EV183-S-00A

85V_{AC}/60Hz to 265V_{AC}/50Hz, 12V/0.25A Output, Zero Standby Regulator in SOIC-8 Package Evaluation Board

DESCRIPTION

The EV183-S-00A is an evaluation board designed to demonstrate the capabilities of the MP183. The MP183 is a primary-side constant voltage regulator that provides accurate constant voltage (CV) regulation without an optocoupler. It supports buck, buck-boost, boost, and flyback topologies.

The EV183-S-00A is designed as a buck application. It typically outputs 3W with a 12V/250mA load from an 85V_{AC} to 265V_{AC} input.

The EV183-S-00A achieves zero standby power consumption and high efficiency under full-load and light-load conditions.

The EV183-S-00A can pass the IEC 61000-4-5 surge immunity test and meets EN55022/CISPR 22 Class B standards for conducted emissions. The radiated emissions performance is also improved.

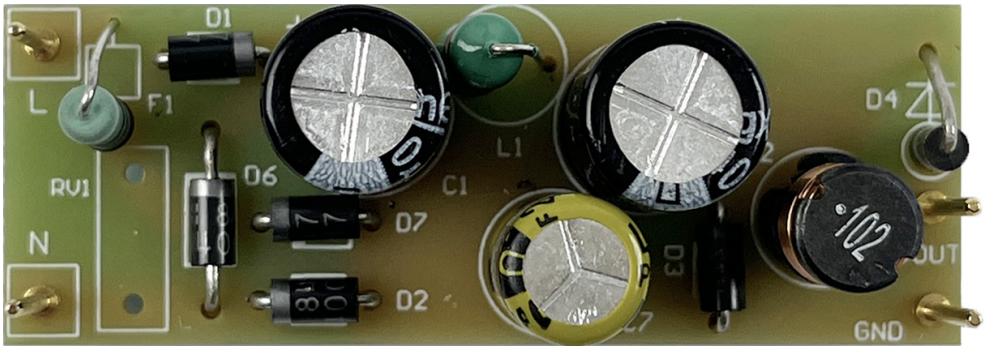
Full protection features include thermal shutdown (TSD), V_{CC} under-voltage lockout (UVLO), brown-in (B/I), overload protection (OLP), short-circuit protection (SCP), and open-loop detection (OLD).

PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range		85V_{AC} to 265V_{AC}
Output voltage (V_{OUT})	V_{IN} = 85V_{AC} to 265V_{AC}, I_{OUT} = 0A to 0.25A	12V
Maximum output current (I_{OUT})	V_{IN} = 85V_{AC} to 265V_{AC}	0.25A
Typical efficiency	V_{IN} = 230V_{AC}, V_{OUT} = 12V, I_{OUT} = 0.25A	>75%

EVALUATION BOARD



Top View

Bottom View

LxWxH (56mmx20mmx17mm)

Board Number	MPS IC Number
EV183-S-00A	MP183GS

QUICK START GUIDE

1. Preset the power supply input voltage (V_{IN}) to be between $85V_{AC}$ and $265V_{AC}$.
2. Turn off the power supply.
3. Connect the power supply terminals to:
   a. Line terminal: L port
   b. Neutral terminal: N port
4. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
5. After making the connections, turn on the power supply. The device should start up automatically.

Figure 1 shows the measurement equipment set-up.

