EVBL2171-J-00A

5.5V, 1A, 2.6MHz, Synchronous, Step-Down Switch-Mode Converter Evaluation Board

DESCRIPTION

The EVBL2171-J-00A is an evaluation board designed to demonstrate the MP2171 and the MPQ2171. The evaluation board features an integrated MPS power inductor.

The MP2171 is a low-voltage, high-frequency, step-down switch-mode converter with integrated, internal power MOSFETs. It can achieve up to 1A of highly efficient output current (I_{OUT}) across a wide 2.5V to 5.5V input voltage (V_{IN}) range, with constant-on-time (COT) control for fast loop response.

The device is ideal for powering portable equipment that runs on a single-cell Lithium-ion (Li-ion) battery. Its output voltage (V_{OUT}) can be regulated to as low as 0.6V.

High power efficiency across the entire load range is achieved by scaling down the switching frequency (f_{SW}) at light loads. This reduces the switching loss during COT control.

Full protection features include cycle-by-cycle over-current protection (OCP), short-circuit protection (SCP) with hiccup mode, and thermal shutdown for reliable, fault-tolerant operation.

The MP2171 is available in a TSOT23-8 package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	2.5 to 5.5	V
Output voltage	V_{OUT}	1.2	V
Output current	I_{OUT}	1	A

FEATURES

- Wide 2.5V to 5.5V Operating Input Voltage (V_{IN}) Range
- Up to 1A Output Current (I_{OUT})
- 40µA Quiescent Current (I_Q)
- 90mΩ and 50mΩ Internal Power MOSFETs
- 2.6MHz Default Switching Frequency (f_{SW}) with 3.3V Input and 1.8V Output
- Enable (EN) and Power Good (PG) for Power Sequencing
- Stable with Low ESR Ceramic Output Capacitors
- Internal Soft Start (SS)
- Cycle by Cycle Over-Current Protection (OCP)
- Shutdown Auto-Discharge
- Short-Circuit Protection (SCP) with Hiccup Mode
- Thermal Shutdown
- Available in a TSOT23-8 Package

MPL Optimized Performance with MPS Inductor MPL-AL5030 Series

APPLICATIONS

- Automotive Infotainment Systems
- Automotive Clusters
- Automotive Telematics
- Low-Voltage I/O Power Systems
- Handheld and Battery-Powered Systems

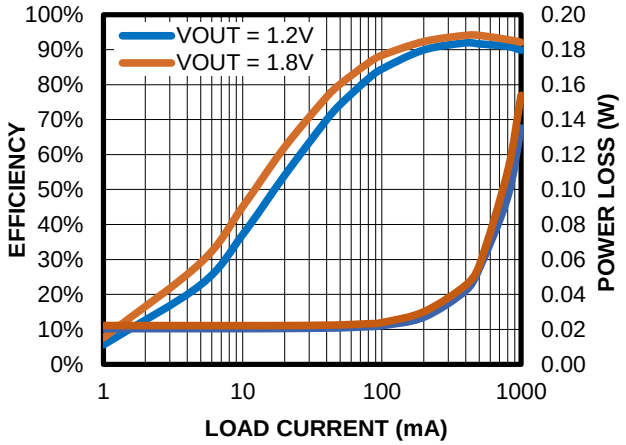
EVBL2171-J-00A EVALUATION BOARD

LxWxH (6.35cmx6.35cmx1.2cm)

Board Number	MPS IC Number	MPS Inductor
EVBL2171-J-00A	MP2171GJ, MPQ2171GJ	MPL-AL5030-1R0

Efficiency vs. Load Current vs. Power Loss

V_{IN} = 3.3V



QUICK START GUIDE

1. Connect load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
2. Preset the power supply between 2.5V and 5.5V, then turn off the power supply. If longer cables (>0.5m total) are being used between the source and the evaluation board, install a damping capacitor at the input terminals.
3. Connect power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. Turn on the power supply. The evaluation board should start up automatically.
5. To use the enable (EN) function, apply a digital input to the EN pin. Drive EN above 1.2V to turn the converter on; drive EN below 0.4V to turn it off.
6. The output voltage (V_{OUT}) is set via an external resistor divider (R1 + R2). Choose R1 to be about 41.2kΩ. Then R2 can be calculated with below Equation (1):

$$R2 = \frac{R1}{\frac{V_{OUT}}{0.6} - 1} \quad (1)$$

Figure 1 shows the feedback circuit.

