EVBL4420H-J-00A

2A, 36V, Synchronous Step-Down Converter Evaluation Board

DESCRIPTION

The EVBL4420H-J-00A is an evaluation board for the MP4420H/MPQ4420H with MPS power inductor stuffed. MP4420H/MPQ4420H is a high-frequency, synchronous, rectified, step-down, switch-mode converter with build-in power MOSFETs. It offers a very compact solution to achieve a 2A continuous output current with excellent load and line regulation over a wide input supply range. The MP4420H/MPQ4420H has synchronous mode operation for higher efficiency over the output current load range.

Current-mode operation provides fast transient response and eases loop stabilization.

Full protection features include over-current protection and thermal shut down.

The EVBL4420H-J-00A is assembled and tested with TSOT23-8 package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	4-36	V
Output Voltage	V_{OUT}	3.3	V
Output Current	I_{OUT}	2	A

FEATURES

- Wide 4V to 36V Continuous Operating Input Range
- 90mΩ/55mΩ Low RDS(ON) Internal Power MOSFETs
- High-Efficiency Synchronous Mode Operation
- Default 410kHz Switching Frequency
- Synchronizes to a 200kHz to 2.2MHz External Clock
- High Duty Cycle for Automotive Cold-crank
- Power-Save Mode
- Internal Soft-Start
- Power Good
- OCP Protection and Hiccup
- Thermal Shutdown
- Available in AEC-Q100 Grade 1
- Fully Assembled and Tested
- MPS Power Inductor Stuffed

APPLICATIONS

- Automotive
- Industrial Control System
- Distributed Power Systems

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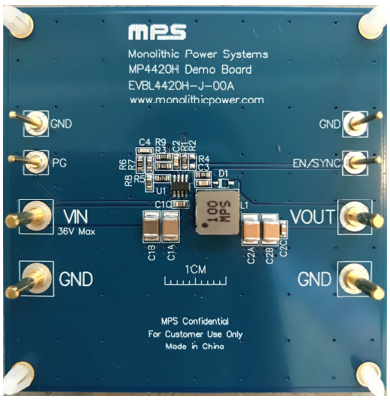
EVBL4420H-J-00A EVALUATION BOARD

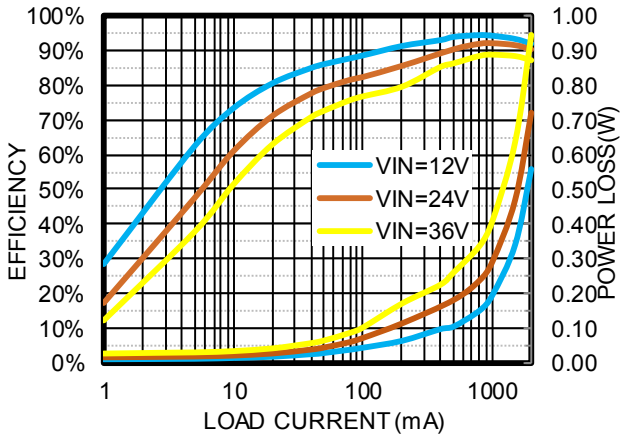


(L x W x H) 2.5” x 2.5” x 0.2”
(6.35cm x 6.35cm x0.5cm)

