

# Motor Drive

e-mobility • robotics • drones

## GaN Motors...Smaller, Faster, More Precise

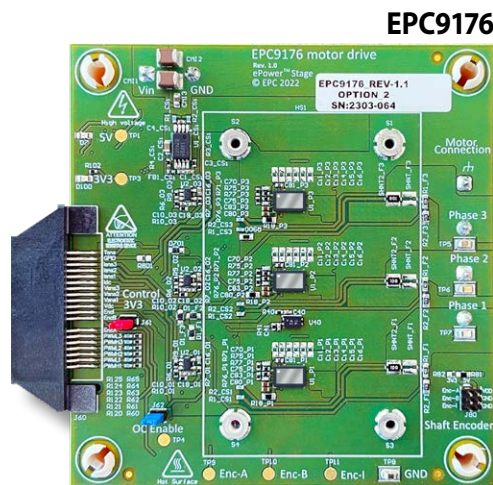
eGaN® FETs and ICs provide the small size, light weight, and precision control that brushless DC (BLDC) motors require for applications such as robotics, e-mobility, industrial automation, and drones. EPC offers a variety of modular demonstration boards and kits to evaluate the performance advantages of gallium-nitride FETs and ICs for motor drive applications. With GaN inverters, motors can become more efficient due to higher PWM frequency, smaller dead time and usage of ceramic capacitors in place of electrolytic capacitors.

## Motor Drive Demo Boards

### EPC9176 – 20 A<sub>RMS</sub> Motor Drive Inverter

The **EPC9176** evaluation board is a 3-phase BLDC motor drive inverter featuring the **EPC23102** ePower™ Stage IC 6.6 mΩ maximum  $R_{DS(on)}$ , 100 V maximum device voltage. The EPC9176 can deliver up to 28 Apk (20 A<sub>RMS</sub>) steady state output current.

The board can also be configured for multi-phase DC-DC conversion and the EPC23102 supports PWM switching frequencies up to 250 kHz in motor drive applications and 500 kHz in DC-DC applications.



EPC9176

#### EPC9176 Features

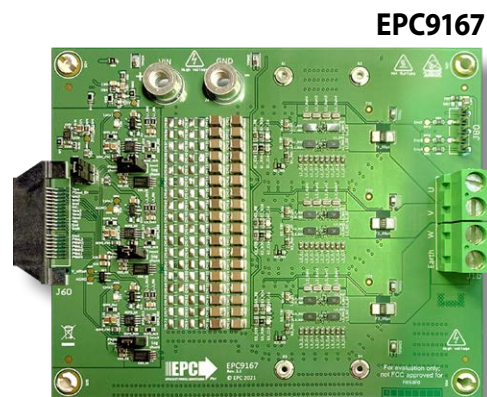
- 60 V - 20 A<sub>RMS</sub> phase current
- Current sensing with high accuracy and bandwidth
- All phase voltage sensing
- Temperature monitoring circuit
- Over-current and input supply under voltage lockout

### EPC9167/EPC9167HC – 20 A<sub>RMS</sub> / 30 A<sub>RMS</sub> Motor Drive Inverter

The **EPC9167** evaluation board is a 3-phase BLDC motor drive inverter featuring the **EPC2065** eGaN FET 3.6 mΩ maximum  $R_{DS(on)}$ , 80 V maximum device voltage.

The EPC9167 can deliver up to 20 A<sub>RMS</sub> maximum output current and the EPC9167HC can deliver up to 30 A<sub>RMS</sub> maximum output current.

The board can also be configured for multi-phase DC-DC conversion and the EPC2065 supports PWM switching frequencies up to 500 kHz.



EPC9167

#### EPC9167 Features

- 60 V, 20 - 30 A<sub>RMS</sub> phase current
- Current sensing on each phase
- All phase voltage sensing
- Temperature sensing circuit
- Over-current and input supply under voltage lockout

## Motor Drive Demo Boards *(continued)*

### EPC9173 – 35 A<sub>RMS</sub> Motor Drive Inverter

The **EPC9173** evaluation board is a 3-phase BLDC motor drive inverter featuring the **EPC23101** ePower™ Stage IC. The EPC9173 can deliver up to 50 Apk (35 A<sub>RMS</sub>) maximum output current.

