EVQ8633B-H-LE-00A

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

DESCRIPTION

The EVQ8633B-H-LE-00A is an evaluation board for the MPQ8633B-H, which is a high-efficiency, monolithic, synchronous, step-down converter.

The EVQ8633B-H-LE-00A can deliver 20A of continuous load current over a wide operating input range. High efficiency can be achieved over a wide output current load range.

The MPQ8633B-H utilizes an internally compensated constant-on-time (COT) control mode that provides fast transient response and eases loop stabilization.

This EVB can be turned on or off via a remote on/off input (EN) 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

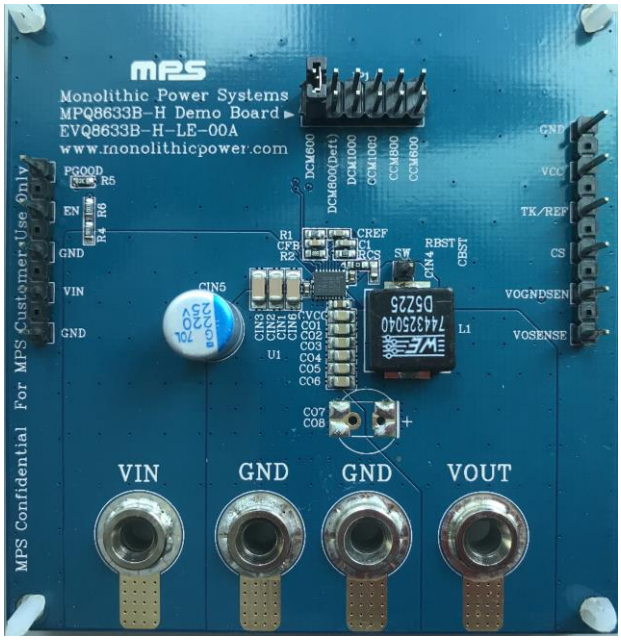
FEATURES

- 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
- Proprietary Switching Loss Reduction Technique
- Adaptive COT Control for Ultra-Fast Transient Response
- Stable with Zero-ESR Output Capacitor
- 0.5% Reference Voltage across 0°C to +70°C T_J Range, 1% Reference Voltage across -40°C to +125°C T_J Range, Selectable Pulse-Skip Mode or Forced CCM
- Excellent Load Regulation
- Output Voltage Tracking, Output Voltage Discharge
- PGOOD Active Clamped Low during Power Failure
- Programmable Soft-Start Time from 1ms
- Pre-Biased Start-Up
- Selectable Switching Frequency: 600kHz, 800kHz, or 1000kHz
- Non-Latch OCP, UVP, UVLO, OVP, and Thermal Shutdown
- Output Adjustable from 0.6V to 90% x V_{IN}, Up to 5.5V Max
- Available in a QFN-21 (3mmx4mm) Package

APPLICATIONS

- Telecom and Networking Systems
- Servers, Cloud Computing, and Storage
- Base Stations
- General-Purpose Point of Load (PoL)
- 12V Distribution Power Systems
- High-End TVs
- Game Consoles and Graphics Cards

EVQ8633B-H-LE-00A EVALUATION BOARD



(LxWxH) 81.3mmx77.5mmx1.6mm

Board Number	MPS IC Number
EVQ8633B-H-LE-00A	MPQ8633B-HGLE

QUICK START GUIDE

The input voltage of the evaluation board can range from 8V to 16V. The minimum 8V input voltage is limited by the EN signal, which is derived from VIN through a resistor divider (R4 and R6). A lower input voltage (as low as 2.7V) can be set by fine-tuning the resistor divider values or by overdriving EN with an external control signal. Follow the steps below to turn on the evaluation board:

