EVL2193-C-00B

2.5V to 5.5V, 3A, Synchronous Step-Down Converter with 25µA I_Q in a WLCSP Package Evaluation Board

DESCRIPTION

The EVL2193-C-00B evaluation board is designed to demonstrate the capabilities of the MP2193, a step-down, switch-mode converter with built-in, internal power MOSFETs.

The MP2193 is a monolithic, step-down switch-mode converter with built-in, internal power MOSFETs. The MP2193 can achieve up to 3A of continuous output current (I_{OUT}) across a 2.5V to 5.5V input voltage (V_{IN}) range, with excellent load and line regulation.

The output voltage (V_{OUT}) can be regulated to as low as 0.6V. Constant-on-time (COT) control provides fast transient response and eases loop stabilization. Fault protections include cycle-by-cycle current limiting and thermal shutdown.

It is recommended to read the datasheet for the MP2193 prior to making any changes to the EVL2193-C-00B.

PERFORMANCE SUMMARY (1)

Specifications are at T_A = 25°C, unless otherwise noted.

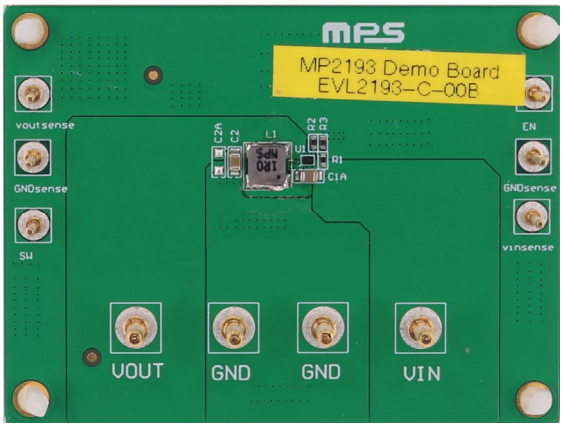
Parameters	Conditions	Value
Input voltage (V_{IN}) range		2.5V to 5.5V (2)
Output voltage (V_{OUT})	V_{IN} = 2.5V to 5.5V, I_{OUT} = 0A to 3A	V_{OUT} = 1.2V
Maximum output current (I_{OUT})	V_{IN} = 2.5V to 5.5V	3A
Typical efficiency	V_{IN} = 5V, V_{OUT} = 1.2V, I_{OUT} = 3A, f_{SW} = 1.1MHz	82.7%
Peak efficiency	V_{IN} = 5V, V_{OUT} = 1.2V, I_{OUT} = 0.7A, f_{SW} = 1.1MHz	91.7%
Switching frequency (f_{SW})		1.1MHz

Note:

1) For different V_{IN} and V_{OUT} specifications with different output capacitors/inductors, the application circuit parameters may require changes.
2) For applications where V_{IN} < 3.3V, additional input capacitors may be required.

MPL Optimized Performance with MPS Inductor MPL-AL4020 Series

EVALUATION BOARD



(LxWxH) 6.35cmx4.82cmx1.4cm

Board Number	MPS IC Number
EVL2193-C-00B	MP2193

QUICK START GUIDE

The EV2193-C-00B evaluation board is easy to set up and use to evaluate the MP2193's performance. The EV2193-C-00B 's output voltage (V_{OUT}) is set externally, and can be regulated as low as 0.6V while operating from 2.5V to 5.5V input voltage (V_{IN}). The default V_{OUT} is 1.2V. For proper measurement equipment set-up, refer to Figure 1 and follow the steps below:

1. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
2. Preset the power supply output between 2.5V and 5.5V, then turn off the power supply.
3. Connect the power supply output terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. Turn on the power supply. The board should automatically start up.
5. V_{OUT} can be set by varying R3. R2 is typically 200kΩ. R3 can then be calculated using Equation (1):

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

For example, to set V_{OUT} to 1.8V, R2 = 200kΩ and R3 = 100kΩ.

