Efficiency and Harmonics Regulations Drive the Efficiency Challenge in Power Supplies

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Before we can discuss what's driving the efficiency challenge, it probably makes sense to define: What is the efficiency challenge? As I see it, it is the drive to increase power supply efficiency and density even in the face of factors that make it exceedingly difficult to do so.

On one side, we have the US pushing the 80 Plus program (www.80plus.org), that requires computer power supplies to be at least 80% efficient at 20%, 50%, and 100% of rated load, with a true power factor of at least 0.9 to gain program certification. The effort is driven by the US Environmental Protection Agency's EnergyStar® program (www.energystar.gov). Compliance with the program spec represents a significant improvement in power supply performance over typical supplies, which last year had efficiencies in the range of 70-75%. The spec also essentially mandates active PFC (power factor correction) in every unit. Sponsors of 80 plus include several North American utilities companies who are among those who stand to benefit from the reduction in power demand and the increase in power quality.

Now we have the European Union (followed quickly by China) responding to their grid challenges in requiring all loads of greater than 75W (IEC 61000-3-2, which also applies to a wide range of electrical and electronic equipment) to meet stringent harmonic content limits – again, effectively a requirement for active PFC. Meeting these new mandates will not be easy, cost is everything. Anyone who's been in the power supply industry for a while knows it. So there's the challenge:

meeting what you must, but at a rock-bottom cost. This balancing act is no accident.

If we had a "90 plus" mandate instead of 80 plus, at this point it would certainly add astronomically to the cost of a supply, and would take us to the absolute limits of current technology. Therefore more reasonable, achievable targets have been set ¨C but even getting to 80% efficiency with 0.9 power factor at various operating points is likely to add something to the cost of a power supply. As energy prices increase and the world becomes more aware of the need for efficiency, the job of merely keeping up with the specs at the traditional "same or lower cost" is a challenge. Add to this the fact that in the last year, component suppliers have been using a favorable pricing environment and rising raw materials costs to justify substantial price increases.

The power supply industry is now pressed in the middle of all these factors yet manufacturers are responding with ever more creative ways to meet the evolving regulatory environment, while being cost-competitive. The opportunity for semiconductor suppliers and power suppliers alike is to help each other to meet the stringent requirements of the market trend toward greater efficiency. But that's of course not as easy as it sounds.

There are already many techniques for increasing the efficiency of the power conversion function available to power supply R&D managers. We may think the question is, "Which one of those techniques provides the ***highest*** efficiency increase for the least amount of money?" But in reality, the question for most R&D managers turns out to be which approach will provide them ***adequate*** efficiency to meet the market requirement, for the lowest amount of money. The challenge for semiconductor and passives suppliers will be in creating devices that will enable power supply manufacturers meet their efficiency and power quality requirements, at the lowest cost.

I have until recently been an industry analyst and it has not been possible to discuss confidential details of how R&D people in the semiconductor and power supply industries are planning to meet these challenges. But as I now transition back into the position of component supplier, these challenges will be at the forefront of my thoughts. I'm confident that we'll be talking again soon about the types of components that will provide the best solutions.

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