Development Board EPC9038 Quick Start Guide

EPC2102

Monolithic Half-Bridge with Gate Drive

Revision 1.0

EFFICIENT POWER CONVERSION

DESCRIPTION

These development boards are in a monolithic half bridge topology with onboard gate drives, featuring the EPC2102 eGaN*IC* (Enhancement-mode Gallium Nitride Integrated Circuits). The purpose of these development boards is to simplify the evaluation process of these monolithically integrated 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 2" and contains one eGaN*IC* in half bridge configuration using the Texas Instruments LM5113 gate driver, supply and bypass capacitors. The board contains all critical components and layout for optimal switching performance and has additional area to add buck output filter components on board. 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 EPC2102 eGaN*IC*, please refer to the datasheets 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°C) EPC9038

Symbol	Parameter	Conditions	Min	Max	Units
V_{DD}	Gate Drive Input Supply Range		7	12	V
V_{IN}	Bus Input Voltage Range			48*	V
V_{OUT}	Switch Node Output Voltage			60*	V
I_{OUT}	Switch Node Output Current			20**	A
V_{PWM}	PWM Logic Input Voltage Threshold	Input 'High'	3.5	6	V
		Input 'Low'	0	1.5	V
	Minimum 'High' State Input Pulse Width	V_{PWM} rise and fall time < 10ns	50		ns
	Minimum 'Low' State Input Pulse Width	V_{PWM} rise and fall time < 10ns	100#		ns

*Maximum input voltage depends on inductive loading.

** Maximum current depends on die temperature – actual maximum current with be subject to switching frequency, bus voltage and thermal cooling. Symmetrical eGaN intended for 50% duty cycle or low step-down ratio applications.

Limited by time needed to 'refresh' high side bootstrap supply voltage.

SETUP AND OPERATION

The development boards are easy to set up to evaluate the performance of the eGaN*IC*. The board allows the on-board placement of buck output filter components. 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 voltages).
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.

