**Tutorial #7**

**The Pros and Cons of Using GaN HEMTs in PFC Circuit Applications**

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**Biography**

ric Persson is a 37-year veteran of the power electronic industry. His career spans 20 years of hands-on power converter and inverter design, followed by 17 years in applications engineering in the semiconductor industry at International Rectifier, now Infineon Technologies. He is presently responsible for GaN Applications at Infineon. Eric has presented more than 80 tutorials and papers at various international conferences. He is a regular lecturer, presenting short courses and tutorials at UW Madison, the University of Minnesota and Purdue University. He is also Chairman, Board of Directors of the Power Source Manufacturers Association (PSMA), and General Chairman for APEC 2018. Mr. Persson holds 13 patents, and is a recipient of the IEEE Third Millennium Medal.

**Abstract**

Since the turn of the century, the vast majority of all electronic equipment over 75 W that connects to the grid requires Power Factor Correction (PFC) to minimize harmonic currents. Early PFC circuits were based on a boost circuit topology, and operated in the range of 20 – 50 kHz using planar Silicon MOSFETs and fast-recovery rectifiers in conjunction with a full-wave bridge rectifier on the input. As semiconductors improved and became more cost-effective, superjunction MOSFETs and SiC Schottky rectifiers began to replace the older Silicon technologies in PFC circuits. After many generational improvements in both superjunction and SiC technology in the past decade, this combination has become the de-facto standard for the power stage used in most bridge and semi-bridgeless PFC stages today. The technology is mature and the cost and reliability are well-known. Now GaN HEMTs are gaining traction and are starting mass production in high-performance power supplies. Yet adoption has been slow and questions remain about the real benefit of GaN versus conventional semiconductors for PFC applications: Is GaN rugged enough to reliably handle voltage surges and inrush current from lightning strikes, line-cycle dropouts, and other line disturbances? Is GaN cheaper now or will it be cheaper, when? How is deadtime and diode-mode conduction managed, and what controller options exist? Why is GaN typically used at low frequencies (<100 kHz) in PFC applications? Can density really be improved by moving to high-frequency (MHz)? This seminar provides answers to these questions and more, using examples from real-world designs operating at both low and high-frequencies.