1. Preset the power supply output voltage between 8V and 16V, then turn the power supply off.
2. Connect the load to:
    a. Positive (+): VOUT
    b. Negative (-): GND
3. Connect the power supply terminals to:
    a. Positive (+): VIN
    b. Negative (-): GND
4. Ensure that the power supply has a high enough current limit to supply the power, then turn the power supply on. The EVQ8633B-H-LE-00A should start up automatically.
5. 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.
6. Use R1 and R2 to set the output voltage with V_{FB} = 0.6V. Refer to the Application Information section in the MPQ8633B-H datasheet to select the proper values for R1, R2, the inductor, and the output capacitor when the output voltage is changed.
7. Use the JP1 jumper to select the switching frequency (600kHz, 800kHz, or 1000kHz) and the light-load operation mode (pulse-skip mode, or forced continuous conduction mode).

EVALUATION BOARD SCHEMATIC

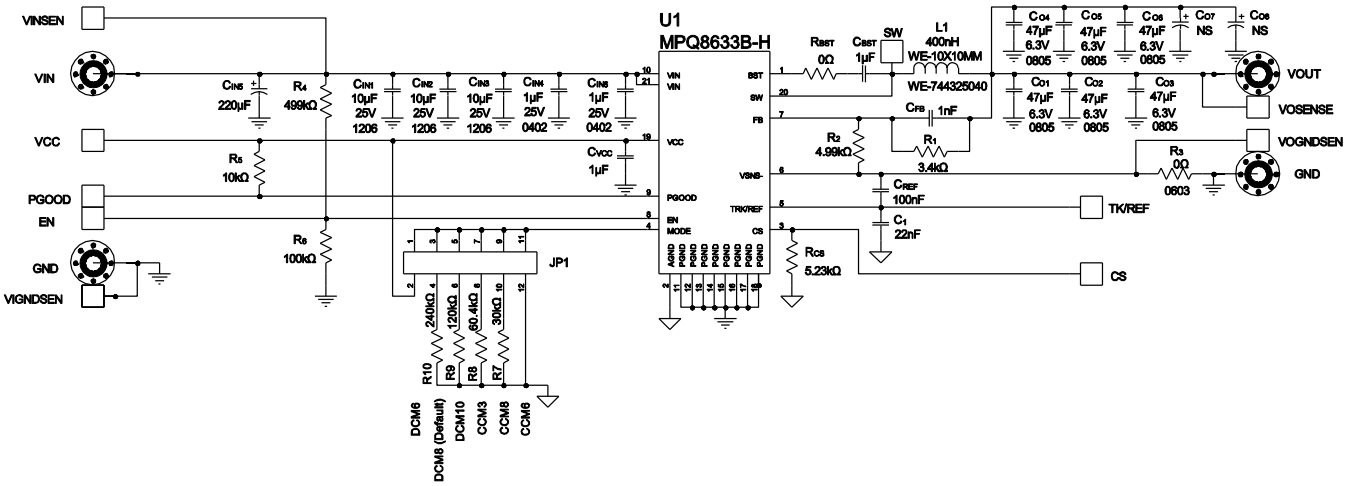


Figure 1: Evaluation Board Schematic

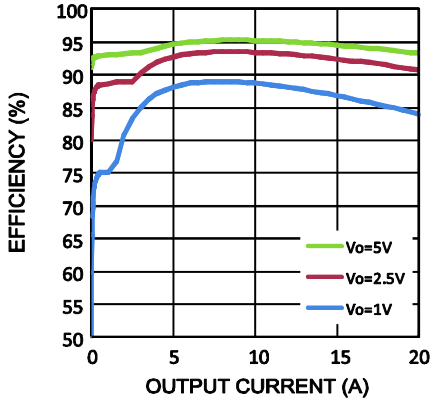
EVQ8633B-H-LE-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Part Number
1	C1	22nF	Capacitor, 25V, 10%, X7R	CAP0603	Generic	
2	CBST, CVCC	1µF	Ceramic capacitor, 1µF, 6.3V, 10%, X7R 0603	CAP0603	Generic	
1	CFB	1nF	Capacitor, 50V, 10%, X7R	CAP0603	Generic	