The board can also be configured for multi-phase DC–DC conversion.



**EPC9173**

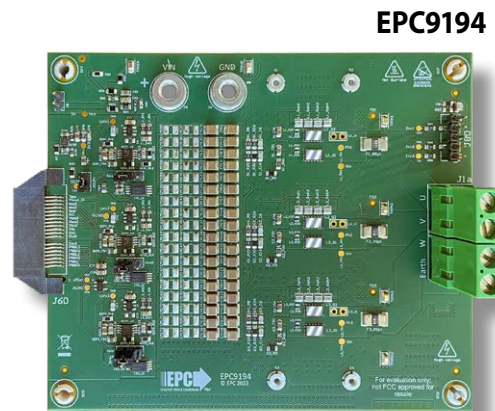
#### EPC9173 Features

- 60 V–35 A<sub>RMS</sub> phase current
  - Current sensing with high accuracy and bandwidth
  - All phase voltage sensing
  - Temperature monitoring circuit
  - Over-current and input supply under voltage lockout

### EPC9194 – 40 A<sub>RMS</sub> Motor Drive Inverter

The **EPC9194** evaluation board is a 3-phase BLDC motor drive inverter featuring the **EPC2302** eGaN FET 3.6 mΩ maximum R<sub>DS(on)</sub>, 80 V maximum device voltage.

The EPC9194 can deliver up to 40 A<sub>RMS</sub> maximum output current.



**EPC9194**

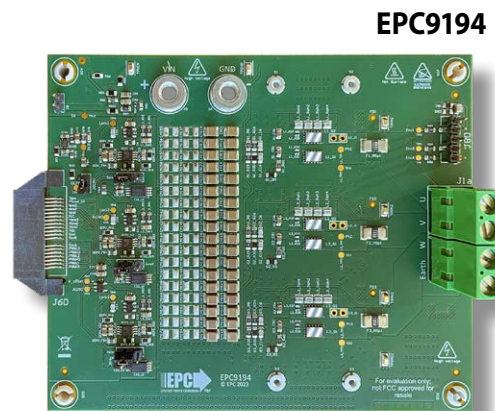
#### EPC9194 Features

- 60 V–40 A<sub>RMS</sub> phase current
  - Current sensing with high accuracy and bandwidth
  - All phase voltage sensing
  - Temperature monitoring circuit
  - Over-current and input supply under voltage lockout

### EPC9186 – 150 A<sub>RMS</sub> Motor Drive Inverter

The **EPC9186** evaluation board is a 3-phase BLDC motor drive inverter featuring four (4) **EPC2302** eGaN FETs in parallel per switch position.

The EPC9186 can deliver up to 150 A<sub>RMS</sub> maximum output current.



**EPC9186**

#### EPC9186 Features

- 60 V–40 A<sub>RMS</sub> phase current
  - Current sensing with high accuracy and bandwidth
  - All phase voltage sensing
  - Temperature monitoring circuit
  - Over-current and input supply under voltage lockout

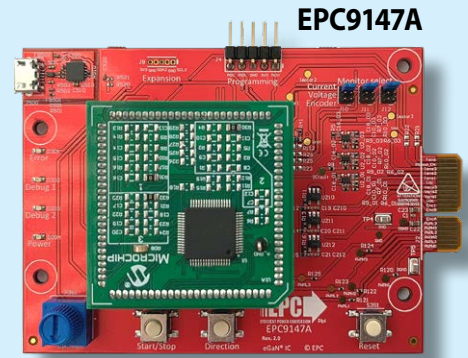
## Controller Interface Boards

The power boards can be paired with each EPC9147 mating board. This allows the designer to use mainstream microcontroller official development boards, leveraging existing resources for quick development.

### EPC9147A – Motor Drive Controller Interface Board – Microchip DSP

The **EPC9147A** board is an interface board that accepts the Microchip MA330031-2 Plug-In-Module (PIM), and is fitted with the dsPIC33EP256MC506 Digital Signal Processor (DSP), and interfaces to a 3-phase eGaN FET/IC motor drive inverter board. This interface board allows users to utilize the existing Microchip motorBench® Development Suite resources to program the PIM that controls a motor powered by an eGaN FET/IC 3-phase inverter using sensorless field orientated control with space vector pulse width modulation.

