EVQ2242-D-00A

2A, 6V, Configurable-Frequency, Synchronous Buck Converter Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ2242-D-00A is an evaluation board designed to demonstrate the capabilities of the MPQ2242, a configurable-frequency (300kHz to 2.2MHz), synchronous step-down converter with an integrated high-side MOSFET (HS-FET) and a synchronous rectifier to provide high efficiency without an external Schottky diode.

The MPQ2242 can achieve up to 2A of continuous output current (I_{OUT}) across a 2.7V to 6V input voltage (V_{IN}) range, with an output voltage (V_{OUT}) down to 0.606V. It is ideal for a wide range of applications, including automotive infotainment systems, clusters, and telematics, as well as portable instruments.

Advanced asynchronous modulation (AAM) mode provides high efficiency by reducing switching losses at light loads, while forced continuous conduction mode (FCCM) has a controllable switching frequency (f_{SW}) and a lower V_{OUT} ripple. Peak current control mode provides excellent transient response and high efficiency.

An open-drain power good (PG) signal indicates whether the V_{OUT} is within 85% to 115% of the nominal voltage.

Full protection features include over-current protection (OCP) with valley current detection to avoid current runaway, short-circuit protection (SCP), over-voltage protection (OVP), and thermal shutdown with automatic recovery.

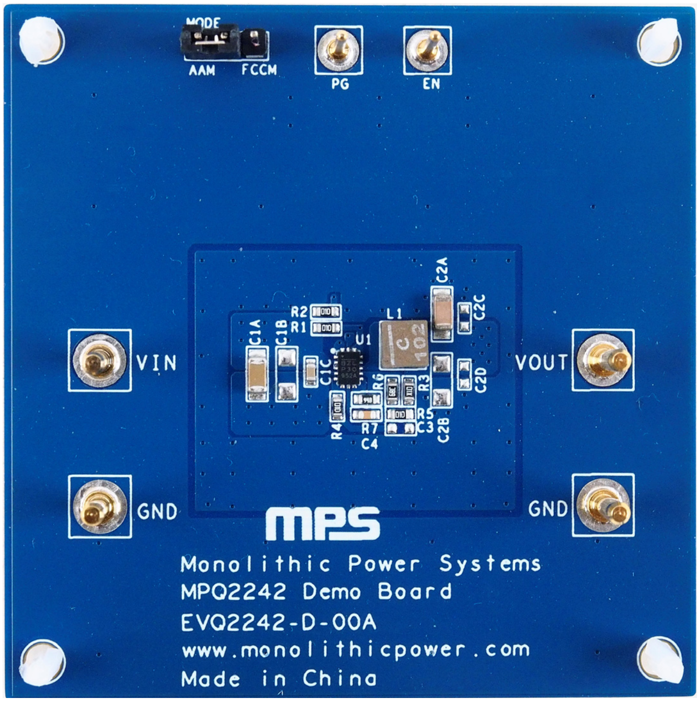
The EVQ2242-D-00A is fully assembled and tested. The MPQ2242 is available in a QFN-9 (2mmx3mm) package, and is available in AEC-Q100 Grade 1.

PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range		2.7V to 6V
Output voltage (V_{OUT})	V_{IN} = 2.7V to 6V, I_{OUT} = 0A to 2A	1.8V
Maximum output current (I_{OUT})	V_{IN} = 2.7V to 6V	2A
Typical efficiency	V_{IN} = 5V, V_{OUT} = 1.8V, I_{OUT} = 2A	92.1%
Peak efficiency	V_{IN} = 2.7V, V_{OUT} = 1.8V, I_{OUT} = 0.6A	95.1%
Switching frequency (f_{SW})		2.1MHz

EVQ2242-D-00A EVALUATION BOARD



LxWxH (6.35cmx6.35cmx0.85cm)

Board Number	MPS IC Number
EVQ2242-D-00A	MPQ2242GDE-AEC1

QUICK START GUIDE

The EVQ2242-D-00A evaluation board is easy to set up and use to evaluate the MPQ2242's performance. For proper measurement equipment set-up, refer to Figure 2 on page 4 and follow the steps below:

1. Preset the power supply between 2.7V and 6V, then turn off the power supply.
2. Set the load current between 0A and 2A. Electronic loads represent a negative impedance to the converter. Setting a current too high may trigger over-current protection (OCP) (e.g. if the inductor current reaches the peak current limit, OCP is triggered).
3. If longer cables are used between the source and the evaluation board (>0.5m total), place a damping capacitor at the input terminals.
4. Connect the power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
5. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
6. After making the connections, turn on the power supply.
7. To use the enable (EN) function, apply a digital input to the EN pin. Pull EN above 1.2V to turn the converter on; pull EN below 0.4V to turn it off. If the EN function is not used, connect the EN pin directly to VIN.
8. The external resistor divider sets the output voltage (V_{OUT}) (see Figure 1).

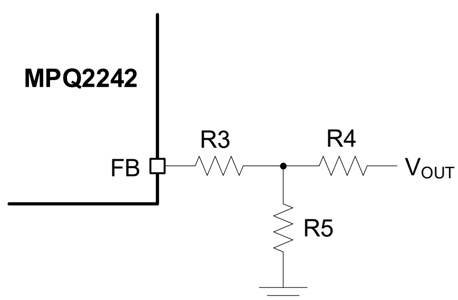


Figure 1: Feedback Divider Network with Adjustable Output

Choose R3 and R4 to be 100kΩ. R5 can be calculated using Equation (1):

$$R5 = \frac{R4}{\frac{V_{OUT}}{0.606V} - 1} \quad (1)$$

Refer to the Application Information section in the MPQ2242 datasheet to calculate the inductance and output capacitance for different V_{OUT} values.

