EVQ4480-V-00A

6A,36V,Step-Down Converter for Automotive, AEC-Q100 Qualified Evaluation Board

DESCRIPTION

The EVQ4480-V-00A Evaluation Board is designed to demonstrate the capabilities of MPS' MPQ4480, which is a high-frequency, synchronous rectified, step-down, switch-mode converter. It achieves 6A output current over a wide input-supply range with excellent load and line regulation over a wide input-supply range. The MPQ4480 has synchronous-mode operation for higher efficiency over the output-load range.

Fault condition protection includes hiccup current limiting, OVP, ground short to battery protection and thermal shutdown (TSD).

The MPQ4480 requires a minimum number of readily available, standard, external components. The MPQ4480 is available in a QFN25 (4mmx5mm) package

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	12	V
Output Voltage	V_{OUT}	5	V
Output Current	I_{OUT}	6	A
Switching Frequency	F_S	440	kHz

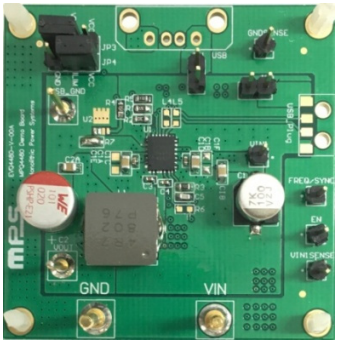
FEATURES

- 4.2V to 36V Operating Input-Voltage Range
- 6A Output Current
- Internal Auto EN Pull-up
- 20mΩ/15mΩ Low $R_{DS(ON)}$ Internal Buck Power MOSFETs
- Integrated 4mΩ Ground Sensing Resistor
- Frequency Adjustable (235kHz to 2.2MHz)
- CC Output-Current Limit, 3 level adjustable, 2.75A/3.75A/7.5A
- Forced PWM Mode
- Support 300kHz to 2.1MHz Frequency SYNC Input
- EN Shutdown Discharge
- Low Dropout Mode
- Battery Short to Ground Protect Driver
- Output Over Voltage Protection
- Adjustable Line Drop Compensation
- Available in AEC-Q100 Grade 1

