EVL8030-QJ-00B

IEEE 802.3af/at/bt Compatible, PoE PD with PD Interface and Primary-Side Regulated Flyback Controller Evaluation Board

PRELIMINARY SPECIFICATIONS SUBJECT TO CHANGE

DESCRIPTION

The EVL8030-QJ-00B is an evaluation board designed to demonstrate the capabilities of the MP8030, a fully integrated, IEEE 802.3af/at/bt compatible, power over Ethernet (PoE) powered device (PD) with a PD interface and high-efficiency, primary-side regulated (PSR) flyback controller.

The PD interface has all IEEE 802.3af/at/bt functions. It also has a 100V integrated hot-swap MOSFET and a gate driver (GATE1) to improve efficiency for high-power applications. The second gate driver (GATE2) supports the external, low $R_{DS(ON)}$ N-channel MOSFET, which replaces the traditional diode O-ring to avoid power loss on the diode while powered by an adaptor.

The flyback controller is designed for both small-sized, isolated, PSR flyback applications, as well as high-efficiency, secondary-side regulated (SSR), active-clamped forward applications. The MP8030 can also be used for SSR flyback topologies.

The MP8030 is available in a QFN-32 (5mmx6mm) package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	41 to 57	V
Output voltage	V_{OUT}	12	V
Output current	I_{OUT}	6	A

FEATURES

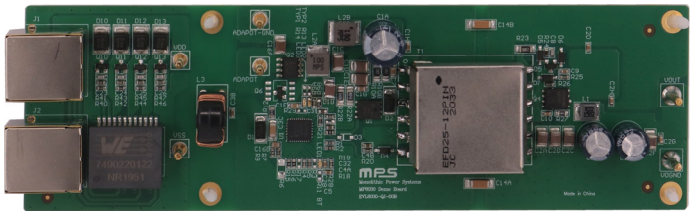
- 41V to 57V Power over Ethernet (PoE) Input or 48V Auxiliary Adapter Input
- 12V Output Voltage and 6A Output Current
- Primary-Side Regulation (PSR) Flyback
- 802.3af/at/bt Compatible
- Integrated Detection Resistor
- GATE2 N-Channel MOSFET for Adapter
- Supports Automatic Classification
- Automatic Maintain Power Signature (MPS)
- Frequency Dithering for EMI Reduction
- Auxiliary Winding Supply (VCC) for Power Loss Reduction
- OLP, SCP, and OVP with Hiccup Mode
- Thermal Shutdown
- Available in a QFN-32 (5mmx6mm) Package

MPL Optimized Performance with MPS Inductor

APPLICATIONS

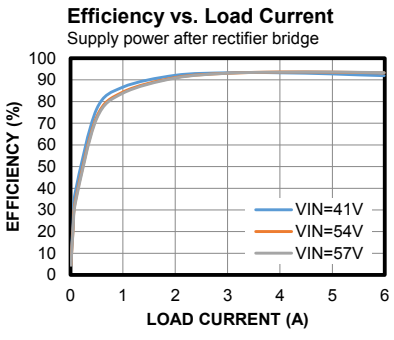
- IEEE 802.3af/at/bt Compatible Devices
- Security Cameras
- Video Phones
- WLAN Access Points
- Internet of Things (IoT)
- Pico Base Stations

EVL8030-QJ-00B EVALUATION BOARD



LxWxH (16.2cmx5cmx2cm)

Board Number	MPS IC Number	MPS Inductor
EVL8030-QJ-00B	MP8030GQJ	MPL-AL5050-100



QUICK START GUIDE

The evaluation board's output voltage (V_{OUT}) is set at 12V. The board layout accommodates most commonly used components. There are two methods to start up the board, described below.

Start-Up Method 1

1. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): VOUT_GND
2. Plug the PSE cable into the ethernet jack (J1). The board should start up automatically.

Start-Up Method 2

1. Preset the power supply between 41V and 57V.
2. Turn off the power supply.
3. Connect the power supply terminals to:
   a. Positive (+): VDD
   b. Negative (-): VSS
4. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): VOUT_GND
5. After making the connections, turn on the power supply. The board should start up automatically.
6. The MP8030 is enabled on the evaluation board once V_{DD} is applied.
7. To use the adapter supply function, follow steps 7 and 8:
   a. Positive (+): ADAPOT
   b. Negative (-): ADAPOT_GND
8. After making the connections, turn on the adapter. The board should automatically be supplied via the adapter.

