



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

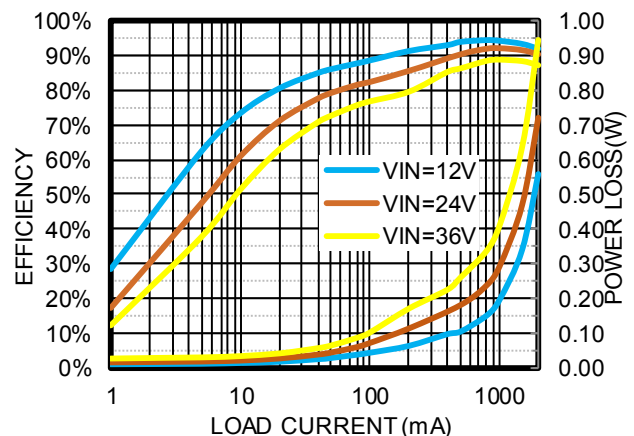


(L x W x H) 2.5" x 2.5" x 0.2"
(6.35cm x 6.35cm x 0.5cm)

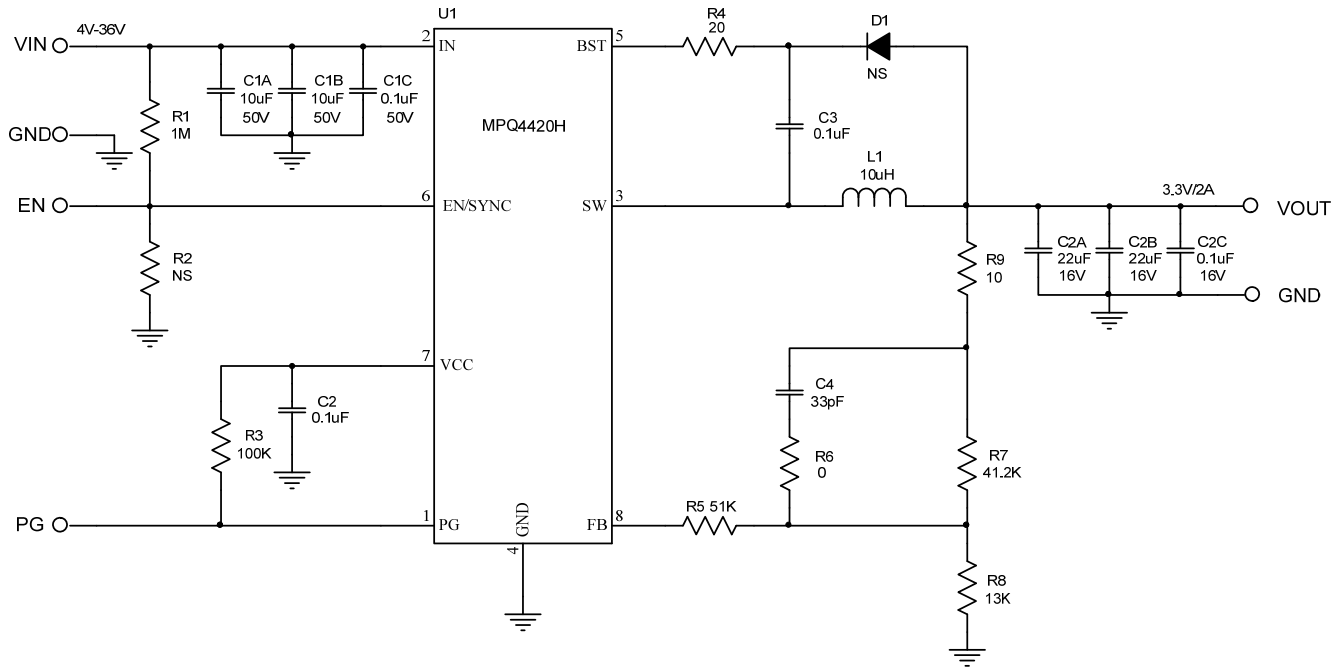
| Board Number | MPS IC Number |
|-----------------|---------------|
| EVBL4420H-J-00A | MPQ4420HGJ |

