

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

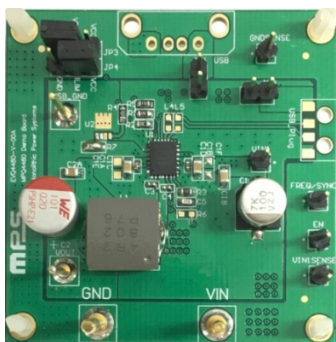
APPLICATIONS

- Automotive Infotainment System
- Automotive USB Hub

All MPS parts are lead-free and adhere to the RoHS directive. For MPS green status, please visit MPS website under Products, Quality Assurance page.

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EVQ4480-V-00A EVALUATION BOARD

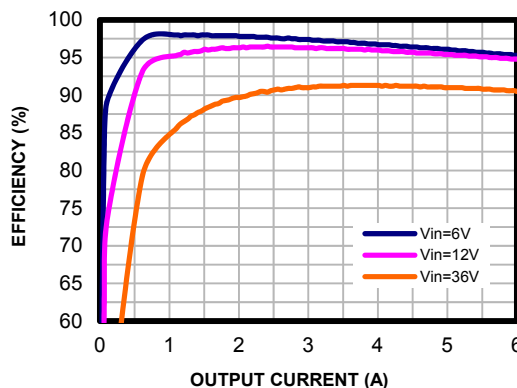


(L × W × H) 50mm × 50mm × 18mm

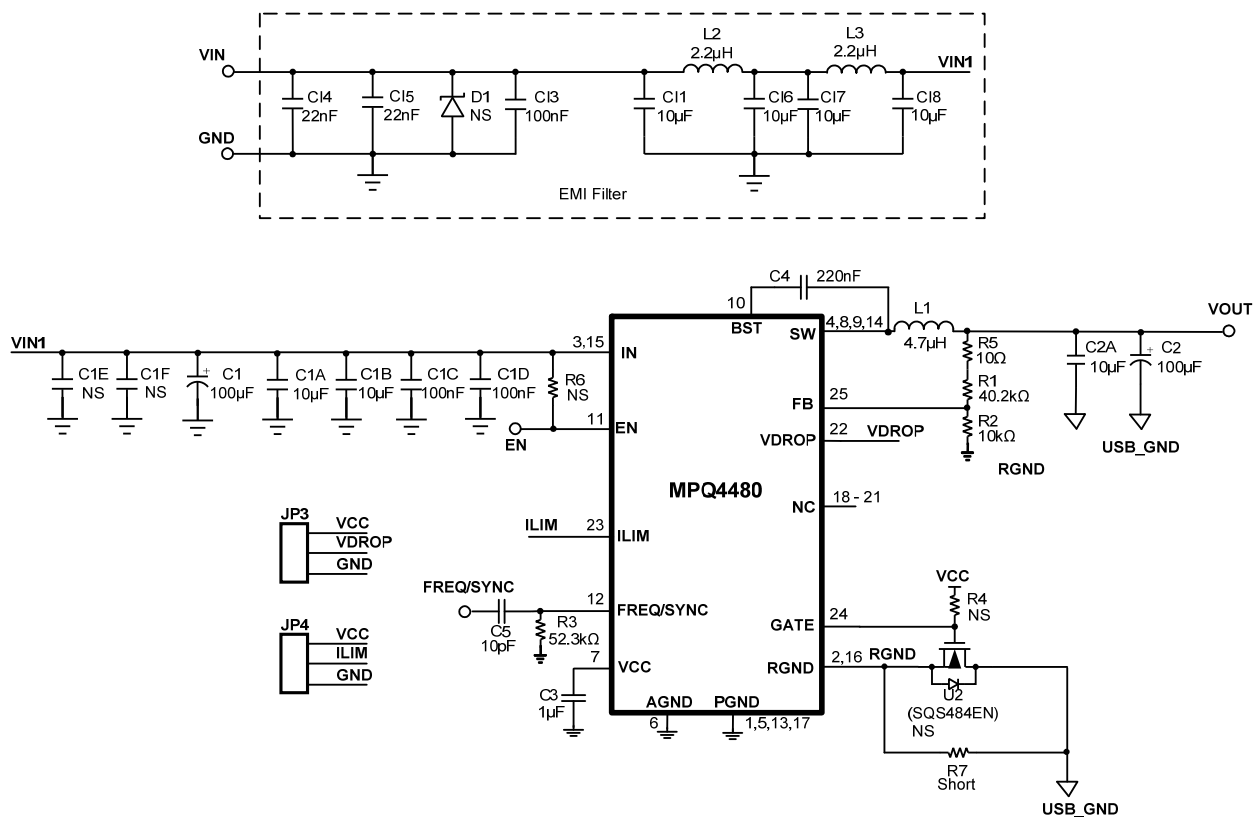
Board Number	MPS IC Number
EVQ4480-V-00A	MPQ4480GV-AEC1

