EVQ8880A-V-00A

60V, 4.5A, High-Efficiency, Digital, Configurable Synchronous Step-Down Converter Evaluation Board

DESCRIPTION

The EVQ8880A-V-00A is an evaluation board designed to demonstrate the capabilities of the MPQ8880A, a fully integrated, high-efficiency, synchronous step-down converter with a wide input voltage (V_{IN}) range and up to 4.5A of output current (I_{OUT}).

The MPQ8880A adopts current mode control to provide fast transient response and simplify loop stabilization. The MPQ8880A implements full protection features, including under-voltage lockout (UVLO), over-voltage protection (OVP), over-current protection (OCP), and thermal shutdown. The MPQ8880A supports paralleled operation with up to 4 phases for a higher I_{OUT}. Refer to the MPQ8880A datasheet for more detailed information.

The MPQ8880A is available in a QFN-20 (4mmx5mm) package.

It is recommended to read the MPQ8880A datasheet prior to making any changes to the EVQ8880A-V-00A.

PERFORMANCE SUMMARY (1)

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

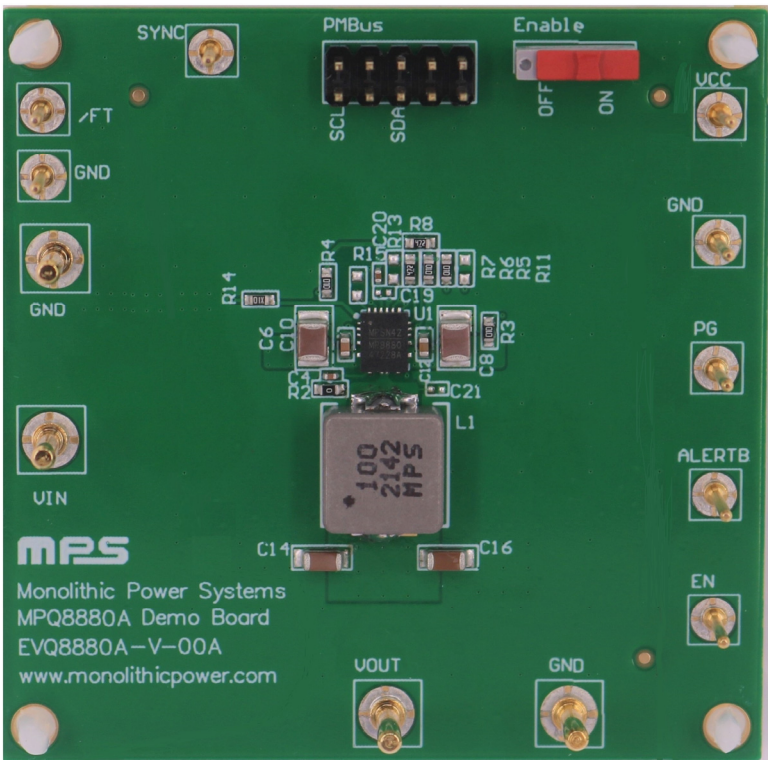
Parameters	Conditions	Value
Input voltage (V_{IN}) range		4V to 60V
Output voltage (V_{OUT})	V_{IN} = 4V to 60V, I_{OUT} = 0A to 4.5A	5V (2)
Maximum output current (I_{OUT})	V_{IN} = 4V to 60V	4.5A
Full-load efficiency	V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 4.5A, f_{SW} = 450kHz	91%
Peak efficiency	V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 2A, f_{SW} = 450kHz	93.2%
Default switching frequency (f_{SW})		450kHz

Notes:

1) For different V_{IN} and V_{OUT} specifications with different output capacitors and inductors, the application circuit parameters may require changes.
2) V_{OUT} can be adjusted from 0.6V to 24V via the digital interface. The MPQ8880A can support up to 48V of V_{OUT} in external feedback divider mode. Refer to the MPQ8880A datasheet for more information.

MPL Optimized Performance with MPS Inductor MPL-AY1050 Series

EVALUATION BOARD



LxWxH (6.4cmx6.4cmx1.6cm)

4 Layers (2oz, 1oz, 1oz, and 2oz)

Board Number	MPS IC Number
EVQ8880A-V-00A	MPQ8880AGVE-0000-AEC1

DEFAULT MTP CONFIGURATIONS

Table 1 and Table 2 show the default multiple-time programmable (MTP) memory configurations for the MPQ8880AGVE-0000-AEC1. Table 1 shows the parameters for the default settings.

