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Development Board EPC9013

Quick Start Guide

EPC2001C

100 V Parallel Evaluation for High Current Applications



DESCRIPTION

www.epc-co.com

The EPC9013 development board features the 100 V EPC2001C enhancement mode (*eGaN*[®]) field effect transistor (FET) operating up to a 35 A maximum output current with four half bridges in parallel and a single onboard gate drive. The purpose of this development board is to simplify the evaluation process of the EPC2001C *eGaN* FET for high current operation by including all the critical components on a single board that can be easily connected into any existing converter.

The EPC9013 development board is 2" x 2" and features eight EPC2001C *eGaN* FETs using the Texas Instruments LM5113 gate

driver. The development board configuration is recommended for high current applications. The board contains all critical components and the printed circuit board (PCB) layout is designed for optimal switching performance. There are also various probe points to facilitate simple waveform measurement and evaluate *eGaN* FET efficiency. A complete block diagram of the circuit is given in Figure 1.

For more information on the EPC2001s *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 (TA = 25°C)

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNITS
V _{DD}	Gate Drive Input Supply Range		7	12	V
V _{IN}	Bus Input Voltage Range			70*	V
V _{OUT}	Switch Node Output Voltage			100	V
I _{OUT}	Switch Node Output Current	200 LFM		35*	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	60		ns
	Minimum 'Low' State Input Pulse Width	V _{PWM} rise and fall time < 10ns	100†		ns

* Assumes inductive load, maximum current depends on die temperature – actual maximum current will be subject to switching frequency, bus voltage and thermals.

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

Quick Start Procedure

Development board EP913 is easy to set up to evaluate the performance of the EP2010 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_{GD} (J1, Pin-1) and ground return to -V_{GD} (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 100 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 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.

THERMAL CONSIDERATIONS

The EP913 development board showcases the EP2010 eGAN FET. Although the electrical performance surpasses that for traditional silicon devices, their relatively smaller size does magnify the thermal management requirements. The EP913 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 EP913 development board does not have any current or thermal protection on board.

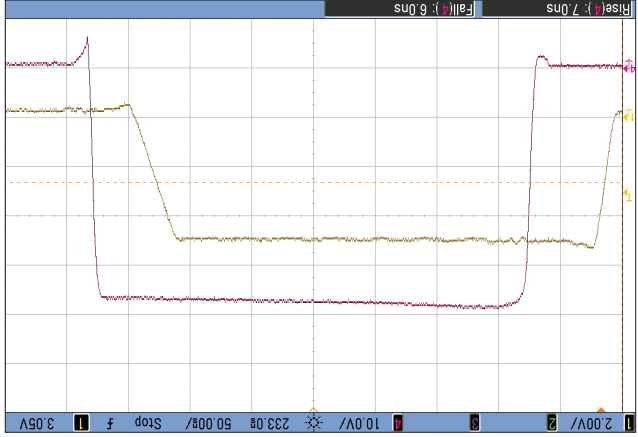


Figure 4: Typical Waveforms for $V_{in} = 48\text{ V}$ to $5\text{ V}/35\text{ A}$ (300 kHz) Buck converter
 CH1: PWM input voltage (V_{PWM}) – CH4: Switch node voltage (V_{SW})

