EVL9929-QW-00A

100V Input, Current Mode, Synchronous Step-Down Controller Evaluation Board

DESCRIPTION

The EVL9929-QW-00A is an evaluation board designed to demonstrate the capabilities of the MP9929, a high-voltage, synchronous step-down switching regulator controller.

The MP9929 is a high-voltage controller that can directly step down voltages from up to 100V. The MP9929 uses a pulse-width modulation (PWM) current control architecture with accurate cycle-by-cycle current limiting. It can drive dual N-channel MOSFET switches. Advanced asynchronous modulation (AAM) mode enables asynchronous operation and pulse-skip mode (PSM) to optimize light-load efficiency. The MP9929's switching frequency (f_{SW}) can be configured via an external resistor or synchronized to an external clock for noise-sensitive applications. Fault protections include precision output over-voltage protection (OVP), output over-current protection (OCP), and thermal shutdown.

It is recommended to read the datasheet for the MP9929 prior to making any changes to the EVL9929-QW-00A.

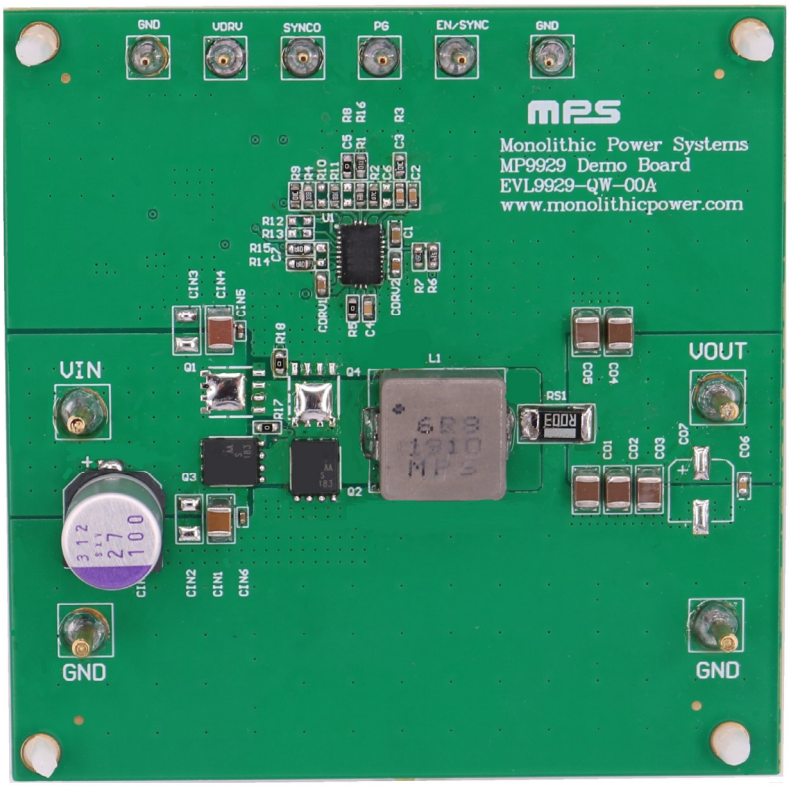
PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range		22V to 100V
Output voltage (V_{OUT})	V_{IN} = 22V to 100V, I_{OUT} = 0A to 10A	12V
Maximum output current (I_{OUT})	V_{IN} = 22V to 100V	10A
Typical efficiency	V_{IN} = 56V, V_{OUT} = 12V, I_{OUT} = 10A	95.0%
Peak efficiency	V_{IN} = 56V, V_{OUT} = 12V, I_{OUT} = 10A	95.0%
Switching frequency		250kHz

MPL Optimized Performance with MPS Inductor MPL-AY1265 Series

EVALUATION BOARD



LxWxH (8cmx8cmx2cm)

Board Number	MPS IC Number
EVL9929-QW-00A	MP9929GQW

QUICK START GUIDE

The EVL9929-QW-00A evaluation board is easy to set up and use to evaluate the performance of the MP9929. For proper measurement equipment set-up, refer to Figure 1 and follow the steps below:

1. Preset the power supply to 56V, then turn off the power supply. (1)
2. Connect the power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
3. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
4. After making the connections, turn on the power supply. The board should automatically start up.
5. Check for the proper output voltage (V_{OUT}) between the VOUT and GND terminals. Once the proper V_{OUT} is established, adjust the load within the operating range (2) and measure the efficiency, output ripple voltage (3), as well as other parameters.
6. After completing all tests, adjust the load to 0A, and turn off the input power supply.

Notes:

1) Ensure that the input voltage (V_{IN}) does not exceed 100V.
2) The EVL9929-QW-00A only supports 10A, but as a controller, the MP9929 can support higher currents up to 15A with special design. Contact an MPS FAE for support.
3) When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe.