EVALUATION BOARD SCHEMATIC

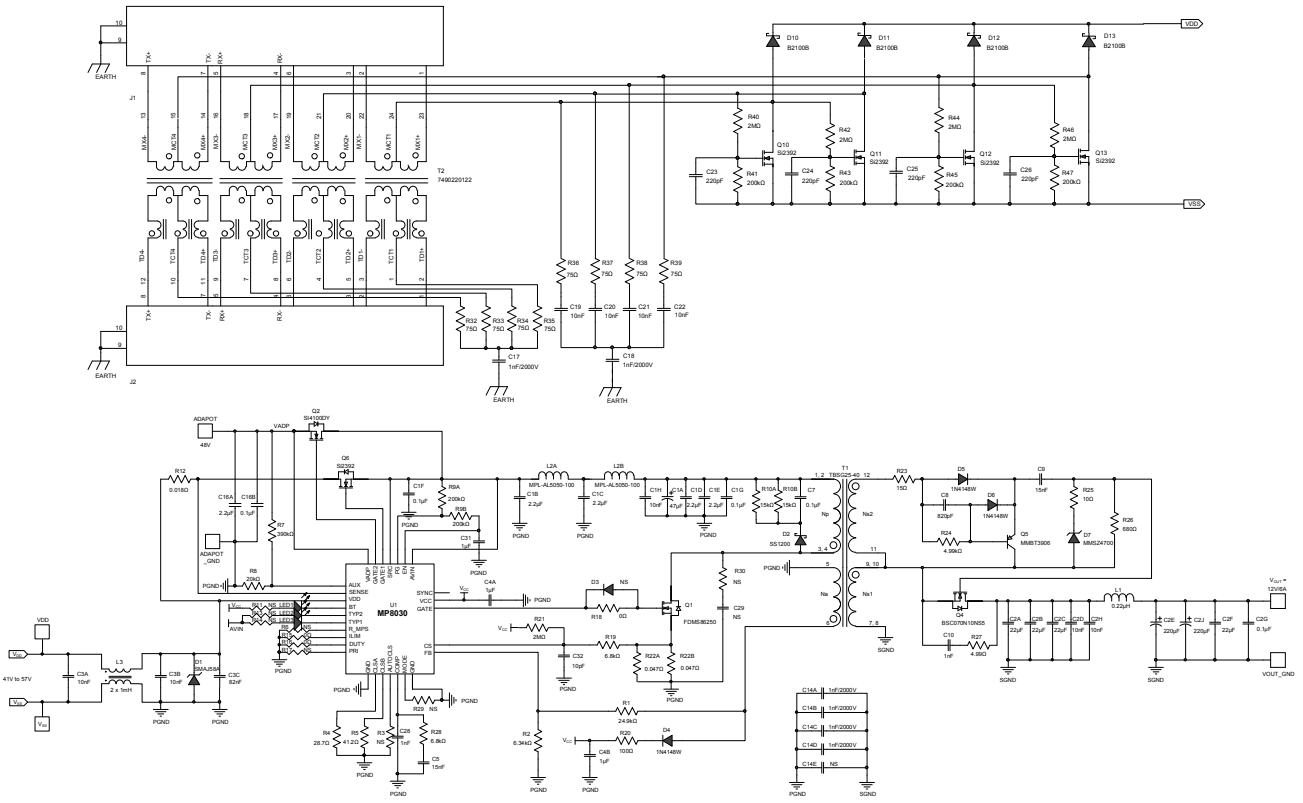


Figure 1: Evaluation Board Schematic (1) (2)

Note:

1) Resistor R19 enables frequency dithering. The frequency dithering function can also be disabled by setting R19 below 1kΩ. Choose R21 such that it maintains the original R21:R19 ratio (2MΩ:6.8kΩ).
2) To enable the LED indicator, set R11 to 9.09kΩ, R13 to 53.6kΩ, and R14 to 53.6kΩ. R11, R13, and R14 are not soldered to the evaluation board by default.

EVL8030-QJ-00B BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	L2A, L2B	10µH	Inductor, I_{RATED} = 4.8A, I_{SAT} = 5.5A, RDC = 37mΩ	5050	MPS	MPL-AL5050-100
1	C1A	47µF	Electrolytic capacitor, 100V	DIP	Jianghai	ECR2AXY470MLB100012
5	C1B, C1C, C1D, C1E, C16A	2.2µF	Ceramic capacitor, 100V, X7R	1210	Murata	GRM32ER72A225KA88L
4	C1F, C1G, C7,C16B	0.1µF	Ceramic capacitor, 100V, X7R	0805	Murata	GRM21BR72A104KAC4L
3	C1H, C3A, C3B	10nF	Ceramic capacitor, 100V, X7R	0603	Murata	GRM188R72A103KA01D
4	C2A, C2B, C2C, C2F	22µF	Ceramic capacitor, 25V, X7R	1210	Murata	GRM32ER71E226KE15L
2	C2D, C2H	10nF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E103KA01D
2	C2E, C2J	220µF	Electrolytic capacitor, 25V	DIP	Jianghai	CD284
1	C2G	0.1µF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E104KA01D
1	C3C	82nF	Ceramic capacitor, 100V, X7R	1206	Murata	GRM319R72A823KA01D
3	C4A, C4B, C31	1µF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E105KA01D
1	C5	15nF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R71C153KA01D
1	C8	820pF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E821JA01D
1	C9	15nF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E153KA01D
1	C10	1nF	Ceramic capacitor, 100V, X7R	0603	Murata	GRM188R72A102KA01D
6	C14A, C14B, C14C, C14D, C17, C18	1nF	Ceramic capacitor, 2000V, X7R	1808	Murata	GR442QR73D102KW01L
0	C14E, C29, D3, R3, R11, R13, R14, R17, R29, R30	NS				
4	C19, C20, C21, C22	10nF	Ceramic capacitor, 100V, X7R	0603	Murata	GRM188R72A103KA01D
4	C23, C24, C25, C26	220pF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H221KA01D
1	C28	1nF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R71C102KA01D
1	C32	10pF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H100KA01D
1	D1	400W	TVS diode, 4.3A	SMA	Littelfuse, Inc.	SMAJ58A
1	D2	200V	Schottky diode, 1A	SMA	Micro Commercial	SS1200
3	D4, D5, D6	100V	Diode switch	SOD-123	Diodes, Inc.	1N4148W
1	D7	13V	Zener diode	SOD-123	General Semiconductor	MMSZ4700
4	D10, D11, D12, D13	100V	Schottky diode, 2A	SMB	Diodes, Inc.	B2100-13-F
2	J1, J2	1.5A	Jack connecter, RJ45, $120V_{AC}$	8P8C	Wurth	615008140121

