EVL8794-LE-00A

High Efficiency, 20A, 16V, Synchronous Step-Down Converter Evaluation Board

DESCRIPTION

The EVL8794-LE-00A is an evaluation board designed to demonstrate the capabilities of the MP8794. The MP8794 is a high-efficiency, monolithic, synchronous step-down converter.

The evaluation board can deliver 20A of continuous load current across a wide operating input range. High efficiency can be achieved across a wide output current load range.

The MP8794 adopts internally compensated constant-on-time (COT) control mode that provides fast transient response and eases loop stabilization.

This evaluation board can be turned on or off via a remote on/off input (EN) that is referenced to ground. This input is compatible with popular logic devices.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	8 to 16	V
Output voltage	V_{OUT}	1	V
Output current	I_{OUT}	20	A

FEATURES

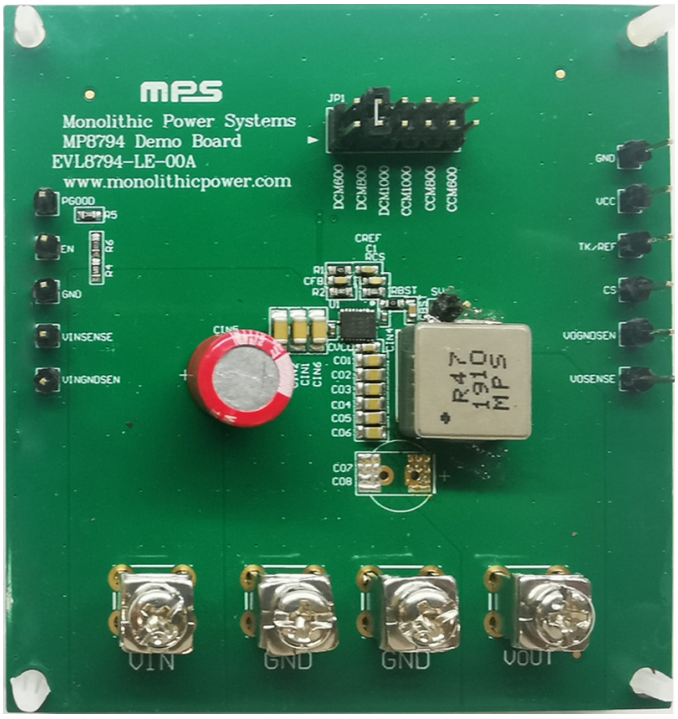
- Wide Input Voltage Range from 2.7V:
  - 2.7V to 16V with External 3.3V VCC Bias
  - 4V to 16V with Internal VCC Bias or External 3.3V VCC Bias
- Differential Output Voltage Remote Sense
- Programmable Accurate Current Limit Level
- 20A Output Current
- Low $R_{DS(ON)}$ Integrated Power MOSFETs
- Adaptive COT for Ultra-Fast Transient Response
- Stable with Zero-ESR Output Capacitor
- Excellent Load Regulation
- Output Voltage Tracking
- Output Voltage Discharge
- PGOOD Active Clamped Low Level during Power Failure
- Programmable Soft-Start Time from 1ms
- Pre-Biased Start-Up
- Selectable Switching Frequency: 600kHz, 800kHz, or 1000kHz
- Non-Latch OCP, OVP, UVP, UVLO, Thermal Shutdown
- Output Adjustable from 0.6V to 90% of V_{IN}, Up to 5.5V Max
- Available in a QFN (3mmx4mm) Package

MPL Optimized Performance with MPS Inductor MPL-AY1265 Series

APPLICATIONS

- FPGAs
- Flat-Panel Televisions and Monitors
- Multi-Functional Printers
- Access Points and Routers
- Optical Modules

EVL8794-LE-00A EVALUATION BOARD



(LxWxH) 81.3mmx77.5mmx16mm

Board Number	MPS IC Number	MPS Inductor
EVL8794-LE-00A	MP8794GLE	MPL-AY1265-R47

QUICK START GUIDE

The EVL8794-LE-00A's input voltage (V_{IN}) can range from 8V to 16V. The minimum 8V V_{IN} is limited by the EN signal, which is derived from V_{IN} through a resistor divider (R4 and R6). Lower V_{IN} values (as low as 2.7V) can be set by fine-tuning the resistor divider values, or by overdriving EN with an external control signal. To set up and use the evaluation board, follow the steps below:

