# EV2451-J-00A

## 0.6A, 2MHz, 36V Step-Down Converter Evaluation Board

## DESCRIPTION

The EV2451-J-00A is an evaluation board for the MP/MPQ2451, a fixed 2MHz frequency step-down switching regulator with an integrated internal high-side high voltage power MOSFET. The IC provides 0.6A output with current mode control for fast loop response and easy compensation.

High power conversion efficiency over a wide load range is achieved by scaling down the switching frequency at light load condition to reduce the switching and gate driving losses.

The soft-start function helps prevent inductor current runaway during startup and thermal shutdown provides reliable, fault tolerant operation.

By switching at 2MHz, smaller value inductor and input/output capacitor can be used to lower down cost and save board space.

## ELECTRICAL SPECIFICATIONS

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 8-36 | V |
| Output Voltage | $V_{OUT}$ | 5 | V |
| Output Current | $I_{OUT}$ | 0-0.6 | A |

## FEATURES

- 130μA Operating Quiescent Current
- Wide 3.3V-to-36V Operating Input Range
- 500mΩ Internal Power MOSFET
- 2MHz Fixed Switching Frequency
- Internally Compensated
- Stable with Ceramic Output Capacitors
- Internal Soft-Start
- Precision Current Limit Without Current Sensing Resistor
- > 90% Efficiency
- Output Adjustable from 0.8V to 0.9·$V_{IN}$, Fixed 5V & 3.3V Output
- Includes SOT23 and TSOT23 Packages
- Available in AEC-Q100 Grade 1

## APPLICATIONS

- High Voltage Power Conversion
- Automotive Systems
- Industrial Power Systems
- Distributed Power Systems
- Battery Powered Systems

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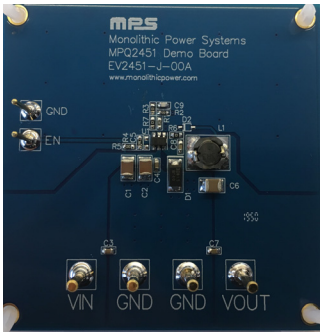
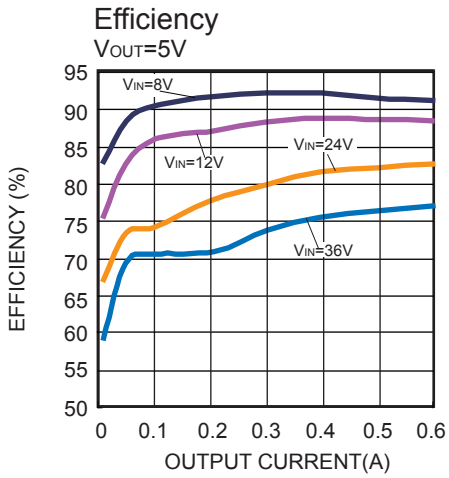
## EV2451-J-00A EVALUATION BOARD




**(L x W x H) 2.5” x 2.5” x 0.4”**
**6.35cm x 6.35cm x 1.0cm**

| Board Number | MPS IC Number |
|---|---|
| EV2451-J-00A | MP/MPQ2451DJ |





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## QUICK START GUIDE

1. Connect the positive terminal of the load to VOUT pins, and the negative terminal of the load to GND pins.

   Be aware that electronic loads represent a negative impedance to the regulator and if set to a too high current will trigger SCP mode.

2. Preset the power supply output to 8V-36V and 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. Especially when $V_{IN}$ is ≥ 24V.

3. Connect the positive terminal of the power supply output to the VIN pin and the negative terminal of the power supply output to the GND pin.

4. Turn on the power supply. The MP/MPQ2451 will automatically start up.

5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.5V to turn on the regulator or less than 1.1V to turn it off. Note that floating the EN pin will turn it off.

6. To adjust the output voltage, change the values of R1 and R2. Generally, Choose R2 around 124kΩ for optimal transient response. For $V_{FB}$=0.8V, R2=124kΩ, R1 can be determined by:

$$R1 = \frac{R2}{\frac{V_{OUT}}{0.8V} - 1}$$

   Please follow the application information on the MP/MPQ2451 datasheet to recalculate/select compensation values, the inductor value and the output capacitor value if the output voltage needs to be reprogrammed.