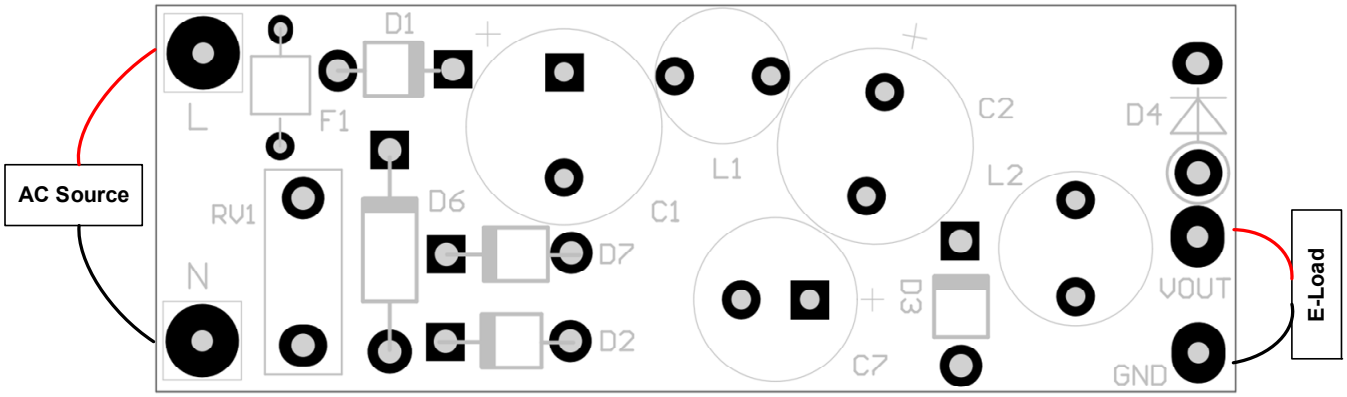


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

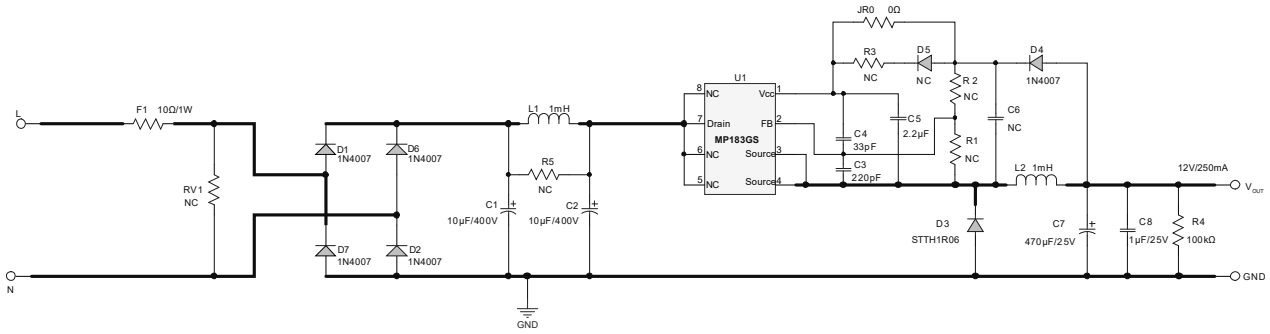


Figure 2: Evaluation Board Schematic

EV183-S-00A BILL OF MATERIALS

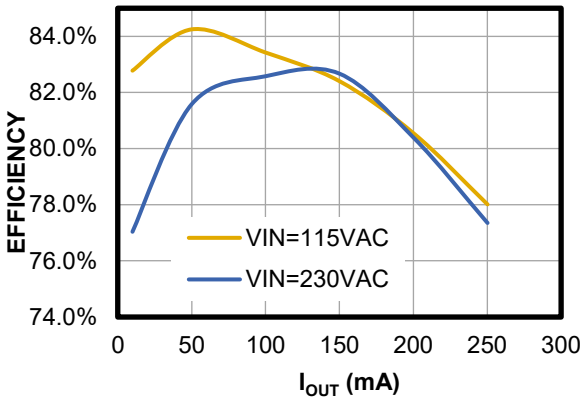
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	C1, C2	10μF	Electrolytic capacitor, 400V, 20%	DIP	Any	
1	C3	220pF	Ceramic capacitor, 50V, X7R	0603	Wurth	885012206079
1	C4	33pF	Ceramic capacitor, 50V, COG	0603	Murata	GRM1885C1H330JA01D
1	C5	2.2μF	Ceramic capacitor, 25V, X7S	0603	Murata	GRM188C71E225KE11D
1	C7	470μF	Electrolytic capacitor, 25V	DIP	YongMing	LKM_25V_470uF_8*11.5
1	C8	1μF	Ceramic capacitor, 25V, X7R	0603	Murata	GCM188R71E105KA64D
5	D1, D2, D4, D6, D7	1000V	Diode, 1A	DO-41	Diodes, Inc.	1N4007
1	D3	600V	Diode, 1A	DO-41	ST	STTH1R06
1	F1	10Ω	Fuse resistor, 5%, 1W	DIP	Yageo	FKN1WSJT-52-10R
1	L1	1mH	Inductor, 1000μH, 8Ω, 0.1A	DIP	Any	
1	L2	1mH	Inductor, 2.5Ω, 420mA	DIP	Wurth	744743102
1	R4	100kΩ	Film resistor, 1%	1206	Yageo	RC1206FR-07100KL
1	JR0	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	U1	MP183	Primary-side regulator	SOIC-8	MPS	MP183GS

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 230V_{AC}, V_{OUT} = 12V, I_{OUT} = 0.25A, T_A = 25°C, unless otherwise noted.

