EVBL4473-L-00A

3.5A, 36V, High-Efficiency, Fast Transient Response, Step-Down Converter Evaluation Board

DESCRIPTION

The EVBL4473-L-00A evaluation board is designed to demonstrate the capabilities of the MP/MPQ4473, a high-efficiency, step-down regulator that features an MPS power inductor and integrated power MOSFETs.

The MP/MPQ4473 offers a very compact solution to achieve 3.5A of continuous output current (I_{OUT}) with excellent load and line regulation across a wide input supply range. It also provides fast transient response and good stability across a wide input supply and load range.

The EVBL4473-L-00A is a fully assembled and tested evaluation board. It generates a 3.3V output voltage (V_{OUT}) at load currents up to 3.5A across a 4.5V to 36V input voltage (V_{IN}) range. The switching frequency (f_{SW}) is set to 500kHz.

The MP/MPQ4473 is available in a QFN-20 (3mmx4mm) package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	4.5 to 36	V
Output voltage	V_{OUT}	3.3	V
Output current	I_{OUT}	3.5	A

FEATURES

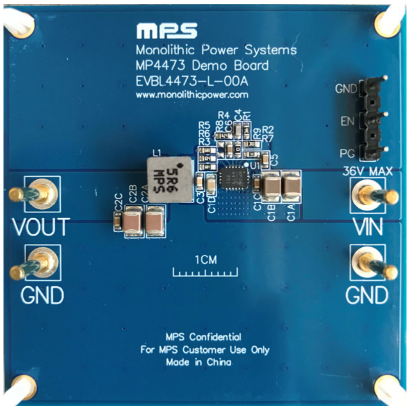
- Wide 4.5V to 36V Operating Input Voltage (V_{IN}) Range
- Up to 3.5A Continuous Output Current (I_{OUT})
- Internal 40mΩ High-Side, 20mΩ Low-Side Power MOSFETs
- Proprietary Switching Loss Reduction Technology
- 1% Reference Voltage (V_{REF})
- Configurable Soft-Start Time (t_{SS})
- Low-Dropout Mode
- Short-Circuit Protection (SCP), Over-Current Protection (OCP), Over-Voltage Protection (OVP), Under-Voltage Protection (UVP), and Thermal Shutdown
- MPS Power Inductor

MPL Optimized Performance with MPS Inductor MPL-AL6050 Series

APPLICATIONS

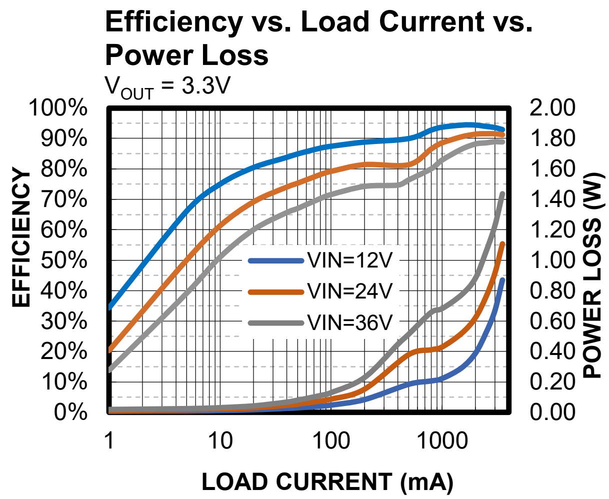
- Notebook Systems and I/O Power
- Automotive Systems
- Networking Systems
- Industrial Supplies
- Optical Communications Systems
- Distributed Power and Point-of-Load (POL) Systems

EVBL4473-L-00A EVALUATION BOARD



LxWxH (6.4cmx6.4cmx1.0cm)