1. Connect the load terminals to:
    a. Positive (+): VOUT
    b. Negative (-): GND
2. Preset the power supply output voltage between 8V and 16V, then turn off the power supply.
3. Connect the power supply output terminals to:
    a. Positive (+): VIN
    b. Negative (-): GND
4. Ensure that the power supply has a high enough current limit to supply the power.
5. Turn the power supply on. The board should automatically start up.
6. To use the enable function, apply a digital input to the EN pin. Drive EN above 1.5V to turn the regulator on; drive EN below 1V to turn it off.
7. Use R1 and R2 to set V_{OUT} with V_{FB} = 0.6V. Refer to the MP8794 datasheet to select the proper values for R1, R2, the inductor, and the output capacitor values when V_{OUT} is changed.
8. Use the jumper (JP1) to select the operating frequency (600kHz, 800kHz, or 1000kHz).

EVALUATION BOARD SCHEMATIC

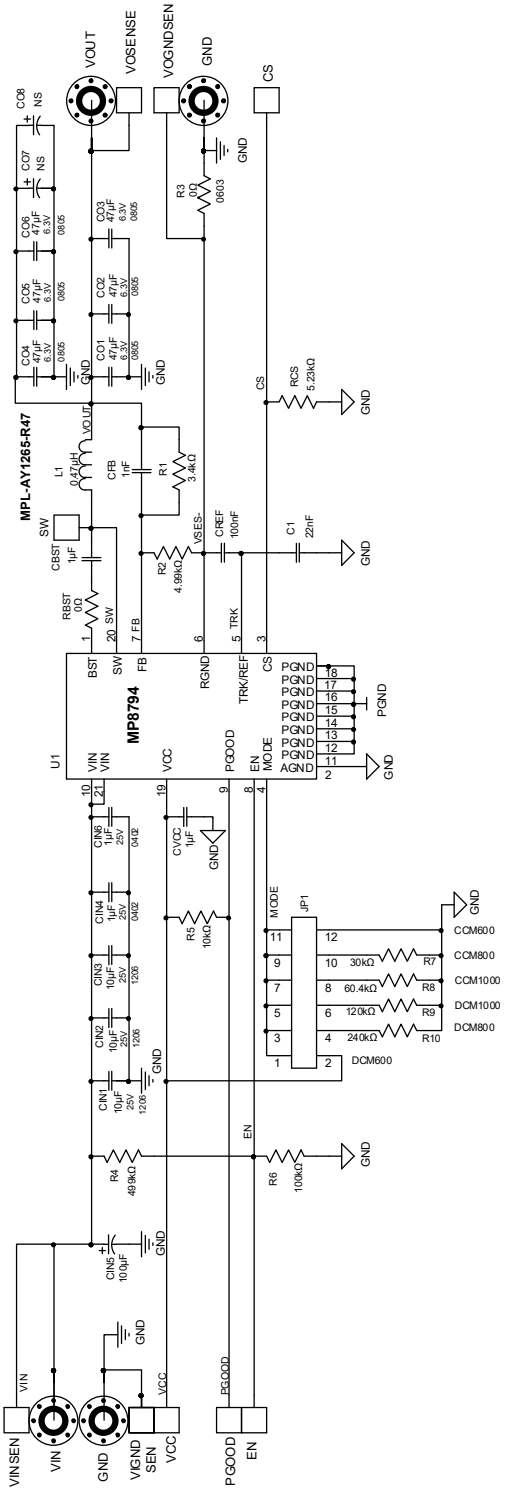


Figure 1: Evaluation Board Schematic

EVL8794-LE-00A BILL OF MATERIALS

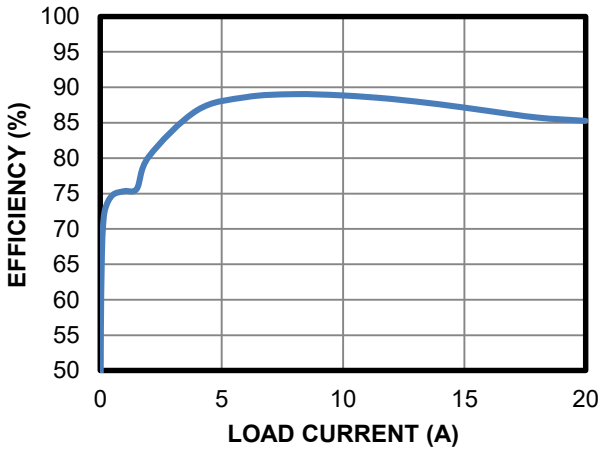
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	C1	22nF	Ceramic capacitor, 25V, X7R	0603	Wurth	885012206067
2	CBST, CVCC	1µF	Ceramic capacitor, 16V, X7R	0603	Wurth	885012206052
1	CFB	1nF	Ceramic capacitor, 50V, X7R	0603	Wurth	885012206083
3	CIN1, CIN2, CIN3	10µF	Ceramic capacitor, 25V, X5R	1206	Murata	GRM188R61E106MA73L
