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

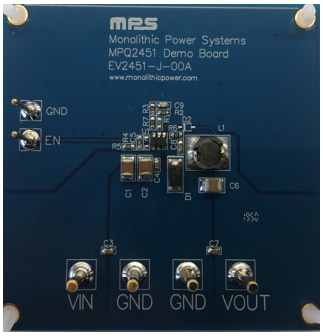
FEATURES

- 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

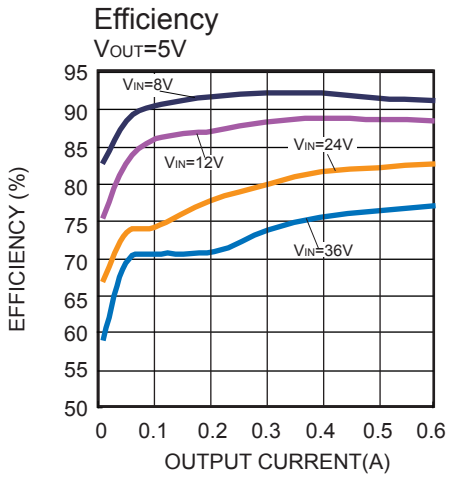
- High Voltage Power Conversion
- Automotive Systems
- Industrial Power Systems
- Distributed Power Systems
- Battery Powered Systems

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



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:

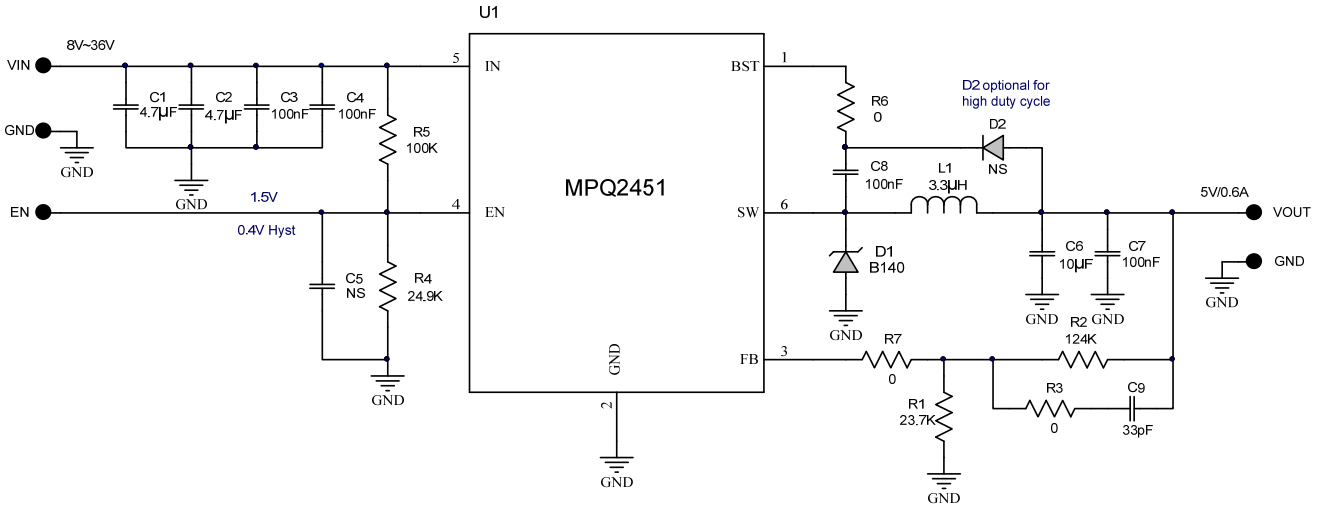
$$R1 = \frac{R2}{\frac{V_{OUT}}{0.8V} - 1}$$

   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.