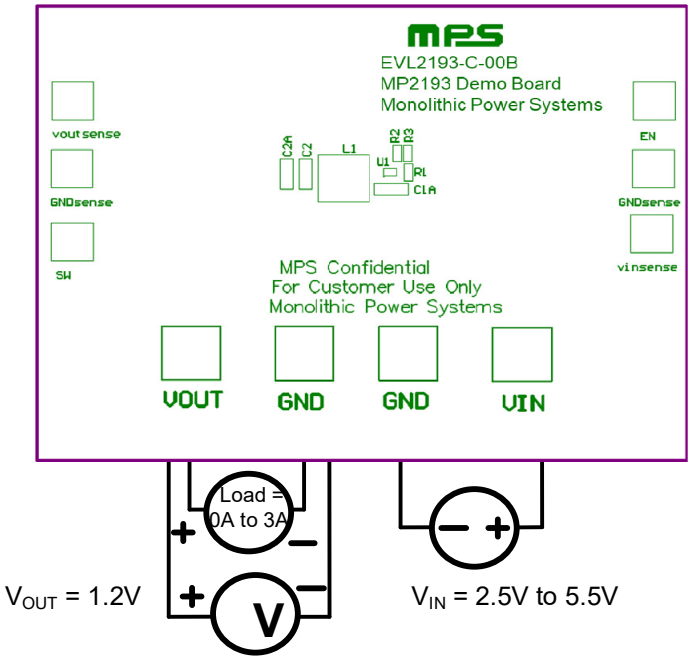


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

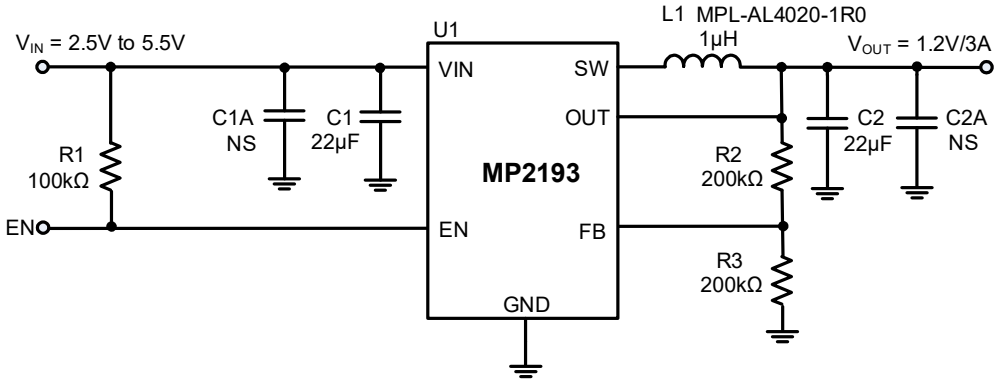


Figure 2: Evaluation Board Schematic

EVL2193-C-00C BILL OF MATERIALS

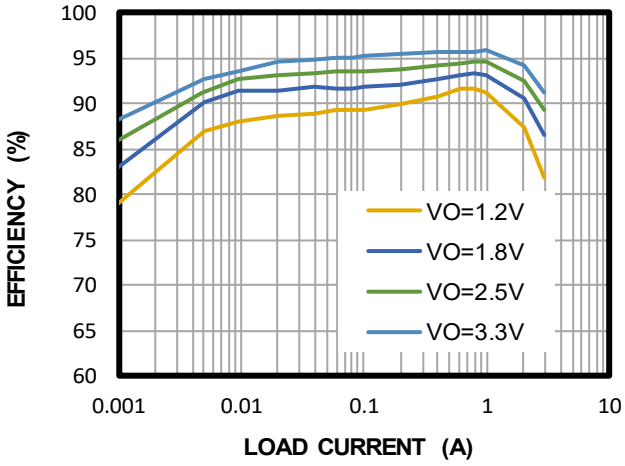
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	C1, C2	22μF	Ceramic capacitor, 10V, X5R	0805	Murata	GRM21BR61A226ME51L
2	R2, R3	200kΩ	Film resistor, 1%	0402	Any	
1	R1	100kΩ	Film resistor, 1%	0402	Any	
1	L1	1.0μH	Inductor, I_{SAT} = 8.6A, DCR = 11mΩ	SMD	MPS	MPL-AL4020-1R0
1	U1	MP2193	3A, 2.5V to 5.5V, synchronous step-down converter	WLCSP-6 (0.85mmx 1.25mm)	MPS	MP2193GC