APPLICATIONS

- Automotive Infotainment System
- Automotive USB Hub

EVQ4480-V-00A EVALUATION BOARD

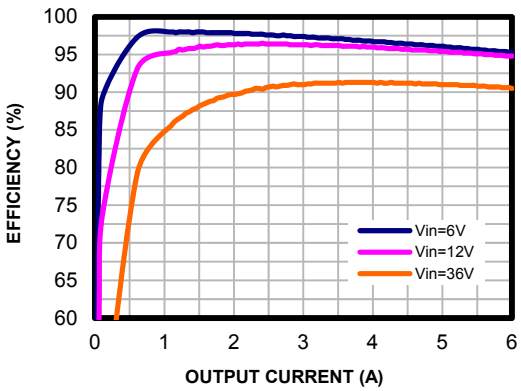


(L × W × H) 50mm × 50mm × 18mm

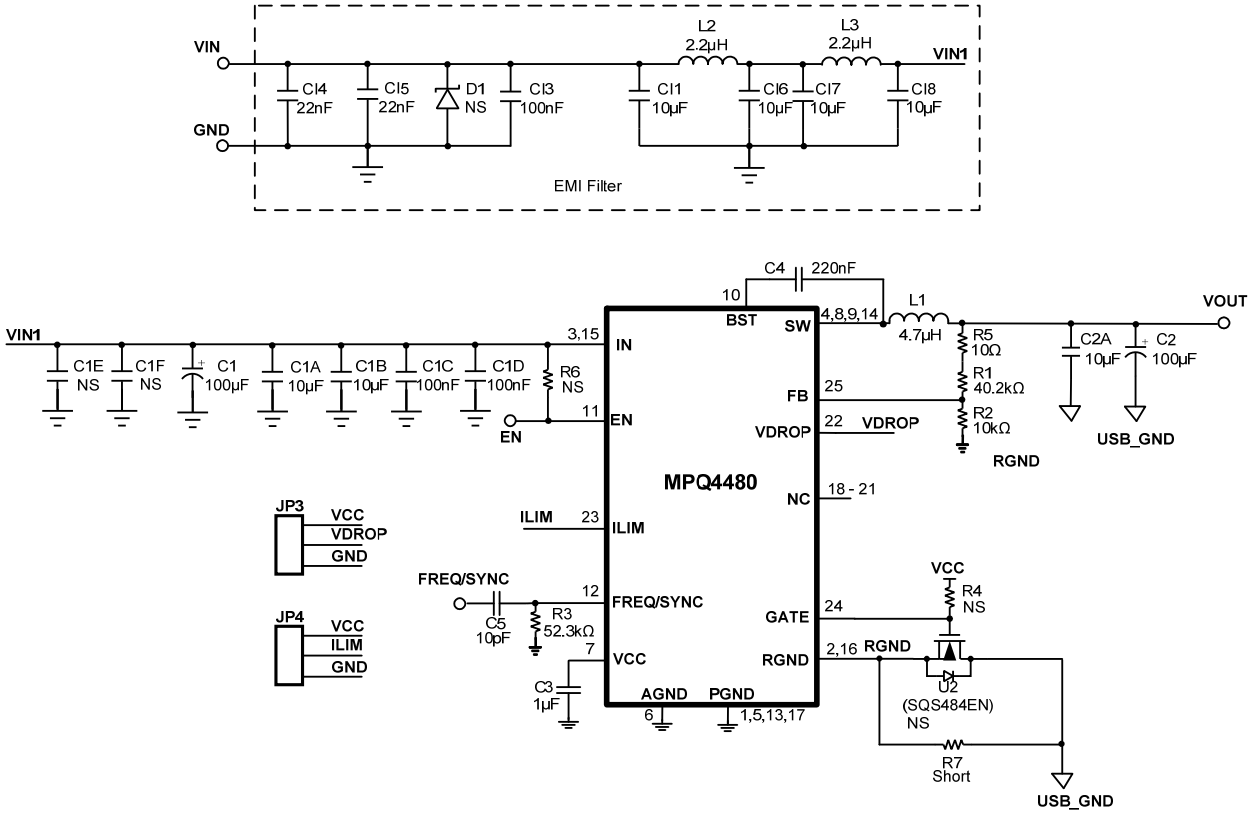
Board Number	MPS IC Number
EVQ4480-V-00A	MPQ4480GV-AEC1

Efficiency vs. Load Current

V_{OUT}=5V, F_s=440kHz, L=4.7μH



EVALUATION BOARD SCHEMATIC



Default setting**:** ILIM =VCC, through a jumper; VDROP=GND, through a jumper.

