

Optimized Power Processing and Energy Efficiency

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Power management plays a key role in enabling energy efficiency advancements in the vast number of products that we depend on as we go about our daily lives. However, it's a term that has been misused by companies looking to gain traction with Internet keywords optimized for Google and Yahoo searches as they seek to exploit the growing buzz around saving the world's dwindling energy reserves.

So what exactly is power management? It is power sequencing or communication and in some cases, regulation, and it is the first link in the power processing chain. To achieve real power savings in a system, the integration of multiple components is required that encompasses both the power management and the power conversion stages.

When you combine load-centric power conversion with system-centric power management, you have a better chance of improving efficiency within an application. This is the essence of optimized power processing. The result is longer battery life, fewer kilowatt hours when your notebook is plugged into the wall, or more functionality from your cell phone because each component is being managed more efficiently.

The opportunity to save energy using this approach is enormous. Take the data center as an example. Information about the power load needs to be combined with information going on at the board level, inside the server rack and in the entire room to maximize efficiency. This doesn't happen when components aren't integrated effectively, and with data centers now consuming as much as 3 percent of all power, there is growing pressure to curb their energy consumption.

Electric motors present another golden opportunity. Consuming over 50 percent of the world's electricity,



more than 80 percent of these motors are wastefully controlled electro-mechanically. Designs are moving towards variable-speed permanent magnet motors that are smaller, lighter and lower cost, and as long as you have a good control technique, permanent magnet inverterized motor control can achieve 95 percent efficiency by co-designing the power train and the driver, and an algorithm to control them.

This all points back to power processing and engineers are forced into making tradeoffs between higher efficiency and maximum cost-effectiveness, or to deliver efficiency and density at a higher price.

These issues can be solved by providing complete solutions from switch to drive scheme to power management. Matching and optimizing digital and analog control with power stage components, and integrating them with new packaging technologies will continue to increase the power density with less wasted energy while simultaneously reducing system size, complexity and cost.

In some cases, new techniques are required for building components and in

others, new materials are needed. As a market leader, it is natural for IR to pursue opportunities for advancing power conversion technology by leveraging the company's 60-year heritage in power conversion expertise in AC-DC converters, DC-DC converters, motor drives and lighting systems.

The advent of GaN on Silicon epitaxial technology together with the ability to develop a process that is compatible with IR's silicon manufacturing facilities allows IR to offer customers commercially viable products using GaN-based power devices.

These devices can provide customers with improvements in key application-specific figures of merit (FOM) of up to a factor of ten compared to state-of-the-art silicon-based technology platforms, dramatically increasing performance and cutting energy consumption in end applications in market segments including computing and communications, automotive and appliances.

GaN-based power devices will eventually be used in most of the same applications as current silicon-based power devices, as well as new applications currently not possible with silicon devices. These applications will evolve over the coming decades, as GaN-based power devices replace silicon based power devices as the technology platform of choice. Early adopters will be market segments and applications that take full advantage of the revolutionary capability of transforming the value realization of the key features of power density, power conversion efficiency and cost.

All of these innovations are geared toward achieving more functionality using significantly less power—and a sharp reduction in the number of buzzwords needed to accomplish it.

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