EVB TEST RESULTS

V_{IN} = 5V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

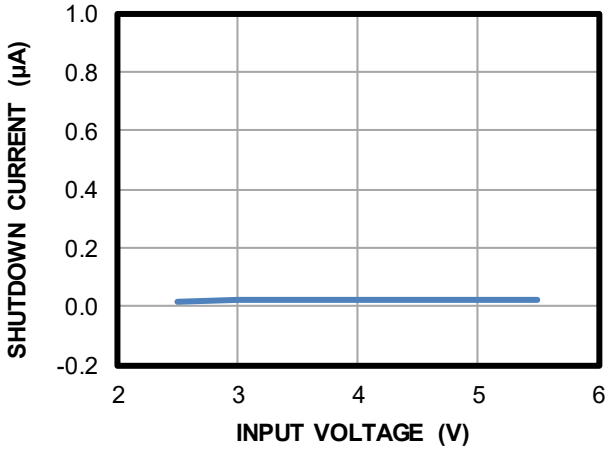
Efficiency vs. Load Current

V_{IN} = 5V, L = 1µH



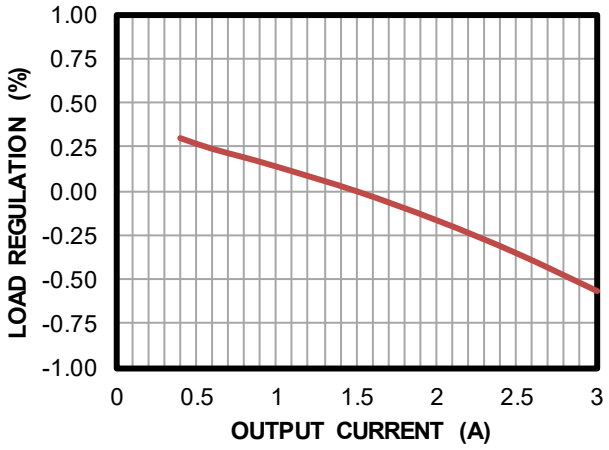
Shutdown Current vs. Input Voltage

V_{EN} = 0V

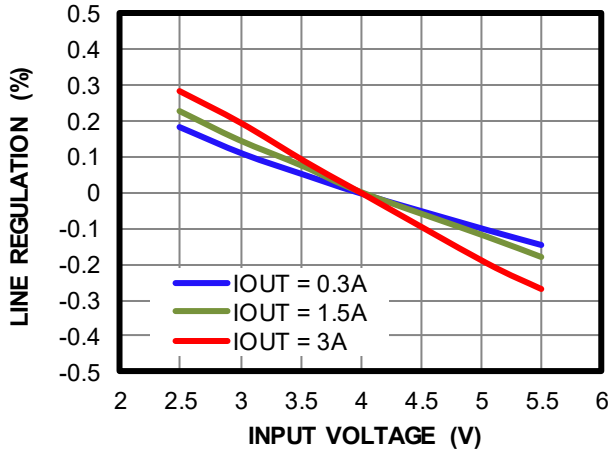


Load Regulation

V_{OUT} = 1.2V

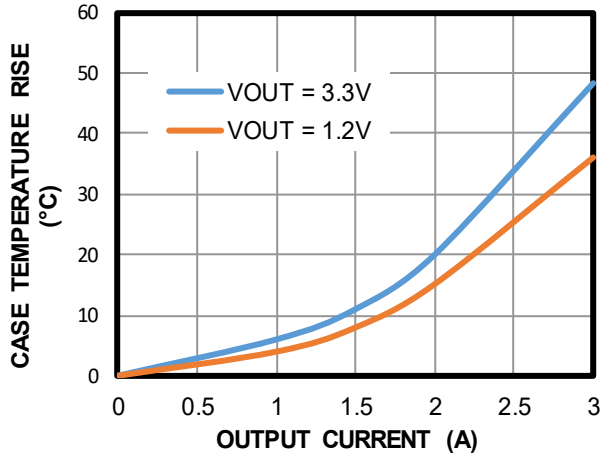


Line Regulation

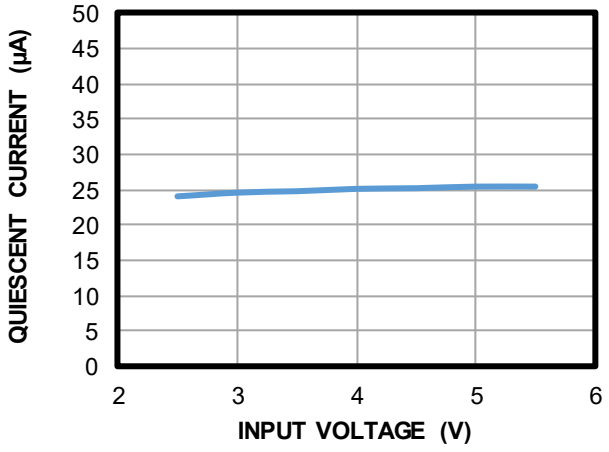


Case Temperature Rise vs. Output Current

V_{IN} = 5V



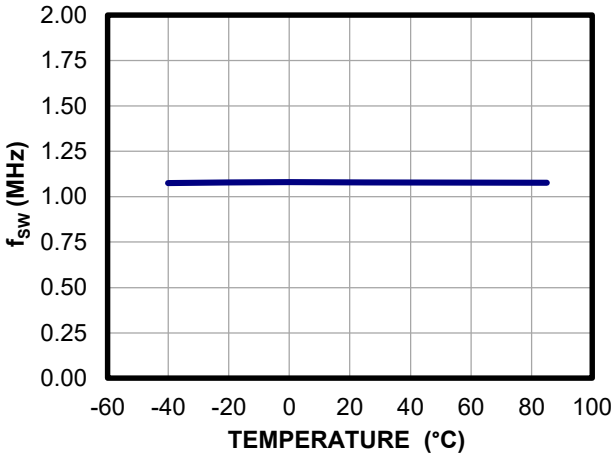
