EVQ28164-D-00A

High Efficiency Single Inductor Buck-Boost DC-DC Converter Evaluation Board

DESCRIPTION

The EVQ28164-D-00A Evaluation Board is designed to demonstrate the capabilities of MPS' MPQ28164.

The MPQ28164 is a highly-efficient, low quiescent current Buck-Boost converter, which operates from input voltage above, below and equal to the output voltage. The device provides power solution for products powered by a one-cell Lithium-Ion or multi-cell alkaline battery applications where the output voltage is within battery voltage range.

The MPQ28164 operates with input voltage from 1.2V to 5.5V to provide adjustable output voltage (1.5V to 5V), and is available in QFN10-3x3mm package.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Start-Up Voltage	V_{ST}	1.8-5.5	V
Operation Voltage	V_{IN}	1.2 – 5.5	V
Output Voltage	V_{OUT}	3.3	V
Output Current	I_{OUT}	0 – 2(1)	A

FEATURES

- 1.8V minimum startup input voltage
- 1.2V to 5.5V input work range
- 4A switching current limit
- 2MHz switching frequency
- Selectable PSM / PWM mode.
- Typical 25μA Quiescent current
- High efficiency up to 95%.
- Load disconnect during shutdown
- Internal soft start and compensation
- Power good indicator
- Hiccup mode for SCP
- OTP, OVP
- small QFN-11(2mmx3mm) package

APPLICATIONS

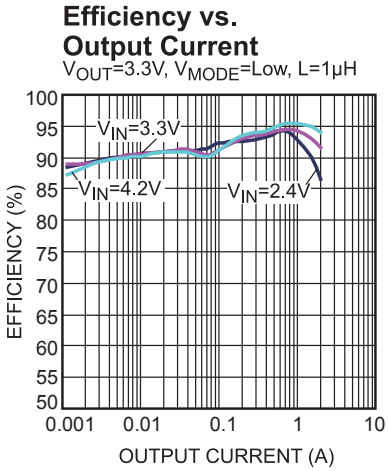
- Battery-powered product
- Portable instruments
- Tablet PC
- Super-cap Charger

Note 1): This board can support 2A load if VIN>2.4V, the load capability is lower when VIN<2.4V due to inductor peak current limit.