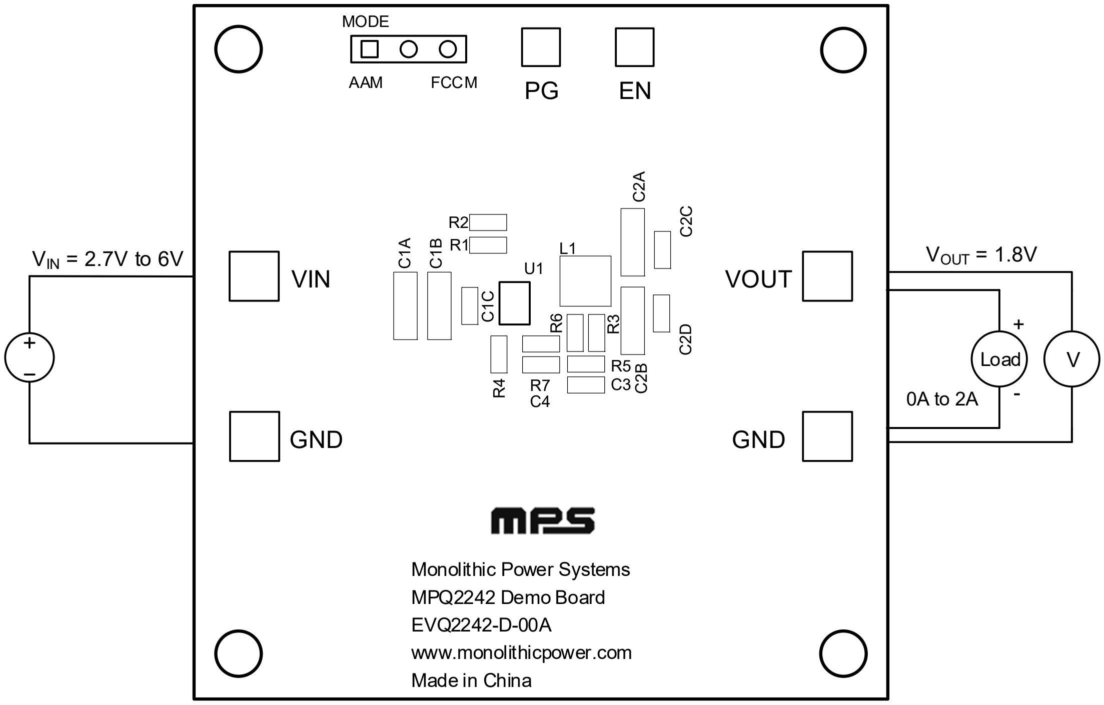
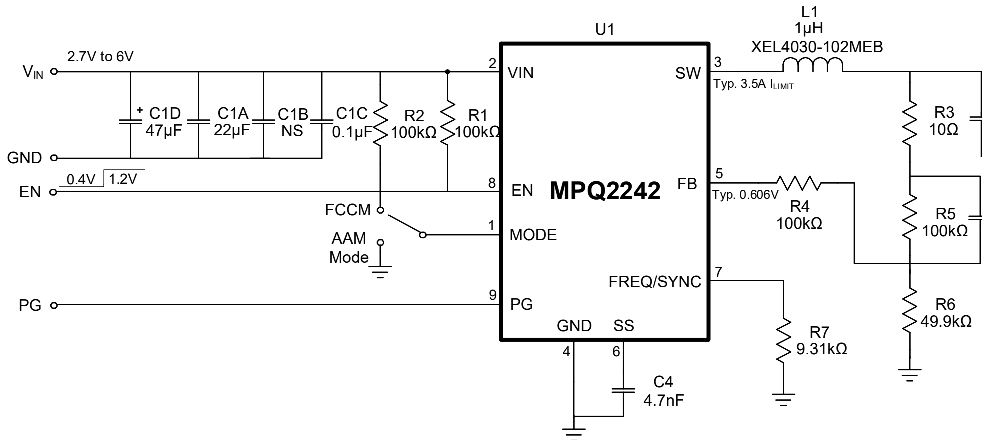


Figure 2: Measurement Equipment Set-Up

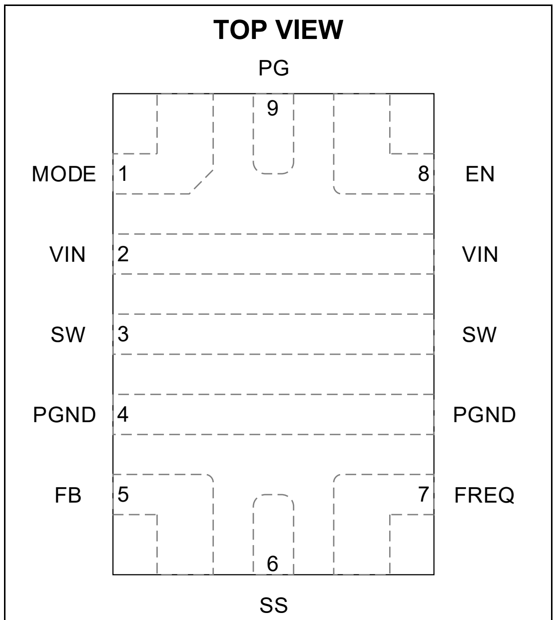
EVALUATION BOARD SCHEMATIC



V_{OUT} (V)	R4 (kΩ)	R5 (kΩ)	R6 (kΩ)
1.2	100 (1%)	100 (1%)	100 (1%)
1.5	100 (1%)	100 (1%)	66.5 (1%)
1.8	100 (1%)	100 (1%)	49.9 (1%)
2.5	100 (1%)	100 (1%)	31.6 (1%)
3.3	100 (1%)	100 (1%)	22.1 (1%)

Figure 3: Evaluation Board Schematic

PACKAGE REFERENCE



QFN-9 (2mmx3mm)

EVQ2242-D-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	C4	4.7nF	Ceramic capacitor, 50V, X7R	0603	Wurth	885012206087
1	C1A	22µF	Ceramic capacitor, 16V, X5R	1206	Murata	GRM31CR61C226 ME15L
1	C1C	0.1µF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R71C104 KA01D
1	C1D	47µF	Electrolytic capacitor, 16V	SMD	Jianghai	VZ2-16V47
1	C2A	22µF	Ceramic capacitor, 10V, X7R	1206	Murata	GCJ31CR71A226 ME01L
5	C3, C1B, C2B, C2C, C2D	NS				
1	L1	1µH	Inductor, 8.9mΩ, 9A	SMD	Coilcraft	XEL4030-102MEB
4	R1, R2, R4, R5	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R3	10Ω	Film resistor, 1%	0603	Yageo	RC0603FR-0710RL
1	R6	49.9kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0749K9L
1	R7	9.31kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-079K31L
4	VIN, GND, GND, VOUT	2mm	Golden pin	DIP	Custom (1)	
2	PG, EN	1mm	Golden pin	DIP	Custom (1)	
1	MODE	2.54mm	Test pin, 3-pin	DIP	Custom (1)	
1	U1	MPQ2242	2A, 6V, synchronous buck converter, AEC-Q100	QFN-9	MPS	MPQ2242GDE-AEC1

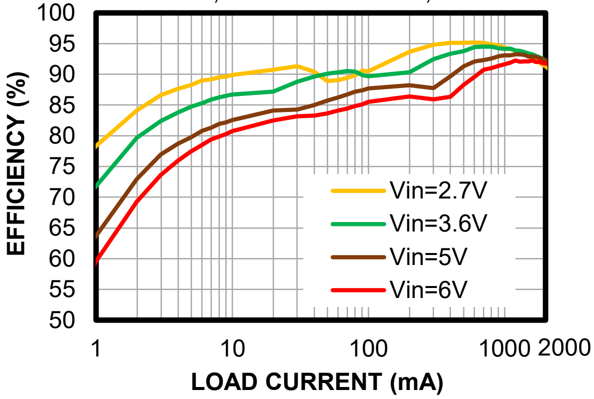
Note:

1) Contact an MPS FAE for more information regarding custom pins.