   Below table lists the recommended feedback resistor values for common output voltages

| $V_{OUT}$(V) | R1(kΩ) | R2(kΩ) |
|---|---|---|
| 0.8 | NS | 124(1%) |
| 1.2 | 249(1%) | 124(1%) |
| 3.3 | 40.2(1%) | 124(1%) |
| 5 | 23.7(1%) | 124(1%) |


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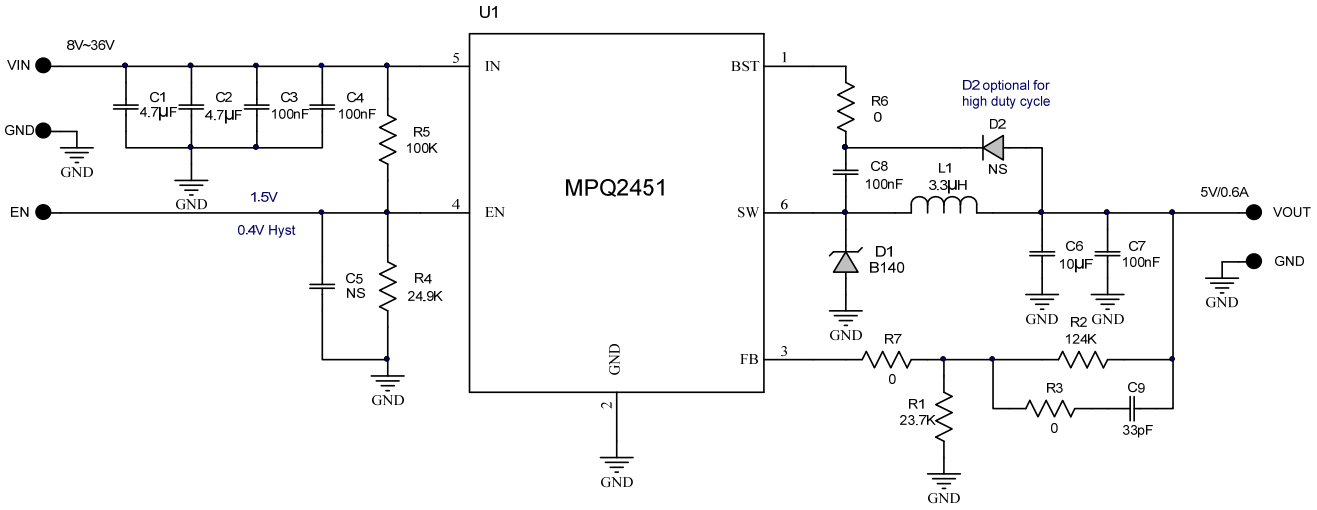
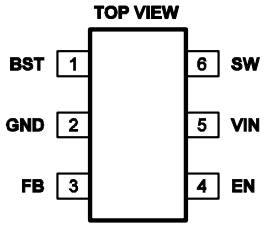
## EVALUATION BOARD SCHEMATIC




Package Reference




Resistor Selection vs. Output Voltage Setting

| Vout(V) | R1(KΩ) | R2(KΩ) |
|---|---|---|
| 0.8 | NS | 124(1%) |
| 1.2 | 249(1%) | 124(1%) |
| 3.3 | 40.2(1%) | 124(1%) |
| 5 | 23.7(1%) | 124(1%) |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## EV2451-J-00A BILL OF MATERIALS

