

Development Board EPC9014 Quick Start Guide

200V Half Bridge with Gate Drive,
Using EPC2019

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DESCRIPTION

The EPC9014 development board is a 200 V maximum device voltage, 4 A maximum output current, half bridge with onboard gate drives, featuring the EPC2019 enhancement mode (eGaN®) field effect transistor (FET). The purpose of this development board is to simplify the evaluation process of the EPC2019 eGaN FET by including all the critical components on a single board that can be easily connected into any existing converter.

The EPC9014 development board is 2" x 1.5" and contains not only two EPC2019 eGaN FET in a half bridge configuration with gate drivers, but also an on board gate drive supply and bypass capacitors. The board contains all critical components and layout for optimal switching performance. There are also various probe points to facilitate simple waveform measurement and efficiency calculation. A complete block diagram of the circuit is given in Figure 1.

For more information on the EPC2019s eGaN FET please refer to the datasheet available from EPC at www.epc-co.com. The datasheet should be read in conjunction with this quick start guide.

Table 1: Performance Summary ($T_A = 25^\circ\text{C}$)

Symbol	Parameter	Conditions	Min	Max	Units
V_{DD}	Gate Drive Input Supply Range		7	12	V
V_{IN}	Bus Input Voltage Range			160	V
V_{OUT}	Switch Node Output Voltage			200	V
I_{OUT}	Switch Node Output Current			4*	A
V_{PWM}	PWM Logic Input Voltage Threshold	Input 'Low'	3.5	6	V
		Input 'High'	0	1.5	V
	Minimum "High" State Input Pulse Width	V_{PWM} rise and fall time < 10ns	100		ns
	Minimum "Low" State Input Pulse Width	V_{PWM} rise and fall time < 10ns	500#		ns

* Assumes inductive load, maximum current depends on die temperature – actual maximum current will be subject to switching frequency, bus voltage and thermals.
Dependent on time needed to 'refresh' high side bootstrap supply voltage.

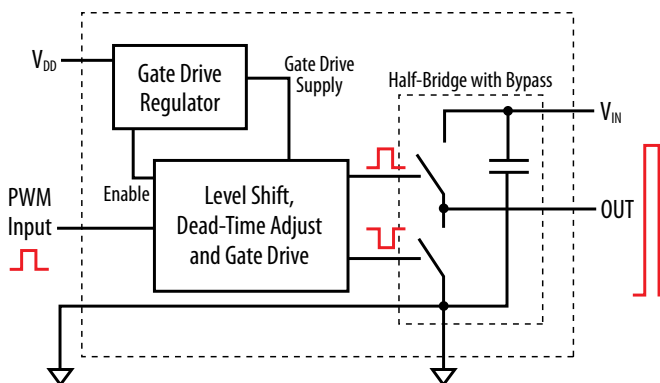


Figure 1: Block Diagram of EPC9014 Development Board

Demonstration Board Notification

The EPC9014 board is intended for product evaluation purposes only and is not intended for commercial use. As an evaluation tool, it is not designed for compliance with the European Union directive on electromagnetic compatibility or any other such directives or regulations. As board builds are at times subject to product availability, it is possible that boards may contain components or assembly materials that are not RoHS compliant. Efficient Power Conversion Corporation (EPC) makes no guarantee that the purchased board is 100% RoHS compliant. No Licenses are implied or granted under any patent right or other intellectual property whatsoever. EPC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.

EPC reserves the right at any time, without notice, to change said circuitry and specifications.

QUICK START PROCEDURE

Development board EPC9014 is easy to set up to evaluate the performance of the EPC2019 *eGaN* FET. Refer to Figure 2 for proper connect and measurement setup and follow the procedure below:

1. With power off, connect the input power supply bus to $+V_{IN}$ (J5, J6) and ground / return to $-V_{IN}$ (J7, J8).
2. With power off, connect the switch node of the half bridge OUT (J3, J4) to your circuit as required.
3. With power off, connect the gate drive input to $+V_{DD}$ (J1, Pin-1) and ground return to $-V_{DD}$ (J1, Pin-2).
4. With power off, connect the input PWM control signal to PWM (J2, Pin-1) and ground return to any of the remaining J2 pins.
5. Turn on the gate drive supply – make sure the supply is between 7 V and 12 V range.
6. Turn on the bus voltage to the required value (do not exceed the absolute maximum voltage of 200 V on V_{OUT}).
7. Turn on the controller / PWM input source and probe switching node to see switching operation.
8. Once operational, adjust the bus voltage and load PWM control within the operating range and observe the output switching behavior, efficiency and other parameters.
9. For shutdown, please follow steps in reverse.

NOTE. When measuring the high frequency content switch node (OUT), care must be taken to avoid long ground leads. Measure the switch node (OUT) by placing the oscilloscope probe tip through the large via on the switch node (designed for this purpose) and grounding the probe directly across the GND terminals provided. See Figure 3 for proper scope probe technique.