EVL8030-QJ-00B BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	L1	0.22µH	I_{RATED} = 9.5A, RDC = 6.5mΩ	4020	Sunlord	WPN4020HR22MT
		0.22µH	I_{RATED} = 9.5A, RDC = 6.6mΩ	4020	Wurth	744373240022
1	L3	2 x 1mH	Common mode choke 2 x 1mH, 2.5A, 2 x 55mΩ	DIP	Wurth	7448012501
3	LED1, LED2, LED3	2.2V	Green LED, 2.2V, 20mA	0603	Rohm Semiconductor	SML-D12M8WT86
1	Q1	25mΩ	N-channel MOSFET, 150V, 6.7A	Power 56	On Semiconductor	FDMS86250
1	Q2	63mΩ	N-channel MOSFET, 100V, 6.8A	SOIC-8	Vishay	Si4100DY-T1-GE3
1	Q4	7mΩ	N-channel MOSFET, 100V, 80A	PG-TDSON-8	Infineon	BSC070N10NS5
1	Q5	350mW	PNP general-purpose amplifier, 40V, 0.2A	SOT-23	Micro Commercial	MMBT3906
5	Q6, Q10, Q11, Q12, Q13	126mΩ	N-channel MOSFET, 100V, 3.1A	SOT-23	Vishay	Si2392DS-T1-GE3
1	R1	24.9kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-0724K9L
1	R2	6.34kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-076K34L
1	R4	28.7Ω	Film resolution, 1%	0603	Yageo	RL0603FR-0728R7T
1	R5	41.2Ω	Film resolution, 1%	0603	Yageo	RL0603FR-0741R2T
0	R6	NS		1206		
1	R7	390kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-07390KL
1	R8	20kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-0720KL
2	R9A, R9B	200kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-07200KL
2	R10A, R10B	15kΩ	Film resolution, 1%	1206	Yageo	RL1206FR-0715KL
1	R12	0.018Ω	Film resolution, 1%	0805	Yageo	RL0805FR-070R018L
3	R15, R16, R18	0Ω	Film resolution, 1%	0603	Yageo	RL0603FR-070RL
2	R19, R28	6.8kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-076K8L
1	R20	100Ω	Film resolution, 1%	0603	Yageo	RL0603FR-07100RL
5	R21, R40, R42, R44, R46	2MΩ	Film resolution, 1%	0603	Yageo	RL0603FR-072ML
2	R22A, R22B	0.047Ω	Film resolution, 1%	1206	Yageo	RL1206FR-070R047L
1	R23	15Ω	Film resolution, 1%	1206	Yageo	RL1206FR-0715RL
1	R24	4.99kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-074K99L
1	R25	10Ω	Film resolution, 1%	0603	Yageo	RL0603FR-0710RL
1	R26	680Ω	Film resolution, 1%	0603	Yageo	RL0603FR-07680RL
1	R27	4.99Ω	Film resolution, 1%	0805	Yageo	RL0805FR-074R99L
8	R32, R33, R34, R35, R36, R37, R38, R39	75Ω	Film resolution, 1%	0603	Yageo	RL0603FR-0775RL
4	R41, R43, R45, R47	200kΩ	Film resolution, 1%	0603	Yageo	RL0603FR-07200KL
1	T1	55µH	Np:Ns1:Na:Ns2 = 18:6:5:5	EFD25	Chengdu Jinzhichuan	TBSG25-40

EVL8030-QJ-00B BILL OF MATERIALS *(continued)*

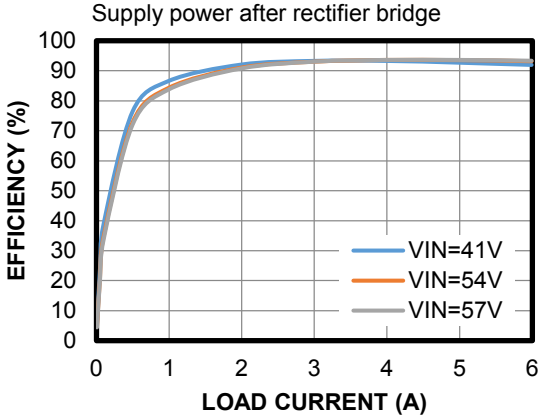
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	T2	350µH	LAN 10/100/1000 base-T transformer, WE-LAN series	SMD	Wurth	7490220122
1	U1	MP8030	PoE PD with PD interface and high-efficiency, PSR flyback/forward controller	QFN-32 (5mmx 6mm)	MPS	MP8030GQJ

EVB TEST RESULTS

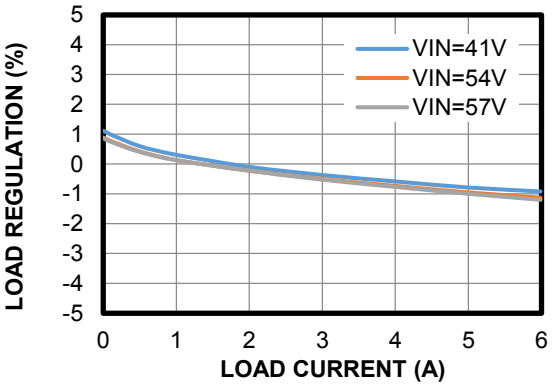
V_{IN} = 54V, V_{OUT} = 12V, I_{OUT} = 6A, T_A = 25°C, unless otherwise noted.