| Qty | Ref | Value | Description | Package | Manufacturer | Manufacturer P/N |
|---|---|---|---|---|---|---|
| 2 | C1,C2 | 4.7µF | Ceramic Cap, X7R, 50V | 1210 | muRata | GRM32ER71H475KA88L |
| 2 | C3,C4 | 0.1µF | Ceramic Cap, X7R, 50V | 0603 | muRata | GRM188R71H104KA93D |
| 1 | C5 | NS | | | | |
| 1 | C6 | 10µF | Ceramic Cap, X7R, 16V | 1210 | muRata | GRM32DR71C106KA01L |
| 2 | C7,C8 | 0.1µF | Ceramic Cap, X7R, 16V | 0603 | muRata | GRM188R71C104KA01D |
| 1 | C9 | 33pF | Ceramic Cap, C0G, 50V | 0603 | muRata | GRM1885C1H330JA01 |
| 1 | R1 | 23.7k | Film Res, 1% | 0603 | Yageo | RC0603FR-0723K7L |
| 1 | R2 | 124k | Film Res, 1% | 0603 | Yageo | RC0603FR-07124KL |
| 3 | R3,R6, R7 | 0R | Film Res, 5% | 0603 | Yageo | RC0603JR-070RL |
| 1 | R4 | 24.9k | Film Res, 1% | 0603 | Yageo | RC0603FR-0724K9L |
| 1 | R5 | 100k | Film Res, 1% | 0603 | Yageo | RC0603FR-07100KL |
| 1 | D1 | | Diode Schottky, 40V, 1A | SMA | Diodes Inc | B140-13-LF |
| 1 | D2 | NS | | | | |
| 1 | L1 | 3.3µH | Inductor, 3.3µH, 1.89A | SMD | TOKO | D62CB-#A920CY-3R3M |
| 1 | U1 | | Step-Down Regulator | TSOT23-6 | MPS | MP/MPQ2451DJ |


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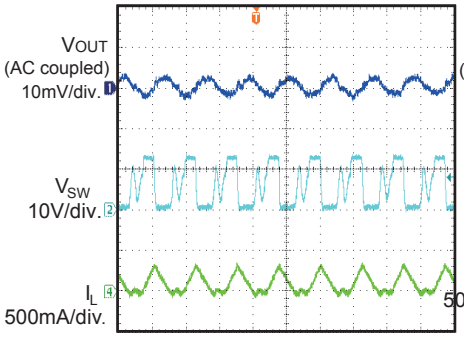
## EVB TEST RESULTS

**$V_{IN}$=12V, C1=4.7µF, C2=10µF, L=3.3µH and $T_A$=+25°C, unless otherwise noted.**

### Steady State

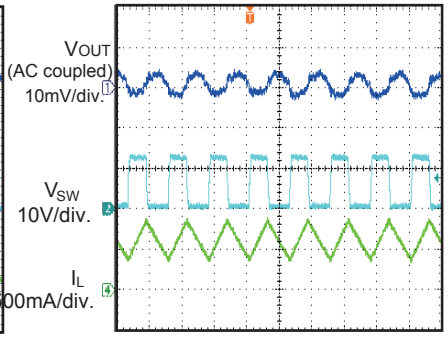
$V_{IN}$=12V,$V_{OUT}$=5V,$I_{OUT}$=0.1A




400ns/div.

### Steady State

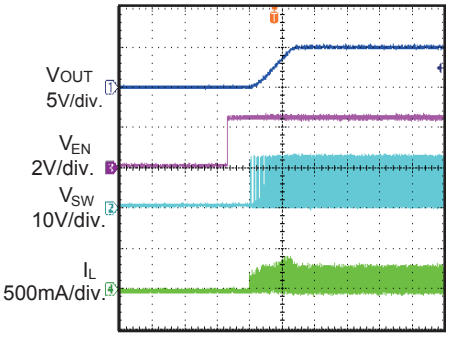
$V_{IN}$=12V,$V_{OUT}$=5V,$I_{OUT}$=0.6A




400ns/div.

### Startup Through EN

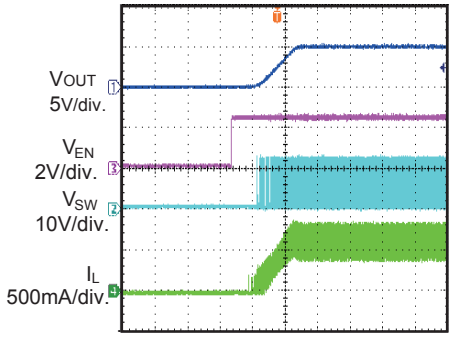
$V_{IN}$=12V,$V_{OUT}$=5V,$I_{OUT}$=0.1A




400µs/div.

### Startup Through EN

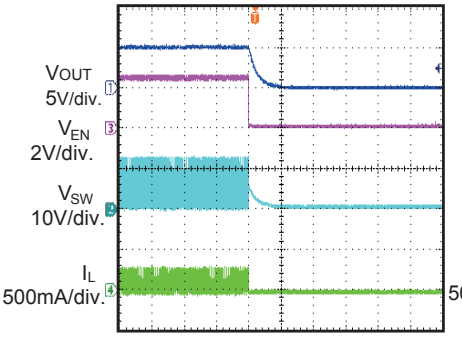
$V_{IN}$=12V,$V_{OUT}$=5V,$I_{OUT}$=0.6A




400µs/div.