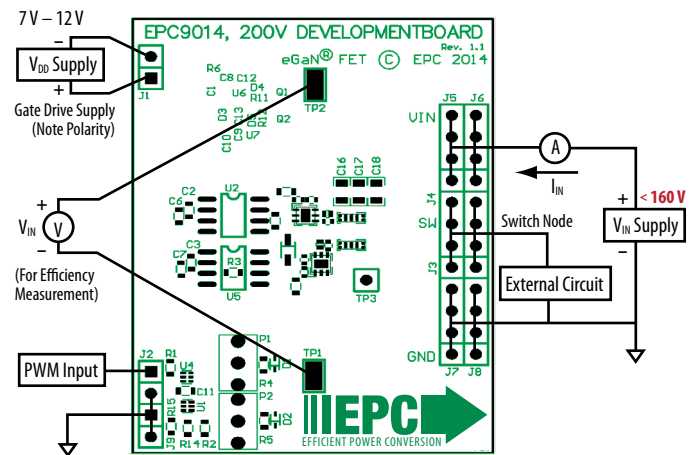


Figure 2: Proper Connection and Measurement Setup

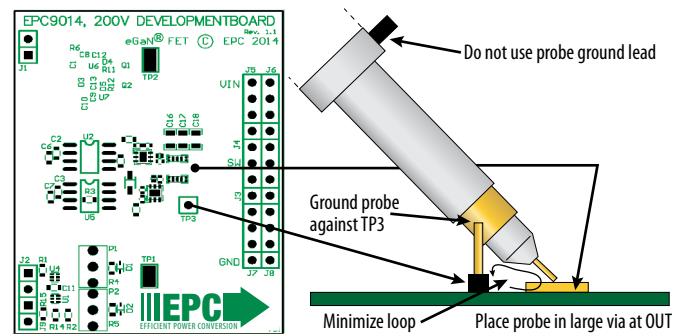


Figure 3: Proper Measurement of Switch Node – OUT

THERMAL CONSIDERATIONS

The EPC9014 development board showcases the EPC2019 *eGaN* FET. Although the electrical performance surpasses that for traditional Si devices, their relatively smaller size does magnify the thermal management requirements. The EPC9014 is intended for bench evaluation with low ambient temperature and convection cooling. The addition of heat-sinking and forced air cooling can significantly increase the current rating of these devices, but care must be taken to not exceed the absolute maximum die temperature of 125°C.

NOTE. The EPC9014 development board does not have any current or thermal protection on board.

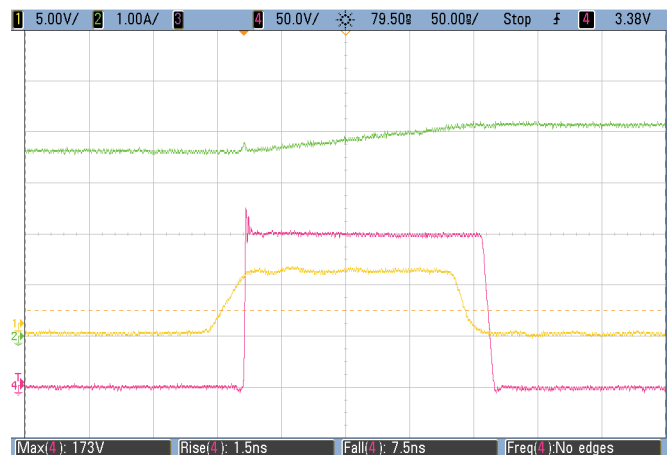


Figure 4: Waveforms for $V_{IN} = 150$ V to 5 V/4 A (200kHz) Buck converter
CH1: V_{DD} Input voltage – CH2: Inductor current – CH4: (V_{OUT}) Switch node voltage

Table 2 : Bill of Material

Item	Qty	Reference	Part Description	Manufacturer / Part #
1	5	C1, C2, C3, C10, C11	Capacitor, 1uF, 10%, 25V, X5R	Murata, GRM188R61E105KA12D
2	2	C6, C7	Capacitor, 100pF, 5%, 50V, NP0	TDK, C1608C0G1H101J
3	4	C8, C9, C12, C13	Capacitor, 0.22uF, 10%, 16V, X7R	TDK, C1005X7R1C224K
4	3	C16, C17, C18	Capacitor, 0.1uF, 10%, 250V, X7S	C2012X7T2E104K125AA
5	2	D1, D2	Schottky Diode, 30V	Diodes Inc., SDM03U40-7
6	1	D3	Diode, 200V	Diodes Inc., BAV21WS-7-F
7	2	D4, D5	Diode, 40V	Diodes Inc., BAS40LP-7
8	1	J1	Connector	2pins of Tyco, 4-103185-0
9	1	J2	Connector	4pins of Tyco, 4-103185-0
10	1	J3, J4, J5, J6, J7, J8	Connector	FCI, 68602-224HLF
11	2	Q1, Q2	eGaN FET	EPC, EPC2019
12	1	R1	Resistor, 10.0K, 5%, 1/8W	Stackpole, RMCF0603FT10K0
13	2	R11, R12	Resistor, 1 Ohm, 1%, 1/16W	Stackpole, RMCF0402FT1R00
14	4	R2, R3, R6, R15	Resistor, 0 Ohm, 1/8W	Stackpole, RMCF0603ZT00R0
15	1	R4	Resistor, 1000 Ohm, 1%, 1/8W	Stackpole, RMCF0603FT100R
16	1	R5	Resistor, 470 Ohm, 1%, 1/8W	Stackpole, RMCF0603FT470R
17	2	TP1, TP2	Test Point	Keystone Elect, 5015
18	1	TP3	Connector	1/40th of Tyco, 4-103185-0
19	1	U1	I.C., Logic	Fairchild, NC7SZ00L6X
20	1	U2	I.C., Opto-coupler	Silicon Labs, Si8610BC
21	1	U4	I.C., Logic	Fairchild, NC7SZ08L6X
22	2	U6, U7	I.C., Gate driver	Texas Instruments, UCC27611
23	0	P1, P2	Optional potentiometer	
24	0	R13	Optional resistor	
25	0	U5	Optional I.C.	

