Development Board EPC9047 Quick Start Guide

Half Bridge with Gate Drive for EPC2033

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EFFICIENT POWER CONVERSION

DESCRIPTION

The EPC9047 development boards are in a half bridge topology with onboard gate drives, featuring the EPC2033 eGaN® field effect transistors (FETs). The purpose of these development boards is to simplify the evaluation process of these eGaN FETs by including all the critical components on a single board that can be easily connected into any existing converter.

The development board is 2" x 1.5" and contains two eGaN FETs in a half bridge configuration using the Texas Instruments UCC27611 gate driver, 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 EPC2033 eGaN FET please refer to the data sheet available from EPC at www.epc-co.com. The data sheet should be read in conjunction with this quick start guide.

Table 1: Performance Summary (T_A = 25°C)

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNITS
V_{DD}	Gate Drive Input Supply Range		7	12	V
V_{IN}	Bus Input Voltage Range			110	V
V_{OUT}	Switch Node Output Voltage			150	V
I_{OUT}	Switch Node Output Current			12*	A
V_{PWM}	PWM Logic Input Voltage Threshold	Input 'High' Input 'Low'	3.5 0	6 1.5	V 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 thermal management.
Dependent on time needed to 'refresh' high side bootstrap supply voltage.

QUICK START PROCEDURE

The development boards are easy to set up to evaluate the performance of the 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 150 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.