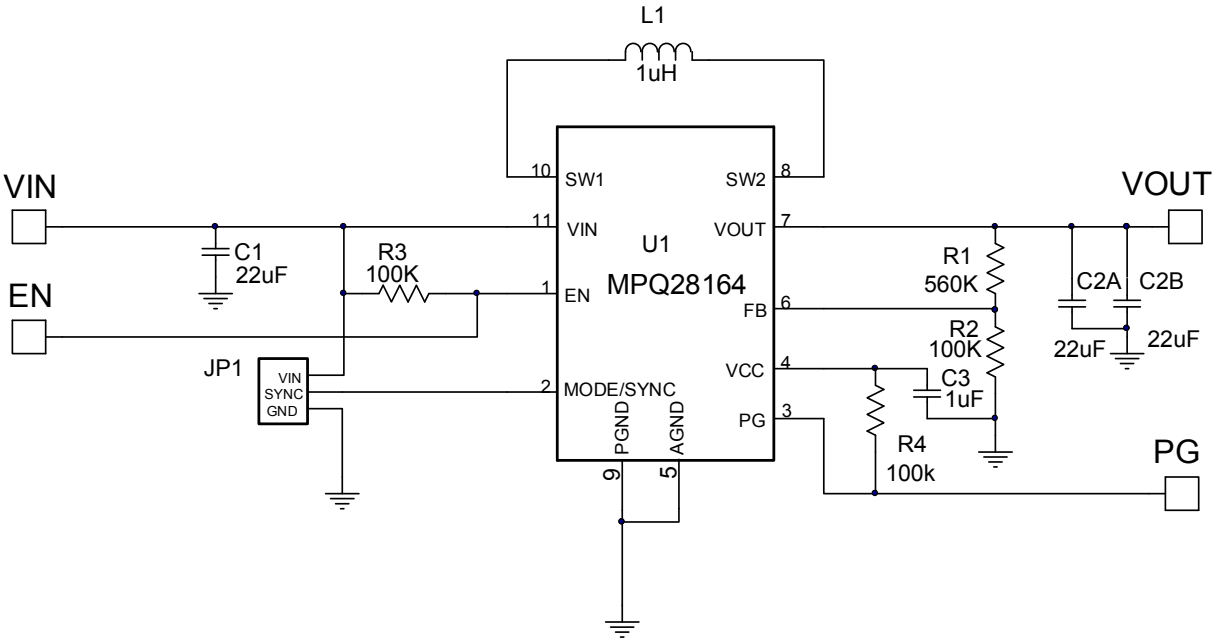
EVQ28164-D-00A EVALUATION BOARD

(L × W × H) 5.08cm × 5.08cm × 1.3cm

Board Number	MPS IC Number
EVQ28164-D-00A	MPQ28164GD



EVALUATION BOARD SCHEMATIC



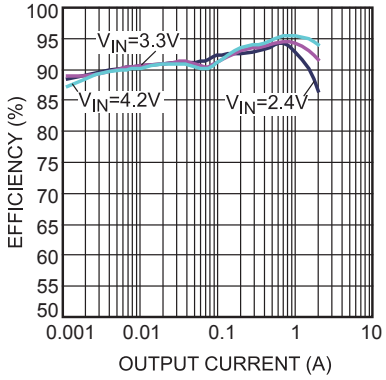
EVQ28164-D-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer P/N
3	C1, C2A, C2B	22μF	Ceramic Cap,10V,X5R	0805	muRata	GRM21BR61A226KE19L
1	C3	1μF	Ceramic Cap,10V,X7R	0603	muRata	GRM188R71A105KA61D
1	JP1		Header, 3-Pin	DI		
1	L1	1μH	4.6mOhm, 19A inductor	SMD	Wurth	744311100
1	R1	560k	Film Res., 1%	0603	Yageo	RC0603FR-07560K
1	R2	100k	Film Res., 1%	0603	Yageo	RC0603FR-07100K
2	R3,R4	100k	Film Res., 5%	0603	Yageo	RC0603JR-07100K
1	U1	MPQ28164	1.8-5.5V, 2MHz,4A, Buck-Boost Converter	QFN-11 (2mmX3mm)	MPS	MPQ28164GD

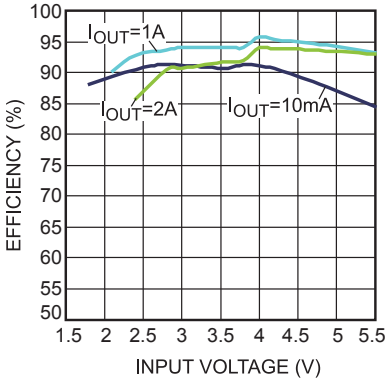
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.
V_{IN} = 3.3V, V_{OUT} = 3.3V, L=1μH, C_{OUT} = 2x22μF, T_A = 25°C, unless otherwise noted.

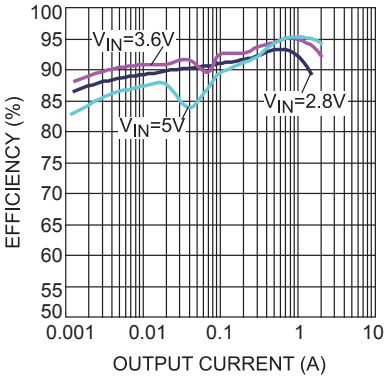
Efficiency vs. Output Current
V_{OUT}=3.3V, V_{MODE}=Low, L=1μH



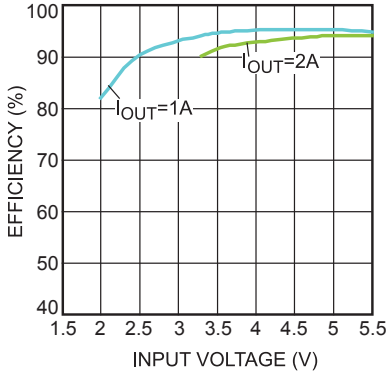
Efficiency vs. Input Voltage
V_{OUT}=3.3V, V_{MODE}=Low, L=1μH