Table 1: 0000 Suffix Code Configuration

MTP Items	Parameter Settings
VOUT_SET_MODE	Internal feedback divider mode
MFR_VOUT_CTRL	Range 3, 1:4, 0.6V to 6.138V
OUTPUT_VOLTAGE	5V
VOBIAS_EN	Enabled
OUTPUT_INITIAL_STATE	On
PWM_MODE	Advanced asynchronous modulation (AAM) mode
TON_RISE	1ms
TOFF_FALL	1ms
PEAK_CURRENT_LIMIT	9A
VALLEY_CURRENT_LIMIT	6.5A
SWITCHING_FREQUENCY_SET	450kHz
OCP_RESPONSE_MODE	Hiccup mode
SWITCHING_RISING_SLEW_RATE	2V/ns
SWITCHING_FALLING_SLEW_RATE	2V/ns
PMBUS_ADDRESS	0x00 with R_{ADDR} = 0Ω
MTP_CONFIGURE_CODE	0x0000

V_{OUT} is determined by the reference voltage (V_{REF}) and feedback (FB) divider ratio. V_{REF} is set via VOUT_COMMAND (1.5mV/LSB), and the internal FB divider ratio is selected via MFR_VOUT_CTRL. In internal FB divider mode, use the digital interface to adjust V_{OUT}. Table 2 shows the default register values for the MPQ8880AGVE-0000-AEC1.

Table 2: 0000 Suffix Code Register Values

Suffix Code	Register	Hex Value	Suffix Code	Register	Hex Value
0000	0x01	80h	0000	0xD4	2h
0000	0x21	341h	0000	0xD6	20h
0000	0x24	3FFh	0000	0xD7	78h
0000	0x25	382h	0000	0xD8	0h
0000	0x26	2FEh	0000	0xD9	3h
0000	0x35	0h	0000	0xDA	11h
0000	0x36	0h	0000	0xDB	1Bh
0000	0x55	1FCh	0000	0xE0	37h
0000	0x60	0h	0000	0xE1	60h
0000	0x61	1h	0000	0xE2	A0h
0000	0x64	0h	0000	0xE3	0h
0000	0x65	1h	0000	0xE4	C0h
0000	0xD0	0h	0000	0xE5	1h
0000	0xD1	0h	0000	0xE6	20h
0000	0xD2	1Ah	0000	0xE9	24h
0000	0xD3	1h	0000	0xEA	0h

QUICK START GUIDE

The EVQ8880A-V-00A is easy to set up to evaluate the performance of the MPQ8880A. For the proper measurement equipment set-up, refer to Figure 1 and follow the guidelines below:

1. Preset the power source (V_{IN}) to be between 4V and 60V. (3)
2. Turn off the power source.
3. Connect the power source terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. Connect the load (the initial load is no load) to:
   a. Positive (+): VOUT
   b. Negative (-): GND
5. Set the enable (EN) switch to “on.”
6. After making the connections, turn on the power supply. The board should start up automatically.
7. Check for the proper output voltage (V_{OUT}).
8. Once the proper V_{OUT} is established, adjust the load within the operating range and measure the efficiency, V_{OUT} voltage, and any other relevant parameters. (4)
9. After completing all tests, adjust the load to 0A, then turn off the input power supply.

Notes:

3) Ensure that V_{IN} does not exceed 60V.
4) When measuring the V_{OUT} ripple or input voltage ripple, do not use the long ground lead on the oscilloscope probe.