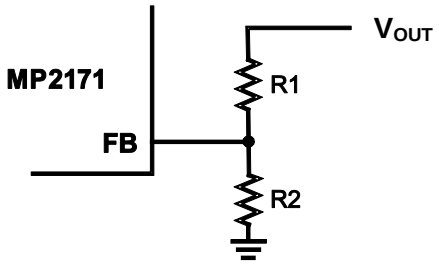


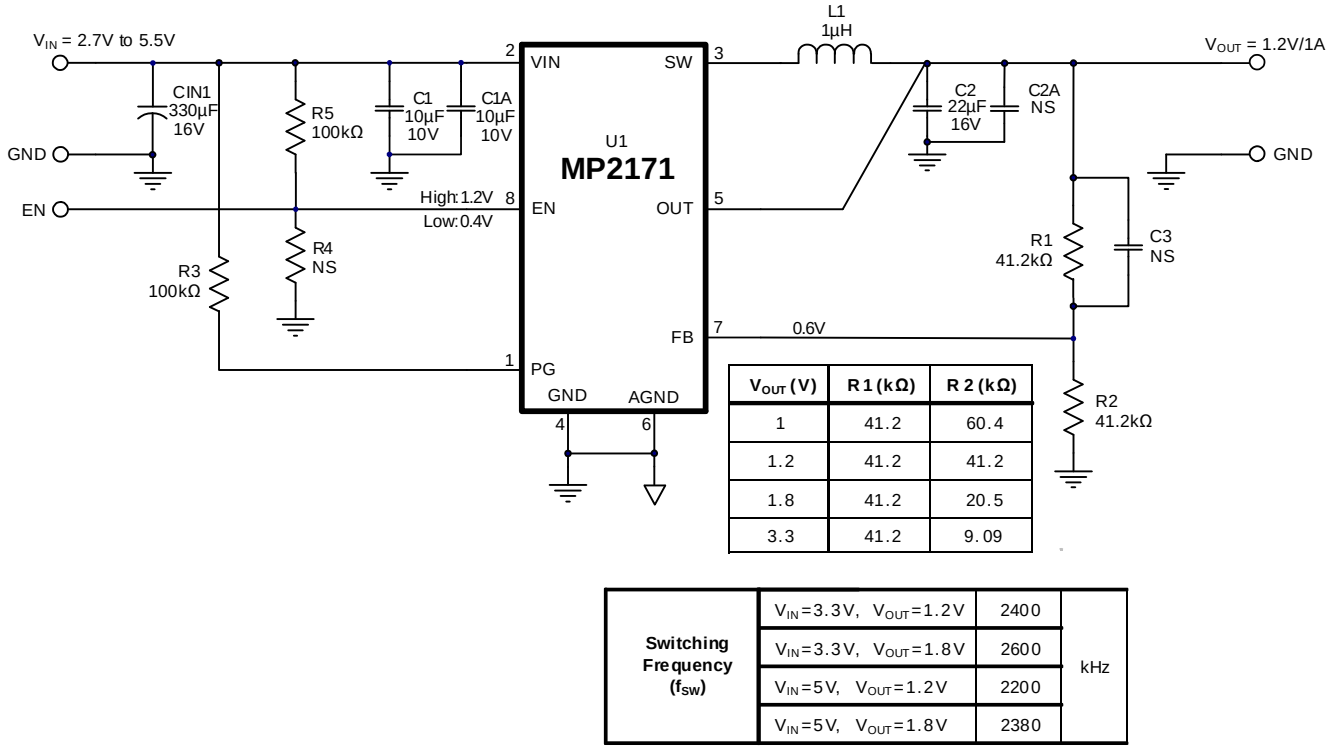
Figure 1: Feedback Circuit

Table 1 lists the recommended feedback resistor values for common output voltages.

Table 1: Recommended Resistor Values for Common Output Voltages

V_{OUT} (V)	R1 (kΩ)	R2 (kΩ)
1	41.2 (1%)	60.4 (1%)
1.2	41.2 (1%)	41.2 (1%)
1.8	41.2 (1%)	20.5 (1%)
3.3	41.2 (1%)	9.09 (1%)

EVALUATION BOARD SCHEMATIC

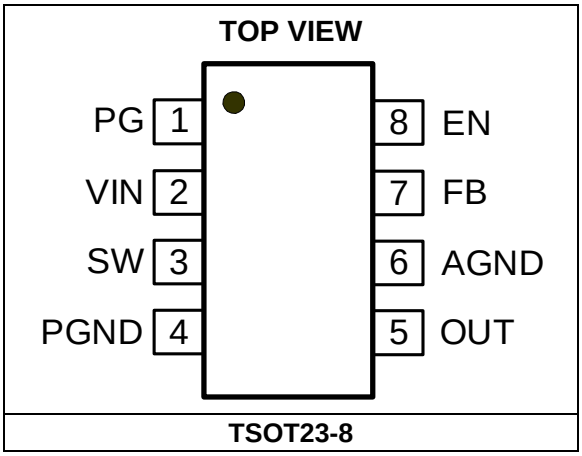


V_{OUT} (V)	R1 (kΩ)	R2 (kΩ)
1	41.2	60.4
1.2	41.2	41.2
1.8	41.2	20.5
3.3	41.2	9.09

Switching Frequency (f_{SW})	V_{IN}=3.3V, V_{OUT}=1.2V	2400	kHz
	V_{IN}=3.3V, V_{OUT}=1.8V	2600	
	V_{IN}=5V, V_{OUT}=1.2V	2200	
	V_{IN}=5V, V_{OUT}=1.8V	2380	

