



The Future of Analog IC Technology®

# EVQ8616-L-6-00A

High Efficiency, 6A, 6V  
Synchronous Step-down Converter  
Evaluation Board

## DESCRIPTION

The EVQ8616-L-6-00A is an evaluation board for the MPQ8616GL-6, a high efficiency monolithic synchronous step-down converter.

The Evaluation Board can deliver 6A continuous load current from a 3V to 6V input with excellent load and line regulation.

Constant-On-Time (COT) control mode provides fast transient response and eases loop stabilization.

The Evaluation Board can be turned on or shut down via a remote ON/OFF input that is reference to ground. This input is compatible with popular logic devices.

## ELECTRICAL SPECIFICATION

| Parameter           | Symbol    | Value | Units |
|---------------------|-----------|-------|-------|
| Input Voltage       | $V_{IN}$  | 3 – 6 | V     |
| Output Voltage      | $V_{OUT}$ | 1.2   | V     |
| Output Current      | $I_{OUT}$ | 6     | A     |
| Switching Frequency | $f_{sw}$  | 600   | kHz   |

## FEATURES

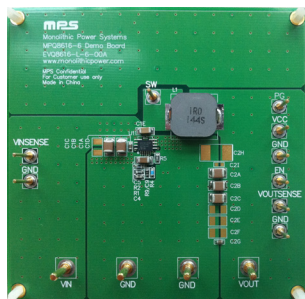
- Wide 3V to 6V Operating Input Range
- 6A Output Current
- 19.8m  $\Omega$ /15.3m  $\Omega$  Internal Power MOSFETs
- Proprietary Switching Loss Reduction Technique
- Adaptive COT for Ultrafast Transient Response
- 1% Reference Voltage Over -20 to +85 Junction Temperature Range
- Programmable Soft Start Time
- Pre-Bias Start up
- Programmable Switching Frequency from 300kHz to 1MHz.
- Non-Latch OCP, Non-Latch OVP Protection and Thermal Shutdown
- Available in a QFN3x4 package

## APPLICATIONS

- Telecom System Base Station
- Networking System
- Server
- Personal Video Recorders
- Flat Panel Television and Monitors
- Distributed Power Systems

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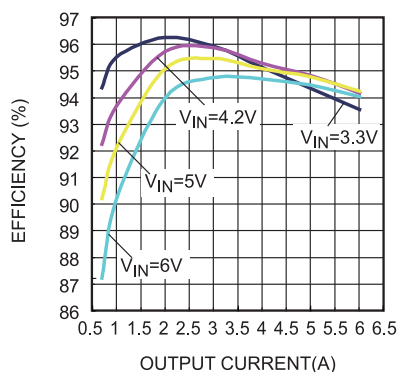
## EVQ8616-L-6-00A EVALUATION BOARD



