



The Future of Analog IC Technology®

## EV4420-J-00A

2A, 36V, Synchronous  
Step Down Converter

### DESCRIPTION

The EV4420-J-00A is an evaluation board for the MP4420/MPQ4420, 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 MP4420/MPQ4420 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 MPQ4420 requires a minimal number of readily-available standard external components, and is available in a space-saving TSOT23-8 package.

### ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input Voltage	$V_{IN}$	4-30	V
Output Voltage	$V_{OUT}$	3.3	V
Output Current	$I_{OUT}$	2	A

### FEATURES

- Wide 4V to 30V Continuous Operating Input Range
- 36V Input Transient Tolerance for Automotive Load Dump
- 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
- Output Adjustable from 0.8V
- Available in an TSOT23-8 package
- Available in AEC-Q100 Grade 1

### APPLICATIONS

- Automotive
- Industrial Control System
- Distributed Power Systems

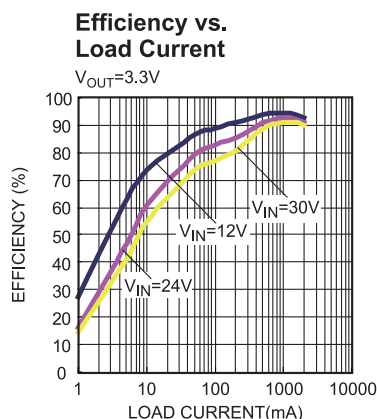
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### EV4420-J-00A EVALUATION BOARD

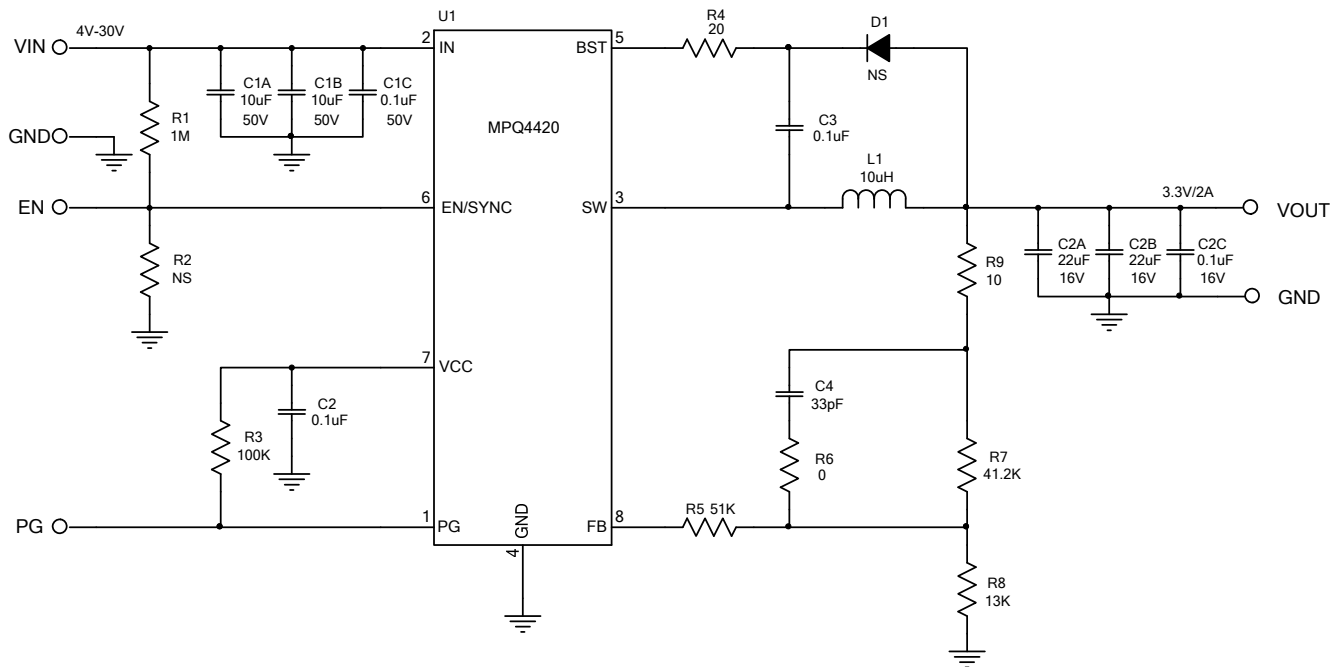


(L x W x H) 2.5" x 2.5" x 0.2"  
(6.35cm x 6.35cm x 0.5cm)