Figure 1: Block Diagram of EPC913 Development Board

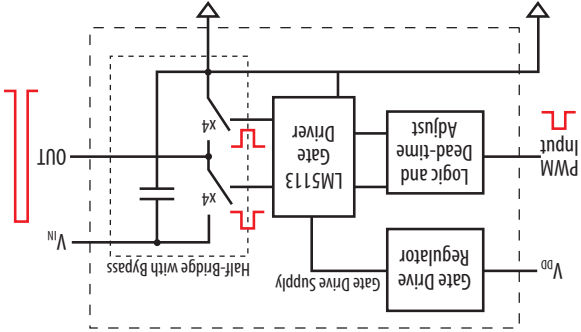


Figure 2: Proper Connection and Measurement Setup

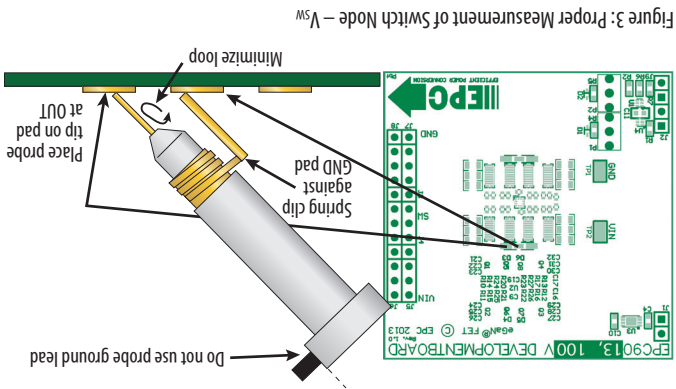
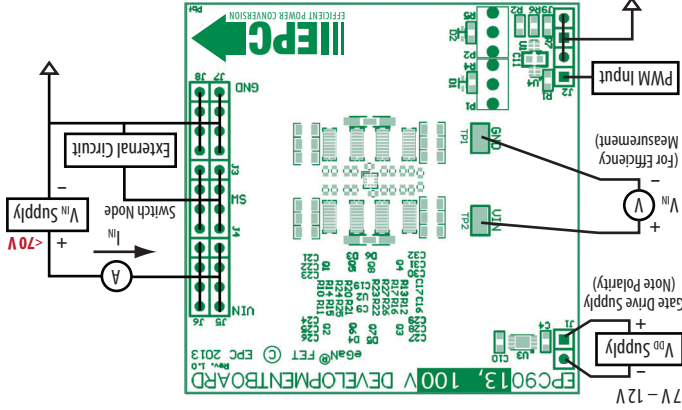


Figure 3: Proper Measurement of Switch Node – V_{SW}

Table 2 : Bill of Material

Item	Qty	Reference	Part Description	Manufacturer / Part #
1	3	C4, C10, C11	Capacitor, 1uF, 10%, 25V, X5R	Murata, GRM188R61E105KA12D
2	2	C16, C17	Capacitor, 100pF, 5%, 50V, NP0	Kemet, C0402C101K5GACTU
3	2	C9, C19	Capacitor, 0.1uF, 10%, 25V, X5R	TDK, C1005X5R1E104K
4	12	C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32	Capacitor, 1uF, 10%, 100V, X7R	TDK, CGA4J3X7S2A105K125AE
5	2	D1, D2	Schottky Diode, 30V	Diodes Inc., SDM03U40-7
6	3	J1, J2, J9	Connector	2pins of Tyco, 4-103185-0
7	6	J3, J4, J5, J6, J7, J8	Connector	FCI, 68602-224HLF
8	8	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8	eGaN® FET	EPC, EPC2001C
9	1	R1	Resistor, 10.0K, 5%, 1/8W	Stackpole, RMCF0603FT10K0
10	2	R2, R7	Resistor, 0 Ohm, 1/8W	Stackpole, RMCF0603ZT0R00
11	1	R4	Resistor, 100 Ohm, 1%, 1/8W	Stackpole, RMCF0603FT100R
12	1	R5	Resistor, 220 Ohm, 1%, 1/8W	Stackpole, RMCF0603FT220R
13	8	R10, R11, R12, R13, R20, R21, R22, R23	Resistor, 4.7 Ohm, 1%, 1/16W	
14	8	R14, R15, R16, R17, R24, R25, R26, R27	Resistor, 2.0 Ohm, 1%, 1/16W	
15	2	TP1, TP2	Test Point	Keystone Elect, 5015
16	1	U1	I.C., Logic	Fairchild, NC7SZ00L6X
17	1	U2	I.C., Gate driver	Texas Instruments, LM5113TM
18	1	U3	I.C., Regulator	Microchip, MCP1703T-5002E/MC
19	1	U4	I.C., Logic	Fairchild, NC7SZ08L6X
20	1	R6	Optional Resistor	
21	1	D3, D4, D5, D6	Optional Diode	
22	0	P1, P2	Optional Potentiometer	