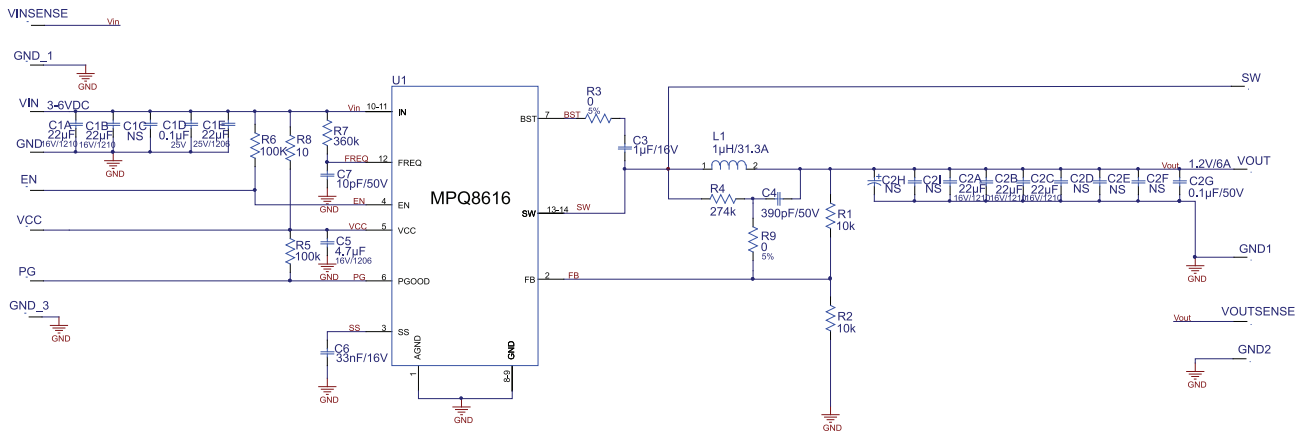
(L x W x H) 8.55cm x 8.55cm x 1.6cm

| Board Number    | MPS IC Number |
|-----------------|---------------|
| EVQ8616-L-6-00A | MPQ8616GL-6   |

### Efficiency



## EVALUATION BOARD SCHEMATIC



## EVQ8616-L-6-00A BILL OF MATERIALS

| Qty | Ref                               | Value | Description                      | Package | Manufacture | Part Number        |
|-----|-----------------------------------|-------|----------------------------------|---------|-------------|--------------------|
| 7   | C1A, C1B, C1C, C2A, C2B, C2C, C2D | 22µF  | Ceramic Capacitor; 16V;X7R;      | 1210    | Murata      | GRM32ER71C226KE18L |
| 2   | C1D, C2G                          | 0.1µF | Ceramic Capacitor; 50V;X7R;0603; | 0603    | Murata      | GRM188R71H104KA93D |
| 1   | C1E                               | 22µF  | Ceramic Capacitor; 25V;X5R       | 1206    | Murata      | GRM31CR61E226KE15  |
| 4   | C2E, C2F, C2H,C2I                 | NS    | Ceramic Capacitor; 16V;X7R;      | 1210    | Murata      | GRM32ER71C226KE18L |
| 1   | C3                                | 1µF   | Ceramic Capacitor; 16V;X7R;0603; | 0603    | Murata      | GRM188R71C105KA12D |
| 1   | C4                                | 390pF | Ceramic Capacitor; 50V;X7R;0603  | 0603    | LION        | 0603B391K500T      |
| 1   | C5                                | 4.7µF | Ceramic Capacitor; 16V;X7R;1206  | 1206    | Murata      | GRM31CR71C475KA01  |
| 1   | C6                                | 33nF  | Ceramic Capacitor; 16V;X7R;0603; | 0603    | Murata      | GRM188R71C333KAO1D |
| 1   | C7                                | 10pF  | Ceramic Capacitor; 50V;X7R;0603; | 0603    | Murata      | GRM1885C1H100JA01  |

**EVQ8616-L-6-00A BILL OF MATERIALS** *(continued)*

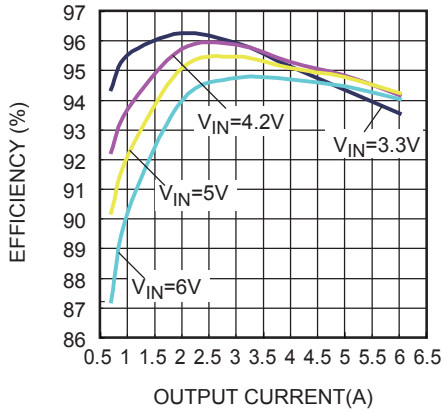
| Qty | Ref   | Value     | Description                           | Package      | Manufacture | Part Number      |
|-----|---|-----------|---------------------------------------|--------------|-------------|------------------|
| 9   | EN, GND2,<br>GND_1,<br>GND_3, PG,<br>SW, VCC,<br>VINSENSE,<br>VOUTSENSE |           | Connector                             | CONN/1M<br>M |             |                  |
| 4   | GND, GND1,<br>VIN, VOUT   |           | Connector                             | CONN/2M<br>M |             |                  |
| 1   | L1  | 1 $\mu$ H | Inductor;1 $\mu$ H;<br>1.72mOhm;31.3A | SMD          | TOKO        | FDU1250C-1R0M    |
| 2   | R1, R2  | 10k       | Film Resistor;1%;                     | 0603         | Yageo       | RC0603FR-0710KL  |
| 2   | R3, R9  | 0         | Film Resistor;5%;                     | 0603         | Yageo       | RC0603JR-070RL   |
| 1   | R4  | 274k      | Film Resistor;1%;                     | 0603         | Yageo       | RC0603FR-07274KL |
| 2   | R5, R6  | 100k      | Film Resistor;1%;                     | 0603         | Yageo       | RC0603FR-07100KL |
| 1   | R7  | 360k      | Film Resistor;1%;                     | 0603         | Yageo       | RC0603FR-07360KL |
| 1   | R8  | 10        | Film Resistor;1%;                     | 0603         | Yageo       | RC0603FR-0710RL  |
| 1   | U1  |           | Step Down<br>Converter                | QFN 3X4      | MPS         | MPQ8616GL-6      |