Board Number	MPS IC Number
EV4420-J-00A	MPQ4420GJ



## EVALUATION BOARD SCHEMATIC



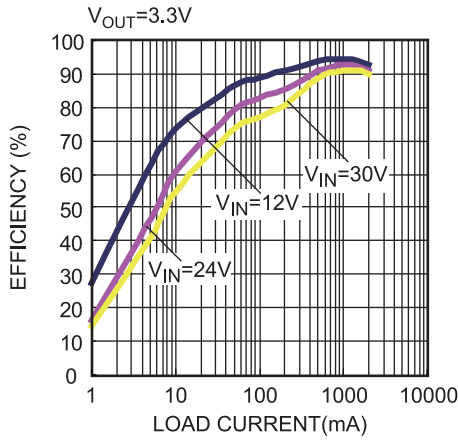
# EV4420-J-00A BILL OF MATERIALS

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, 40.9mOhm DCR, 4.9A	SMD	Coilcraft	XAL5050-103ME
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	MPQ4420GJ

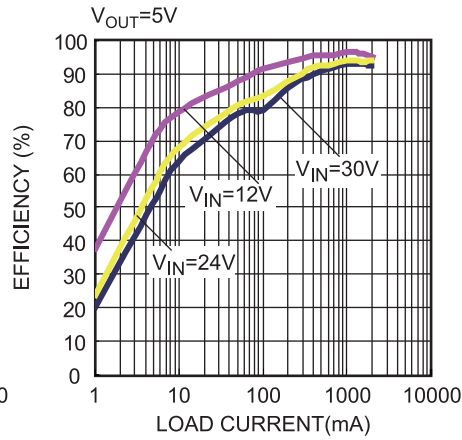
## EVB TEST RESULTS

$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $C_{OUT} = 2 \times 22\mu F$ ,  $L = 10\mu H$ ,  $T_A = +25^\circ C$ , unless otherwise noted.

