# EV4470/4470A-L-01A

## High-Efficiency, Fast-Transient, 5A, 36V Step-Down Converter Evaluation Board

The Future of Analog IC Technology

## DESCRIPTION

The EV4470-L-01A is an evaluation board for the MP/MPQ4470, while EV4470A-L-01A is an evaluation board for the MP/MPQ4470A.

MP/MPQ4470 and MP/MPQ4470A are high-efficiency step-down regulator with integrated power MOSFETs. They offer a very compact solution to achieve a 5A, continuous-output current over a wide input-supply range with excellent load and line regulation. They also provide fast transient response and good stability for wide input-supply and load range. MP/MPQ4470 have OVP latch while MP/MPQ4470A have no this function.

The EV4470-L-01A and EV4470A-L-01A are fully assembled and tested evaluation boards. They generate +3.3V output voltage at load current up to 5A from a 4.5V to 36V input range. Switching frequency of both boards are set at 500kHz.

## ELECTRICAL SPECIFICATIONS

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 4.5 – 36 | V |
| Output Voltage | $V_{OUT}$ | 3.3 | V |
| Output Current | $I_{OUT}$ | 5 | A |

## FEATURES

- Wide 4.5V-to-36V Operating Input Range
- Guaranteed 5A, Continuous Output Current
- Internal 40mΩ High-Side, 20mΩ Low-Side Power MOSFETs
- Proprietary Switching-Loss-Reduction Technology
- 1% Reference Voltage
- Programmable Soft-Start Time
- Low Drop-out Mode
- SCP, OCP, OVP latch (EV4470 only), UVP and Thermal Shutdown

## APPLICATIONS

- Notebook Systems and I/O Power
- Automotive Systems
- Networking Systems
- Industrial Supplies
- Optical Communications Systems
- Distributed Power and POL Systems