Efficiency vs. Load Current

$V_{OUT}=5V$, $F_s=440kHz$, $L=4.7\mu H$



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, C1I, C16, C17,C18, C2A	10 μ F	Ceramic Cap., 50V, X5R	0805	Murata	GRM21BR61H106KE43L
1	C13	100nF	Ceramic Cap., 50V, X7R	0603	Murata	GRM188R71H104KA93D
2	C14, C15	22nF	Ceramic Cap., 50V, X5R	0603	Murata	GRM188R71H223KA01D
1	C1	100 μ F	Electrolytic Cap., 100 μ F 35V	SMD	CHEMICON	EMZJ350ADA101MF80G
2	C1C, C1D	100nF	Ceramic Cap., 50V, X7R	0402	Murata	GRM155R71H104ME14D
1	C2	100 μ F	Polymer Cap., 100 μ F 20V,	DIP	WE	875115452003
1	C3	1 μ F	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	4.7 μ H	Inductor, RDC=8.3m Ω , Isat=15.7A	SMD	Cyntec	VCHA105D-4R7MS6-89
2	L2, L3	2.2 μ H	Inductor, RDC=35m Ω , Isat=6.2A	SMD	WE	74438356022
1	U1	MPQ44 80	Step-down converter	QFN- 25(4mmx5 mm)	MPS	MPQ4480GV-AEC1
0	C1E, C1F, D1, R4, R6, U2	NS				

EVB TEST RESULTS

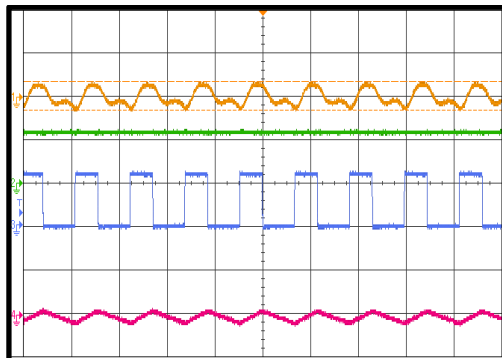
Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, $F_S = 440kHz$, $T_A = 25^\circ C$, unless otherwise noted.

Output Ripple

$F_S = 440kHz$, $L = 4.7\mu H$, $I_{OUT} = 0A$

CH1:
 V_{OUT}/AC
50mV/div.
CH2: V_{IN}
10V/div.
CH3: V_{SW}
10V/div.
CH4: I_L
5A/div.

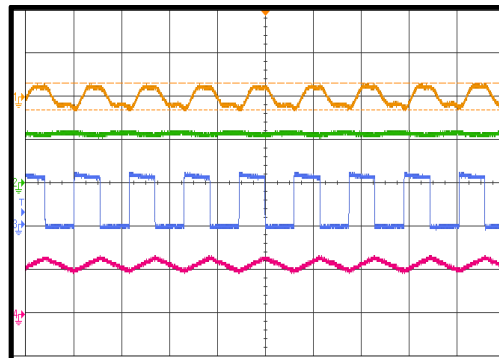


2µs/div.

Output Ripple

$F_S = 440kHz$, $L = 4.7\mu H$, $I_{OUT} = 6A$

CH1:
 V_{OUT}/AC
50mV/div.
CH2: V_{IN}
10V/div.
CH3: V_{SW}
10V/div.
CH4: I_L
5A/div.

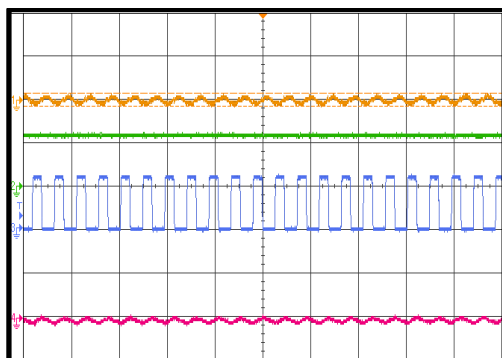


2µs/div.