Efficiency vs. Load Current

$V_{OUT}=3.3V$



EVALUATION BOARD SCHEMATIC



EVBL4420H-J-00A BILL OF MATERIALS

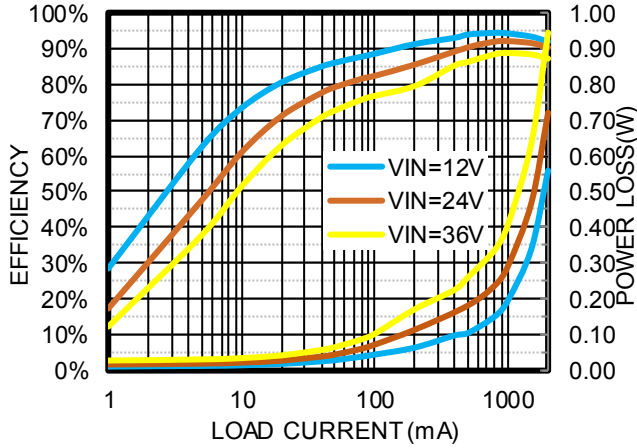
| Qty | Ref | Value | Description | Package | Manufacturer | Manufacturer_P/N |
|-----|-------------|-------|--------------------------|----------|--------------|--------------------|
| 2 | C1A, C1B | 10µF | Ceramic Cap., 50V, X7R | 1210 | muRata | GRM32ER71H106KA12L |
| 1 | C1C | 0.1µF | Ceramic Cap., 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 |

EVB TEST RESULTS

$V_{IN} = 12V$, $V_{OUT} = 3.3V$, $C_{OUT} = 2x22\mu F$, $L = 10\mu H$, $T_A = +25^\circ C$, unless otherwise noted.

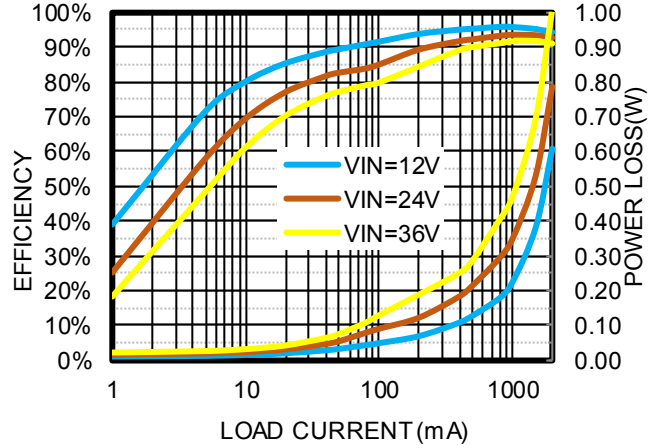
EFFICIENCY VS. LOAD CURRENT

$V_{OUT} = 3.3V$



EFFICIENCY VS. LOAD CURRENT

$V_{OUT} = 5V$

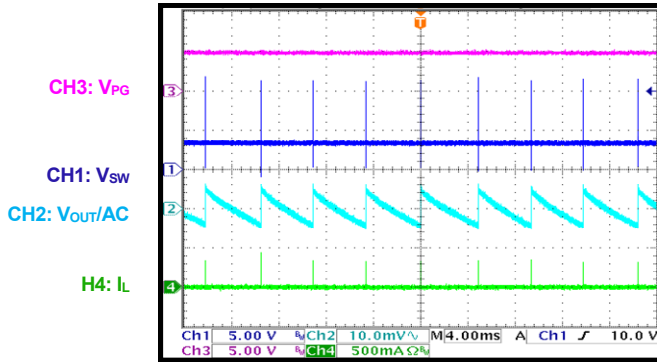


EVB TEST RESULTS *(continued)*

$V_{IN} = 12V$, $V_{OUT} = 3.3V$, $C_{OUT} = 2x22\mu F$, $L = 10\mu H$, $T_A = +25^\circ C$, unless otherwise noted.