Board Number	MPS IC Number
EVBL4473-L-00A	MP/MPQ4473GL



QUICK START GUIDE

1. Preset the power supply output between 4.5V and 36V, then turn off the power supply.
2. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
3. Connect the power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. After making the connections, turn on the power supply. The board should start up automatically.
5. Apply a digital input to the EN pin to use the enable function. Drive EN above 1.25V to turn the regulator on; drive EN below 0.86V to turn it off.
6. Add the resistor dividers, R5 and R8, to use the under-voltage lockout (UVLO) function. Calculate the V_{IN} UVLO threshold with Equation (1):

$$0.86 \times \left(1 + \frac{R5}{R8}\right) \quad (1)$$

   Where the falling edge EN threshold is 0.86V.
7. Set the output voltage (V_{OUT}) using R1 and R2, where V_{FB} = 0.815V and R2 = 10kΩ. Calculate R1 with Equation (2): (1)

$$R1 = 12.27 \times (V_{OUT} - 0.815)(k\Omega) \quad (2)$$

Note:

1) Refer to the Application Information section in the MP/MPQ4473 datasheet to recalculate the compensation, inductor, and output capacitor values when V_{OUT} is changed.

EVALUATION BOARD SCHEMATIC

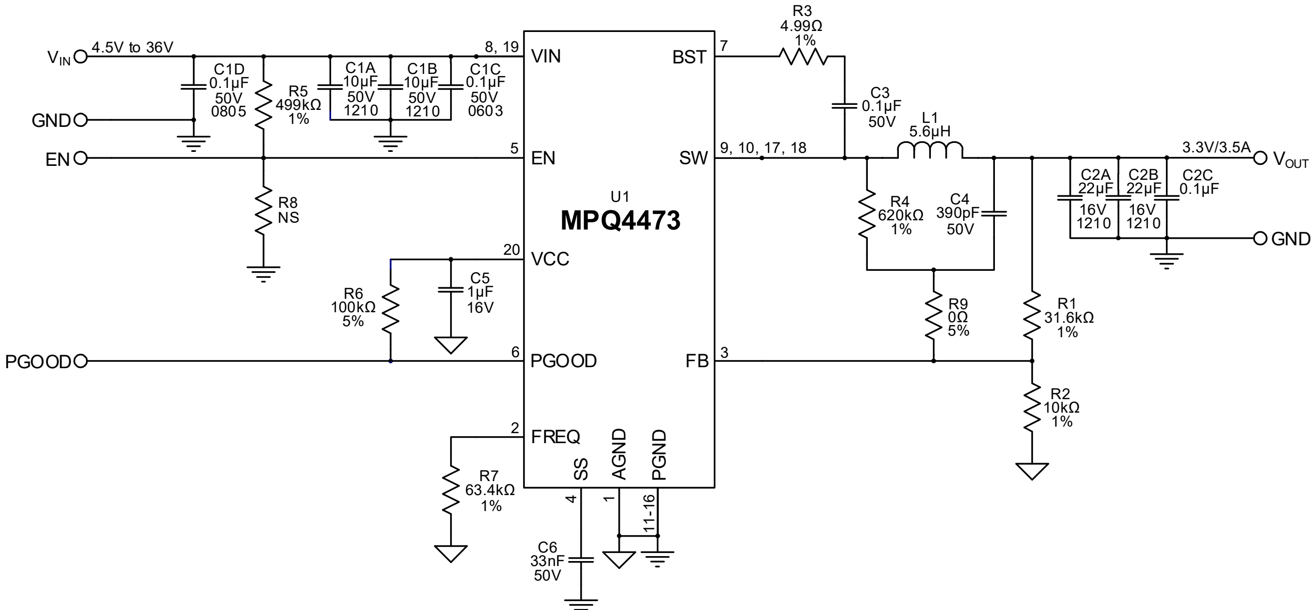


Figure 1: Evaluation Board Schematic

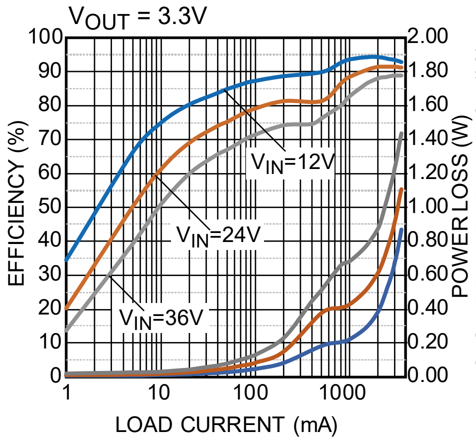
EVBL4473-L-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	C1A, C1B	10µF	Ceramic capacitor, 50V, X7R	1210	Murata	GRM32ER71H106KA12L