Quiescent Current vs. Input Voltage



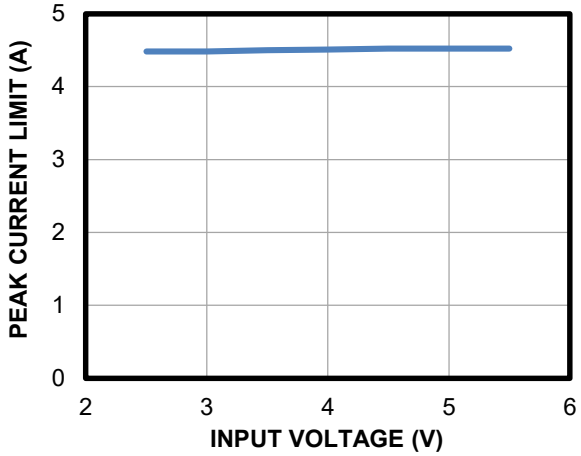
EVB TEST RESULTS *(continued)*

V_{IN} = 5V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

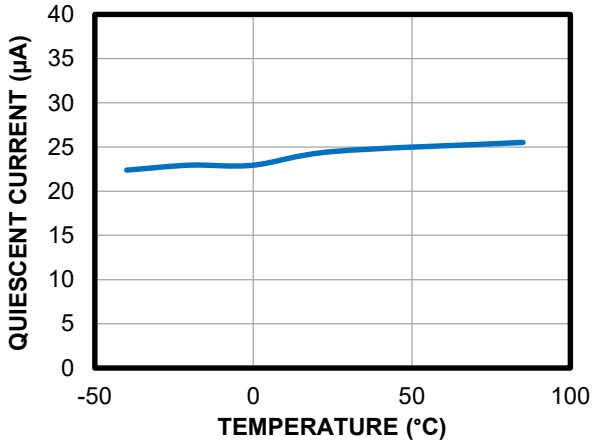
Switching Frequency vs. Temperature



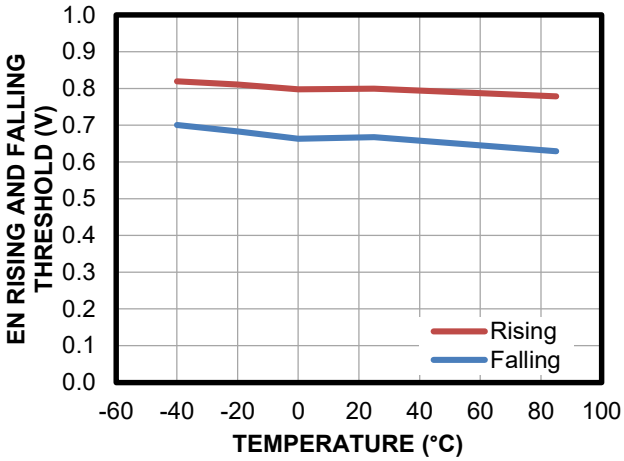
Peak Current Limit vs. Input Voltage



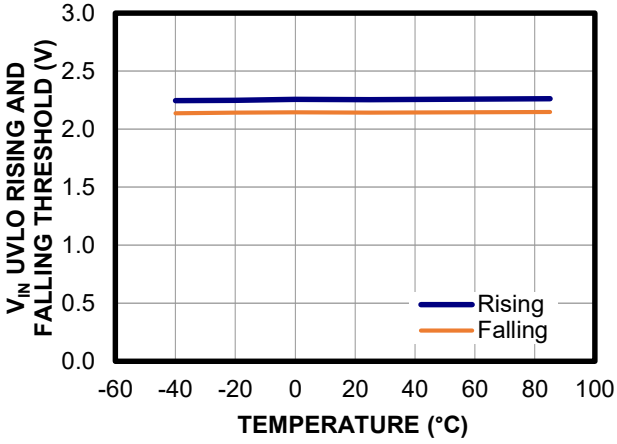
Quiescent Current vs. Temperature



EN Rising and Falling Threshold vs. Temperature



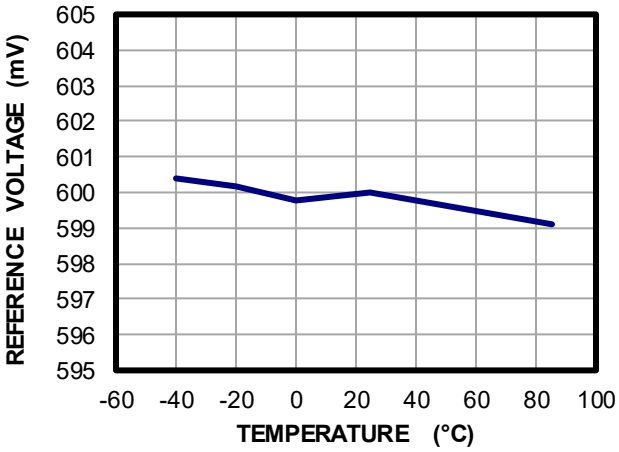
V_{IN} UVLO Rising and Falling Threshold vs. Temperature