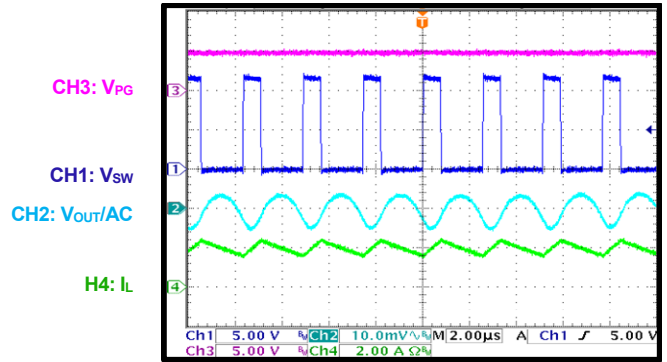
Steady State

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



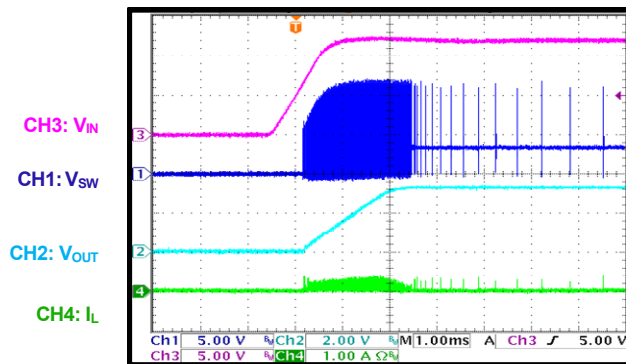
Steady State

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



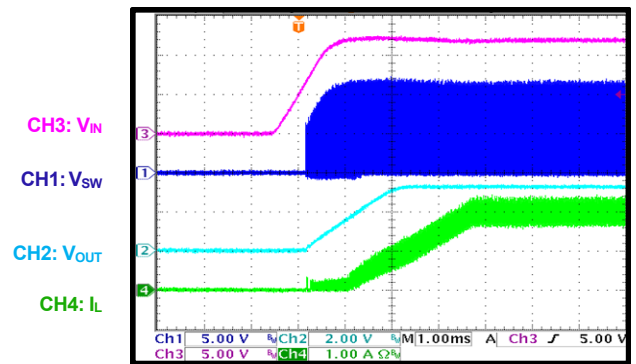
Power On

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



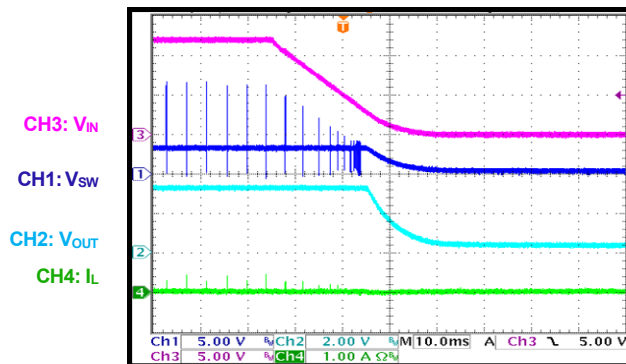
Power On

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



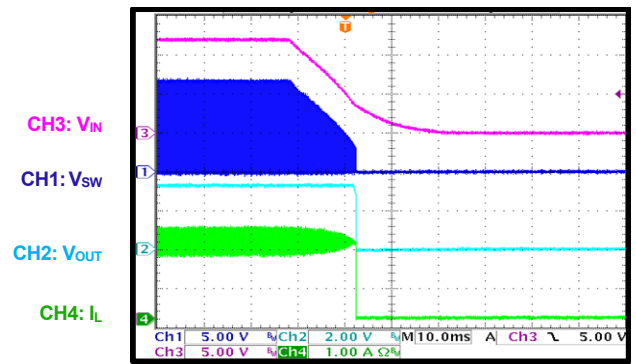
Power Off

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



Power Off

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

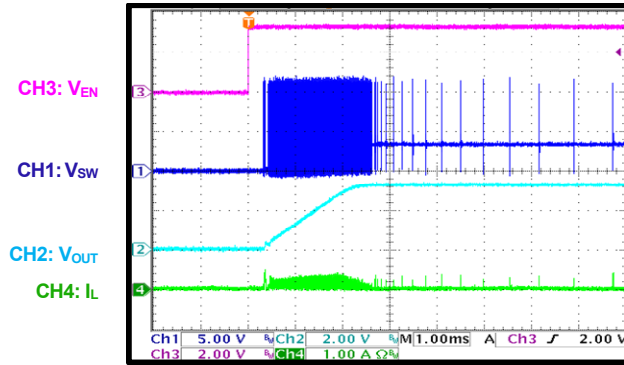


EVB TEST RESULTS (continued)