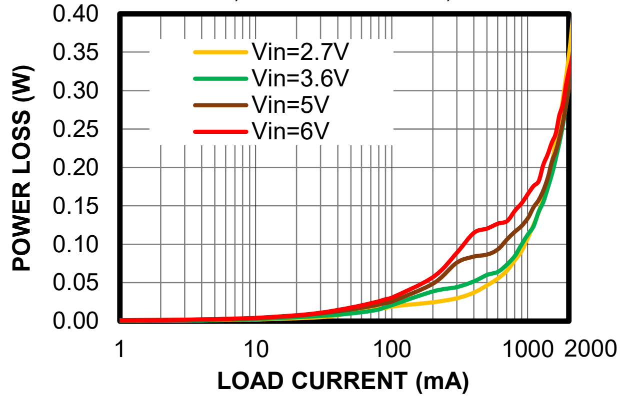
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

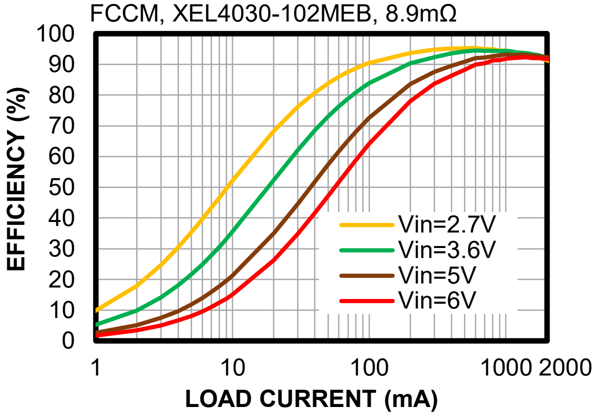
Efficiency vs. Load Current
AAM mode, XEL4030-102MEB, 8.9mΩ



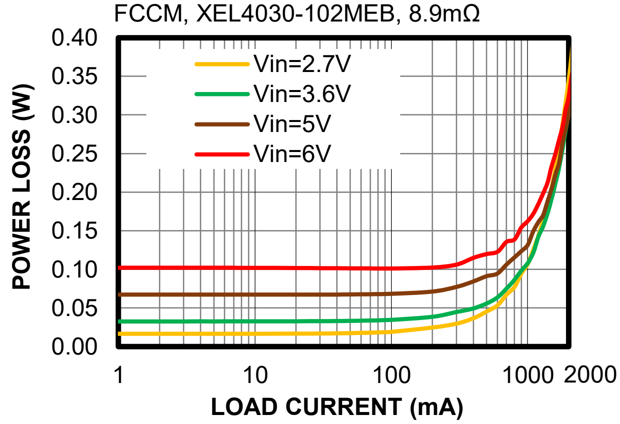
Power Loss vs. Load Current
AAM mode, XEL4030-102MEB, 8.9mΩ



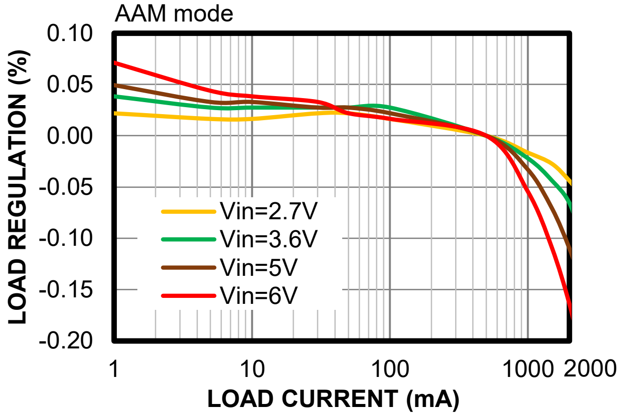
Efficiency vs. Load Current
FCCM, XEL4030-102MEB, 8.9mΩ



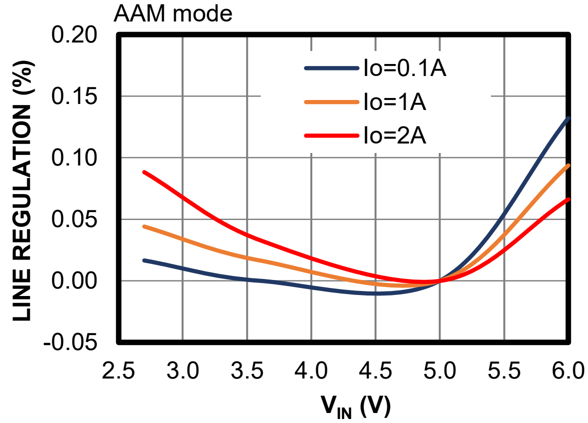
Power Loss vs. Load Current
FCCM, XEL4030-102MEB, 8.9mΩ



