EVL8886-U-00A

45V Input, Dual 3A/Single 6A Output, Digital, Configurable, Synchronous Buck Converter Evaluation Board

DESCRIPTION

The EVL8886-U-00A evaluation board is designed to demonstrate the capabilities of the MP8886, a 45V input, dual-phase, dual-output, high-efficiency, synchronous step-down converter with a PMBus control interface and multiple-time programmable (MTP) memory. The device can achieve up to 3A of continuous output current (I_{OUT}) for two channels, or up to 6A of continuous I_{OUT} for a single channel, with excellent load and line regulation across a wide input voltage (V_{IN}) range.

The output voltage (V_{OUT}) can be controlled on-the-fly via the PMBus serial interface. V_{OUT} can be set between 0.6V and 24V. The voltage transition rate, switching frequency (f_{SW}), and power-saving modes can also be configured via the PMBus interface.

It is recommended to read the MP8886 datasheet prior to making any changes to the EVL8886-U-00A.

PERFORMANCE SUMMARY (1)

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

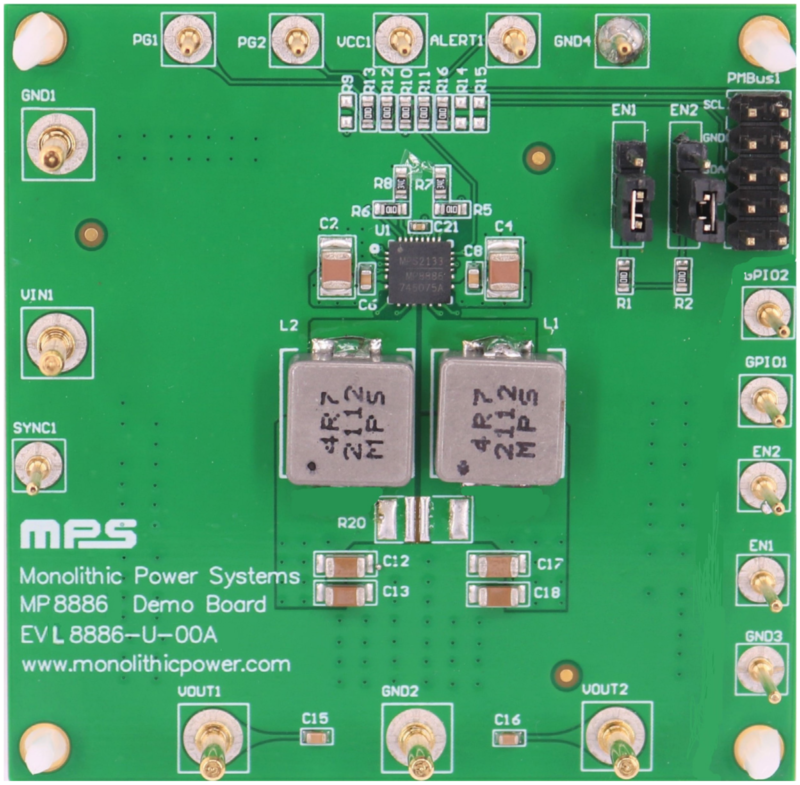
Parameters	Conditions	Value
Input voltage (V_{IN}) range		4V to 45V
Output voltage (V_{OUT1}, V_{OUT2})	V_{IN} = 4V to 45V, I_{OUT1} = I_{OUT2} = 0A to 3A	V_{OUT1} = V_{OUT2} = 3.3V
Maximum output current (I_{OUT1}, I_{OUT2})	V_{IN} = 4V to 45V	3A
Typical efficiency	V_{IN} = 24V, V_{OUT} = 3.3V, I_{OUT} = 3A, f_{SW} = 600kHz	89.69%
Peak efficiency	V_{IN} = 24V, V_{OUT} = 12V, I_{OUT} = 2A, f_{SW} = 600kHz	96.51%
Switching frequency (f_{SW})		600kHz

Notes:

1) For different input/output voltage specifications with different inductors, the application circuit parameters may require changes.
2) The output voltage (V_{OUT}) can be adjusted from 0.6V to 24V via the digital interface; refer to the MP8886's datasheet for more information.

