to achieve better than 3% after life and radiation degradation."

Toland also notes the greater availability of documentation for this new ULDO series, and customer-driven changes in radiation performance.

"With the new offering we have done all radiation testing and posted all reports on our website. In the past these reports, except for TID were available only as a custom request," says Toland. "The newer devices we rate at 300 kRad. We have tested the devices to 500 kRad...Our research of the customer base has shown that this meets the market need and 1 MRad is not required."

"The biggest improvement we have seen is in the ELDRS performance. The previous devices would drift by 3% or 4% depending on the lot of die. Our ELDRS data through 110 kRad of testing has shown no greater than 0.4% shift in the output voltage. We attribute this to the controller technology which is silicon-on-insulator CMOS. This technology is inherently rad hard and SEE immune. We have tested the parts to 84 meV/cm. We also have performed neutron fluence testing. All radiation testing was performed in accordance with MIL STD 1019 for TID and ELDRS and 1017 for neutron fluence. To support our test efforts our radiation test plan has been submitted to DSCC for approval," says Toland.

Another distinction for these new ULDOs will be their availability as a DSCC-certified SMD part number. Approval is pending but as of now the company is certified as class K space-level compliant. This approval will avoid the customer need to create an SCD drawing. The customer can guarantee that the part has been fully qualified and that IR manufactures in accordance with the government requirements for space-level performance.

Application notes for the part can be found on the data sheet including the mounting instructions. According to Toland, the most useful application note pertains to the required load capacitance. He notes that IR has done extensive characterization to assure adequate gain and phase margin during all load conditions. The required output capacitance and physical location to guarantee this stability is included in the data sheet making it easy for the designer to use this product.

Datasheets, TID radiation report and an application note are available at www.irf.com. Pricing ranges from US \$600 for the unscreened non-flight model IRUH330125AP to US \$1290 for the IRUH330125AK, each in 100-unit quantities. Production orders are available immediately.



Figure. International Rectifier's new series of 3-A rad-hard ultra-low dropout regulators feature redesigned die that ensure device availability while improving specifications such as reference voltage, output tolerance, and radiation performance.

Table . Specifications for IR's ultra-low dropout RAD-Hard hybrid linear voltage regulators

Part Number	VIN (V)	VOUT (V)	IOUT (A)	Package
IRUH330118AK	3.3	1.8	3	8 Lead Flat Pack
IRUH330118AP		1.8		
IRUH330125AK		2.5		
IRUH330125AP		2.5		
IRUH330133AK		3.3		
IRUH330133AP		3.3		
IRUH3301A1AK		ADJ		
IRUH3301A1AP		ADJ		
IRUH3301A2AK		ADJ		
IRUH3301A2AP		ADJ		