### EVB TEST RESULTS

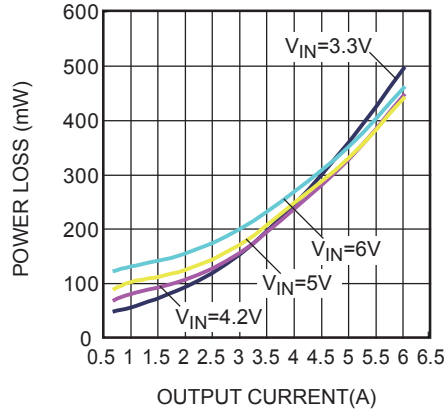
Performance waveforms are tested on the EVQ8616-L-6-00A.

$V_{IN} = 5V$ ,  $V_{OUT} = 1.2V$ ,  $L = 1.0\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

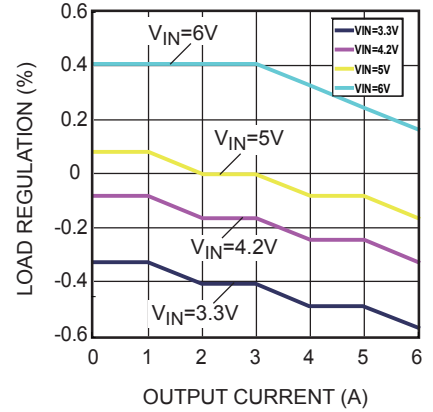
Efficiency



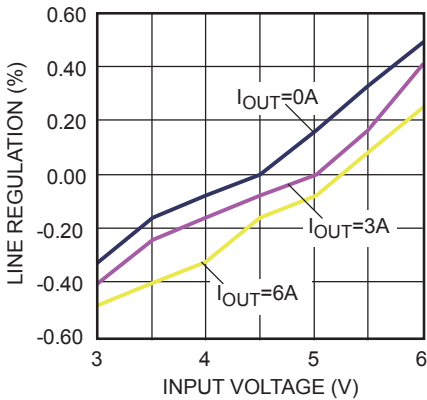
Power Loss



Load Regulation



Line Regulation

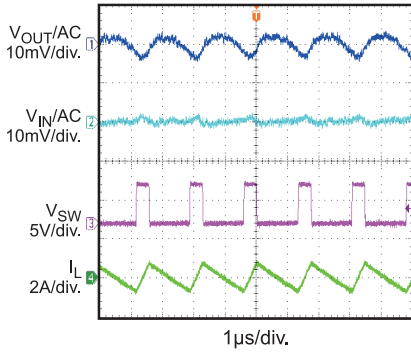


**EVB TEST RESULTS** (continued)

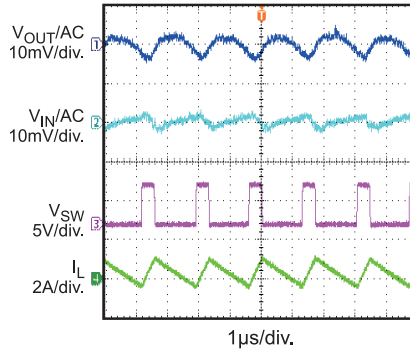
Performance waveforms are tested on the EVQ8616-L-6-00A.