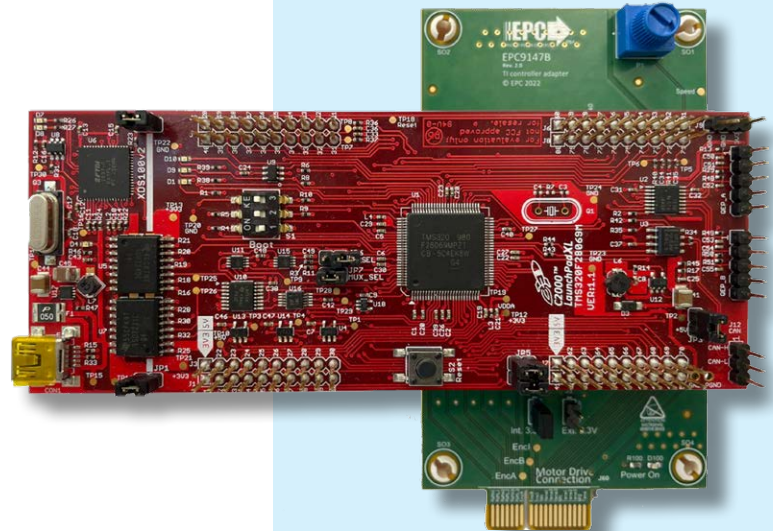
The EPC9147A includes a standard Microchip compatible programming port (J4), I<sup>2</sup>C expansion port (J8) and, a 40-pin card edge connector (J2) that interfaces the PWM, analog feedback signal, errors states and 3.3 V power to the motor drive inverter board.



EPC9147B

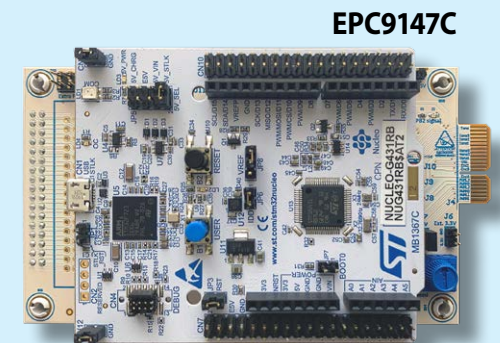
### EPC9147B – Motor Drive Controller Interface Board – Texas Instruments LAUNCHXL

The **EPC9147B** is an interface board that accepts the TI LAUNCHXL development kit, such as the F28379D, or the F28069M, that features the TI C2000 microcontroller, and connects to a compatible 3-phase eGaN® FET/ IC motor drive inverter board, as it can be seen in the photo to the right. This interface board allows users to utilize the existing TI InstaSPIN\_UNIVERSAL GUI resources together with EPC-dedicated files to program the controller board and control a motor powered by an eGaN FET/IC 3-phase inverter using sensor-less field oriented control and space vector pulse width modulation.



### EPC9147C – Motor Drive Controller Interface Board – ST Micro DSP

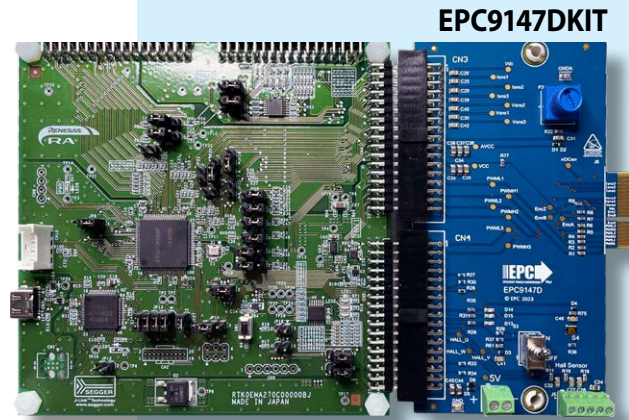
The **EPC9147C** board is an interface board that accepts the STMicroelectronics STM32 NUCLEO-G431RB motor drive development board, and is fitted with the STM32G431RBT6 ARM Digital Controller, and interfaces to a 3-phase eGaN FET/IC motor drive inverter board. This interface board allows users to utilize the existing STMicroelectronics Integrated Development Environment resources to program the controller board that controls a motor powered by an eGaN FET/IC 3-phase inverter using sensor-less field oriented control with space vector pulse width modulation.