3	C1C, C2C, C3	0.1µF	Ceramic capacitor, 50V, X7R	0603	TDK	C1005X7R1C104K
1	C1D	0.1µF	Ceramic capacitor, 50V, X7R	0805	Murata	GRM21BR72A104KAC4L
2	C2A, C2B	22µF	Ceramic capacitor, 16V, X7R	1210	Murata	GRM32ER71C226KE79
1	C4	390pF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM1885C1H391JA01D
1	C5	1µF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R71C105KA12D
1	C6	33nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H333KA61D
1	R1	31.6kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0731K6L
1	R2	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	R3	4.99Ω	Film resistor, 1%	0603	Yageo	RC0603FR-074R99L
1	R4	620kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07620KL
1	R5	499kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07499KL
1	R6	100kΩ	Film resistor, 5%	0603	Yageo	RC0603FR-07100KL
1	R7	63.4kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0763K4L
1	R9	0Ω	Film resistor, 5%	0603	Yageo	RC0603FR-070RL
0	R8	NS				
1	L1	5.6µH	Inductor, DCR = 14mΩ, I_{SAT} = 9.5A	SMD (6mmx 6.4mmx 4.8mm)	MPS	MPL-AL6050-5R6
1	U1	MP4473	3.5A, 36V step-down regulator	QFN-20 (3mmx 4mm)	MPS	MP4473GL

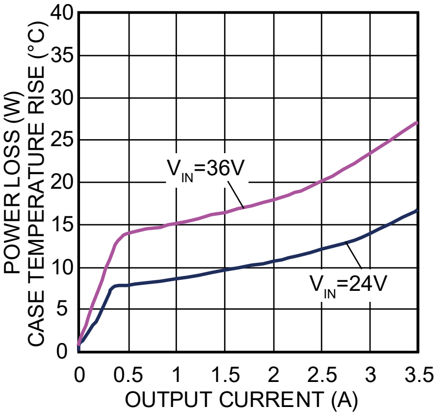
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT} = 3.3V, T_A = 25°C, unless otherwise noted.

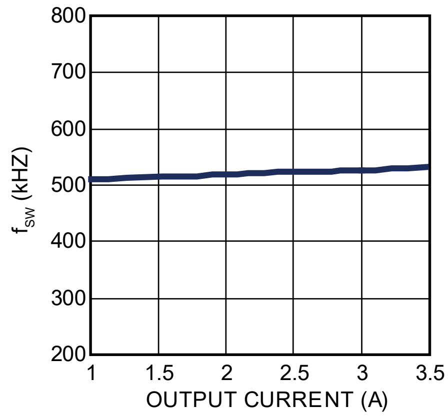
Efficiency vs. Load Current vs. Power Loss



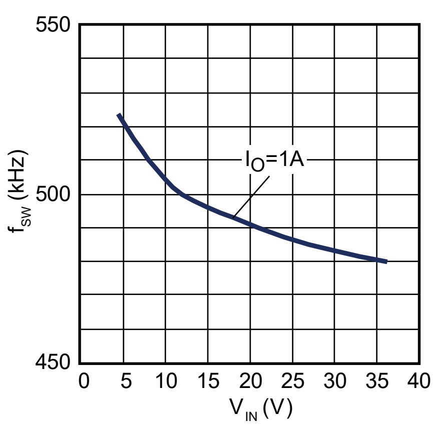
Case Temperature Rise vs. Output Current