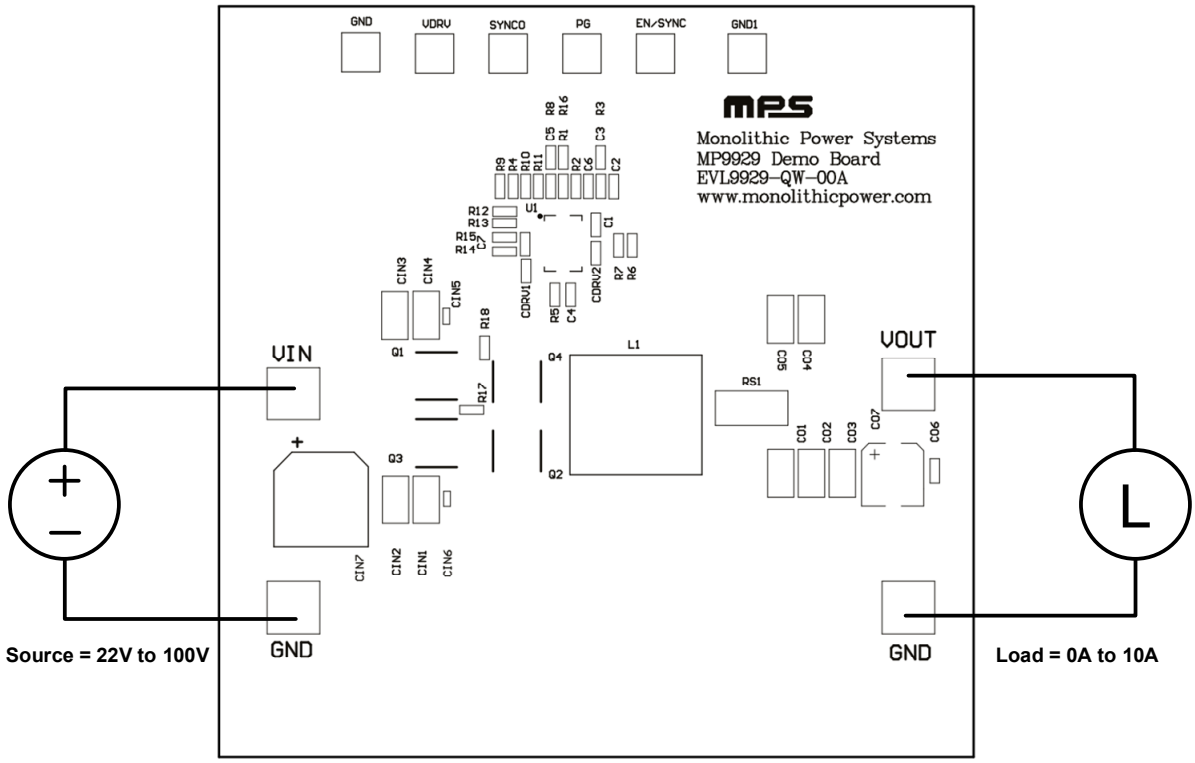


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

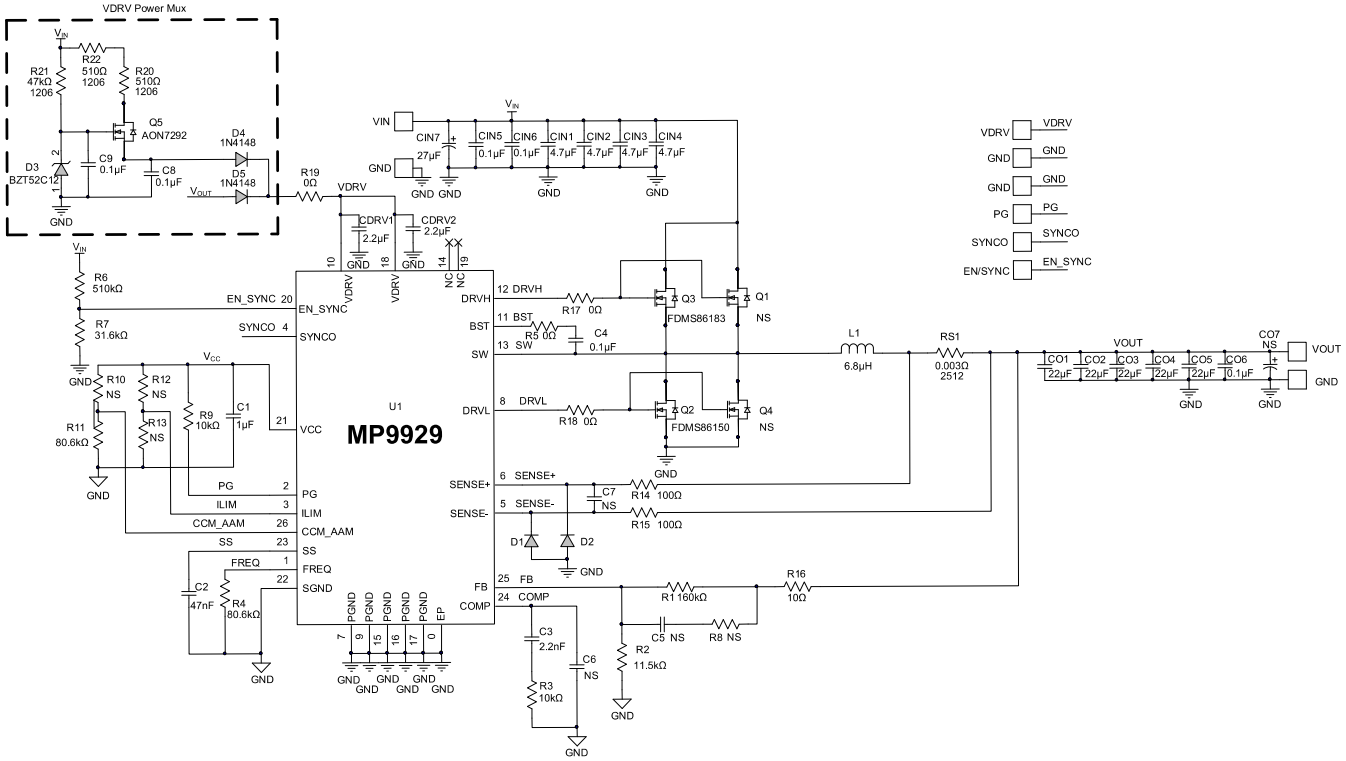


Figure 2: Evaluation Board Schematic

EVL9929-QW-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	C1	1µF	Ceramic capacitor, 25V, X7R	0603	Wurth	885012206076
1	C2	47nF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E473KA01D
1	C3	2.2nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H222KA01D
4	C4, C8, C9, CO6	0.1µF	Ceramic capacitor, 25V, X7R	0603	Wurth	885012206071
2	CDRV1, CDRV2	2.2µF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R61H225KE11D
2	CIN1, CIN4	4.7µF	Ceramic capacitor, 100V, X7S	1210	TDK	C3225X7S2A475K
2	CIN5, CIN6	0.1µF	Ceramic capacitor, 100V, X7R	0402	Murata	GRM155R62A104KE14D
1	CIN7	27µF	Conductive polymer aluminum solid capacitor	SMD	Panasonic	100SXV27M
5	CO1, CO2, CO3, CO4, CO5	22µF	Ceramic capacitor, 25V, X7R	1210	Wurth	885012109014
0	C5, C6, C7, CIN2, CIN3, CO7	NC				
1	R1	160kΩ	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-07160KL
1	R2	11.5kΩ	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-0711K5L
2	R3, R9	10kΩ	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-0710KL
2	R4, R11	80.6kΩ	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-0780K6L
5	R5, R8, R17, R18, R19	0Ω	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-070RL