Output Ripple

$F_S = 2.2MHz$, $L = 2.2\mu H$, $I_{OUT} = 0A$

CH1:
 V_{OUT}/AC
50mV/div.
CH2: V_{IN}
10V/div.
CH3: V_{SW}
10V/div.
CH4: I_L
5A/div.

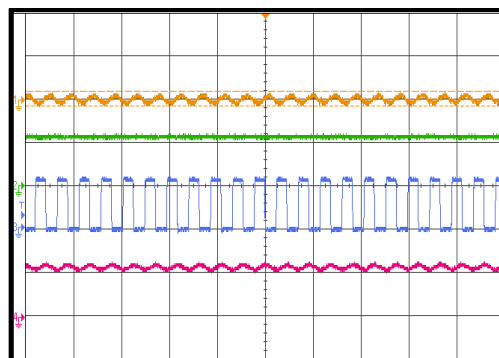


1µs/div.

Output Ripple

$F_S = 2.2MHz$, $L = 2.2\mu H$, $I_{OUT} = 6A$

CH1:
 V_{OUT}/AC
50mV/div.
CH2: V_{IN}
10V/div.
CH3: V_{SW}
10V/div.
CH4: I_L
5A/div.

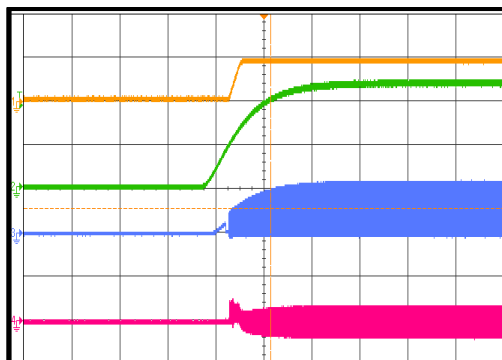


1µs/div.

Power Start-Up

$I_{OUT} = 0A$

CH1: V_{OUT}
5V/div.
CH2: V_{IN}
5V/div.
CH3: V_{SW}
10V/div.
CH4: I_L
2A/div.

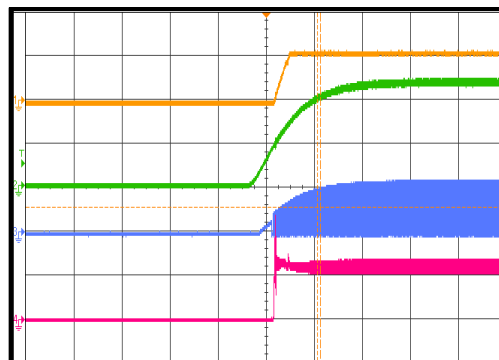


5ms/div.

Power Start-Up

$I_{OUT} = 6A$

CH1: V_{OUT}
5V/div.
CH2: V_{IN}
5V/div.
CH3: V_{SW}
10V/div.
CH4: I_L
5A/div.



5ms/div.

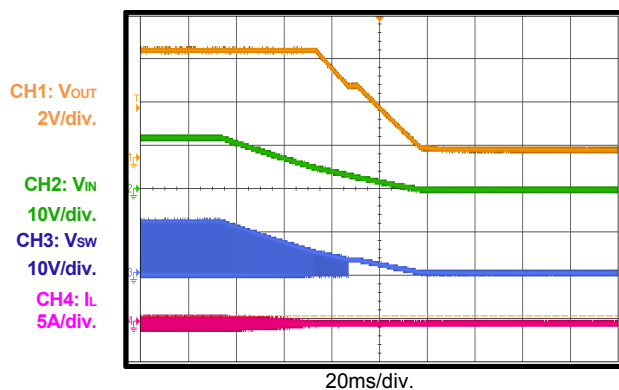
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, $F_s = 440kHz$, $T_A = 25^\circ C$, unless otherwise noted.