Efficiency vs. Load Current

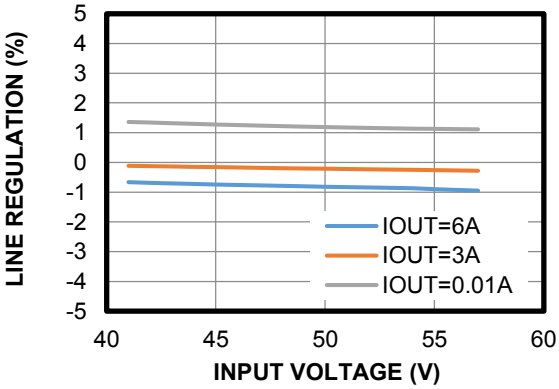
Supply power after rectifier bridge



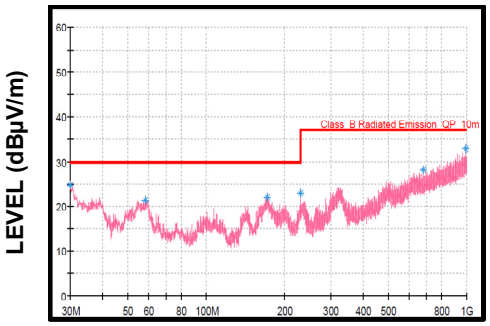
Load Regulation



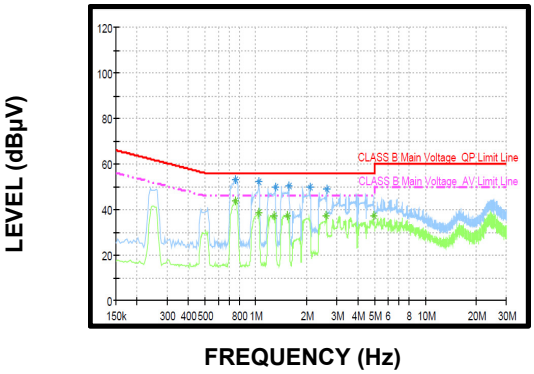
Line Regulation



Radiated Emissions Results



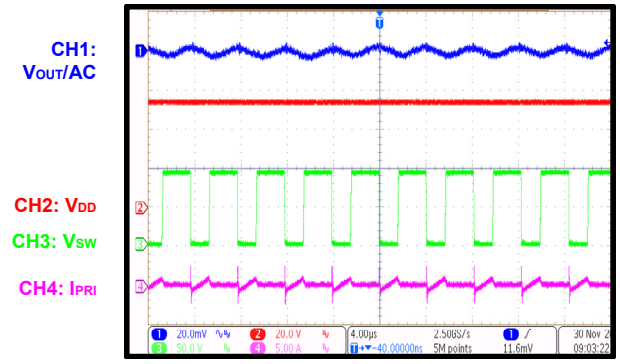
Conducted Emissions Results



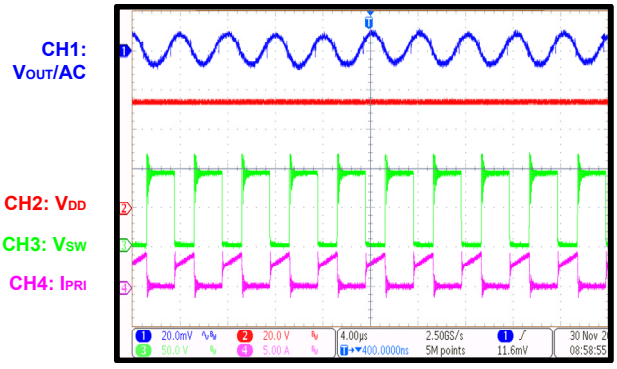
EVB TEST RESULTS *(continued)*

V_{IN} = 54V, V_{OUT} = 12V, I_{OUT} = 6A, T_A = 25°C, unless otherwise noted.