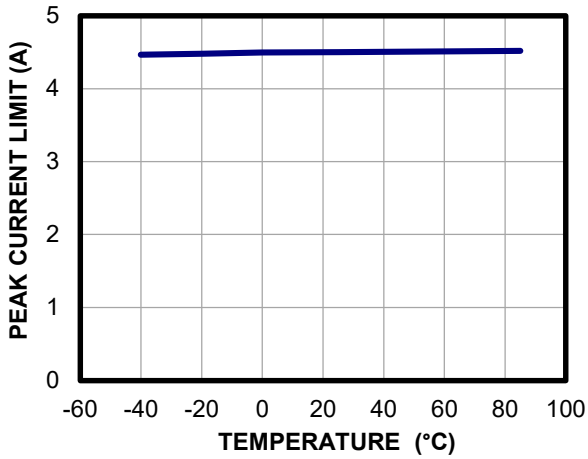
EVB TEST RESULTS *(continued)*

V_{IN} = 5V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

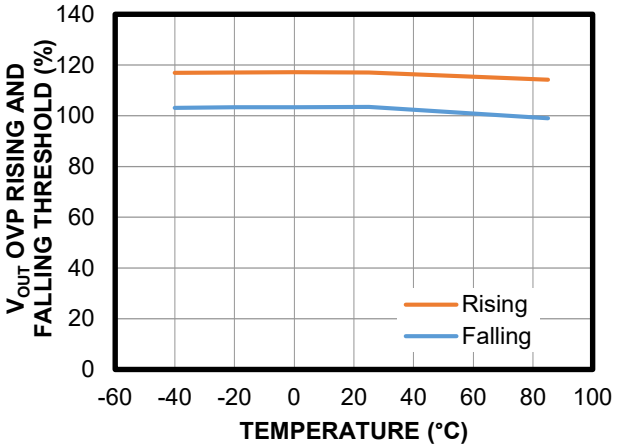
Reference Voltage vs. Temperature



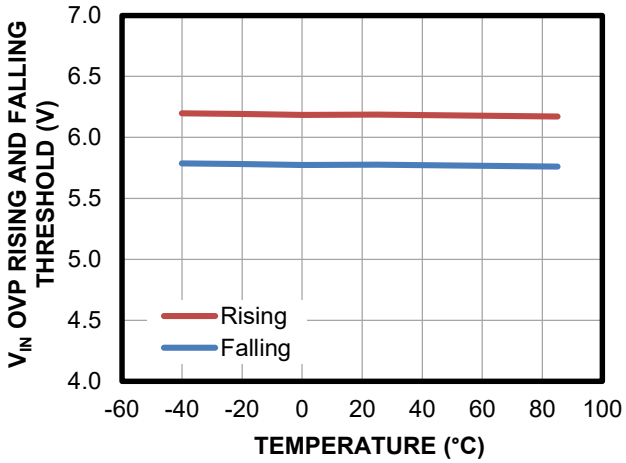
Peak Current Limit vs. Temperature



V_{OUT} OVP Rising and Falling Threshold vs. Temperature

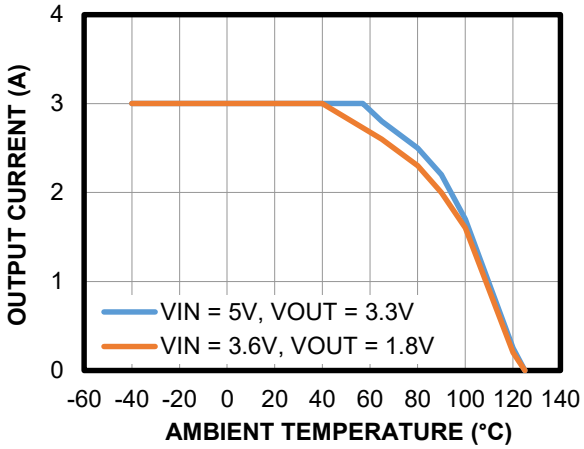


V_{IN} OVP Rising and Falling Threshold vs. Temperature



Output Current Derating vs. Ambient Temperature

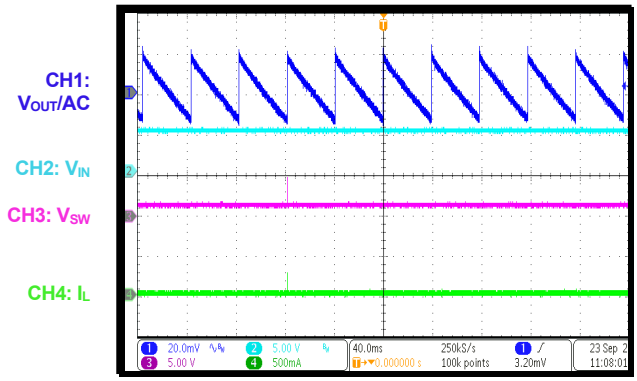
$T_J \leq 125°C$



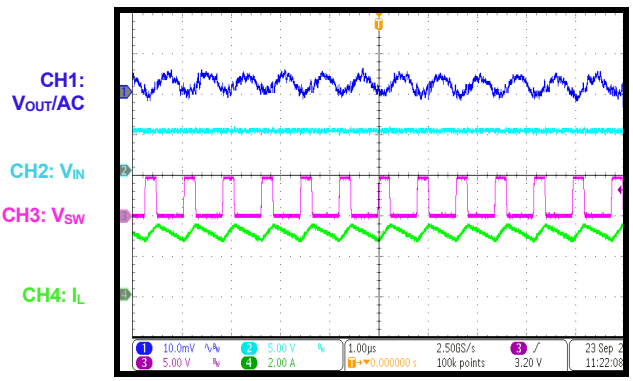
