EVQ8633A-LE-01A

High Efficiency, 16V, 12A Synchronous Step-Down Converter Evaluation Board

DESCRIPTION

The EVQ8633A-LE-01A is an evaluation board for the MPQ8633A, a high efficiency, monolithic, synchronous step-down converter.

The EV board can deliver 12A continuous load current over a wide operating input range. High efficiency can be achieved over a wide output current load range.

The MPQ8633A adopts internally compensated constant-on-time (COT) control mode that provides fast transient response and eases loop stabilization.

This EV 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 SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	8-16	V
Output Voltage	V_{OUT}	1.2	V
Output Current	I_{OUT}	12	A

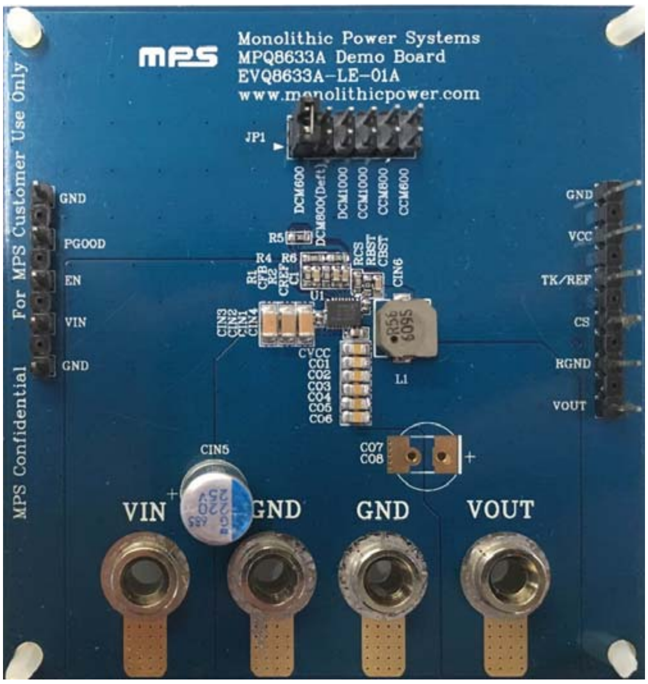
FEATURES

- Wide Input Voltage Range from 2.7V:
  - o 2.7V to 16V with External 3.3V VCC Bias
  - o 4V to 16V with Internal VCC Bias or External 3.3V VCC Bias
- Differential Output Voltage Remote Sense
- Programmable Accurate Current Limit Level
- 12A Output Current
- Low R_{DS}(ON) Integrated Power MOSFETs
- Proprietary Switching Loss Reduction Technique
- Adaptive COT for Ultrafast Transient Response
- Stable with Zero-ESR Output Capacitor
- 0.5% Reference Voltage Over 0°C to +70°C Junction Temperature Range
- 1% Reference Voltage Over -40°C to +125°C Junction Temperature Range
- Selectable Pulse-Skip or Forced-CCM Operation
- Excellent Load Regulation
- Output Voltage Tracking
- Output Voltage Discharge
- PGOOD Active Clamped Low Level during Power Failure
- Programmable Soft Start Time from 1ms
- Pre-Bias Start up
- Selectable Switching Frequency of 600kHz, 800kHz and 1000kHz
  Non-latch OCP, UVP, UVLO, Thermal Shutdown, and Latch-off for OVP
- Output Adjustable from 0.6V to 90%*Vin, Up to 5.5V max.
- Available in a QFN3X4 mm Package

APPLICATIONS

- Telecom and Networking Systems
- Server, Cloud-Computing, Storage
- Base Stations
- General Purpose Point-of-Load (PoL)
- 12V Distribution Power Systems
- High-end TV
- Game Consoles and Graphic Cards