MPL Optimized Performance with MPS Inductor MPL-AY1050 Series

EVALUATION BOARD



(LxWxH) 6.4cmx6.4cmx1.8cm
4 Layers, 2oz/1oz/1oz/2oz

Board Number	MPS IC Number
EVL8886-U-00A	MP8886GUT-0000

DEFAULT MTP CONFIGURATIONS

Table 1 shows the default MTP configurations for the MP8886GUT-0000.

Table 1: MP8886GUT-0000 Default MTP Configurations

Items	Channel 0	Channel 1
VOUT_SET_MODE	Internal feedback divider mode	Internal feedback divider mode
MFR_VOUT_CTRL	1:4, 0.6V to 6.138V	1:4, 0.6V to 6.138V
OUTPUT_VOLTAGE	3.3V	3.3V
OUTPUT_INITIAL_STATE	On	On
PWM_MODE	AAM mode	AAM mode
TON_RISE	1ms	1ms
TOFF_FALL	1ms	1ms
PEAK_CURRENT_LIMIT	6A	6A
VALLEY_CURRENT_LIMIT	5A	5A
OCP_RESPONSE_MODE	Hiccup mode	Hiccup mode
SWITCHING_FREQUENCY_SET	600kHz	
OPERATION_MODE_SET	GPIO1B set	
PMBUS_ADDRESS	0x00 with R_{ADDR} = 0Ω	
MTP_CONFIGURE_CODE	0x0000	

QUICK START GUIDE

The EVL8886-U-00A is easy to set up to evaluate the performance of the MP8886. Refer to Figure 1 for the proper measurement equipment set-up and follow the guidelines below:

1. Preset the power source (V_{IN}) to be between 4V and 45V. The typical value is 24V. (3)
2. Turn the power source off.
3. Connect the power source terminals to:
    a. Positive (+): VIN
    b. Negative (-): GND
4. Connect the load1 (the initial load is no load) terminals to:
    a. Positive (+): VOUT1
    b. Negative (-): GND
5. Connect the load2 (the initial load is no load) terminals to:
    a. Positive (+): VOUT2
    b. Negative (-): GND
6. Turn the power supply on after making the connections. The board should automatically start up.
7. Check for the proper output voltages.
8. Once the proper output voltage (V_{OUT}) is established, adjust the load within the operating range and measure the efficiency, output ripple voltage, and any other relevant parameters. (4)
9. After completing all tests, adjust the load to 0A, then turn the input power supply off.

Notes:

3) Ensure that V_{IN} does not exceed 45V.
4) When measuring the output voltage ripple or input voltage ripple, do not use the long ground lead on the oscilloscope probe.