## EVALUATION BOARD

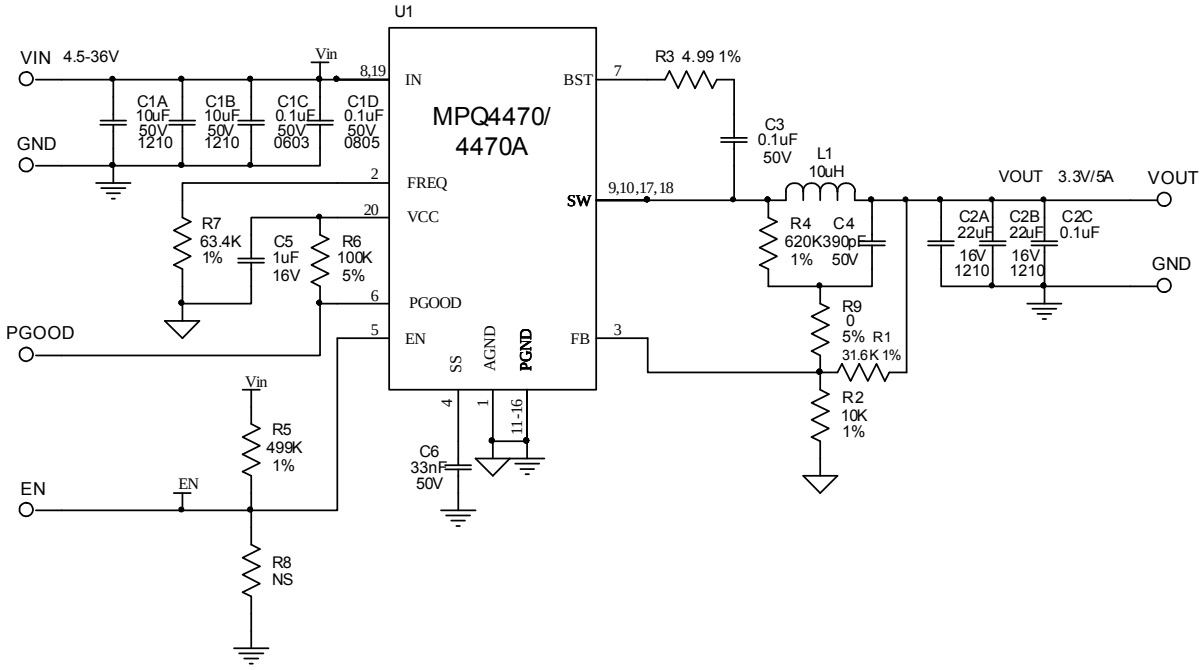

**(L x W x H) 2.5" x 2.5" x 0.4"**
**(6.4cm x 6.4cm x 1.0cm)**

| Board Number | MPS IC Number |
|---|---|
| EV4470-L-01A | MPQ4470GL |


**(L x W x H) 2.5" x 2.5" x 0.4"**
**(6.4cm x 6.4cm x 1.0cm)**

| Board Number | MPS IC Number |
|---|---|
| EV4470A-L-01A | MPQ4470AGL |

## EVALUATION BOARD SCHEMATIC



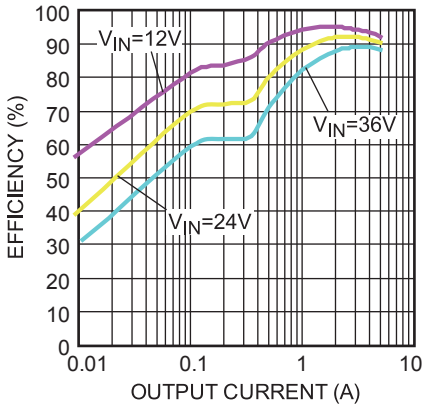

## EV4470/4470A-L-01A BILL OF MATERIALS

| Qty | RefDes | Value | Description | Package | Manufacturer | Manufactuer_P/N |
|---|---|---|---|---|---|---|
| 2 | C1A,C1B | 10uF | Ceramic Cap., 50V, X7R | 1210 | muRata | GRM32ER71H106KA12L |
| 3 | C1C,C2C, C3 | 0.1uF | Ceramic Cap., 50V, X7R | 0603 | TDK | C1608X7R1H104K |
| 1 | C1D | 0.1uF | Ceramic Cap., 50V, X7R | 0805 | muRata | GRM21BR72A104KAC4L |
| 2 | C2A,C2B | 22uF | Ceramic Cap., 16V, X7R | 1210 | muRata | GRM32ER71C226KE79 |
| 1 | C4 | 390pF | Ceramic Cap., 50V, C0G | 0603 | muRata | GRM1885C1H391JA01D |