EVB TEST RESULTS *(continued)*

V_{IN} = 5V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

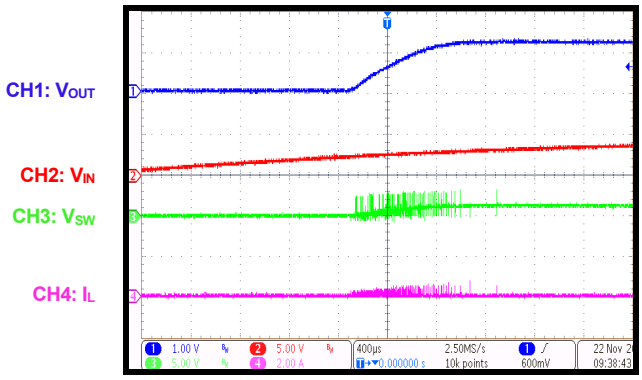
Steady State
I_{OUT} = 0A



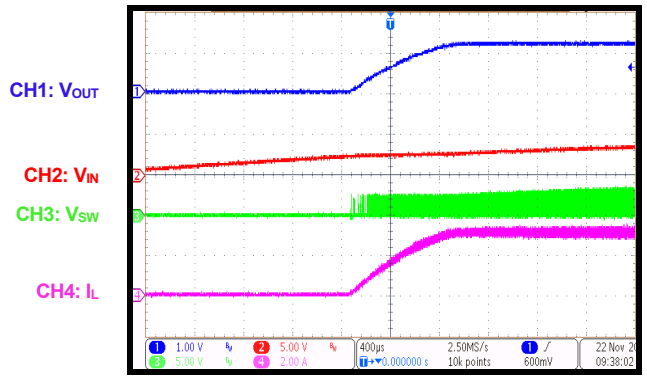
Steady State
I_{OUT} = 3A



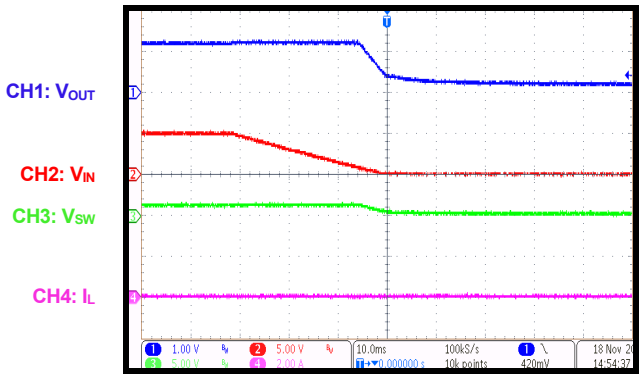
Start-Up through VIN
I_{OUT} = 0A



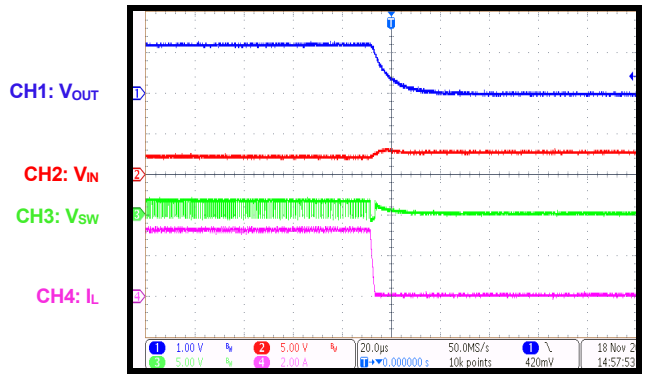
Start-Up through VIN
I_{OUT} = 3A



Shutdown through VIN
I_{OUT} = 0A



Shutdown through VIN
I_{OUT} = 3A

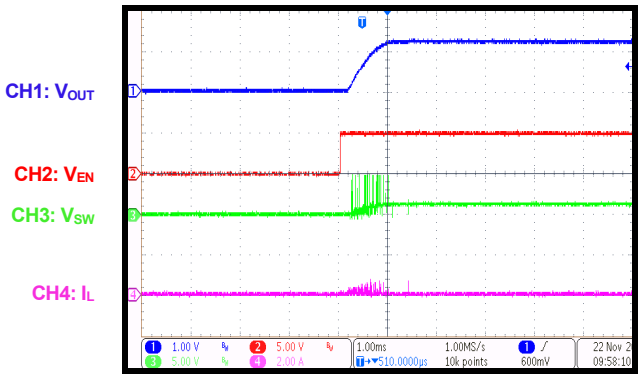


EVB TEST RESULTS *(continued)*

V_{IN} = 5V, V_{OUT} = 1.2V, L = 1µH, C_{OUT} = 22µF, T_A = 25°C, unless otherwise noted.