Figure 2: Evaluation Board Schematic

PACKAGE REFERENCE



EVBL2171-J-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	L1	MPL-AL5030-1R0	Inductor, 1μH, 12A, 7mΩ	SMD	MPS	MPL-AL5030-1R0
1	CIN1	330μF	Conductive aluminum-polymer solid capacitor, 10V, 330μF, 17mΩ	SMD	Panasonic	10SVP330M
2	C2A, C3	NS				
2	C1, C1A	10μF	Ceramic capacitor, 10V, 20%, X5R	1206	Taiyo Yuden	LMK212BJ106MG-T
1	C2	22μF	Ceramic capacitor, 6.3V, 10%, X5R	1206	Murata	GRM218R70J226KE76L
2	R1, R2	41.2kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0741K2L
2	R3, R5	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-074100KL
1	R4	NS				
1	U1	MP2171	Synchronous, step-down converter, 5.5V, 1A	TSOT23-8	MPS	MP2171GJ
4	VIN, GND, VOUT, GND	2mm	2mm golden pin, test point	DIP	Custom (1)	
9	EN, GND, PG, VINSENSE, GND, VOUTSENSE, GND, SW, GND	1mm	1mm golden pin, test point	DIP	Custom (1)	

Note:

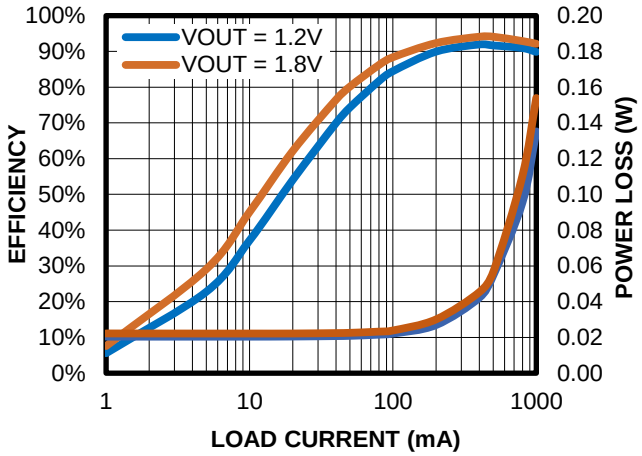
1) These pins are custom-made by MPS. For more information, contact an MPS FAE.

EVB TEST RESULTS

Performance waveforms are tested on the evaluation board. V_{IN} = 3.3V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

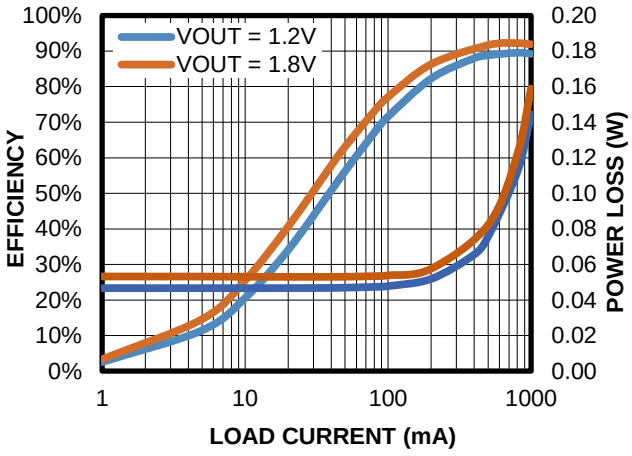
Efficiency vs. Load Current vs. Power Loss