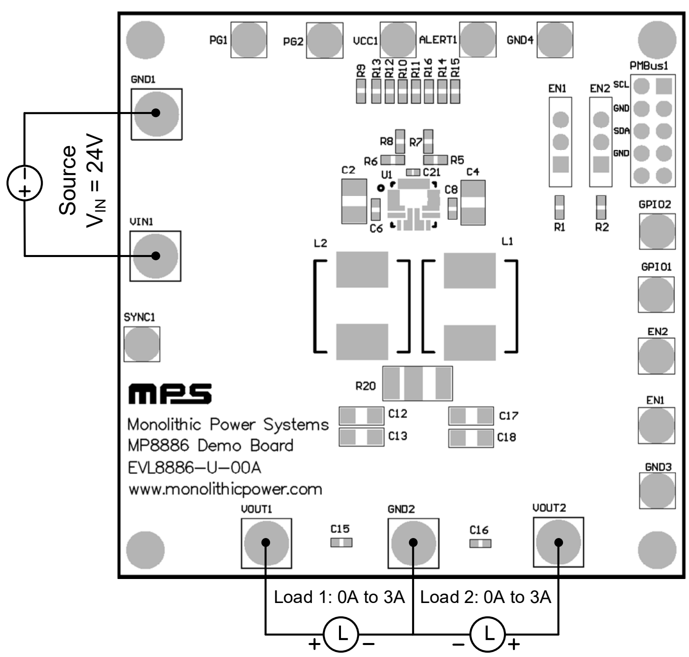


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

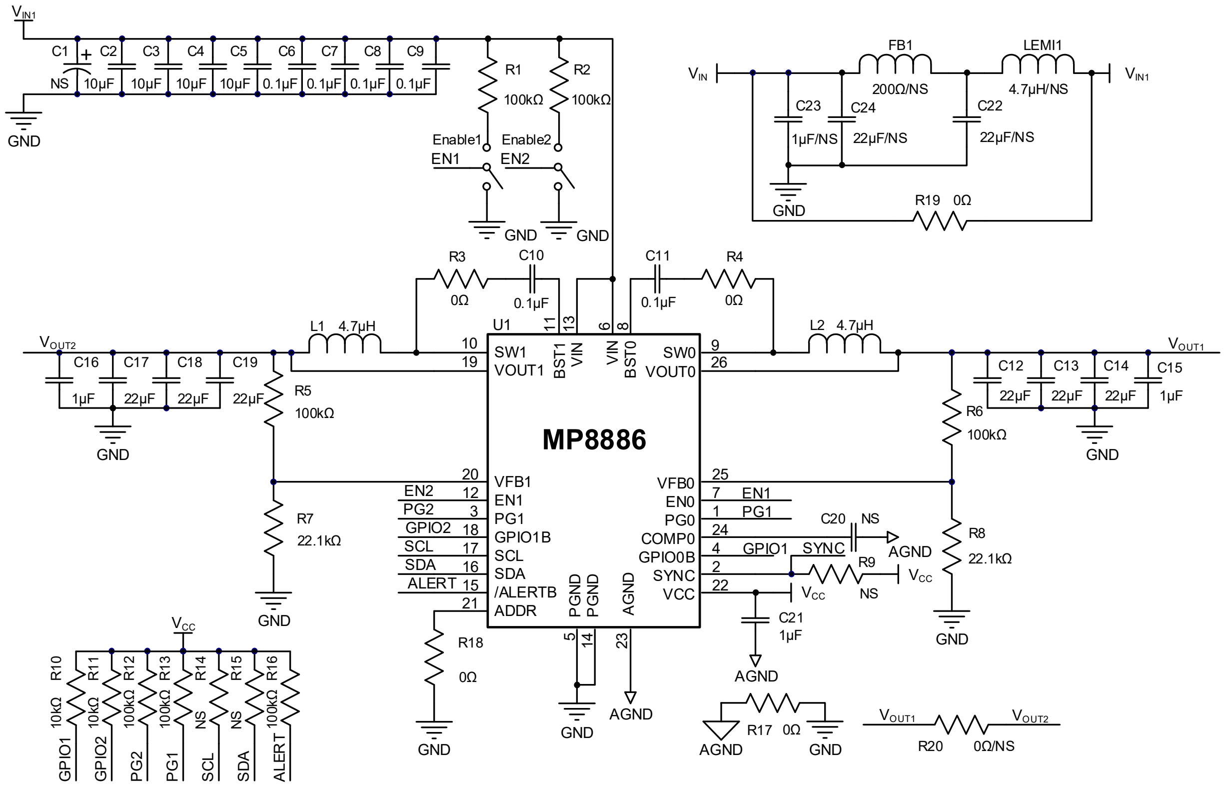


Figure 2: Evaluation Board Schematic

EVL8886-U-00A BILL OF MATERIALS

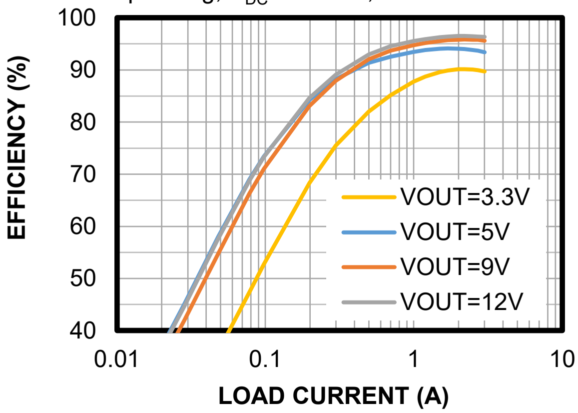
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
0	FB1, LEMI1	NS				
4	C2, C3, C4, C5	10µF	Ceramic capacitor, 50V, X5R	1210	Murata	GRM32ER61H106KA12L
4	C6, C7, C8, C9	0.1µF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H104KA93D
2	C10, C11	0.1µF	Ceramic capacitor; 50V, X7R	0402	Murata	GRM155R71H104ME14D
6	C12, C13, C14, C17, C18, C19	22µF	Ceramic capacitor, 25V, X5R	1206	Murata	GRM31CR61E226KE15L
2	C15, C16	1µF	Ceramic capacitor, 25V, X7R	0603	Murata	GRT188R71E105KE13D
1	C21	1µF	Ceramic capacitor, 10V, X5R	0402	Wurth	885012105012
0	C1, C20, C22, C23, C24	NS				
7	R1, R2, R5, R6, R12, R13, R16	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
4	R3, R4, R17, R18	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
2	R7, R8	22.1kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0722K1L
2	R10, R11	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	R19	0Ω	Film resistor, 1%	2512	Yageo	RC2512FK-070RL
0	R9, R14, R15, R20	NS				
1	U1	MP8886GUT	45V, dual 3A/single 6A step-down converter	TQFN-26 (5mmx 5mm)	MPS	MP8886GUT-0000
2	L1, L2	4.7µH	Inductor, I_{SAT} = 15A, R_{DS} = 9.5mΩ	1050	MPS	MPL-AY1050-4R7

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT1} = V_{OUT2} = 3.3V, L_1 = L_2 = 4.7µH, f_{SW} = 600kHz, T_A = 25°C, unless otherwise noted.

