Multiphysics Modeling of High-Power Microwave Transistors
Dr. Peter Aaen, Freescale Semiconductor

Abstract

High-power transistors for wireless infrastructure applications have become increasingly complex over the past two decades; from a single die mounted in the package to sophisticated multichip modules. The transistor has total gate widths of several hundred millimeters, achieved by connecting many gate fingers in parallel. In-package matching networks, comprising several bond-wire arrays connecting metal–oxide semiconductor (MOS) capacitors, and other passive circuit elements, used to create the matching networks, completes the design. As communications systems become more sophisticated, these transistors are required to operate at ever-higher frequencies and output powers, all while meeting stringent linearity requirements. As a result, design methodologies are becoming increasingly complex and they require new comprehensive modeling strategies. This presentation will provide a comprehensive overview of the simulation and modeling methodologies used to model these devices. The talk will review recent advances in multiphysics modeling where a comprehensive description of the packaged transistor is created by combining electromagnetic and thermal simulations with nonlinear electrothermal transistor models in harmonic-balance circuit simulations. This approach enables a greater understanding of the internal operation of the power transistor and reveals new avenues for performance optimization.

Biography

Peter H. Aaen received the B.A.Sc. degree in Engineering Science and the M.A.Sc. degree in Electrical Engineering, both from the University of Toronto, Toronto, ON., Canada, and the Ph.D. degree in Electrical Engineering from Arizona State University, Tempe, AZ., USA, in 1995, 1997 and 2005, respectively. He is the Manager of the RF Modeling and Measurement Technology team of the RF Division of Freescale Semiconductor, Inc, Tempe, AZ, USA. His areas of expertise include calibration techniques for microwave measurements, development of package modeling techniques, development of passive and active compact models for the design of microwave power transistors and RFICs, and development of efficient electromagnetic simulation and optimization methodologies for complex packaged environments. His current work focuses on the development and validation of multi-physics based modeling methodologies for high-power and high-frequency electronic devices. He is a Senior Member of the IEEE, a member of the Microwave Theory and Techniques Society, and is an active member of many technical committees including: IEEE Technical Committee (MTT-1) on Computer-Aided Design, technical program committee (TPC) of the IEEE Conference on Electrical Performance of Electronic Packaging and Systems (EPEPS), executive committee member of the Automatic RF Techniques Group (ARFTG), and the IMS TPRC sub-committee for CAD Algorithms and Techniques. Dr. Aaen co-authored Modeling and Characterization of RF and Microwave Power FETs (Cambridge University Press, 2007) and has authored over thirty papers, articles and workshops in the fields of electromagnetic simulation, package modeling, and microwave device modeling and characterization.

Date: Thursday, Feb. 28th, 2013
Location: Arizona State University Goldwater Center, GWC487, 650 E. Tyler Mall, Tempe, AZ
Time: 6:00 PM Presentation, Pizza will be served following the Seminar
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