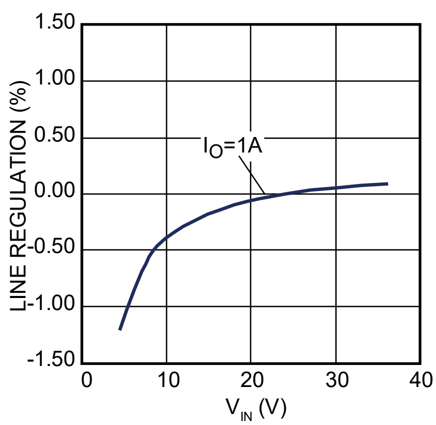
f_{SW} vs. Output Current



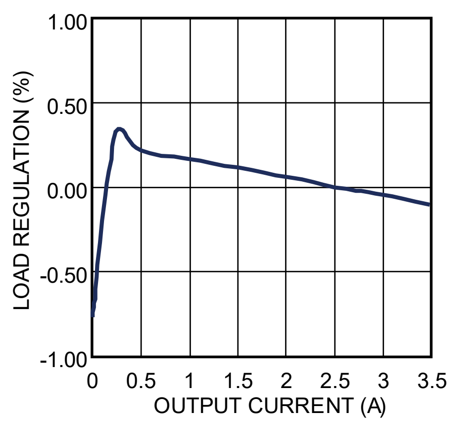
f_{SW} vs. V_{IN}



Line Regulation



Load Regulation

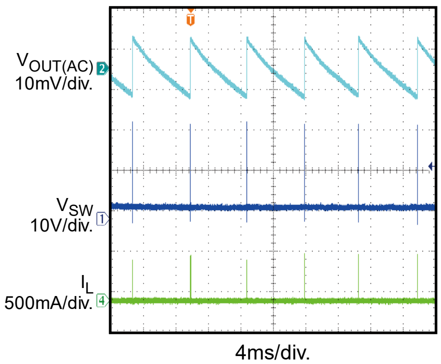


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT} = 3.3V, T_A = 25°C, unless otherwise noted.