V_{IN} = 3.3V

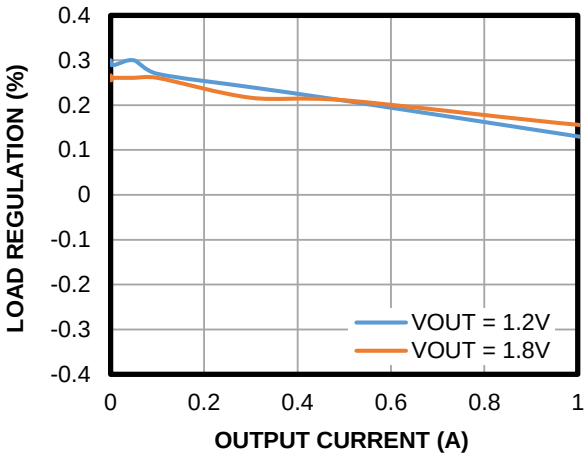


Efficiency vs. Load Current vs. Power Loss

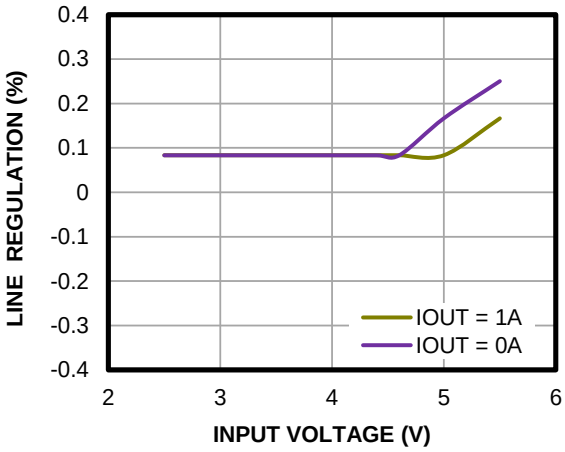
V_{IN} = 5V



Load Regulation

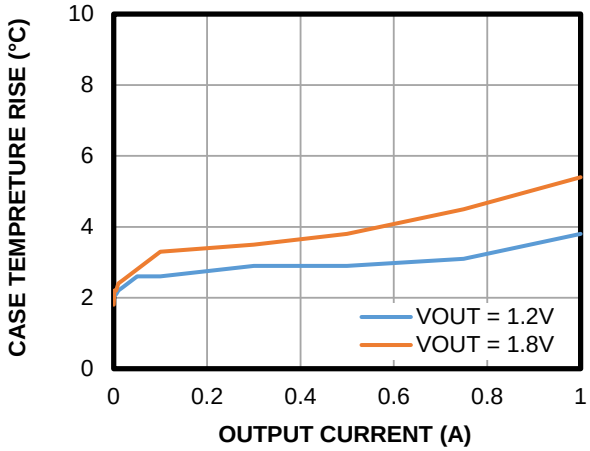


Line Regulation



Case Temperature Rise

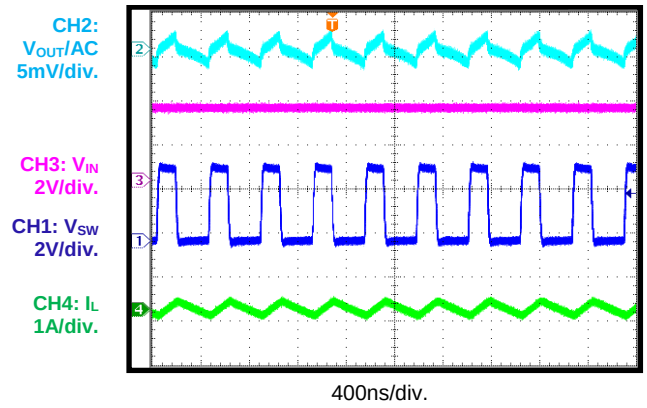
V_{IN} = 3.3V



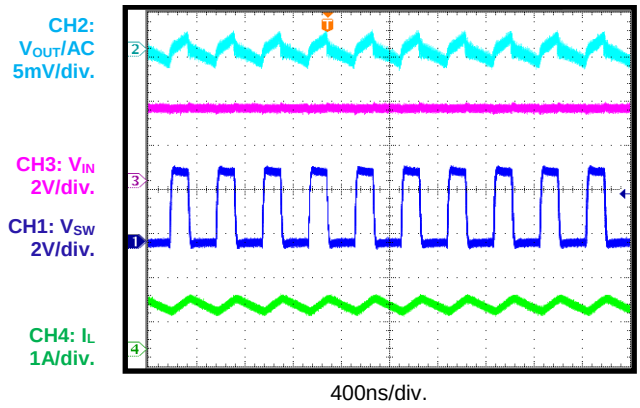
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 3.3V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