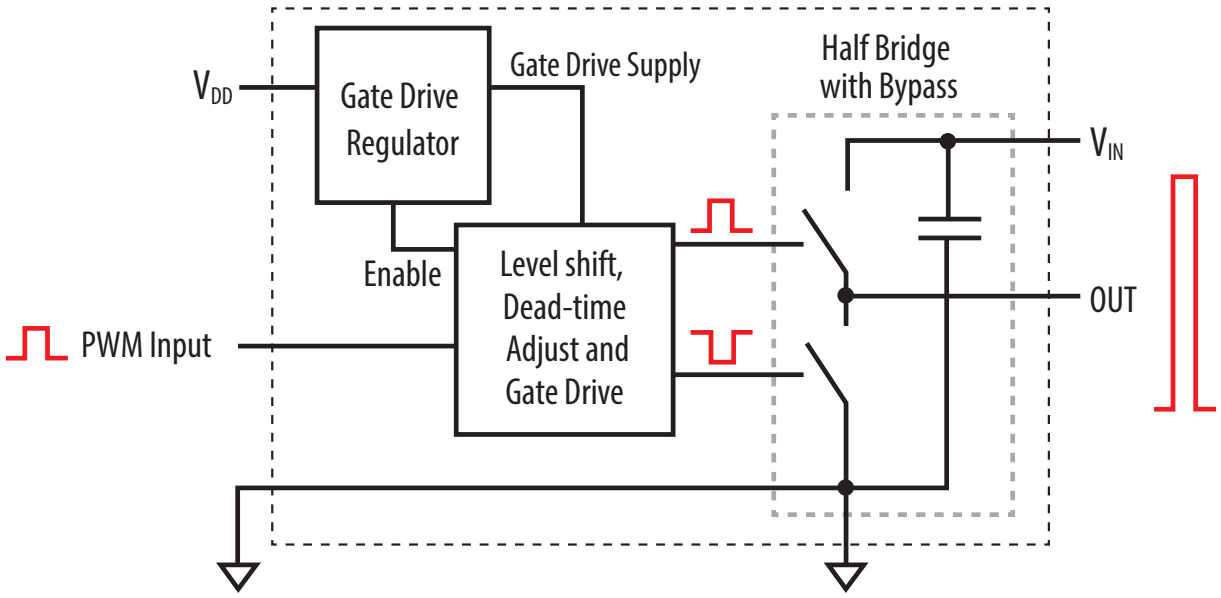

Figure 1: Block Diagram of Development Board

QUICK START PROCEDURE

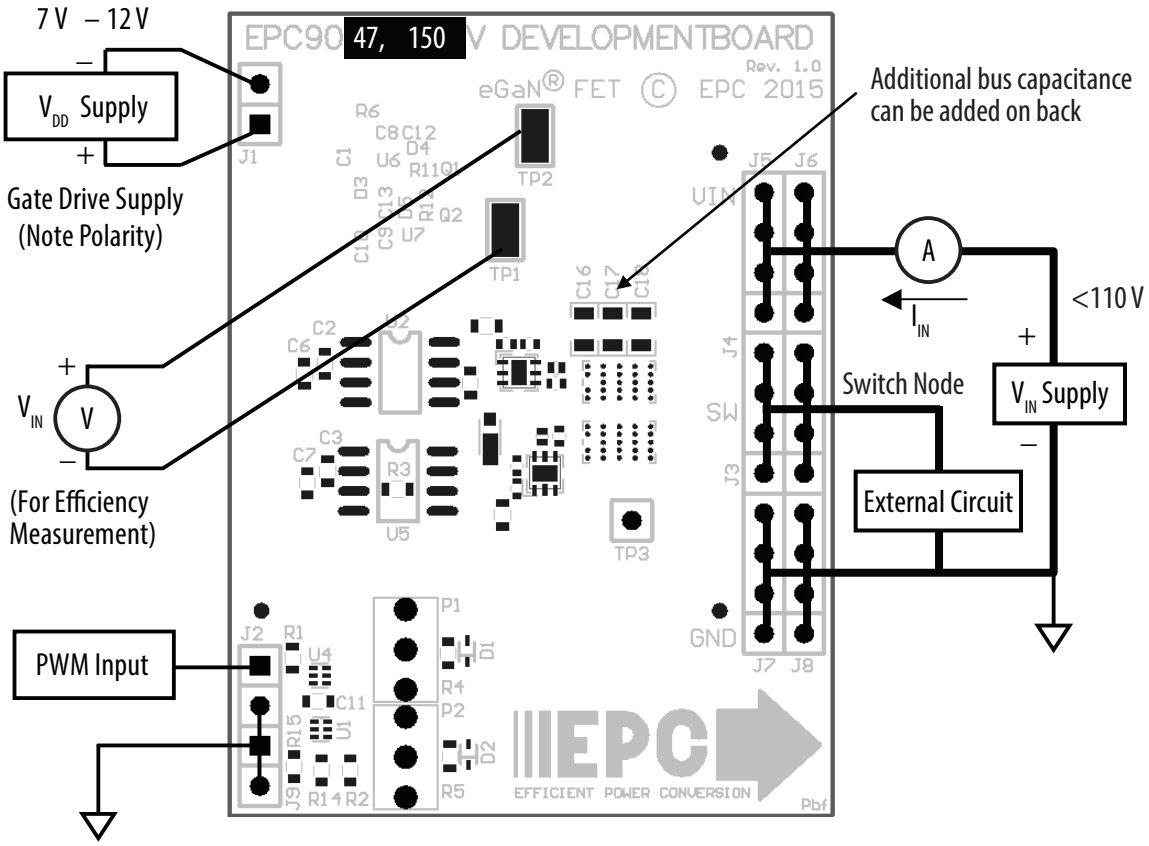

Figure 2: Proper Connection and Measurement Setup

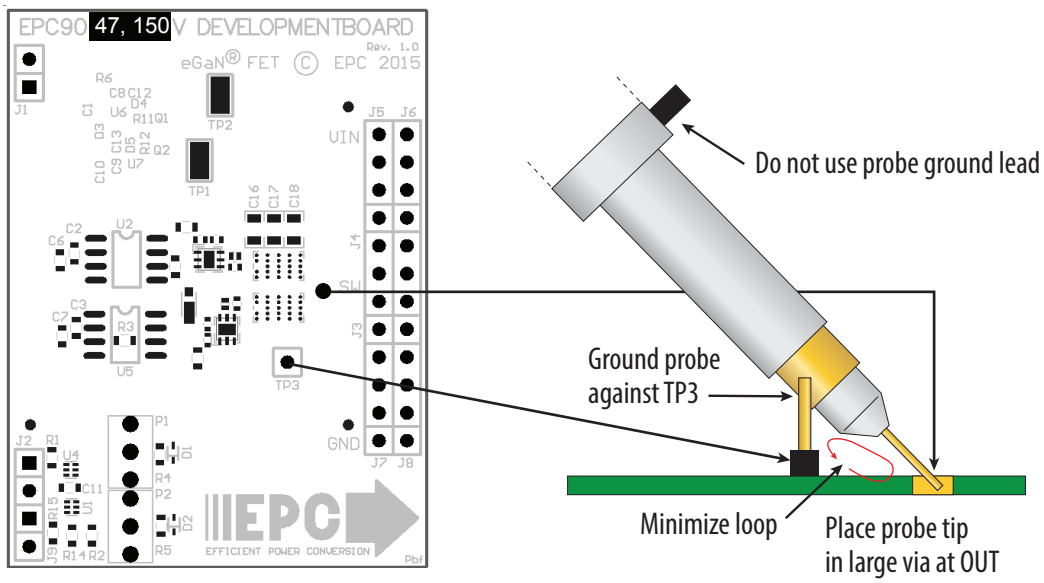

Figure 3: Proper Measurement of Switch Node – OUT

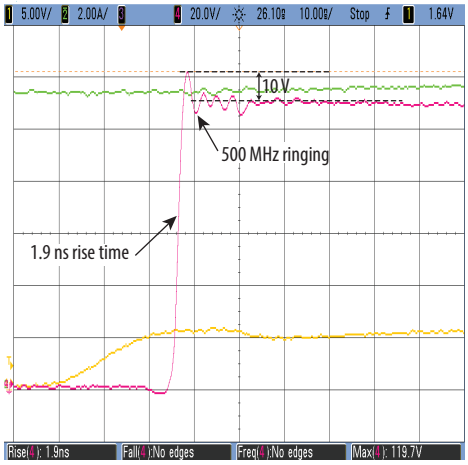

Figure 4 (a) – Rising Edge

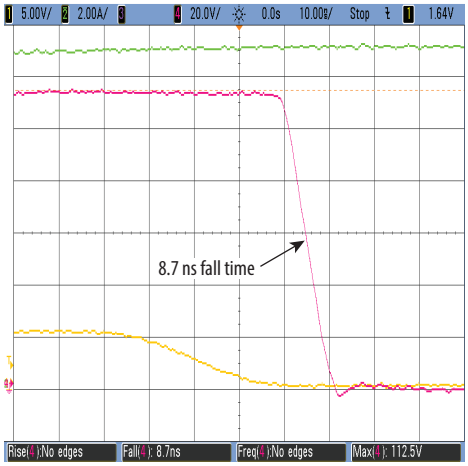

Figure 4 (b) – Falling Edge

Figure 4: Typical Waveforms for EPC9047. V_{IN} = 110 V to 5 V/12 A (100 kHz) Buck converter showing rising and falling edges, CH1: (V_{PWM}) Input logic signal – CH2: (I_{OUT}) Output inductor current – CH4: (V_{OUT}) Switch node voltage

THERMAL PERFORMANCE

The EPC9047 development boards showcase the EPC2033 eGaN FETs. These development boards are 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 150°C.

NOTE. The EPC9047 development boards do not have any current or thermal protection on board.

