Integrating Magnetics on a Single Planar Core

By John Day, Contributing Editor, *Power Electronics Technology*

The ongoing evolution in magnetic components plays a vital role in the performance of modern power supplies. Because these components primarily determine the overall footprint and profile of the supply, as well as its performance and cost, the drive to improve them continues. Thus, blending numerous magnetic components on a single core, planar integrated magnetics is gathering momentum as an alternative to make a difference in the switch-mode power supplies (SMPS). Coupled with improved cost-effective cores, new design capabilities are making viable progress.

"Magnetics are the most expensive element in a power supply," says Ed Bloom of e/j Bloom Associates (San Rafael, Calif.). "There are obvious benefits to minimizing the number of magnetic functions by combining them on a single piece of core material. The volume of material and the cost goes down, as does the size of the finished product."

Planar integrated magnetics has gained much traction over the past four years, says Paul Yeaman, product line engineer at Vicor Corp. (Andover, Mass.). "Everyone making high-density power products is using integrated planar to provide low-profile, high-reliability magnetic structures for high-density power converters." He adds that the benchmark for power density, watts/cc, "is always shifting upward. Until a few years ago, anything greater than 100 W/cc was high-density. Now we're at the 1 kW/cc level. As the largest single component, magnetics takes up a lot of space."

In addition to shrinking a part's profile, embedding coils in a pc board can improve reliability, says Yeaman. "There is some degree of unreliability inherent in soldering a large component onto a board. Solder joints are a failure concern because of their vulnerability to shock and vibration,"

"It's a simple, low-profile approach to solving our magnetics needs," adds Trey Burns, vice president of product development at Artesyn Technologies Inc. (Boca Raton, Fla.). "We use embedded planar magnetics in our Typhoon line of high-density bricks."

For Artesyn, the low profile afforded by the use of integrated planar magnetics is the technology's top benefit. "Other alternatives have something on top of the pc board," Burns says. "We want the lowest profile possible."

"There is a cost penalty," he adds. "If you bury the windings, the pc board becomes more complex and more expensive, and you need a variety of pc board layouts." Burns says Artesyn designs its isolated brick products to minimize the differences among them but nevertheless requires multiple board layouts.

Artesyn Technologies exploits planar magnetics to meet stringent profile and current density requirements in its bricks.

"Given what customers are requiring, we have to go this way. The cost penalty isn't enough to keep us from using integrated planar. It's pretty much a requirement, and we see it as a growing market. There's continuous pressure on density and continued efforts at integrating everything—semiconductors, magnetics and even capacitors."

As important as it may be to component makers and OEMs, integrated planar magnetics is a potential threat to manufacturers of discrete planar devices. "[Integrating transformer and inductor functions] makes sense on paper, but I'm not sure it's cost-effective unless space is a prime consideration," says Jim Marinos, executive vice president of marketing and engineering at Payton America Ltd. (Boca Raton, Fla.), maker of planar transformers and inductors.

Marinos estimates the space saving from integrating both components on a single core is 20% to 40%, but adds, "Other than space, I don't see an advantage. Designers have better control over performance characteristics when they separate the two components; also, there are limits on the power levels at which integrated magnetics can be used."

Coilcraft Inc. (Cary, Ill.) makes traditional ferrite cores with round magnet wire around a bobbin winding. "Now we're also in planar," says Paul Liebman, vice president of marketing. "With a discrete planar transformer, we source the board that has layers of copper to make the windings, then put ferrite cores around it. In some cases, the OEM does the windings in his board, buys ferrite cores, slaps them around the board and has a transformer."

Liebman says the embedded business is growing rapidly, albeit from a small base. "It will account for some percentage of the market, but it's not going to be pervasive. A product has to be high volume, and has to be around for years to see payback on the investment. It's unlikely it will soon displace much of the discrete power transformer business." **PETech**

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