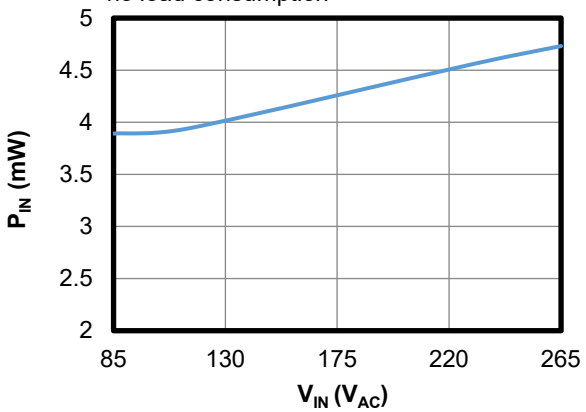
Efficiency vs. I_{OUT}

V_{IN} = 115V_{AC} or 230V_{AC}, I_{OUT} = 0mA to 250mA



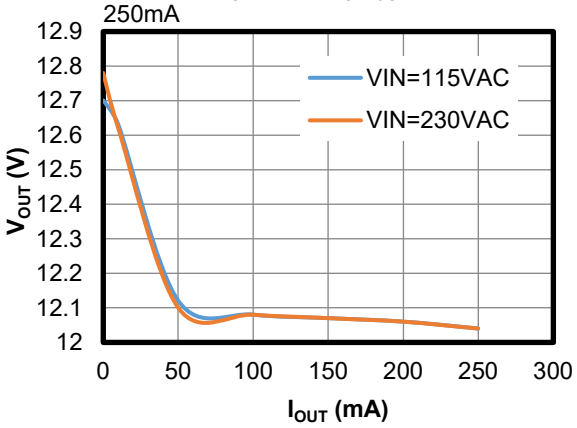
P_{IN} vs. V_{IN} (1)

V_{IN} = 85V_{AC} to 265V_{AC}, I_{OUT} = 0A, no load consumption



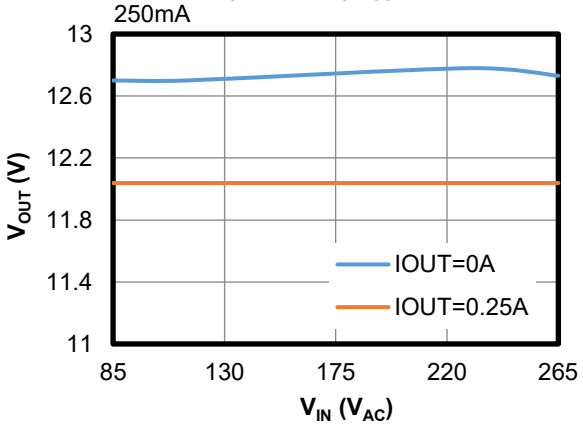
V_{OUT} vs. I_{OUT}

V_{IN} = 115V_{AC} or 230V_{AC}, I_{OUT} = 0mA to 250mA



V_{OUT} vs. V_{IN}

V_{IN} = 85V_{AC} to 265V_{AC}, I_{OUT} = 0mA to 250mA



Note:

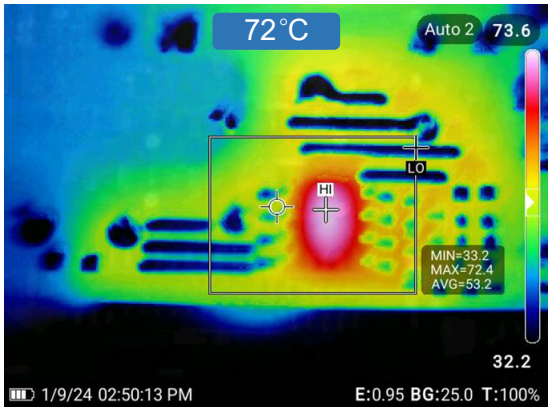
1) The test for standby power should be conducted after tens of minutes from start-up. In this scenario, the leakage current of the electrolytic capacitors tends to be low and stable. The test results may differ considering the consistency of the capacitor.

EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 230V_{AC}, V_{OUT} = 12V, I_{OUT} = 0.25A, T_A = 25°C, unless otherwise noted.