3	CIN1, CIN2, CIN3	10µF	Capacitor, 25V, X7R, 10%	CAP1206	Murata or generic	GRM31CR71E106KA12L
2	CIN4, CIN6	1µF/ 25V	Ceramic capacitor, 1µF, 25V, 10%, X6S 0402	CAP0402	Murata or generic	GRM155C81E105KE11D
1	CIN5	220µF	220µF, 25V, 16mΩ, ESR	D8P3.5mm	Chemi-Con or generic	APSG250ELL221MHB5S
6	CO1, CO2, CO3, CO4, CO5, CO6	47µF	Capacitor, 6.3V, X5R, 20%	CAP0805	Murata or generic	GRM21BR60J476ME15L
1	CO7	NS		D2		
1	CO8	NS		D8P3.5mm		
1	CREF	100nF	Ceramic capacitor, 0.1µF, 25V, 10%, X7R 0603	CAP0603	Generic	
1	L1	0.4µH	Inductor	10mmx10mm	Wurth or generic	WE-744325040
1	R1	3.4kΩ	Film resistor, 1%	0603	Generic	
1	R2	4.99kΩ	Film resistor, 1%	0603	Generic	
2	R3, RBST	0Ω	Film resistor, 5%	0603	Generic	
1	R4	499kΩ	Film resistor, 1%	0603	Generic	
1	R5	10kΩ	Film resistor, 1%	0603	Generic	
1	R6	100kΩ	Film resistor, 1%	0603	Generic	
1	R7	30kΩ	Film resistor, 1%	0603	Generic	
1	R8	60.4kΩ	Film resistor, 1%	0603	Generic	
1	R9	120kΩ	Film resistor, 1%	0603	Generic	
1	R10	240kΩ	Film resistor, 1%		Generic	
1	RCS	5.23kΩ	Film resistor, 1%	0603	Generic	
1	U1	MPQ8633B	16V/20A, step-down converter	QFN-21 (3mmx4mm)	MPS	MQ8633B-HGLE

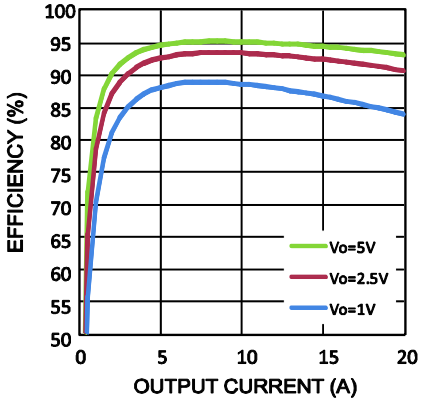
EVB TEST RESULTS

Performance waveforms are tested on the EVQ8633B-H-LE-00A evaluation board. V_{IN} = 12V, V_{OUT} = 1V, L = 400nH, T_A = 25°C, unless otherwise noted.