| 1 | C5 | 1uF | Ceramic Cap., 16V, X7R | 0603 | muRata | GRM188R71C105KA12D |
| 1 | C6 | 33nF | Ceramic Cap., 50V, X7R | 0603 | muRata | GRM188R71H333KA61D |
| 1 | L1 | 10uH | Inductor, 16.3mOhm, 7.2A | SMD | Wurth | 7443251000 |
| 1 | R1 | 31.6k | Film Res., 1% | 0603 | Yageo | RC0603FR-0731K6L |
| 1 | R2 | 10k | Film Res., 1% | 0603 | Yageo | RC0603FR-0710KL |
| 1 | R3 | 4.99Ω | Film Res., 1% | 0603 | Yageo | RC0603FR-074R99L |
| 1 | R4 | 620k | Film Res., 1% | 0603 | Yageo | RC0603FR-07620KL |
| 1 | R5 | 499k | Film Res., 1% | 0603 | Yageo | RC0603FR-07499KL |
| 1 | R6 | 100k | Film Res., 5% | 0603 | Yageo | RC0603JR-07100KL |
| 1 | R7 | 63.4k | Film Res., 1% | 0603 | Yageo | RC0603FR-0763K4L |
| 1 | R9 | 0Ω | Film Res., 5% | 0603 | Yageo | RC0603JR-070RL |
| 1 | R8 | NS | | | | |
| 1 | U1 | | Step-Down Regulator | QFN20-3x4 | MPS | MPQ4470GL (for EV4470)<br>MPQ4470AGL (for EV4470A) |