### Shutdown Through EN

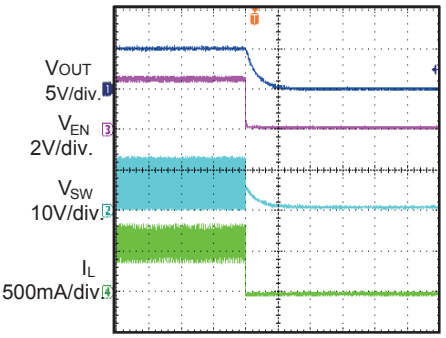
$V_{IN}$=12V,$V_{OUT}$=5V,$I_{OUT}$=0.1A




2ms/div.

### Shutdown Through EN

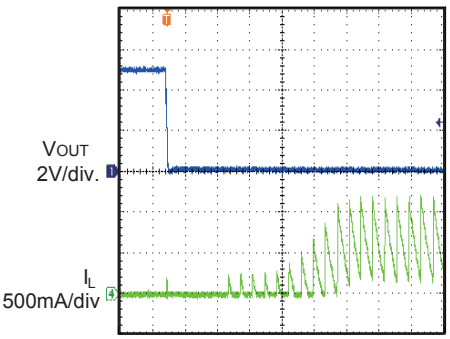
$V_{IN}$=12V,$V_{OUT}$=5V,$I_{OUT}$=0.6A




200µs/div.

### Short Circuit Entry

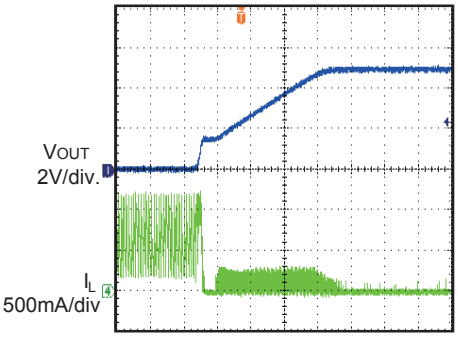
$I_{OUT}$=0A to Short




20µs/div.

### Short Circuit Recovery

$I_{OUT}$= Short to 0A




100µs/div.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## PRINTED CIRCUIT BOARD LAYOUT

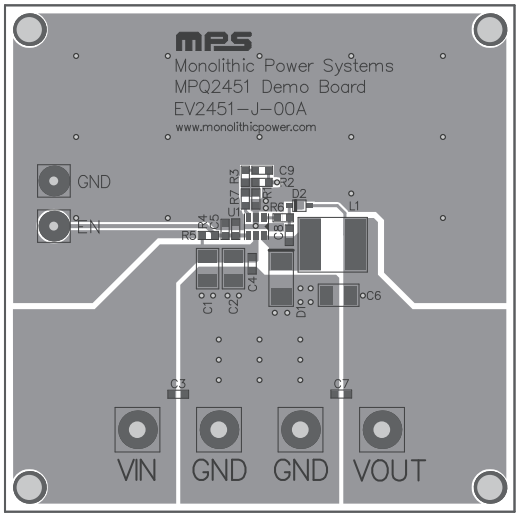


**Figure 1: Top Silk Layer and Top Layer**

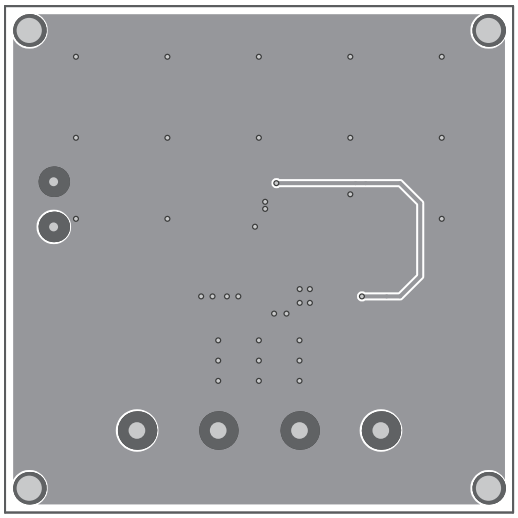

**Figure 2: Bottom Layer**

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