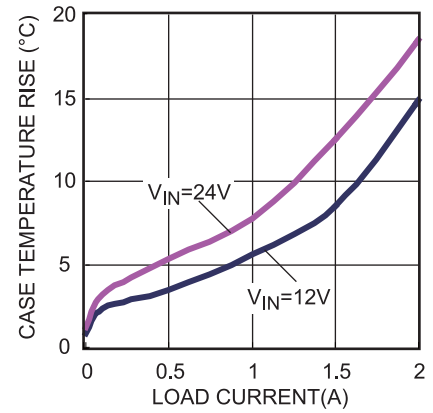
**Efficiency vs. Load Current**



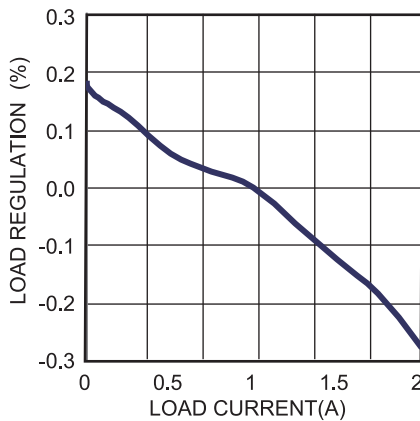
**Efficiency vs. Load Current**



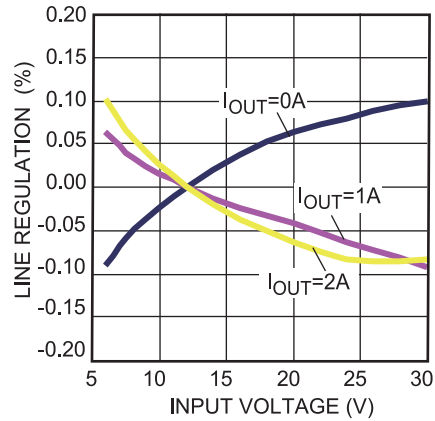
**Thermal Rise**



**Load Regulation**

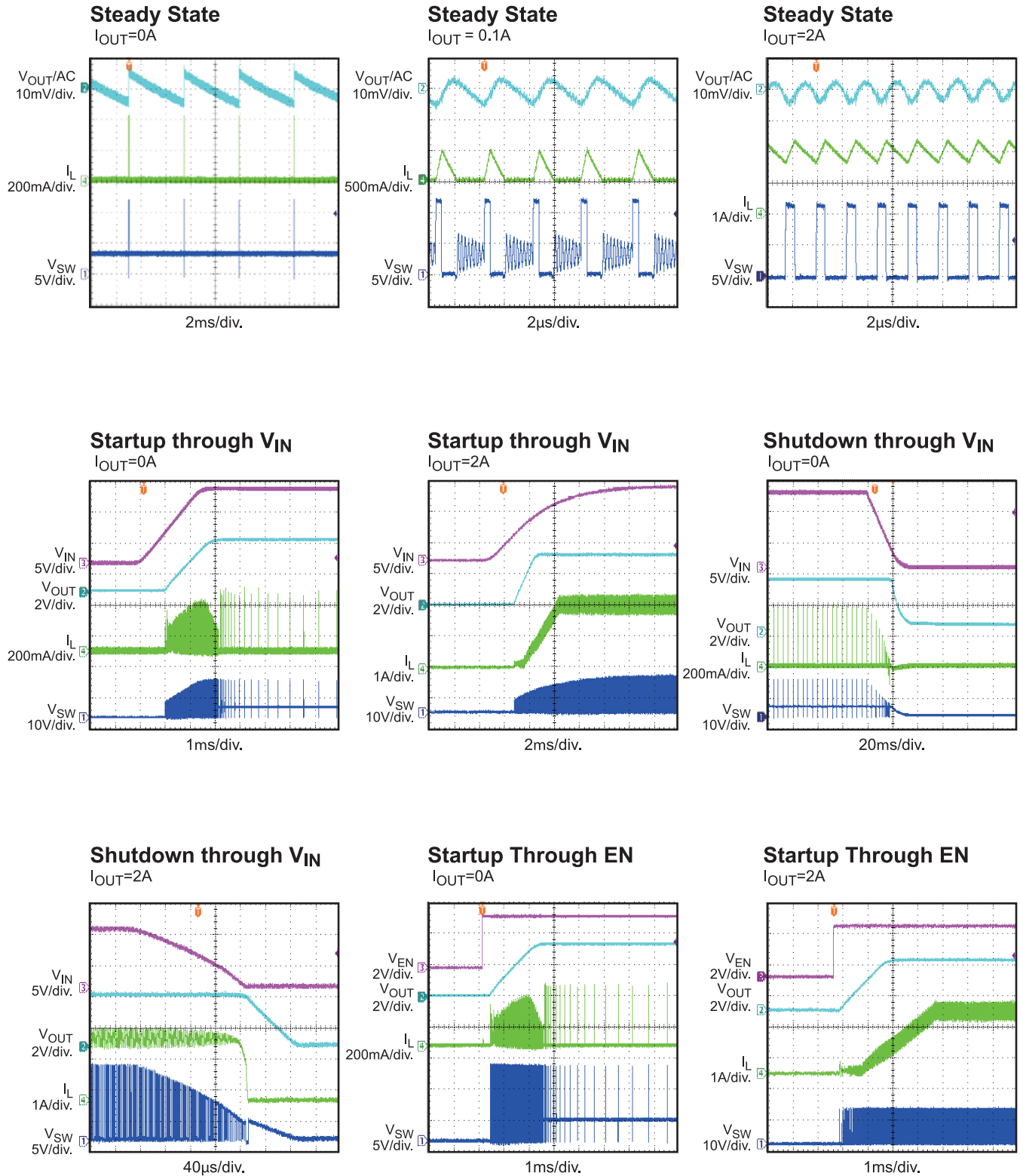


**Line Regulation**



## EVB TEST RESULTS *(continued)*

$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $C_{OUT} = 2 \times 22\mu F$ ,  $L = 10\mu H$ ,  $T_A = +25^\circ C$ , unless otherwise noted.

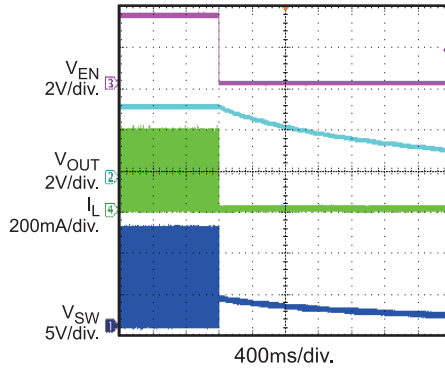


## EVB TEST RESULTS *(continued)*

$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $C_{OUT} = 2 \times 22\mu F$ ,  $L = 10\mu H$ ,  $T_A = +25^\circ C$ , unless otherwise noted.