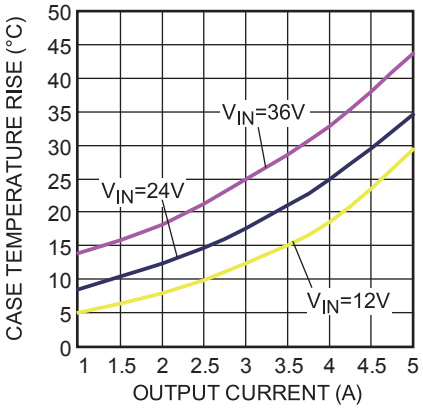
## EVB TEST RESULTS

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 24V, $V_{OUT}$ = 3.3V, $T_A$ = 25°C, unless otherwise noted.**

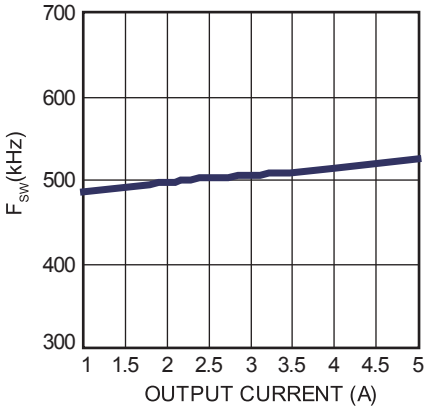
### Efficiency vs. Load Current



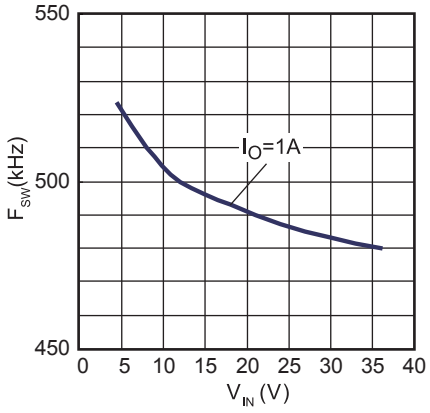

### Case Temperature Rise vs. Output Current



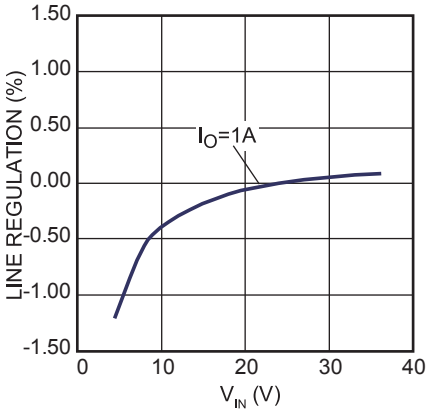

### $F_{SW}$ vs. Output Current



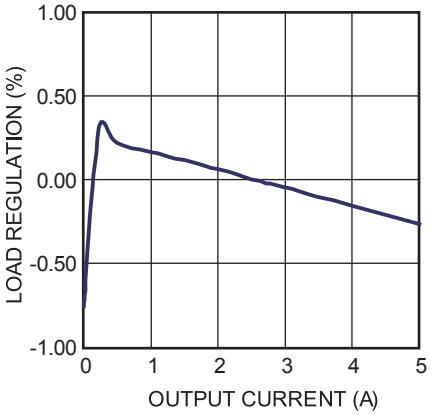

### $F_{SW}$ vs. $V_{IN}$




### Line Regulation



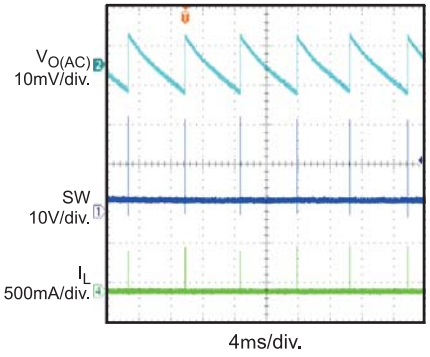

### Load Regulation



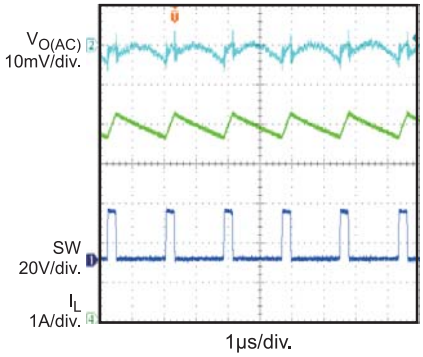
## EVB TEST RESULTS *(continued)*

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 24V, $V_{OUT}$ = 3.3V, $T_A$ = 25°C, unless otherwise noted.**

