High Power Density DC-DC Converters Using Highly Integrated Half-Bridge GaN ICs

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Abstract

This work develops high power density DC-DC converters by combining monolithic integrated lowvoltage
half-bridge GaN ICs with two-advanced packaging approaches. An in-house fabricated monolithic integrated half-bridge is investigated with application-specific gate width ratio. The half-bridge
GaN ICs are assembled and compared using PCB-embedding and flip-chip assembly. Finally, DC-DC
converters with a power density of >1000 W/in3 are realized by combing GaN Power ICs and advanced
packaging technologies.

Design of Low-Resistance and Area-Efficient GaN-HEMTs for Low-Voltage Power Applications

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Abstract

This work analyzes different layouts for low-resistance and area-efficient GaN-HEMT devices, which are intended for low-voltage power applications. The current distribution in interdigital comb and matrix structures is investigated, and geometry parameters optimized to achieve the lowest possible area-specific resistance for given technology limits. A new model is analytically derived to investigate the static on-state behavior in matrix structures. Fabricated large area power transistors feature low specific on-state resistances $R_{ON} \cdot A$ of 0.61 mΩ·cm² for the comb structure, a reduced specific on-state resistance of 0.37 mΩ·cm² for the matrix structure, and a further reduced specific on-state resistance of 0.23 mΩ·cm² for a high-density, fully symmetrical matrix structure.