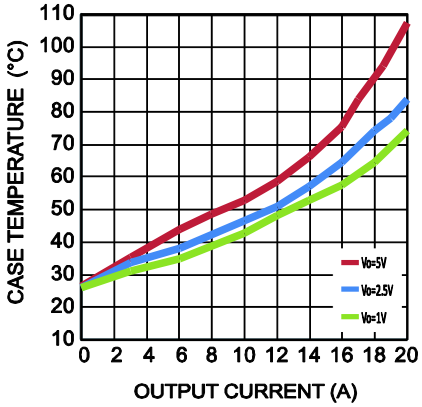
Efficiency
Pulse skip, 0.4µH, 800kHz



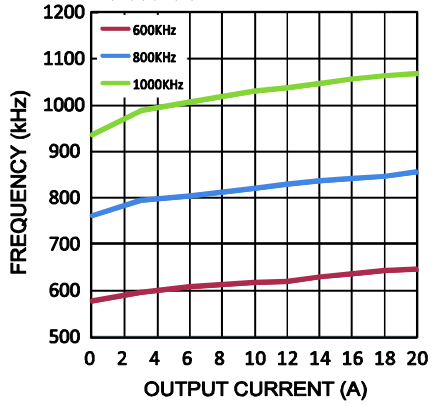
Efficiency
Forced CCM, 0.4µH, 800kHz



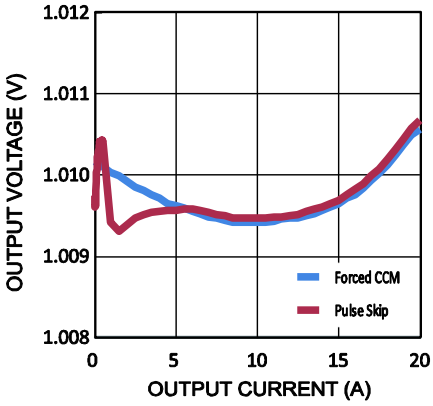
Thermal Results
800kHz, no airflow



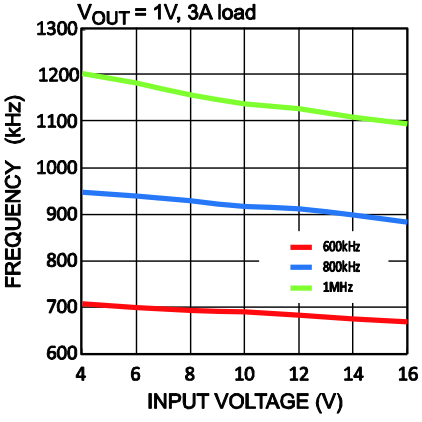
Switching Frequency vs. Output Current
Forced CCM



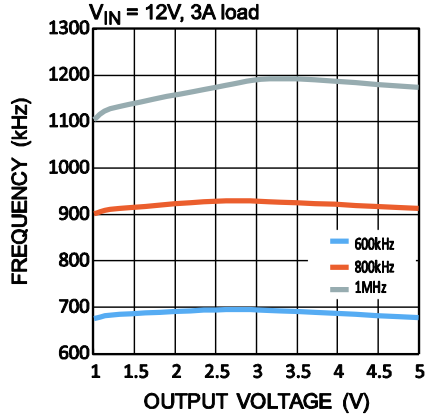
Output Voltage Load Regulation



Switching Frequency vs. Input Voltage
V_{OUT} = 1V, 3A load



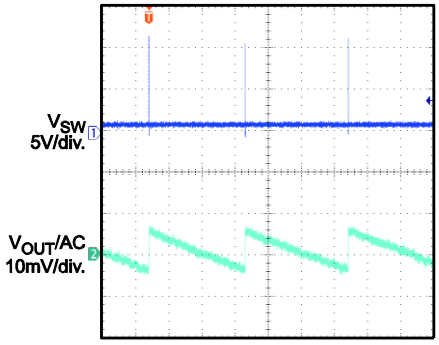
Switching Frequency vs. Output Voltage
V_{IN} = 12V, 3A load



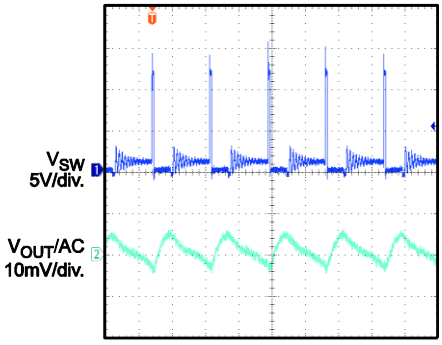
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVQ8633B-H-LE-00A evaluation board. V_{IN} = 12V, V_{OUT} = 1V, L = 400nH, T_A = 25°C, unless otherwise noted.