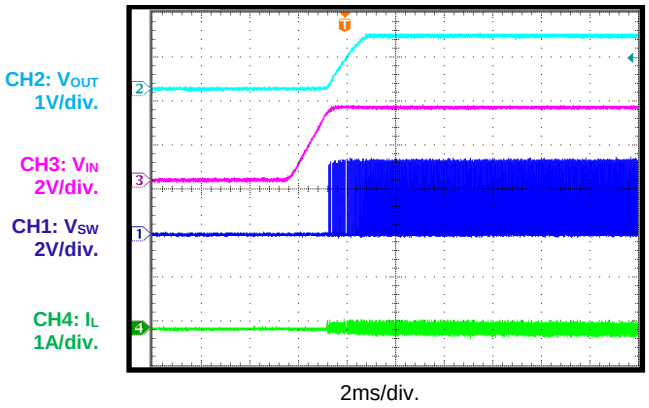
Output Ripple
I_{OUT} = 0A



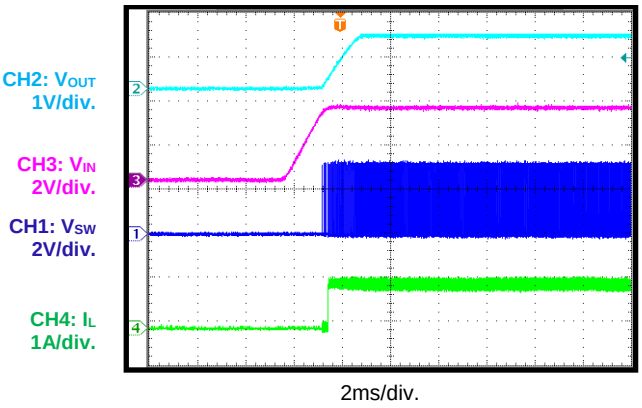
Output Ripple
I_{OUT} = 1A



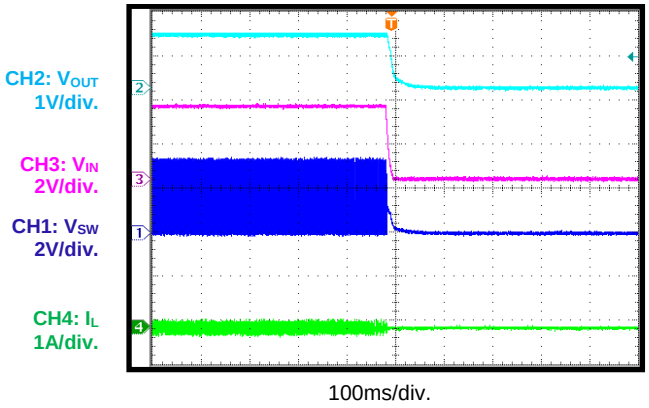
Start-Up through VIN
I_{OUT} = 0A



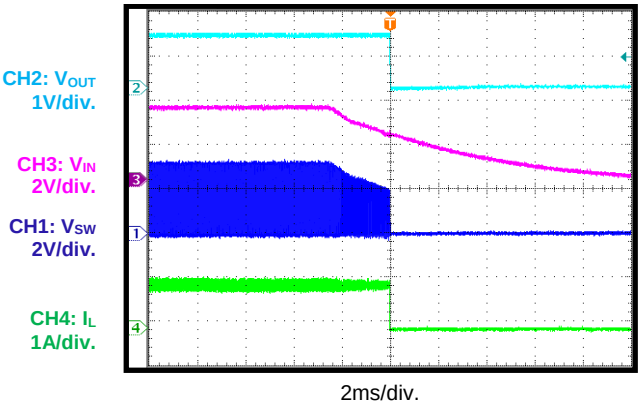
Start-Up through VIN
I_{OUT} = 1A



Shutdown through VIN
I_{OUT} = 0A



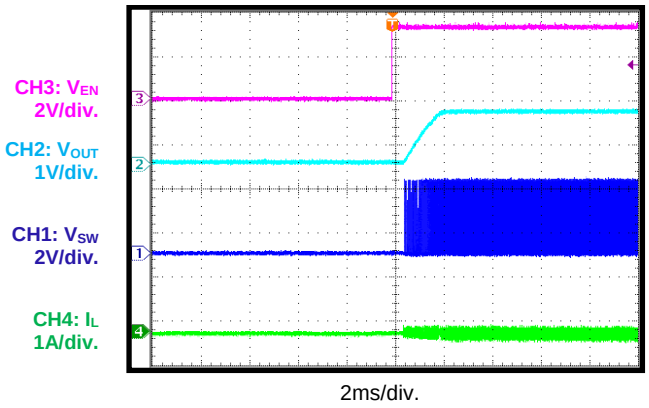
Shutdown through VIN
I_{OUT} = 1A



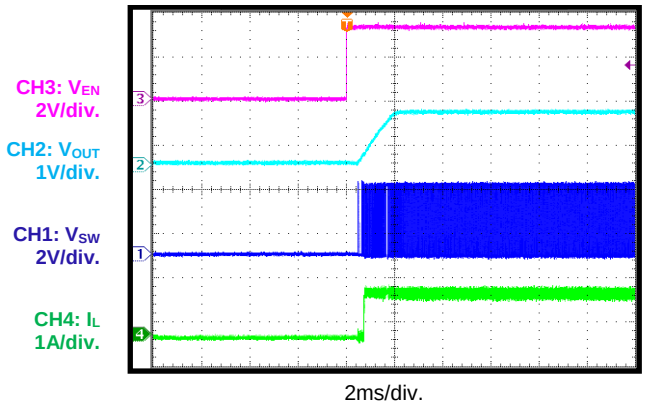
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 3.3V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