## Controller Interface Boards *(continued)*

### EPC9147D – Motor Drive Controller Interface Board – Renesas RA6T2/RA4T1 Controller Board

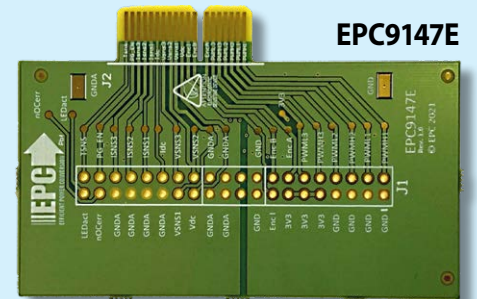
The **EPC9147D** is an interface board that permits connection of the Renesas controller Board RTK0EMA270C0000BJ, equipped with an RA6T2 microcontroller, to a compatible 3-phase eGaN® FET/ IC motor drive inverter board. The interface board allows users to utilize the existing Renesas Motor Workbench together with dedicated files to program the Renesas controller board to control a motor with an EPC eGaN®FET/IC 3-phase inverter.



### EPC9147E – Motor Drive Controller Interface Board – Generic

The **EPC9147E** board is an interface board that interfaces to a 3-phase eGaN FET/IC motor drive inverter board. This interface board allows users to connect to a custom controller of choice using fly wires or ribbon cable. It can also be used to for debug by probing control signals.

The EPC9147E is not sold separately, it ships with the motor drive kits.



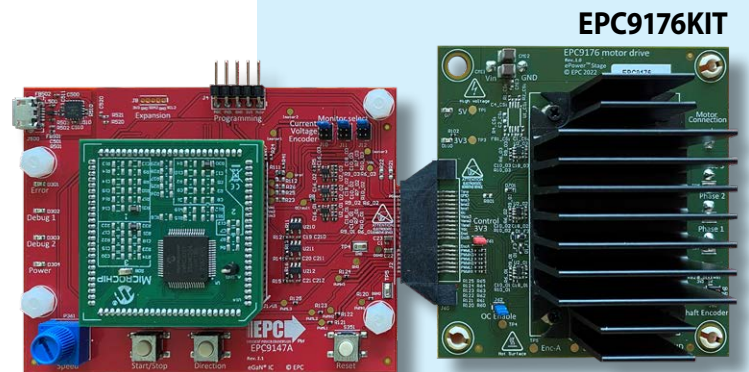
## Motor Drive Kits

All controllers are compatible with all motor drive boards.

### EPC9176KIT - 20 A<sub>RMS</sub> Motor Drive Evaluation Kit

The **EPC9176KIT** includes:

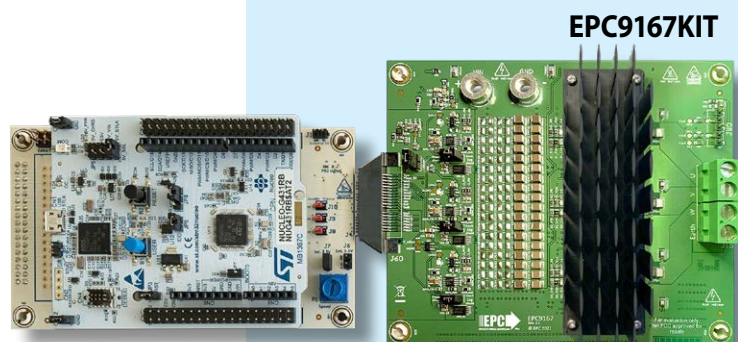
- One (1) EPC9176 20 A<sub>RMS</sub> GaN-based motor inverter board
- One (1) EPC9147A mate board for dsPIC33EP256MC506 Plug-In Module
- One (1) EPC9147E generic interface board for custom controller of choice



