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GaN-Based Inverter Reference Design For Medium-Voltage Motor Drives

From Efficient Power Conversion (EPC), the EPC9196 is a high-performance 25-Arms, three-phase BLDC motor drive inverter reference design powered by the EPC2304 eGaN FET. The EPC9196 is specifically designed for medium-voltage (96 V to 150 V) battery-powered motor drive applications, including steering systems in automated guided vehicles (AGVs), traction motors in compact autonomous vehicles, and precision motor joints in robotics.

The EPC9196 is said to fill a critical gap in the motor drive reference design landscape. With no other available reference designs operating at this voltage and current combination, according to the vendor, EPC offers system designers a compact, efficient, and ready-to-deploy solution that accelerates development and optimizes system performance in the lower end of the 25- to 400-Arms application range.

At the heart of the EPC9196 is the EPC2304, a 200-V-rated, 3.5-mΩ (typical) eGaN FET in a thermally enhanced QFN package. The EPC2304 enables the EPC9196 to deliver up to 35 Apk (25 Arms) phase current at switching frequencies up to 100 kHz. This performance translates to low switching losses, minimal dead time, and a smooth, low-noise motor drive profile even at high PWM speeds.

Key features of the EPC9196 include a wide input voltage range from 30 V to 170 V; integrated gate drivers, housekeeping power, current and voltage sense, overcurrent protection, and thermal monitoring (see Figs. 1 to 3); and compatibility with multiple motor drive controller platforms from Microchip, ST, TI, and Renesas. It also offers dv/dt control optimized for motor drive applications (<10 V/ns) and is ready for sensorless or encoder-based control configurations.

The EPC9196 has been validated in real-world conditions, powering a 3-kW servo motor at 150 Vdc and 60-kHz switching frequency. The design delivers clean waveforms with minimal ringing and demonstrates excellent thermal behavior with and without a heatsink, making it suitable for both bench evaluation and production-intent prototyping.

"With the introduction of the EPC9196, we're enabling engineers working in robotics, AGVs, and compact EVs to take full advantage of GaN's superior performance without redesigning for high current," said Marco Palma, director of Motor Drive Systems and Applications at EPC.

The EPC9196 reference design boards are priced at $812.50. Reference design boards and devices are available for immediate delivery from Digi-Key. For more information, see the EPC9196 page.

Fig. 1. The EPC9196 is a 25-Arms, three-phase BLDC motor drive inverter design optimized for 96-V to 150-V battery applications such as those founds in robotics, automated guided vehicles (AGVs), and compact EVs It leverages the low losses of the EPC2304, a 200-V-rated, 3.5-mΩ (typical) eGaN FET in a thermally enhanced QFN package.