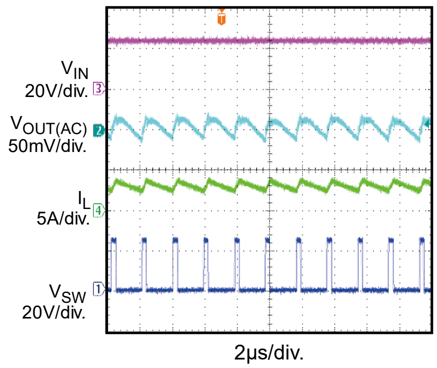
Output Voltage Ripple

I_{OUT} = 0A



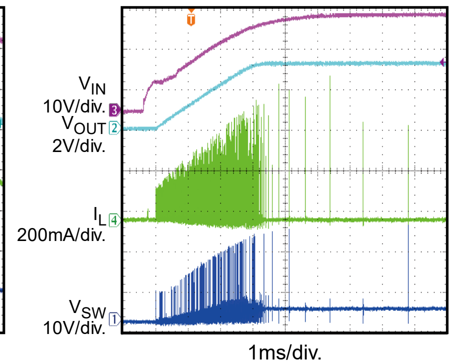
Output Voltage Ripple

I_{OUT} = 3A



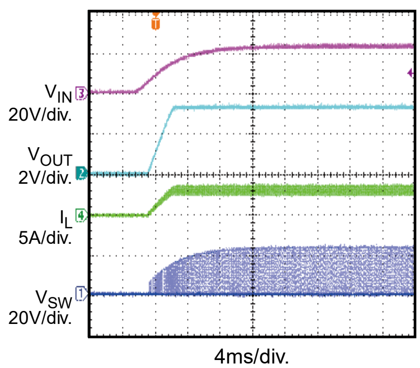
Start-Up through VIN

I_{OUT} = 0A



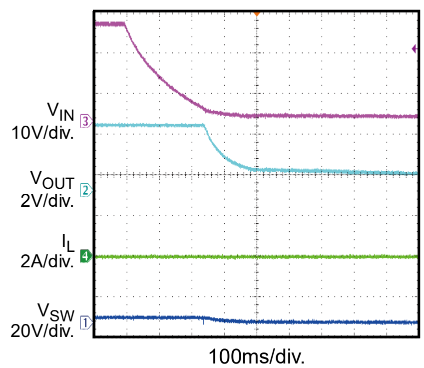
Start-Up through VIN

I_{OUT} = 3A



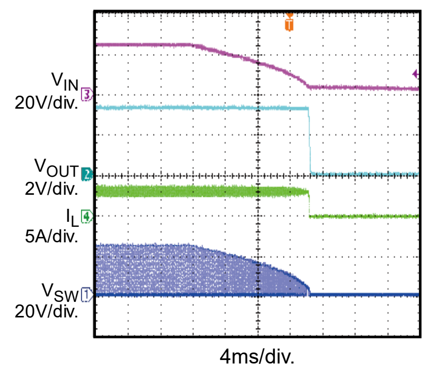
Shutdown through VIN

I_{OUT} = 0A



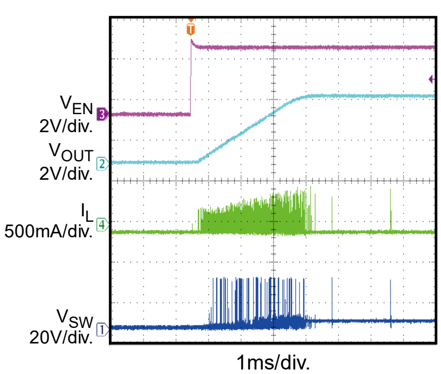
Shutdown through VIN

I_{OUT} = 3A



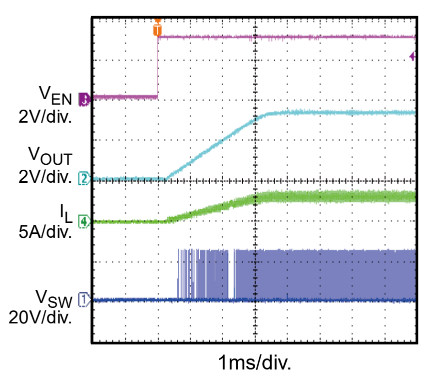
Start-Up through EN

I_{OUT} = 0A



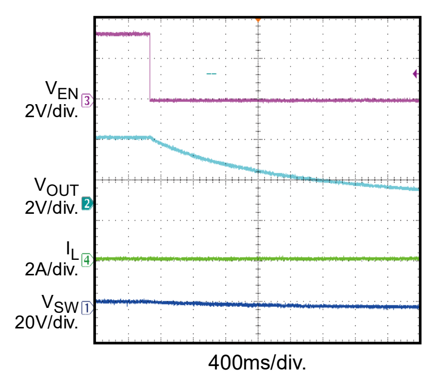
Start-Up through EN

I_{OUT} = 3A



Shutdown through EN

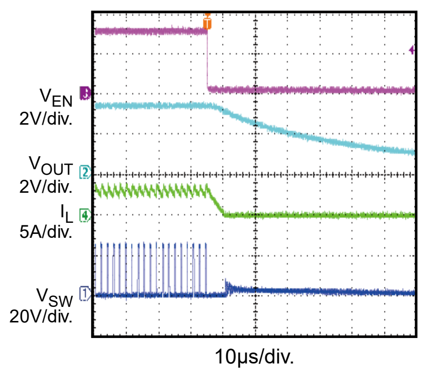
I_{OUT} = 0A



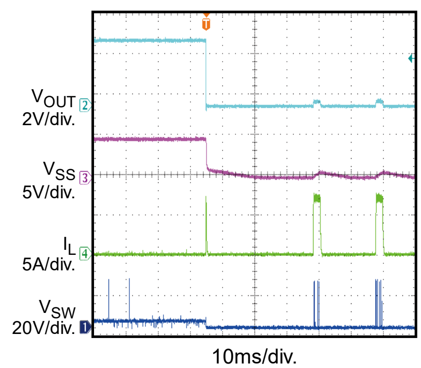
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT} = 3.3V, T_A = 25°C, unless otherwise noted.