1	R6	510kΩ	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-07510KL
1	R7	31.6kΩ	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-0731K6L
2	R14, R15	100Ω	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-07100RL
1	R16	10Ω	Film resistor, 1%, 0603	0603	Yageo	RC0603FR-0710RL
2	R20, R22	510Ω	Film resistor, 1%, 1206	1206	Yageo	RC1206JR-07510RL
1	R21	47kΩ	Film resistor, 1%, 1206	1206	Yageo	RC1206FR-0747KL
1	RS1	3mΩ	Film resistor, 1%, 2512	2512	Yageo	PA2512FKF7T0R003E
0	R10, R12, R13	NC				
0	D1	NC				
1	D2	80V, 1A	Diode, 80V, 1A	SOD-123	Diodes, Inc.	MBR180S1
1	D3	12V	Diodes, V_F = 12V, I_F = 5mA, 500mW	SOD-123	Diodes, Inc.	BZT52C12V
2	D4, D5	75V	Diode, 75V, 0.15A	SOD-323	Diodes, Inc.	1N4148WS-7-F
1	Q2	100V	100V, 80A, 4.85mΩ	PQFN (5mmx 6mm)	onsemi	FDMS86150

EVL9929-QW-00A BILL OF MATERIALS *(continued)*

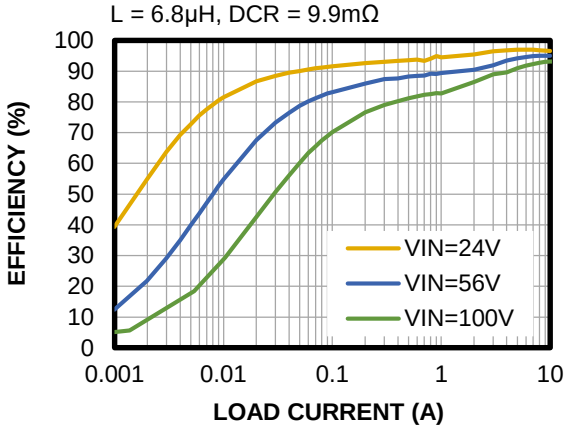
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	Q3	100V	100V, 51A, 12.8mΩ	PQFN(5mmx 6mm)	onsemi	FDMS86183
1	Q5	100V	100V, N-channel alpha MOSFET	DFN (3.3mmx 3.3mm)	AOSMD	AON7292
0	Q1, Q4	NS				
1	U1	MP9929	100V, step-down controller	QFN-26 (4mmx 6mm)	MPS	MP9929GQW
1	L1	6.8μH	Inductor, R_{DC} = 9.9mΩ, I_{SAT} = 19.5A	SMD	MPS	MPL-AY1265-6R8

EVB TEST RESULTS

V_{IN} = 56V, V_{OUT} = 12V, L = 6.8µH, f_{SW} = 250kHz, T_A = 25°C, unless otherwise noted.