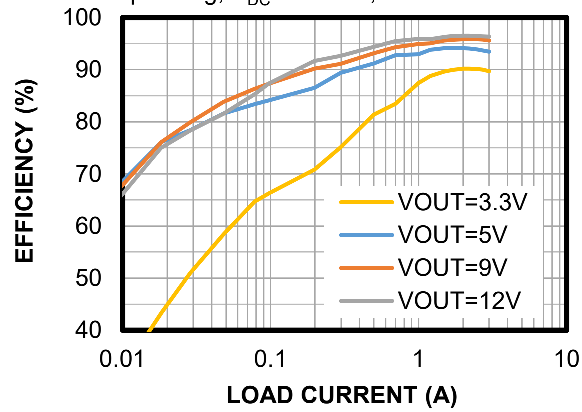
Efficiency vs. Load Current

Dual-output operation, only one channel is operating, R_{DC} = 9.3mΩ, FCCM



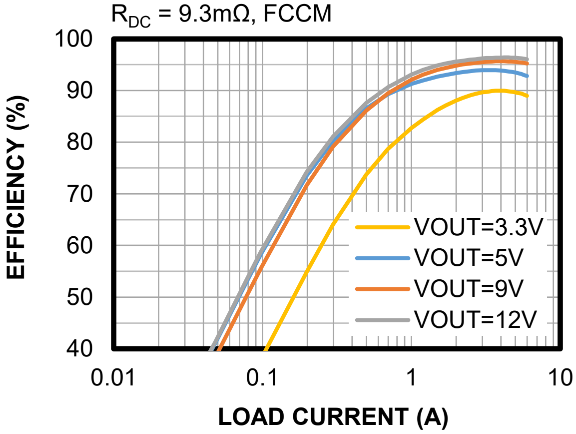
Efficiency vs. Load Current

Dual-output operation, only one channel is operating, R_{DC} = 9.3mΩ, AAM mode



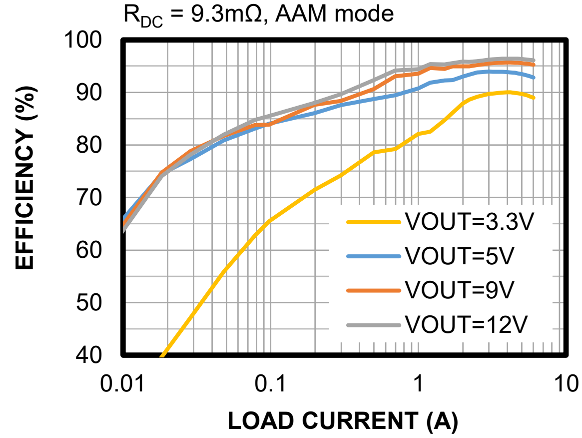
Efficiency vs. Load Current

Dual-phase, single-output operation, R_{DC} = 9.3mΩ, FCCM



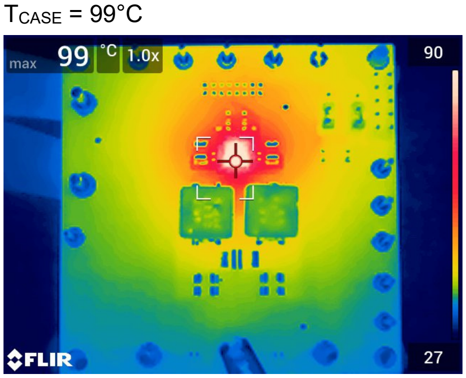
Efficiency vs. Load Current

Dual-phase, single-output operation, R_{DC} = 9.3mΩ, AAM mode



Thermal Performance

I_{OUT1} = I_{OUT2} = 3A, no forced airflow, T_{CASE} = 99°C

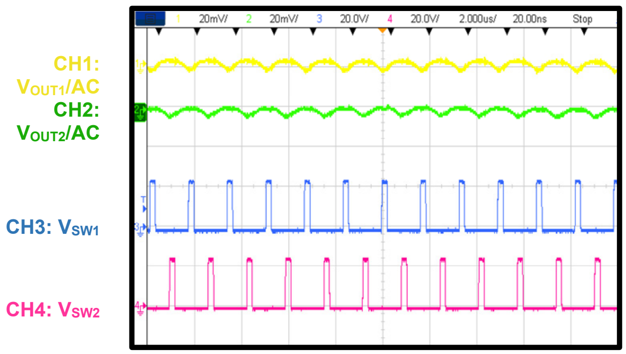


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT1} = V_{OUT2} = 3.3V, L_1 = L_2 = 4.7µH, f_{SW} = 600kHz, T_A = 25°C, unless otherwise noted.