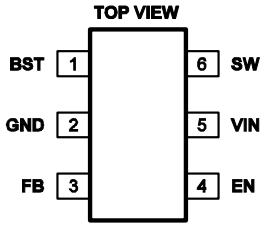
   Below table lists the recommended feedback resistor values for common output voltages

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%)

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%)

EV2451-J-00A BILL OF MATERIALS

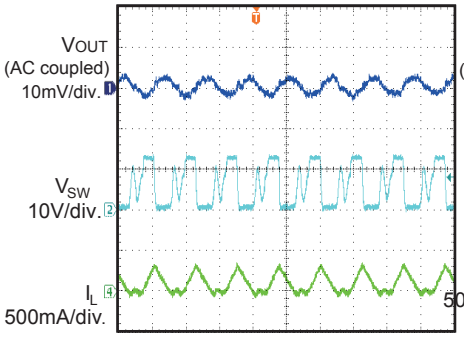
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer P/N
2	C1,C2	4.7µF	Ceramic Cap, X7R, 50V	1210	muRata	GRM32ER71H475KA88L
2	C3,C4	0.1µF	Ceramic Cap, X7R, 50V	0603	muRata	GRM188R71H104KA93D
1	C5	NS				
1	C6	10µF	Ceramic Cap, X7R, 16V	1210	muRata	GRM32DR71C106KA01L
2	C7,C8	0.1µF	Ceramic Cap, X7R, 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

EVB TEST RESULTS

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

Steady State

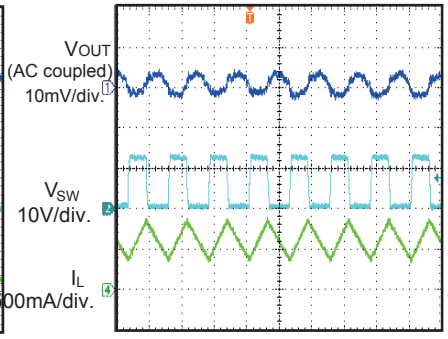
V_{IN}=12V,V_{OUT}=5V,I_{OUT}=0.1A



400ns/div.

Steady State

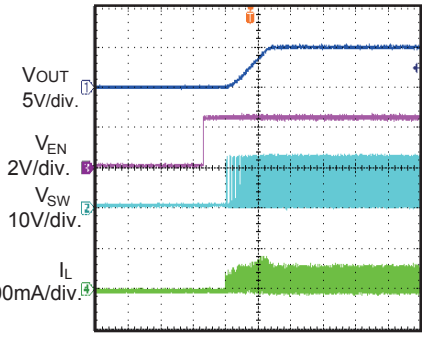
V_{IN}=12V,V_{OUT}=5V,I_{OUT}=0.6A



400ns/div.

Startup Through EN

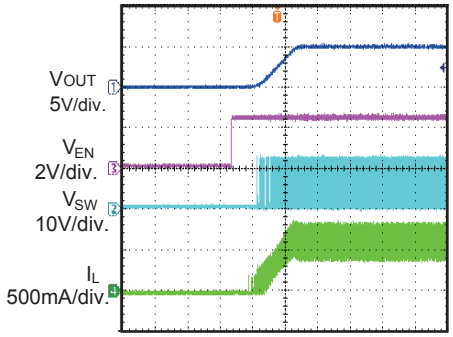
V_{IN}=12V,V_{OUT}=5V,I_{OUT}=0.1A



400µs/div.

Startup Through EN

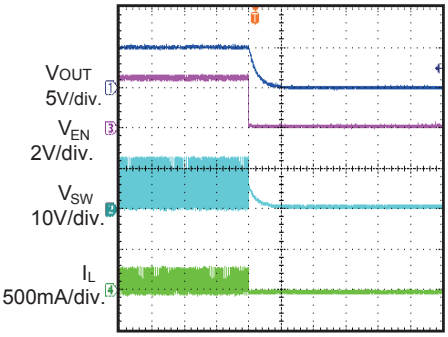
V_{IN}=12V,V_{OUT}=5V,I_{OUT}=0.6A



400µs/div.

