



Spring 2017 Seminar Series

High-Voltage SiC and GaN: Devices, Techniques, and Applications

FRIDAY MARCH 31, 2017

11:00 AM – HEC 450

From high power inverters for solar farms and electric vehicles to sub 10W adaptors for smartphones, the efficiency and density standards are pushing existing power semiconductors to their limits and compels designers to pursue alternative technologies. At 1200V and above, Silicon Carbide (SiC) devices appear to be the emerging standard for high efficiency switches. The SiC JFET was the first commercially available SiC switch and we will review the device structure, performance, and applications that continue to drive the power JFET development. At 650V, the competition for power switches now comprises three choices for power designers: Si, SiC, and Gallium Nitride (GaN) devices. Success for high-voltage GaN in this space will require not only high performance and low cost, but the ability to exploit the unique advantages of GaN devices with optimal implementation and further development of new topologies and applications. We will continue with a review of the market drivers behind the push for new WBG devices in the server and telecom markets, and compare the different GaN device structures and figures of merit in comparison with existing technologies. As GaN power devices become commercially viable, the understanding of reliability physics of dynamic charge trapping and material related leakage mechanisms are critical research areas. A review of these issues and impact on converters will be discussed.

David Sheridan

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David Sheridan received his B.S., M.S., and Ph.D. degrees in electrical engineering from Auburn University in 1995, 1997, and 2001, respectively. His research in WBG devices started in 1995 with the development of high temperature SiC devices and packaging and extending to optimization of process, design and edge termination techniques for early multi-kV SiC JBS diodes. From 2001 until 2006 he was with the IBM Semiconductor Research and Development Center working on device design for several generations of SiGe BiCMOS and CMOS technologies from 0.5 μ m to 32nm. In 2006 he joined the SiC start-up SemiSouth Laboratories as the Director of Engineering responsible for product and device design of high voltage (600V-1.7kV) JFETs, JBS diodes, and power modules. Through this work in providing early commercial high performance SiC devices to industry and academia, hundreds of papers were published on new characterization methods, drive techniques, and circuit topologies for emerging WBG devices. In 2012 Dr. Sheridan joined RFMD as the Director of Engineering for Power Conversion Devices led the development of the GaN power products R&D. He is currently the Senior Director of GaN products at Alpha and Omega Semiconductor, a major provider of power discretes and ICs. Dr. Sheridan has authored and co-authored over 80 technical publications, 2 book chapters, awarded 30 U.S. patents, and has given several invited talks across a wide range of semiconductor and application topics. He has served on the committees of several IEEE conferences and standards bodies including industry liaison to the Compact Modeling Council (2003-2005), technical committee member BCTM (2005), WBG committee member ISPSD (2008-2014), chair of WBG committee ISPSD (2011,2014), executive council of ISPSD (2014), IEDM Power and Compound Semiconductor committee (2014-2015), and WBG committee of the International Reliability Physics Symposium (2017).