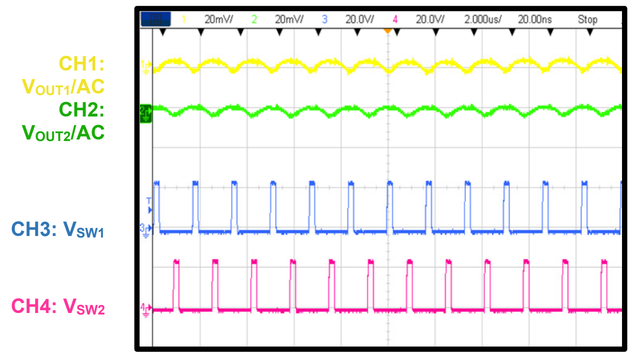
Steady State

Dual-output operation, V_{OUT1} = V_{OUT2} = 3.3V, I_{OUT1} = I_{OUT2} = 1.5A



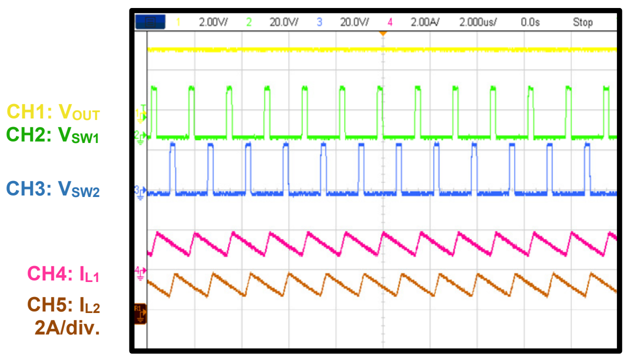
Steady State

Dual-output operation, V_{OUT1} = V_{OUT2} = 3.3V, I_{OUT2} = I_{OUT2} = 3A



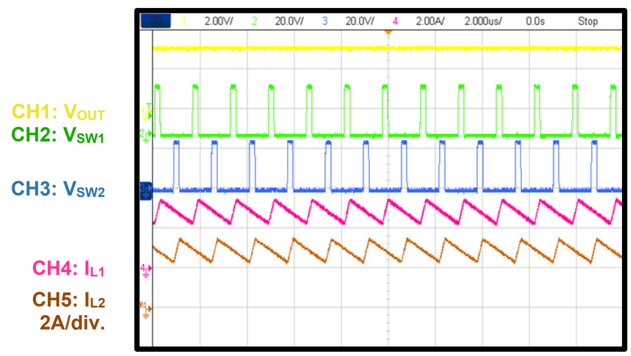
Steady State

Dual-phase, single-output operation, V_{OUT} = 3.3V, I_{OUT} = 3A



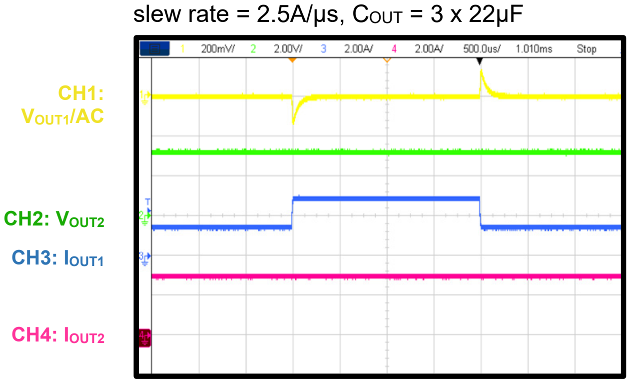
Steady State

Dual-phase, single-output operation, V_{OUT} = 3.3V, I_{OUT} = 6A



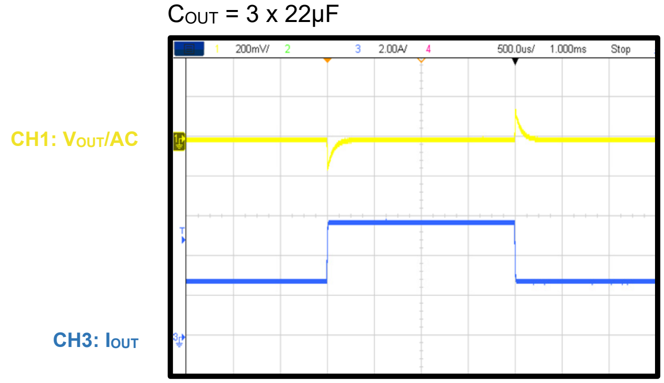
Load Transient Response

Dual-output operation, V_{OUT1} = V_{OUT2} = 3.3V, I_{OUT2} = 3A, I_{OUT1} = 1.5A to 3A, e-load transient slew rate = 2.5A/µs, C_{OUT} = 3 x 22µF



Load Transient Response

Dual-phase, single-output operation, V_{OUT} = 3.3V, I_{OUT} = 3A to 6A, e-load 2.5A/µs, C_{OUT} = 3 x 22µF