Shutdown Through EN

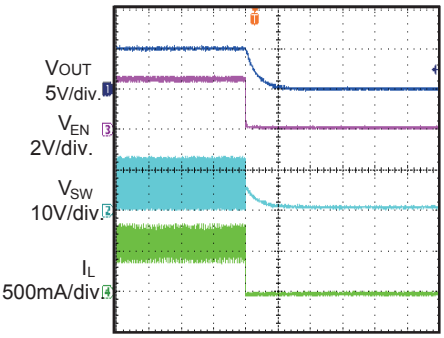
V_{IN}=12V,V_{OUT}=5V,I_{OUT}=0.1A



2ms/div.

Shutdown Through EN

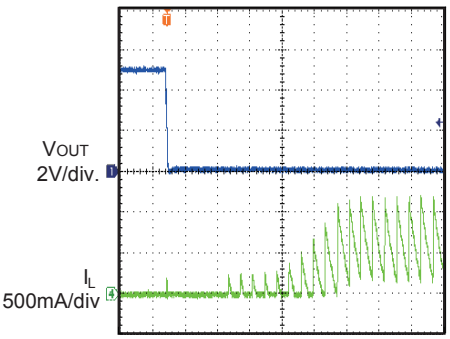
V_{IN}=12V,V_{OUT}=5V,I_{OUT}=0.6A



200µs/div.

Short Circuit Entry

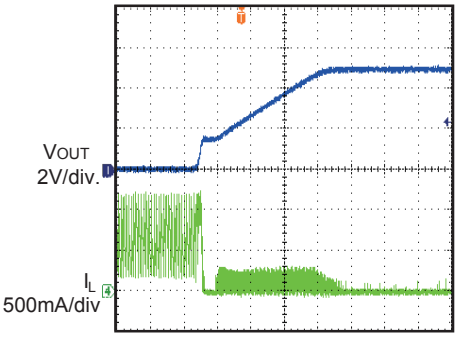
I_{OUT}=0A to Short



20µs/div.

Short Circuit Recovery

I_{OUT}= Short to 0A



100µs/div.

PRINTED CIRCUIT BOARD LAYOUT

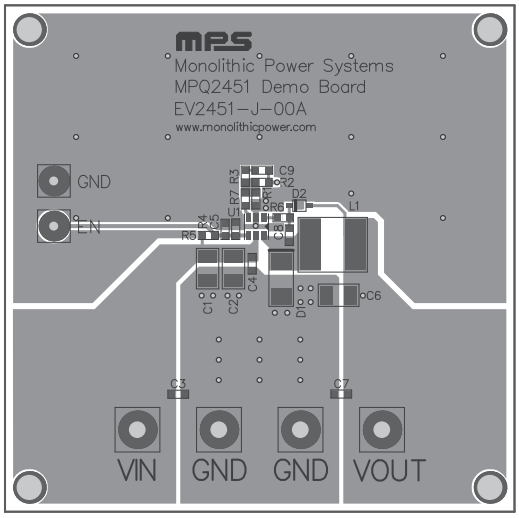


Figure 1: Top Silk Layer and Top Layer

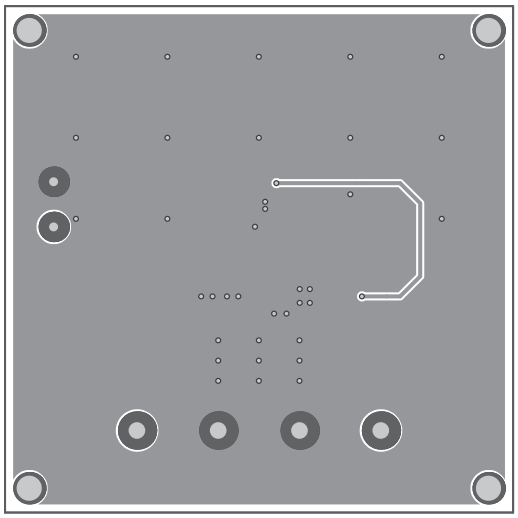


Figure 2: Bottom Layer