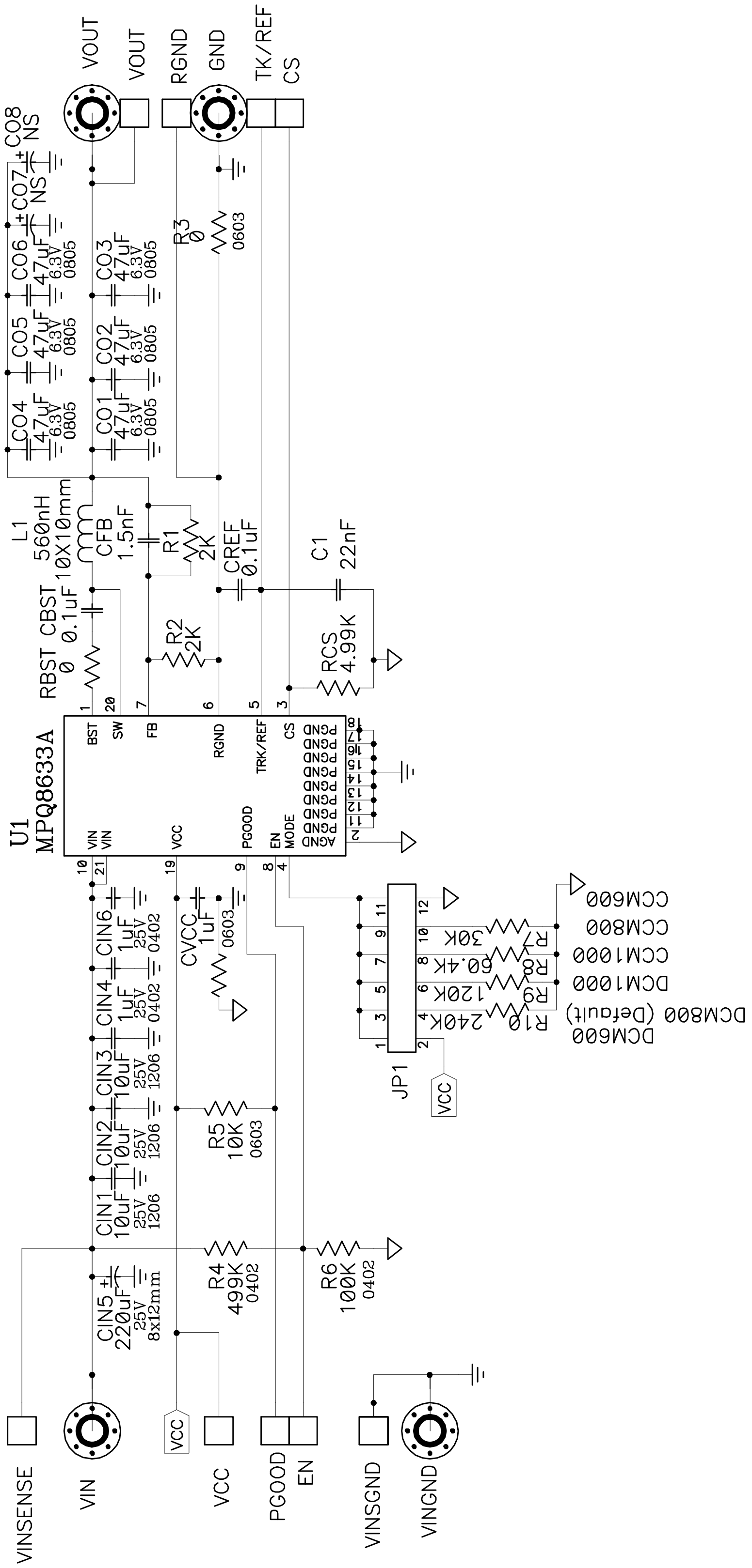
EVQ8633A-LE-01A EVALUATION BOARD



(L x W x H)81.3 mm x 77.5mm x 1.6 mm)