2	CIN4, CIN6	1µF	Ceramic capacitor, 25V, X5R	0402	Murata	GRM155R61E105KA12D
1	CIN5	100µF	Electrolytic capacitor, 25V, ±20%	DIP	Nippon Chemi-Con	EMZJ350ARA101MHA0G
6	CO1, CO2, CO3, CO4, CO5, CO6	47µF	Ceramic capacitor, 6.3V, X5R	0805	Wurth	885012107006
0	CO7, CO8	NS				
1	CREF	100nF	Ceramic capacitor, 25V, X7R	0603	Wurth	885012206071
1	R1	3.4kΩ	Film resistor, 1%,	0603	Yageo	RC0603FR-073K4L
1	R2	4.99kΩ	Film resistor, 1%,	0603	Yageo	RC0603FR-074K99L
2	R3, RBST	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	R4	499kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07499KL
1	R5	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	R6	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R7	30kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0730KL
1	R8	60.4kΩ	Film resistor, 1%,	0603	Yageo	RC0603FR-0760K4L
1	R9	120kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07120KL
1	R10	240kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07240KL
1	RCS	5.23kΩ	Film resistor, 1%,	0603	Yageo	RC0603FR-075K23L
1	L1	0.47µH	Inductor, DCR = 0.89mΩ, I_{SAT} = 64A	13.5mmx 12.6mm	MPS	MPL-AY1265-R47
1	U1	MP8794	16V, 20A, step-down converter	QFN-21 (3mmx 4mm)	MPS	MP8794GLE

EVB TEST RESULTS

Performance waveforms are tested on the EVL8794-LE-00A evaluation board. V_{IN} = 12V, V_{OUT} = 1V, f_{SW} = 800kHz, T_A = 25°C, unless otherwise noted.

