



### Tutorial Title:

Power Semiconductors in Electrified Powertrains – Transitioning from Silicon to Wide Bandgap Devices?

### Organizer:

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### Abstract:

This tutorial will provide a broad overview of power semiconductors in typical automotive xEV applications such as on-board charger, DC/DC and especially the traction inverter.

The session starts with the fundamentals of the semiconductor devices like IGBT/diodes (IGBT and RC-IGBTs) as well as wide band gap solutions (SiC and GaN) used in these applications resulting in key performance differentiators and figures of merits.

The purpose of the introduction is to gain a better understanding for typical selection criteria. Therefore, the presentation will discuss pros and cons and give several trade-offs, e.g. the qualitative cost performance trade-off.

Although the focus of this tutorial is power semiconductors, the performance of a semiconductor strongly depends on the package characteristics. The characteristics of the devices can be tuned to optimize power module performance. Both the device and module performance strongly influence the inverter efficiency, which, in turn, impacts MPG rating of the vehicle. Heat losses from the devices and module thermal performance determine the semiconductor and module size and therefore the cost of the inverter.

By connecting various aspects of power device and module characteristics, the discussion leads finally to a potential market picture from the application point of view. Besides the technical content, the presentation will also give some ideas of recent and future trends and topics like chip shortage, coexistence or cost parity of WBG and Silicon based solution will be briefly touched.

### Bio:

**Dr. Andre Christmann** is a lead principal for high power systems at Infineon Technologies and he has over 17 years' experience in this area. After completing his Ph. D. degree from Ruhr Universität Bochum in 2000, Dr. Christmann worked for 3 years at the Fraunhofer Institute for Microelectronic Circuits and Systems (IMS Duisburg, Germany) in the area of power semiconductor development. From 2004 – 2011, he was responsible for the development of power semiconductor modules for hybrid-electric vehicle applications at Infineon Technologies AG (Warstein, Germany). During this time, he designed HybridPACK1 module, which became an industry wide standard footprint for automotive power module. In 2011, he transferred to Infineon North America where he took over a position as Senior Specialist for Technology and Innovation in the area of power modules. Since 2019, he is working as a Product Definition Engineer for power semiconductors.



Dr. Christmann is author of several publications, lead classes in seminars/tutorials and gave presentations on international conferences like APE (France), PCIM (Germany), ITEC (USA), APEC (USA) and ECCE (USA). He also holds patents on power module design.