Board Number	MPS IC Number
EVQ8633A-LE-01A	MPQ8633AGLE

EVALUATION BOARD SCHEMATIC



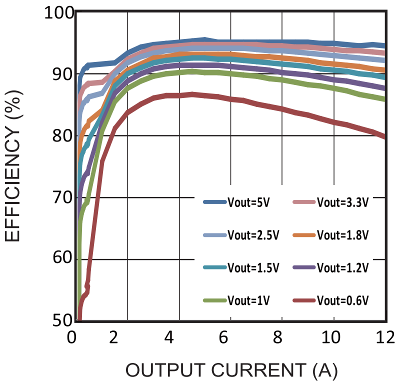
EVQ8633A-LE-01A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Part Number
1	C1	22nF	CAP, 25V, 10%, X7R	CAP0603	Generic	
2	CBST, CREF	0.1μF	CAP CER 0.1μF 25V 10% X7R 0603	CAP0603	Generic	
1	CFB	1.5nF	CAP, 50V, 10%, X7R	CAP0603	Generic	
3	CIN1, CIN2, CIN3	10μF	Capacitor, 25V, X7R, 10%	CAP1206	Murata or Generic	GRM31CR71E106KA12L
2	CIN4, CIN6	1μF/25V	CAP CER 1μF 25V 10% X6S 0402	CAP0402	Murata or Generic	GRM155C81E105KE11D
1	CIN5	220μF	220μF, 25V, 16mOhm ESR	D8P3.5mm	Chemi-Con or Generic	APSG250ELL221MHB5S
6	CO1, CO2, CO3, CO4, CO5, CO6	47μF	CAP, 6.3V, X5R, 20%	CAP0805	Murata or Generic	GRM21BR60J476ME15L
1	CO7	NS		D2		
1	CO8	NS		D8P3.5mm		
1	CVCC	1μF	CAP CER 1μF 6.3V 10% X7R 0603	CAP0603	Generic	
1	L1	560nH	Inductor ,14A, 2.8mΩ	7x7mm	TOKO or Generic	FCUL0630-H-R56M
2	R1, R2	2k	Film Res., 1%	0603	Generic	
2	R3, RBST	0	Film Res., 5%	0603	Generic	
1	R4	499k	Film Res., 1%	0603	Generic	
1	R5	10k	Film Res., 1%	0603	Generic	
1	R6	100k	Film Res., 1%	0603	Generic	
1	R7	30k	Film Res., 1%	0603	Generic	
1	R8	60.4k	Film Res., 1%	0603	Generic	
1	R9	120k	Film Res., 1%	0603	Generic	
1	R10	240k	Film Res., 1%		Generic	
1	RCS	4.99k	Film Res., 1%	0603	Generic	
1	U1	MQ8633A GLE	16V/12A Step Down Convert	QFN21-3x4mm	MPS	MQ8633AGLE

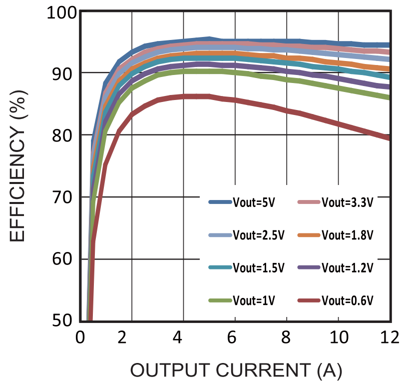
EVB TEST RESULTS

Performance waveforms are tested on the EVQ8633A-LE-01A evaluation board.
V_{IN} = 12V, V_{OUT} = 1.2V, L = 560nH, T_A = +25ºC, unless otherwise noted.