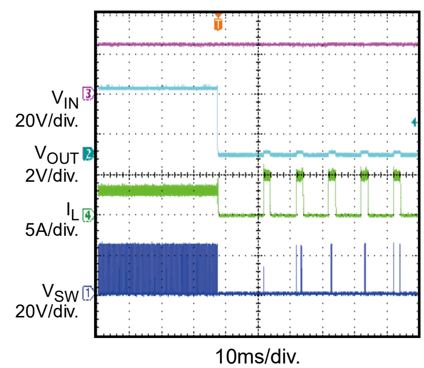
Shutdown through EN
I_{OUT} = 3A



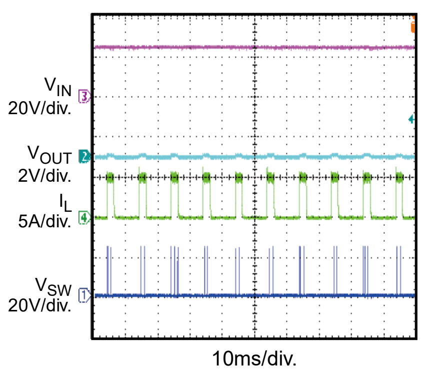
Short Circuit Entry
I_{OUT} = 0A



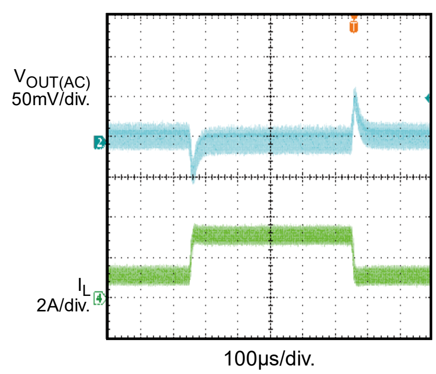
Short Circuit Entry
I_{OUT} = 3A



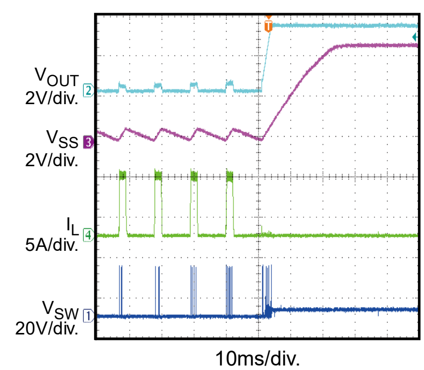
Short Circuit Steady State



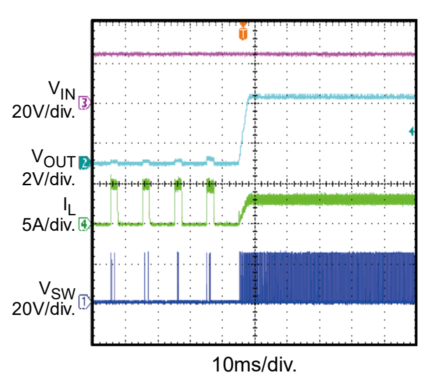
Load Transient
I_{OUT} = 1A to 3A



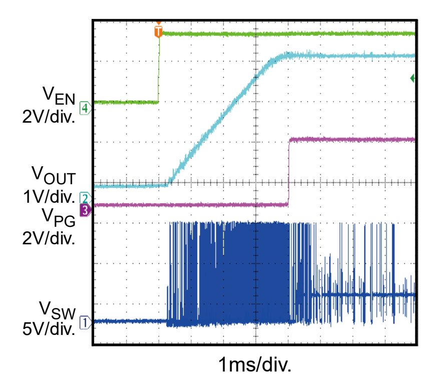
Short Circuit Recovery
I_{OUT} = 0A