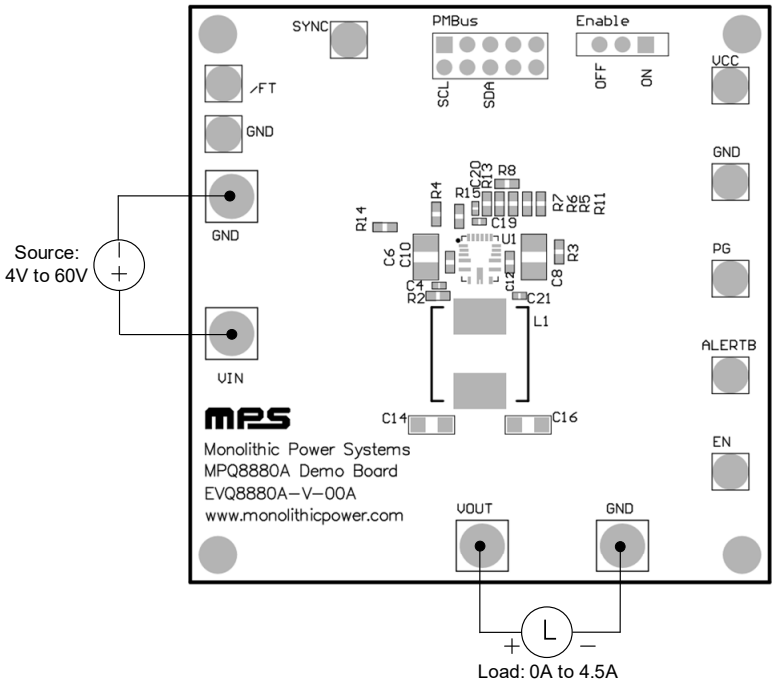


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

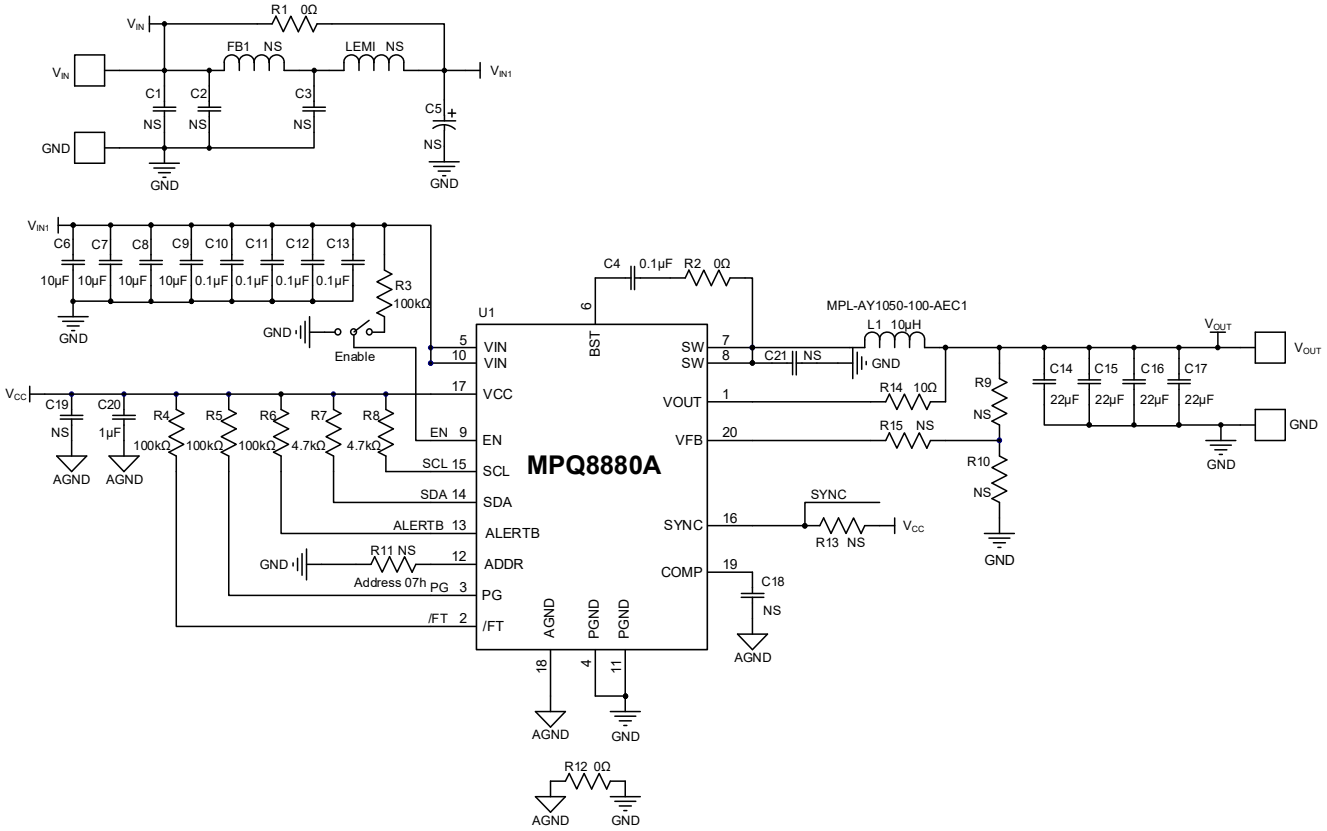


Figure 2: Evaluation Board Schematic

EVQ8880A-V-00A BILL OF MATERIALS

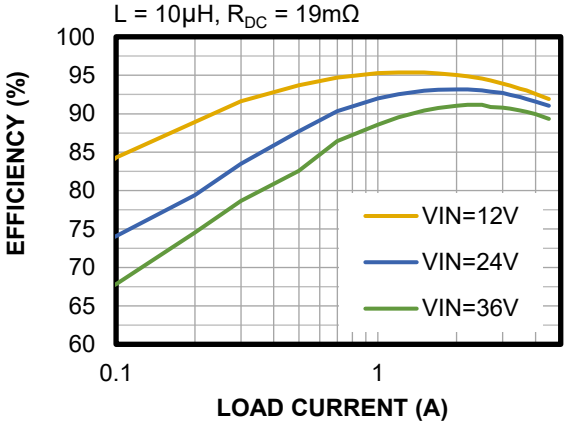
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	C4	0.1µF	Ceramic capacitor, 50V, X7R	0402	TDK	CGA2B3X7R1H104K T0Y0F
4	C6, C7, C8, C9	10µF	Ceramic capacitor, 75V, X7R	1210	TDK	C3225X7R1N106K
4	C10, C11, C12, C13	0.1µF	Ceramic capacitor, 100V, X5R	0603	Murata	GRM188R72A104KA 35D
4	C14, C15, C16, C17	22µF	Ceramic capacitor, 35V, X5R	1206	TDK	C3216X5R1V226M
1	C20	1µF	Ceramic capacitor, 25V, X5R	0402	Murata	GRM155R61E105KA 12D
0	C1, C2, C3, C5, C18, C19, C21	NS				
1	R1	0Ω	Film resistor, 1%	2512	Yageo	RC2512FK-070RL
4	R3, R4, R5, R6	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
2	R7, R8	4.7kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-074K7L