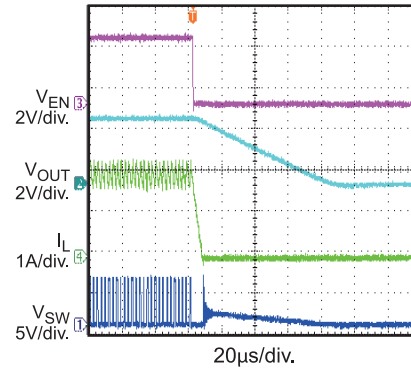
**Shutdown Through EN**

$I_{OUT} = 0A$



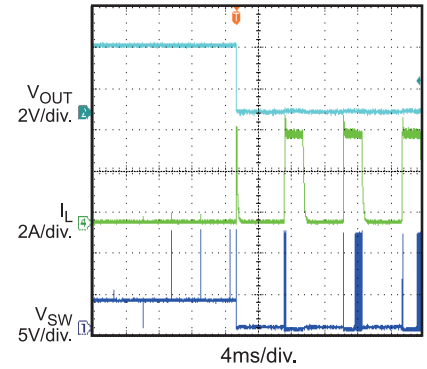
**Shutdown Through EN**

$I_{OUT} = 2A$



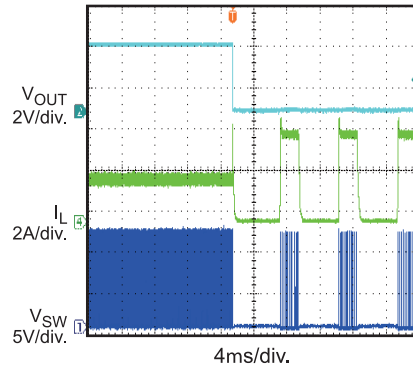
**SCP Entry**

$I_{OUT} = 0A$  to Short Circuit

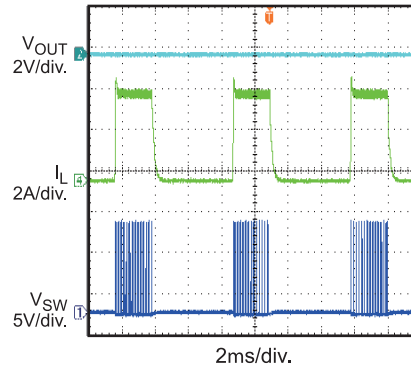


**SCP Entry**

$I_{OUT} = 2A$  to Short Circuit

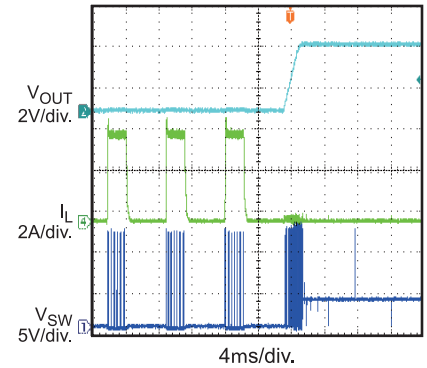


**SCP Steady State**



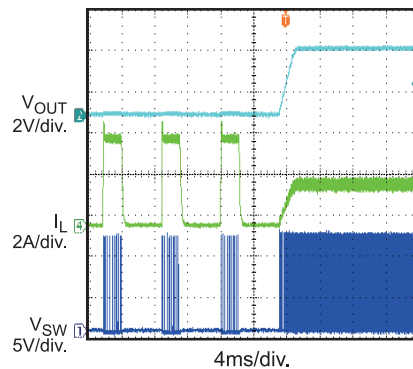
**SCP Recovery**

Short Circuit to  $I_{OUT} = 0A$



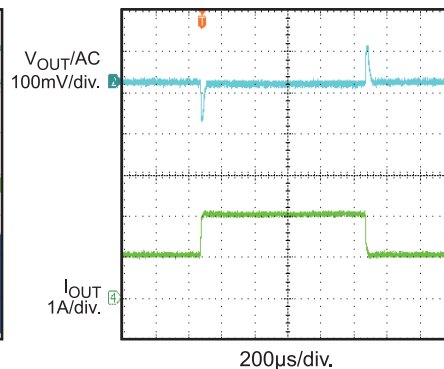
**SCP Recovery**

Short Circuit to  $I_{OUT} = 2A$



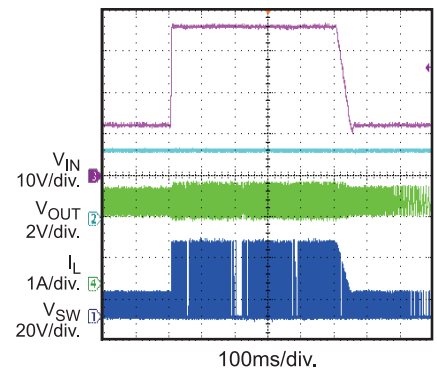
**Load Transient**

$I_{OUT} = 1A \leftrightarrow 2A$ ,  $1.6A/\mu s$



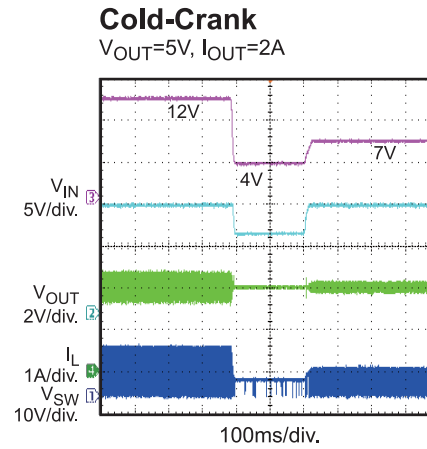
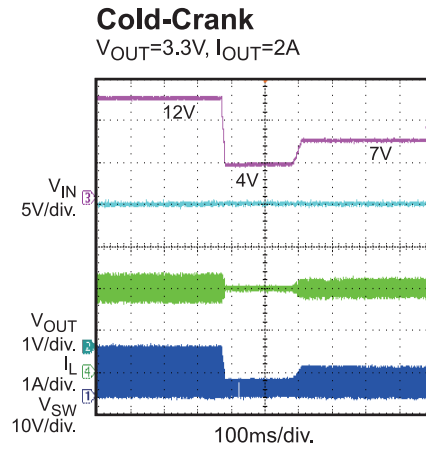