PCB LAYOUT

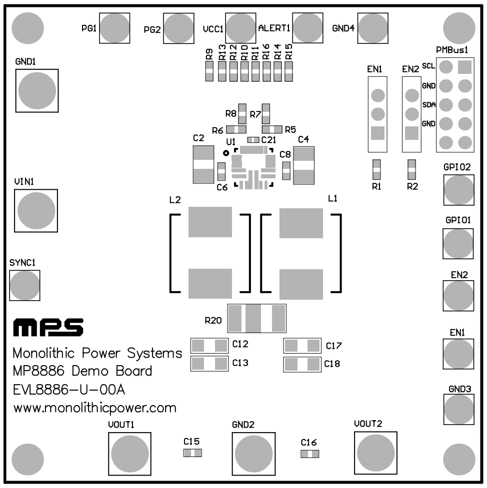


Figure 3: Top Silk

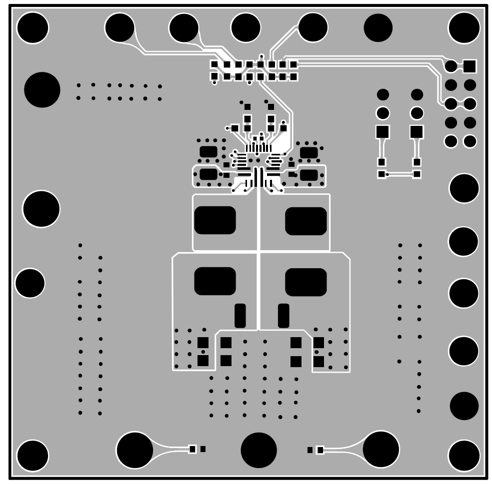


Figure 4: Top Layer

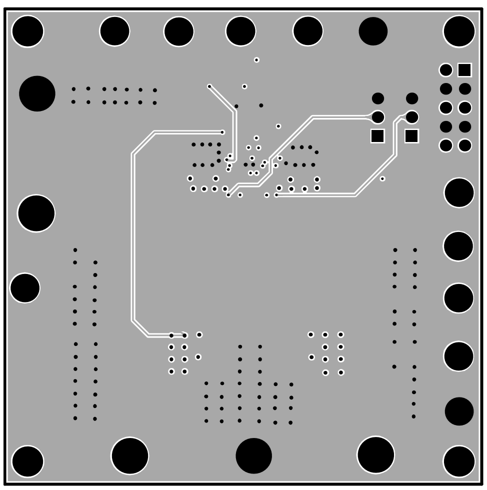


Figure 5: Mid-Layer 1

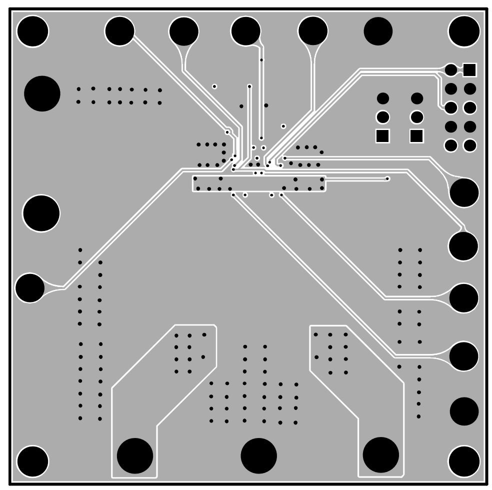


Figure 6: Mid-Layer 2

PCB LAYOUT *(continued)*

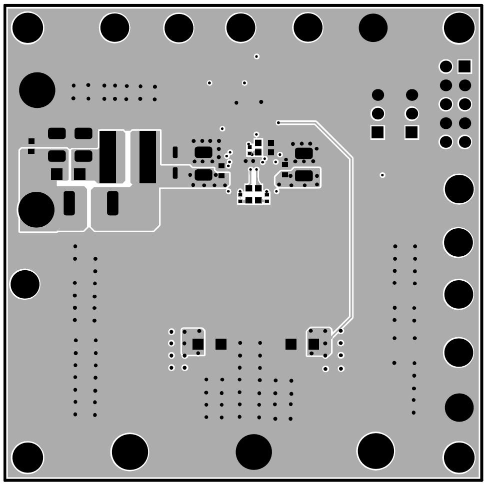


Figure 7: Bottom Layer

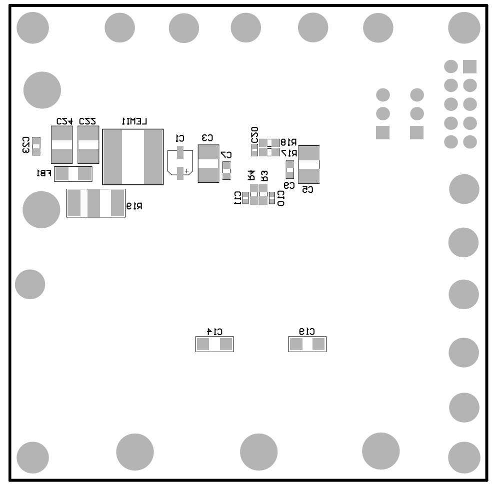


Figure 8: Bottom Silk

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	7/12/2024	Initial Release	-