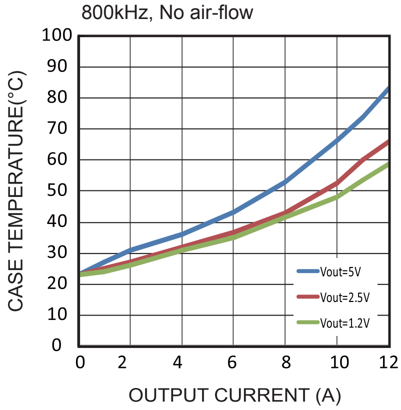
Efficiency
Pulse Skip, 1.1uH, 800kHz



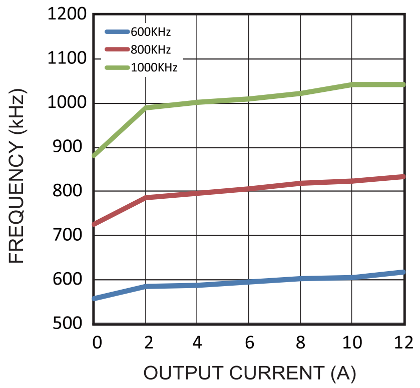
Efficiency
Forced CCM, 1.1uH, 800kHz



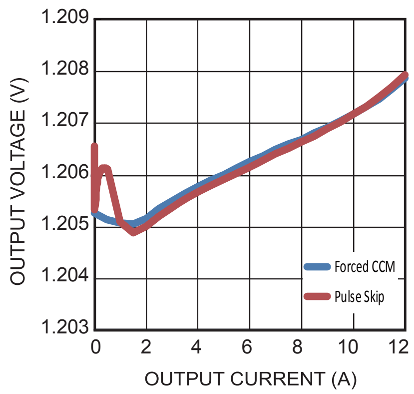
Thermal Results
800kHz, No air-flow



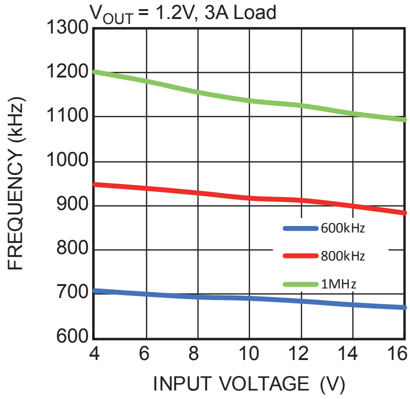
Switching Frequency vs. Output Current
Forced CCM



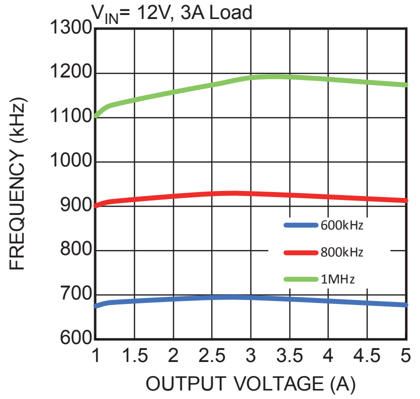
Output Voltage Load Regulation



Switching Frequency vs. Input Voltage
V_{OUT} = 1.2V, 3A Load



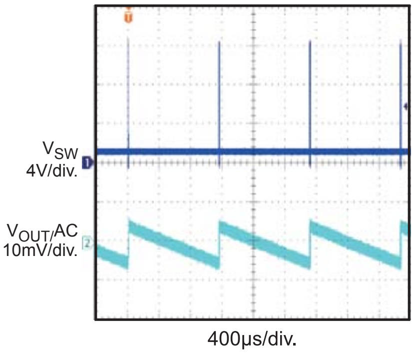
Switching Frequency vs. Input Voltage
V_{IN}= 12V, 3A Load



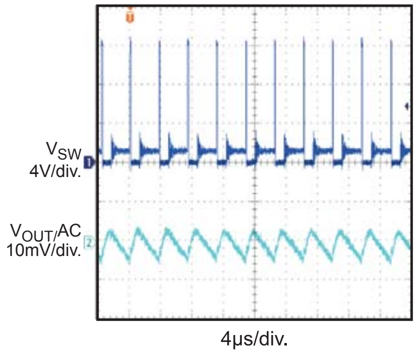
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVQ8633A-LE-01A evaluation board.
V_{IN} = 12V, V_{OUT} = 1.2V, L = 560nH, T_A = +25ºC, unless otherwise noted.

