

Gallium Nitride (GaN) High-Electron-Mobility Transistors (HEMTs) for High-Voltage Power Applications with Enhanced Efficiency

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Abstract:

GaN-based electron devices are set to make substantial contributions as the leading future green technologies for the generation, conversion, and transmission of electrical energy with remarkable efficiency. A portable GaN-based power adapter offers faster and more efficient charging for mobile phones, laptops, and tablets compared to silicon-based chargers. GaN transistors, known for their distinctive characteristics, are considered to play key roles in future systems, including electric vehicles and electric planes. GaN-based microwave power amplifiers also show significant potential for use in cellular base stations and wireless power transmission applications. In this presentation, we will begin with a brief introduction of GaN materials and device structures, followed by an overview of various research activities focused on GaN-based High-Electron-Mobility Transistors (HEMTs). These activities include GaN substrate characterization for high-voltage operation, field plate electrode technology to ensure stable high-voltage operation, MOS-gate technology for achieving high-gain operation in microwaves, and matching circuit design to enhance the efficiency of microwave operation.

Biography:



Masaaki Kuzuhara was born in Osaka, Japan. He received the B.E., M.E., and Ph.D. degrees all in Electrical Engineering from Kyoto University, Kyoto, Japan, in 1979, 1981, and 1991, respectively. In 1981, he joined Central Research Laboratories, NEC Corporation, Kawasaki, Japan, where his research focused on GaAs-based microwave transistors. From 1998, he started working on the development of GaN-based heterojunction FETs for microwave power applications as a senior manager. In 2004, he took on the position of a professor at the Graduate School of Engineering, University of Fukui, Fukui, Japan. He then joined the School of Engineering, Kwansei Gakuin University, Hyogo, Japan in 2020. His current research interests include III-nitride heterojunction devices for both high-voltage and high-frequency applications.

In recognition of his contributions, he was honored with the 2002 Ichimura Prize by the New Technology Development Foundation for his pioneering work in the development of 3V GaAs-HEMTs for cellular handsets. He was also awarded the 2016 Fukui-Prefecture Science Award for his achievements in high-voltage GaN transistors. He is a Fellow of IEEE.