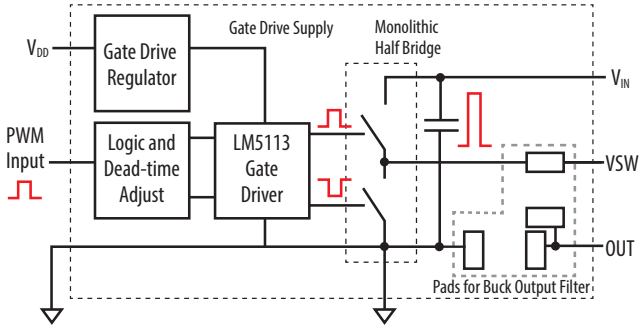

Figure 1: Block Diagram of Development Board

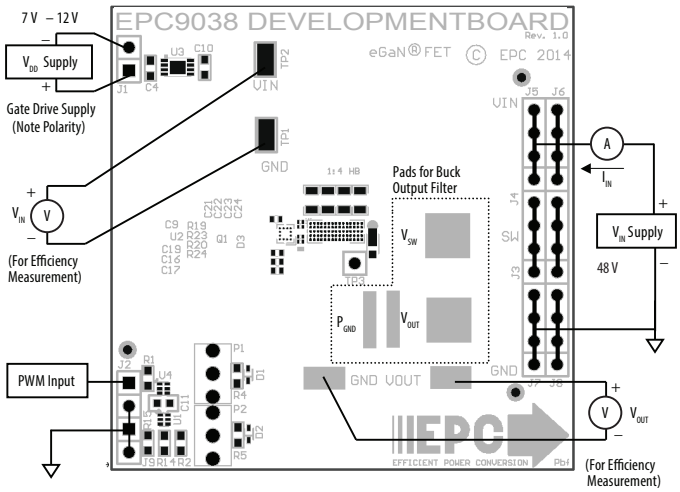

Figure 2: Proper Connection and Measurement Setup

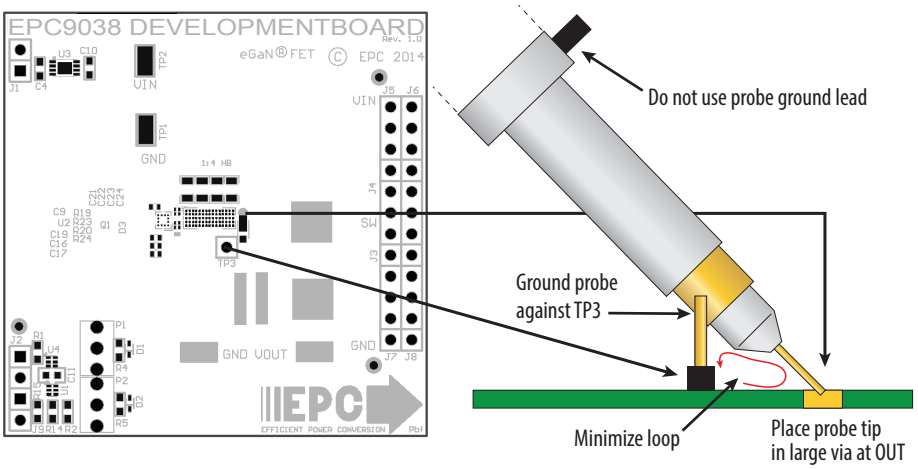

Figure 3: Proper Measurement of Switch Node – OUT

THERMAL CONSIDERATIONS

The EPC9038 development boards showcase the EPC2102 eGaN*IC*. 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. These development boards do not have any current or thermal protection on board.

Table 2: Bill of Material

Item	Qty	Reference	Part Description	Manufacturer / Part#
1	3	C4, C10, C11,	Capacitor, 1 µF, 10%, 25 V, X5R	Murata, GRM188R61E105KA12D
2	2	C16, C17	Capacitor, 100 pF, 5%, 50 V, NP0	Kemet, C0402C101K5GACTU
3	2	C9, C19	Capacitor, 0.1 µF, 10%, 25 V, X5R	TDK, C1005X5R1E104K
4	4	C21, C22, C23, C24	Capacitor - 1 µF, 10%, 100 V, X7S	TDK, CGA4J3X7S2A105K125AE
5	2	D1, D2	Schottky Diode, 30 V	Diodes Inc., SDM03U40-7
6	3	J1, J2, J9	Connector	2 pins of Tyco, 4-103185-0
7	6	J3, J4, J5, J6, J7, J8	Connector	FCI, 68602-224HLF
8	1	Q1	eGaN*IC*	EPC2102
9	1	R1	Resistor, 10.0 k, 5%, 1/8 W	Stackpole, RMCF0603FT10K0
10	2	R2, R15	Resistor, 0 Ω, 1/8 W	Stackpole, RMCF0603ZT0R00
11	1	R4	Resistor, 47 Ω, 1%, 1/8W	Stackpole, RMCF0603FT47R0
12	1	R5	Resistor, - 75 Ω, 1%, 1/8W	Stackpole, RMCF0603FT75R0
13	4	R19, R20, R23, R24	Resistor, 0 Ω, 1/20 W	Panasonic, ERJ-1GE0R00C
14	2	TP1, TP2	Test Point	Keystone Elect, 5015
15	1	TP3	Connector	1/40th of Tyco, 4-103185-0
16	1	U1	I.C., Logic	Fairchild, NC7SZ00L6X
17	1	U2	I.C., Gate driver	Texas Instruments, LM5113
18	1	U3	I.C., Regulator	Microchip, MCP1703T-5002E/MC
19	1	U4	I.C., Logic	Fairchild, NC7SZ08L6X
20	0	R14	Optional Resistor	
21	0	D3	Optional Diode	
22	0	P1, P2	Optional Potentiometer	