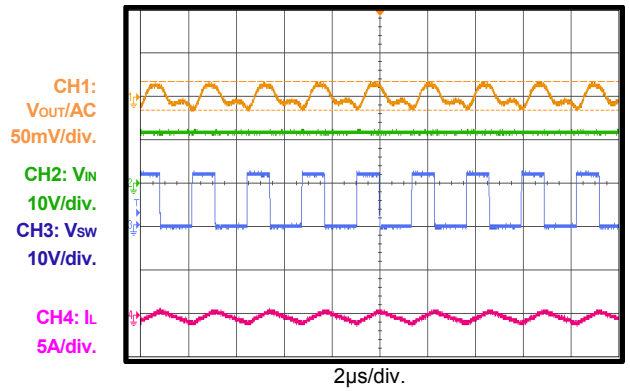
EVQ4480-V-00A BILL OF MATERIALS

Qty	RefDes	Value	Description	Package	Manufacturer	Manufacturer_P/N
7	C1A,C1B, CI1, CI6, CI7,CI8, C2A	10μF	Ceramic Cap., 50V, X5R	0805	Murata	GRM21BR61H106KE43L
1	CI3	100nF	Ceramic Cap., 50V, X7R	0603	Murata	GRM188R71H104KA93D
2	CI4, CI5	22nF	Ceramic Cap., 50V, X5R	0603	Murata	GRM188R71H223KA01D
1	C1	100μF	Electrolytic Cap., 100μF 35V	SMD	CHEMICON	EMZJ350ADA101MF80G
2	C1C, C1D	100nF	Ceramic Cap., 50V, X7R	0402	Murata	GRM155R71H104ME14D
1	C2	100μF	Polymer Cap., 100μF 20V,	DIP	WE	875115452003
1	C3	1μF	Ceramic Cap., 16V, X6S	0402	Murata	GRM155C81C105KE11D
1	C4	220nF	Ceramic Cap., 16V, X5R	0402	WE	885012105017
1	C5	10pF	Ceramic Cap., 50V, NP0	0603	WE	885012006051
1	R1	40.2k	Film Res, 1%, 0603, 40K2	0603	YAGEO	RC0603FR-0740K2L
1	R2	10k	Film Res, 1%, 0603, 10K	0603	YAGEO	RC0603FR-0710KL
1	R3	52.3k	Film Res, 1%, 0603, 52K3	0603	YAGEO	RC0603FR-0752K3L
1	R5	10	Film Res, 1%, 0603, 10R	0603	YAGEO	RC0603JR-0710RL
1	R7	Short	Film Res, 1%, 0805, Short	0805		
1	L1	4.7μH	Inductor, RDC=8.3mΩ, Isat=15.7A	SMD	Cyntec	VCHA105D-4R7MS6-89
2	L2, L3	2.2μH	Inductor, RDC=35mΩ, Isat=6.2A	SMD	WE	74438356022
1	U1	MPQ4480	Step-down converter	QFN-25(4mmx5mm)	MPS	MPQ4480GV-AEC1
0	C1E, C1F, D1, R4, R6, U2	NS				

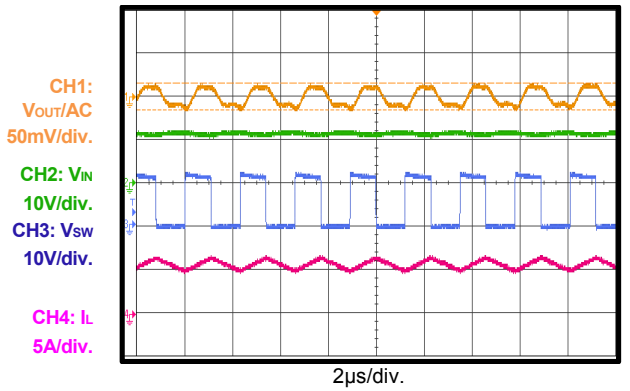
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, F_S = 440kHz, T_A = 25°C, unless otherwise noted.

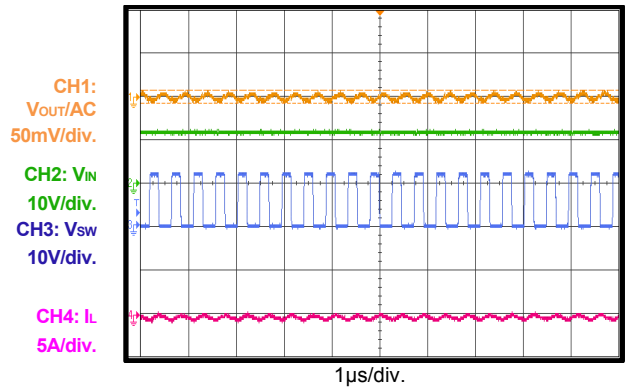
Output Ripple
F_S=440kHz, L=4.7µH, I_{OUT}=0A



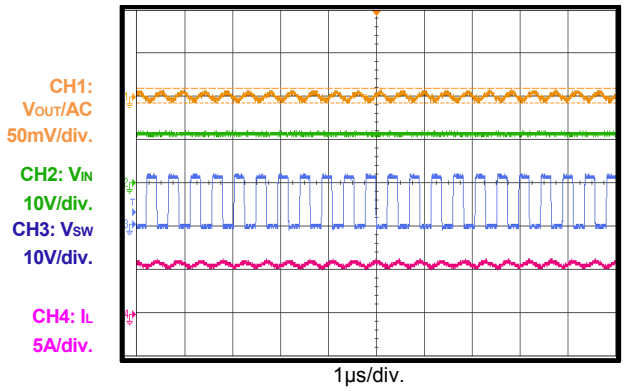
Output Ripple
F_S=440kHz, L=4.7µH, I_{OUT}=6A