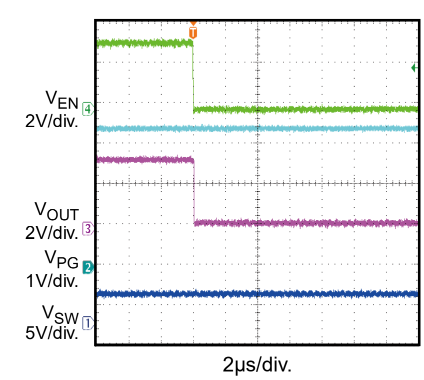
Short Circuit Recovery
I_{OUT} = 3A



Power Good in Start-Up through EN



Power Good in Shutdown through EN



PCB LAYOUT

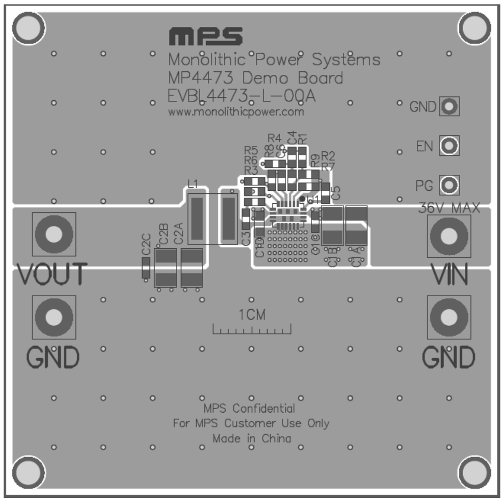


Figure 2: Top Silk

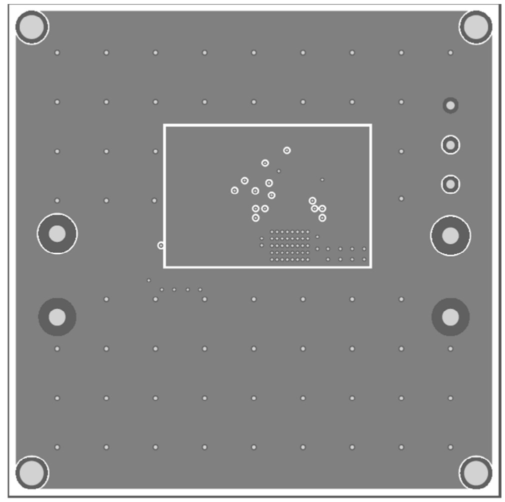


Figure 3: Mid-Layer 1

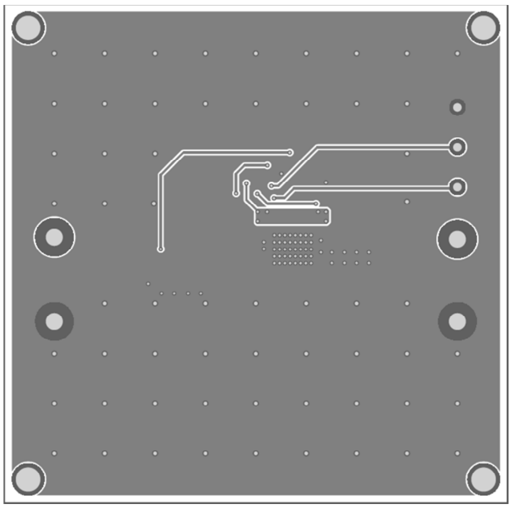


Figure 4: Mid-Layer 2

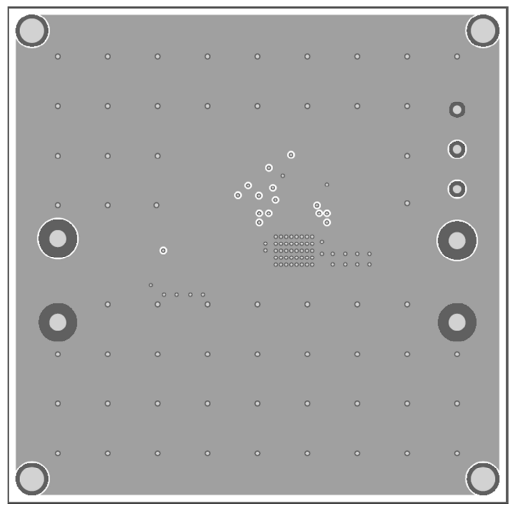


Figure 5: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	4/11/2022	Initial Release	-