$V_{IN} = 5.0V$ ,  $V_{OUT} = 1.2V$ ,  $L = 1.0\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

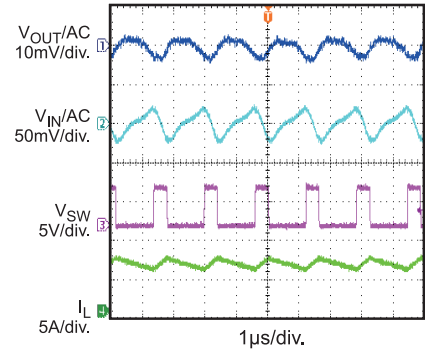
**Input/Output Voltage Ripple**  
 $I_{OUT} = 0A$



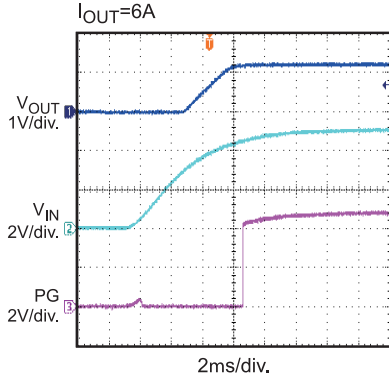
**Input/Output Voltage Ripple**  
 $I_{OUT} = 0.3A$



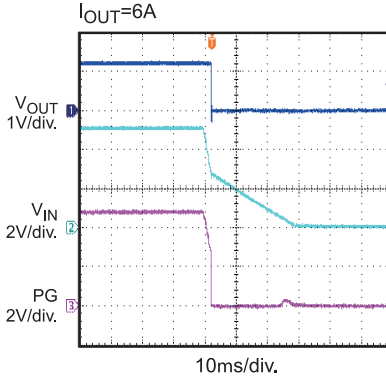
**Input/Output Voltage Ripple**  
 $I_{OUT} = 6A$



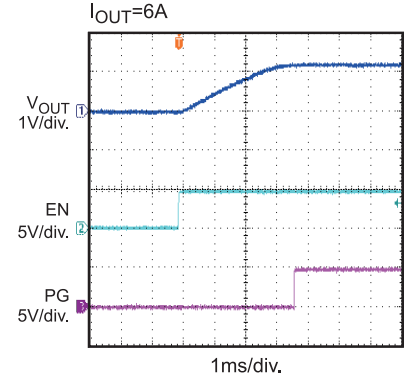
**Power Good Through VIN Start-Up**  
 $I_{OUT} = 6A$



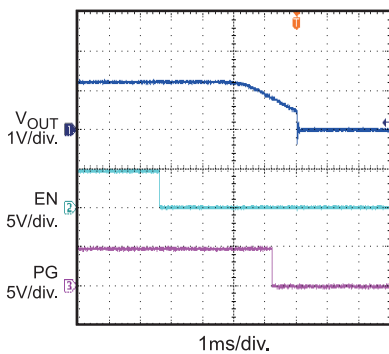
**Power Good Through Shutdown**  
 $I_{OUT} = 6A$



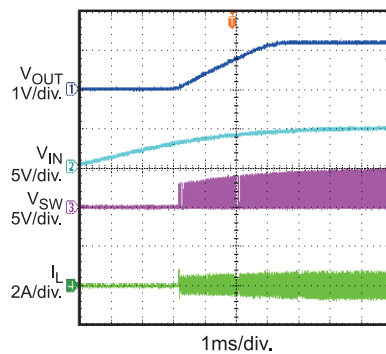
**Power Good Through EN Start-Up**  
 $I_{OUT} = 6A$



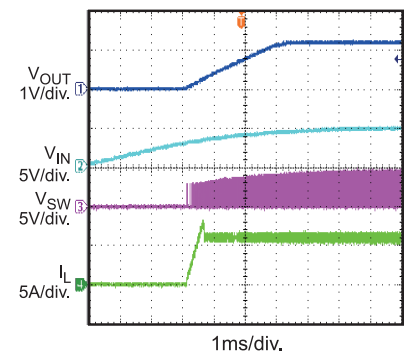
**Power Good Through EN Shutdown**  
 $I_{OUT} = 6A$