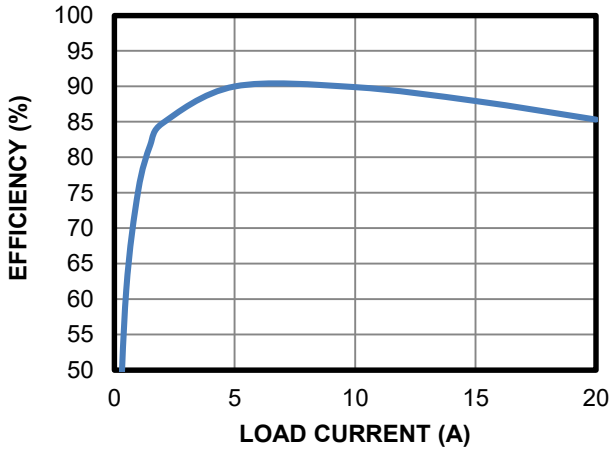
Efficiency

PSM, 0.47μH, 800kHz



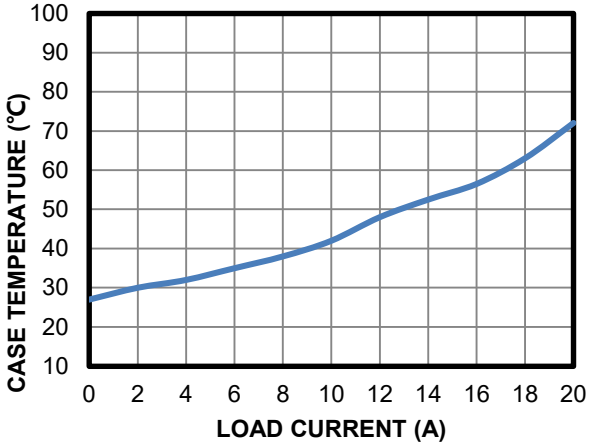
Efficiency

FCCM, 0.47μH, 800kHz



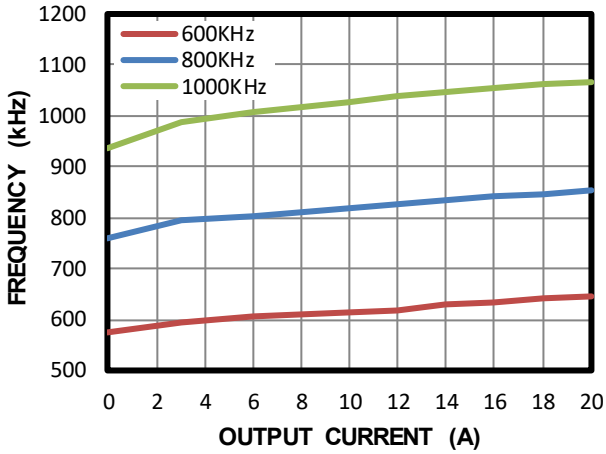
Thermal Results

800kHz, no air flow

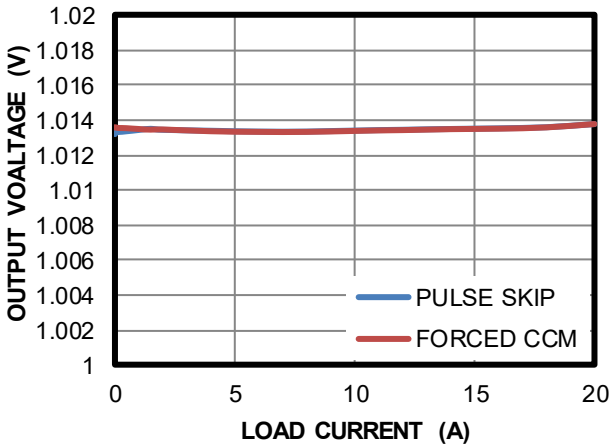


Switching Frequency vs. Output Current

FCCM



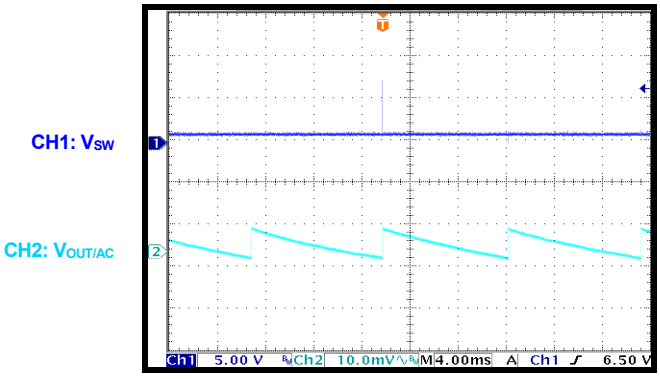
Output Voltage Load Regulation



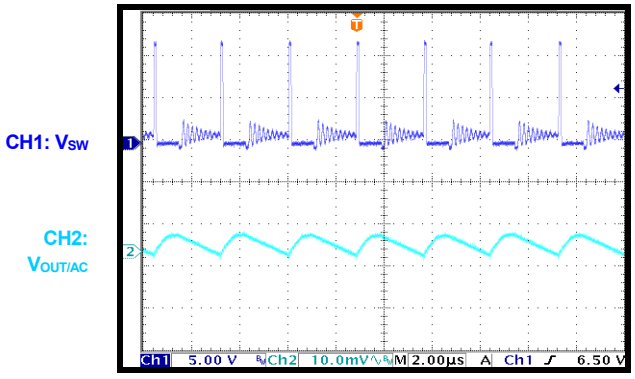
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVL8794-LE-00A evaluation board. V_{IN} = 12V, V_{OUT} = 1V, f_{SW} = 800kHz, T_A = 25°C, unless otherwise noted.

