Development Board EPC9079 Quick Start Guide

EPC2046

200 V Half-bridge with Gate Drive, Using EPC2046

EFFICIENT POWER CONVERSION

DESCRIPTION

The EPC9079 development board (figure 1) is a 200 V maximum device voltage, 6 A maximum output current, half bridge with onboard gate drives, featuring two EPC2046 enhancement mode (eGaN®) field effect transistors (FETs). The purpose of this development board is to simplify the evaluation process of the EPC2046 eGaN FETs by including all the critical components on a single board that can be easily connected into any existing converter.

The EPC9079 development board is 1.5" x 2" and contains two EPC2046 eGaN FETs in a half bridge configuration. As supplied, the high side gate drive uses a digital isolator and both FETs use the Texas Instruments UCC27611 gate driver. The board also contains all critical components and layout for optimal switching performance. There are also various probe points to facilitate simple waveform measurement and efficiency calculation, as well as the option to add trimmer resistors for adjustable deadtime, to provide separate high and low side inputs, and to add an isolator for the low side gate drive. A block diagram of the circuit is given in figure 2.

For more information on the EPC2046 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.

QUICK START PROCEDURE

Development board EPC9079 is easy to set up to evaluate the performance of EPC2046 eGaN FETs. Refer to figure 3 for proper connect and measurement setup and follow the procedure below:

1. With power off, connect the input power supply bus to +VIN (J5, J6) and ground / return to –VIN (J7, J8).
2. With power off, connect the switch node (SW) of the half bridge OUT (J3, J4) to your circuit as required (half bridge configuration).
3. With power off, connect the gate drive power supply to +VDD (J1, Pin-1) and ground return to –VDD (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 7.5 V and 12 V range.
6. Turn on the controller / PWM input source.
7. Turn on the bus voltage to the required value (do not exceed the absolute maximum voltage) and probe switching node to see switching operation.
8. Once operational, adjust the PWM control, bus voltage, and load within the operating range and observe the output switching behavior, efficiency and other parameters.
9. For shutdown, please follow steps in reverse.

Table 1: Performance Summary (T_A = 25°C) EPC9079

Symbol	Parameter	Conditions	Min	Max	Units
V_{DD}	Gate Drive Input Supply Range		7.5	12	V
V_{IN}	Bus Input Voltage Range(1)			160	V
I_{OUT}	Switch Node Output Current (2)			6	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	50		ns
	Minimum 'Low' State Input Pulse Width (3)	V_{PWM} rise and fall time < 10ns	50		ns

(1) Maximum input voltage depends on inductive loading, maximum switch node ringing must be kept under 200 V for EPC2046.
(2) Maximum current depends on die temperature – actual maximum current with be subject to switching frequency, bus voltage and thermal cooling.
(3) Limited by time needed to 'refresh' high side bootstrap supply voltage.

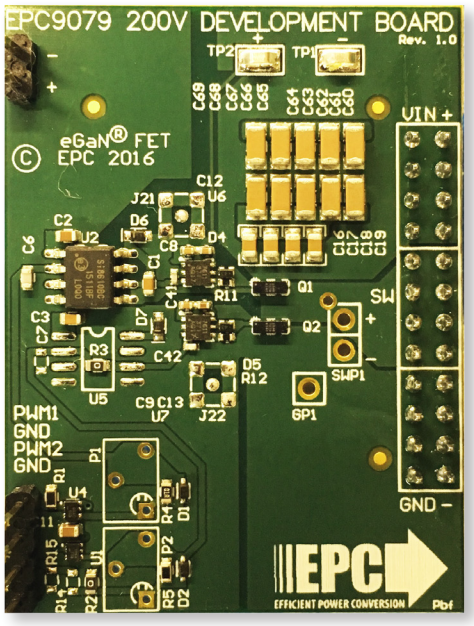


Figure 1: EPC9079 development board

NOTE. When measuring the high frequency content switch node, care must be taken to provide an accurate high speed measurement. An optional two pin header (SWP1) is included for switch node measurement. It is recommended to install measurement point on backside of board to prevent contamination of the top side components.