Load Regulation
AAM mode

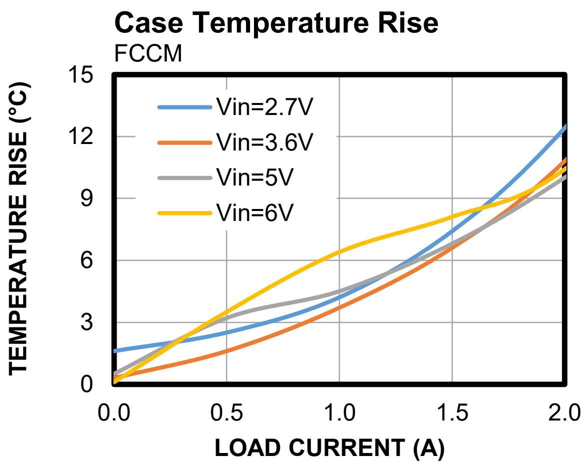


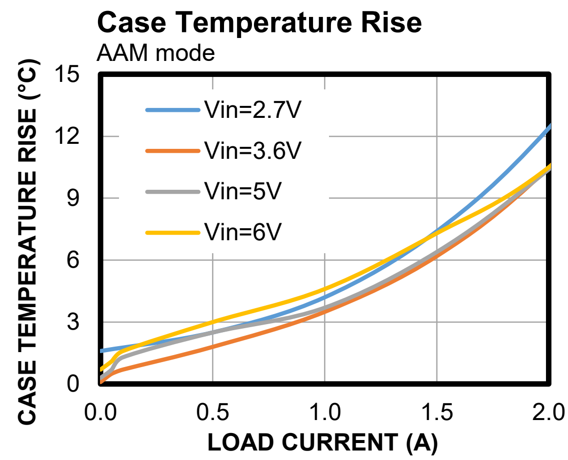
Line Regulation
AAM mode

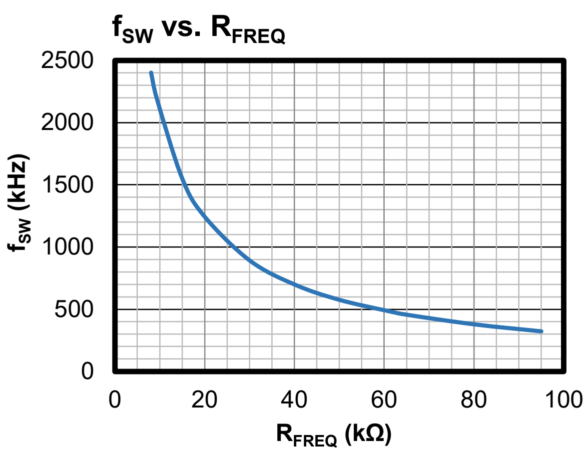


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.