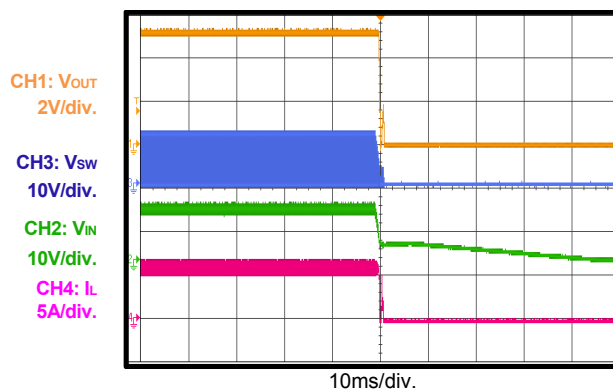
Power Shutdown

$I_{OUT}=0A$



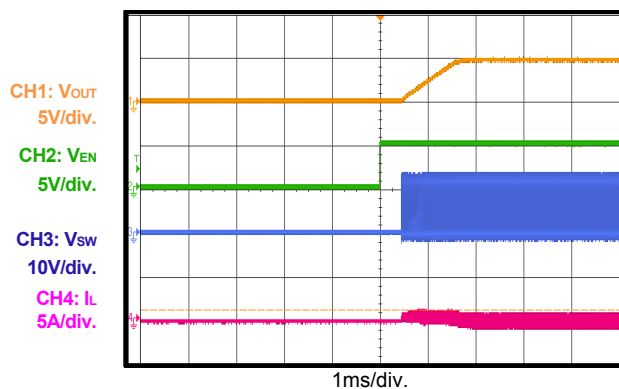
Power Shutdown

$I_{OUT}=6A$



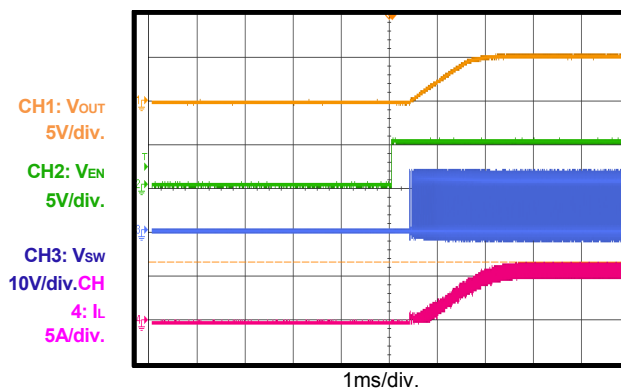
EN Start-Up

$I_{OUT}=0A$



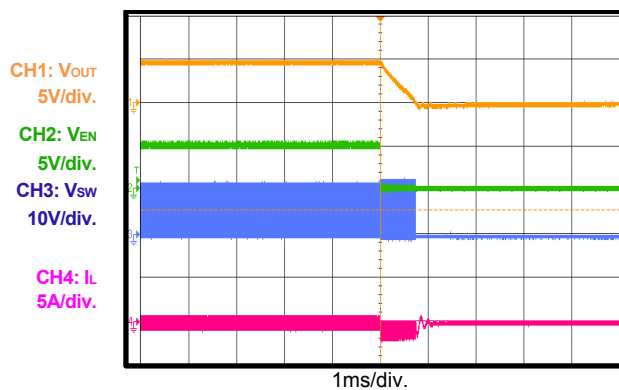
EN Start-Up

$I_{OUT}=6A$



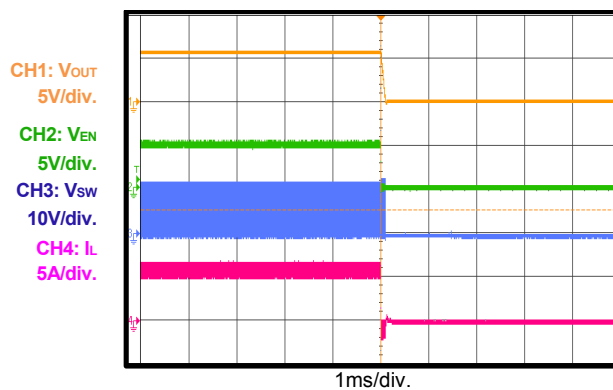
EN Shutdown

$I_{OUT}=0A$



EN Shutdown

$I_{OUT}=6A$



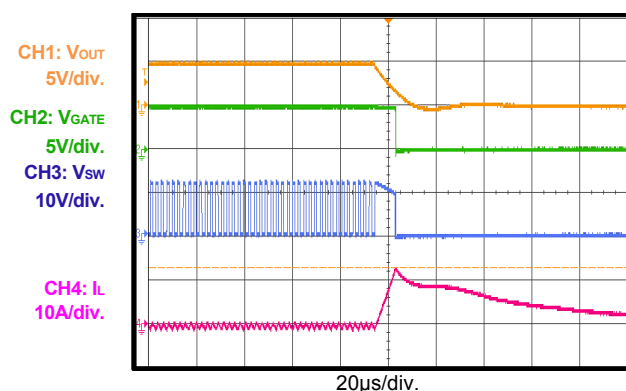
EVb TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, $F_s = 440kHz$, $T_A = 25^\circ C$, unless otherwise noted.