For information about measurement techniques, please review the how to GaN series: HTG09- Measurement

http://epc-co.com/epc/DesignSupport/TrainingVideos/HowtoGaN/

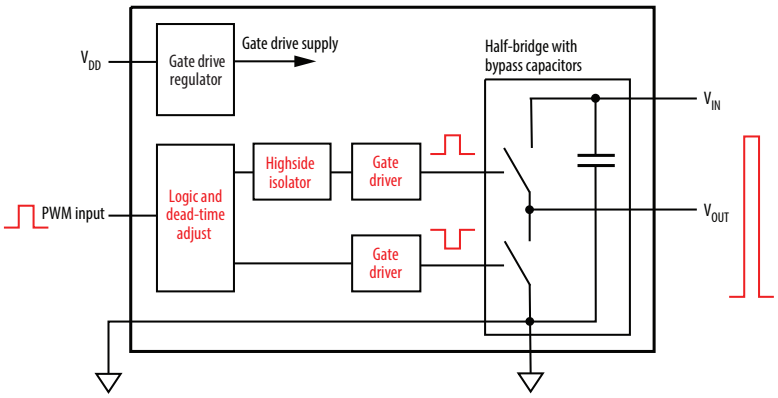


Figure 2: Block diagram of EPC9079 development board.

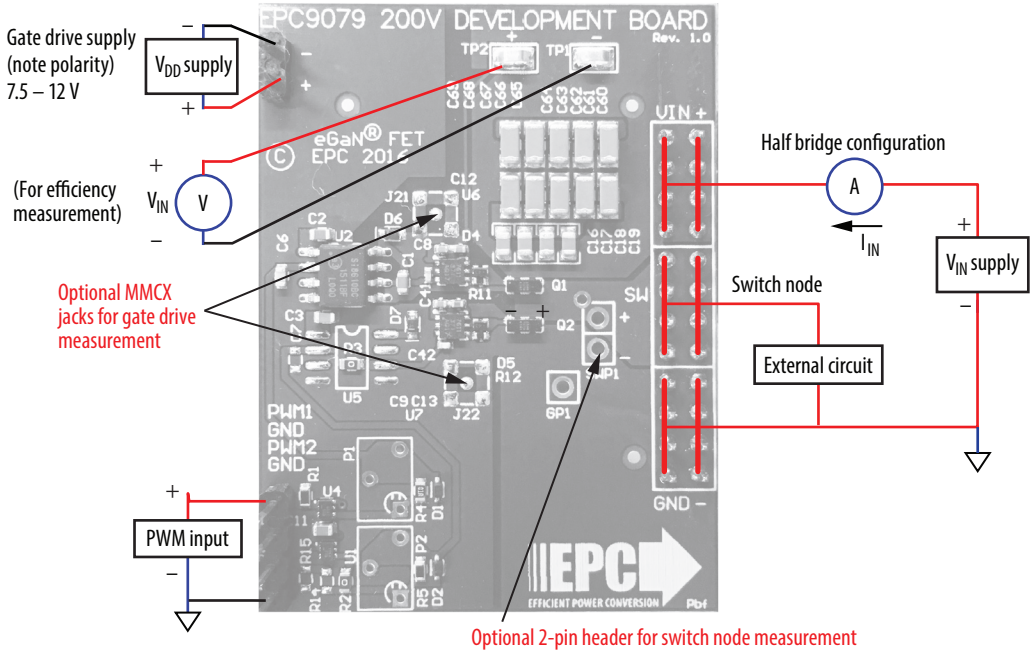


Figure 3: Proper connection and measurement setup.

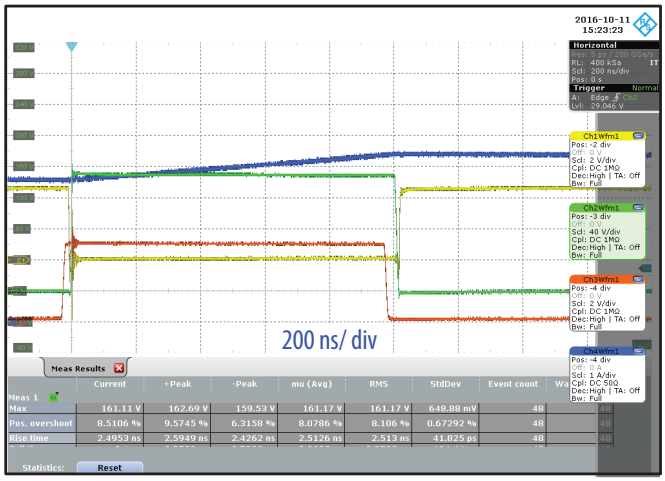


Figure 4: Typical Waveform for V_{IN} = 150 V to 15 V_{OUT}, 5 A, (100 kHz) buck converter.