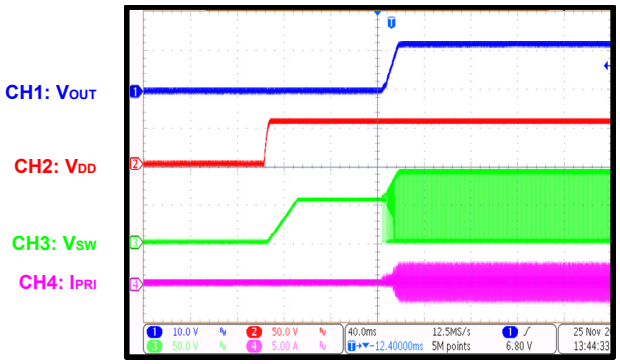
Steady State
I_{OUT} = 0A



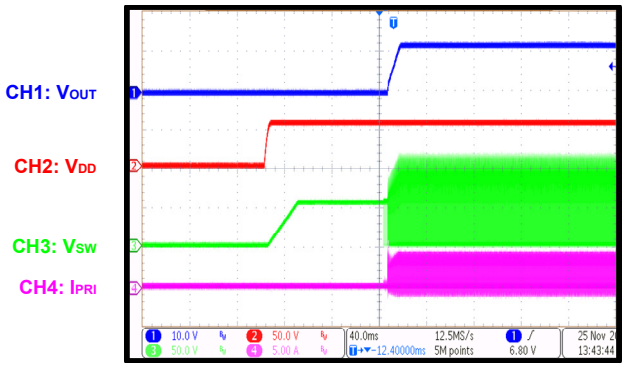
Steady State
I_{OUT} = 6A



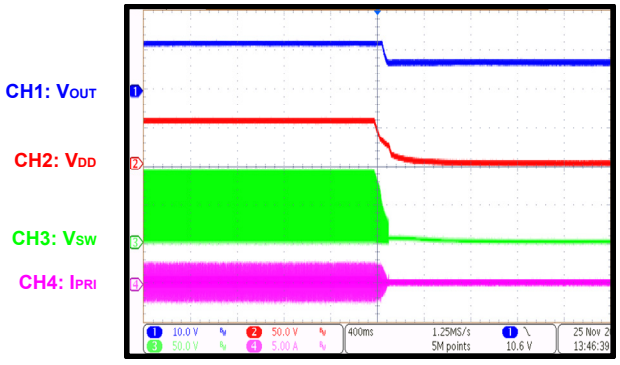
Start-Up through VDD
I_{OUT} = 0A



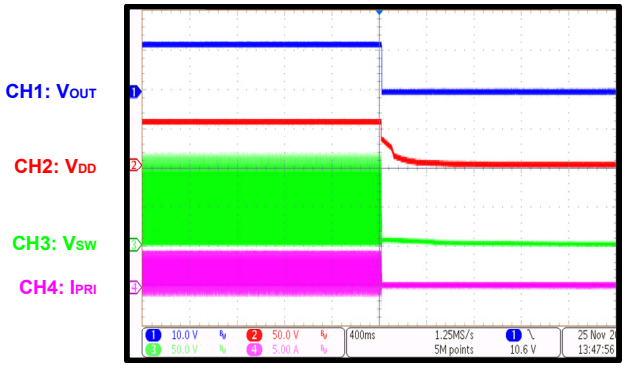
Start-Up through VDD
I_{OUT} = 6A



Shutdown through VDD
I_{OUT} = 0A



Shutdown through VDD
I_{OUT} = 6A

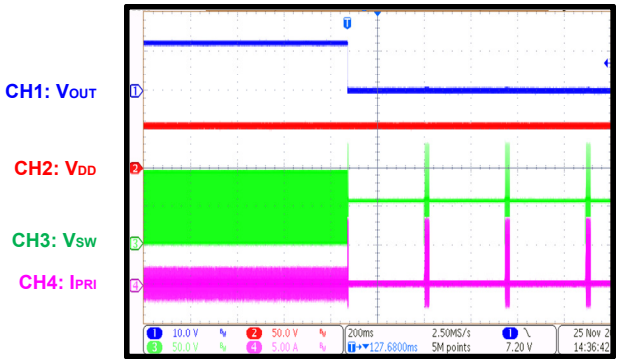


EVB TEST RESULTS *(continued)*

V_{IN} = 54V, V_{OUT} = 12V, I_{OUT} = 6A, T_A = 25°C, unless otherwise noted.