### EPC9167KIT/HCKIT – 20 A<sub>RMS</sub> / 30 A<sub>RMS</sub> Motor Drive Evaluation Kit

The **EPC9167/HCKIT** includes:

- One (1) EPC9167 or (1) EPC9167HC GaN-based motor inverter board
- One (1) EPC9147C mate board for STMicroelectronics STM32 Nucleo
- One (1) EPC9147E generic interface board for custom controller of choice

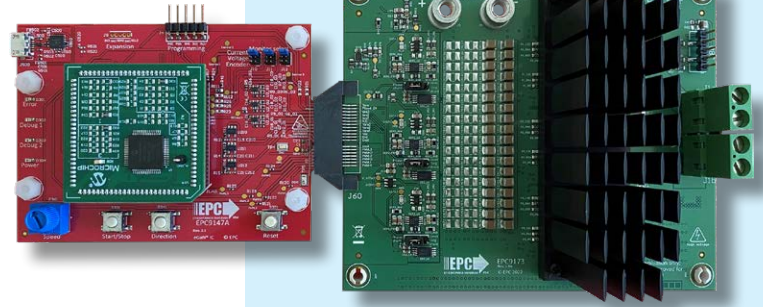


## Motor Drive Kits *(continued)*

### EPC9173KIT – 35 A<sub>RMS</sub> Motor Drive Evaluation Kit

The **EPC9173KIT** includes:

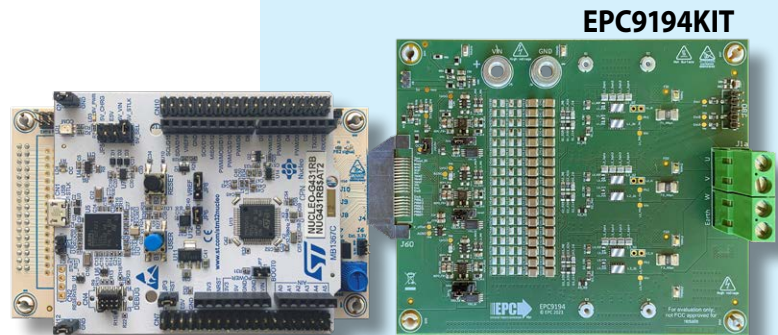
- One (1) EPC9173 35 A<sub>RMS</sub> GaN-based motor inverter board
- One (1) EPC9147A mate board for dsPIC33EP256MC506 Plug-In Module
- One (1) EPC9147E generic interface board for custom controller of choice



### EPC9194KIT - 40 A<sub>RMS</sub> Motor Drive Evaluation Kit

The **EPC9194KIT** includes:

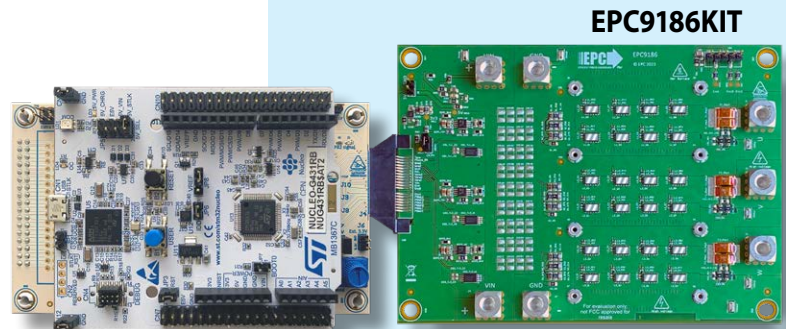
- One (1) EPC9194 40 A<sub>RMS</sub> GaN-based motor inverter board
- One (1) EPC9147C mate board for STMicroelectronics STM32 Nucleo
- One (1) EPC9147E generic interface board for custom controller of choice



### EPC9186KIT – 150 A<sub>RMS</sub> Motor Drive Evaluation Kit

The **EPC9186KIT** includes:

- One (1) EPC9186 150 A<sub>RMS</sub> GaN-based motor inverter board
- One (1) EPC9147C mate board for STMicroelectronics STM32 Nucleo
- One (1) EPC9147E generic interface board for custom controller of choice



#### For More Information

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