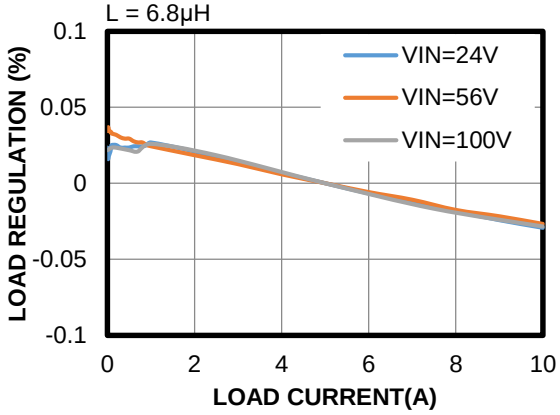
Efficiency vs. Load Current

L = 6.8µH, DCR = 9.9mΩ



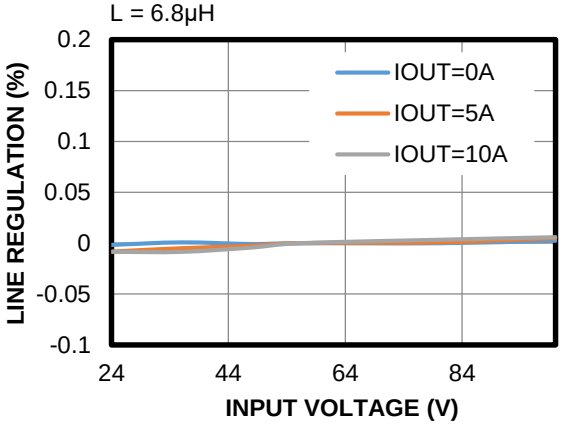
Load Regulation（Buck）

L = 6.8µH

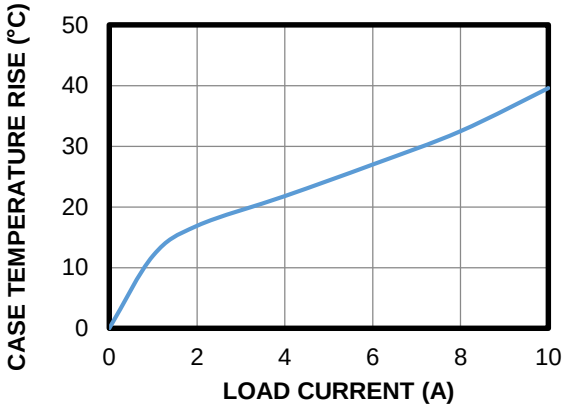


Line Regulation

L = 6.8µH

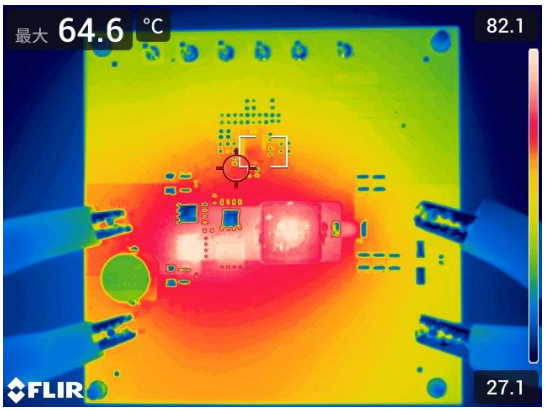


Case Temperature Rise vs. Load Current



Thermal Performance

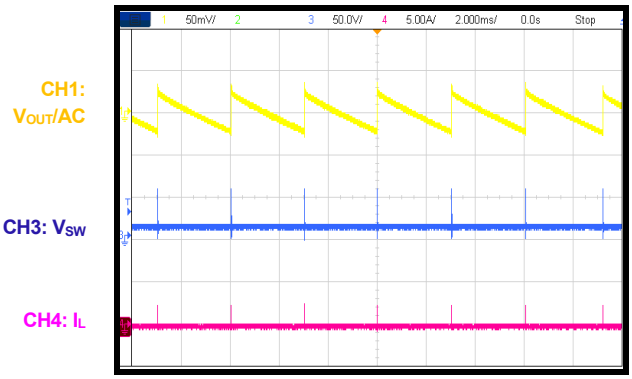
I_{OUT} = 10A, no forced airflow, T_{CASE} = 64.6°C



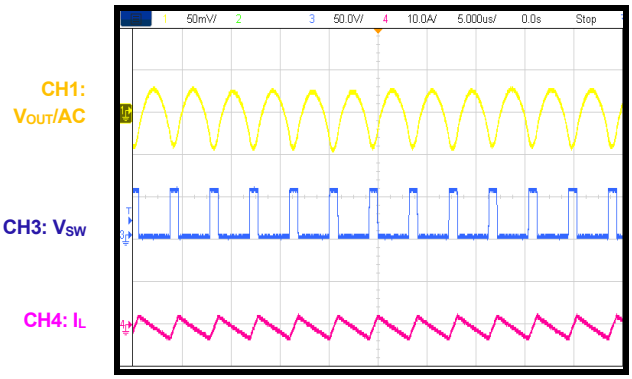
EVB TEST RESULTS *(continued)*

V_{IN} = 56V, V_{OUT} = 12V, L = 6.8µH, f_{SW} = 250kHz, T_A = 25°C, unless otherwise noted.

