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# Enpirion EN5335QI 3A DCDC Converter w/Integrated Inductor Evaluation Board

## Introduction

Thank you for choosing Altera Enpirion power products!

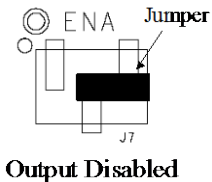
You are evaluating a complete power system on silicon:

- The EN5335QI features integrated inductor, power MOSFETS, Gate Drive, Compensation Network, and controller and protection circuitry. This level of integration delivers a substantial reduction in footprint and part count over competing solutions.
- The EN5335QI features a 3 pin VID output voltage selector and requires only ceramic input and output capacitors, and a small capacitor for soft-start programming. The 3 pin VID allows the user to choose from one of seven predefined output voltage settings.
- The input capacitor is a 10V rated 22uF X5R MLCC and the output capacitor is a 6.3V rated 47uF X5R MLCC. The Soft-start capacitor is a small 10V rated 15nF X5R MLCC.
- Pads are available to add up to one additional input capacitor and up to four additional output capacitors to allow for evaluation of performance over a wide range of input/output capacitor combinations.
- Easy jumpers are provided for the following signals:
  - Enable
  - VS0-VS2 output voltage select
- Numerous test points are provided as well as clip leads for input and output connections
- The board comes with input decoupling and reverse polarity protection to protect the device from common setup mishaps.

## Quick Start Guide

Figure 1 shows a top view of the evaluation board.

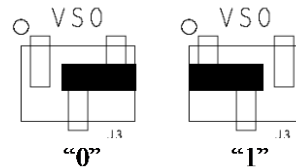
**WARNING:** complete steps 1 through 4 before applying power to the EN5335QI evaluation board.



STEP 1: Set the “ENA” jumper to the Disable Position.

STEP 2: Set the output voltage select pins for the desired output voltage setting. Refer to the section on output voltage select to determine the setting.

**CAUTION:** Voltage select pins MUST NOT be changed while the EN5335QI is enabled. Doing so will result in damage to the part.



STEP 3: Connect Power Supply to the input power connectors, VIN (+) and GND (-) as indicated in Figure 1.

**CAUTION:** be mindful of the polarity. Even though the evaluation board comes with reverse polarity protection diodes, it is rarely a good idea to reverse the input polarity.

STEP 4: Connect the load to the output connectors VOUT (+) and GND (-), as indicated in Figure 1.

STEP 5: Power up the board and move the ENA jumper to the enabled position. The EN5335QI is now powered up.

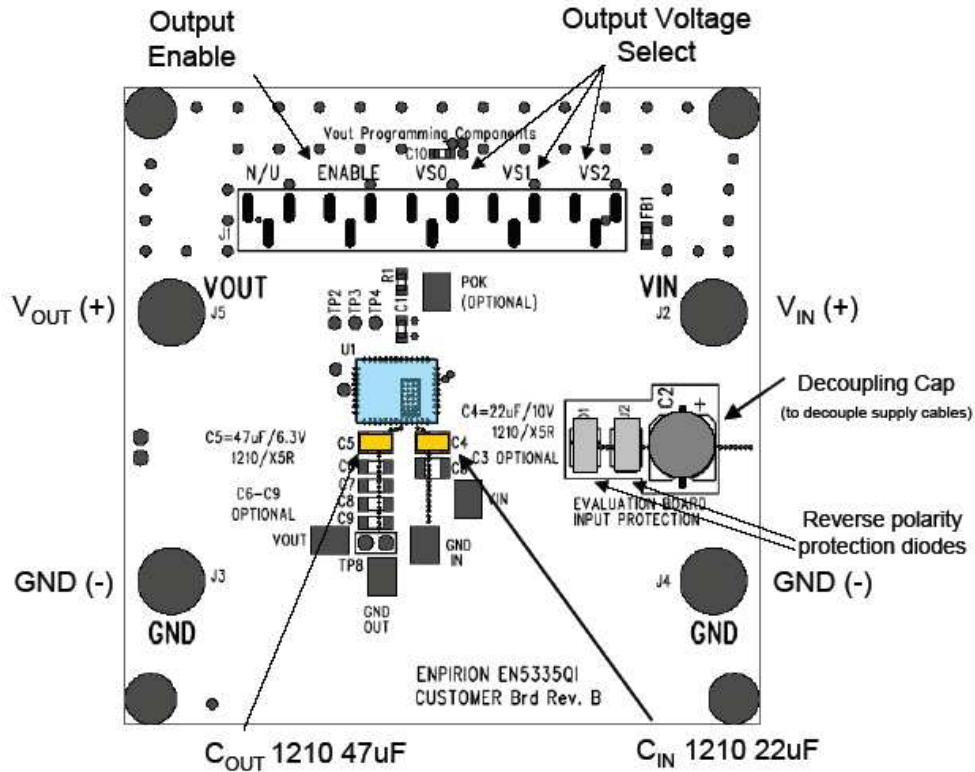


Figure 1. Evaluation Board Layout.

## Output Voltage Select

The EN5335QI utilizes a 3 pin output voltage selector. The output voltage is programmed by setting the VS<sub>x</sub> jumpers to either a logic “1” or a logic “0” as described in the Quick Start section. The voltage select pins are pulled up internally and so will default to a logic “1” if left open.

VS2*	VS1*	VS0*	Output Voltage
0	0	0	3.3V
0	0	1	2.5V
0	1	0	1.8V
0	1	1	1.5V
1	0	0	1.25V
1	0	1	1.2V
1	1	0	0.8V
1	1	1	Reserved

Table 1 shows the truth table for V<sub>OUT</sub> selection. There are seven preset output voltage levels which can be chosen via the VS<sub>x</sub> jumpers.

Table 1. Output Voltage Select Truth Table

**WARNING:** Voltage select pins must not be adjusted while part is enabled. Doing so will result in damage to the part. Always disable part when changing output voltage setting.

## Test Recommendations

To guarantee measurement accuracy, the following precautions should be observed:

1. Make all input and output voltage measurements at the board using the test points provided. This will eliminate voltage drop across the line and load cables that can produce false readings.
2. Measure input and output current with series ammeters or accurate shunt resistors. This is especially important when measuring efficiency.
3. Use a balanced impedance probe tip to measure switching signals to avoid noise coupling into the probe ground lead.

## Input and Output Capacitors

The **input** capacitance requirement is 22  $\mu\text{F}$  for the EN5335QI. Altera recommends that a low ESR MLCC capacitor be used. The voltage rating should be rated high enough to provide adequate margin for your application. There is a pre-tinned pad for one additional 1210 capacitor to experiment with input filter performance.

The **output** capacitance requirement is approximately 50 $\mu\text{F}$  of capacitance and comes populated with a 47 $\mu\text{F}$  1210 6.3V MLCC. The board has pre-tinned pads for up to 4 additional output capacitors with 1210 or 1206 footprint. Various combinations of output capacitor can be used to reduce effective series resistance.

**NOTE:** Capacitors must be X5R or X7R dielectric formulations.



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