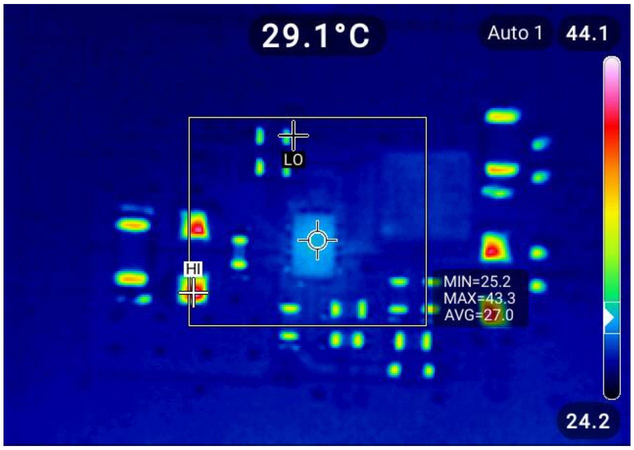


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

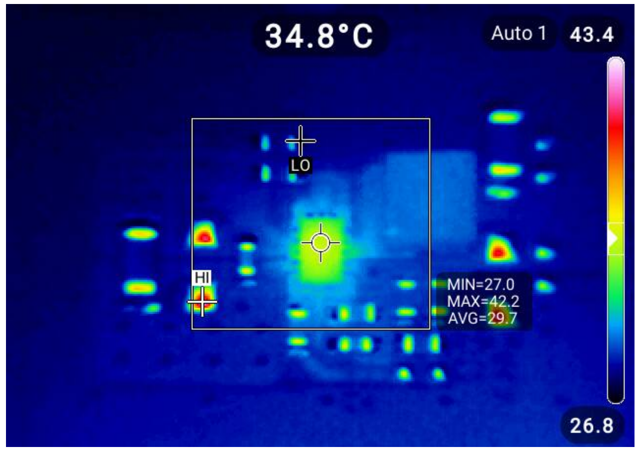
Thermal Performance

I_{OUT} = 1A, no forced airflow, T_{CASE} = 29.1°C



Thermal Performance

I_{OUT} = 2A, no forced airflow, T_{CASE} = 34.8°C

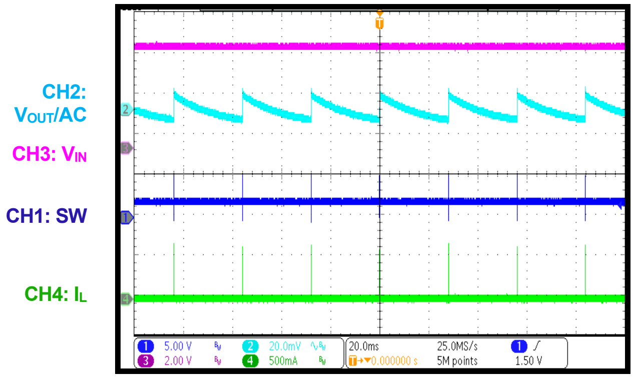


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

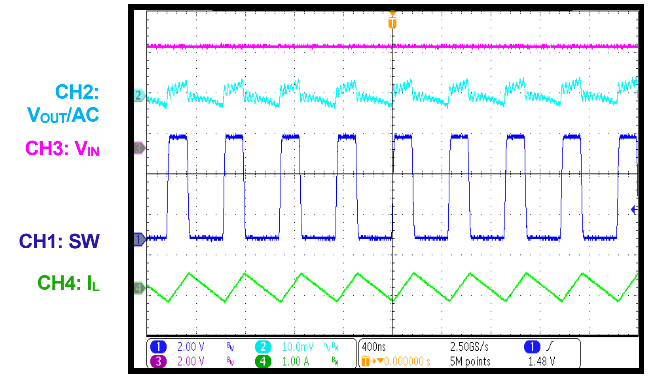
Steady State

I_{OUT} = 0A, AAM mode



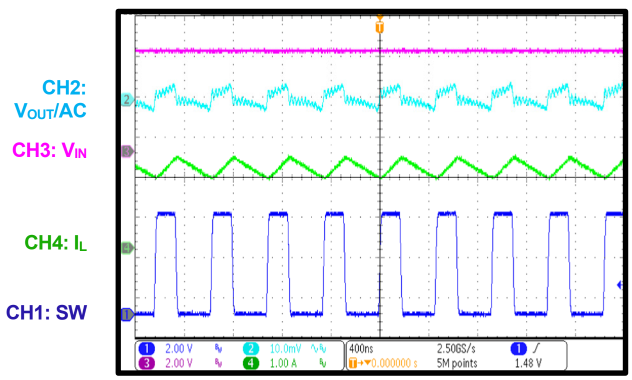
Steady State

I_{OUT} = 0A, FCCM



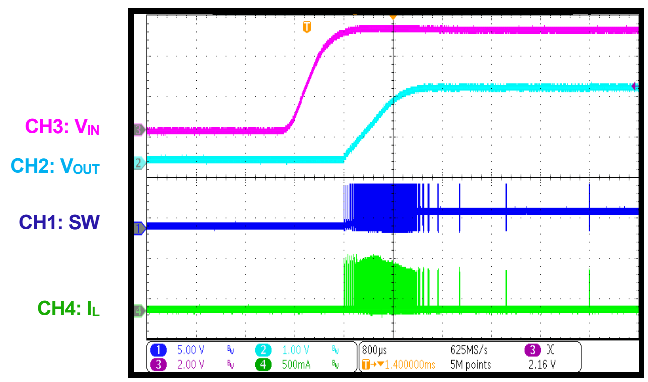
Steady State

I_{OUT} = 2A



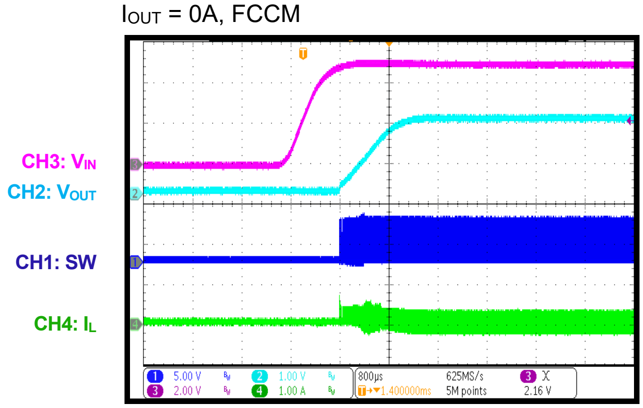
Start-Up through VIN

I_{OUT} = 0A, AAM mode



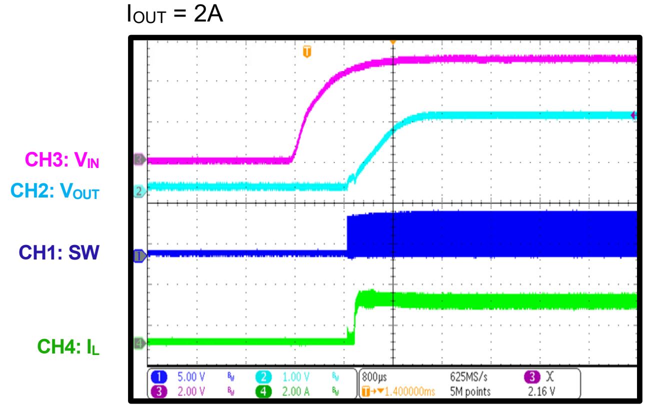
Start-Up through VIN

I_{OUT} = 0A, FCCM



Start-Up through VIN

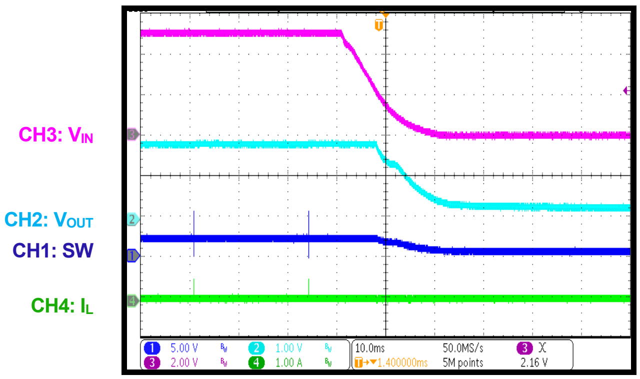
I_{OUT} = 2A



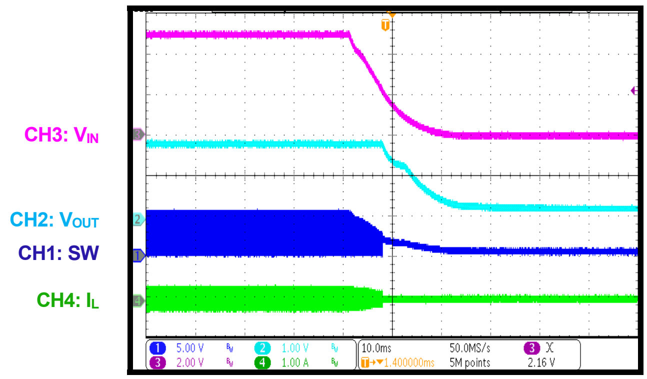
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

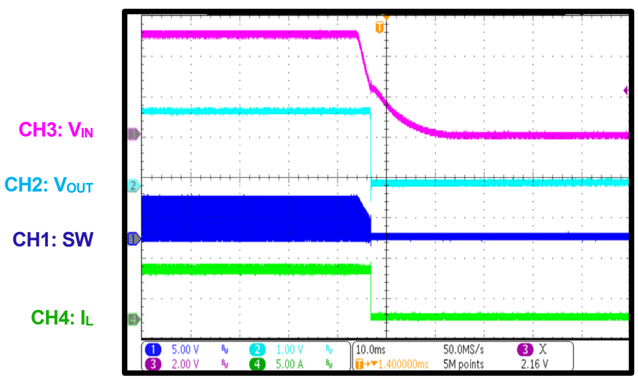
Shutdown through VIN
I_{OUT} = 0A, AAM mode



