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GaN-Based Inverter Reference Design Shrinks Motor Drives For eBikes And Drones

EPC's EPC9173 GaN-based inverter reference design enhances motor system size, performance, range, precision, torque, all while simplifying design for faster time-to-market. The extremely small size of this inverter allows integration into the motor housing resulting in the lowest EMI, highest density, and lowest weight, according to the vendor.

The EPC9173 is a three-phase BLDC motor drive inverter using the EPC23101 eGaN IC with embedded gate driver function and a floating power GaN FET with 3.3-mΩ $R_{DS(ON)}$. The inverter reference design operates from an input supply voltage between 20 V and 85 V and can deliver up to 50 Apk (35 ARMS). This voltage range and power level makes the solution well suited for a variety of motor drive applications including e-bikes, scooters, city cars, drones, and robotics (Fig. 1).

Major benefits of a GaN-based motor drive are exhibited with these reference design boards, including less than 30-ns deadtime for very high motor + inverter system efficiency for longer range, lower distortion for lower acoustic noise, lower current ripple for reduced magnetic loss, lower torque ripple for improved precision, and lower filtering for lower cost.

The lower weight and size of the EPC9173 solution enables incorporation of the drive into the motor housing and supports low inductance, higher power density motors. When configured for a 100-kHz frequency, the input filter and the number of capacitors can be dramatically reduced, and the electrolytic capacitors can be eliminated from the board.

The use of the EPC23101 integrated GaN-on-silicon device offers higher performance in a smaller footprint with significantly reduced design engineering requirements for fast time to market, says the vendor. The solution enables phase current sensing and leg shunt current sensing, for maximum flexibility (Fig. 2). EPC provides full demonstration kits, which include interface boards that connect the inverter board to the controller board development tool for fast prototyping that reduces design cycle times.

The EPC9173 boards measure just 130 mm x 100 mm (including connector). The boards can also be configured for multiphase dc-dc conversion topologies including buck, boost, half bridge, full bridge, or LLC converters.

"Designers can use the GaN IC to make lighter weight and more precise battery-operated motor drives for eMotion, robotic arms, and drones," said Alex Lidow, CEO of EPC. "GaN enables motor systems that are smaller, lighter, less noisy, have more torque, more range, and greater precision."

The EPC9173 reference design board is priced at $900.00 and is available for immediate delivery from Digi-Key. For more information see the EPC9173 - Development Board page.