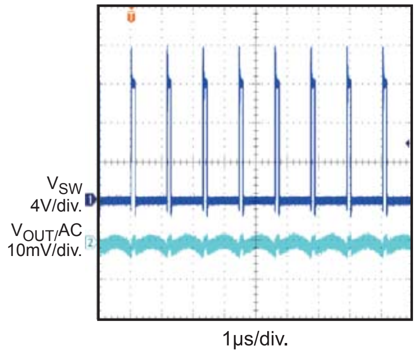
Steady State
I_{OUT} = 0A, Pulse Skip



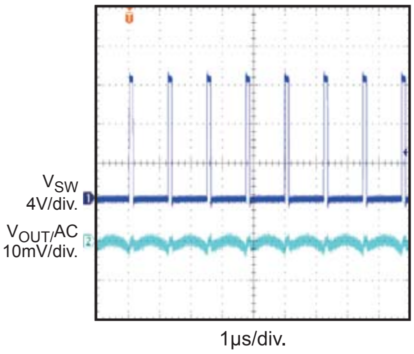
Steady State
I_{OUT} = 0.5A, Pulse Skip



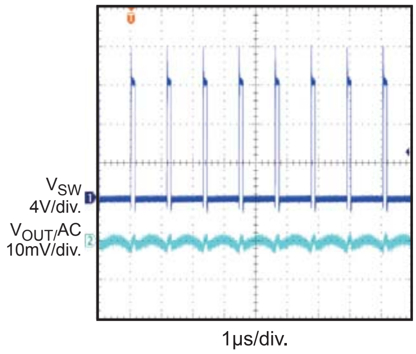
Steady State
I_{OUT} = 12A, Pulse Skip



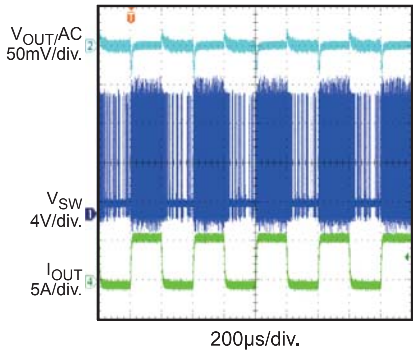
Steady State
I_{OUT} = 0A, Forced CCM



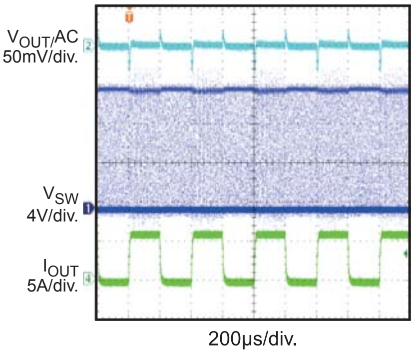
Steady State
I_{OUT} = 12A, Forced CCM



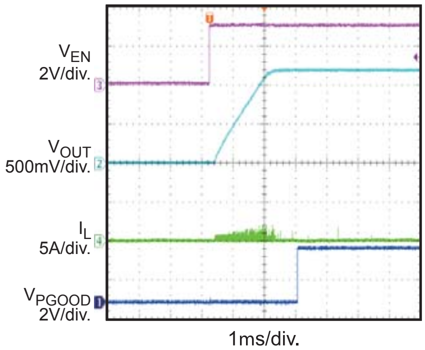
Load Transient
I_{OUT} = 0A-6A, Pulse Skip



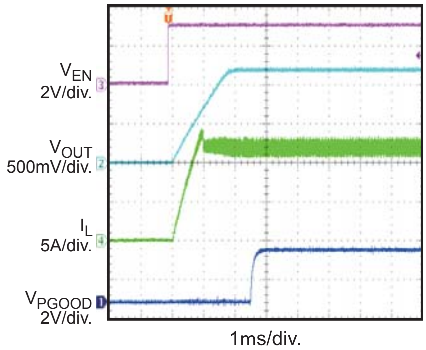
Load Transient
I_{OUT} = 0A-6A, Forced CCM



Power Up through EN
I_{OUT} = 0A, Pulse Skip



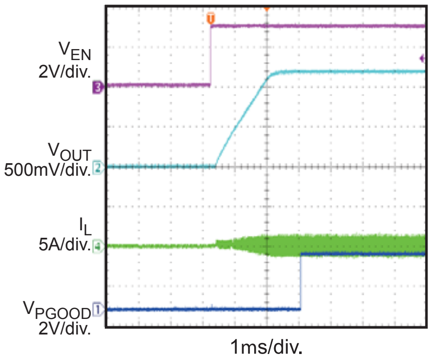
Power Up through EN
I_{OUT} = 12A, Pulse Skip



