

Hollistic System Integration of Wide Band Gap Devices

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Silicon-based power electronics systems are nearing their power density limits while energy demands require higher efficiency and smarter electrical transmission. The use of wide band gap semiconductors (WBG) – such as SiC and GaN – promise to increase power density, reduce losses, and save size, weight, and cost of magnetics. These benefits however come at the cost of significant technical challenges for next generation power electronic system including: lower inductances, improved thermal management, enhanced reliability and low cost potential.

This talk will discuss specific industrial research efforts – both at ABB and beyond – which are aiming to develop holistic smart power electronic systems which will be more compact and provide greater electrical efficiency for the future of electrical conversion.

Specific areas such as electrical optimisation, novel thermal management techniques and the enhanced reliability will be addressed and their interdependencies. In addition, the talk will demonstrate a low voltage 3-phase inverter module embedded in a PCB substrate considering packaging, thermal resistance, reliability and insulation. The embedded active devices – 6 IGBT and 6 diodes – are rated to 1.2kV and with a nominal current of 25A and are benchmarked with a comparable traditional wire bond semiconductor module of the same voltage and current rating.

Finally, the future direction and the application potential of this embedding technology to advance future low voltage power electronic applications will be addressed.