

# Development Board EPC9001

## Quick Start Guide

*40 V Half-Bridge with Gate Drive, Using EPC2015*



## DESCRIPTION

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

The EPC9001 development board is a 40 V maximum device voltage, 15 A maximum output current, half bridge with onboard gate drives, featuring the EPC2015 enhancement mode (eGaN®) field effect transistor (FET). The purpose of this development board is to simplify the evaluation process of the EPC2015 eGaN FET by including all the critical components on a single board that can be easily connected into any existing converter.

The EPC9001 development board is 2" x 1.5" and contains not only two EPC2015 eGaN FET 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 EPC2015s eGaN FET please refer to the datasheet 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.

**Table 1: Performance Summary (TA = 25°C)**

| 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                |                                            |      | 28* | V     |
| V <sub>OUT</sub> | Switch Node Output Voltage             |                                            |      | 40  | V     |
| I <sub>OUT</sub> | Switch Node Output Current             |                                            |      | 15* | A     |
| V <sub>PWM</sub> | PWM Logic Input Voltage Threshold      | Input 'High'                               | 3.5  | 6   | V     |
|                  |                                        | Input 'Low'                                | 0    | 1.5 | V     |
|                  | Minimum 'High' State Input Pulse Width | V <sub>PWM</sub> rise and fall time < 10ns | 60   |     | ns    |
|                  | Minimum 'Low' State Input Pulse Width  | V <sub>PWM</sub> rise and fall time < 10ns | 200# |     | 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 EPC9001 is easy to set up to evaluate the performance of the EPC2015 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 40 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.

**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.

### THERMAL CONSIDERATIONS

The EPC9001 development board showcases the EPC2015 eGaN FET. Although the electrical performance surpasses that for traditional silicon devices, their relatively smaller size does magnify the thermal management requirements. The EPC9001 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 EPC9001 development board does not have any current or thermal protection on board.

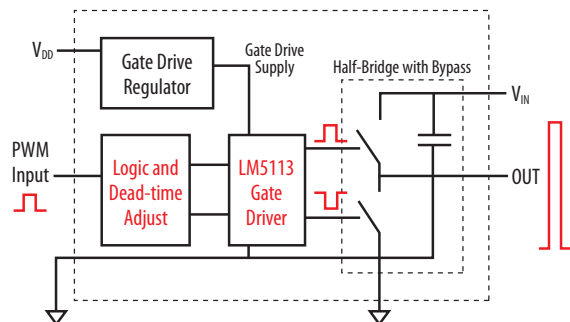


Figure 1: Block Diagram of EPC9001 Development Board

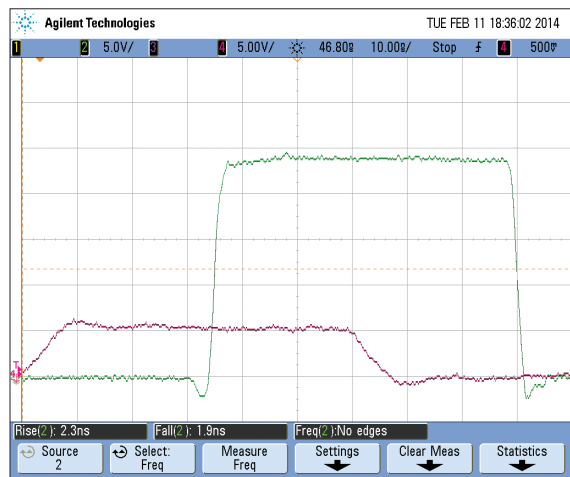


Figure 4: Typical Waveforms for  $V_{IN} = 24V$  to  $1.2V/15A$  (500kHz) Buck converter  
CH1:  $V_{PWM}$  Input voltage – CH3: ( $I_{SW}$ ) Switch node current – CH4: ( $V_{OUT}$ ) Switch node voltage