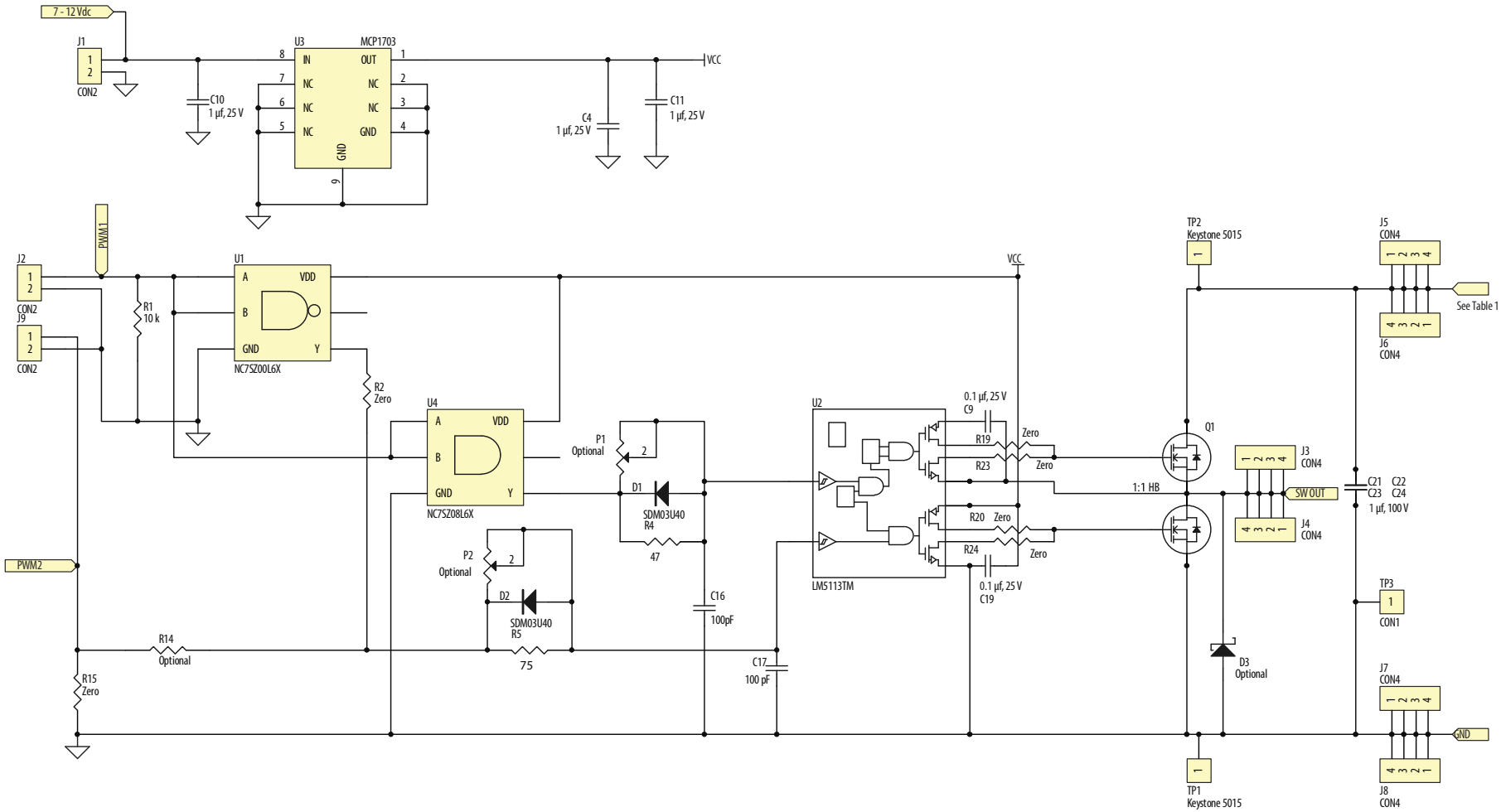

Figure 4: EPC9038 Development Board Schematic