WHITE PAPER

You Could be Designing More Power Chains!

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Electronics is an industry that delivers astounding improvements: semiconductors still roughly follow Moore's law of doubling in performance every 18 months. But power design is one area that frequently fails to show productivity improvements in the key metric of completed development projects per year. In fact, some engineers seem to be designing fewer power chains today than they were five years ago.

The problem is not with the engineers, it's the approach.

Traditional approaches to power system design, which rely on multiple-output power supplies, are no longer appropriate. As systems increase in complexity, the number of different voltages required is increasing. With the rapid advances in silicon technology, new products can be selected during the lifetime of a system, triggering a change in requirement to the low-voltage, high-current rails supplying the semiconductors. Today, power chain design requires a dynamic, flexible approach to meeting complex, challenging and often changing requirements.

As the power systems get more complex, engineers are also being challenged to improve efficiency and power density. Traditional approaches to power system design, such as combining off-the-shelf supplies with point-of-load converters or developing power supplies from discrete components in-house, are just not suited to the needs of modern development projects. Especially when the design requirements change mid design as they are just too inflexible, adding significant delays. Developing a supply specifically for the application – whether in-house or through a third-party power supply specialist – is slow and expensive.

Modern power systems need a modern design approach.

The Benefits of Power Components

Power components provide building blocks to create complete power chains. Unlike power supplies, they provide a high degree of flexibility: individual power components can be swapped out to meet changes in requirements, and the devices can be located in the optimal position for a particular system, whether that is near to the load, or in an otherwise unused space to increase the effective power density.

Power components are much more than just semiconductors. Designed specifically for power systems, they already have passed a number of qualifications, reducing design risk and speeding the testing and approval phase of system development. This means that power components offer both the benefits of low-risk, straightforward design cycles with the ability to respond to a change in requirements with unprecedented speed and flexibility.

Power Component Design Methodology

The Power Component Design Methodology is a simple approach to designing power systems using power components: integrated building blocks that are optimized to perform a specific function within the power chain. This concept is not new at the Point of Load, where designers have been selecting individual PoL converters for some time, but with the introduction of new power components, it can now be applied from the system's AC or DC power source all the way to the PoL.

Because the power components are highly optimized, yet easy to connect, even engineers with limited power design expertise can create high-performance, dense and efficient power systems using the Power Component Design Methodology.

Benefits of the Power Component Design Methodology

The Power Component Design Methodology delivers several important benefits. Its modular nature means it is easy to create a power system that meets the exact needs of the application, and the high functionality of the components means that it is a much easier approach than designing a power supply from discrete components, which significantly reduces development timescales. Additionally, any changes in the requirements for the power system, for example the need to change PoL voltages to accommodate new processors or FPGAs, can be accommodated quickly and easily by changing one or more power components.

The Power Component Design Methodology isn't just for power gurus: because the power components have optimized performance, engineers, even with limited expertise, can develop efficient, dense power chains. The methodology doesn't require one particular approach: the wide range of power components allows designers to choose the optimal power architecture for their application.

By taking a modular design approach, rather than using a large centralized power supply, engineers using the methodology can situate each power component in the optimal physical location in the system. This avoids the compromises inherent when using a power supply, and allows engineers to make best use of the available space. This flexibility also means that cooling can be managed more effectively than with a complex power supply. Some power components are even available in chassis-mount packages, which allows the use of the enclosure as a heatsink, often allowing power designers to increase system reliability and decrease cost by eliminating fans.

The performance of power systems designed using power components is predictable, with tools available to analyze performance even before a prototype is built. This greatly increases the likelihood of the power chain achieving the desired performance first time.

Although power components are designed to perform specific tasks in the power chain, many of them integrate high levels of functionality such as filtering. The pre-qualification of individual components for EMI, safety and other common requirements simplifies the challenge of achieving certifications and significantly reduces the risk of the project being delayed due to the need for a re-spin of the design.

These benefits allow power systems engineers to create high-performance power chains in less time, while ensuring flexibility and predictable performance.

Tools to Support the Power Component Design Methodology

Although building a power chain from the power component building blocks is a straightforward process, design cycles can be made even shorter by the use of appropriate tools, such as Vicor's PowerBench suite of tools.

The flexibility of the Power Component Design Methodology means that there might be several different ways to create a power chain to meet a particular requirement. Each solution will be different in terms of metrics such as how much board area is required, cost and efficiency. Vicor's Power System Designer identifies the best power architecture and the optimal, based on what's most important to a specific application. The PowerBench Whiteboard allows engineers to experiment with different solutions to meet the requirements of the application and analyze the performance of these different approaches, while simulators provide easy circuit configuration and rapid confirmation of electrical and thermal performance.

These online tools ensure optimal solutions are selected and minimize any risk of the power chain failing to meet the application's requirements, give power developers an opportunity to become even more efficient and effective.

Power System Engineers Could Develop More Power Chains

The Power Component Design Methodology reduces power system designers' workload and significantly cuts project development time. Furthermore, it can reduce project risk, making time-consuming and expensive design re-spins much less likely.

By improving the efficiency of the design process, the Power Component Design Methodology offers the prospect of increasing the productivity of power system designers. It also promises to allow designers to focus more of their time on the value-adding tasks of architecting power systems: something that is likely to be far more fun and rewarding than the time-consuming process of adapting conventional power supplies to meet changing application requirements.

Engineers that adopt the Power Component Design Methodology often realize they are working more efficiently when they discover that they're designing more power systems than they were able to develop in the past. So it's clear that, despite the increasing complexity of power system development, the power designers using legacy systems could be designing more power chains.

The Power Behind Performance