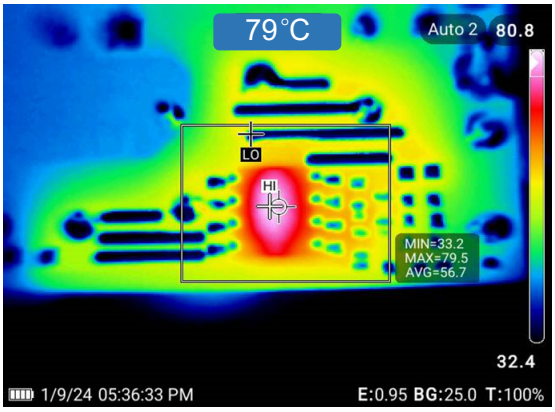
Thermal Performance

V_{IN} = 85V_{AC}, f_{SW} = 35.1kHz



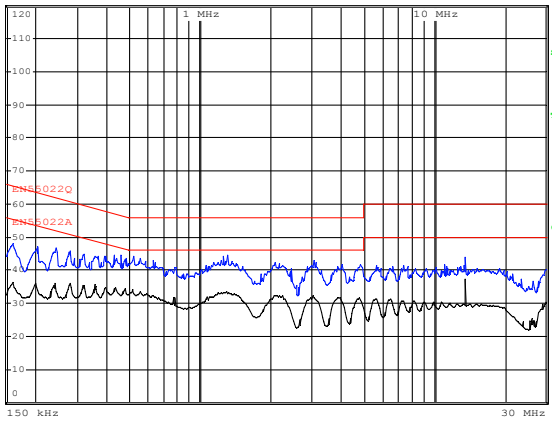
Thermal Performance

V_{IN} = 265V_{AC}, f_{SW} = 38.8kHz



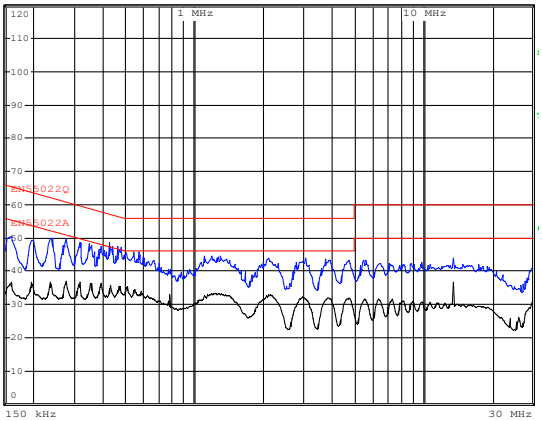
Conducted EMI

L Line



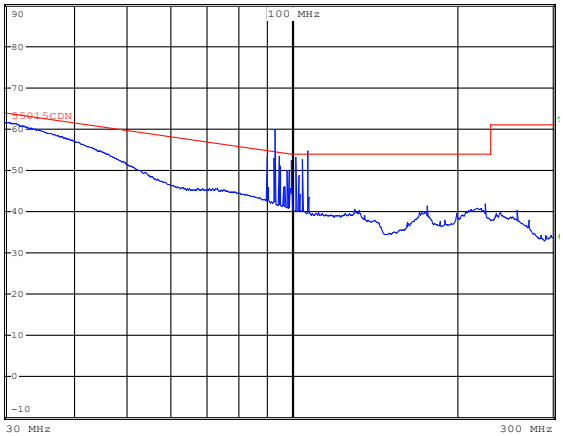
Conducted EMI

N Line



Radiated EMI

CDN

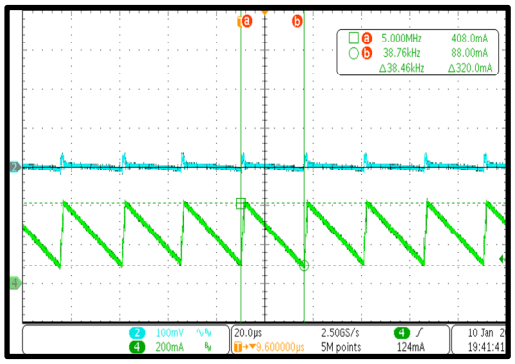


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 230V_{AC}, V_{OUT} = 12V, I_{OUT} = 0.25A, T_A = 25°C, unless otherwise noted.

