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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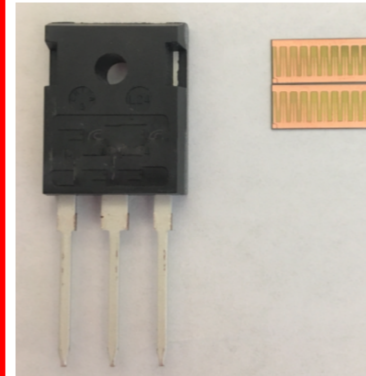
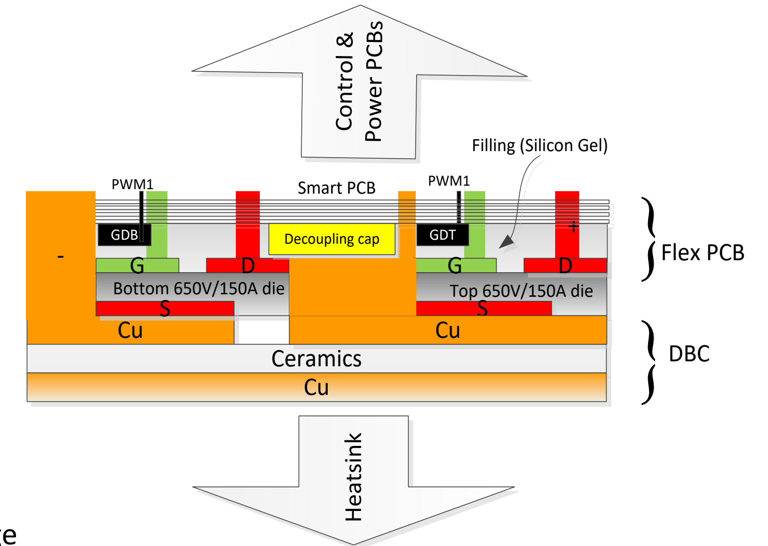


Si TO-247 vs GaN 150A half-bridge



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/>150A 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.