

# Development Boards EPC9031 Quick Start Guide

*Half-Bridge with Gate Drive for EPC2023*

Revision 1.0



**DESCRIPTION**

These development boards are in a half-bridge topology with onboard gate drives, featuring the EPC2023 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 LM5113 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 EPC2023 eGaN FETs, please refer to the datasheets available from EPC at [www.epc-co.com](http://www.epc-co.com). The datasheet should be read in conjunction with this quick start guide.

**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<sub>IN</sub> (J5, J6) and ground / return to -V<sub>IN</sub> (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<sub>DD</sub> (J1, Pin-1) and ground return to -V<sub>DD</sub> (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 on V<sub>OUT</sub>).
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.

**Table 1: Performance Summary (T<sub>A</sub> = 25°C) EPC9031**

Symbol	Parameter	Conditions	Min	Max	Units
V <sub>DD</sub>	Gate Drive Input Supply Range		7	12	V
V <sub>IN</sub>	Bus Input Voltage Range			24 <sup>(1)</sup>	V
V <sub>OUT</sub>	Switch Node Output Voltage			30	V
I <sub>OUT</sub>	Switch Node Output Current			40 <sup>(1)</sup>	A
V <sub>PWM</sub>	PWM Logic Input Voltage Threshold	Input 'Low' Input 'High'	3.5 0	6 1.5	V V
	Minimum "High" State Input Pulse Width	V <sub>PWM</sub> rise and fall time < 10ns	50		ns
	Minimum "Low" State Input Pulse Width	V <sub>PWM</sub> rise and fall time < 10ns	100 <sup>(2)</sup>		ns

(1) Assumes inductive load, maximum current depends on die temperature – actual maximum current with be subject to switching frequency, bus voltage and thermal cooling.  
 (2) Limited by time needed to 'refresh' high side bootstrap supply voltage.

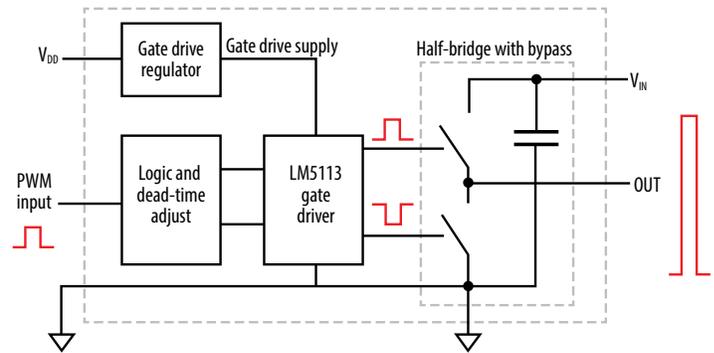


Figure 1: Block diagram of development board.

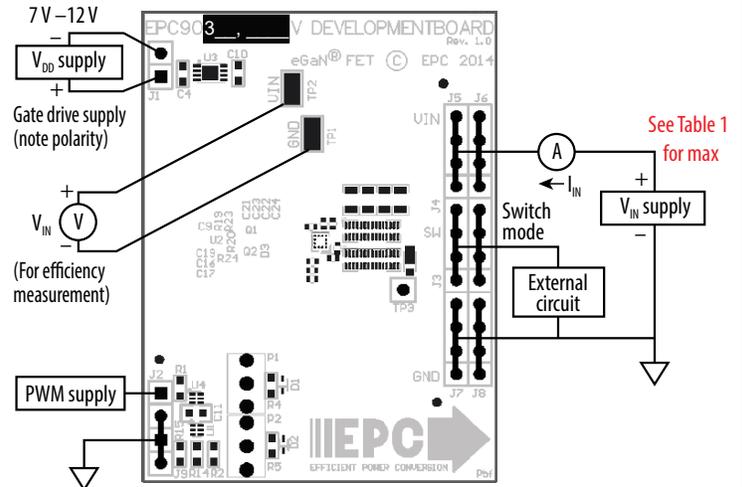


Figure 2: Proper connection and measurement setup.

## THERMAL CONSIDERATIONS

The EPC9031 development boards showcase the EPC2023 eGaN FETs. Although the electrical performance surpasses that for traditional Si devices, their relatively smaller size does magnify the thermal management requirements. 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 EPC9031 development boards do not have any current or thermal protection on board.