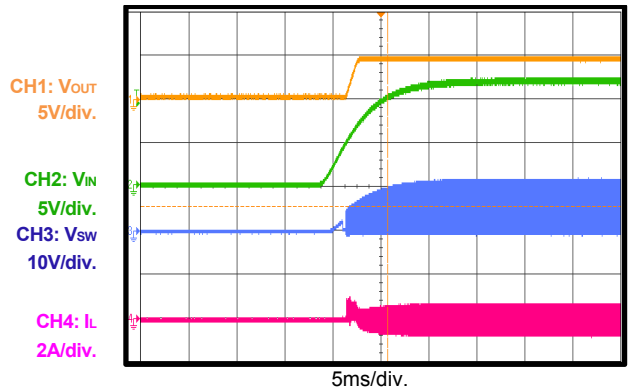
Output Ripple
F_S=2.2MHz, L=2.2µH, I_{OUT}=0A



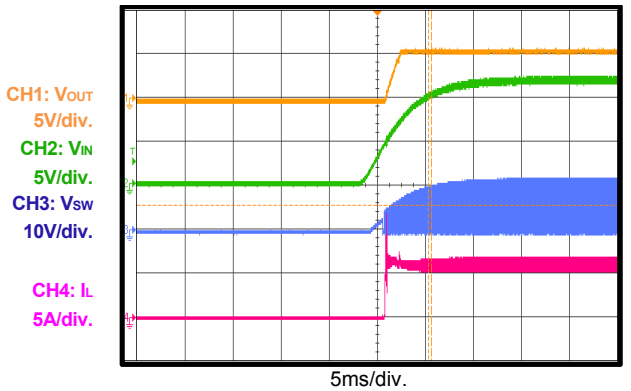
Output Ripple
F_S=2.2MHz, L=2.2µH, I_{OUT}=6A



Power Start-Up
I_{OUT}=0A



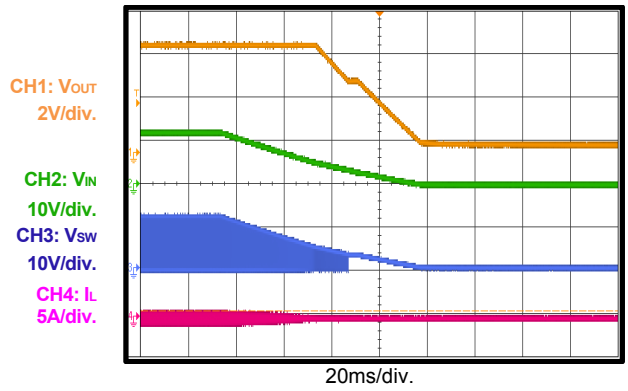
Power Start-Up
I_{OUT}=6A



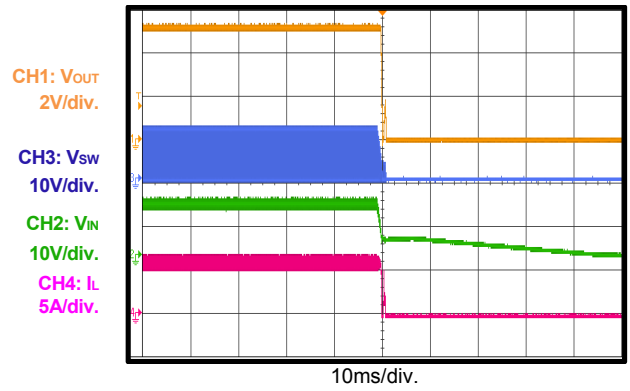
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, F_S = 440kHz, T_A = 25°C, unless otherwise noted.