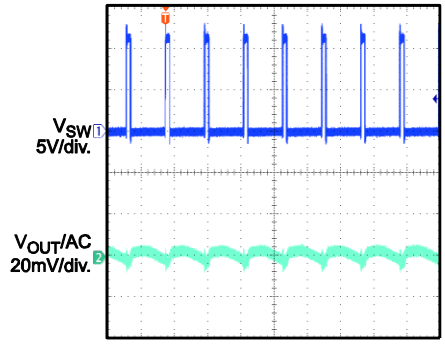
Steady State
I_{OUT} = 0A, pulse skip



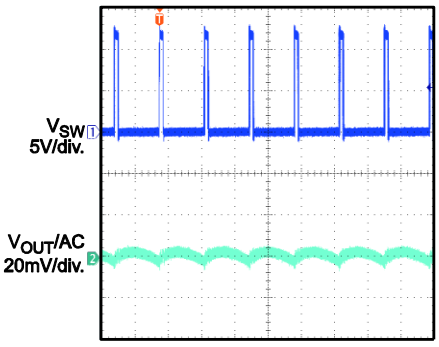
Steady State
I_{OUT} = 0.5A, pulse skip



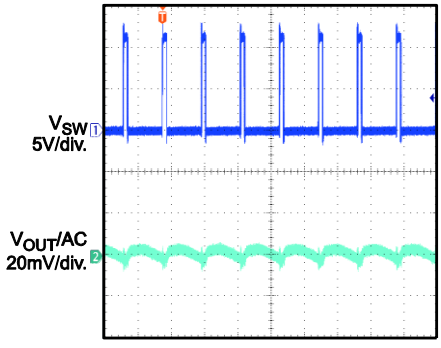
Steady State
I_{OUT} = 20A, pulse skip



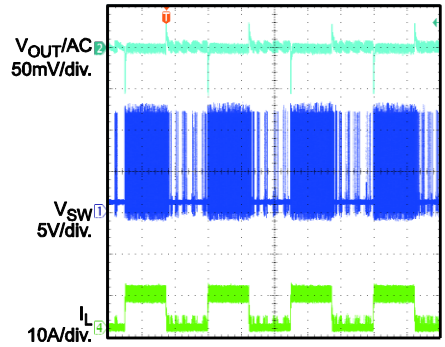
Steady State
I_{OUT} = 0A, forced CCM



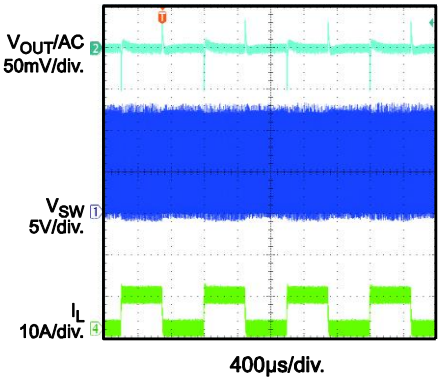
Steady State
I_{OUT} = 20A, forced CCM



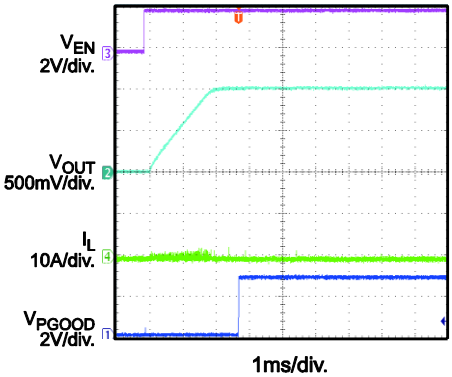
Load Transient
I_{OUT} = 0A to 8A, pulse skip



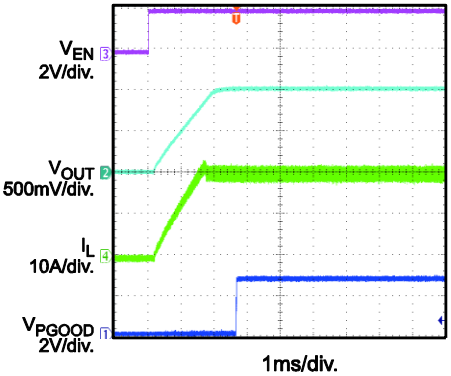
Load Transient
I_{OUT} = 0A to 8A, forced CCM