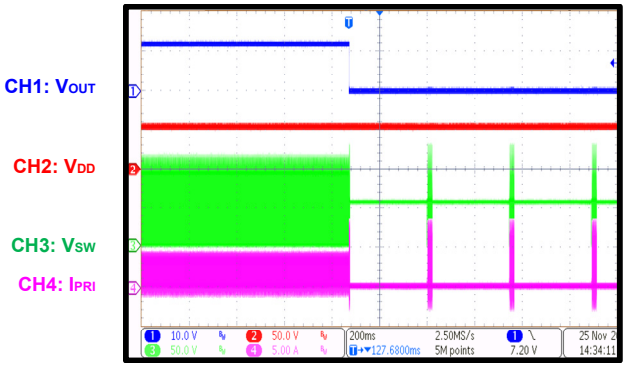
SCP Entry

I_{OUT} = 0A to short



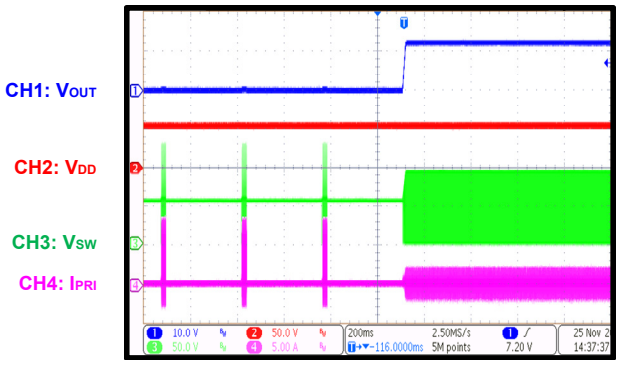
SCP Entry

I_{OUT} = 6A to short



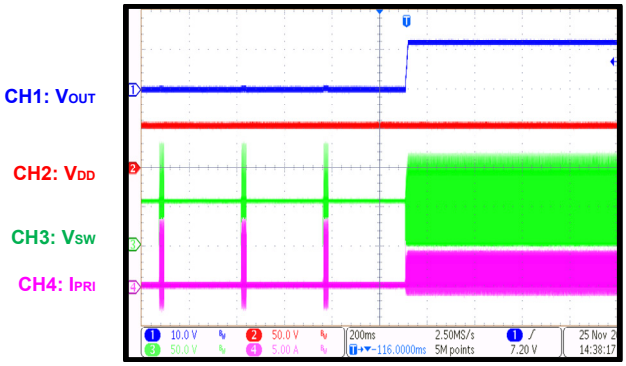
SCP Recovery

I_{OUT} = short to 0A



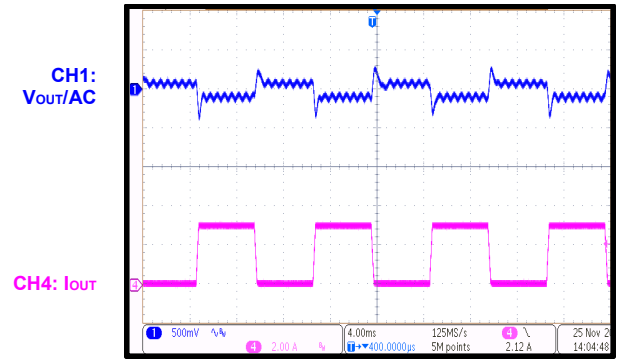
SCP Recovery

I_{OUT} = short to 6A



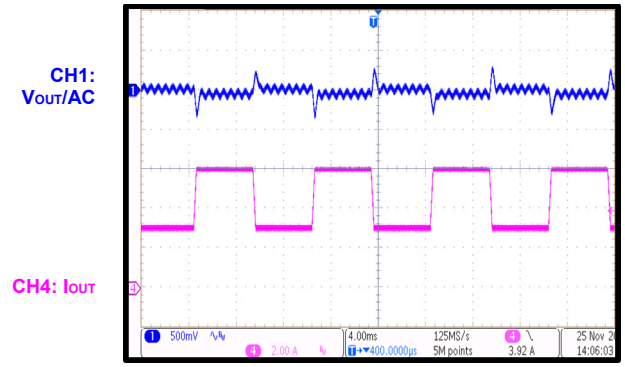
Load Transient

I_{OUT} = 0A to 3A, I_{RAMP} = 25mA/µs



Load Transient

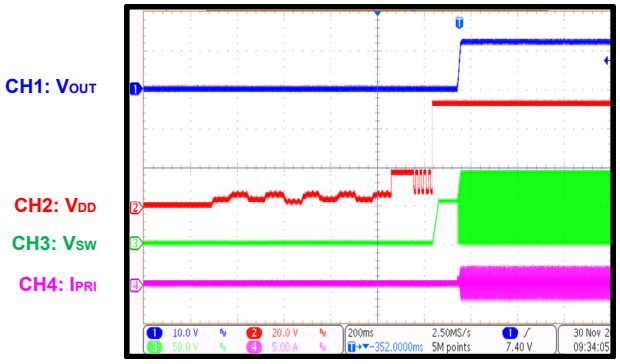
I_{OUT} = 3A to 6A, I_{RAMP} = 25mA/µs



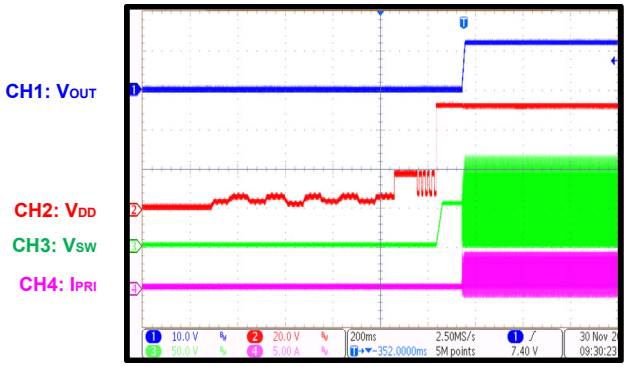
EVB TEST RESULTS *(continued)*

V_{IN} = 54V, V_{OUT} = 12V, I_{OUT} = 6A, T_A = 25°C, unless otherwise noted.

