3.3-kV SiC MOSFETs: Power Packaging and System Applications

Abstract

Wide bandgap devices are enabling medium-voltage power converters having higher efficiencies and reduced footprints when compared to those realized using silicon devices. This seminar addresses the design of a power package for 3.3-kV SiC MOSFET half bridge and two applications of medium-voltage power converters: a 4.16-kV, 2-MVA solar inverter and a 13.8-kV, 750-kVA flying capacitor converter.

Instructor Bios:

H. Alan Mantooth received the B.S.E.E. and M.S.E.E. degrees from the University of Arkansas in 1985 and 1986, and the Ph.D. degree from Georgia Tech in 1990. He then joined Analogy, a startup company in Oregon, where he focused on semiconductor device modeling and the research and development of modeling tools and techniques. In 1998, he joined the faculty of the Department of Electrical Engineering at the University of Arkansas, Fayetteville, where he currently holds the rank of Distinguished Professor. His research interests now include analog and mixed-signal IC design & CAD, semiconductor device modeling, power electronics, power electronics packaging, and cybersecurity. Dr. Mantooth helped establish the National Center for Reliable Electric Power Transmission (NCREPT) at the UA in 2005. Professor Mantooth serves as the Executive Director for NCREPT as well as two of its centers of excellence: the NSF Industry/University Cooperative Research Center on GRid-connected Advanced Power Electronic Systems (GRAPES) and the Cybersecurity Center on Secure, Evolvable Energy Delivery Systems (SEEDS) funded by the U.S. Department of Energy. In 2015, he also helped to establish the UA's first NSF Engineering Research Center entitled Power Optimization for Electro-Thermal Systems (POETS) that focuses on high power density systems for electrified transportation applications. Dr. Mantooth has co-founded three companies in design automation (Lynguent), IC design (Ozark Integrated Circuits), and cybersecurity (Bastazo) as well as advising a fourth in power electronics packaging (Arkansas Power Electronics International) to maturity and acquisition as a board member. Dr. Mantooth holds the 21st Century Research Leadership Chair in Engineering. He currently serves as Senior Past-President for the IEEE Power Electronics Society and Editor-in-Chief of the *IEEE Open Journal of Power Electronics*. Dr. Mantooth is a Fellow of IEEE, a member of Tau Beta Pi and Eta Kappa Nu, and registered professional engineer in Arkansas.

Yuxiang Chen received the B.Sc. and M.Sc. degrees from the Department of Information and Electrical Engineering, China University of Mining and Technology, Xuzhou, China, in 2011 and 2014, respectively, and the Ph.D. degree in the College of Electrical Engineering, Zhejiang University, Hangzhou, China in 2019. She is currently working as a Postdoc at the Department of Electrical Engineering in University of Arkansas, Fayetteville, US. Her research interests include high power module package design and fabrication.

Yue Zhao received a Ph.D. degree in electrical engineering from the University of Nebraska-Lincoln, Lincoln, USA, in 2014. He was an Assistant Professor in the Department of Electrical and Computer Engineering at the Virginia Commonwealth University, Richmond, USA, in 2014-2015. Since 2015, he has been with the University of Arkansas (UA), Fayetteville, USA, where he is currently an Assistant Professor in the Department of Electrical Engineering. His current research interests include electric machines and drives, power electronics, and renewable energy systems. He has 4 U.S. patents granted and co-authored more than 80 papers in refereed journals and international conference proceedings. Dr. Zhao is an Associated Editor of the IEEE Transactions on Industry Applications and IEEE Open Journal of Power Electronics. He was a recipient of 2018 U.S. National Science Foundation CAREER Award, the 2020 IEEE Industry Applications Society Andrew W. Smith Outstanding Young Member Achievement Award and the 2020 UA College of Engineering Dean's Award of Excellence.

Juan Carlos Balda (IEEE M'78 SM'94) received his B.Sc. in Electrical Engineering from the Universidad Nacional del Sur (Bahía Blanca, Argentina) in 1979, and his Ph.D. degree in Electrical Engineering from the University of Natal (Durban, South Africa) in 1986. He was first employed as a researcher and a part-time lecturer at the University of Natal until July 1987. He spent two years as a visiting Assistant Professor at Clemson University, South Carolina. He has been at the University of Arkansas at Fayetteville since July 1989 where he is currently a University Professor, Department Head, associate director for applications of the National Center for Reliable Electric Power Transmission (NCREPT) and a member of the NSF IUCRC Grid-connected Advanced Power Electronic Systems (GRAPES). His main research interests are Power Electronics, Electric Power Distribution Systems, Motor Drives and Electric Power Quality. He is a senior member of the IEEE, member of the Power Electronics and Power & Energy Societies, and the honor societies Eta Kappa Nu and Tau Beta Pi. He is also a chair of IEEE PELS TC5 committee