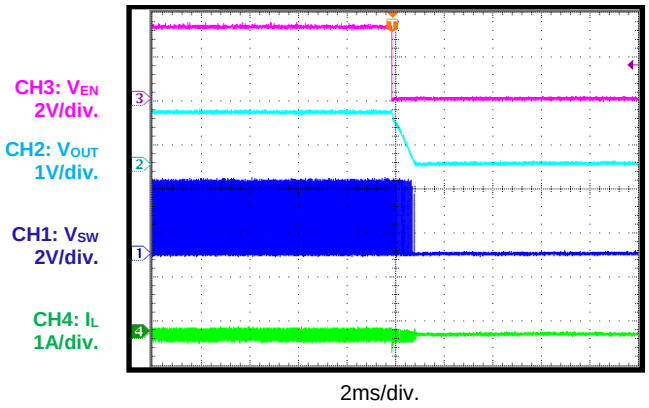
Start-Up through EN
I_{OUT} = 0A



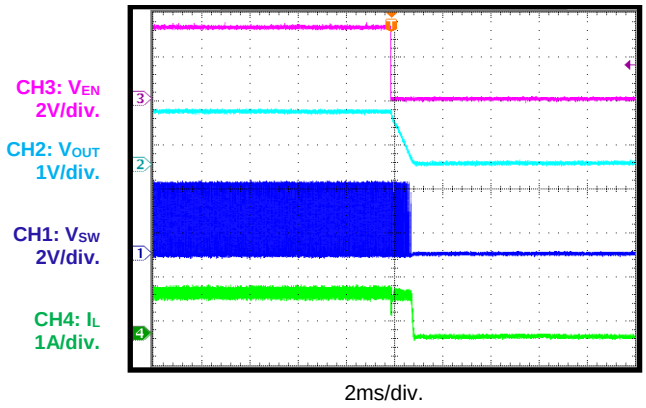
Start-Up through EN
I_{OUT} = 1A



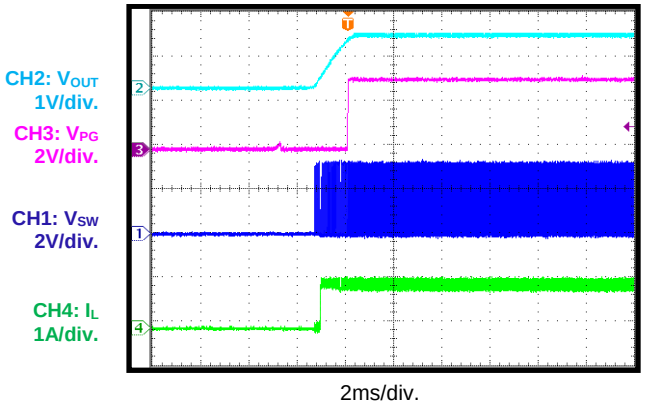
Shutdown through EN
I_{OUT} = 0A



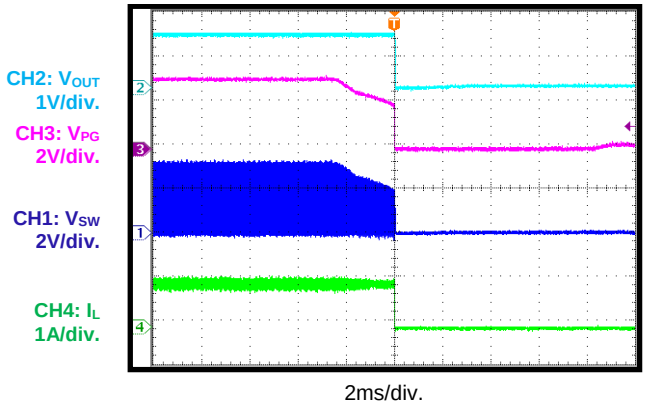
Shutdown through EN
I_{OUT} = 1A



PG Start-Up through VIN
I_{OUT} = 1A



PG Shutdown through VIN
I_{OUT} = 1A

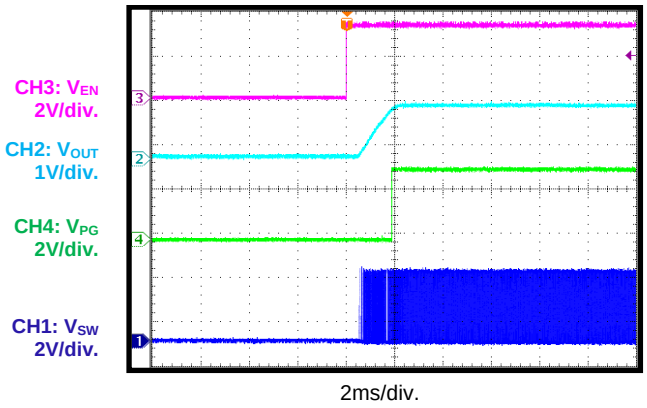


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 3.3V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

