Specialized Design and Verification Methods Break Performance Limits of Catalog Magnetics

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Size, mass, efficiency, and reliability of power electronic systems for aerospace and defense applications are closely linked to the like parameters of constituent inductor and transformer magnetic components which are typically specified in accordance with MIL-PRF-27 guidelines including long established test methods.

While functional power electronic systems can be readily developed using general purpose magnetic components as selected from supplier catalogs in accordance with MIL-PRF-27 guidelines, increasingly demanding expectations for aerospace and defense system improvement in areas of efficiency, density and temperature capability compel expert optimization of magnetic components to reliably increase performance benchmarks. This expert optimization uses computer simulation and iteration to leverage benefits of specialized materials and manufacturing processes. Specialized verification test methods are implemented to more accurately evaluate impacts of application dependent non-sinusoidal wave shapes using high amplitude test methods at operating temperatures. These improved test methods enable more effective new product development and improved production process control using commercially available equipment.

Selected case studies of custom inductor and transformer developments for aerospace and defense applications illustrate the implementation of specialized design and verification test methods to reliably increase inductor energy storage and transformer output ratings by more than 20% compared to results of general purpose configurations. These examples will demonstrate reliable operation at temperatures above 200 C. Specialized test methods and results will be reviewed in detail so audience may apply such improved test methods to more effectively specify and verify magnetic components for aerospace and defense power electronic applications.