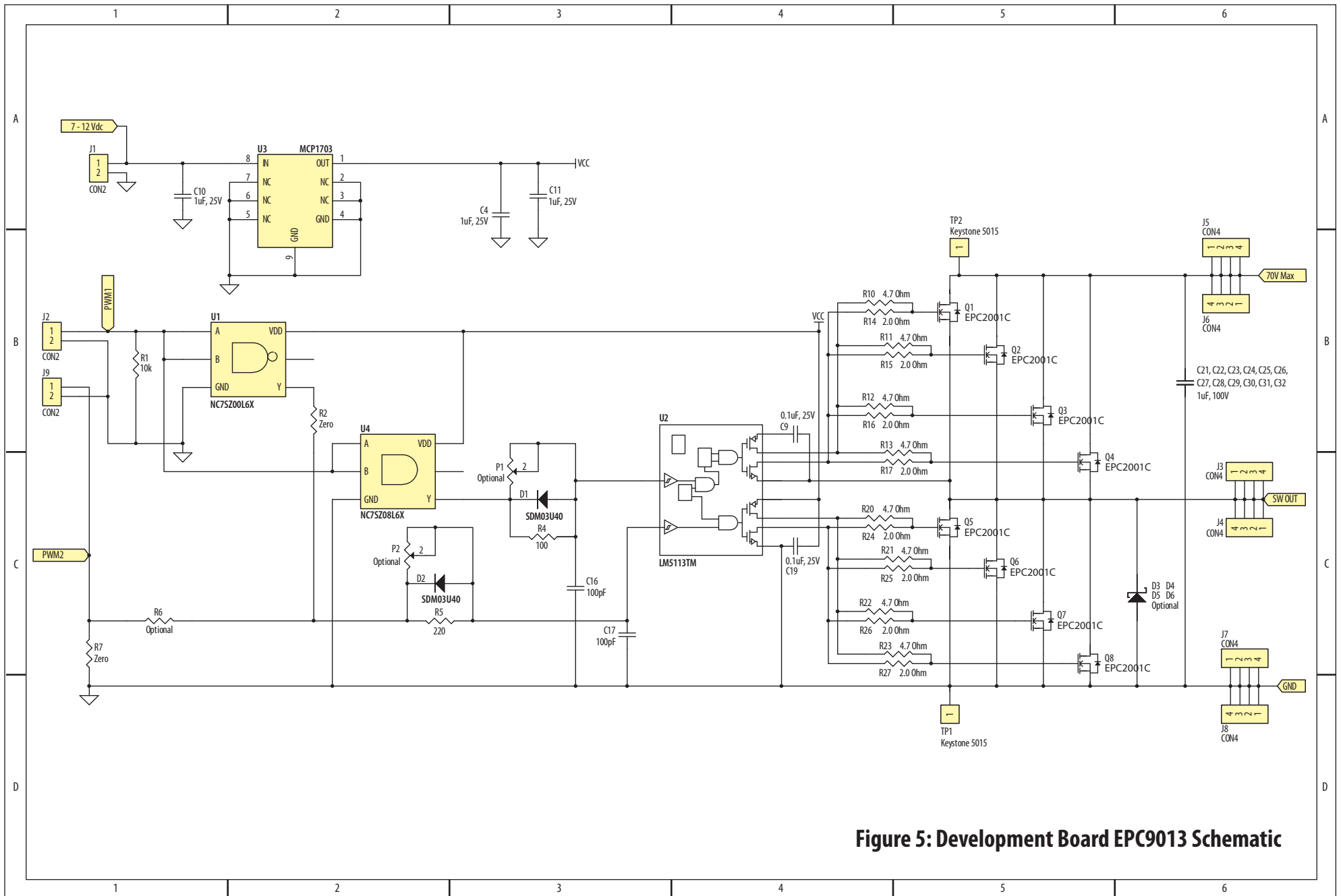


Figure 5: Development Board EPC9013 Schematic

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