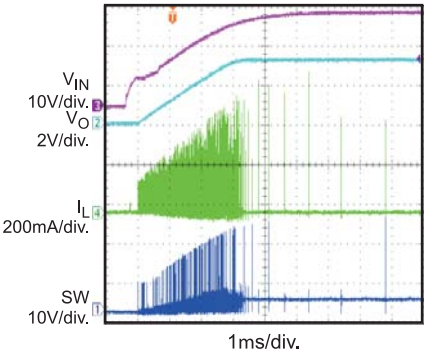
### Output Voltage Ripple
$I_O$ = 0A



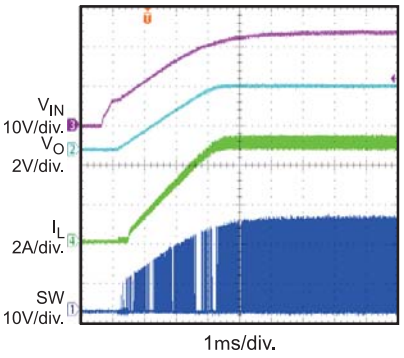

### Output Voltage Ripple
$I_O$ = 5A



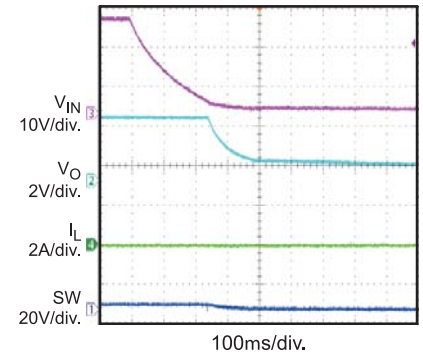

### Start-up Through $V_{IN}$
$I_O$ = 0A



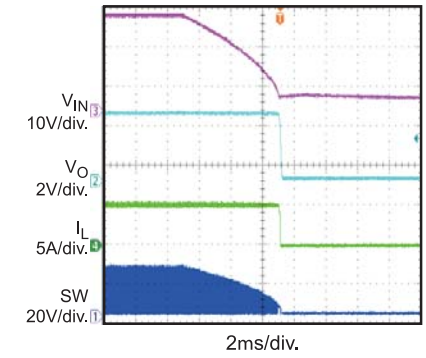

### Start-up Through $V_{IN}$
$I_O$ = 5A



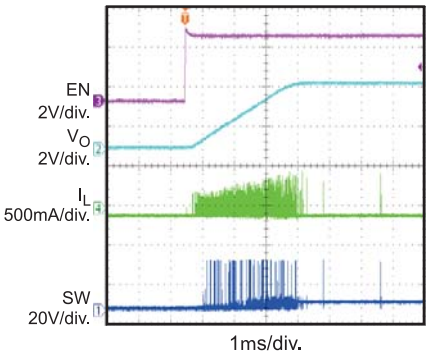

### Shutdown Through $V_{IN}$
$I_O$ = 0A



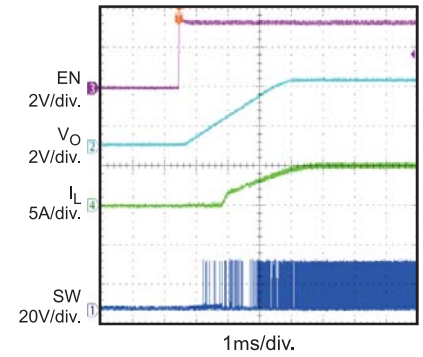

### Shutdown Through $V_{IN}$
$I_O$ = 5A



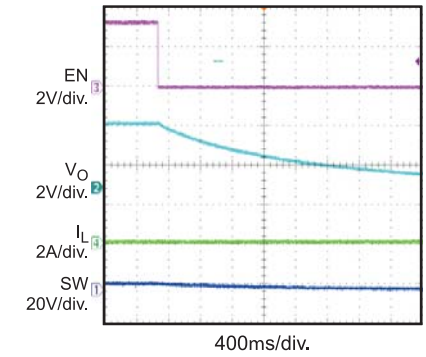

### Start-up Through EN
$I_O$ = 0A




### Start-up Through EN
$I_O$ = 5A



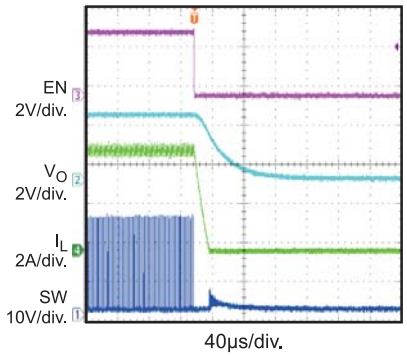

### Shutdown Through EN
$I_O$ = 0A



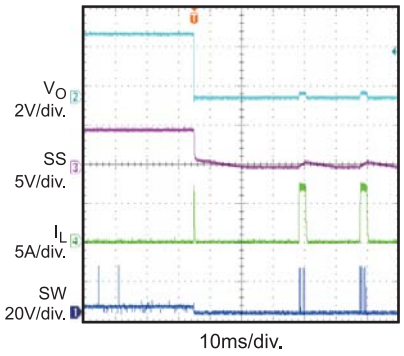
## EVB TEST RESULTS *(continued)*

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 24V, $V_{OUT}$ = 3.3V, $T_A$ = 25°C, unless otherwise noted.**