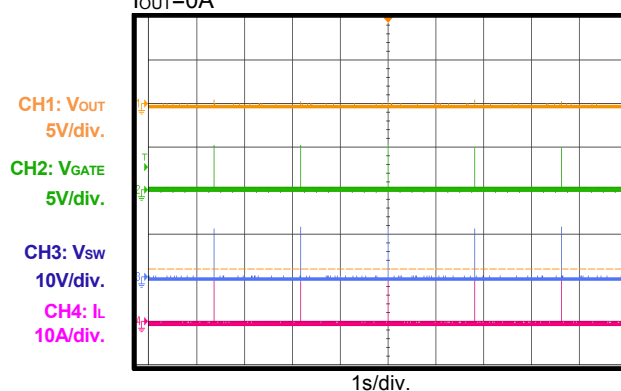
VOUT short to USB_GND entry

$I_{OUT}=0A$



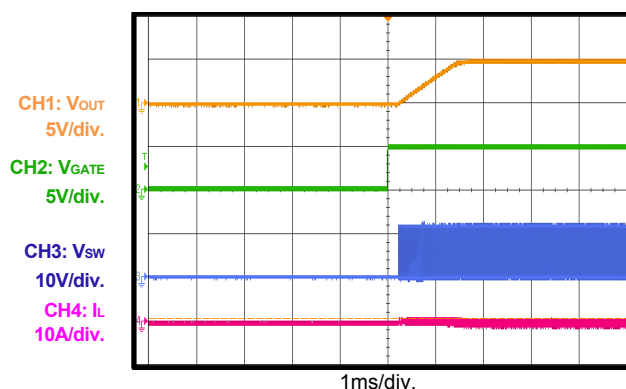
VOUT short to USB_GND Steady State

$I_{OUT}=0A$



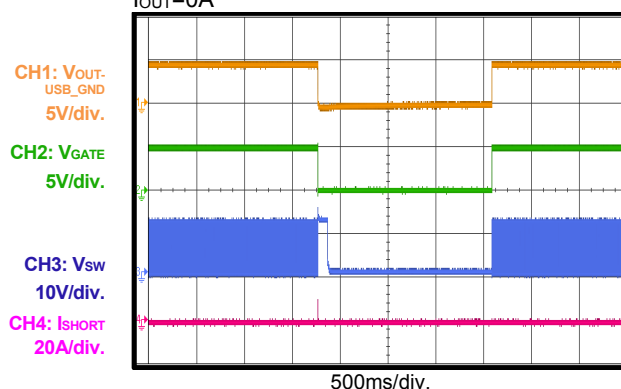
VOUT short to USB_GND Recovery

$I_{OUT}=0A$



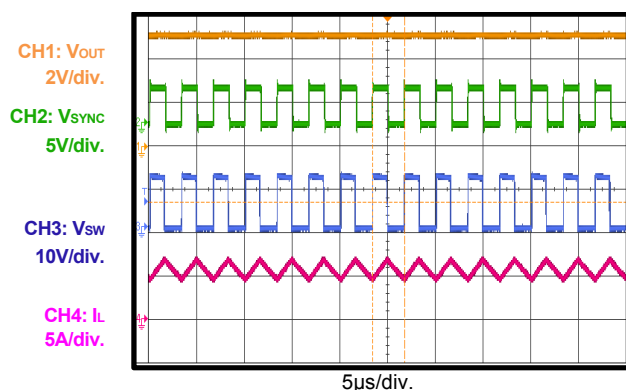
USB_GND short to Battery entry and Recovery

