Hybrid Vehicles Drive Auto Power Chip Market

Part two of two-part series

Part one of this article, which appeared in July/August issue, covered the forecast for automotive power semiconductors and discussed the challenges in implementing inverter switching for hybrid vehicle drive trains. This article examines issues related to hybrid vehicles' control scheme and their isolation and drive challenges.

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Isolation and Drive Issues

One of the significant challenges reported by systems suppliers is the need for a more economical way to implement the isolation and gate driving in the power bridge. Designers wanting to drive a motor with a high-voltage bus have a choice of the same high-side gate drive options that they have had for a decade: optoelectronics, or junction-isolated high-side driver ICs.

This isolation function long been considered expensive by industrial motor-drive designers, but to date a better, less-expensive solution has not been created. As high-voltage motor drives now move into the automotive realm, some Japanese system suppliers are focusing more attention on this function, in the hopes that some way to cost reduce it can be found before it enters high-volume production. However, to this analyst's knowledge, no such solution is yet on the radar screen.

Getting Control of the Control Scheme

Clearly, a vehicle chock full of electronic functions requires some sort of architecture and control network. Presently, this network looks like a Component Area Network (CAN) bus, plus a Local Interconnect Network (LIN) bus and soon another bus or two or

three, each specialized for a specific application or set of applications. Examples of this approach include BMW's proprietary Byteflight high-speed protocol, and FlexRay, a new high-speed scheme developed by BMW, DaimlerChrysler, Motorola and Philips Semiconductors.

It is possible, even likely, that the market will continue to proceed in this application-specific fashion, roughly along lines drawn by the load's speed or bandwidth requirements. But with the impending explosion in the amount of data flowing around the vehicle, another opportunity will emerge.

iSuppli expects that its concept of a Power Operating System (POS) will prove critical to the economical and reliable management of hybrid power trains. Such a system would employ a central microprocessor or microcontroller to manage all of the various components in the hybrid power train. This would be a multi-level, multi-bandwidth network with demanding requirements for data quality.

With the implementation of such an in-vehicle network, it may be useful for the industry to consider handling all of the vehicle's power sources and loads within that control scheme. The power-management unit could handle at least the most important tasks of overall system management, while sending simpler instructions to local smart actuators or hubs.

However, given the challenges seen to date in simply aligning OEMs and suppliers in setting standards in a small subset of automotive functions, it is difficult to imagine that such an overarching system will be achievable. Still, the huge increase in power converters and drive and regeneration functions in hybrid vehicles, and the potential cost and energy savings of power operating systems, makes such a system more worthwhile to seriously consider.

At a recent iSuppli conference in Japan, there was some indication that the Japanese suppliers have been working on just such a solution. Overall, it appears that the Japanese suppliers are still better-coordinated among each other in defining such systems. The American and European OEMs and suppliers will need to coordinate closely and aggressively in order to participate in the hybrid market with any kind of a competitive offering.

It is likely that the explosion in the amount of information flowing around the vehicle also will bring a revolution in software and software quality. Combined with the hardware and architectural advances that will come with more extensively-digitalized motor controls and DC/DC converters in hybrid vehicles, a significantly more robust and efficient automobile power system will result. The devices contained in these new automotive power systems will drive a significant amount of the growth in automotive semiconductors— and they will require significant development to bring them to market.

While automotive electronics are evolving quickly, it will be some time before the fate of this market has been decided, and there remains plenty of room for innovation and aggressive cooperation among semiconductor suppliers and automotive systems manufacturers to help shape that evolution.

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