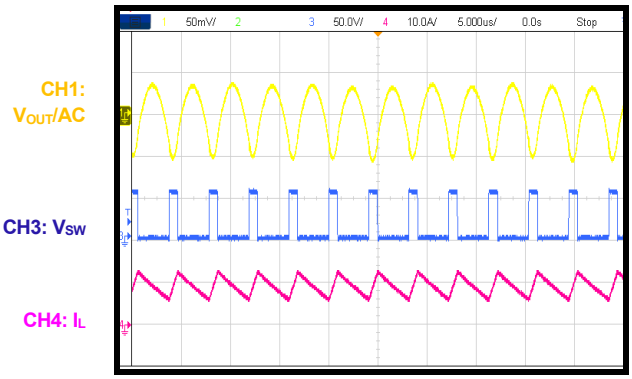
Steady State
I_{OUT} = 0A, AAM mode



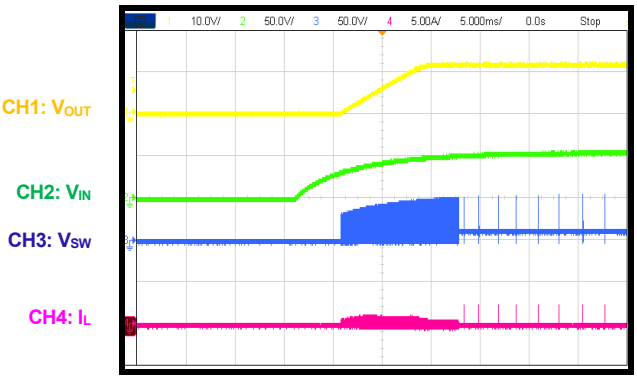
Steady State
I_{OUT} = 0A, FCCM



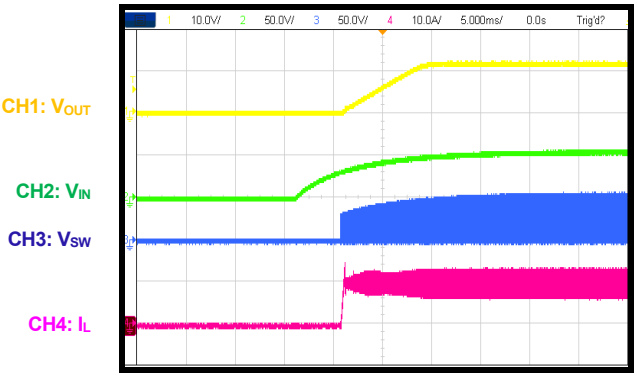
Steady State
I_{OUT} = 10A



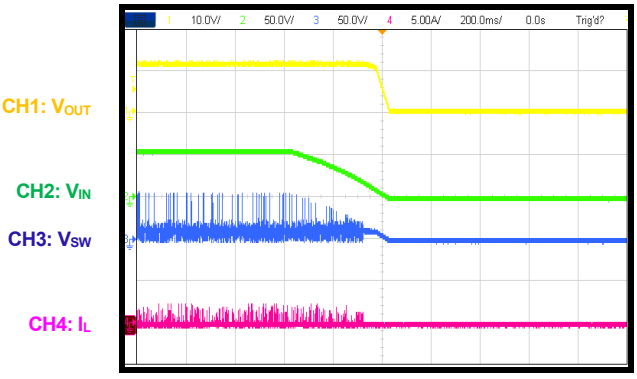
Start-Up through VIN
I_{OUT} = 0A



Start-Up through VIN
I_{OUT} = 10A



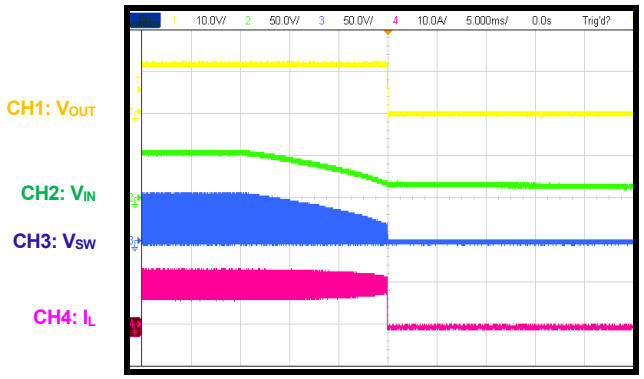
Shutdown through VIN
I_{OUT} = 0A



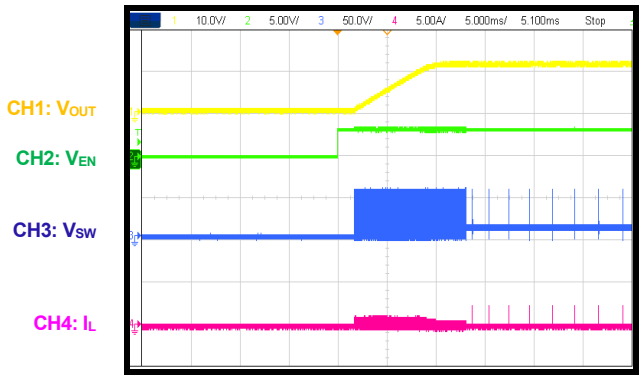
EVB TEST RESULTS *(continued)*

V_{IN} = 56V, V_{OUT} = 12V, L = 6.8µH, f_{SW} = 250kHz, T_A = 25°C, unless otherwise noted.