$I_{OUT}=0A$



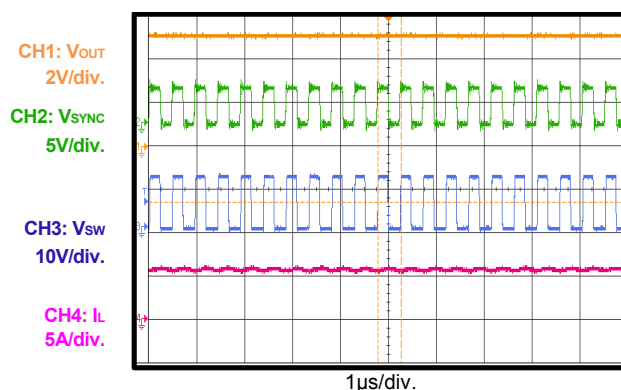
Sync Function

$F_s=300kHz$, $L=4.7\mu H$, $I_{OUT}=6A$



Sync Function

$F_s=2.1MHz$, $L=2.2\mu H$, $I_{OUT}=6A$

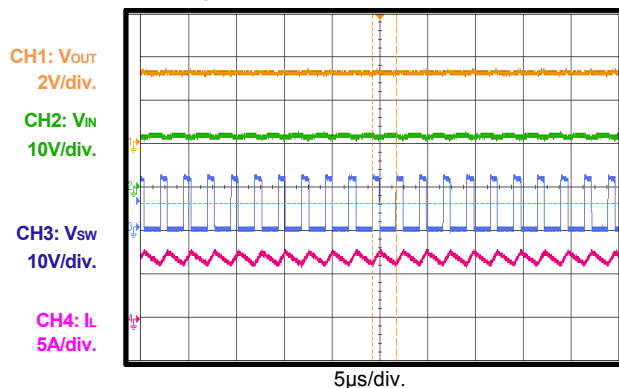


EVb TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

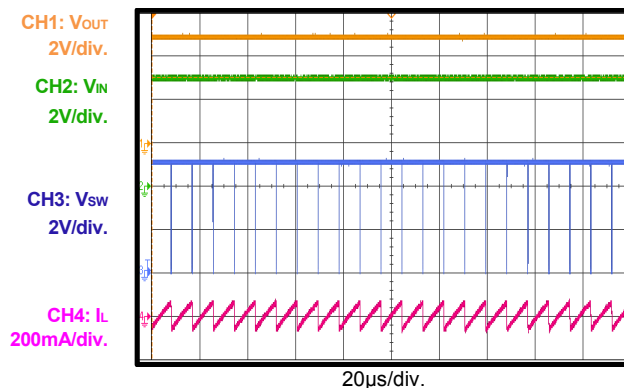
$V_{IN} = 12V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, $F_s = 440kHz$, $T_A = 25^\circ C$, unless otherwise noted.

CC Mode Over-Current-Protection Steady State



Low Dropout Mode

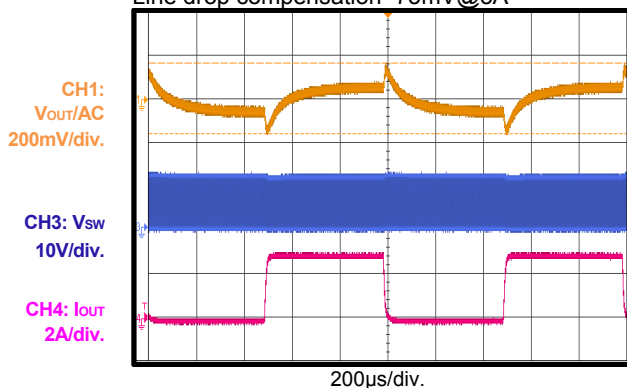
$V_{IN} = 5V$, $V_{OUT} = 4.93V$, $I_{OUT} = 0A$