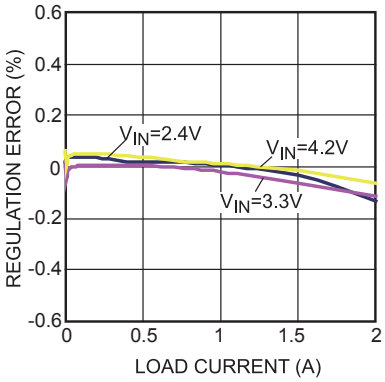
Efficiency vs. Output Current
V_{OUT}=5V, V_{MODE}=Low, L=1.5μH



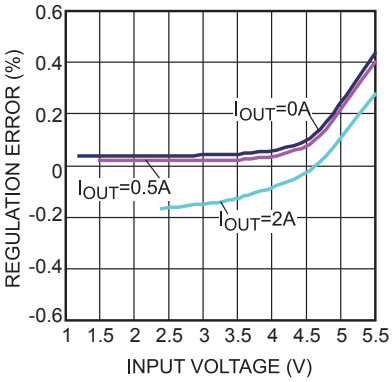
Efficiency vs. Input Voltage
V_{OUT}=5V, V_{MODE}=Low, L=1.5μH



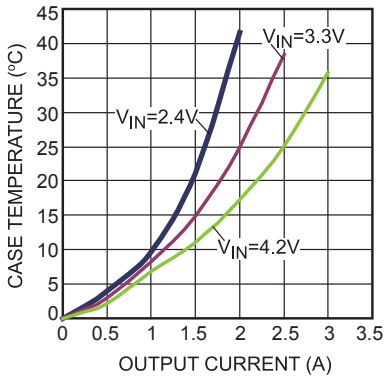
Load Regulation
V_{MODE}=High



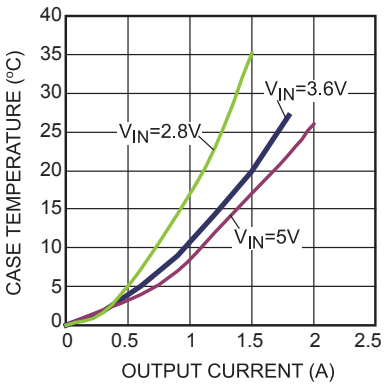
Line Regulation
V_{MODE}=High



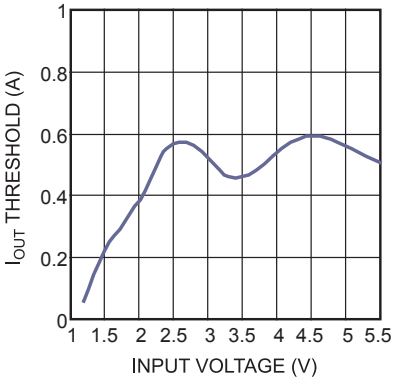
Case Temperature Rise
V_{OUT}=3.3V



Case Temperature Rise
V_{OUT}=5V



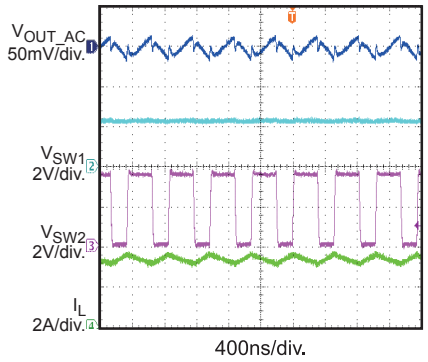
PSM to PWM Transition Threshold
V_{MODE}=Low



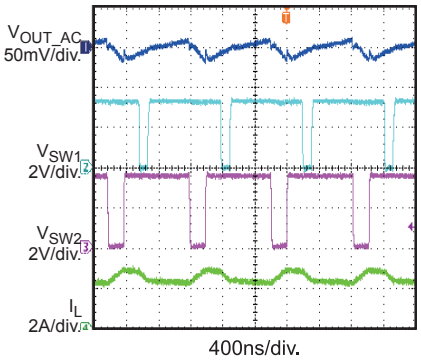
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 3.3V, V_{OUT} = 3.3V, L=1µH, C_{OUT} = 2x22µF, T_A = 25°C, unless otherwise noted.