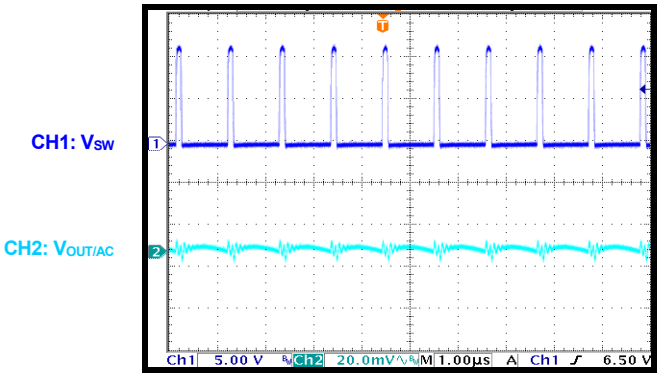
Steady State
I_{OUT} = 0A, PSM



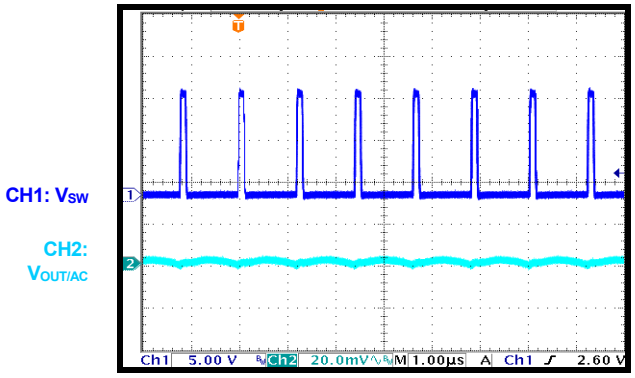
Steady State
I_{OUT} = 0.5A, PSM



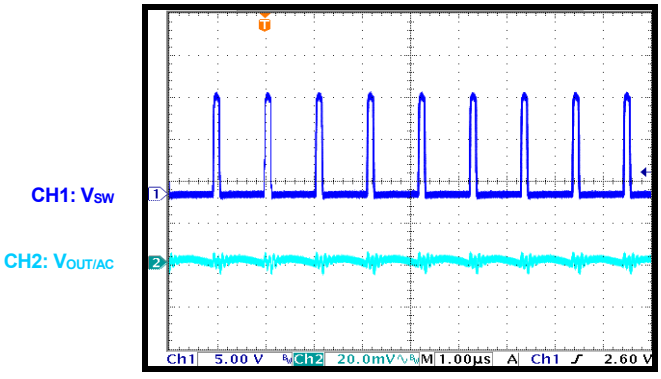
Steady State
I_{OUT} = 20A, PSM



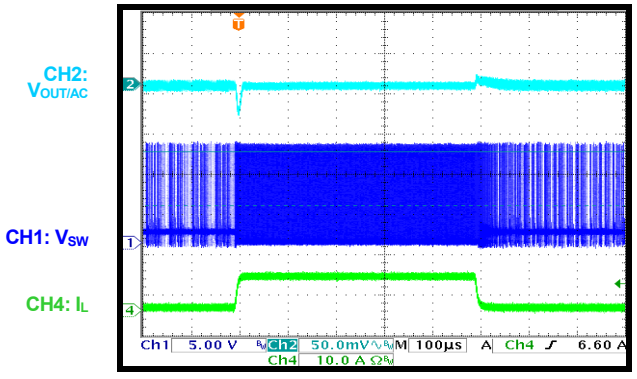
Steady State
I_{OUT} = 0A, FCCM



Steady State
I_{OUT} = 20A, FCCM



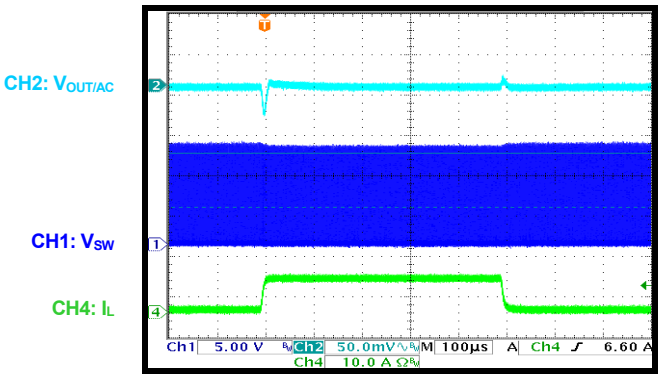
Load Transient
I_{OUT} = 0A to 8A, PSM



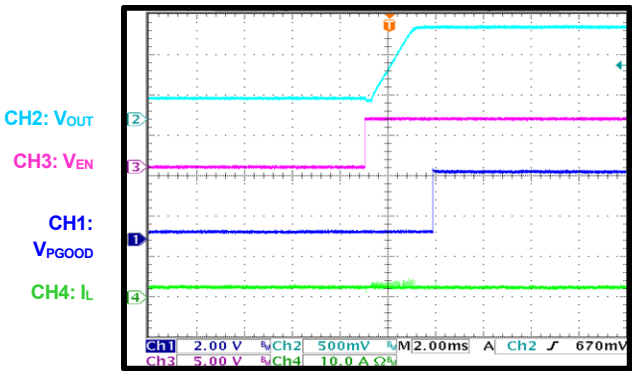
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVL8794-LE-00A evaluation board. V_{IN} = 12V, V_{OUT} = 1V, f_{SW} = 800kHz, T_A = 25°C, unless otherwise noted.