Board Number	MPS IC Number
EVBL4420H-J-00A	MPQ4420HGJ

Efficiency vs. Load Current

V_{OUT}=3.3V



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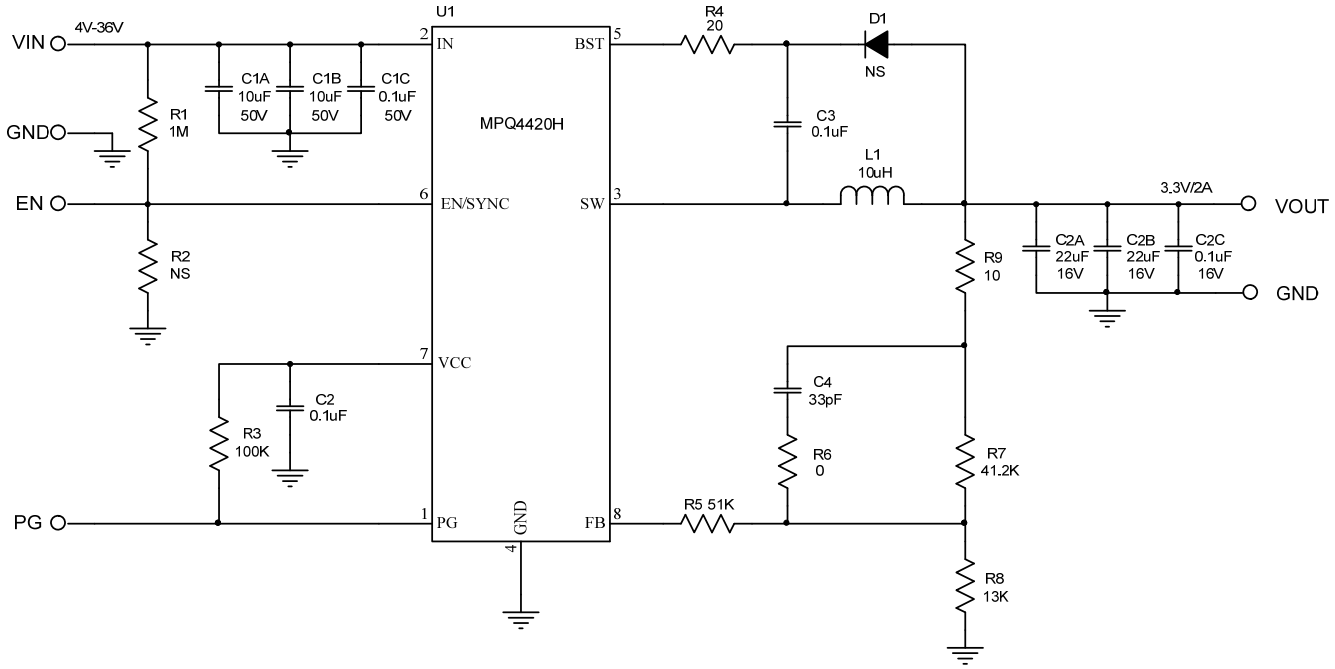
EVALUATION BOARD SCHEMETIC



EVBL4420H-J-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufactuer_P/N
2	C1A, C1B	10μF	Ceramic Cap., 50V, X7R	1210	muRata	GRM32ER71H106KA12L
1	C1C	0.1μF	Ceramic Cap., 50V, X7R	0603	muRata	GRM188R71H104KA93D
2	C2A, C2B	22μF	Ceramic Cap., 16V, X7R	1210	muRata	GRM32ER71C226KE79
3	C2, C2C, C3	0.1μF	Ceramic Cap., 16V, X7R	0603	muRata	GRM188R71C104KA01D
1	C4	33pF	Ceramic Cap., 50V, C0G	0603	muRata	GRM1885C1H330JA01D
1	D1	NS				
1	L1	10μH	Inductor, 27mOhm DCR, 7A	SMD	MPS	MPL-AL6060-100
1	R1	1M	Film Res., 5%	0603	Yageo	RC0603JR-071ML
1	R3	100k	Film Res., 1%	0603	Yageo	RC0603FR-07100KL
1	R4	20	Film Res., 1%	0603	Yageo	RC0603FR-0720RL
1	R5	51k	Film Res., 1%	0603	Yageo	RC0603FR-0751KL
1	R6	0	Film Res., 5%	0603	Yageo	RC0603JR-070RL
1	R7	41.2k	Film Res., 1%	0603	Yageo	RC0603FR-0741K2L
1	R8	13k	Film Res., 1%	0603	Yageo	RC0603FR-0713KL
1	R9	10	Film Res., 1%	0603	Yageo	RC0603FR-0710RL
1	R2	NS				
1	U1		Step-Down Regulator	TSOT23-8	MPS	MPQ4420HGJ