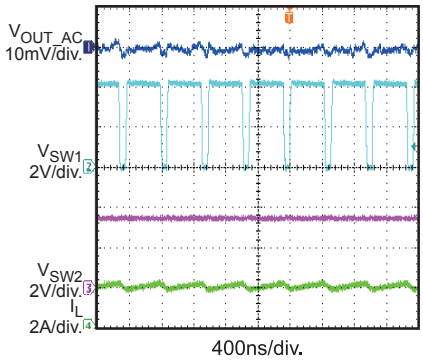
Steady State
V_{IN} = 2.4V, I_{OUT} = 2A,
V_{MODE} = High



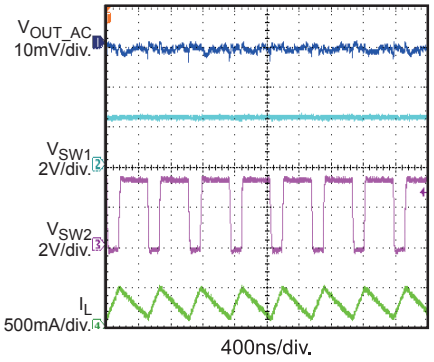
Steady State
V_{IN} = 3.3V, I_{OUT} = 2A,
V_{MODE} = High



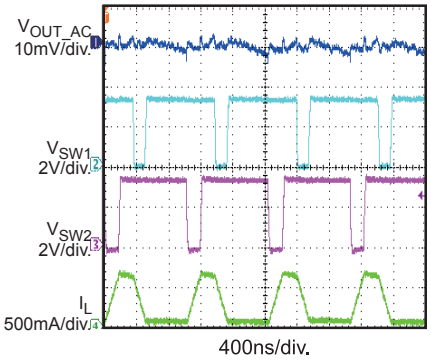
Steady State
V_{IN} = 4.2V, I_{OUT} = 2A,
V_{MODE} = High



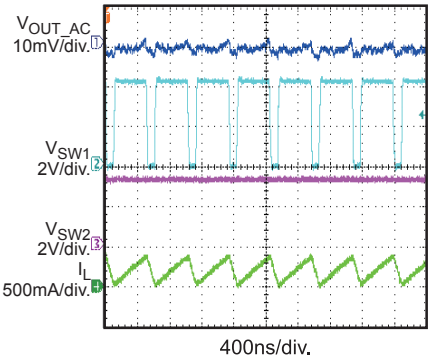
Steady State
V_{IN} = 2.4V, I_{OUT} = 0.2A,
V_{MODE} = High



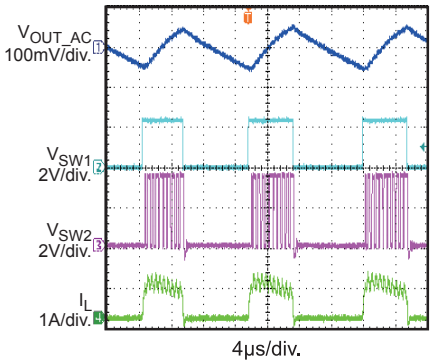
Steady State
V_{IN} = 3.3V, I_{OUT} = 0.2A,
V_{MODE} = High



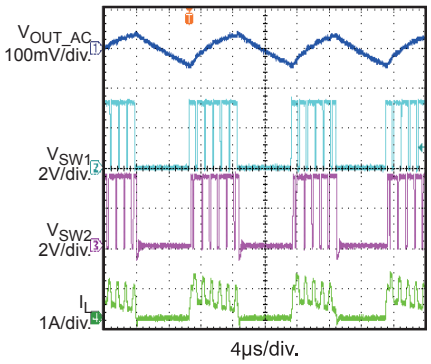
Steady State
V_{IN} = 4.2V, I_{OUT} = 0.2A,
V_{MODE} = High