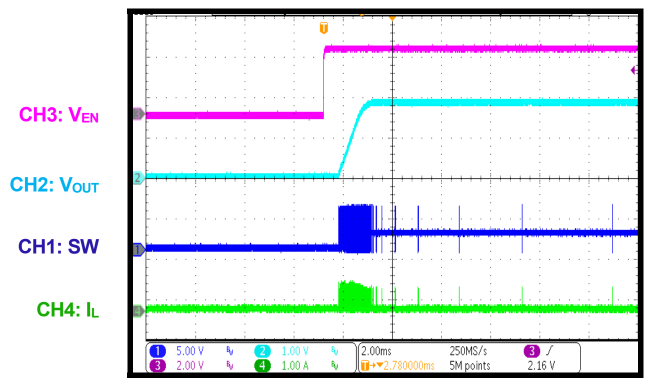
Shutdown through VIN
I_{OUT} = 0A, FCCM



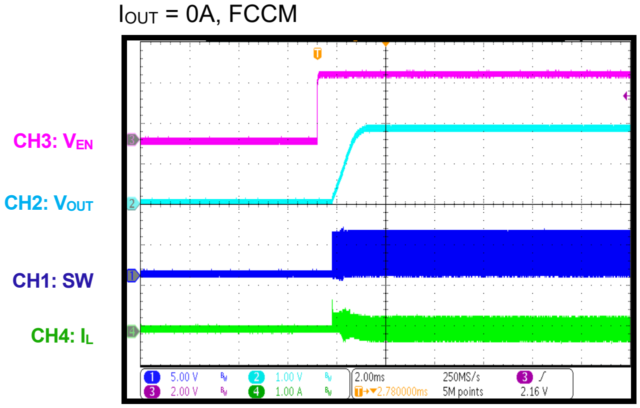
Shutdown through VIN
I_{OUT} = 2A



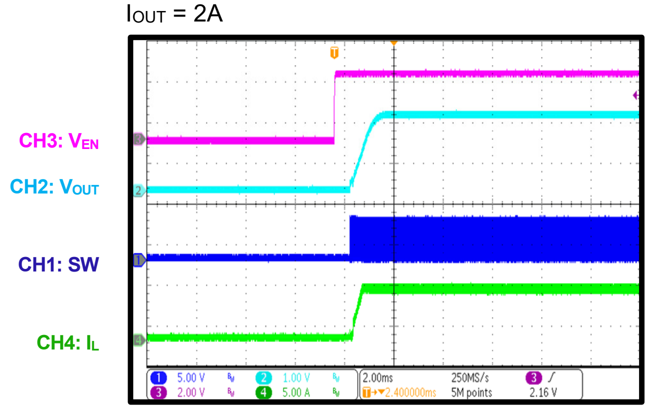
Start-Up through EN
I_{OUT} = 0A, AAM mode



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



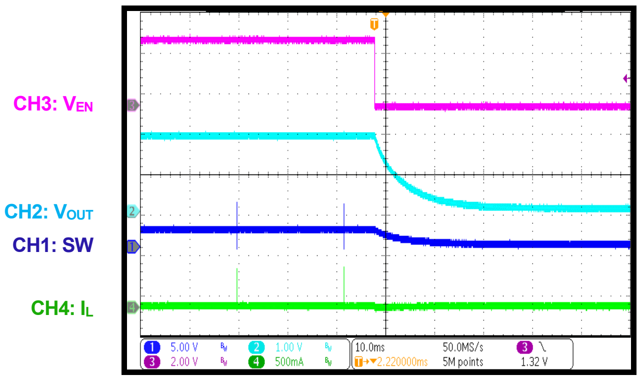
Start-Up through EN
I_{OUT} = 2A



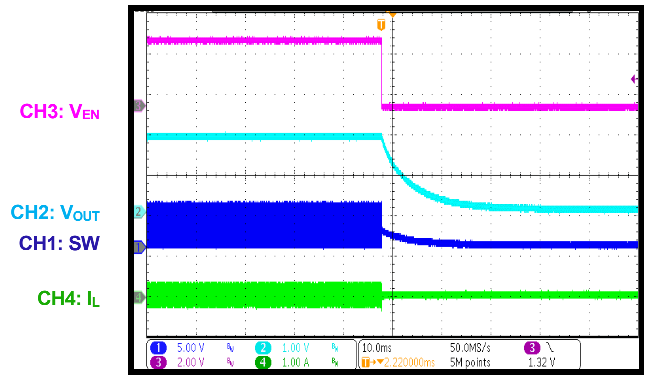
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

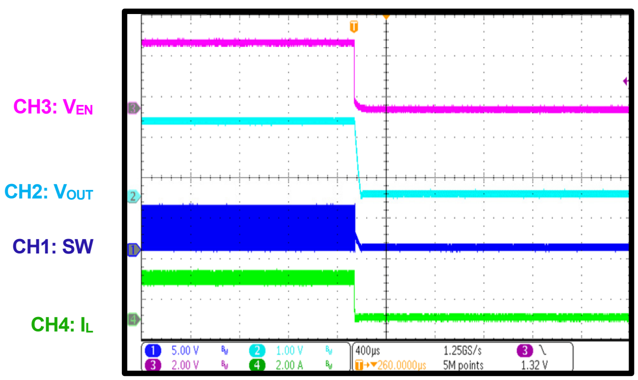
Shutdown through EN
I_{OUT} = 0A, AAM mode