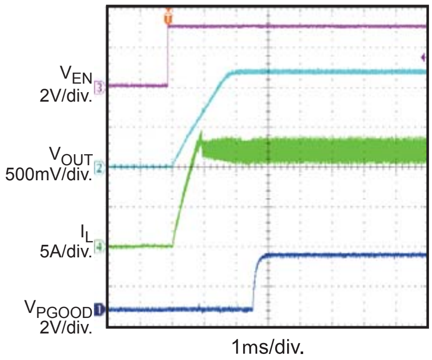
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVQ8633A-LE-01A evaluation board.
V_{IN} = 12V, V_{OUT} = 1.2V, L = 560nH, T_A = +25ºC, unless otherwise noted.

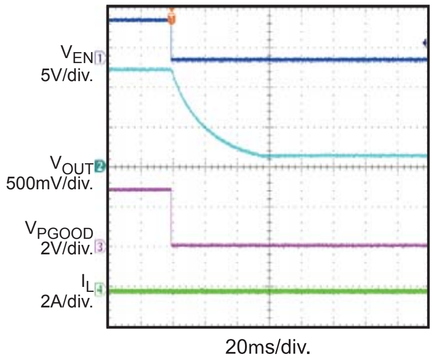
Power Up through EN
I_{OUT} = 0A, Forced CCM



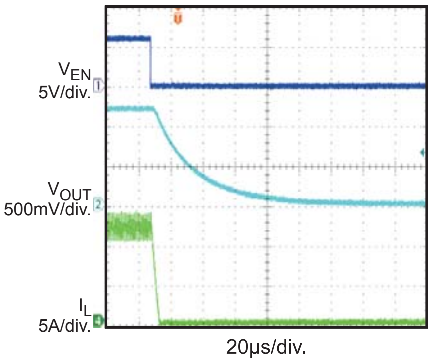
Power Up through EN
I_{OUT} = 12A, Forced CCM



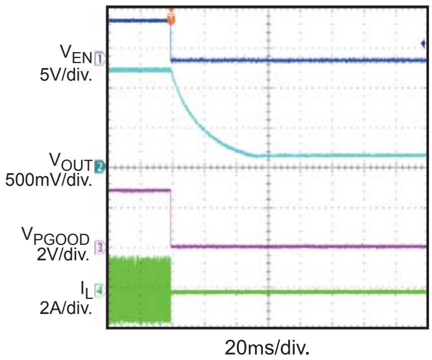
Power Down through EN
I_{OUT} = 0A, Pulse Skip



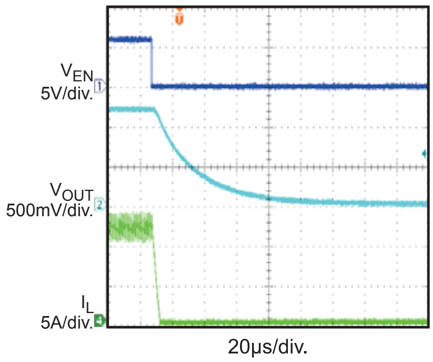
Power Down through EN
I_{OUT} = 12A, Pulse Skip



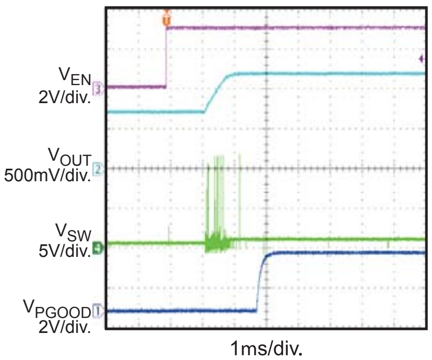
Power Down through EN
I_{OUT} = 0A, Forced CCM



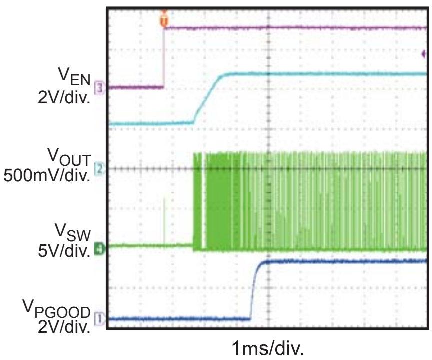
Power Down through EN
I_{OUT} = 12A, Forced CCM