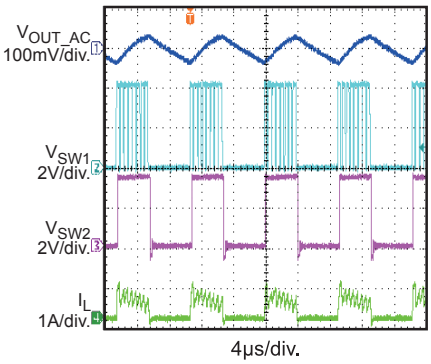
Steady State
V_{IN} = 2.4V, I_{OUT} = 0.2A,
V_{MODE} = Low



Steady State
V_{IN} = 3.3V, I_{OUT} = 0.2A,
V_{MODE} = Low



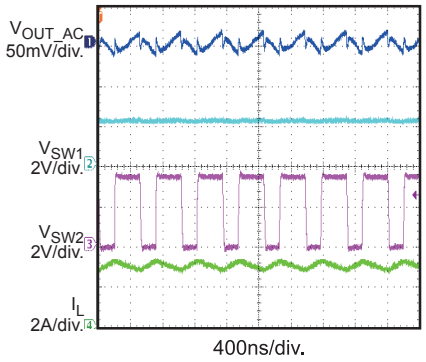
Steady State
V_{IN} = 4.2V, I_{OUT} = 0.2A,
V_{MODE} = Low



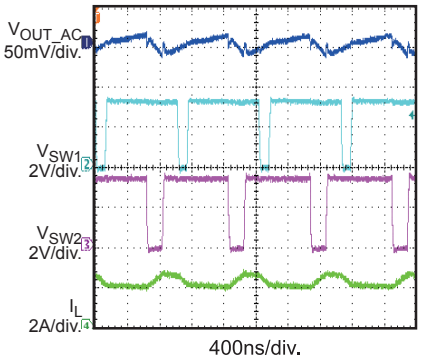
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 3.3V, V_{OUT} = 3.3V, L=1µH, C_{OUT} = 2x22µF, T_A = 25°C, unless otherwise noted.

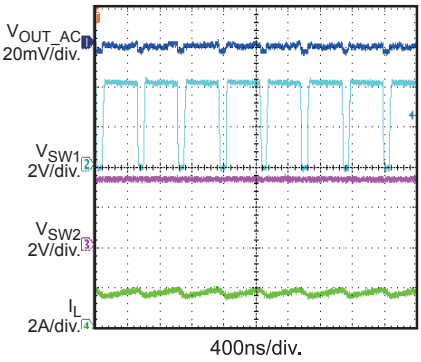
Steady State
V_{IN} = 2.4V, I_{OUT} = 2A, V_{MODE} = Low



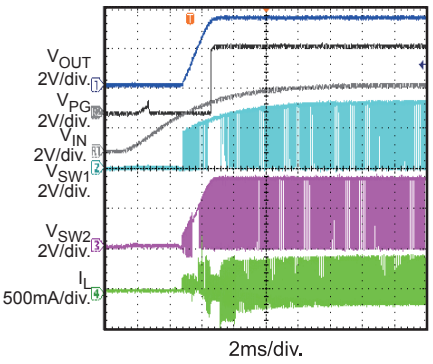
Steady State
V_{IN} = 3.3V, I_{OUT} = 2A, V_{MODE} = Low



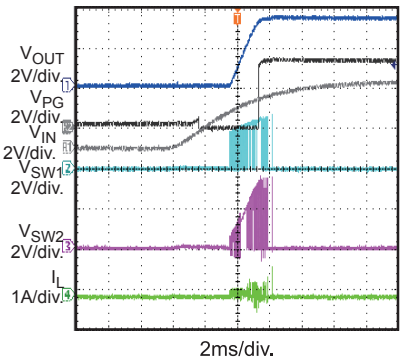
Steady State
V_{IN} = 4.2V, I_{OUT} = 2A, V_{MODE} = Low