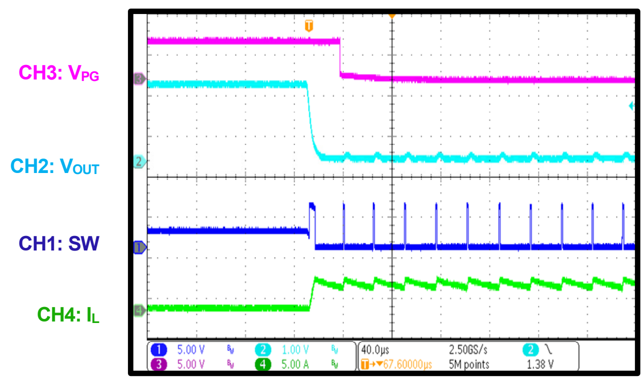
Shutdown through EN
I_{OUT} = 0A, FCCM



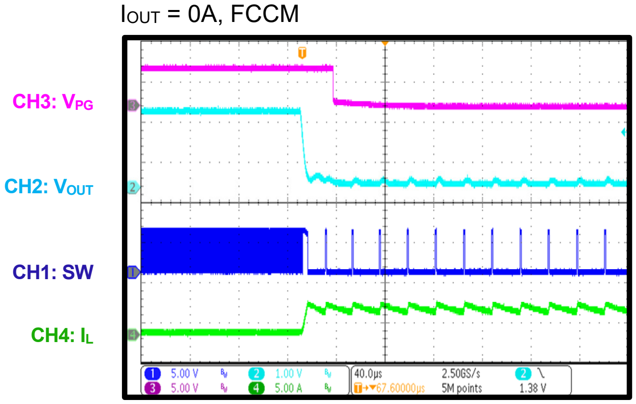
Shutdown through EN
I_{OUT} = 2A



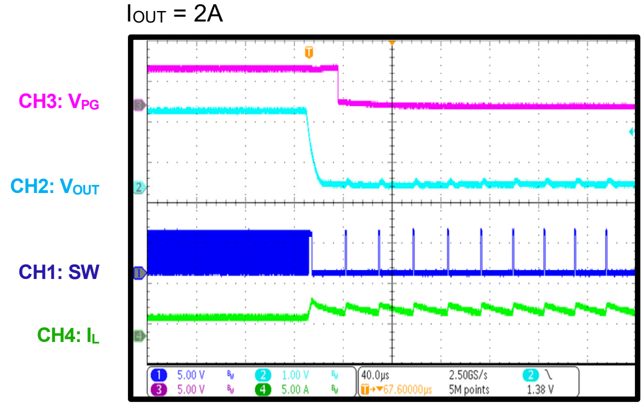
SCP Entry
I_{OUT} = 0A, AAM mode



SCP Entry
I_{OUT} = 0A, FCCM



SCP Entry
I_{OUT} = 2A

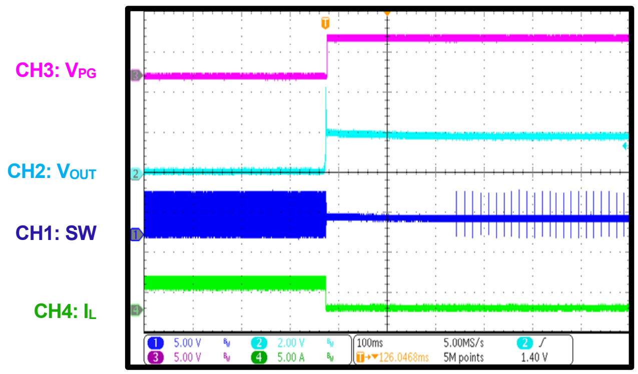


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

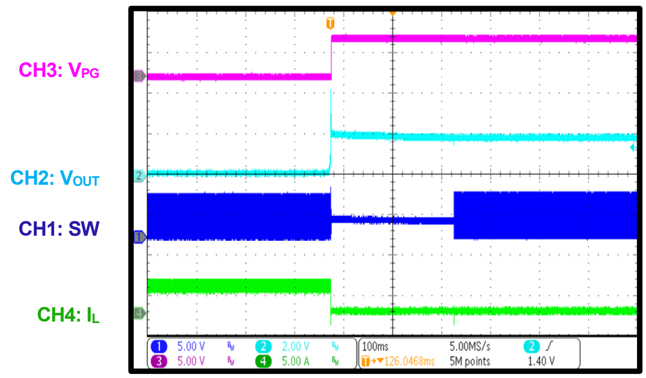
SCP Recovery

I_{OUT} = 0A, AAM mode



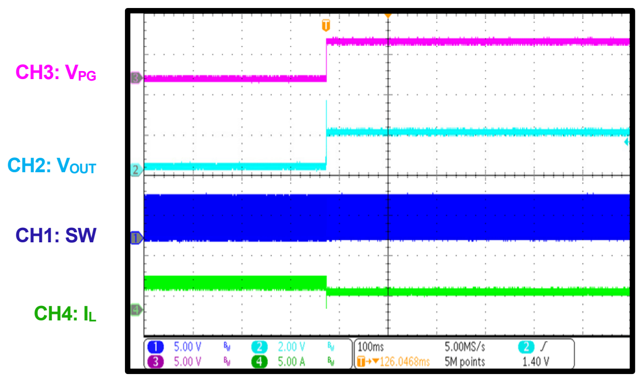
SCP Recovery

I_{OUT} = 0A, FCCM

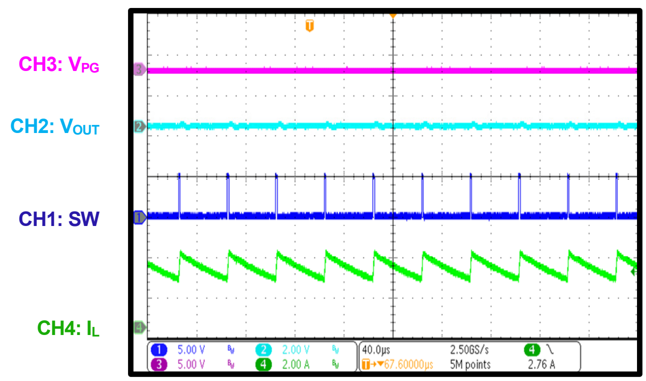


SCP Recovery

I_{OUT} = 2A

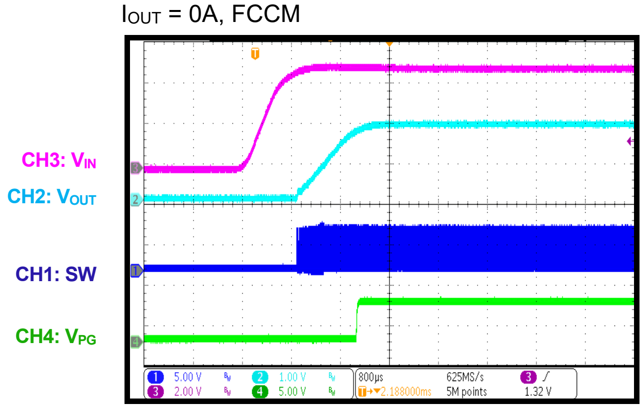


Short-Circuit Protection



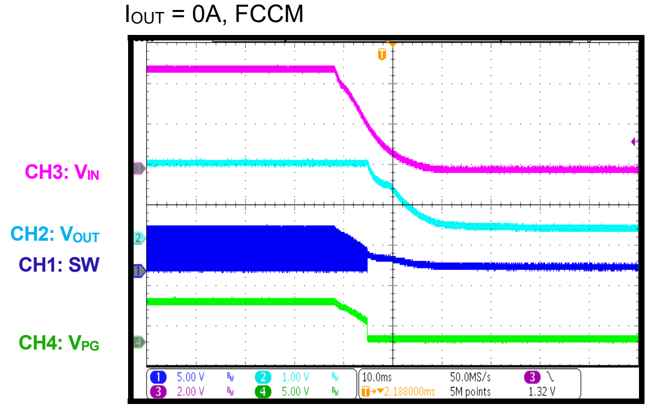
PG Start-Up through VIN

I_{OUT} = 0A, FCCM



PG Shutdown through VIN