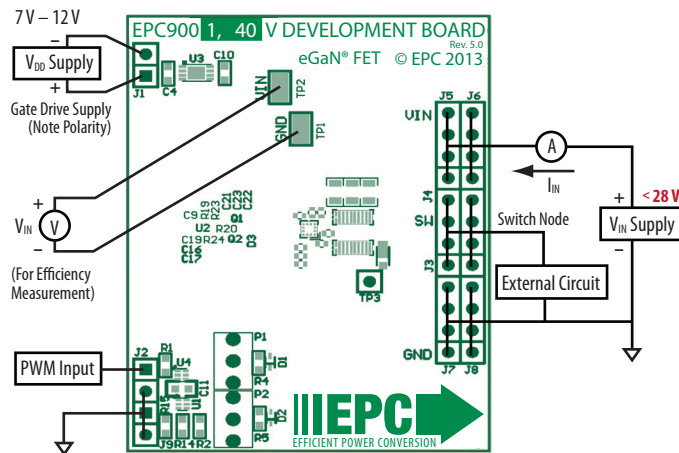


Figure 2: Proper Connection and Measurement Setup

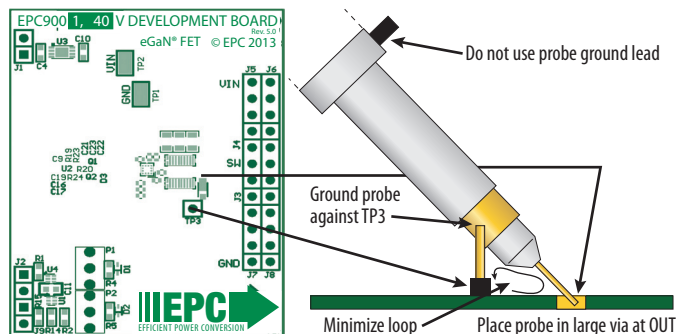
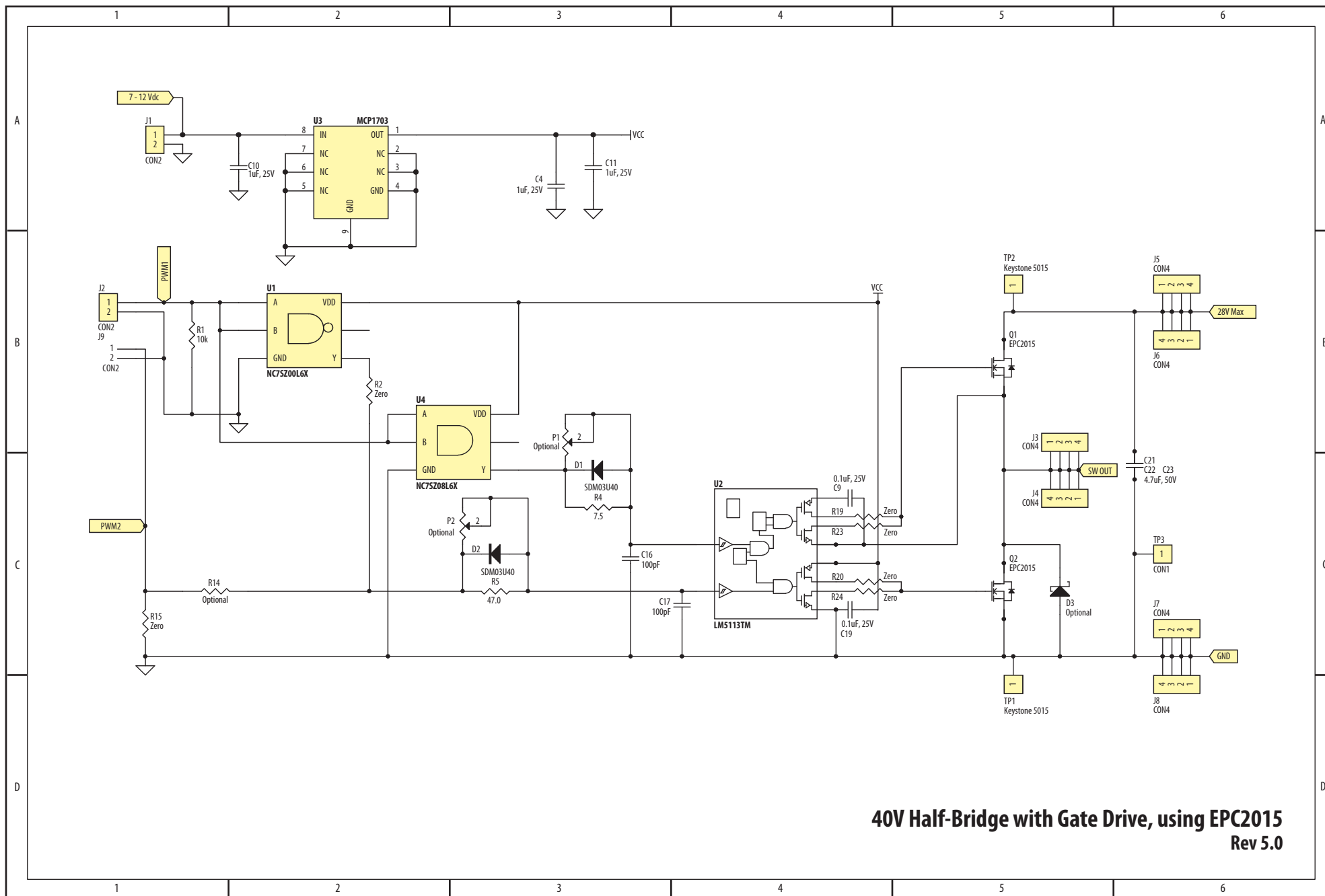


Figure 3: Proper Measurement of Switch Node – OUT

**Table 2 : Bill of Material**

| Item | Qty | Reference              | Part Description                | Manufacturer / Part #        |
|------|-----|------------------------|---------------------------------|------------------------------|
| 1    | 3   | C4, C10, C11,          | Capacitor, 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    | 3   | C21, C22, C23          | Capacitor, 4.7uF, 10%, 50V, X5R | TDK, C2012X5R1H475K125AB     |
| 5    | 2   | D1, D2                 | Schottky Diode, 30V             | Diodes Inc., SDM03U40-7      |
| 6    | 3   | J1, J2, J9             | Connector                       | 2pins of Tyco, 4-103185-0    |
| 7    | 1   | J3, J4, J5, J6, J7, J8 | Connector                       | FCI, 68602-224HLF            |
| 8    | 2   | Q1, Q2                 | eGaN® FET                       | EPC, EPC2015                 |
| 9    | 1   | R1                     | Resistor, 10.0K, 5%, 1/8W       | Stackpole, RMCFF0603FT10K0   |
| 10   | 2   | R2, R15                | Resistor, 0 Ohm, 1/8W           | Stackpole, RMCFF0603ZT0R00   |
| 11   | 1   | R4                     | Resistor, 7.5 Ohm, 1%, 1/8W     | Stackpole, RMCFF0603FT7R50   |
| 12   | 1   | R5                     | Resistor, 47 Ohm, 1%, 1/8W      | Stackpole, RMCFF0603FT47R0   |
| 13   | 4   | R19, R20, R23, R24     | Resistor, 0 Ohm, 1/16W          | Stackpole, RMCFF0402ZT0R00   |
| 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, LM5113TME |
| 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          |                              |



## For More Information:

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