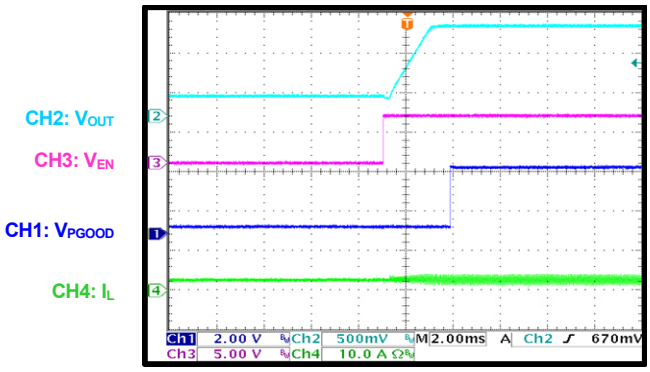
Load Transient
I_{OUT} = 0A to 8A, FCCM



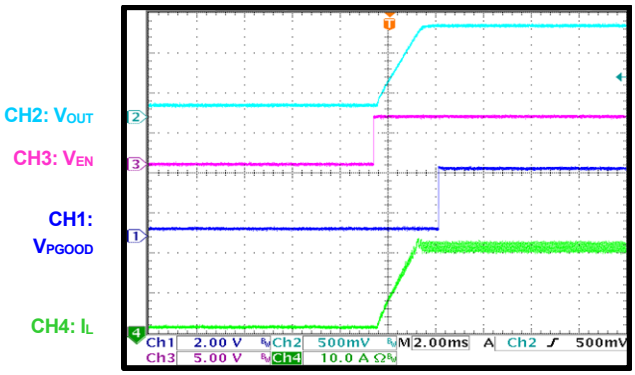
Start-Up through EN
I_{OUT} = 0A, PSM



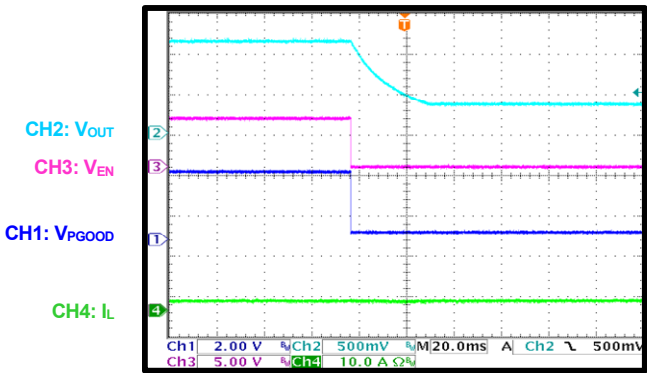
Start-Up through EN
I_{OUT} = 0A, FCCM



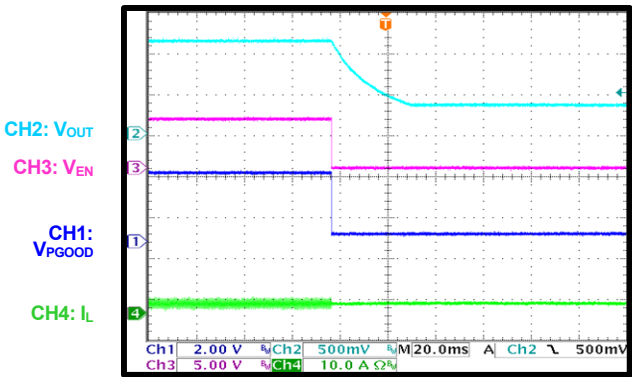
Start-Up through EN
I_{OUT} = 20A



Shutdown through EN
I_{OUT} = 0A, PSM



Shutdown through EN
I_{OUT} = 0A, FCCM



EVB TEST RESULTS *(continued)*

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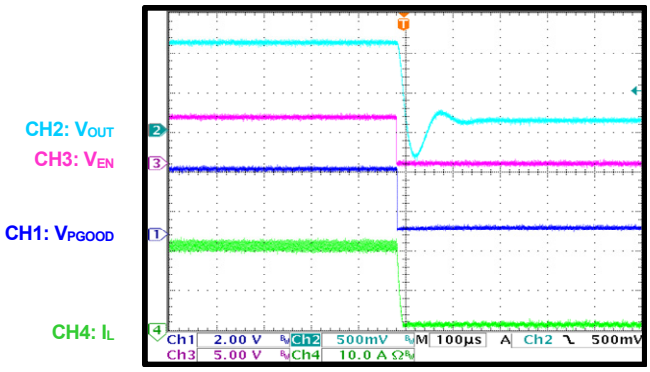
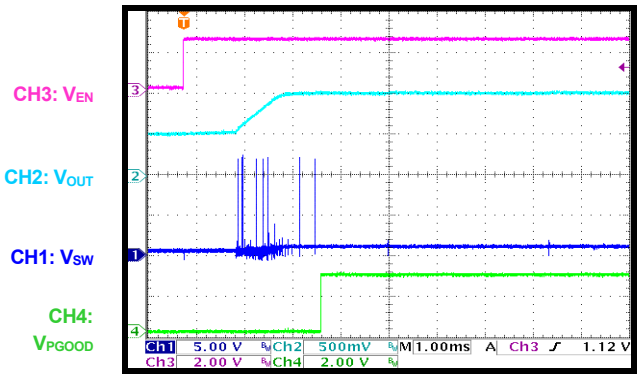
Shutdown through EN