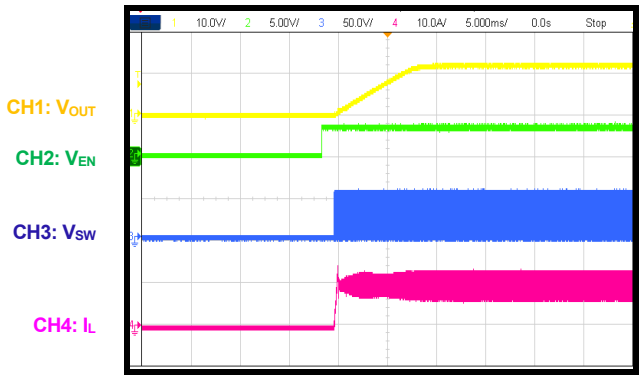
Shutdown through VIN
I_{OUT} = 10A



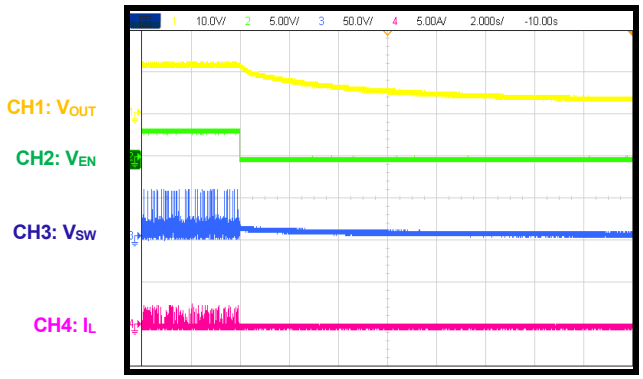
Start-Up through EN
I_{OUT} = 0A



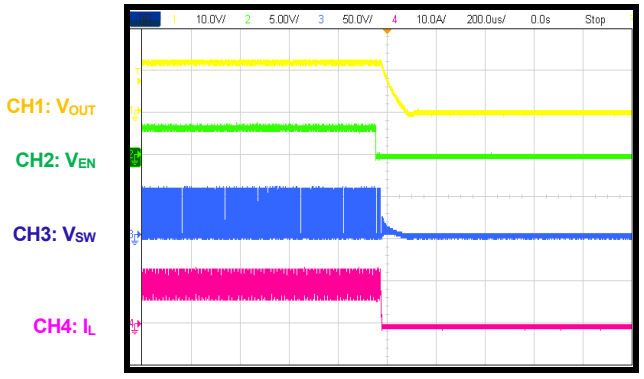
Start-Up through EN
I_{OUT} = 10A



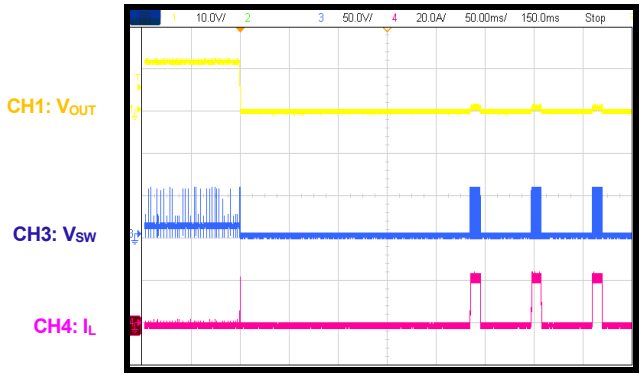
Shutdown through EN
I_{OUT} = 0A



Shutdown through EN
I_{OUT} = 10A



Short-Circuit Protection Entry
I_{OUT} = 0A to short circuit

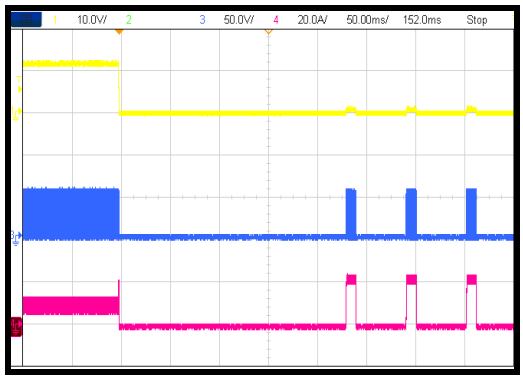


EVB TEST RESULTS *(continued)*

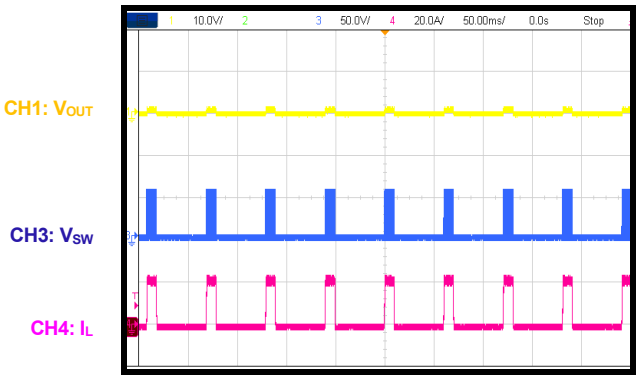
V_{IN} = 56V, V_{OUT} = 12V, L = 6.8µH, f_{SW} = 250kHz, T_A = 25°C, unless otherwise noted.