Start-Up through PSE
I_{OUT} = 0A



Start-Up through PSE
I_{OUT} = 6A



PCB LAYOUT

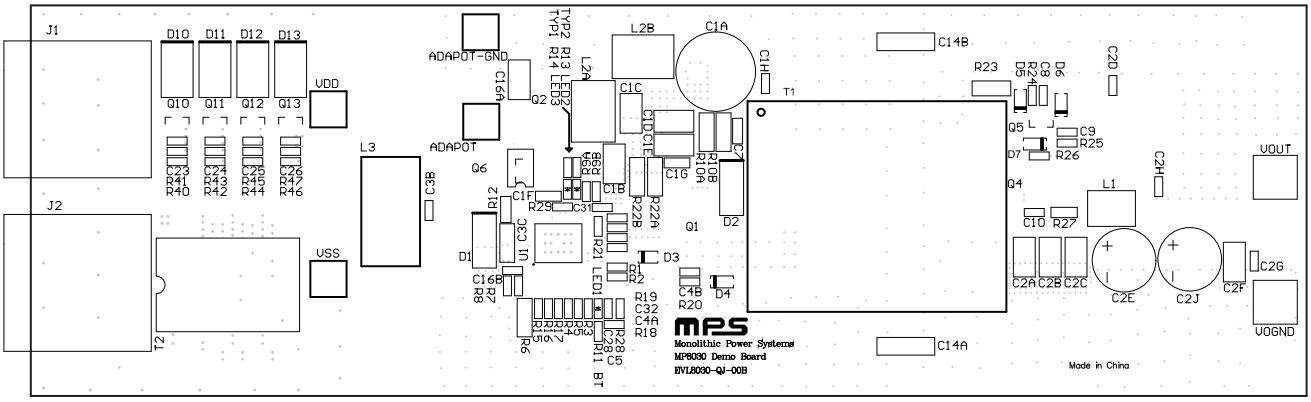


Figure 2: Top Silk

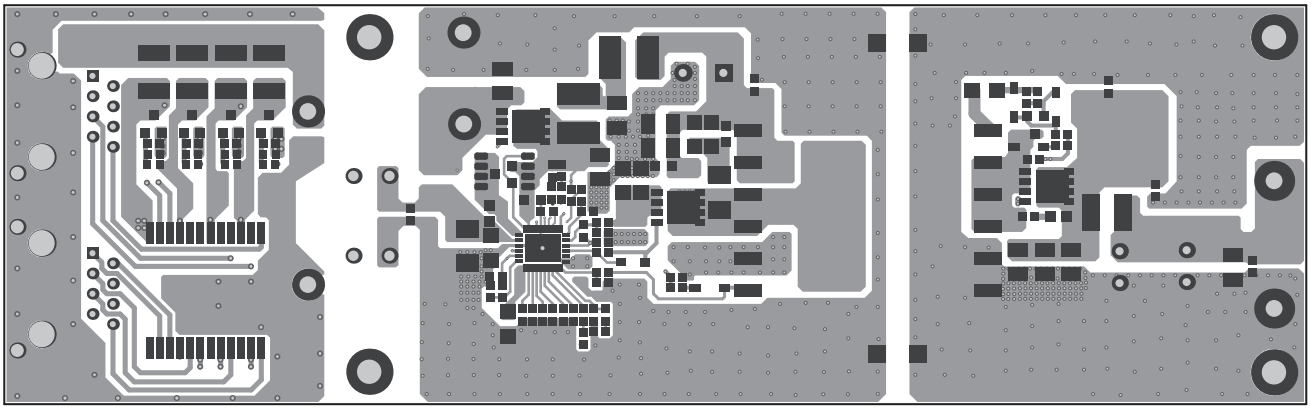


Figure 3: Top Layer

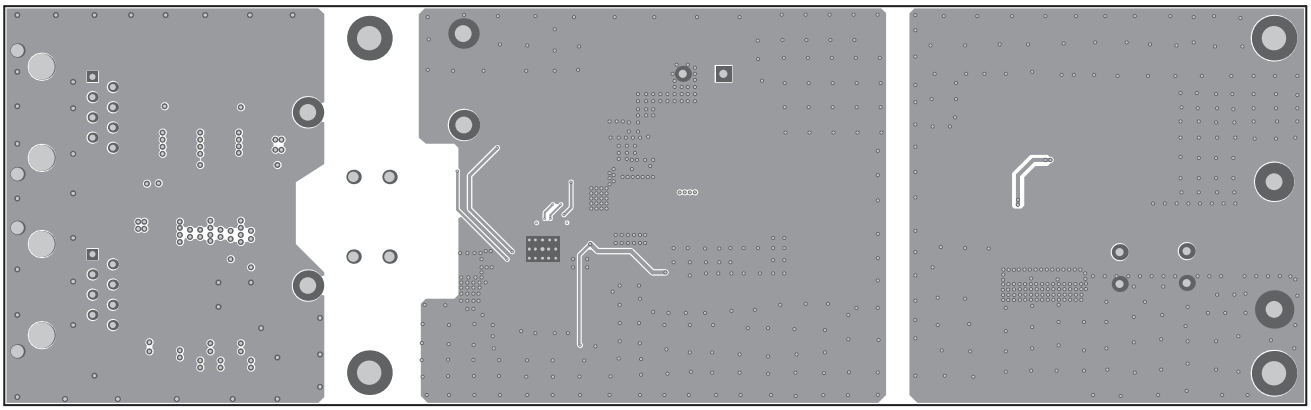