THERMAL CONSIDERATIONS

The EPC9079 development board showcases the EPC2046 eGaN FET. The EPC9079 is intended for bench evaluation with typical room ambient temperature. The addition of heat-sinking and forced air cooling can significantly increase the current capability of these devices, but care must be taken to not exceed the absolute maximum die temperature of 150° C.

NOTE. The EPC9079 development board does not have any current or thermal protection on board.

For more information regarding the thermal performance of EPC eGaN FETs, please consult:

D. Reusch and J. Glaser, *DC-DC Converter Handbook*, a supplement to *GaN Transistors for Efficient Power Conversion*, First Edition, Power Conversion Publications, 2015.

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	1	C6	Capacitor, 100 pF, 5%, 50 V, NP0	TDK, CGA3E2C0G1H101J080AA
3	4	C8, C9, C12, C13	Capacitor, 0.22 µF, 16%, 25 V, X7R	TDK, C1005X7R1C224K050BC
4	4	C16, C17, C18, C19	Capacitor, 0.1 µF, 10%, 250 V, X7T	TDK, C2012X7T2E104K125AA
5	1	C41	Capacitor, 10 pF, 5%, 50 V, NP0	Kemet, C0402C100J5GACTU
6	1	C42	Capacitor, 100 pF, 5%, 50 V, NP0	TDK, C1005C0G1H101J050BA
7	10	C60, C61, C62, C63, C64, C65, C66, C67, C68, C69	Capacitor, 0.22 µF, 10%, 250 V, X7T	TDK, C3216X7T2E224K160AA
8	2	D1, D2	Schottky Diode, 30 V, 30 mA	Diodes Inc., SDM03U40-7
9	1	D3	Diode, 200 V, 1 A	Diodes Inc., DFLS1200
10	2	D4, D5	Diode, 40 V, 200 mA	Diodes Inc., BAS40LP-7
11	2	D6, D7	Diode, 5.61 V, 500 mW	On Semiconductor, MM5Z5V6ST1G
12	3	FD1, FD2, FD3	SML Fiductial	N/A
13	1	GP1	Connector, .1" Male Vert.	Wurth, 61300111121
14	2	J1, SWP1	Connector, .1" Male Vert.	Wurth, 61300211121
15	1	J2	Connector, .1" Male Vert.	4 pins of Tyco, 4-103185-0-04
16	1	J3, J4, J5, J6, J7, J8	Connector, .1" Male Vert.	4 pins of FCI, 68602-224HLF
17	2	J21, J22	Connector, MMCX SMD	Molex, 0734152063
18	2	Q1, Q2	eGaN® FET, 200 V, 25 mΩ	EPC, EPC2046
19	1	R1	Resistor, 10.0 K, 1%, 1/10 W	Stackpole, RMCF0603FT10K0
20	2	R2, R3	Resistor, 0 Ω, 1/10 W	Panasonic, ERJ-3GEY0R00V
21	1	R4	Resistor, 100 Ω, 1%, 1/10 W	Stackpole, RMCF0603FT100R
22	1	R5	Resistor, 470 Ω, 1%, 1/10 W	Stackpole, RMCF0603FT470R
23	4	R6	Resistor, 0 Ω, 1/10 W	Panasonic, ERJ-2GE0R00X
24	2	R11, R12	Resistor, 1 Ω, 1%, 1/16 W	Stackpole, RMCF0402FT1R00
25	2	R21, R22	Resistor, 0 Ω, 1/16 W	Stackpole, RMCF0402ZT0R00
26	2	TP1, TP2	Test Point	Keystone Elect, 5015
27	1	U1	IC, Logic	Fairchild, NC7SZ00L6X
28	1	U2	IC, Opto-coupler	Silicon Labs, Si8610BC
29	1	U4	IC, Logic	Fairchild, NC7SZ08L6X
30	2	U6, U7	IC, Gate driver	Texas Instruments, UCC27611
31	0	P1, P2	Optional potentiometer	
32	0	R14, R15	Optional resistor	
33	0	U5	Optional IC	

