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BIO

Dr.-Ing. Holger Fink is, since 2017, CTO of the BRUSA Elektronik AG, which is one of the pioneers in eMobility and a leading engineering supplier for all electronic and mechanical components of automotive e-powertrains, charging systems and DC/DC-converters. From 2000 to 2017 he was working in several Automotive Divisions of the Robert Bosch GmbH. From 2015 to 2017 he was CEO of Lithium Energy and Power, a Joint Venture for automotive Li-Ion battery cells between Robert Bosch, GS Yuasa Corporation and Mitsubishi Cooperation. From 2012 to 2017 he was as Senior Vice President responsible for the R&D of Li-Ion Battery Systems at Robert Bosch Battery Systems. From 2008 to 2012 he was Chief Engineer at SB LiMotive, a Joint Venture for Li-ion battery cells and systems between Samsung SDI and Robert Bosch which was terminated in 2012. He is Electrical Engineer and did his PHD in 2000 at the Institute for Power Electronics and Control Systems of the University of Stuttgart.

ABSTRACT:

High Performance Voltage Doubler – The Fast Charging Booster for the Porsche Taycan

Leading OEMs for high-performance cars, such as Porsche or Lucid Motors are doubling the battery voltage from 400-V to around 800-V to benefit from reduced charging times and improved economic efficiency. Another application for 800-V systems are high power drive trains used in commercial vehicles. An interface between the conventional 400-V EV fast charging infrastructure and 800-V battery must be introduced, due to low availability of 800-V charging stations. Therefore, there is a need for a highly efficient and compact power electronic converter that allows this operation.

In this tutorial, firstly the main characteristics of conventional voltage boosters with a list of advantages and disadvantages will be shown. Secondly, the operating principle and multiphase architecture of the voltage doubler with a list of advantages over conventional DC/DC converter will be clarified. Thereafter, the implementation details such as the product architecture for fast charging (150-kW), selection of semiconductors, soft switching mechanisms (ZVS and ZCS) with typical current and voltage waveforms and control system will be explained. The performance and efficiency evaluation with the power loss breakdown and EMC measurements will be shown afterwards. Lastly, an outlook with tendencies for the future designs, necessity of unconventional creative solution, and potential impact of further optimization deploying SiC/GaN wide bandgap semiconductor technology will be discussed.