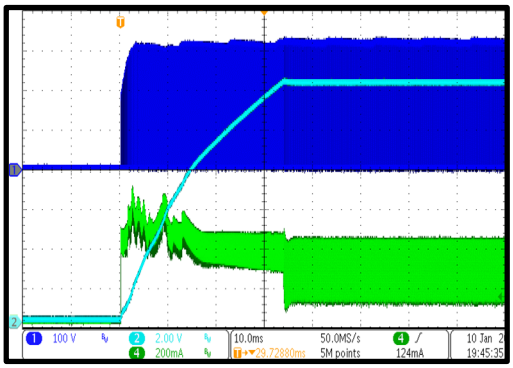
Output Voltage Ripple

V_{IN} = 230V_{AC}, I_{OUT} = 250mA



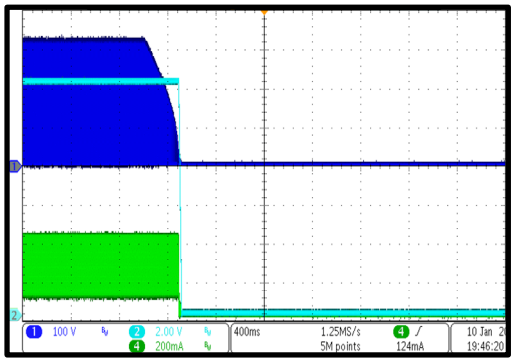
Start-Up

V_{IN} = 230V_{AC}, I_{OUT} = 250mA



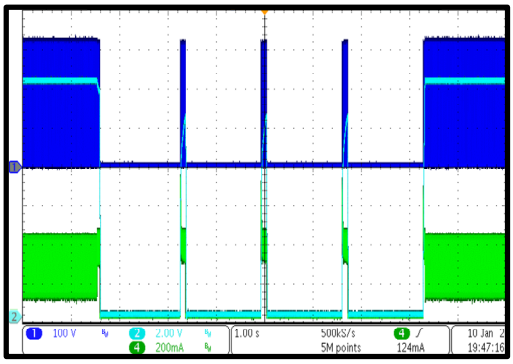
Shutdown

V_{IN} = 230V_{AC}, I_{OUT} = 250mA



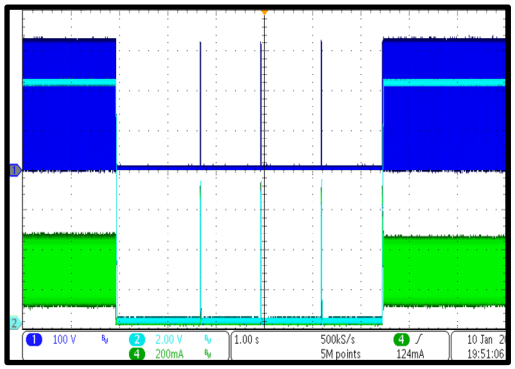
OLP Entry and Recovery

V_{IN} = 230V_{AC}, I_{OUT} = 250mA



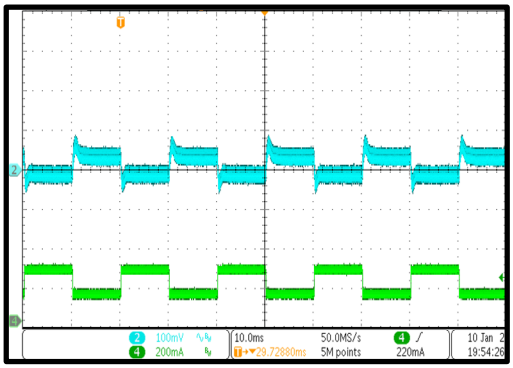
Open Loop Entry and Recovery

V_{IN} = 230V_{AC}, I_{OUT} = 250mA



Load Transient Response

V_{IN} = 230V_{AC}, from half load to full load



SURGE PERFORMANCE

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 230V_{AC}, V_{OUT} = 12V, I_{OUT} = 0.25A, T_A = 25°C, unless otherwise noted.

Surge Level (V)	Input Voltage (V_{AC})	Injection Location	Injection Phase (°)	Test Result (Pass/Fail)
1000	230	L to N	0	Pass
1000	230	L to N	90	Pass
1000	230	L to N	180	Pass
1000	230	L to N	270	Pass
-1000	230	L to N	0	Pass
-1000	230	L to N	90	Pass
-1000	230	L to N	180	Pass
-1000	230	L to N	270	Pass

CIRCUIT DESCRIPTION

The EV183-S-00A is configured in a buck regulator topology. It uses primary-side control and indirect feedback, which can simplify the schematic for a cost-effective BOM. It can also achieve constant-voltage (CV) control and acceptable regulation. The biggest highlight of the EV183-S-00A is its low zero standby power, which makes it well-suited for many auxiliary power supplies.

F1, a fusible resistor, is used to protect the circuit from component failure or some excessive short events. It can also restrain the inrush current.