I_{OUT} = 20A



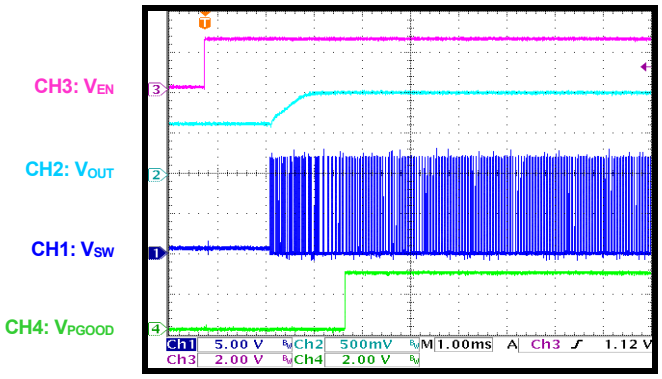
Pre-Biased Start-Up

PSM

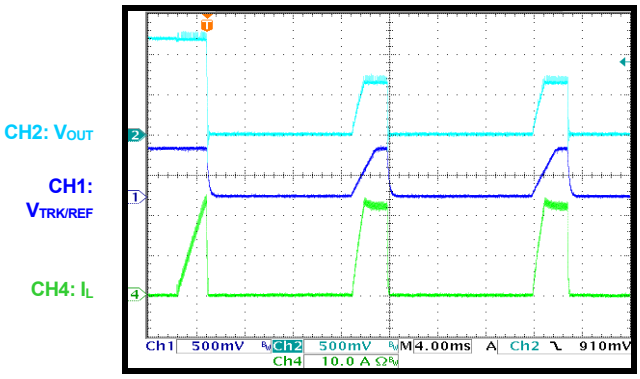


Pre-Biased Start-Up

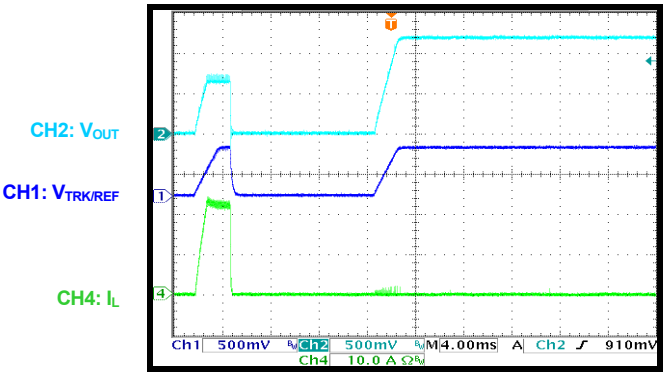
FCCM



Over-Current Protection Entry



Over-Current Protection Recovery



PCB LAYOUT

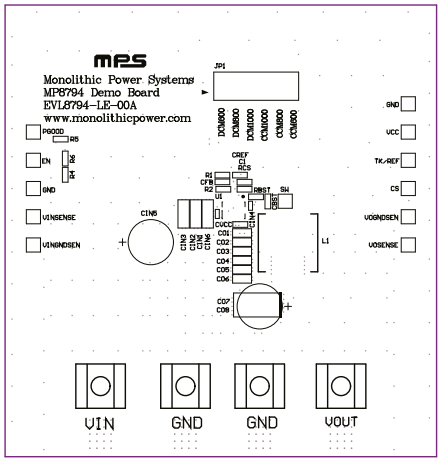


Figure 2: Top Silk