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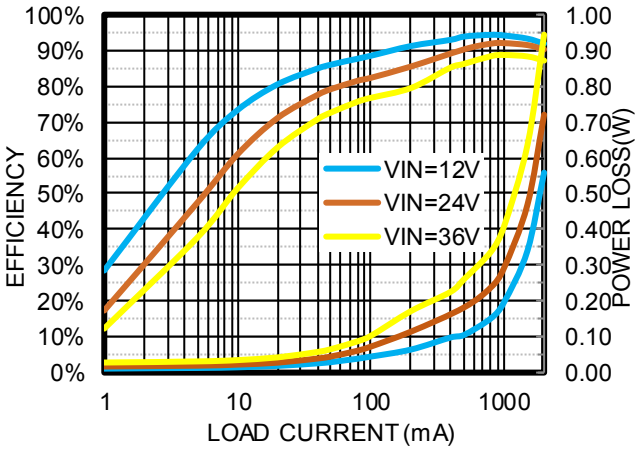
EVB TEST RESULTS

V_{IN} = 12V, V_{OUT} =3.3V, C_{OUT} = 2x22µF, L = 10µH, T_A = +25°C, unless otherwise noted.

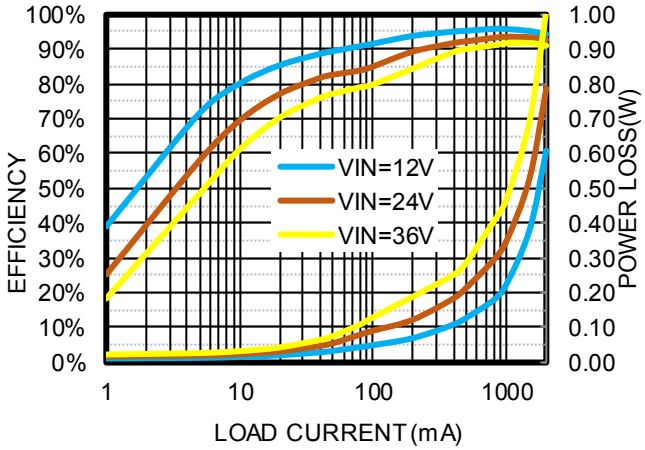
EFFICIENCY VS. LOAD CURRENT

V_{OUT}=3.3V



EFFICIENCY VS. LOAD CURRENT

V_{OUT}=5V



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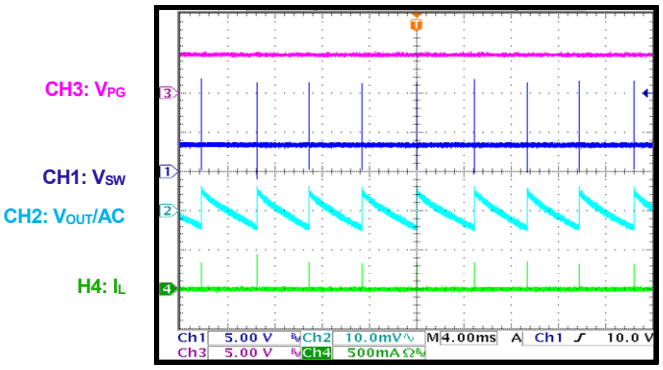
EVB TEST RESULTS *(continued)*

V_{IN} = 12V, V_{OUT} =3.3V, C_{OUT} = 2x22µF, L = 10µH, T_A = +25°C, unless otherwise noted.