2	R2, R12	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	R14	10Ω	Film resistor, 1%	0603	Yageo	RC0603FR-0710RL
0	R9, R10, R11, R13, R15	NS				
1	Enable	3-pin	Single-pole double throw (SPDT) switch	DIP	Wurth	450301014042
0	FB1, LEMI	NS				
1	L1	10µH	Inductor, DCR = 19mΩ, I_{SAT} = 12A	1050	MPS	MPL-AY1050-100-AEC1
1	U1	MPQ8880A	60V, 4.5A, step-down converter	QFN-20 (4mmx 5mm)	MPS	MPQ8880AGVE-0000-AEC1

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT} = 5V, L = 10µH, f_{SW} = 450kHz, T_A = 25°C, unless otherwise noted.

Efficiency vs. Load Current

V_{OUT} = 5V, AAM mode, f_{SW} = 450kHz, L = 10µH, R_{DC} = 19mΩ



Thermal Performance

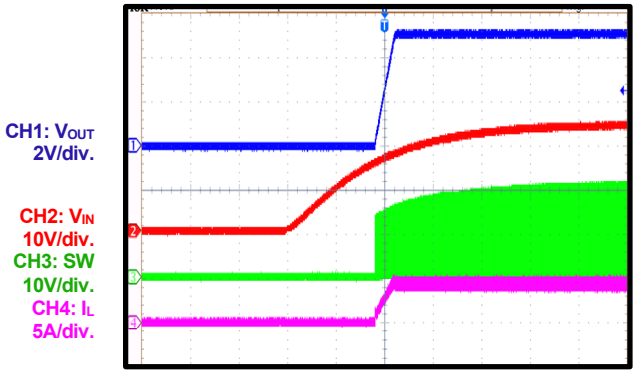
I_{OUT} = 4.5A, no forced airflow, T_{CASE} = 67°C

EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT} = 5V, L = 10µH, f_{SW} = 450kHz, T_A = 25°C, unless otherwise noted.