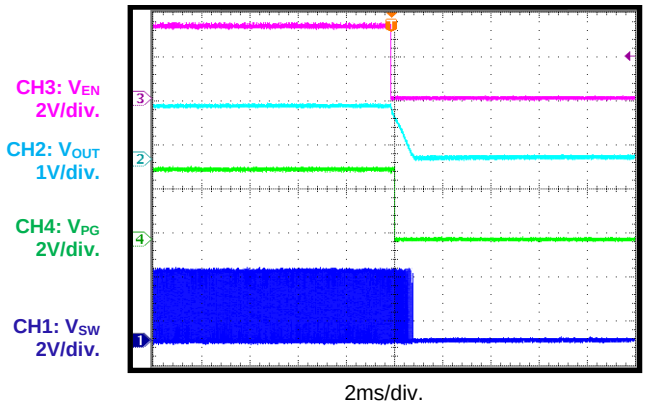
PG Start-Up through EN

I_{OUT} = 1A



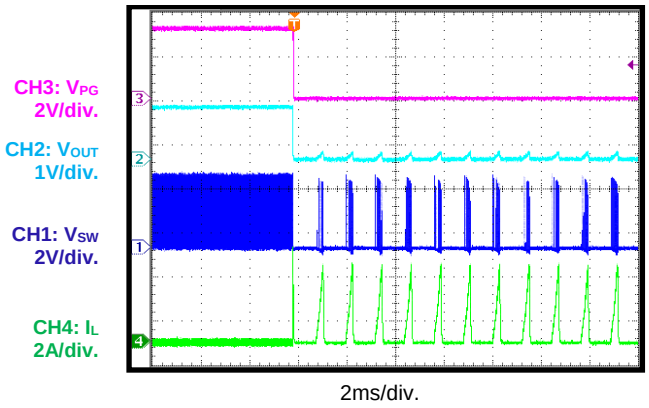
PG Shutdown through EN

I_{OUT} = 1A



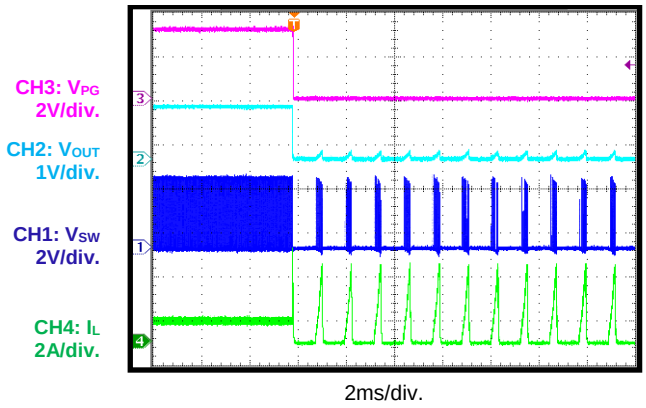
SCP Entry

I_{OUT} = 0A



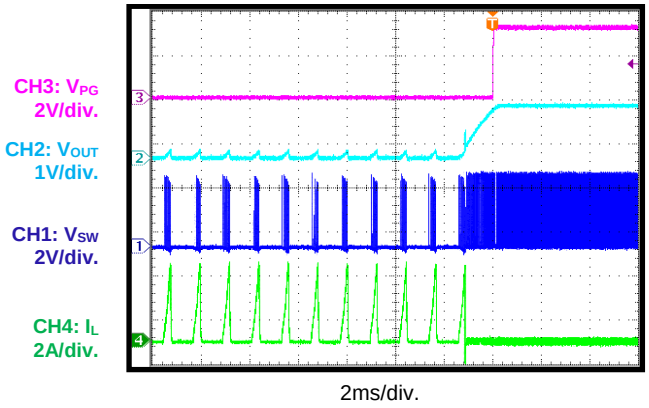
SCP Entry

I_{OUT} = 1A



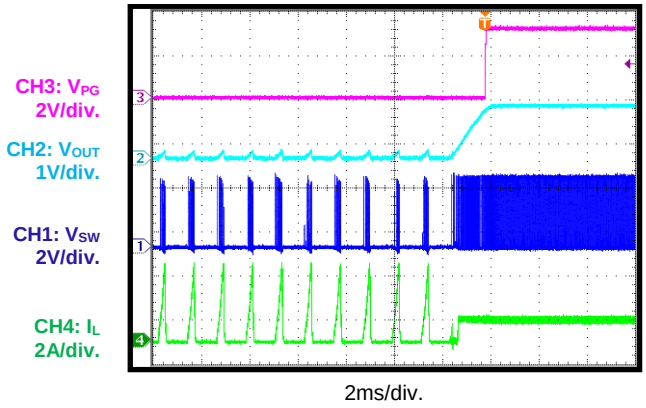
SCP Recovery

I_{OUT} = 0A



SCP Recovery

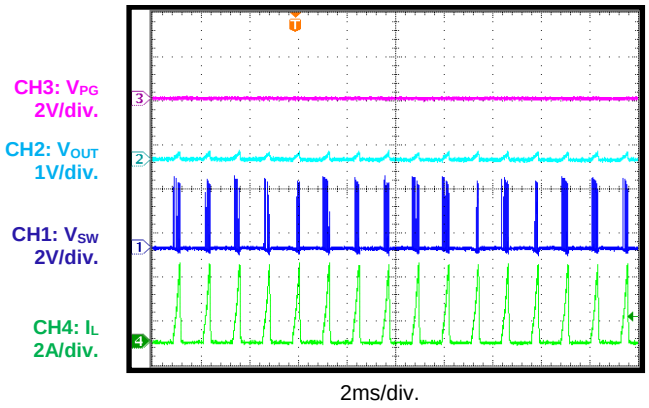