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



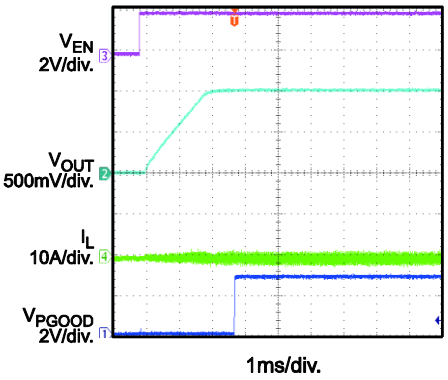
Start-Up through EN
I_{OUT} = 20A, pulse skip



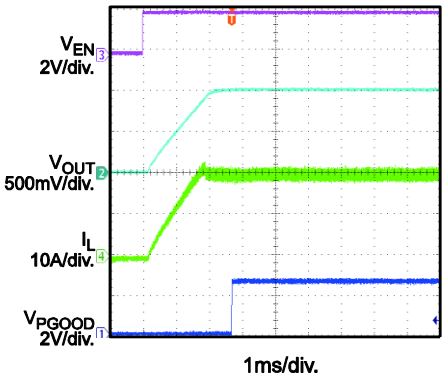
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVQ8633B-H-LE-00A evaluation board. V_{IN} = 12V, V_{OUT} = 1V, L = 400nH, T_A = 25°C, unless otherwise noted.

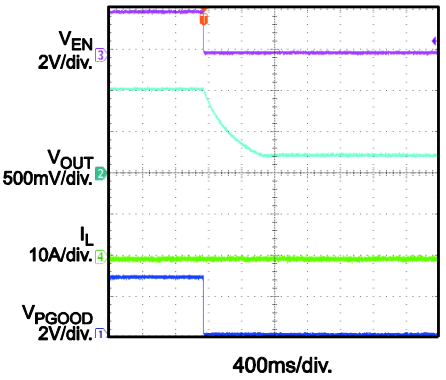
Start-Up through EN
I_{OUT} = 0A, forced CCM



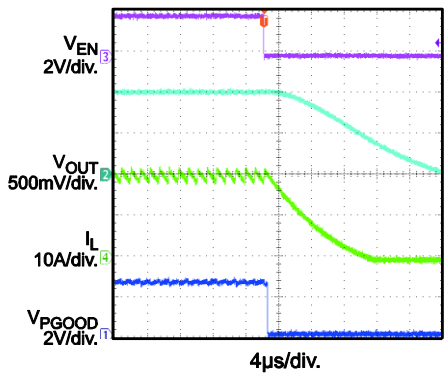
Start-Up through EN
I_{OUT} = 20A, forced CCM



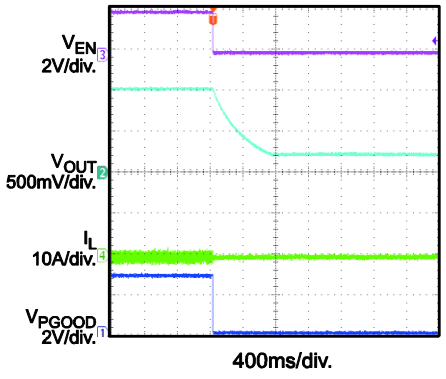
Shutdown through EN
I_{OUT} = 0A, pulse skip



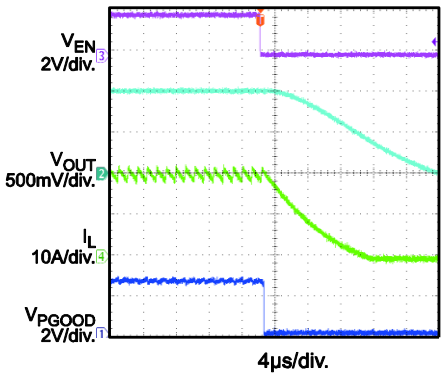
Shutdown through EN
I_{OUT} = 20A, pulse skip