**Start-Up Through VIN**  
 $I_{OUT} = 0A$



**Start-Up Through VIN**  
 $I_{OUT} = 6A$

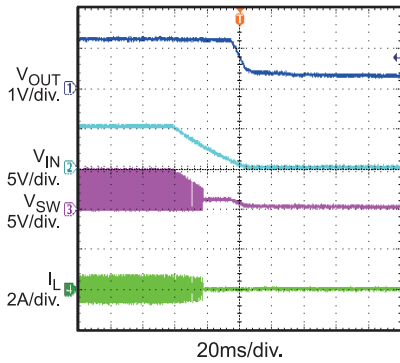


**EVB TEST RESULTS (continued)**

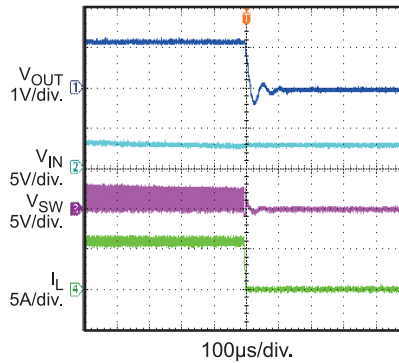
Performance waveforms are tested on the EVQ8616-L-6-00A.

$V_{IN} = 5.0V$ ,  $V_{OUT} = 1.2V$ ,  $L = 1.0\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

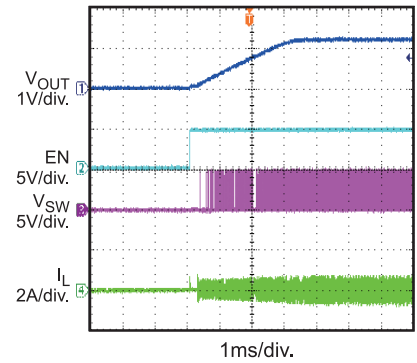
**Shutdown Through  $V_{IN}$**   
 $I_{OUT} = 0A$



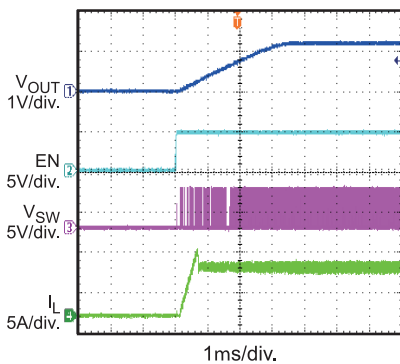
**Shutdown Through  $V_{IN}$**   
 $I_{OUT} = 6A$



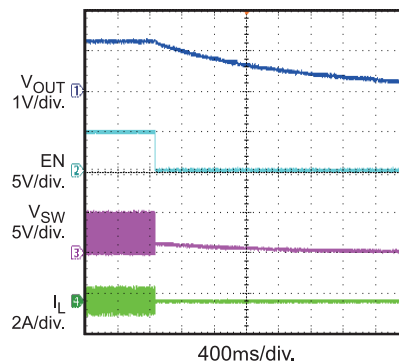
**Start-Up Through EN**  
 $I_{OUT} = 0A$



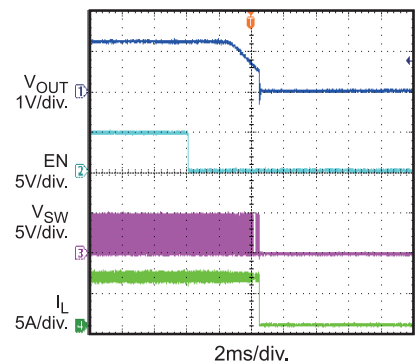
**Start-Up Through EN**  
 $I_{OUT} = 6A$