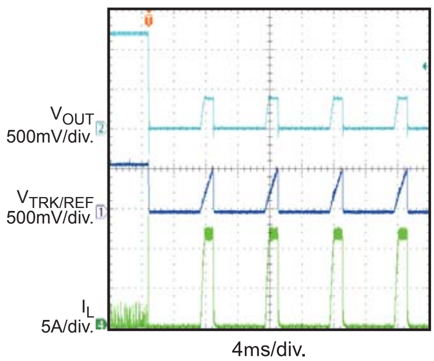
Pre-bias Start Up
Pulse Skip



Pre-bias Start Up
Forced CCM



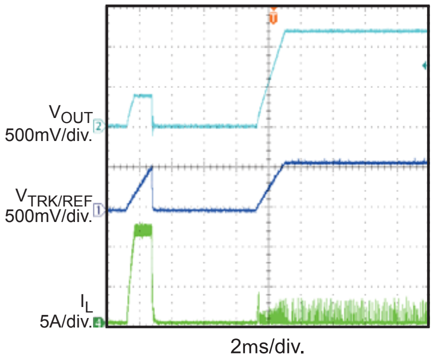
Over-Current Protection Entry



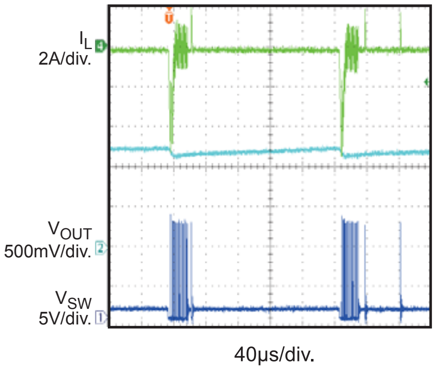
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the EVQ8633A-LE-01A evaluation board.
V_{IN} = 12V, V_{OUT} = 1.2V, L = 560nH, T_A = +25ºC, unless otherwise noted.