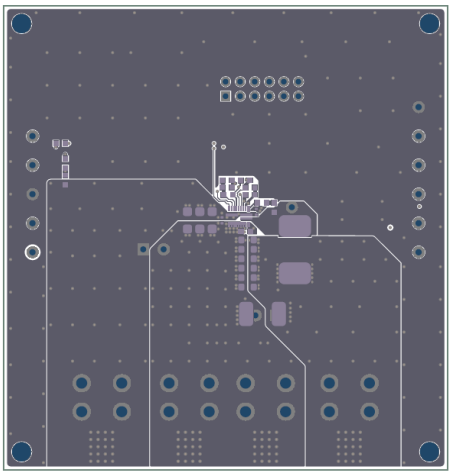


Figure 3: Top Layer

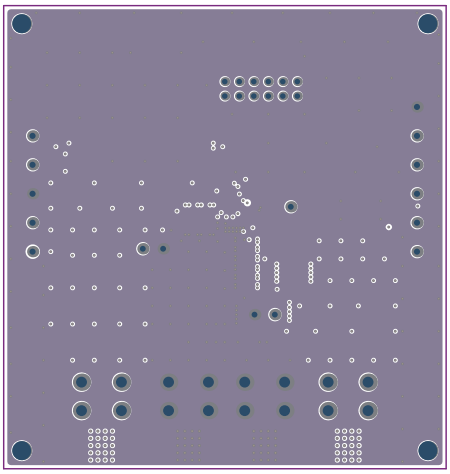


Figure 4: Mid-Layer 1

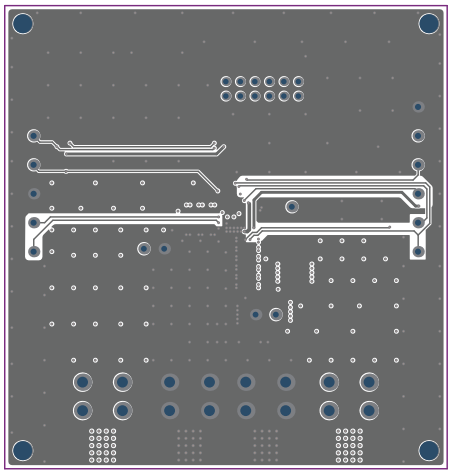


Figure 5: Mid-Layer 2

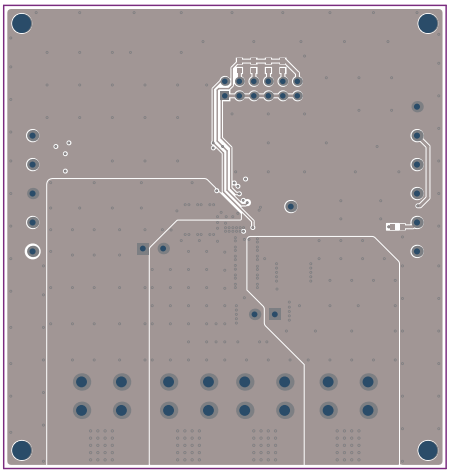


Figure 6: Bottom Layer

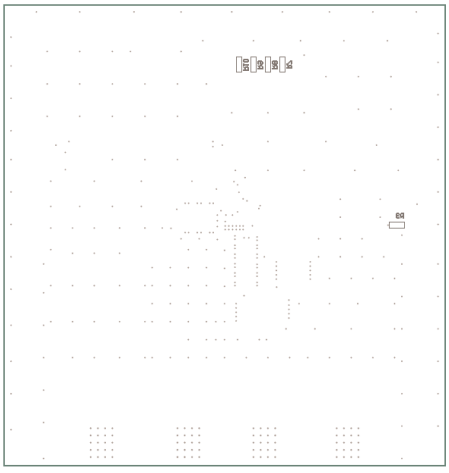


Figure 7: Bottom Silk