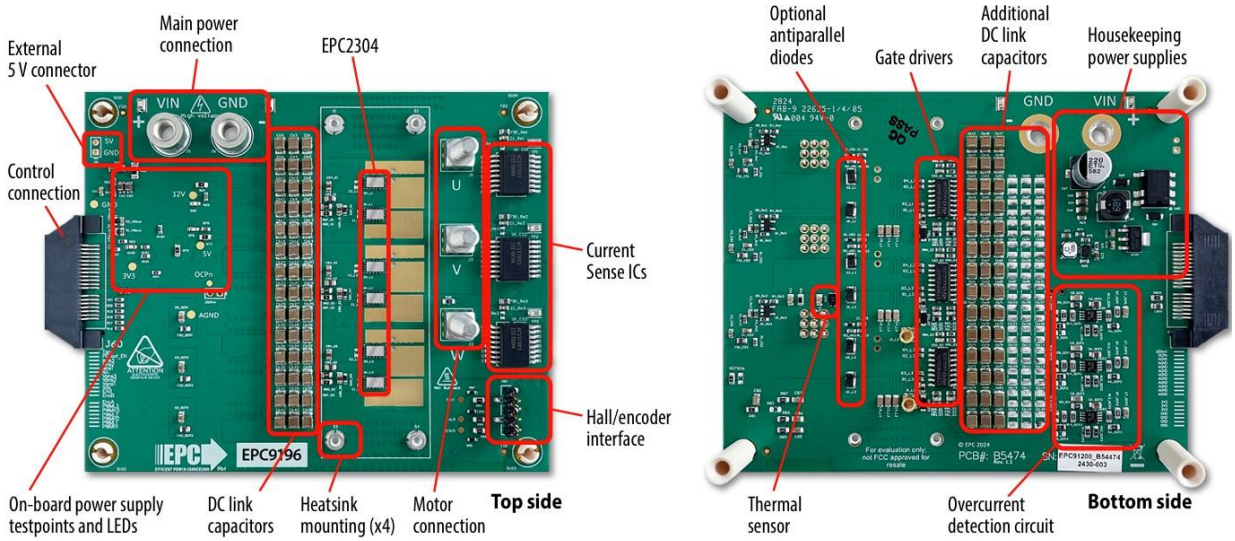

Fig. 2. Top and bottom views of the EPC9196 eval board with key elements labeled. The EPC9196 contains all the necessary critical functions to support a complete motor drive inverter including gate drivers; regulated auxiliary power rails for housekeeping supplies; voltage, and temperature sense; accurate current sense; and protection functions.

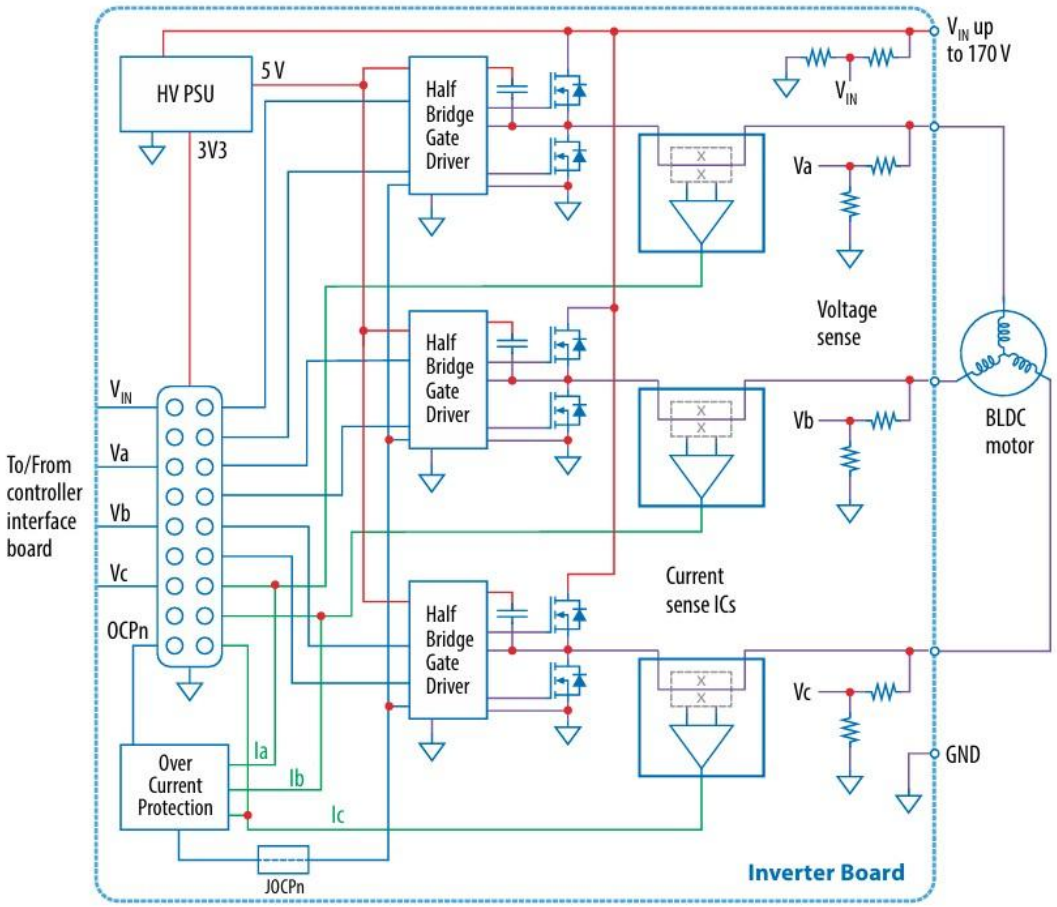

Fig. 3. The functional block diagram of the EPC9196 eval board details the phase current sense, phase and dc voltage sense, the half-bridge power stages, housekeeping power supply and controller interface connection.