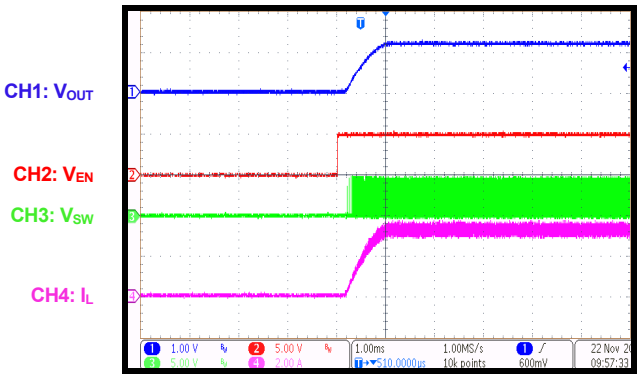
Start-Up through EN

I_{OUT} = 0A



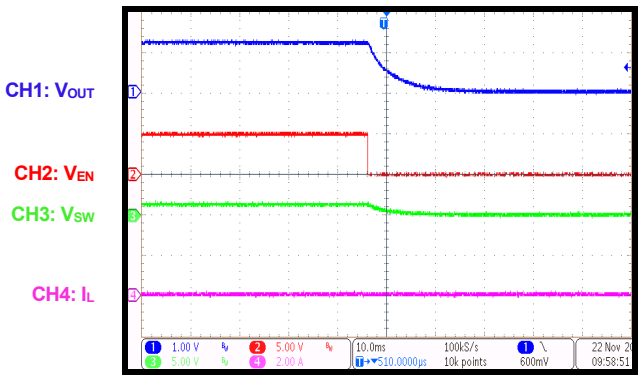
Start-Up through EN

I_{OUT} = 3A



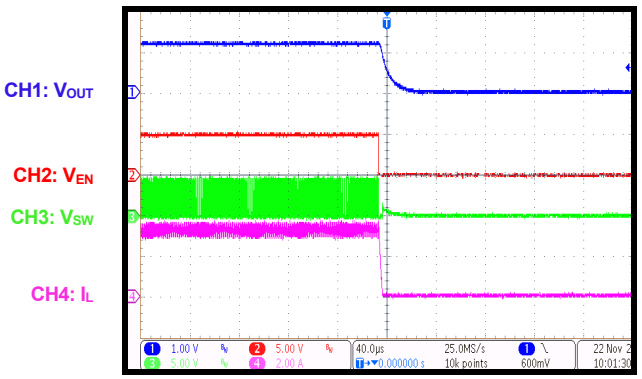
Shutdown through EN

I_{OUT} = 0A



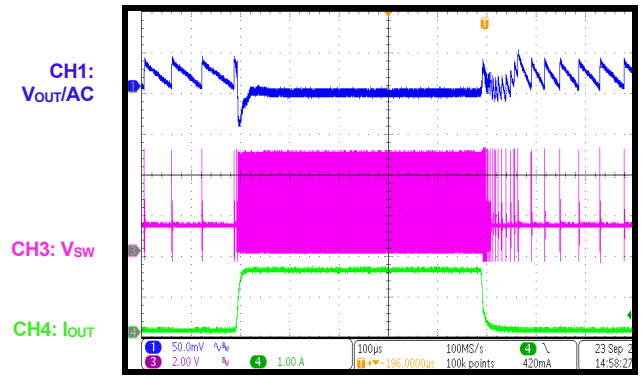
Shutdown through EN

I_{OUT} = 3A



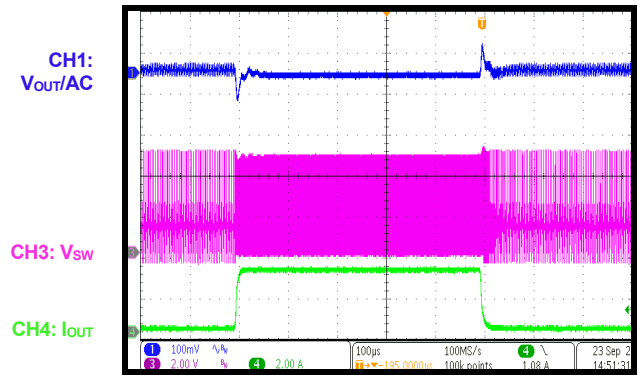