$V_{IN} = 12V$, $V_{OUT} = 3.3V$, $C_{OUT} = 2x22\mu F$, $L = 10\mu H$, $T_A = +25^\circ C$, unless otherwise noted.

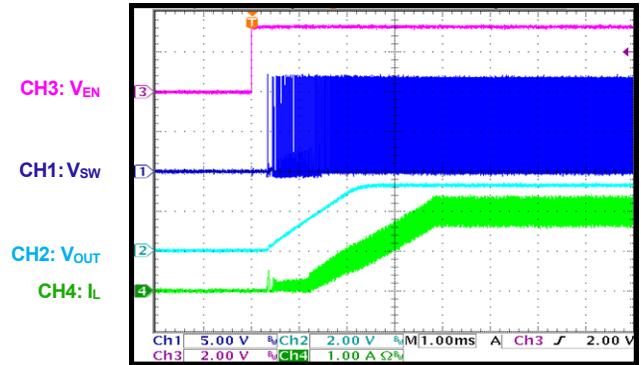
EN On

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



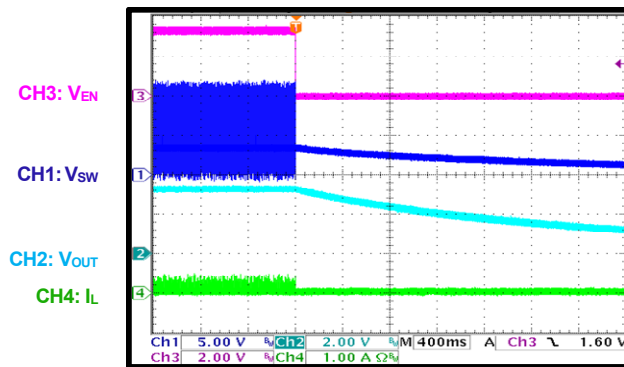
EN On

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



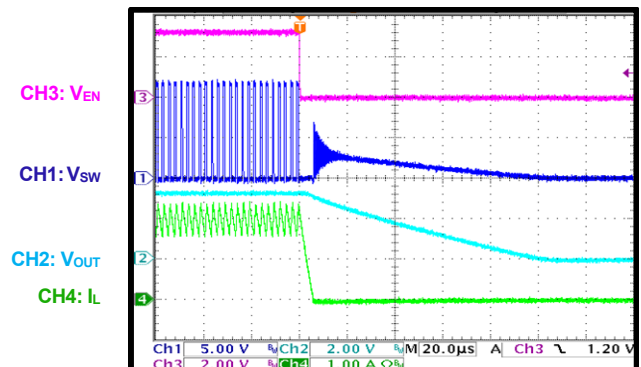
EN Off

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



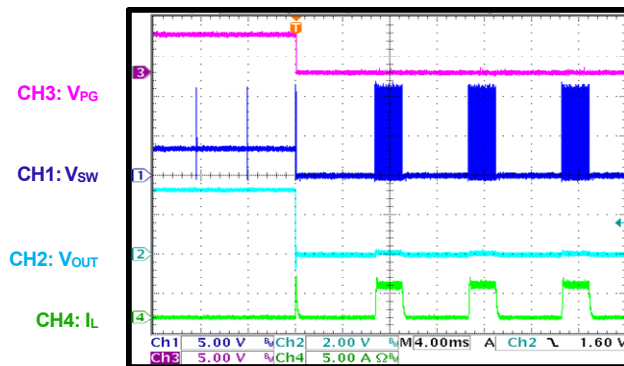
EN Off

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



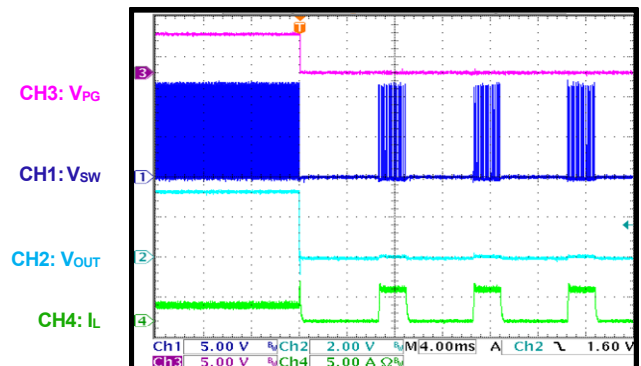
SCP Entry

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



SCP Entry

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

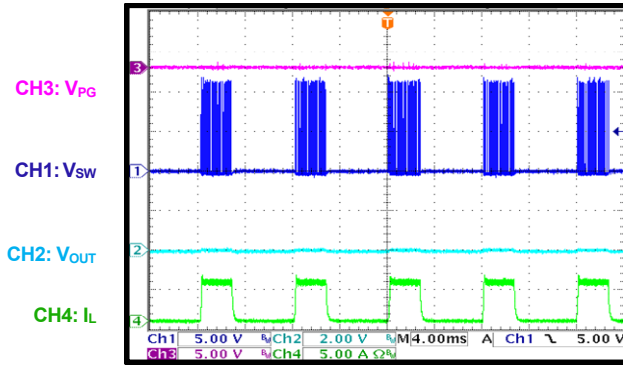


EVB TEST RESULTS (continued)

$V_{IN} = 12V$, $V_{OUT} = 3.3V$, $C_{OUT} = 2x22\mu F$, $L = 10\mu H$, $T_A = +25^\circ C$, unless otherwise noted.