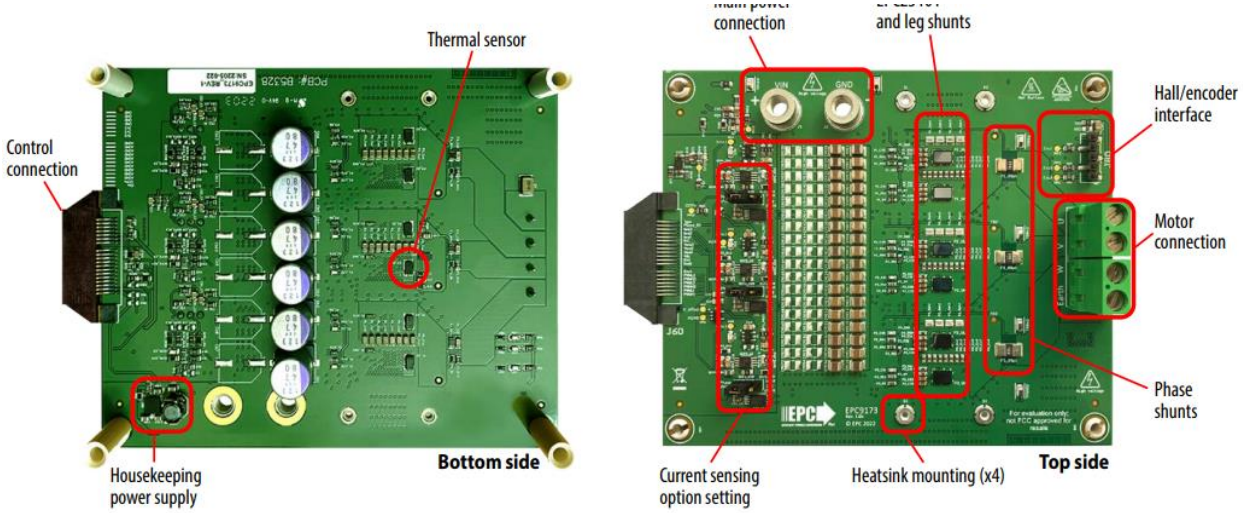

Fig. 1. The EPC9173 contains all the necessary critical function circuits to support a complete motor drive inverter including gate drivers, regulated auxiliary power rails for housekeeping supplies, voltage, and temperature sense, accurate current sense, and protection functions. The lower weight and size of the EPC9173 solution enables incorporation of the drive into the motor housing and supports low inductance, higher power density motors. The board can also be configured for multi-phase dc–dc conversion.

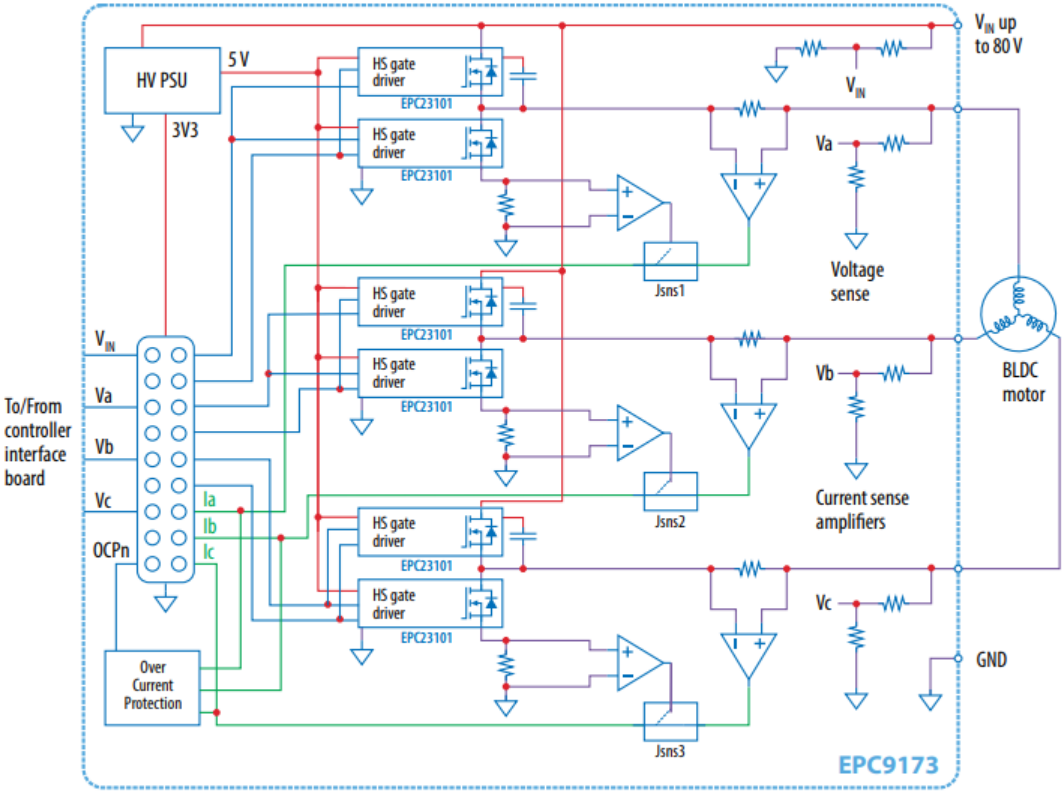

Fig. 2. This functional block diagram of the EPC9173 demo board details the phase current sense, phase and dc voltage sense, the half-bridge power stages, housekeeping power supply and controller interface connection.