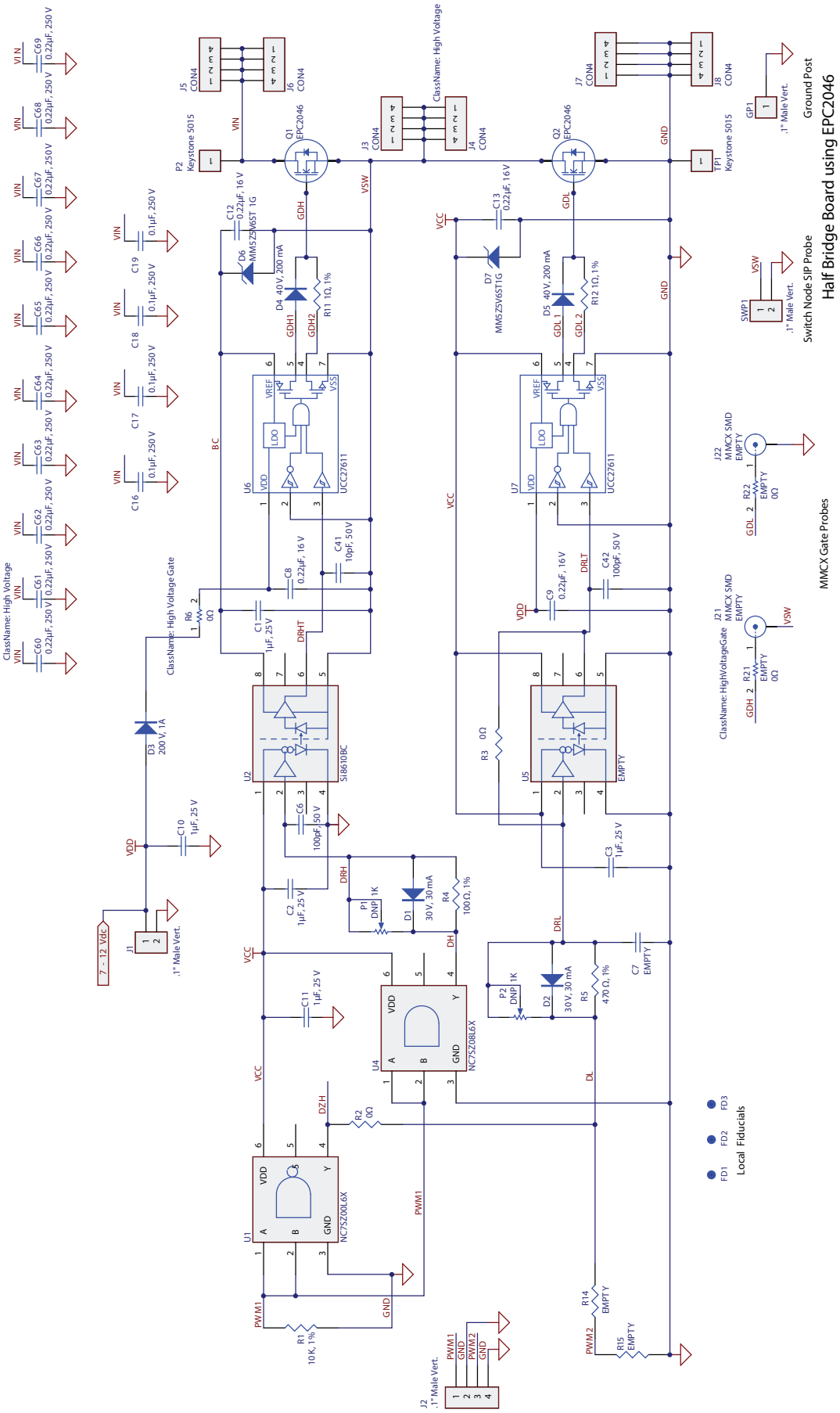


Figure 5: EPC9079 - Schematic

For More Information:

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or your local sales representative

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Demonstration Board Notification

The EPC9079 board is intended for product evaluation purposes only and is not intended for commercial use. Replace components on the Evaluation Board only with those parts shown on the parts list (or Bill of Materials) in the Quick Start Guide. Contact an authorized EPC representative with any questions.

This board is intended to be used by certified professionals, in a lab environment, following proper safety procedures. Use at your own risk.

As an evaluation tool, this board 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.

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