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LLC Transformers And PFC inductors Are Optimized For GaN-Based Power Converters

With the launch of its GaN-ready magnetic capabilities, Precision is now offering GaN-ready LLC transformers and PFC inductors for a broad range of applications including, power factor correction, server, solar, automotive/HEV, industrial motor drives, and power supplies/UPS.

"Due to the many key benefits it provides, GaN switching technology is fast becoming a very popular option in a wide number of applications," explained Welly Chou, design engineering manager at Precision. "Precision is proud to have joined forces with industry-leading GaN switch producers to create and now introduce high-performance GaN technology with demonstrated results."

Precision has partnered with GaN experts including International Rectifier and Transphorm to create ultra-compact power supplies with LLC transformer and PFC inductor technologies designed for optimum performance at high switching frequencies. Precision brought unique expertise in core material selection and parasitic (i.e., leakage inductance and capacitance) management together with an extensive Litz wire selection to cutting edge GaN technologies that are now available worldwide (see the figure.)

Precision provides other custom GaN-ready magnetics in both PFC and LLC formats directly to design engineers and has partnered with both Transphorm and International Rectifier on large circuits with integrated GaN-ready magnetics.

For example, the EZ-GaN Evaluation Board All-in-One Power Supply from Transphorm is a complete high-density 250-W computer power supply using 600-V GaN HEMTs switching at 200 kHz. The system provides up to a 45% reduction in size compared to an silicon-based equivalent with a highly efficient design (greater than 95% peak efficiency). This all-in-one power supply was demonstrated during APEC 2014 at both Transphorm and OnSemi's booths.

Elaborating on the company's design of the transformer and inductors used in Transphorm's All-In-One board, Chou discussed the company's choice of core materials and its use of simulation.

"Core materials were selected based on Precision's understanding of different core materials' properties such as core loss vs. frequency and core loss vs. temperature range and the actual circuit operating conditions such as the LLC resonant switching frequency and operating temperature range to achieve the lowest loss in the magnetic components given the size constraints," said Chou.

Meanwhile, the company turned to finite element analysis (FEA) to manage leakage inductance and winding capacitance.

"Leakage inductance is an integral requirement of the LLC transformer in the All-In-One board. It was analyzed with finite element analysis to achieve the specific leakage inductance needed," said Chou. "Winding capacitance needed to be minimized in the PFC inductor in the All-in-one board in order to minimize switching losses. With the aid of finite element analysis, the winding capacitance was significantly reduced by about 75% through special winding configuration."

Precision also supported International Rectifier's development of a GaN-based, bridgeless totem-pole PFC which employs Precision's PFC-01200-00 inductor. This PFC circuit, which was likewise demonstrated at APEC 2014, achieves 99% efficiency.

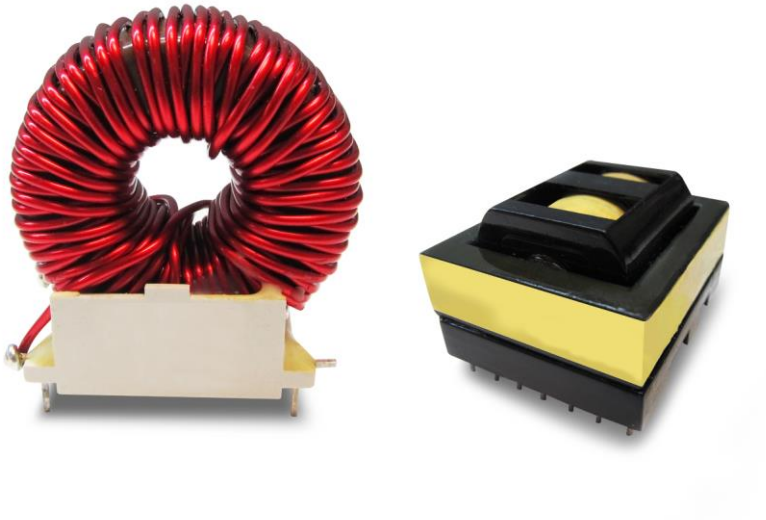

Figure. Designed for optimum performance at high switching frequencies, Precision's GaN-ready LLC transformers and PFC inductors leverage the company's expertise in core material selection and parasitic (i.e., leakage inductance and capacitance) management as well as its extensive Litz wire selection. These components are available directly from the company as well as through GaN switch providers such as Transphorm and International Rectifier.