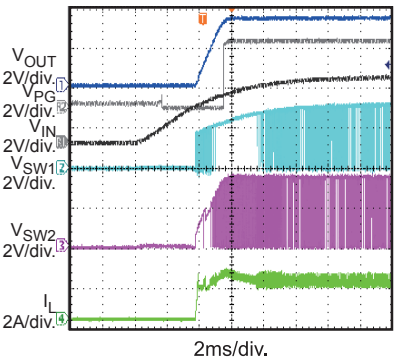
Power On
I_{OUT} = 0A, V_{MODE} = High



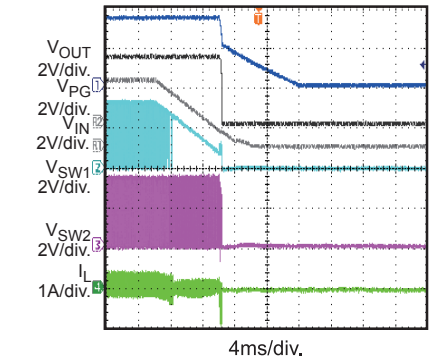
Power On
I_{OUT} = 0A, V_{MODE} = Low



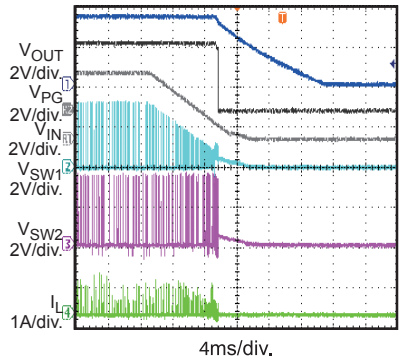
Power On
I_{OUT} = 1A, V_{MODE} = Low



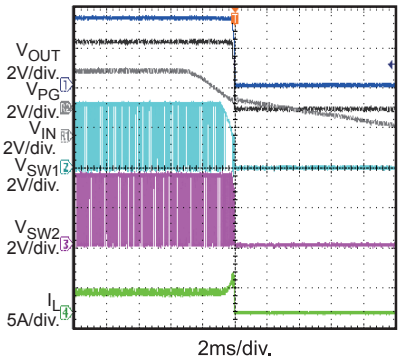
Power Off
I_{OUT} = 0.01A, V_{MODE} = High



Power Off
I_{OUT} = 0.01A, V_{MODE} = Low



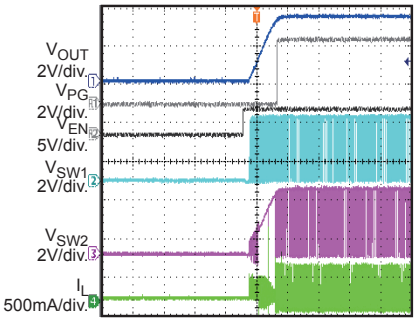
Power Off
I_{OUT} = 2A, V_{MODE} = Low



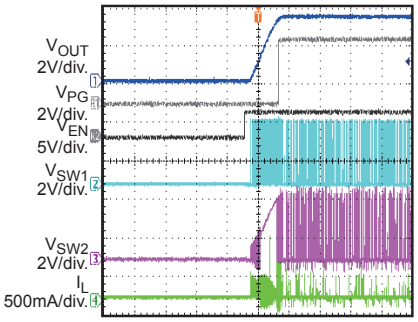
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 3.3V, V_{OUT} = 3.3V, L=1μH, C_{OUT} = 2x22μF, T_A = 25°C, unless otherwise noted.

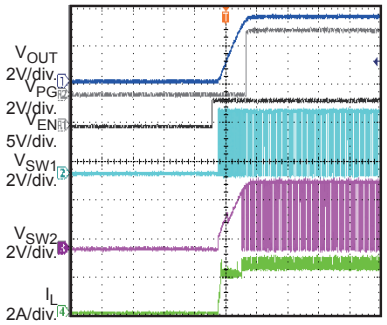
EN Start-Up
I_{OUT} = 0A, V_{MODE} = High



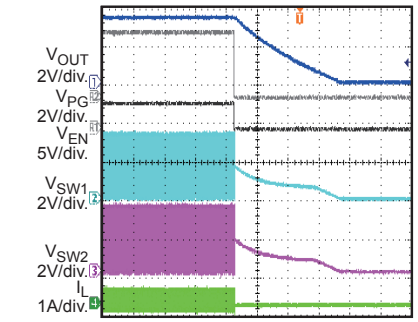
EN Start-Up
I_{OUT} = 0A, V_{MODE} = Low