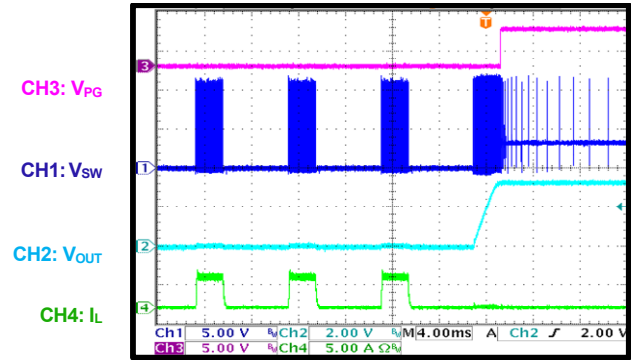
SCP Steady State

$V_{IN} = 12V$



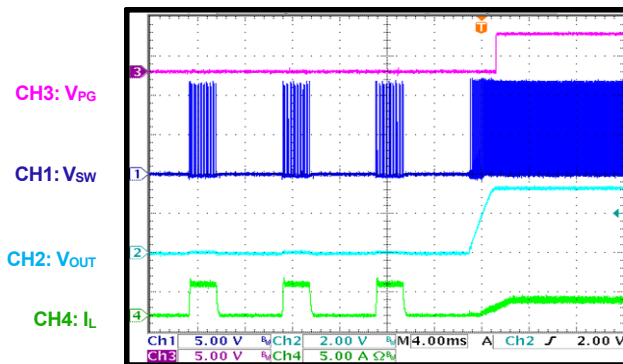
SCP Recovery

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



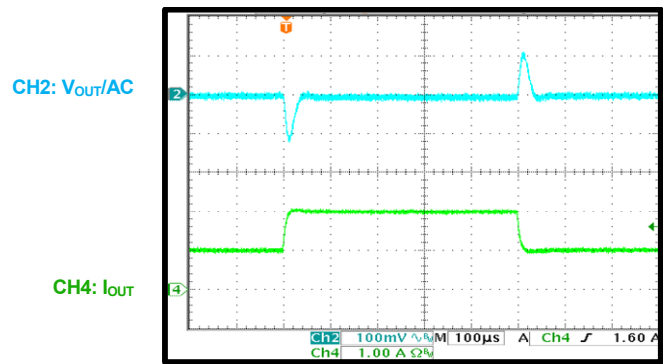
SCP Recovery

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



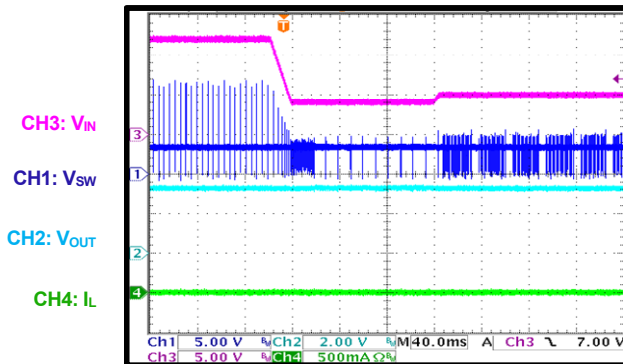
Load Transient

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



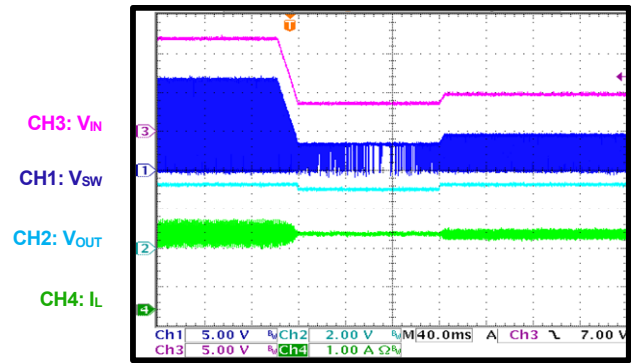
Cold Crank