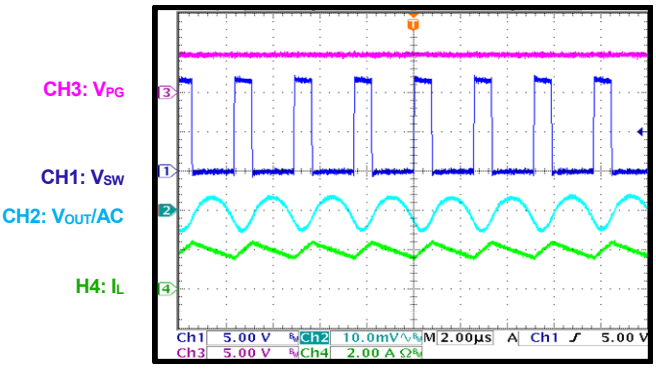
Steady State

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 0A



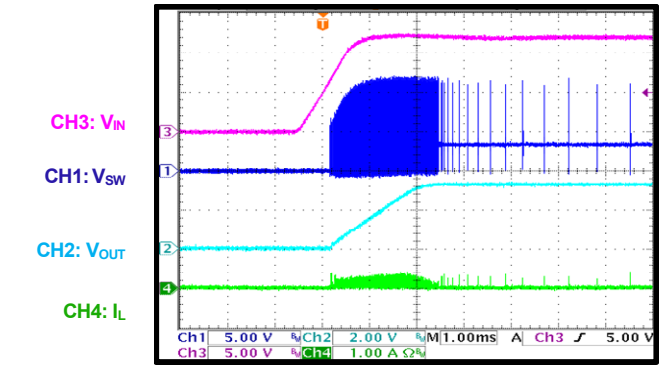
Steady State

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 2A



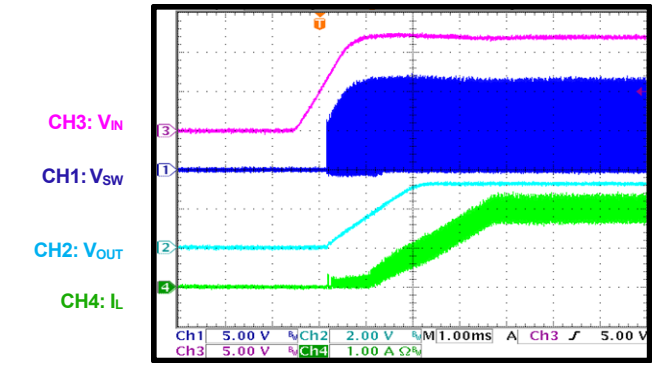
Power On

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 0A



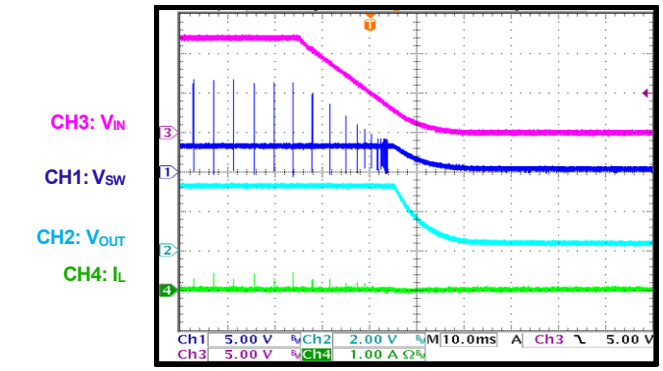
Power On

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 2A



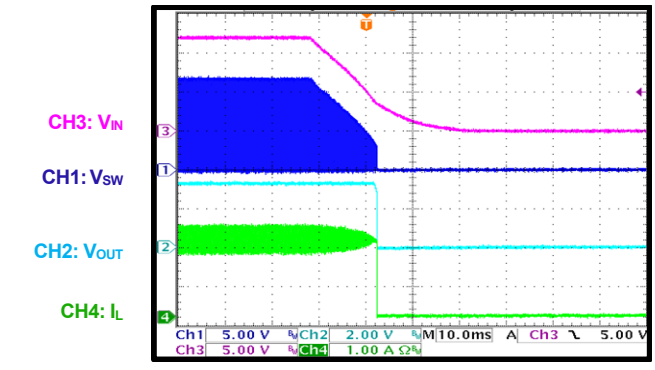
Power Off

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 0A



Power Off

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 2A



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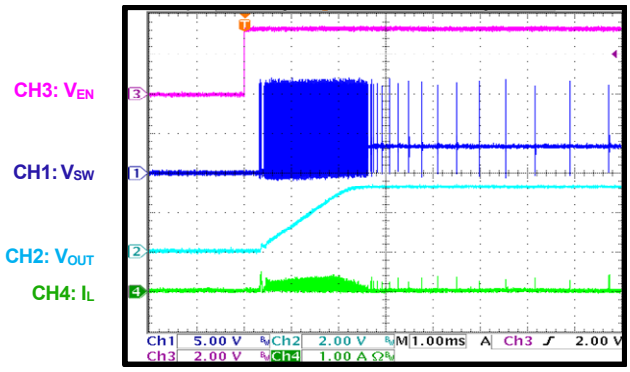
EVB TEST RESULTS *(continued)*

V_{IN} = 12V, V_{OUT} =3.3V, C_{OUT} = 2x22µF, L = 10µH, T_A = +25°C, unless otherwise noted.