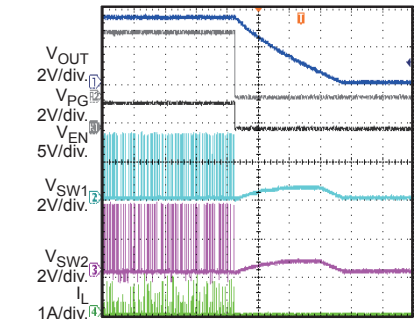
EN Start-Up
I_{OUT} = 2A, V_{MODE} = Low



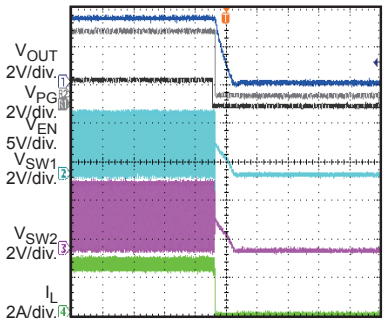
EN Shutdown
I_{OUT} = 0.01A, V_{MODE} = High



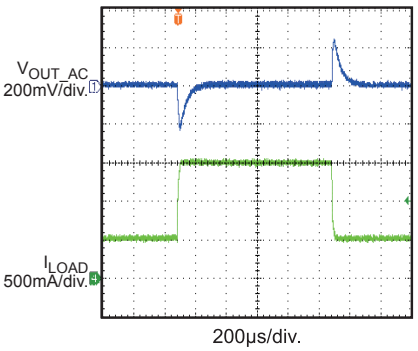
EN Shutdown
I_{OUT} = 0.01A, V_{MODE} = Low



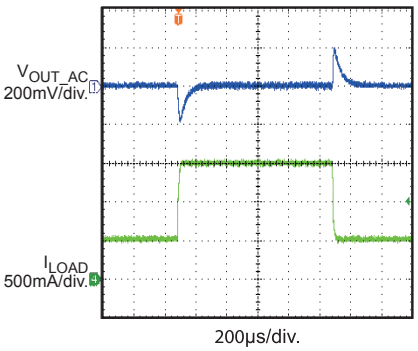
EN Shutdown
I_{OUT} = 2A, V_{MODE} = Low



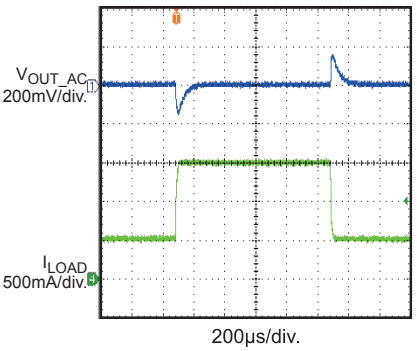
Response to Transient Load
V_{IN} = 2.4V, I_{OUT} = 0.5A to 1.5A,
V_{MODE} = High



Response to Transient Load
V_{IN} = 3.3V, I_{OUT} = 0.5A to 1.5A,
V_{MODE} = High



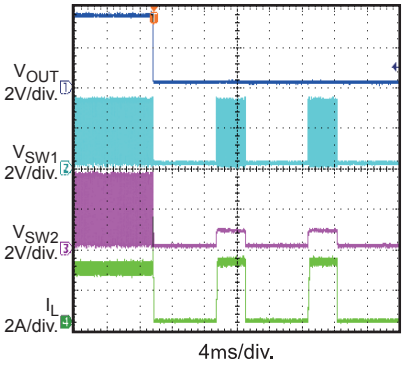
Response to Transient Load
V_{IN} = 4.2V, I_{OUT} = 0.5A to 1.5A,
V_{MODE} = High



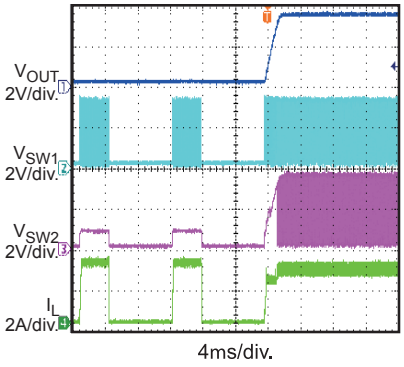
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 3.3V, V_{OUT} = 3.3V, L=1µH, C_{OUT} = 2x22µF, T_A = 25°C, unless otherwise noted.