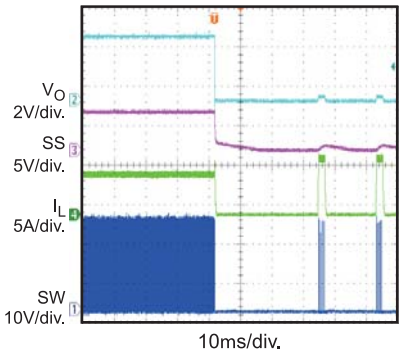
### Shutdown Through EN
$I_O$ = 5A



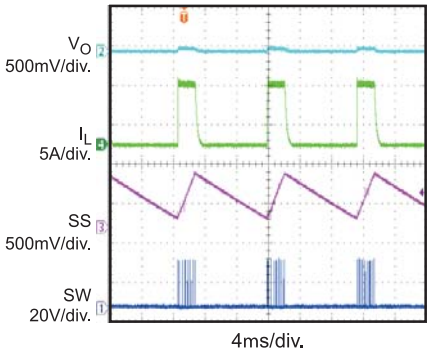

### Short Circuit Entry
$I_O$ = 0A



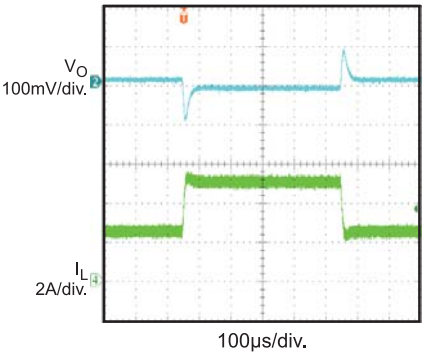

### Short Circuit Entry
$I_O$ = 5A



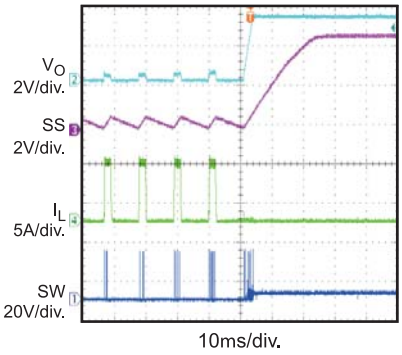

### Short Circuit Steady State



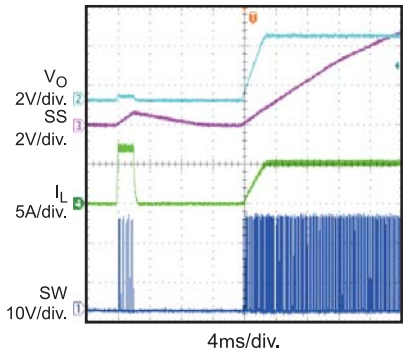

### Load Transient
$I_O$ = 2.5A-5A@1.6A/µs



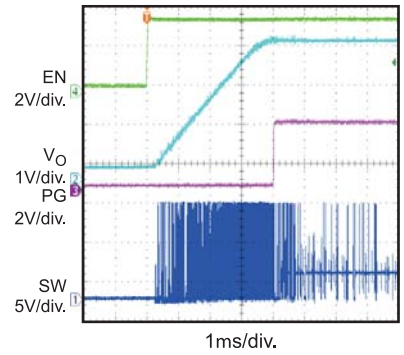

### Short Circuit Recovery
$I_O$ = 0A



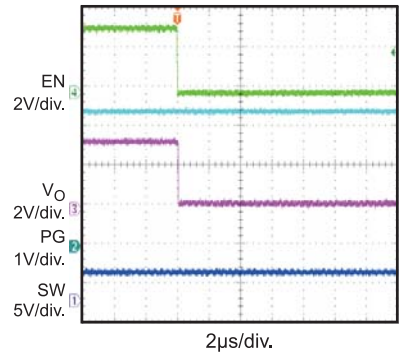

### Short Circuit Recovery
$I_O$ = 5A




### Power Good Through EN Start-up




### Power Good Through EN Shutdown



## PRINTED CIRCUIT BOARD LAYOUT

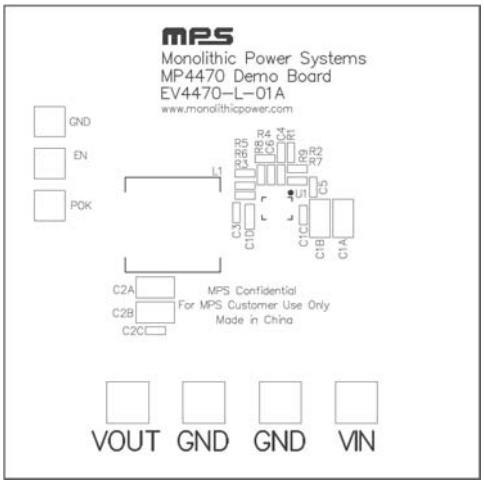



**Figure 1—Top Silk Layer**

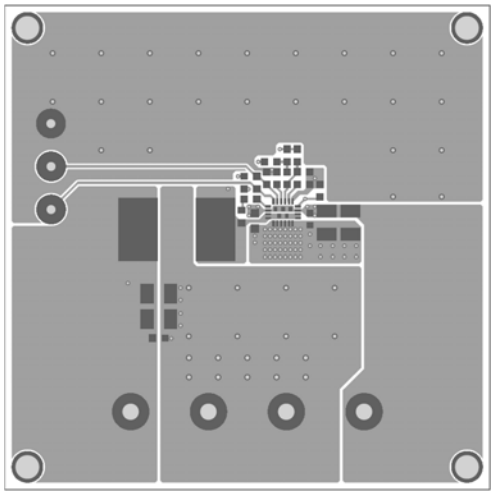


**Figure 2—Top Layer**

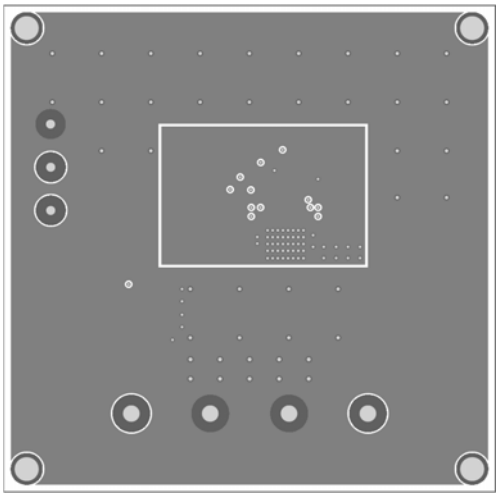