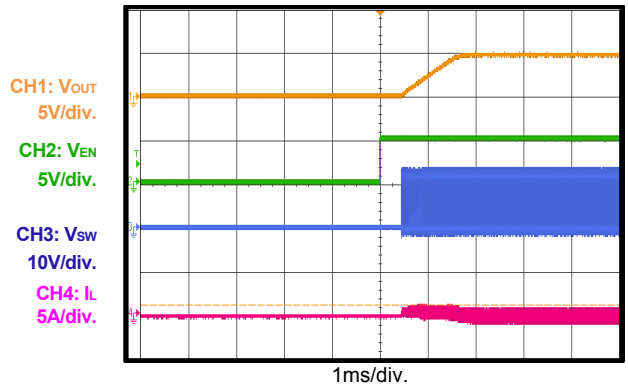
Power Shutdown
I_{OUT}=0A



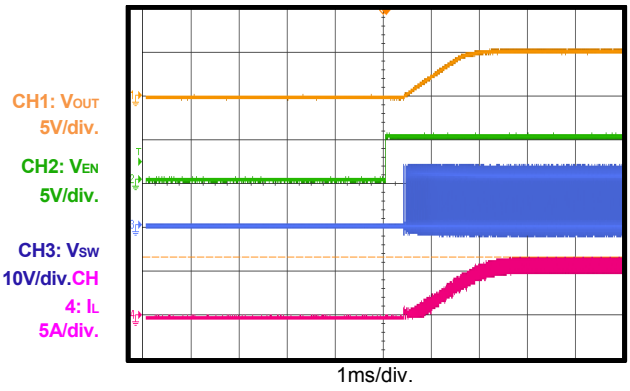
Power Shutdown
I_{OUT}=6A



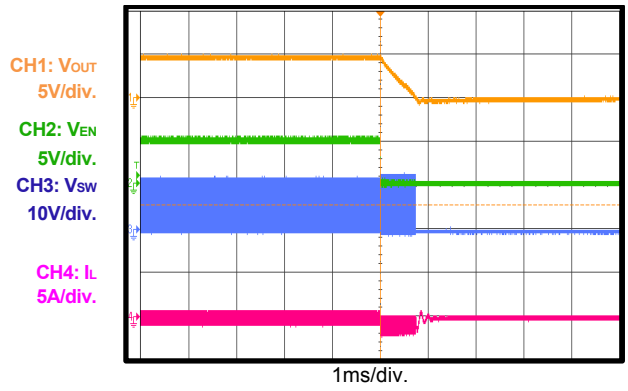
EN Start-Up
I_{OUT}=0A



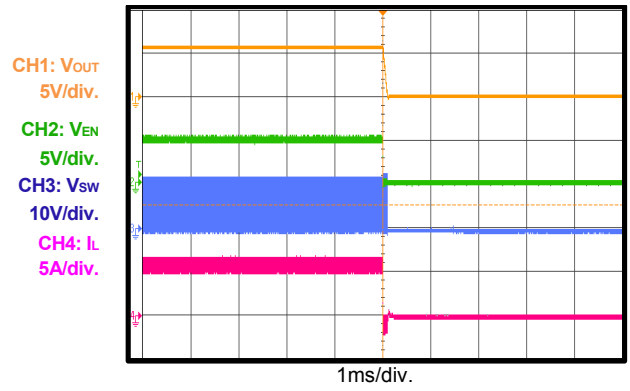
EN Start-Up
I_{OUT}=6A



EN Shutdown
I_{OUT}=0A



EN Shutdown
I_{OUT}=6A

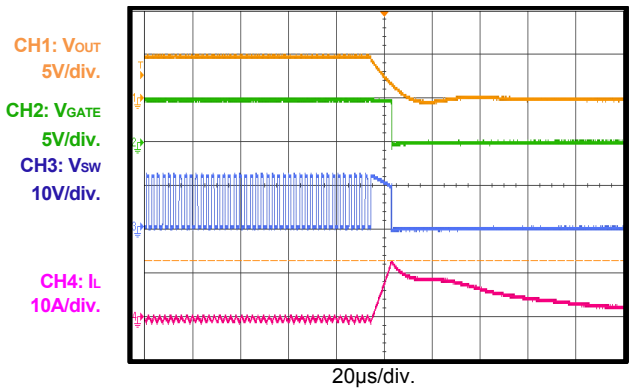


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, F_S = 440kHz, T_A = 25°C, unless otherwise noted.

VOUT short to USB_GND entry

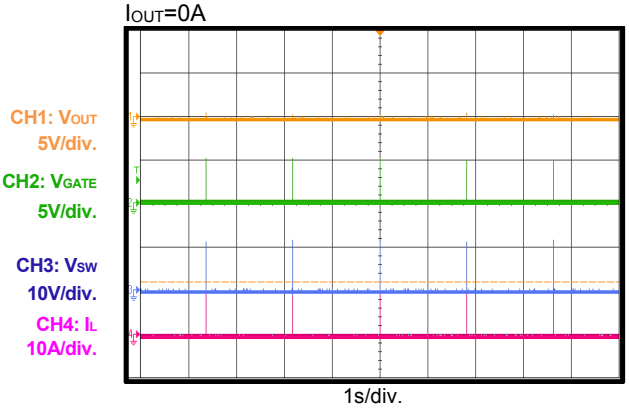
I_{OUT}=0A



20µs/div.