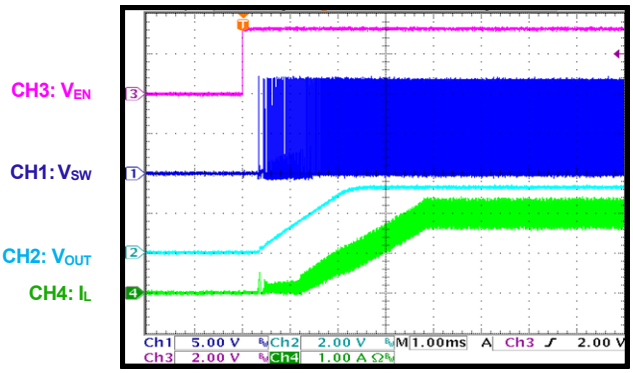
EN On

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 0A



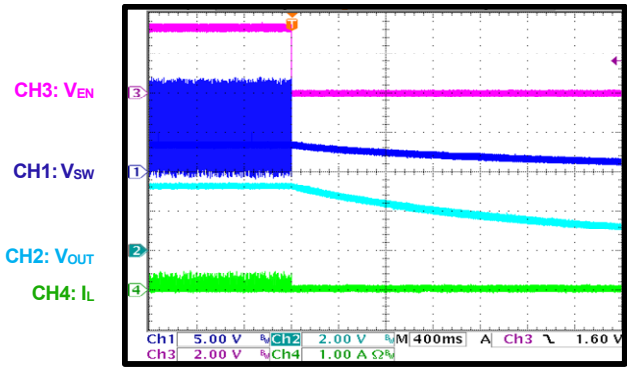
EN On

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 2A



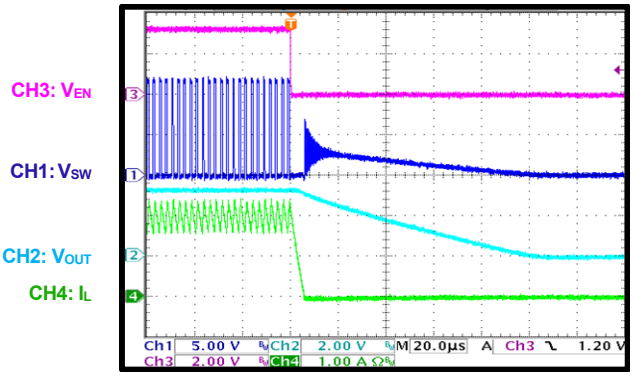
EN Off

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 0A



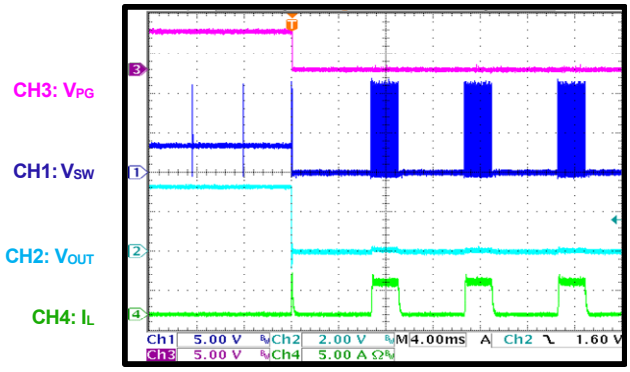
EN Off

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 2A



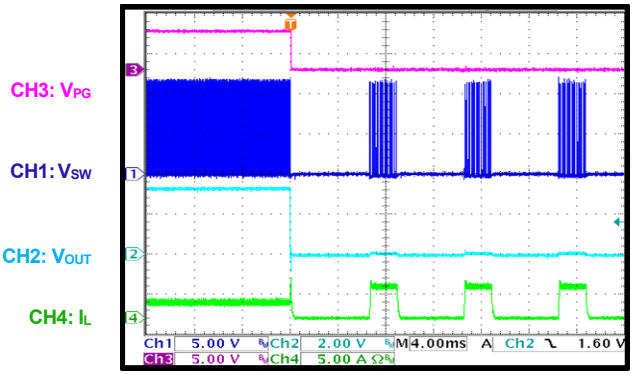
SCP Entry

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 0A



SCP Entry

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 2A



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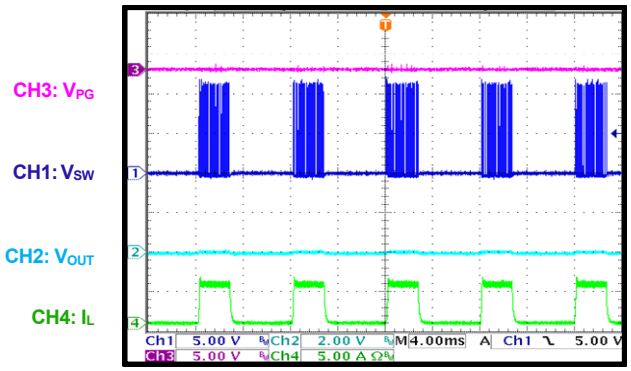
EVB TEST RESULTS *(continued)*

V_{IN} = 12V, V_{OUT} =3.3V, C_{OUT} = 2x22µF, L = 10µH, T_A = +25°C, unless otherwise noted.