Table 2: Bill of Materials

Item	Qty	Reference	Part Description	Manufacturer / Part #
1	5	C1, C2, C3, C10, C11	Capacitor, 1 µF, 10%, 25 V, X5R	Murata, GRM188R61E105KA12D
2	2	C6, C7	Capacitor, 100 pF, 5%, 50V, NP0	TDK, C1005X5R1E224K050BC
3	4	C8, C9, C12, C13	Capacitor, 0.22 µF, 10%, 25 V, X5R	TDK, C2012X7T2E104K125AA
4	3	C16, C17, C18	Capacitor, 0.1 µF, 10%, 250 V, X7S	C2012X7T2E104K125AA
5	2	D1, D2	Schottky Diode, 30 V	Diodes Inc., SDM03U40-7
6	1	D3	Diode, 200 V	Diodes Inc.,BAV21WS-7-F
7	2	D4, D5	Diode, 40 V	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	EPC2033
12	1	R1	Resistor, 10.0 K, 5%, 1/8 W	Stackpole, RMCF0603FT10K0
13	2	R11, R12	Resistor, 1 Ohm, 1%, 1/16 W	Stackpole, RMCF0402FT1R00
14	4	R2, R3, R6, R15	Resistor, 0 Ohm, 1/8 W	Stackpole, RMCF0603ZT00R0
15	1	R4	Resistor, 150 Ohm, 1%, 1/8 W	Stackpole, RMCF0603FT150R
16	1	R5	Resistor, 470 Ohm, 1%, 1/8 W	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	R14	Optional resistor	
25	0	U5	Optional I.C.	

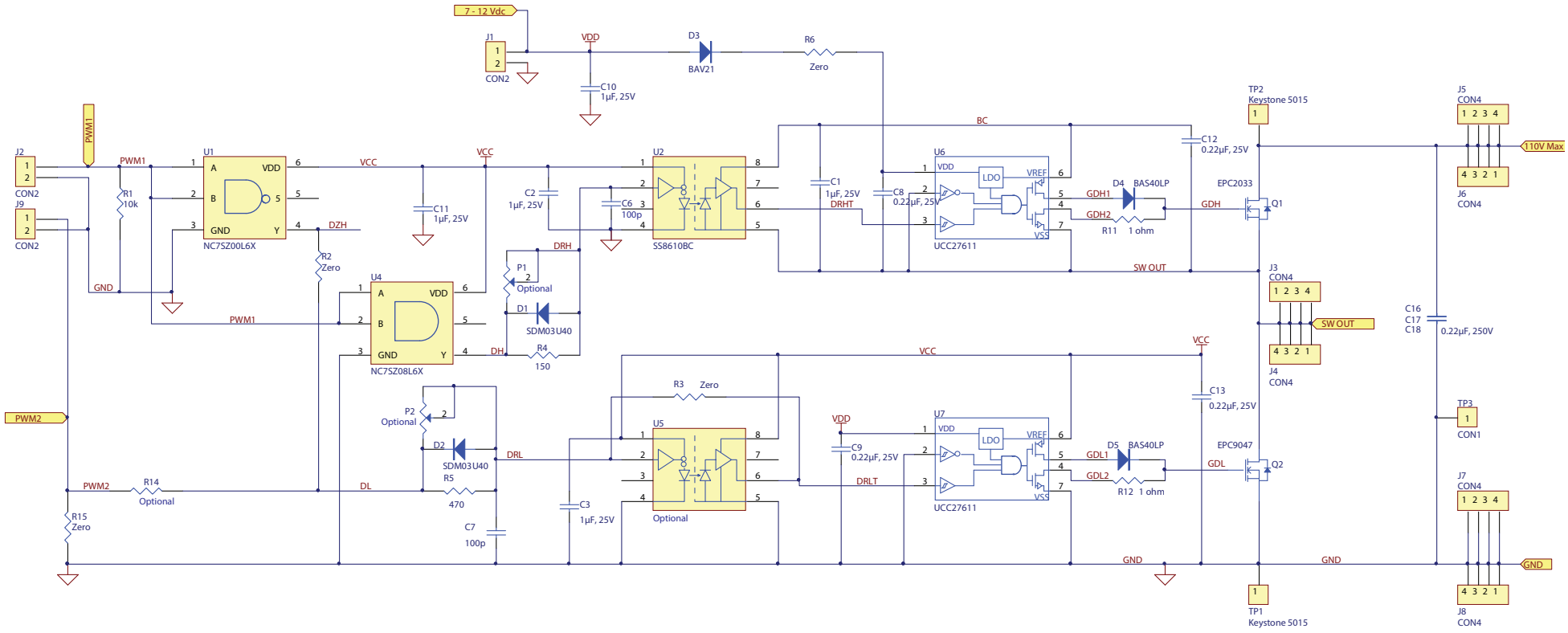

Figure 5: Development Board Schematic