VOUT short to USB_GND Steady State

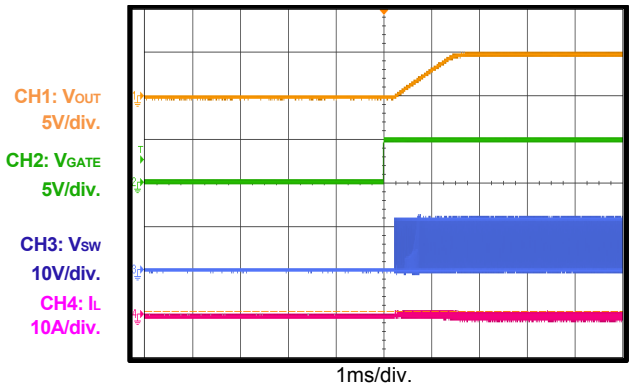
I_{OUT}=0A



1s/div.

VOUT short to USB_GND Recovery

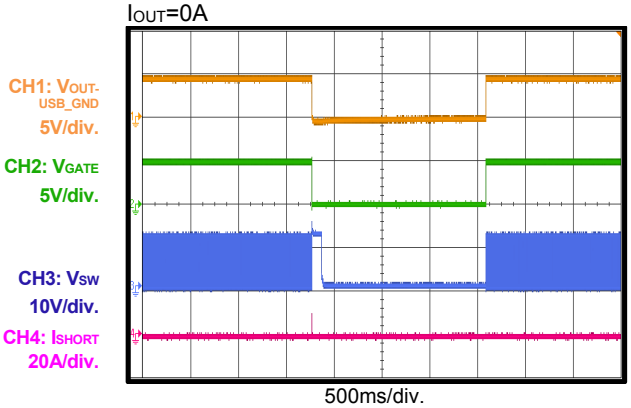
I_{OUT}=0A



1ms/div.

USB_GND short to Battery entry and Recovery

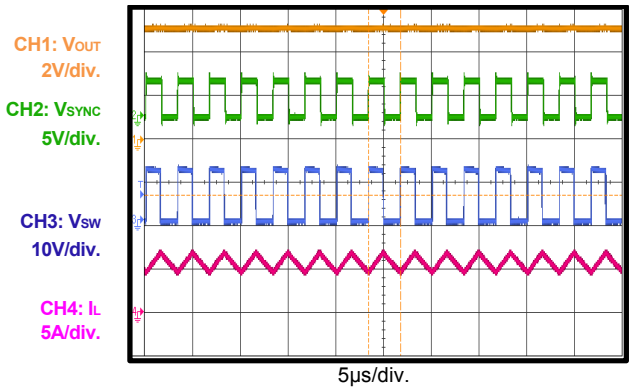
I_{OUT}=0A



500ms/div.

Sync Function

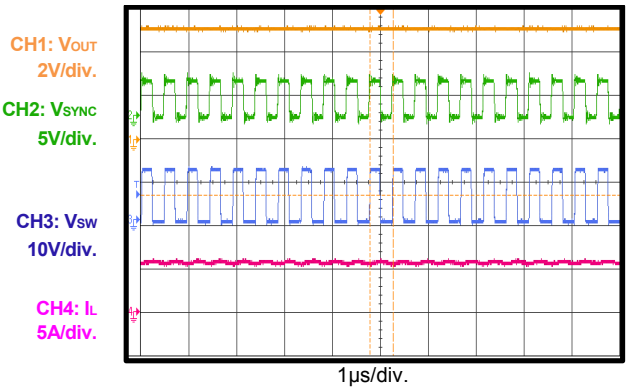
F_S=300kHz, L=4.7µH, I_{OUT}=6A



5µs/div.

Sync Function

F_S=2.1MHz, L=2.2µH, I_{OUT}=6A

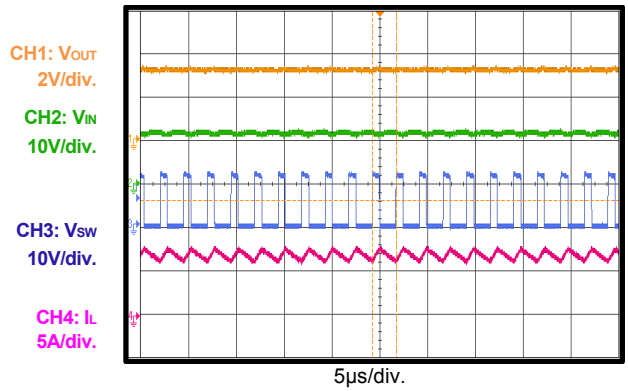


1µs/div.