Short-Circuit Protection Entry

I_{OUT} = 10A to short circuit

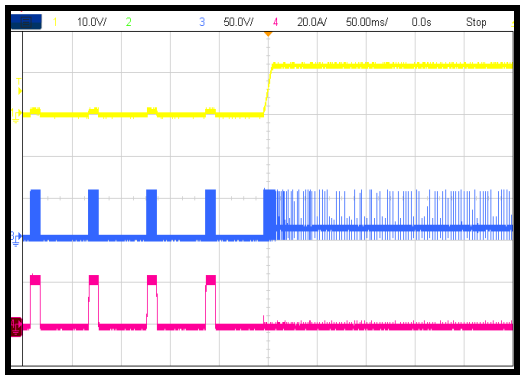


Short-Circuit Protection Steady State



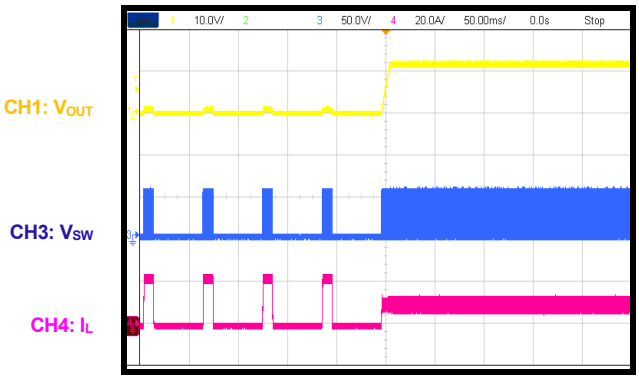
Short-Circuit Protection Recovery

Short circuit to I_{OUT} = 0A



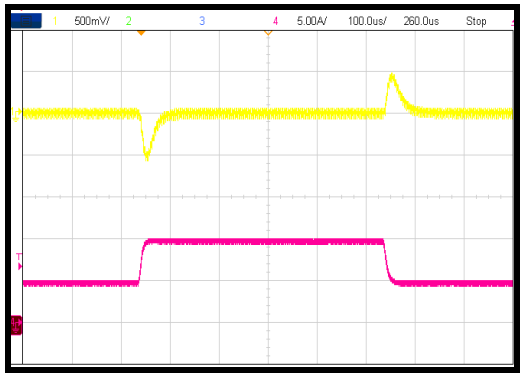
Short-Circuit Protection Recovery

Short circuit to I_{OUT} = 10A



Load Transient Response

I_{OUT} = 5A to 10A, 500mA/µs



PCB LAYOUT

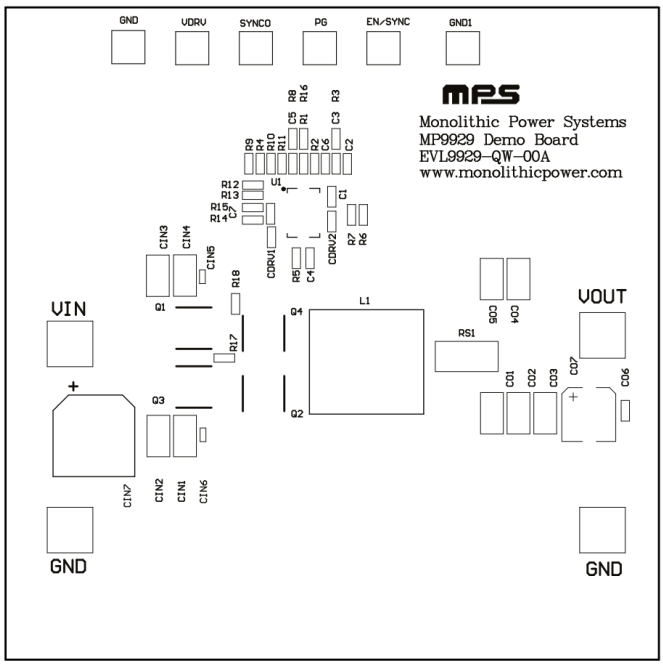