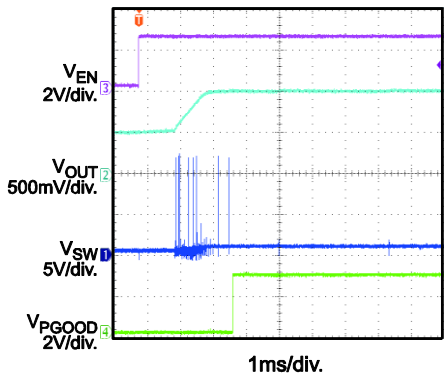
Shutdown through EN
I_{OUT} = 0A, forced CCM



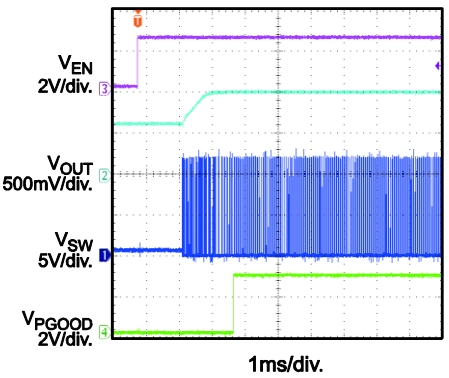
Shutdown through EN
I_{OUT} = 20A, forced CCM



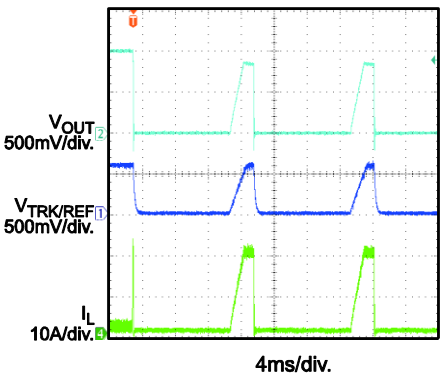
Pre-Biased Start-Up
Pulse skip



Pre-Biased Start-Up
Forced CCM



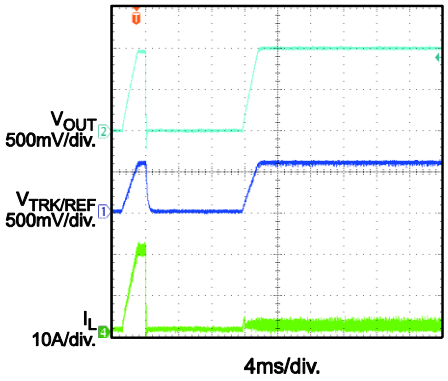
Over-Current
Protection entry



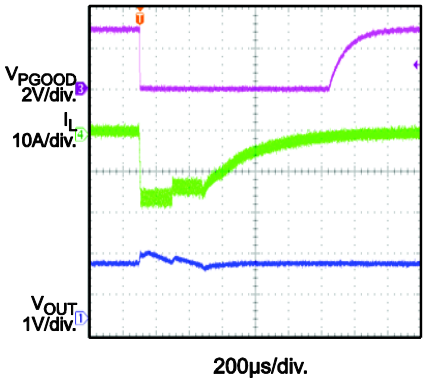
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVQ8633B-H-LE-00A evaluation board. V_{IN} = 12V, V_{OUT} = 1V, L = 400nH, T_A = 25°C, unless otherwise noted.