Figure 4: Mid-Layer 1

PCB LAYOUT *(continued)*

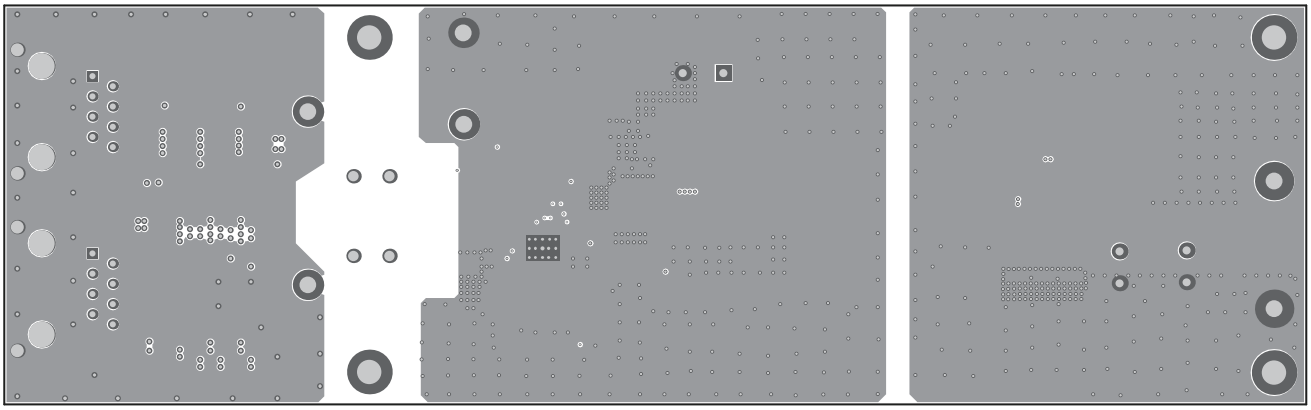


Figure 5: Mid-Layer 2

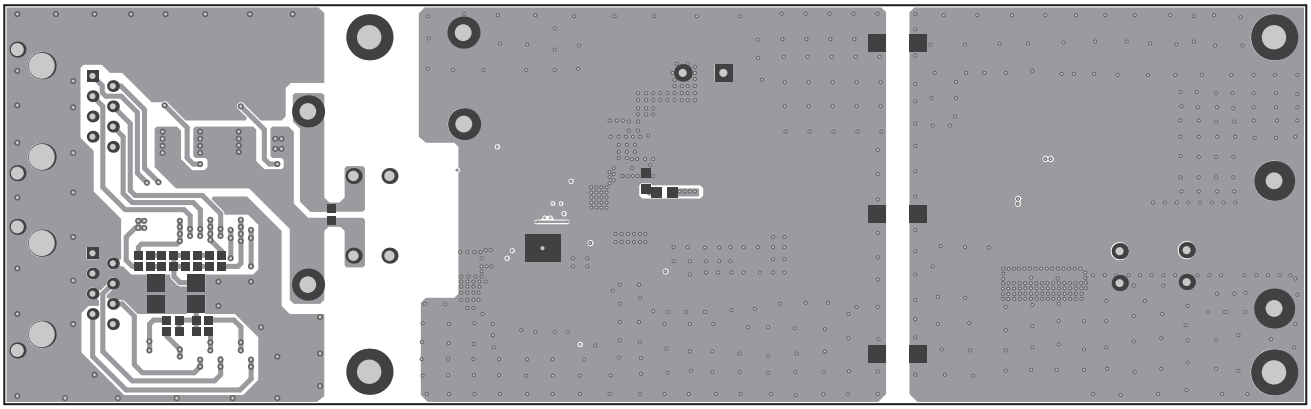


Figure 6: Bottom Layer

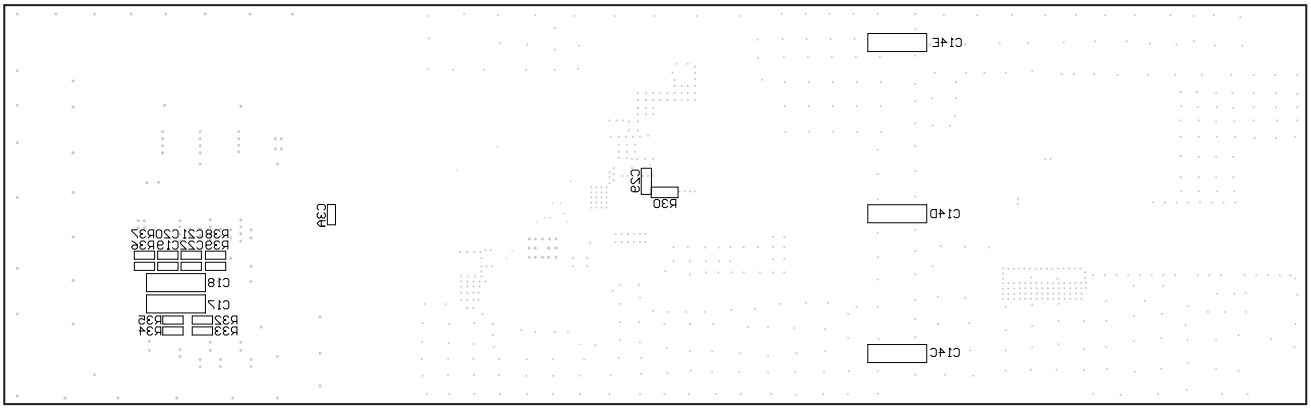


Figure 7: Bottom Silk