Figure 3: Top Silk

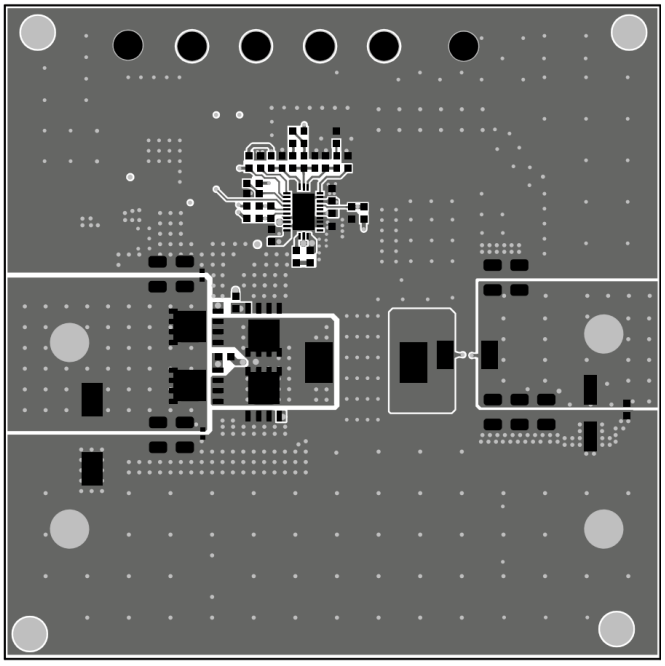


Figure 4: Top Layer

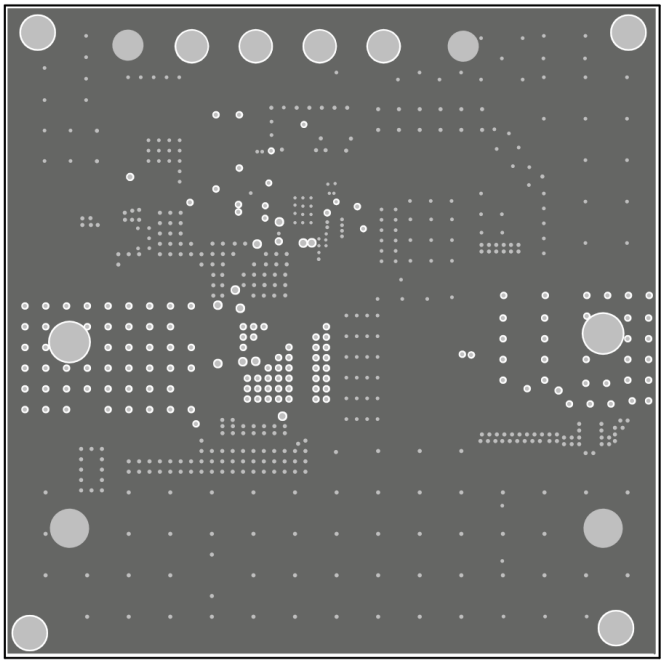


Figure 5: Mid-Layer 1

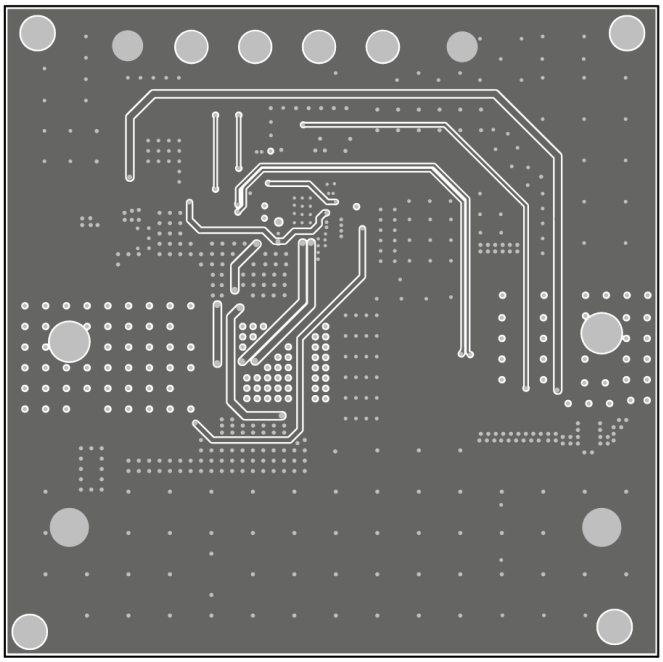


Figure 6: Mid-Layer 2

PCB LAYOUT *(continued)*

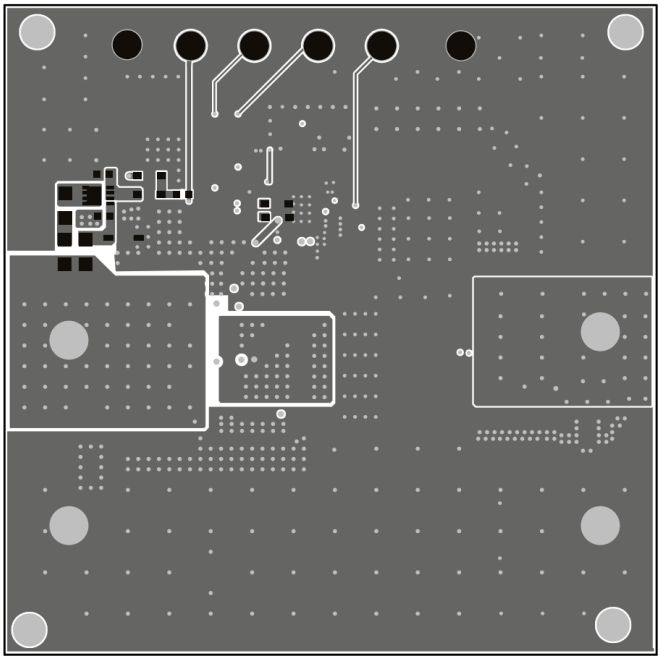


Figure 7: Bottom Layer

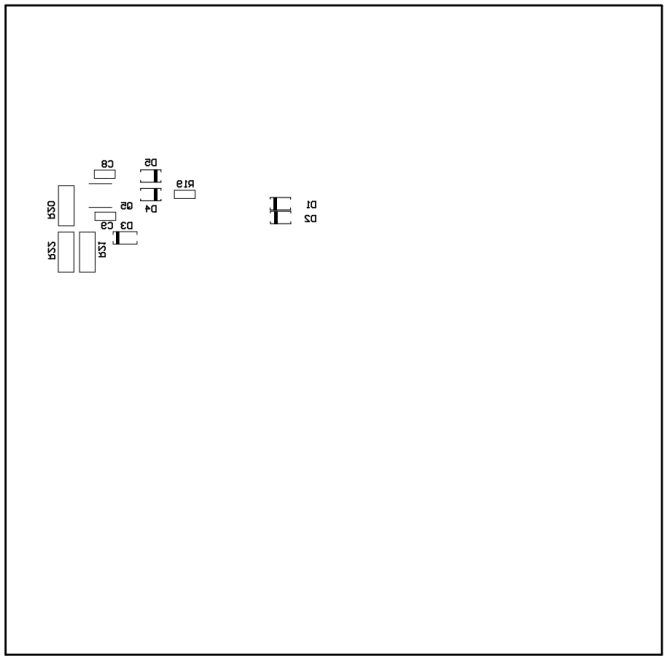


Figure 8: Bottom Silk

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	6/5/2024	Initial Release	-