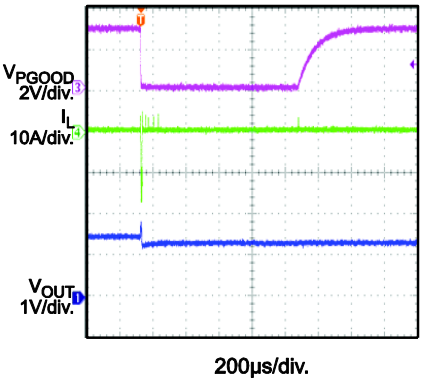
Over-Current
Protection recovery



Over-Voltage Protection
Forced CCM



Over-Voltage Protection
Pulse skip



PCB LAYOUT

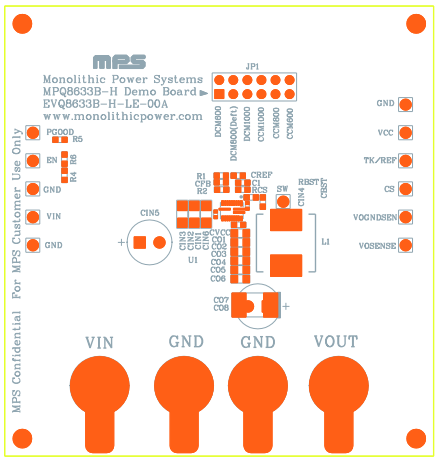


Figure 1: Top Silk Layer

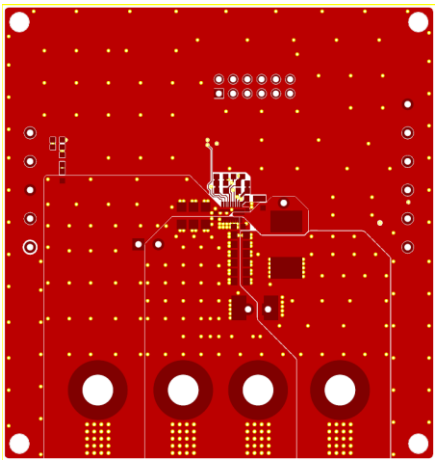


Figure 2: Top Layer

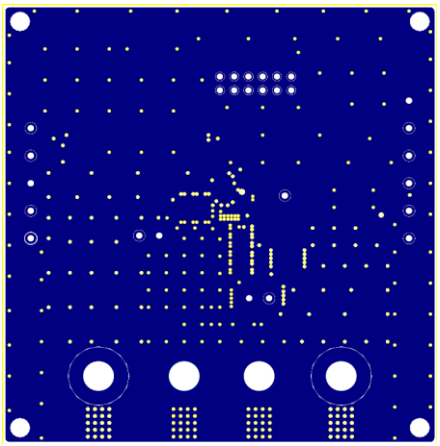


Figure 3: Inner Layer 1

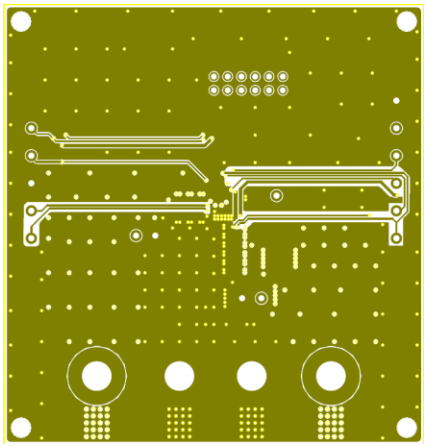


Figure 4: Inner Layer 2

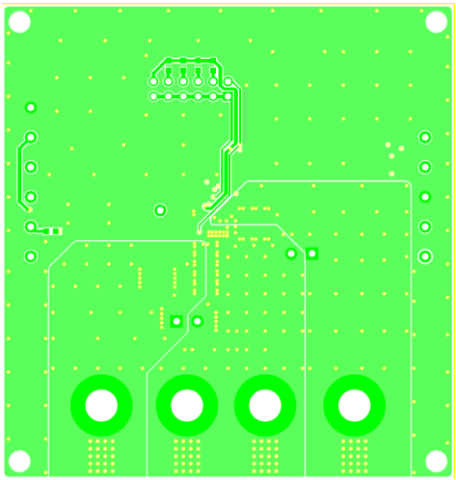


Figure 5: Bottom Layer

Revision History

Revision #	Revision Date	Description	Pages Updated
1.0	9/14/2020	Initial Release	-