

Power

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Addressing Power Management Challenges on Military Aircraft and Ground Vehicles with Solid-State Power Controllers

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The rapid growth in electronic system complexity on military platforms presents challenges for developers in the areas of electrical power distribution, load management, status monitoring, safety, and reliability. It has become difficult for traditional methods of power distribution, based on discrete electromechanical devices, to keep pace with growing system complexity, while meeting strict size and weight limitations. These challenges are magnified by the need for sophisticated power management policies such as load shedding, redundancy, and power sequencing.

The use of Solid-State Power Controllers (SSPCs), to address these power management challenges, has grown rapidly in recent years. In addition to the inherent improvement in reliability provided, which stems from the solid-state implementation, SSPCs also provide significant size and weight savings due to their high-degree of integration. This integrated approach includes embedded controllers, which provide network control of loads and access to load telemetry data such as status, voltage and current. The controller also provides for programmability of the SSPC, such as current trip thresholds and grouping of output channels to handle high-current loads. Programmed settings are then saved in non-volatile memory for normal operation.

Some organizations have the in-house expertise to develop custom SSPC solutions for their projects. Conceptually, an SSPC is a simple device consisting of a collection of switch elements such as power MOSFETs, gate drive circuits, current sense logic, and a microcontroller. However, developing a robust and reliable device requires close attention to thermal design and exact control and timing of gate drive circuits to handle large transient currents. The close proximity of power switches and microcontrollers, and the presence of system power and control buses on SSPCs, require careful attention to design practices that ensure electromagnetic compliance to military and aerospace standards.

An alternative to in-house design of SSPCs is the use of COTS or MOTs products. The trade-off involved between in-house development and the use of COTS/MOTS products, is that while in-house development, or custom outsourcing, can provide an exact fit to system requirements, it often requires a higher investment in internal development time, effort, and resources. COTS or MOTs solutions, on the other hand, provide a close or sufficient fit to requirements, yet with little or no non-recurring engineering charges.

An example of a COTS/MOTS supplier is Data Device Corporation (DDC), which has core expertise and more than two decades of experience in the development and manufacture of SSPC solutions. This experience includes delivering and supporting these solutions on military ground vehicle programs and aerospace platforms such as the AC-130 gunship, tactical UAVs, the F-18 BRU-55 bomb rack unit, and multi-mission aircraft.

DDC is the industry leader in providing SSPC solutions for military ground vehicle programs including the M1A2 tank, Bradley fighting vehicles, and MRAP/MATV, and JLTV vehicles. These high-volume programs have stringent environmental requirements, long life cycles, and require a high-level of customer support.

DDC's wide-ranging COTS products include circuit card assemblies, Line-Replaceable Units (LRUs), Power Distribution Units (PDUs), and modules covering 28VDC, 48VDC, 270VDC, and 115VAC requirements. DDC's customers include both system integrators and power distribution system developers. A significant portion of DDC business involves providing MOTs variants of existing COTS products, which serve as design building blocks.



Figure 1. DDC PDU, Circuit Card, and Module SSPC Products. Source: DDC

DDC is in development of its fourth generation of SSPC products. Each product generation has improved power density, reduced power dissipation, and increased operating temperature, while adding new features and capabilities. For more information, please visit DDC's [Solid State Power Controller page](#).