**Load Dump**

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



## EVb TEST RESULTS *(continued)*

$V_{IN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $C_{OUT} = 2 \times 22\mu F$ ,  $L = 10\mu H$ ,  $T_A = +25^\circ C$ , unless otherwise noted.



## PRINTED CIRCUIT LAYOUT

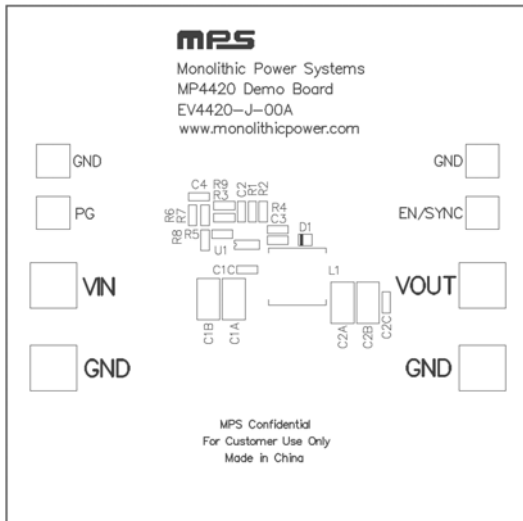


Figure 1 – Top Silk Layer

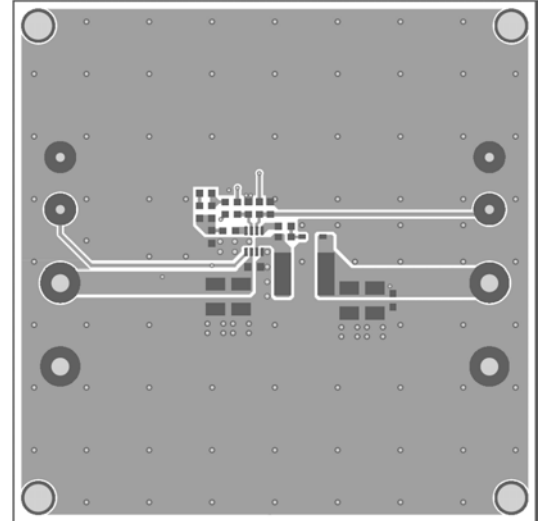


Figure 2 – Top Layer

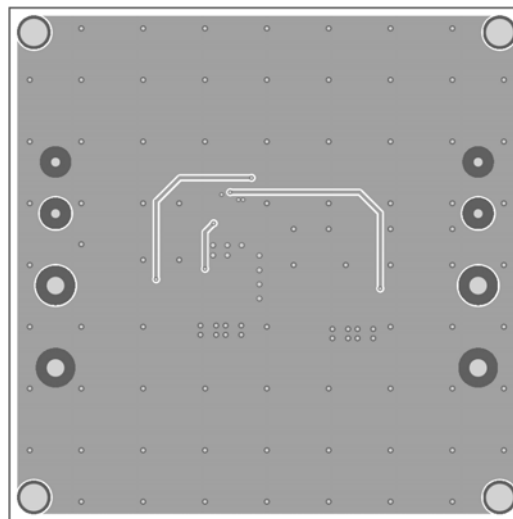


Figure 3 – Bottom Layer

## 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 30V, 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 MP4420/MPQ4420 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 ≤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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