**Shutdown Through EN**  
 $I_{OUT} = 0A$

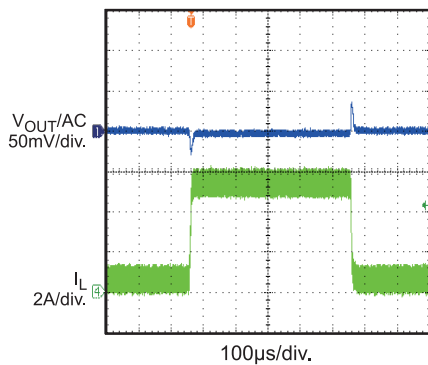


**Shutdown Through EN**  
 $I_{OUT} = 6A$

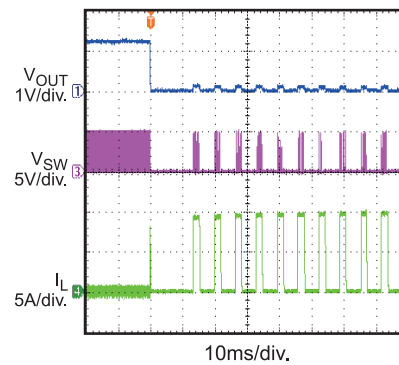


**Transient**

$I_{OUT} = 0.6A - 5.4A @ 2.5A/\mu s$ ,  
 $f_{SW} = 600kHz$ ,  $C_{OUT} = 4 \times 22\mu F$

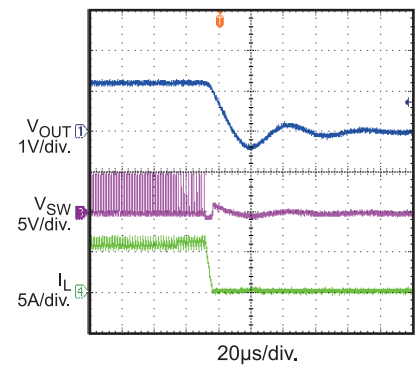


**Short Circuit Protection**



**Thermal Shutdown**

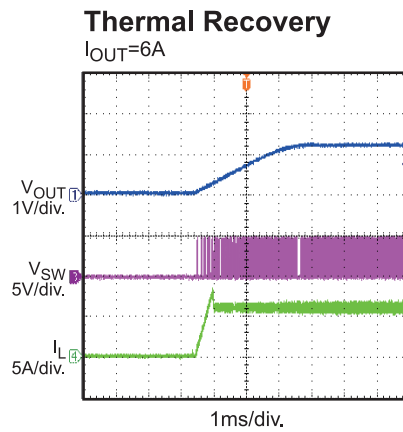
$I_{OUT} = 6A$



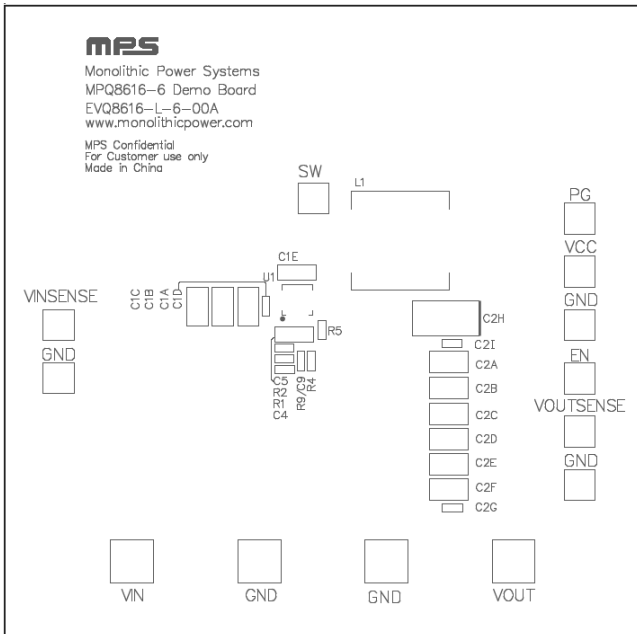
**EVB TEST RESULTS** *(continued)*

Performance waveforms are tested on the EVQ8616-L-6-00A.