Protection for Output Short
I_{OUT} = 2A



Recovery from Output Short Protection
I_{OUT} = 2A



PRINTED CIRCUIT BOARD LAYOUT

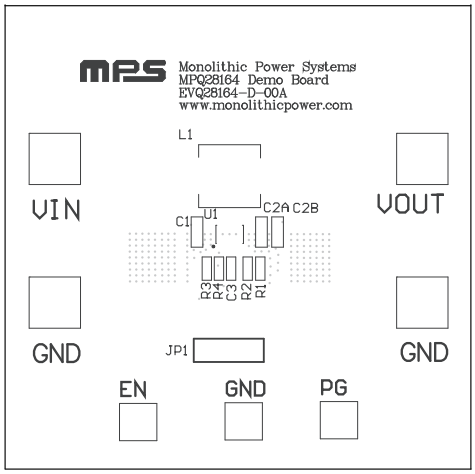


Figure 1: Top Silkscreen Layer

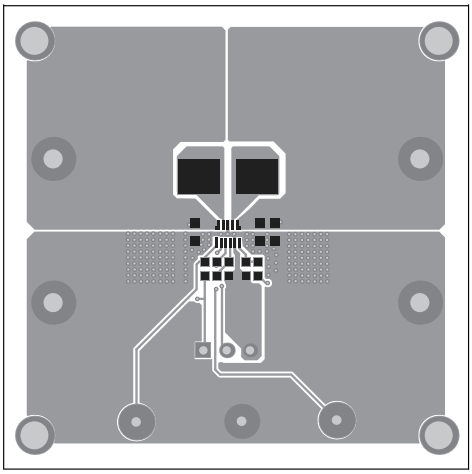


Figure 2: Top Layer

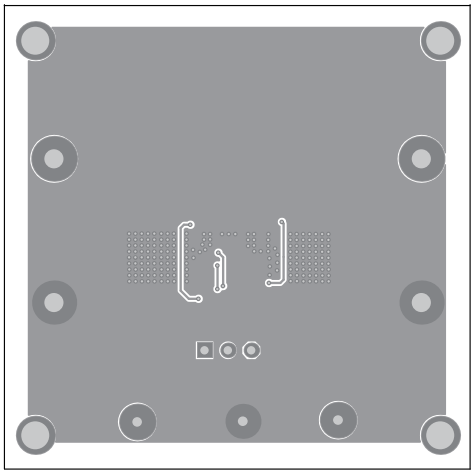


Figure 3: Bottom Layer

QUICK START GUIDE

1. Preset the load to some value, e.g. 0.5A, notice that the MPQ28164 may enter SCP hiccup if starting up with a heavier load due to the startup current limit which is for inrush protection.
2. Connect the positive and negative terminals of the load to the VOUT and GND pins, respectively.
3. Preset the power supply's output voltage (1.8~5.5V), and then turn off the power supply.
4. Connect the positive and negative terminals of the power supply output to the VIN and GND pins, respectively.
5. Turn on the power supply. The MPQ28164 demo board will automatically start up.
6. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.2V to turn on the regulator or less than 0.4V to turn it off.
7. To use MODE pin for forced CCM operation, please turn off Vin then connect the jumper JP1 to VIN.
8. If other output voltage is preferred, the output voltage VOUT can be programmed by changing R1 and R2 according to below equation:

$$R2 = R1 \times \frac{V_{FB}}{V_{OUT} - V_{FB}}$$

Where V_{FB}. Is typically 0.5V, and R1, R2's units are in kΩ, V_{OUT} 's unit is in V. The value of R1 is recommended to be from 300kΩ through 620kΩ for better efficiency at light load. The recommended output voltage can be from 1.5V through 5V.