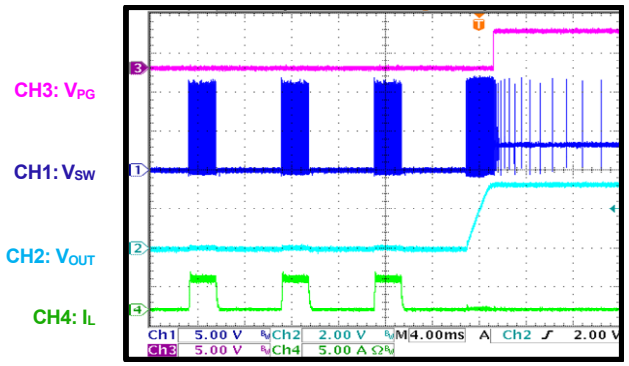
SCP Steady State

V_{IN}=12V



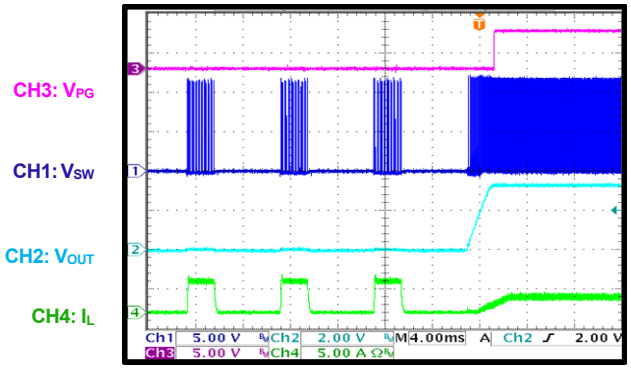
SCP Recovery

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 0A



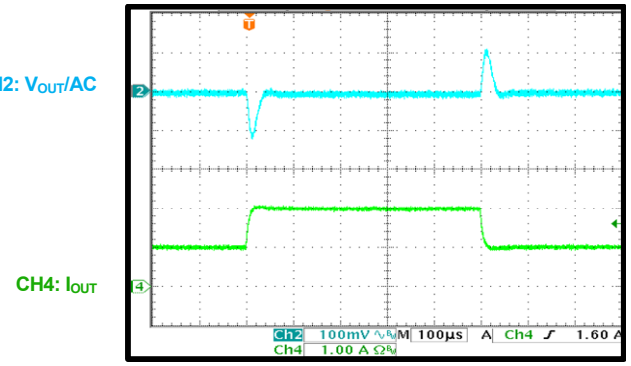
SCP Recovery

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 2A



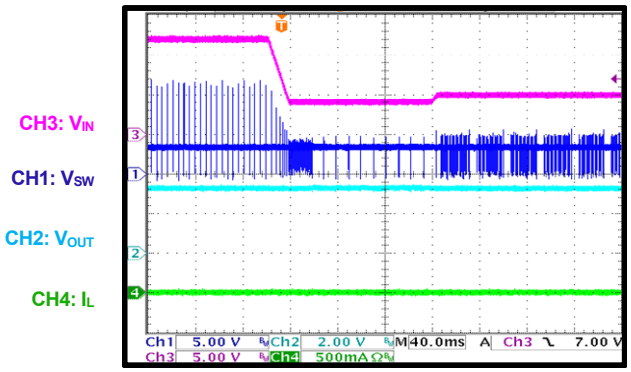
Load Transient

V_{IN} = 12V, V_{OUT} = 3.3V, I_{OUT} = 1A-2A



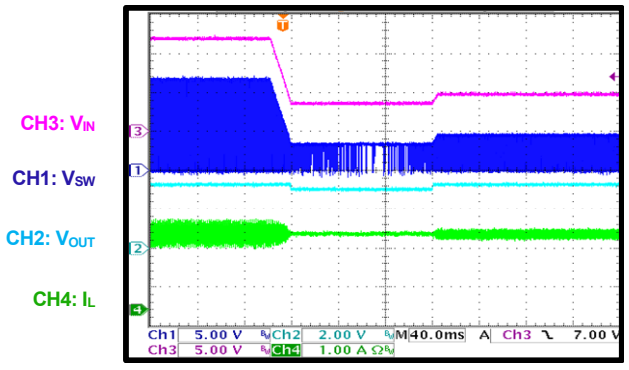
Cold Crank

V_{IN} = 12V→4V→5V, I_{OUT} = 0A



Cold Crank

V_{IN} = 12V→4V→5V, I_{OUT} = 2A



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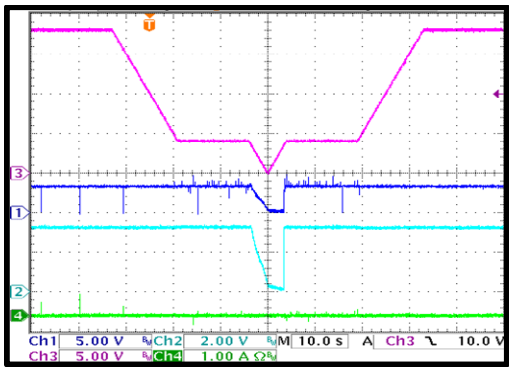
EVB TEST RESULTS *(continued)*

V_{IN} = 12V, V_{OUT} =3.3V, C_{OUT} = 2x22µF, L = 10µH, T_A = +25°C, unless otherwise noted.