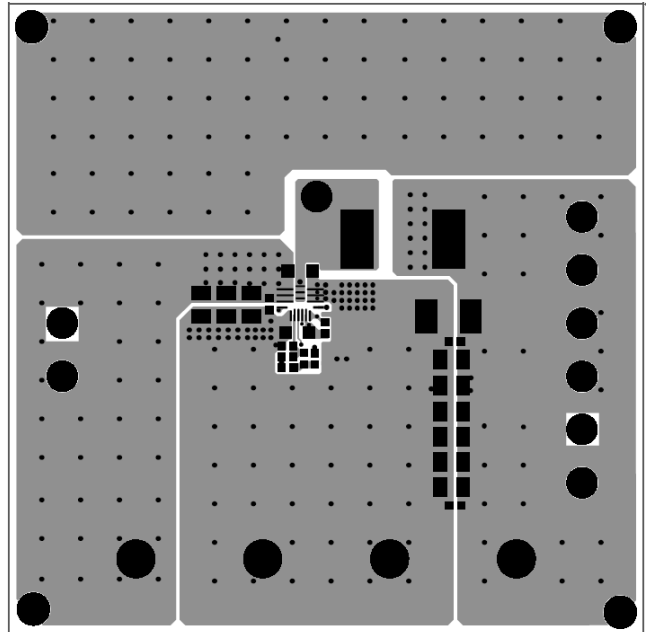
$V_{IN} = 5.0V$ ,  $V_{OUT} = 1.2V$ ,  $L = 1.0\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.