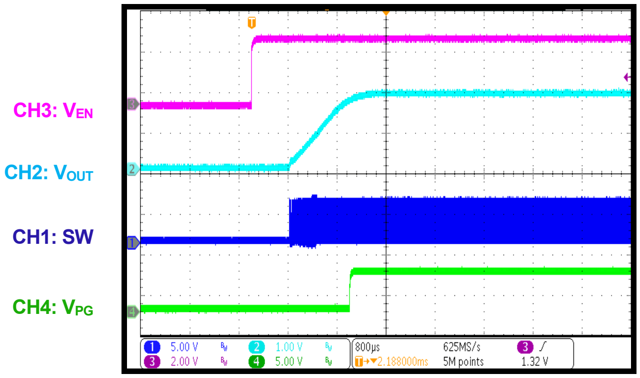
I_{OUT} = 0A, FCCM



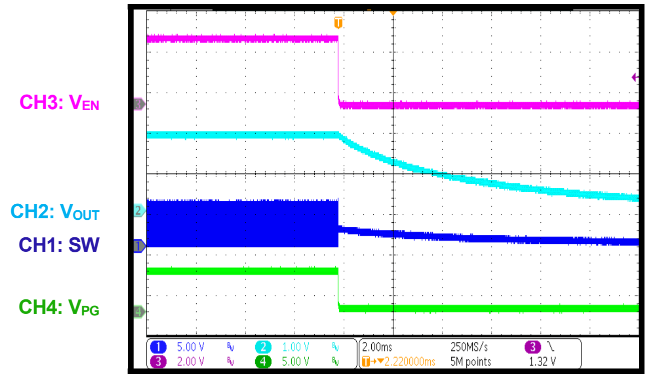
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 5V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

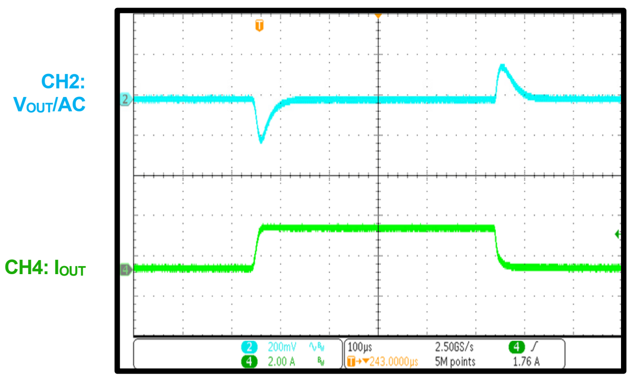
PG Start-Up through EN
I_{OUT} = 0A, FCCM



PG Shutdown through EN
I_{OUT} = 0A, FCCM



Load Transient
I_{OUT} = 0A to 2A, slew rate = 1.6A/μs,
AAM mode



PCB LAYOUT (2)

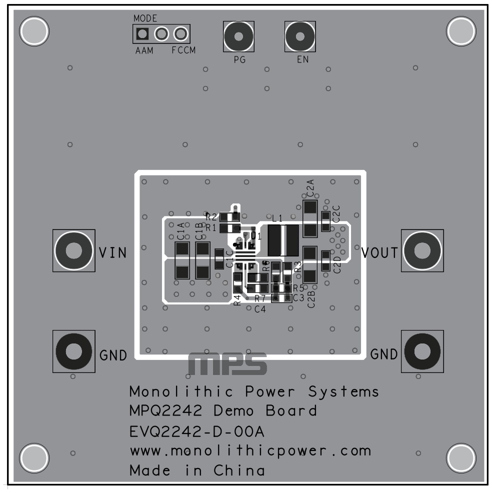


Figure 4: Top Silk and Top Layer

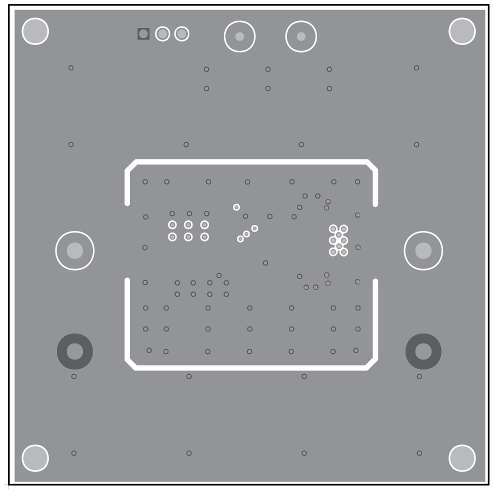


Figure 5: Mid-Layer 1

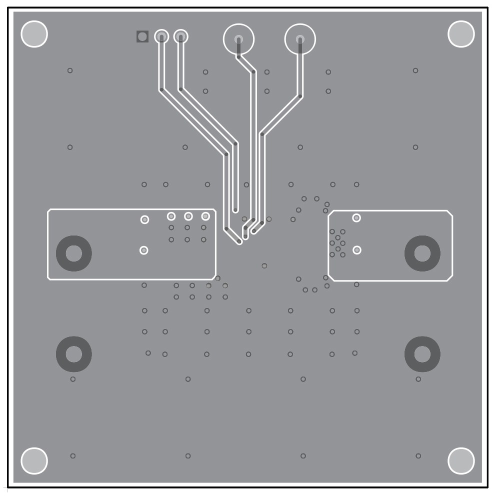


Figure 6: Mid-Layer 2

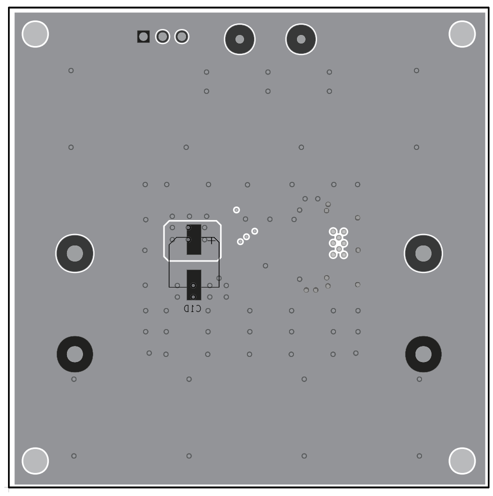


Figure 7: Bottom Layer and Bottom Silk

Note:

2) The copper thickness is 2oz.

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	2/23/2023	Initial Release	-