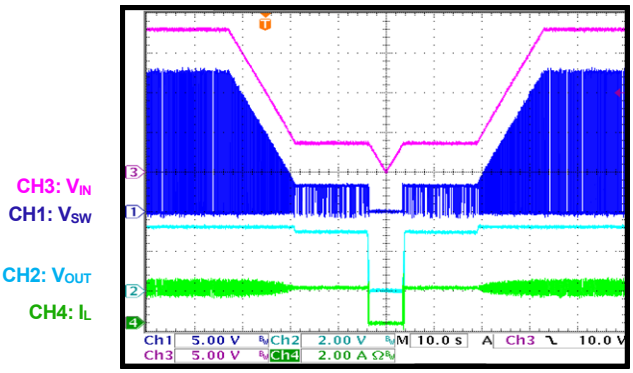
VIN Ramp Down and Up

V_{IN} = 18V→4V→0V→4V→18V, I_{OUT} = 0A



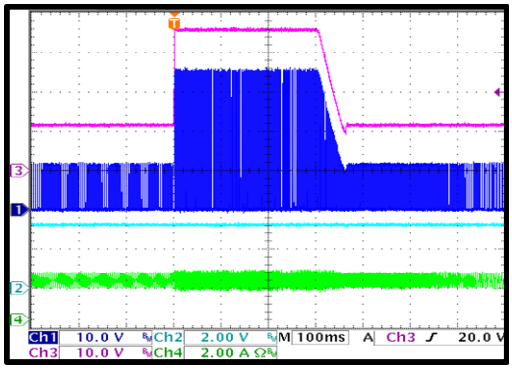
VIN Ramp Down and Up

V_{IN} = 18V→4V→0V→4V→18V, I_{OUT} = 2A



Load Dump

V_{IN} = 12V→36V→12V, I_{OUT} = 2A



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PRINTED CIRCUIT LAYOUT

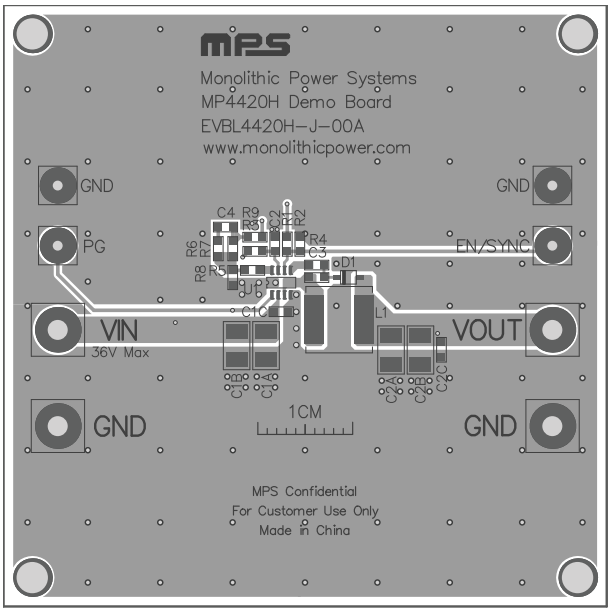

Figure 1 – Top Silk Layer and Top Layer

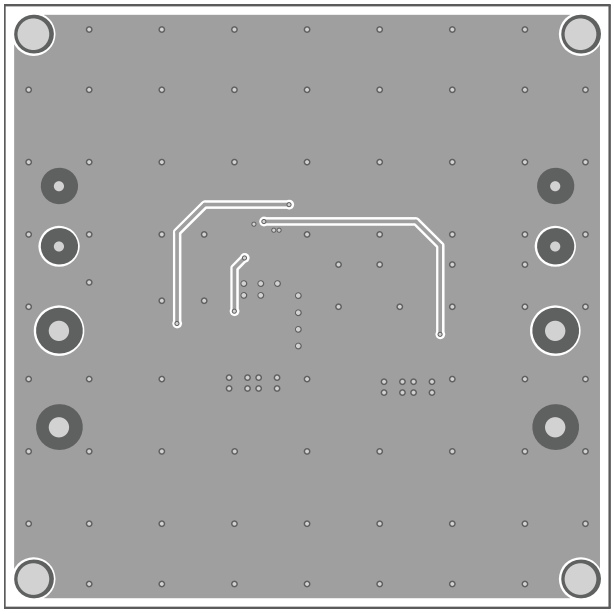

Figure 2 – Bottom Layer

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QUICK START GUIDE

1. Connect the positive and negative terminals of the load to the VOUT and GND pins respectively.
2. Preset the power supply output to between 4V to 36V, and then turn it off.
3. Connect the positive and negative terminals of the power supply output to the VIN and GND pins respectively.
4. Turn the power supply on. The MP4420H/MPQ4420H will automatically startup.
5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.65V to turn on the regulator, drive EN less than 1.05V to turn it off. An internal 500kΩ resistor from EN/SYNC to GND allows EN/SYNC to be floated to shut down the chip.
6. Connect the EN input pin through a pull-up resistor (R1) to any voltage connected to the V_{IN} pin. Make sure R1 big enough to limit the EN input current to less than 150μA. For example, with 12V connected to V_{IN}, make sure R1 ≥ (12V – 6.5V) ÷ 150μA = 36.7kΩ. Connect the EN pin directly to a voltage source without any pull-up resistor requires limiting voltage amplitude to ≤6V to prevent damage to the internal zener diode at EN pin.
7. Connect the EN input pin with an external clock with a range of 200kHz to 2.2MHz after output voltage is set to synchronize the internal clock rising edge to the external clock rising edge. The pulse width of external clock signal should be less than 1.7μs.
8. Use R7 and R8 to set the output voltage with V_{FB}=0.792V. For R7=41.2kΩ, R8 can be determined by:

$$R8 = \frac{R7}{\frac{V_{OUT}}{0.792} - 1}$$

Follow the Application Information section in the device datasheet to recalculate the compensation, inductor and output capacitor values when output voltage is changed.

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