Load Transient

I_{OUT} = 0A to 1.5A, 1A/µs



Load Transient

I_{OUT} = 0.1A to 3A, 1A/µs



PCB LAYOUT

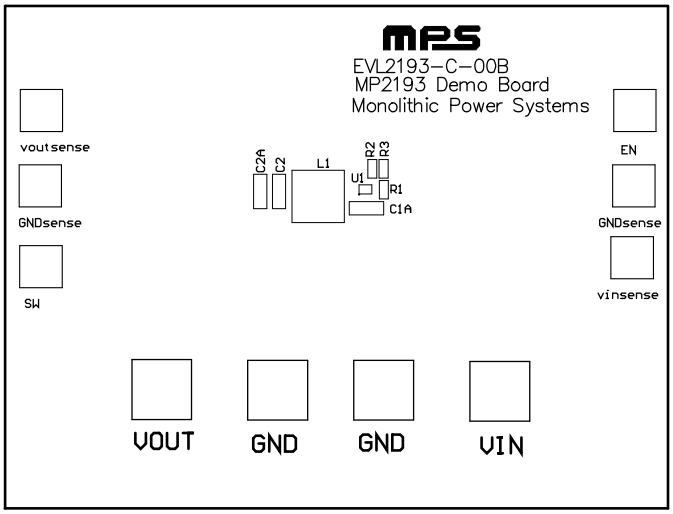


Figure 3: Top Silk

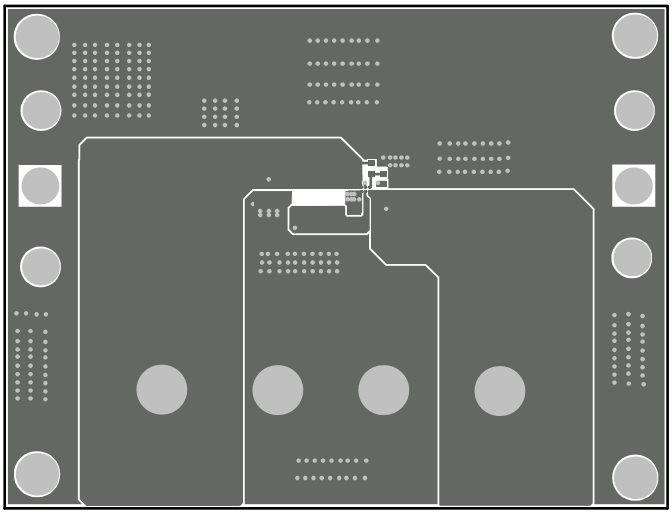


Figure 4: Top Layer

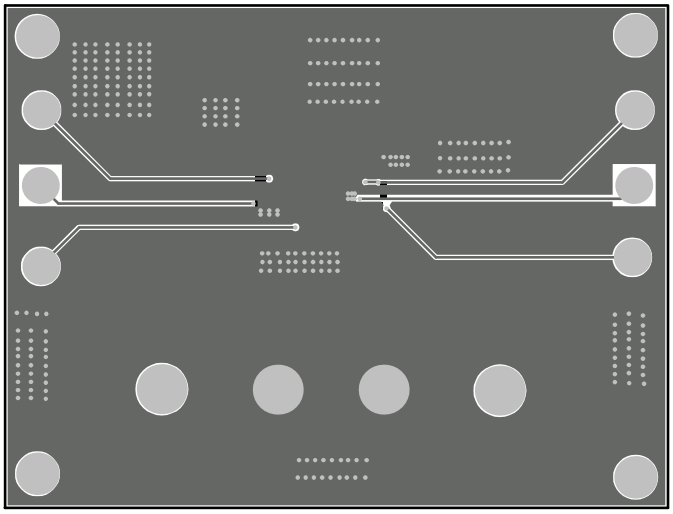


Figure 5: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	4/29/2024	Initial Release	-