EVB TEST RESULTS *(continued)*

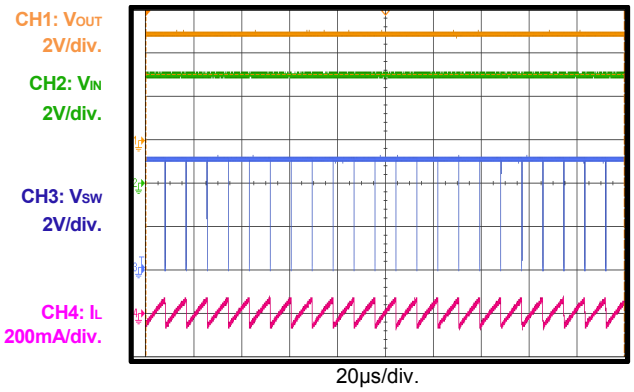
Performance waveforms are tested on the evaluation board.
V_{IN} = 12V, V_{OUT} = 5V, L = 4.7µH, F_S = 440kHz, T_A = 25°C, unless otherwise noted.

CC Mode Over-Current-Protection Steady State



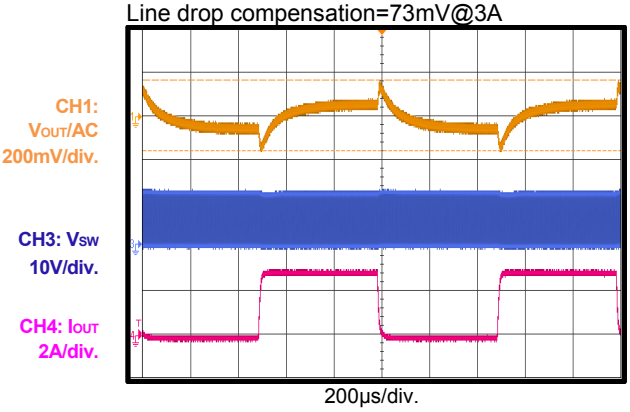
Low Dropout Mode

V_{IN}=5V, V_{OUT}=4.93V, I_{OUT}=0A



Load Transient

I_{OUT}=0 to 3A, 2.5A/µs, VDROP=GND
Line drop compensation=73mV@3A



PRINTED CIRCUIT BOARD LAYOUT

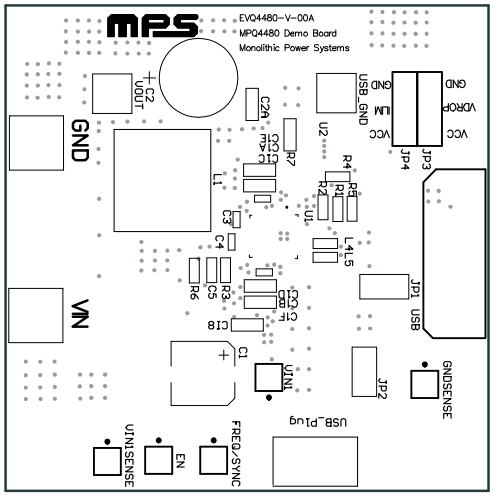


Figure 1: Top Silk Layer

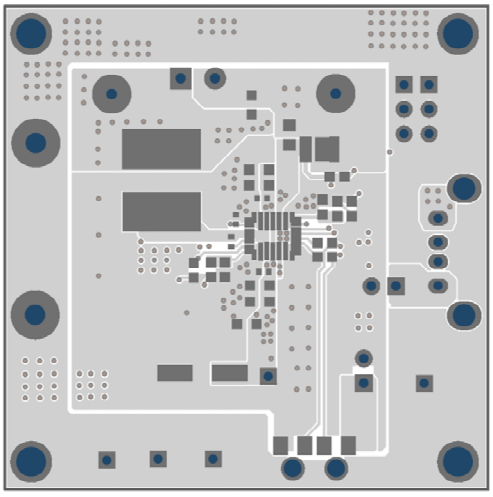


Figure 2: Top Layer

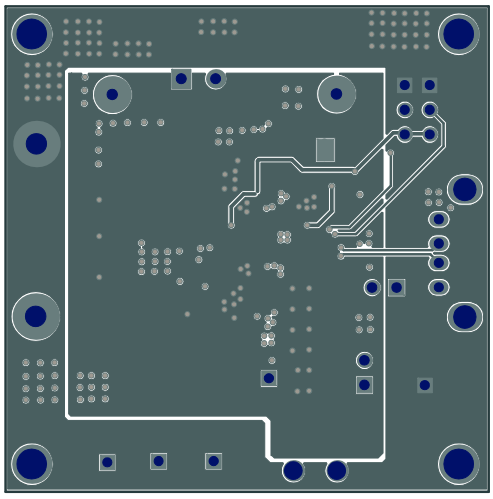


Figure 3: Mid Layer1

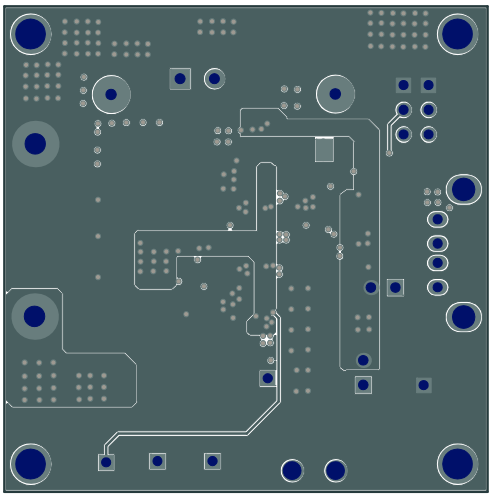


Figure 4: Mid Layer2

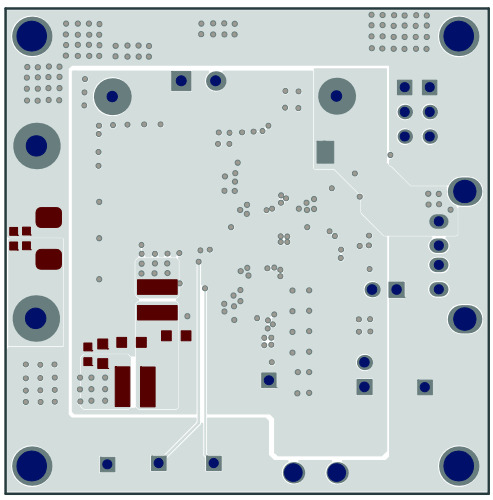


Figure 5: Bottom Layer

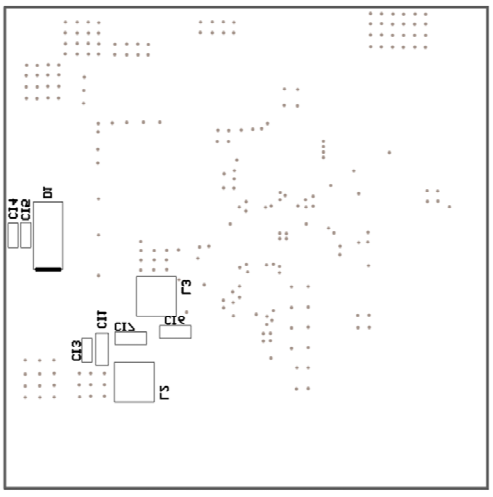


Figure 6: Bottom Silk Layer

QUICK START GUIDE

1. Preset Power Supply V_{IN} =12V.
2. Turn Power Supply off.
3. Connect Power Supply terminals to:
    a. Positive (+): VIN
    b. Negative (–): GND
4. Connect Load to:
    a. Positive (+): VOUT
    b. Negative (–): USB_GND
5. Output line drop compensation can be set up by JP3 (find details in datasheet), default setting is VDROP=GND:

    Typically, for 6A output current, VDROP=GND for 145mV line drop compensation; VDROP=Float for 784mV line drop compensation; VDROP=VCC for 1628mV line drop compensation.

    Output CC current limit can be set up JP4, default setting is ILIM=VCC:

    ILIM=VCC for 6A continuous; ILIM=Float for 3A continuous; ILIM=GND for 2.4A continuous.
6. Turn Power Supply on after making connections. The board will automatically start up.