C1, L1, and C2 compose the π filter to guarantee that the conducted EMI meets the EN55022 standard. C1 and C2 are also used for energy storage and protecting against line surges.

C3 is used to filter the noise on FB. C4 cancels out the delay induced by C3 and the internal resistor divider.

C5 and D4 are used for output voltage sample-holding and the VCC power supply. R1 and R2 are reserved as external dividers to tune the regulated voltage in the event of other output specification requirements.

D3 is the freewheeling diode. For universal voltage applications, use a diode with a 600V reverse-block voltage. An ultra-fast recovery diode is recommended to improve efficiency.

C7 and C8 are output capacitors for the 12V output. C7 should be a low-ESR electrolytic capacitor for a low output voltage ripple. C8 is a small ceramic capacitor that reduces high-frequency noise on the output. R4 is dummy load that lowers the output voltage of the 12V rail under no-load conditions.

PCB LAYOUT

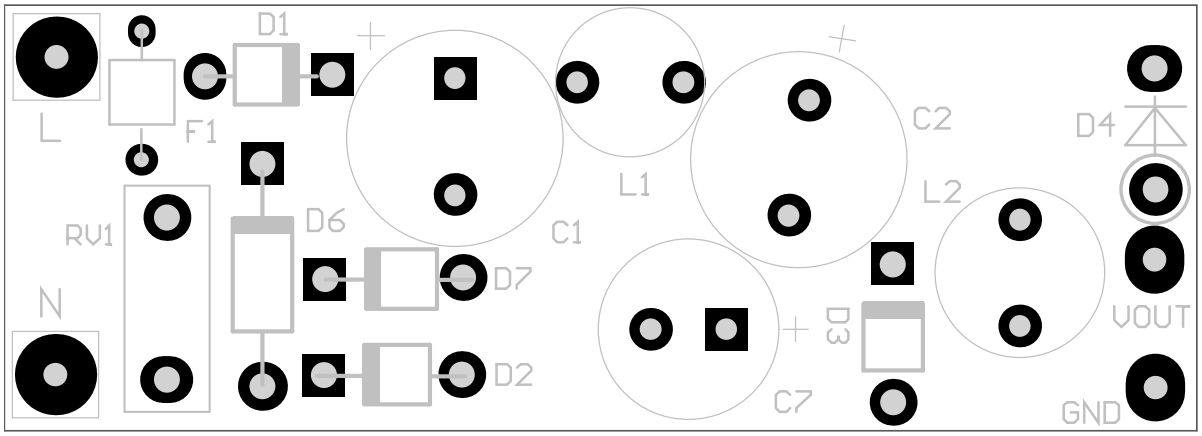


Figure 5: Top Layer

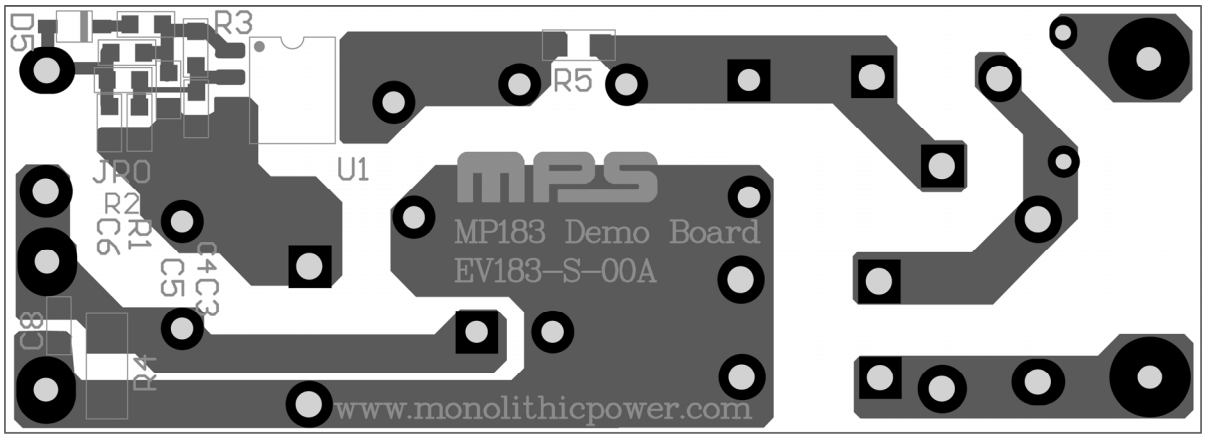


Figure 6: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	6/17/2024	Initial Release	-