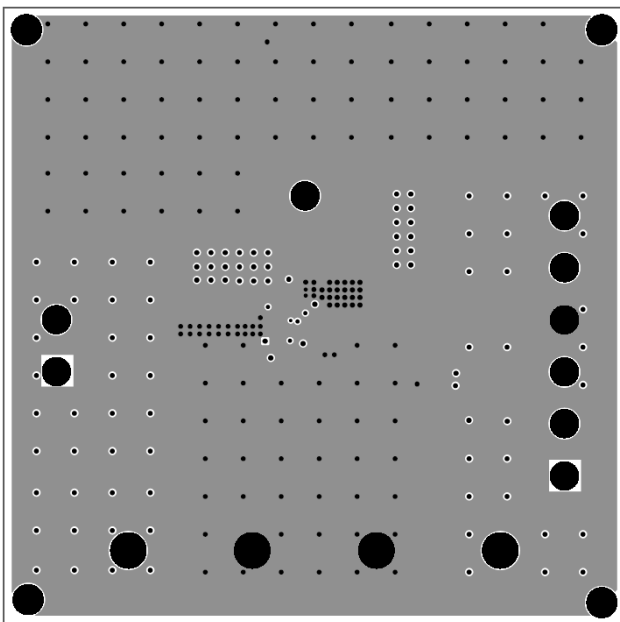
**PRINTED CIRCUIT BOARD LAYOUT**



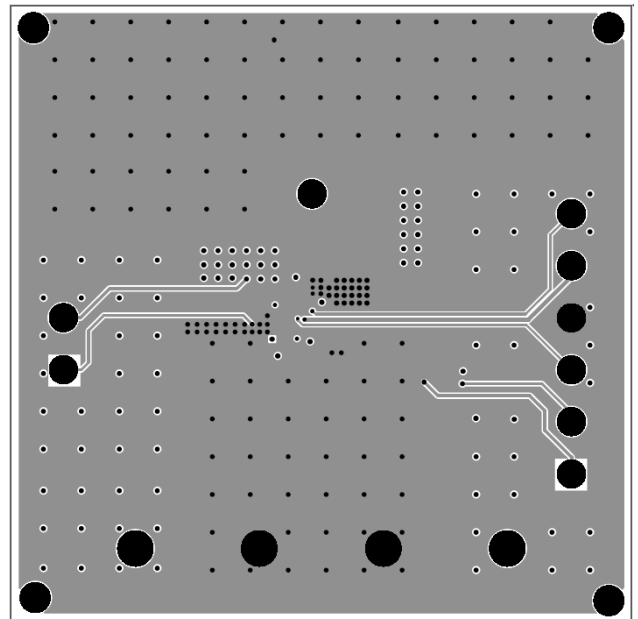
**Figure 1: Top Silk Layer**



**Figure 2: Top Layer**



**Figure 3: Inner Layer1**



**Figure 4: Inner Layer2**



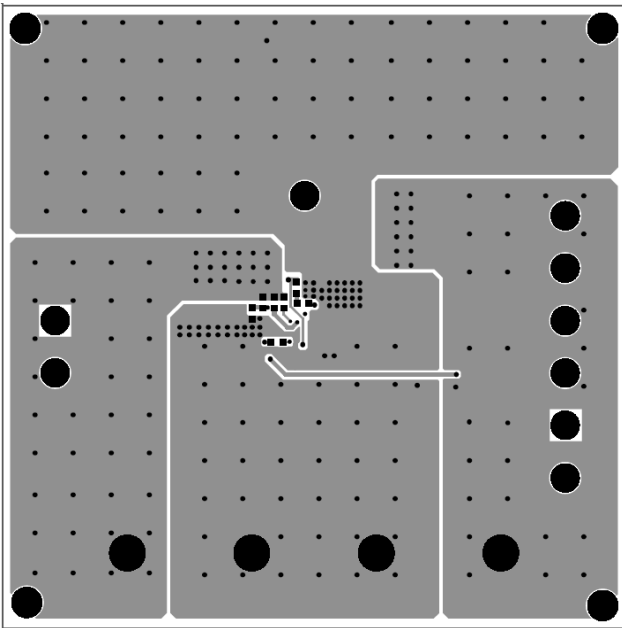


Figure 5: Bottom Layer

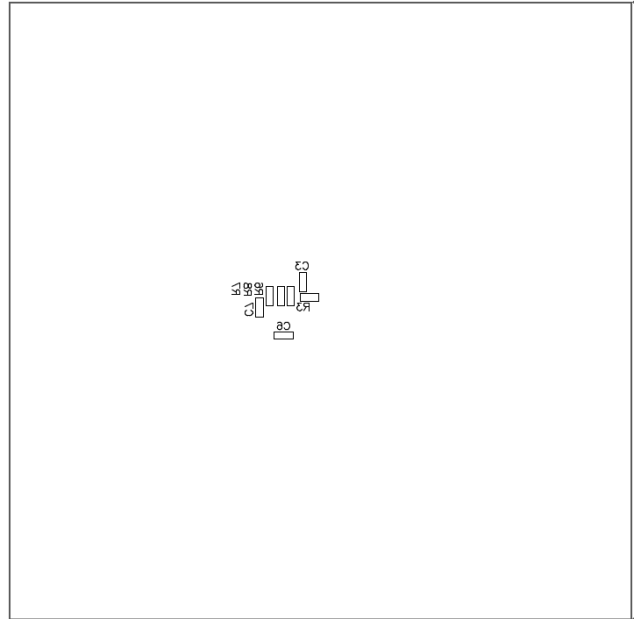


Figure 6: Bottom Silk Layer

## QUICK START GUIDE

1. Connect the positive and negative terminals of the load to the VOUT and GND pins respectively. Be aware that electronic load represents negative impedance to the regulator and if set it to a too high current, the SCP protection may be triggered at startup.
2. Preset the output of power supply between 3V and 6V, and then turn off the power supply. If longer cables are used between the source and the EVB (>0.5m total), a damping capacitor should be installed at the input terminals.
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 MPQ8616GL-6 will automatically start up.
5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 2V to turn on the regulator or less than 0.4V to turn it off.
6. Use R1 and R2 to set the output voltage within  $V_{FB}=0.6V$ . Follow the Application information section in the device datasheet to select the proper value of R1, R2, inductor and output capacitor values when output voltage is changed.
7. If low ripple at light loads is needed, then use TOKO 1.2 $\mu$ H or 1.5 $\mu$ H L1. But with the larger L1, the transient response peak to peak value will become larger too.

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