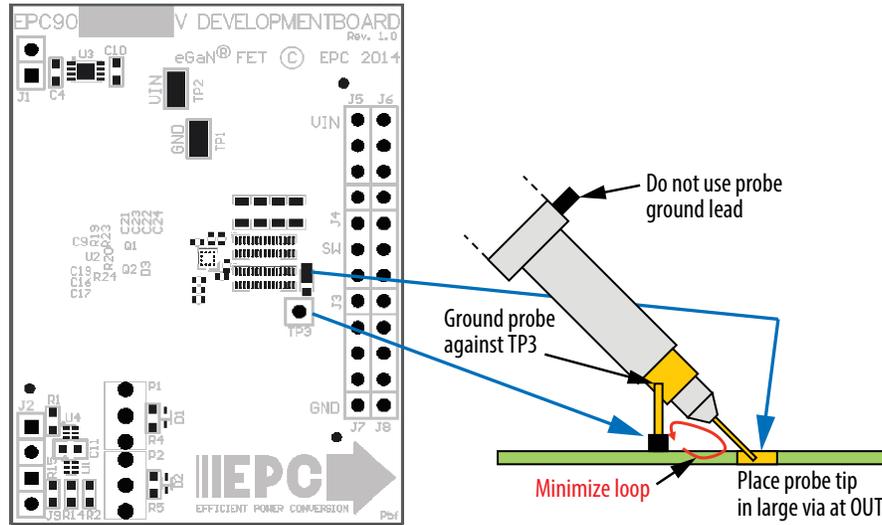


Figure 3: Proper measurement of switch node – OUT.

Table 2 : Bill of Material

Item	Qty	Reference	Part Description	Manufacturer / Part #
1	3	C4, C10, C11	Capacitor, 1 $\mu$ F, 10%, 25 V, X5R	Murata, GRM188R61E105KA12D
2	2	C16, C17	Capacitor, 100 pF, 5%, 50 V, NPO	Kemet, C0402C101K5GACTU
3	2	C9, C19	Capacitor, 0.1 $\mu$ F, 10%, 25 V, X5R	TDK, C1005X5R1E104K
4	4	C21, C22, C23, C24	Capacitor, 4.7 $\mu$ F, 10%, 50 V, X5R	TDK, C2012X5R1H475K125AB
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	1	J3, J4, J5, J6, J7, J8	Connector	FCI, 68602-224HLF
8	2	Q1, Q2	eGaN <sup>®</sup> FET 30 V, 1.45 m $\Omega$	EPC2023
9	1	R1	Resistor, 10.0 k, 5%, 1/8 W	Stackpole, RMCFO603FT10K0
10	2	R2, R15	Resistor, 0 $\Omega$ , 1/8 W	Stackpole, RMCFO603ZT0R00
11	1	R4	Resistor, 10 $\Omega$ , 1%, 1/8 W	Stackpole, RMCFO603FT10R0
12	1	R5	Resistor, 47 $\Omega$ , 1%, 1/8W	Stackpole, RMCFO603FT47R0
13	2	R19, R20	Resistor, 0 $\Omega$ , 1/16 W	Stackpole, RMCFO402ZT0R00
14	2	R23, R24	Resistor, 0 $\Omega$ , 1/16 W	Stackpole, RMCFO402ZT0R00
15	2	TP1, TP2	Test point	Keystone Elect, 5015
16	1	TP3	Connector	1/40th of Tyco, 4-103185-0
17	1	U1	I.C., logic	Fairchild, NC7SZ00L6X
18	1	U2	I.C., gate driver	Texas Instruments, LM5113
19	1	U3	I.C., Regulator	Microchip, MCP1703T-5002E/MC
20	1	U4	I.C., Logic	Fairchild, NC7SZ08L6X
21	0	R14	Optional resistor	
22	0	D3	Optional diode	
23	0	P1, P2	Optional potentiometer	