I_{OUT} = 1A



EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 3.3V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

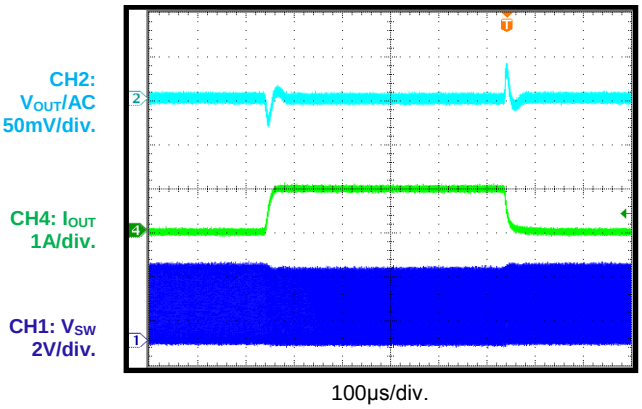
SCP Steady State



2ms/div.

Load Transient

I_{OUT} = 0A to 1A



100µs/div.

PCB LAYOUT

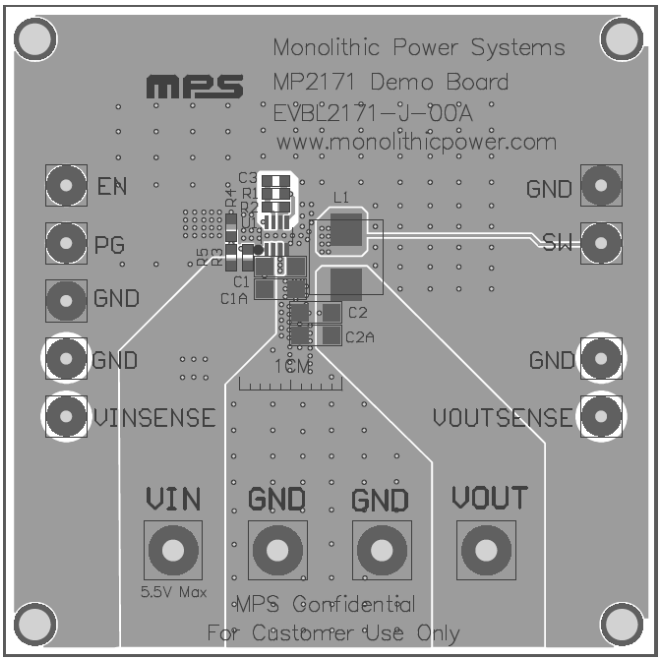


Figure 3: Top Silk and Top Layer

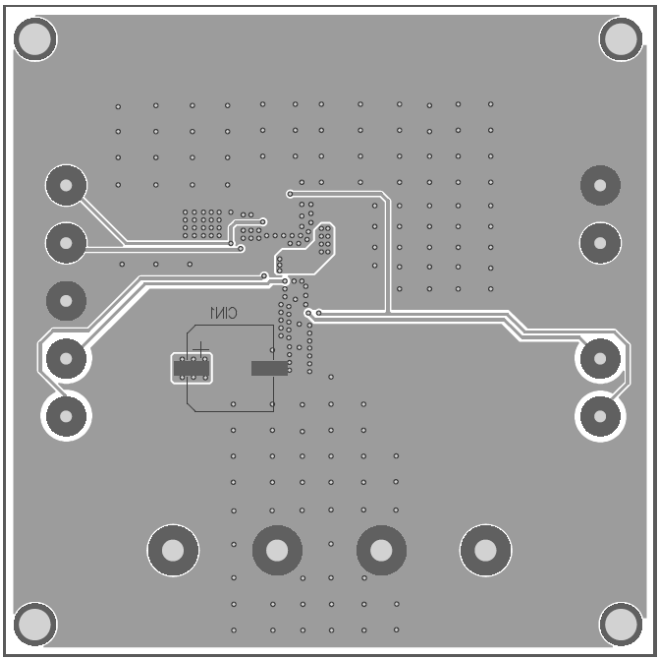


Figure 4: Bottom Layer and Bottom Silk