$V_{IN} = 12V \rightarrow 4V \rightarrow 5V$, $I_{OUT} = 0A$



Cold Crank

$V_{IN} = 12V \rightarrow 4V \rightarrow 5V$, $I_{OUT} = 2A$

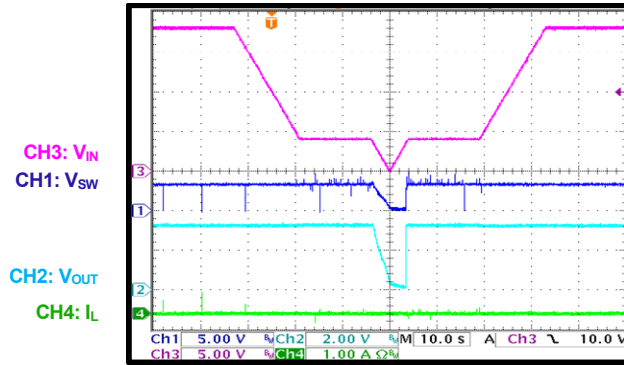


EVB TEST RESULTS (continued)

$V_{IN} = 12V$, $V_{OUT} = 3.3V$, $C_{OUT} = 2x22\mu F$, $L = 10\mu H$, $T_A = +25^\circ C$, unless otherwise noted.

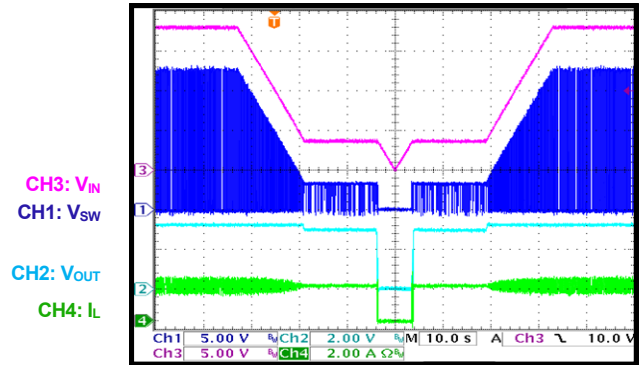
VIN Ramp Down and Up

$V_{IN} = 18V \rightarrow 4V \rightarrow 0V \rightarrow 4V \rightarrow 18V$, $I_{OUT} = 0A$