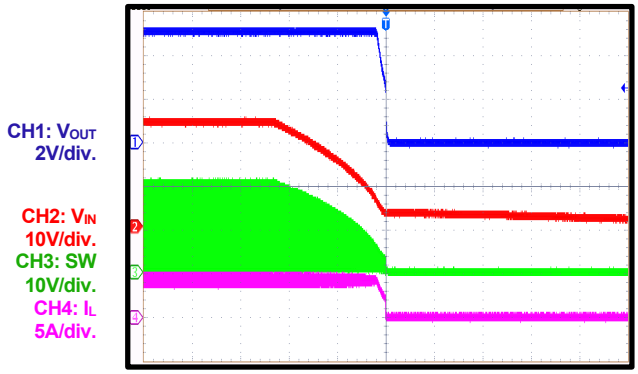
Start-Up through VIN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 4.5A



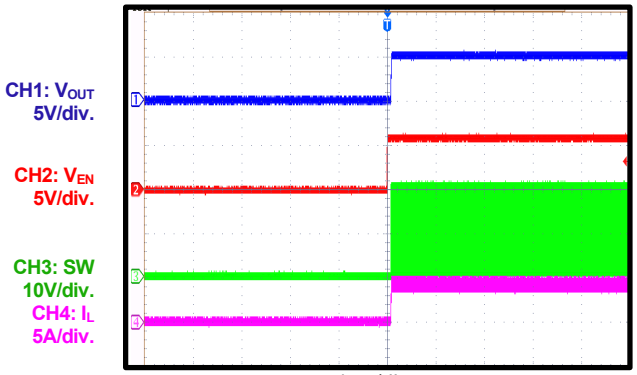
Shutdown through VIN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 4.5A



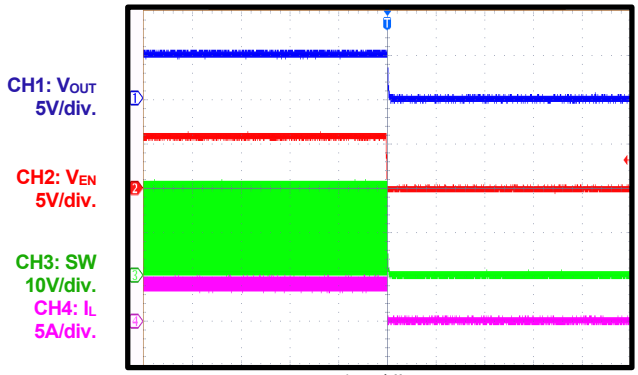
Start-Up through EN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 4.5A



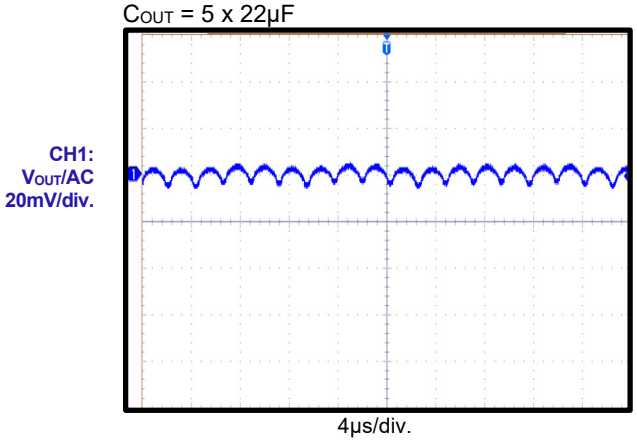
Shutdown through EN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 4.5A