Load Transient

$I_{OUT} = 0$ to 3A, 2.5A/μs, $V_{DROP} = GND$

Line drop compensation = 73mV@3A



PRINTED CIRCUIT BOARD LAYOUT

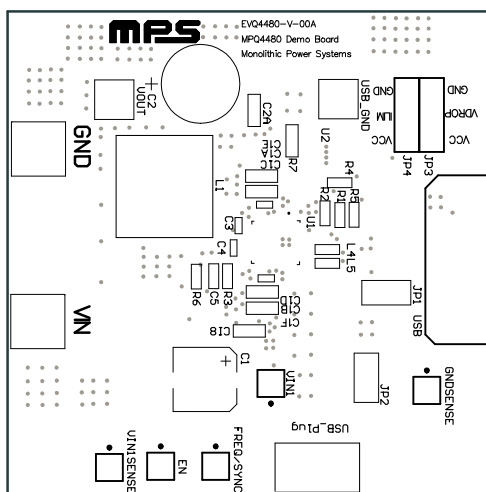


Figure 1: Top Silk Layer

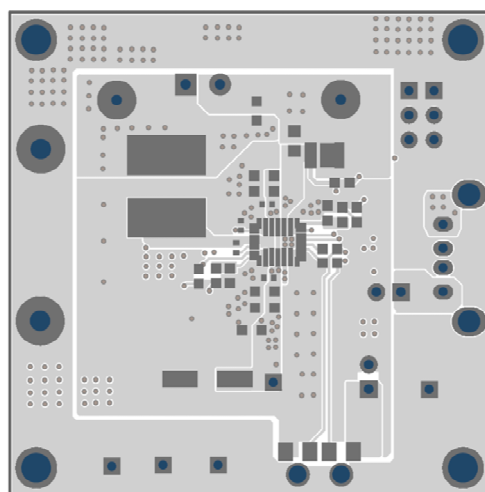


Figure 2: Top Layer

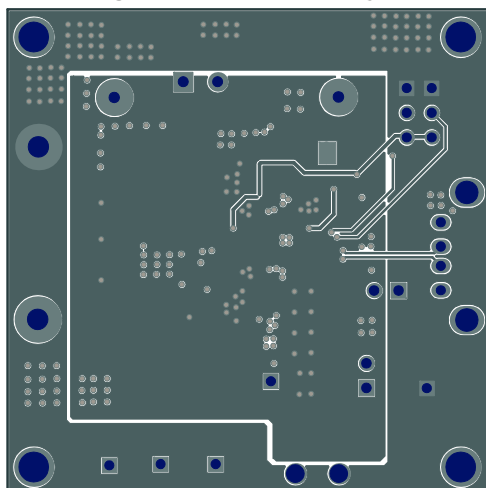


Figure 3: Mid Layer1

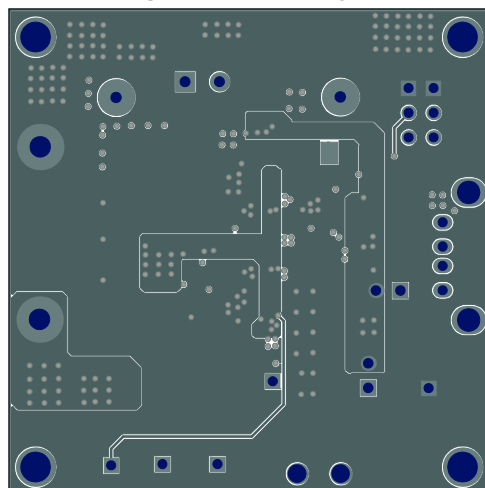


Figure 4: Mid Layer2

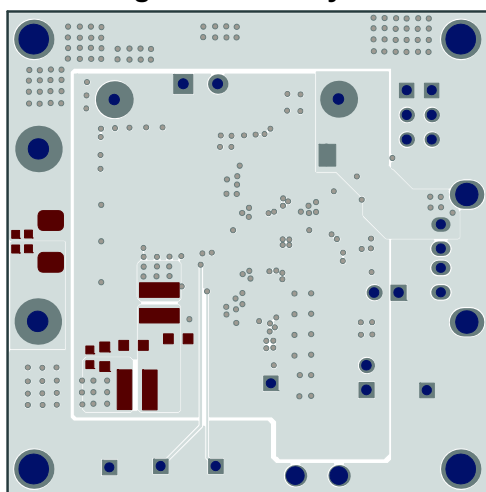


Figure 5: Bottom Layer

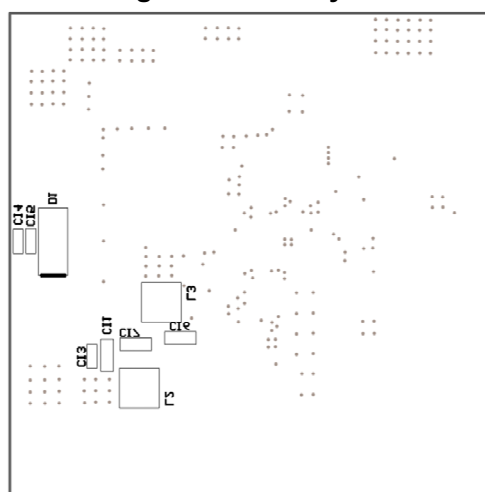


Figure 6: Bottom Silk Layer

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.

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