**Figure 3—Inner1 Layer**

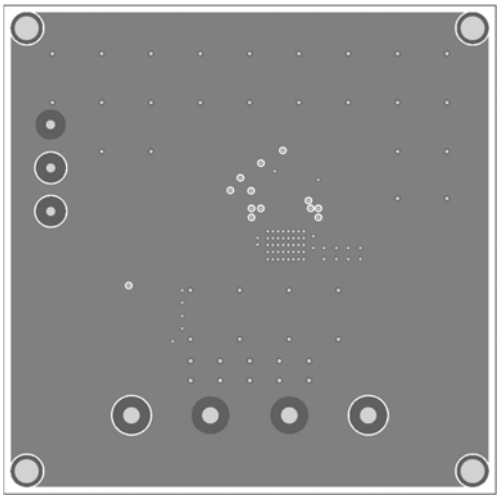


**Figure 4—Inner2 Layer**

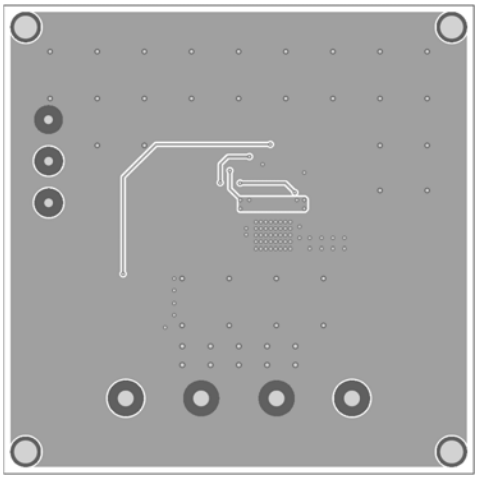


**Figure 5—Bottom Layer**

## 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 4.5 and 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 MPQ4470/4470AGL will automatically startup.
5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.25V to turn on the regulator, drive EN less than 0.86V to turn it off.
6. An input under voltage lockout (UVLO) function is implemented by the addition of a resistor divider R5 and R8. The EN threshold is 0.86V (falling edge), so $V_{IN}$ UVLO threshold is. $0.86\times(1+\frac{R5}{R8})$
7. Use R1 and R2 to set the output voltage with $V_{FB}$ = 0.815V. For R2 = 10kΩ, R1 can be determined by: $R1=12.27\times(V_{OUT}-0.815)$ (kΩ). 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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