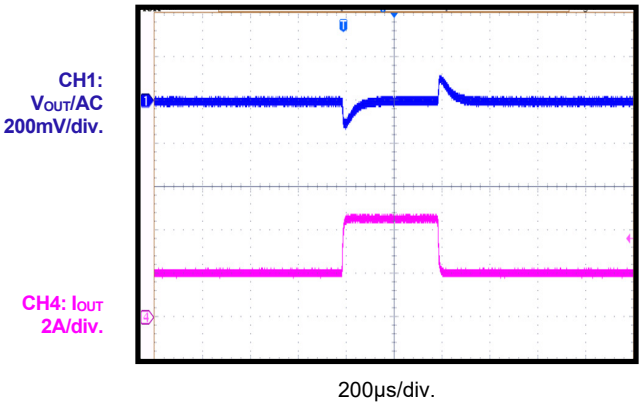
Output Voltage Ripple

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 4.5A,
C_{OUT} = 5 x 22µF



Load Transient Response

V_{OUT} = 5V, I_{OUT} = 2A to 4.5A, 0.8A/µs,
C_{OUT} = 4 x 22µF



PCB LAYOUT

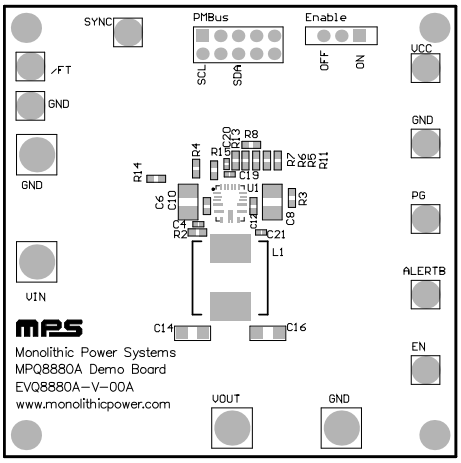


Figure 3: Top Silk

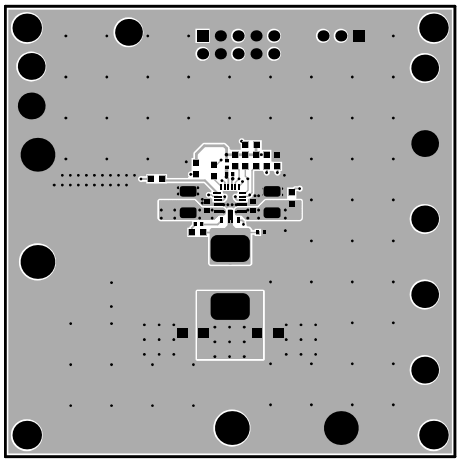


Figure 4: Top Layer

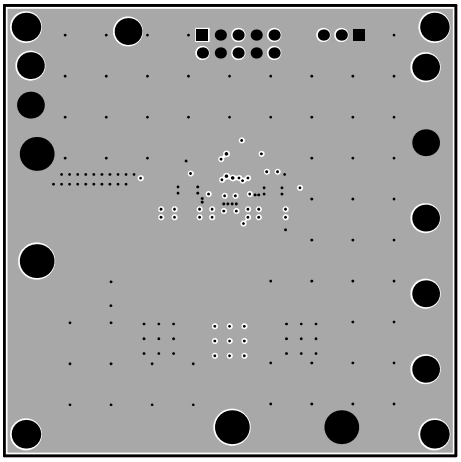


Figure 5: Mid-Layer 1

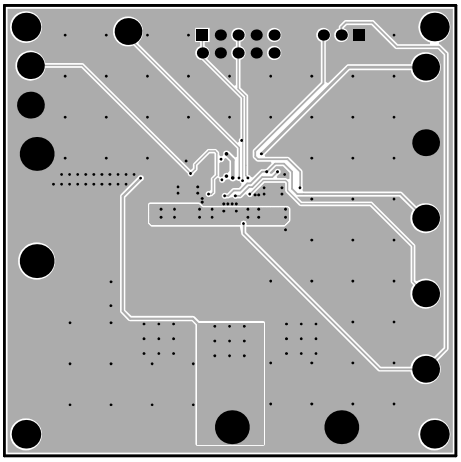


Figure 6: Mid-Layer 2

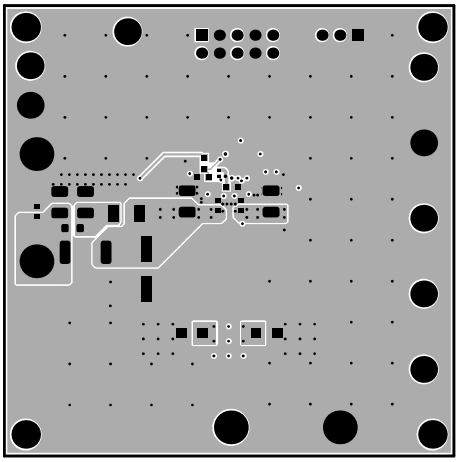


Figure 7: Bottom Layer

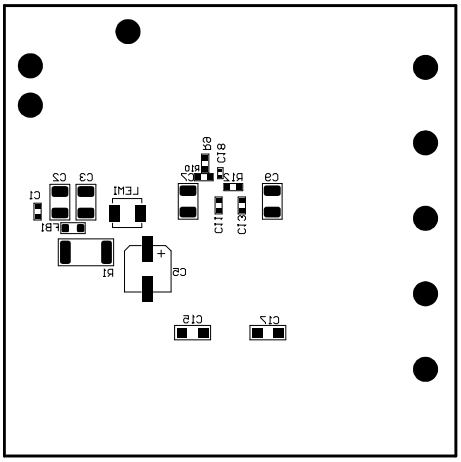


Figure 8: Bottom Silk

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	4/22/2025	Initial Release	-