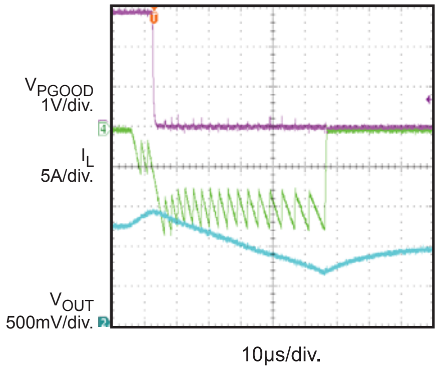
Over-Current Protection Recovery



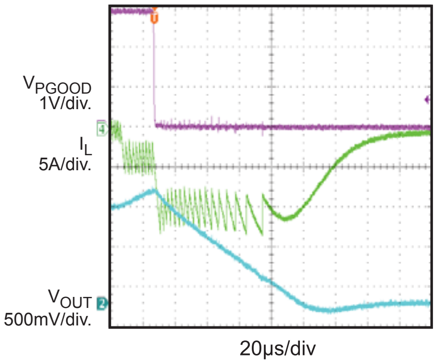
OSM Operation
Pulse Skip Mode



Over-voltage Protection
Pulse Skip Mode



Over-voltage Protection
Forced CCM



PRINTED CIRCUIT BOARD LAYOUT

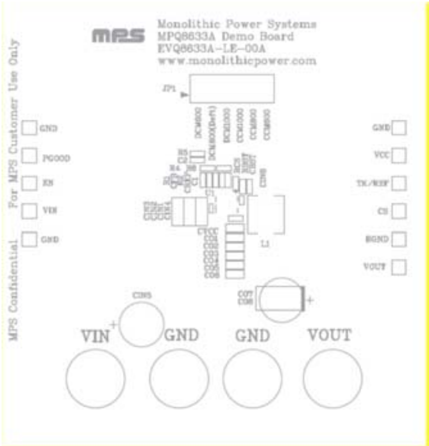


Figure 1—Top Silk Layer

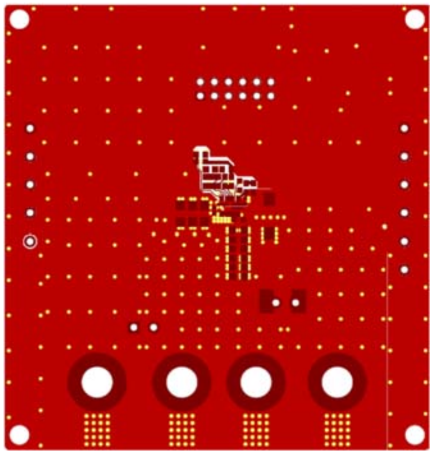


Figure 2—Top Layer

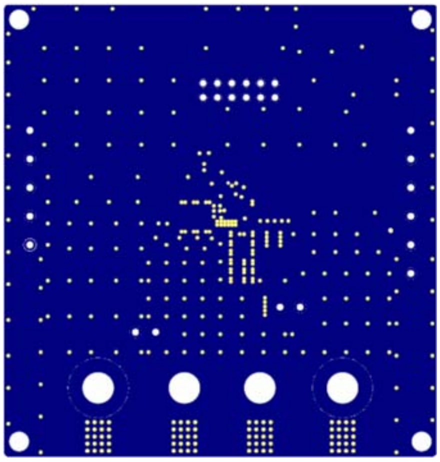


Figure 3—Inner Layer 1

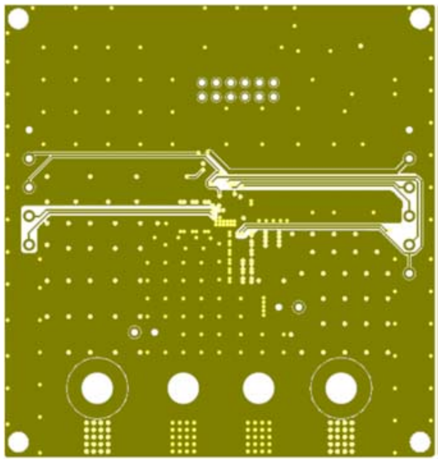


Figure 4— Inner Layer 2

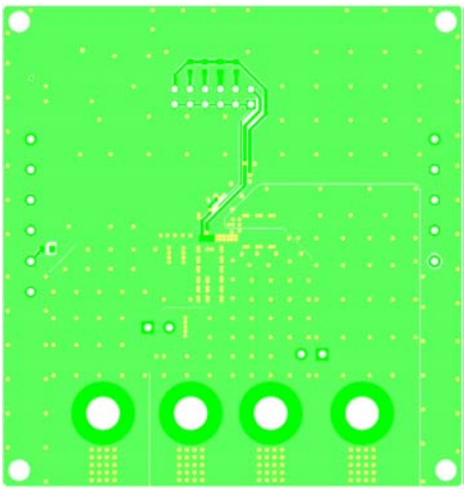


Figure 5—Bottom Layer

QUICK START GUIDE

The input voltage of the EV 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). Lower input voltage (as low as 2.7V with external 3.3V VCC bias) can be set by fine tuning the resistor divider values, or by over-driving the EN with an external control signal. The following is the procedure to turn on the EV board.

1. Connect the positive and negative terminals of the load to the VOUT and GND pins, respectively.
2. Preset the power supply output voltage between 8V and 16V, and then turn off the power supply.
3. Connect the positive and negative terminals of the power supply output to the VIN and GND pins, respectively. Make sure the power supply has high enough current limit to supply the power.
4. Turn the power supply on. The EVQ8633A-LE-01A will automatically startup.
5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.5V to turn on the regulator or less than 0.8V to turn it off.
6. Use R1 and R2 to set the output voltage with VFB = 0.6 V. Follow the Application Information section in the device datasheet to select the proper values of R1, R2, inductor and output capacitor values when output voltage is changed.
7. The JP1 jumper can be used to select the operating frequency (600kHz, 800kHz and 1000kHz) and light load operation mode (Pulse Skip/DCM and CCM).