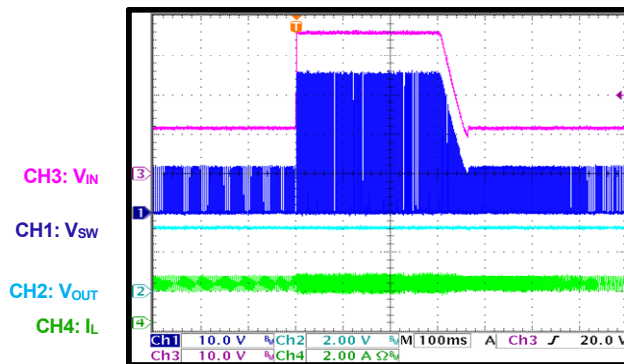
VIN Ramp Down and Up

$V_{IN} = 18V \rightarrow 4V \rightarrow 0V \rightarrow 4V \rightarrow 18V$, $I_{OUT} = 2A$



Load Dump

$V_{IN} = 12V \rightarrow 36V \rightarrow 12V$, $I_{OUT} = 2A$



PRINTED CIRCUIT LAYOUT

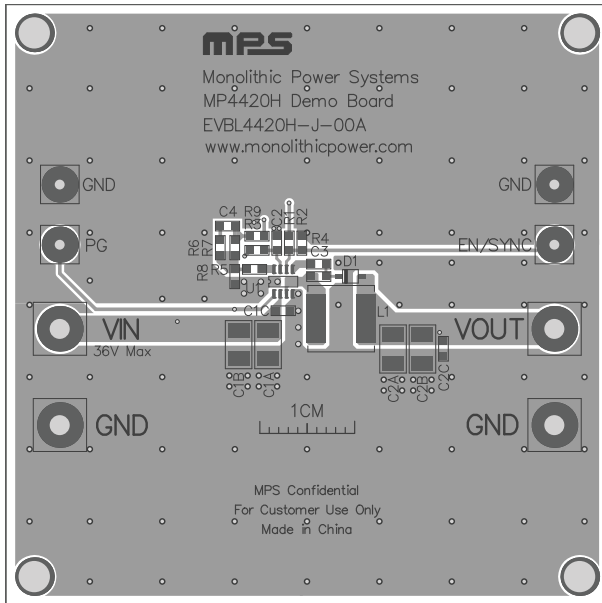


Figure 1 – Top Silk Layer and Top Layer

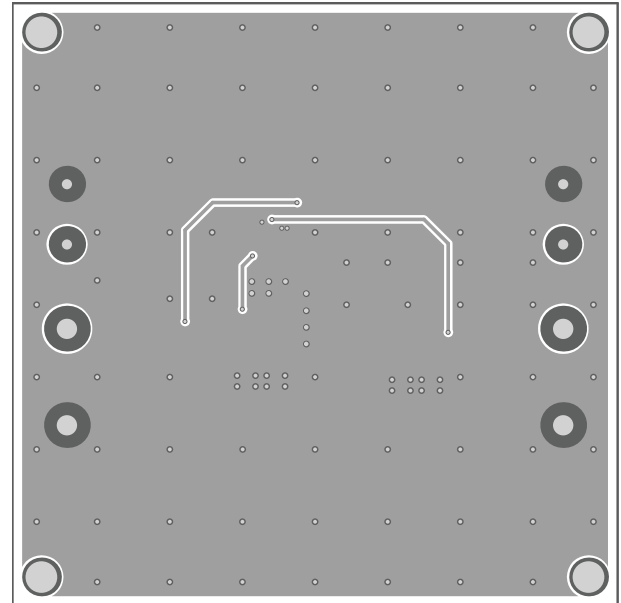


Figure 2 – Bottom Layer

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 VIN pin. Make sure R1 big enough to limit the EN input current to less than 150μA. For example, with 12V connected to VIN, make sure $R1 \geq (12V - 6.5V) \div 150\mu A = 36.7k\Omega$. Connect the EN pin directly to a voltage source without any pull-up resistor requires limiting voltage amplitude to $\leq 6V$ 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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