1. Session Title

SiC and GaN Applications in Electric Vehicles: Current Issues

2. Abstract

According to the International Energy Agency, 10 million electric vehicles (EVs) were in operation globally in 2020, and the rate of increase is accelerating.[1] SiC and GaN semiconductor technology is playing an important role in realizing the growth in EV sales. This is due to the greater power densities, switching frequencies, energy efficiency and thermal management of SiC and GaN devices and modules in comparison to silicon technology.

The advantages SiC and GaN technology bring to EVs include providing increased range before recharging – 5 to 10 percent – and shrinking the space needed for electrical components. This allows more space for batteries and other requirements reducing system cost by hundreds of dollars. According to the market research firm Omdia, the EV market for SiC power semiconductors is expected to triple between 2020 and 2025, reaching $1.5 billion. For GaN power semiconductors, the EV market is expected increase five-fold from 2020 to 2025, reach $50 million.[2]

Several key EV systems can employ SiC and GaN technology. Lower system costs and vehicle design simplification are being improved with WBG device integration with vehicles. Demonstrating the cost competitiveness of WBG semiconductors relative to silicon technology and the systemic cost savings represents the main hurdle for EV applications, as well as understanding the use of GaN vs. SiC in specific applications. Realizing these advantages is not trivial, and this will be the essence of the panel's discussion.

3. Session Organizer

Dr. Victor Veliadis is Executive Director and CTO of PowerAmerica, a wide-bandgap (WBG) semiconductor power electronics consortium. At PowerAmerica, he has managed a budget of $150 million that he strategically allocated to over 200 industrial and university projects to accelerate WBG semiconductor clean energy manufacturing, workforce development, and job creation. His PowerAmerica educational activities have trained 420 full-time university students in applied WBG projects, and engaged 4300 attendees in tutorials, short courses, and webinars. Dr. Veliadis is an ECE Professor at NCSU and an IEEE Fellow and EDS Distinguished Lecturer. He has 27 issued U.S. patents, six book

[1] https://www.iea.org/reports/global-ev-outlook-2021?mode=overview

[2] The Silicon Carbide and Gallium Nitride power semiconductor market: applications, forecasts and key players, PowerAmerica Virtual Wide Bandgap Summer Workshop, USA 5 August 2021, Richard Eden, Principal Analyst

chapters, and over 130 peer-reviewed publications. Prior to entering academia and taking an executive position at Power America in 2016, Dr. Veliadis spent 21 years in the semiconductor industry where his work included design, fabrication, and testing of SiC devices, GaN devices for military radar amplifiers, and financial and operations management of a commercial semiconductor fab. He has a Ph.D. degree in Electrical Engineering from John Hopkins University (1995).

4. Session Panelists/Speakers

Vincent McNeil, Director, Segment Line Powertrain Electrification, Business Line Advanced Analog, NXP Semiconductors

Agasthya Ayachit, Senior Systems Engineer, Mercedes-Benz R&D North America

Brij Singh, Region 4 Manager, External Relationships, Deere & Co.

Llew Vaughan-Edmunds, Senior Director of Marketing, Navitas Semiconductor

Kevin Bai, Associate Professor, CURENT, University of Tennessee-Knoxville