Meeting satellite design challenges with both off-the-shelf and customized space-grade DC-to-DC converter solutions

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Satellite design engineers face many difficult issues. End customers such as the U.S. Air Force are demanding ever higher levels of reliability. Failure in space-related applications is not an option. The products used in satellites must work every time, in a plethora of environmental extremes — often in an unpredictable and hostile environment, bombarded by radiation, for lifecycles that can last decades.

To further exacerbate the situation, military spending cutbacks are forcing subcontractors to reduce their staffing levels. At least one large space contractor has dissolved its power supply design group because the cost to keep the team current in state-of-the-art technologies was prohibitively high. It was cheaper for them to depend on space DC-to-DC-converter suppliers for quality products. While there are perhaps 130 such DC-to-DC suppliers in the military arena, very few have the space-level design heritage and fewer still have the proven expertise in radiation-tolerant and radiation-hardened designs.

Additionally, there are other power design requirements to consider downstream from a DC-to-DC-converter, including: point of load (POL) regulators (both linear and switchers); linear regulators (both positive and negative); hybrid LDOs; regulator building blocks; discrete transistors; diodes and MOSFETS; and radiation-hardened and radiation-tolerant FPGAs with regulators designed to power them. Add these prerequisites to the vendor profile and the list of qualified suppliers is counted on a few fingers. It is important to thoroughly evaluate each supplier based on its portfolio of products and technologies that are critical to the given system design.

Today, the digital design engineer may actually be the one to select the DC-to-DC converter and the downstream POLs and other regulators. Since power conversion is not their expertise, they will most likely choose the lowest-risk source. Designers at space subcontractors tend to be risk-adverse, and for good reason. Nobody

wants to go with the “new guy” or unproven technologies — only to have their design fail in orbit.

Many designers also want off-the-shelf space-grade DC-to-DC converters that can still be customized for special capabilities that they don’t have the staff to implement.

Radiation-hardened and radiation-tolerant components including DC-to-DC converters and a wide variety of downstream POLs and other regulators will continue to play a critical role in space-related power conversion designs. The optimal approach is to partner with a supplier that has deep expertise in space systems and missions, and a portfolio of products that may optionally be customized deliver the necessary capabilities for a broad range of system requirements.

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