University of Tennessee — THE UNIVERSITY OF TENNESSEE KNOXVILLE — Academic Members

Project Title: Packaging A Top-cooled 650V/>150A GaN Power Module with Insulated Thermal Pads and Gate-Drive Circuit.

Objectives: to package a flip-chip high-current GaN half-bridge with electric insulation and gate driver, particularly for EV charger or inverter.

Task No. BP5-3.22

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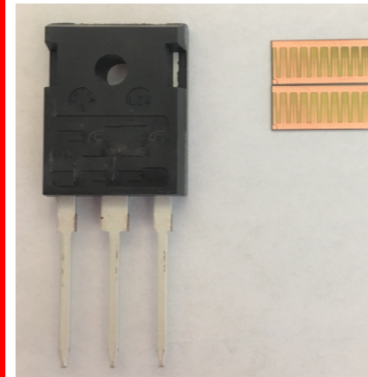

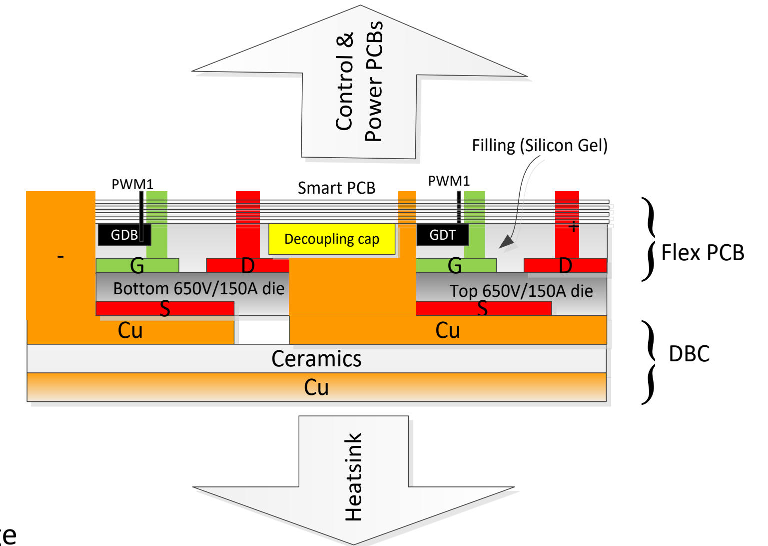

Si TO-247 vs GaN 150A half-bridge

WBG Technology Impact

1. Providing compact high-power GaN modules integrated with gate-driver with much smaller footprint than Si or paralleled discrete GaN HEMTs.
2. Application sector: EV charger, EV motor drive inverter
3. Timeframe for commercialization: 2021~2022
4. Present GaN has thermal pad connected with Source, in need of extra thermal insulator which worsens thermal impedance. The proposed approach eliminates such IMS from 650V/>150A GaN modules, reduces thermal impedance thereby lowering the probability of thermal runaway, and shrinks parasitics thereby maximizing its switching performance.

Accomplishments/Outcomes

1. A 650V/300A flip-chip GaN power module, with the gate-drive circuit fully integrated, which can find the immediate usage in on-board chargers (OBCs) and motor inverters in electric vehicles (EVs), thereby expediting the applications of GaN HEMTs in the electric vehicle industry;
2. Engagement of GaN Systems, HELLA engineers, GM teams and three UTK graduates, which enhances power electronics pipeline and leverages the DOE WBG Traineeship Program in UTK.
3. Packaging course and several short courses to be developed and shared with our industrial partners and WBG community.