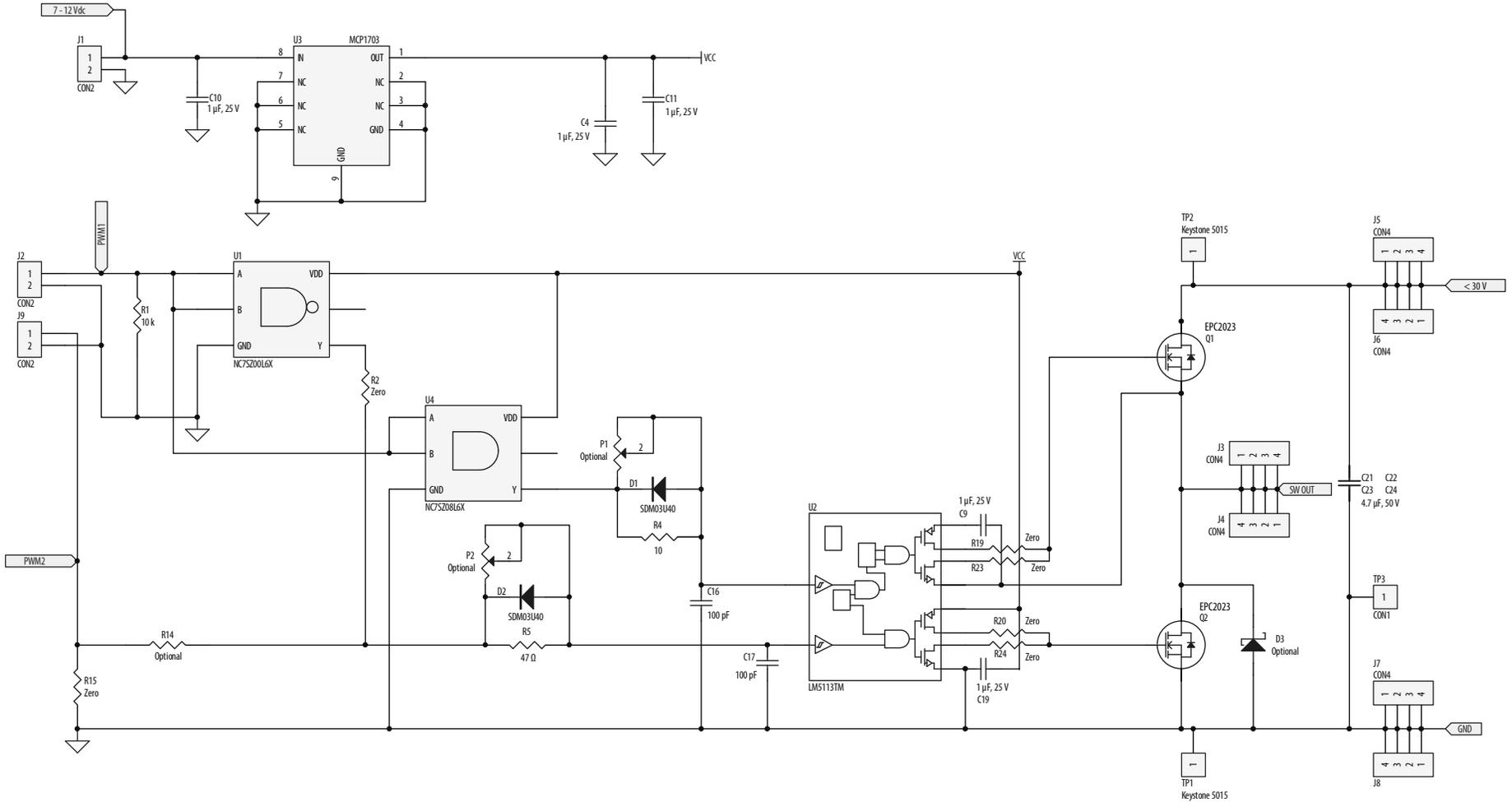


Figure 4: Development board schematic .

## For More Information:

Please contact [info@epc-co.com](mailto:info@epc-co.com)  
or your local sales representative

Visit our website:  
[www.epc-co.com](http://www.epc-co.com)

Sign-up to receive  
EPC updates at  
[bit.ly/EPCupdates](http://bit.ly/EPCupdates)  
or text "EPC" to 22828



EPC Products are distributed through Digi-Key.  
[www.digikey.com](http://www.digikey.com)

### Demonstration Board Notification

**The EPC9031 board is intended for product evaluation purposes only. It is not intended for commercial use nor is it FCC approved for resale.** 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.

The Evaluation board (or kit) is for demonstration purposes only and neither the Board nor this Quick Start Guide constitute a sales contract or create any kind of warranty, whether express or implied, as to the applications or products involved.

Disclaimer: EPC reserves the right at any time, without notice, to make changes to any products described herein to improve reliability, function, or design. EPC does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights, or other intellectual property whatsoever, nor the rights of others.