Commentary

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These Seven Trends May Change Power Design Dramatically

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New power semiconductor technologies such as silicon carbide (SiC) and gallium nitride (GaN) promise to rewrite the record books with respect to power supply performance. In the process, the new components based on these technologies will redefine what's possible in terms of power efficiency, density and other metrics. Existing power supply applications will benefit even as brand new applications are enabled.

But for the component suppliers and the power system designers looking to exploit these new technologies, there will be a price to pay. Design and simulation techniques will need to be modified and adapted to the requirements of the new technologies. Power component and power system designers will need to adapt to rapidly rising switching frequencies by thinking more like RF/microwave designers, and developing/adopting the system-level simulation tools needed to handle the new high-frequency reality.

With that in mind, here are seven developments or trends that I believe will change the way power designers do their jobs in the near future.

1. Switching frequencies and bandwidths will dramatically increase (out of necessity) once SiC hits the mainstream and offers devices we are familiar with, such as MOSFETS. Semiconductor companies that have experience and capability in the big three arenas—power, RF and instrumentation will have a distinct advantage as they already have the simulation tools and knowledge of the power supply-related issues.

2. SiC will win out over GaN mostly due to the significantly better thermal conductivity, higher voltage breakdown capability and the ability to support very high speed, enhancement-mode devices.

3. Power conversion and regulation will become integrated onto the same substrate as the devices they power, specifically low noise amplifiers (LNAs), clocks and other high-speed devices in order to minimize and control the interconnect networks and minimize interconnecting impedances.

4. With the existing highest-speed FPGAs presenting switching times in the vicinity of 400 psec, the power distribution network (PDN) for these devices will move to the microwave arena. SPICE will remain popular and useful for many more years, but high-performance power analysis and simulation will have to move to 3D and large-signal simulators such as Agilent ADS. Speeds will continue to increase exacerbating the issues.

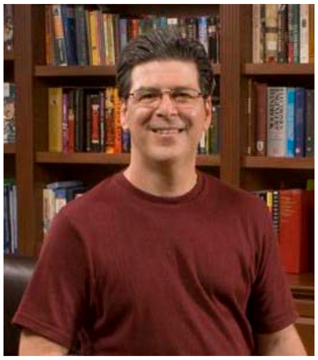
5. Power designers, RF/microwave and instrument engineers will develop a common language since the lines between these fields will become much fuzzier. For example, it is feasible to design a very high-bandwidth regulator using LDMOS, but the specifications for an LDMOS device don't look similar to the specifications for a power device, confusing power engineers.

6. Power device manufacturers will learn that voltage regulators are not "one size fits all." We will have different regulators for clocks and LNAs, which are very noise sensitive. RF engineers use many classes of amplifiers (such as A, B, C, D and E) and they are not all efficient, but each serves a particular purpose. The power engineer still believes it makes sense to power a class A amplifier or a clock from an LDO, but we will learn better.

7. Datasheets and computer models will continue to improve, as the system performance demands. Having the power and the load circuit (such as LNAs and clocks) in the same simulator will greatly improve system performance as the impact of the power performance will be clearly evident. This will, on its own, force regulators to become more stable, with lower output impedance, fewer impedance discontinuities and lower noise.

In time, all of these trends will result in significant improvements in power system performance. Nevertheless, these improvements won't happen without preparation on the part of designers who must adapt to changing technologies and design requirements. Now is the time for power supply engineers to educate themselves and take their skills and knowledge to another level. Those who are willing and able to master the high-speed simulation tools and grasp the high-speed and RF-related issues will be well positioned for the future of power design

About The Author



Steve Sandler is the managing director of Picotest, a Phoenix company that specializes in precision test and measurement equipment. Sandler is also the founder and chief engineer of AEi Systems, where he leads development of high-fidelity simulation models for all types of simulators as well as the design and analysis of both power and RF systems. Sandler has over 30 years of experience in engineering and is a recognized author, educator and entrepreneur in the areas of power, RF and instrumentation.