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Rad Hard POLs Feature Tight Regulation For Digital Processing Applications

From [VPT](#), a HEICO company, the SVPL series space-qualified point-of-load dc-dc converters (POLs) are designed specifically for space applications facing harsh radiation environments while requiring low voltages and tight regulation for high-performance processors. The SVPL products operate over an input range of 3.1 to 13.2 V and are available in 6-A, 9-A, and 12-A output surface-mount options (see the table and the figure).

The SVPL series POLS use Renesas' ISL7000x family of rad-hard synchronous buck regulators to provide high power density, fast transient response, and up to 94% efficiency. The ISL7000x bare-die ICs are characterized for total ionizing dose (TID) of 100 krad(Si), including enhanced low dose rate sensitivity (ELDRS), and are immune to destructive single event effects (SEE) with linear energy transfer (LET) of 86.4 MeV-cm²/mg. The complete series of converters is characterized for TID of 100krad(Si), including ELDRS, and SEE performance to 85 MeV-cm²/mg, per VPT's DLA-approved Radiation Hardness Assurance (RHA) plan.

"The SVPL point of load converters have a high radiation tolerance, particularly regarding single-event transients (SETs)," said Brandon Witcher, senior design engineer for VPT. "The product designs minimize the external capacitance needed to limit SET magnitudes to the levels required by modern rad-hard digital electronics, which is especially important as digital power rail tolerances continue to shrink."

Elaborating on how the SVPL POLs achieve their excellent voltage regulator performance, Witcher said, "The tight regulation is achieved by taking advantage of the low drift characteristics of the Intersil ISL7000x series over temperature, radiation, and aging; active trimming of the SVPLs during production to minimize beginning-of-life error; using sense leads to minimize load regulation error; using feedback resistors that have low temperature coefficient and aging properties; and paying special attention in layout to minimize noise coupling to the sensitive analog circuitry."

He also notes how the new POL series compares with the company's previously introduced series of rad-hard POLs and other possible designs based on the ISL7000x.

"Compared to the SVGA series, the SVPL has better error amplifier properties, better feedback resistor properties, and better load regulation. In theory, an engineer could recreate our converter using packaged versions of the ISL7000x components, but the resulting discrete design would be larger and time-intensive to get the layout right," said Witcher.

Commenting on the source of the parts' high radiation tolerance, he said, "The exceptional SEE performance is driven by the excellent design of the ISL7000x series and smart choices for the supporting passive components. Our test results indicate that both the magnitude and cross-section of the SETs are reduced compared to our SVGA series parts."

Intersil also weighed in on VPT's choice of their regulator ICs.

"We are delighted VPT adopted our Intersil brand of bare-die synchronous buck regulators for their SVPL series," said Philip Chesley, vice president, Industrial Analog and Power Business Division, Renesas Electronics Corporation. "The highly integrated ISL7000x devices are built on six decades of spaceflight product development and leadership."

Additional features of the SVPL series include high power density, output enable control, low output noise, overcurrent protection, and external synchronization to other converters or system clocks. Full power operation of the series is rated for -55°C to +125°C.

The availability of the SVPL series is subject to all applicable U.S. export license restrictions and regulations. Additional information can be obtained by contacting [a local VPT distributor](#). For more information on the SVPL series, see the "DC-DC Converters for Space Systems" [page](#) and look under "Rad Hard Point of Load DC-DC Power Converters - Non-Isolated". Or go directly to the [SVPL3R306SG](#), [SVPL1209SG](#), and [SVPL3R312SG](#) product pages.

Table. Key electrical specifications of the SVPL series of space-grade POLs.

Max output current	Model series	Output voltages (Vdc)	Total dose with ELDRS	SEE	DLA SMD number or drawing
6 A	SVPL3R306SG	-1.5% to 1.5% of Vout	100 krad(Si)	85 MeV-cm ² /mg	5962-17215
9 A	SVPL1209SG				5962-17232
12 A	SVPL3R312SG				5962-17217



Figure. The SVPL series space-qualified point-of-load converters (POLs) provide tight regulation in combination with high radiation tolerance, particularly with respect to single-event transients (SETs) for powering high-performance FPGAs.