

### DESCRIPTION

The EV2454-Q-00A is an evaluation board for the MP2454/MPQ2454, a frequency-programmable (350kHz to 2.3MHz) step-down switching regulator with integrated internal high-side high voltage power MOSFET. It efficiently outputs up to 0.6A, and has current-mode control for fast loop response.

The wide 3.3V-to-36V input range accommodates a variety of step-down applications in automotive-input environments. A 3.5μA shutdown-mode quiescent current allows for use in battery-powered applications. The device also has a high-duty cycle and low drop-out mode for automotive cold-crank conditions.

The MPQ2454 also achieves high power conversion efficiency over a wide load range by scaling down the switching frequency at light load conditions to reduce both switching and gate driving losses.

Frequency fold-back prevents inductor current runaway during start-up and short circuit. Thermal shutdown provides reliable, fault-tolerant operation. An open-drain power-good signal indicates the output is within its nominal voltage.

The EV2454-Q-00A is assembled and tested with QFN-10 (3mmx3mm) package.

### ELECTRICAL SPECIFICATIONS

| Parameter      | Symbol    | Value  | Units |
|----------------|-----------|--------|-------|
| Input Voltage  | $V_{IN}$  | 3.3-36 | V     |
| Output Voltage | $V_{OUT}$ | 3.3    | V     |
| Output Current | $I_{OUT}$ | 0.6    | A     |

### FEATURES

- 60μA Operating Quiescent Current
- Wide 3.3V-to-36V Operating Input Range
- 200mΩ Internal Power MOSFET
- Up to 2.3MHz Programmable Switching Frequency
- Stable with Ceramic Output Capacitors
- Internal Compensation
- External Soft-Start
- > 90% Efficiency
- Low Dropout Operation for Cold-crank
- 3.5μA Low Shutdown Supply Current
- Synchronize to External Clock
- Power Good Output
- Programmable Power Good Delay Time
- Available in AEC-Q100 Grade 1
- Fully Assembled and Tested

### APPLICATIONS

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

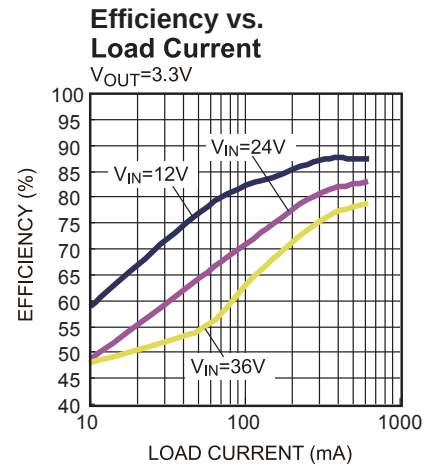
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## EV2454-Q-00A EVALUATION BOARD

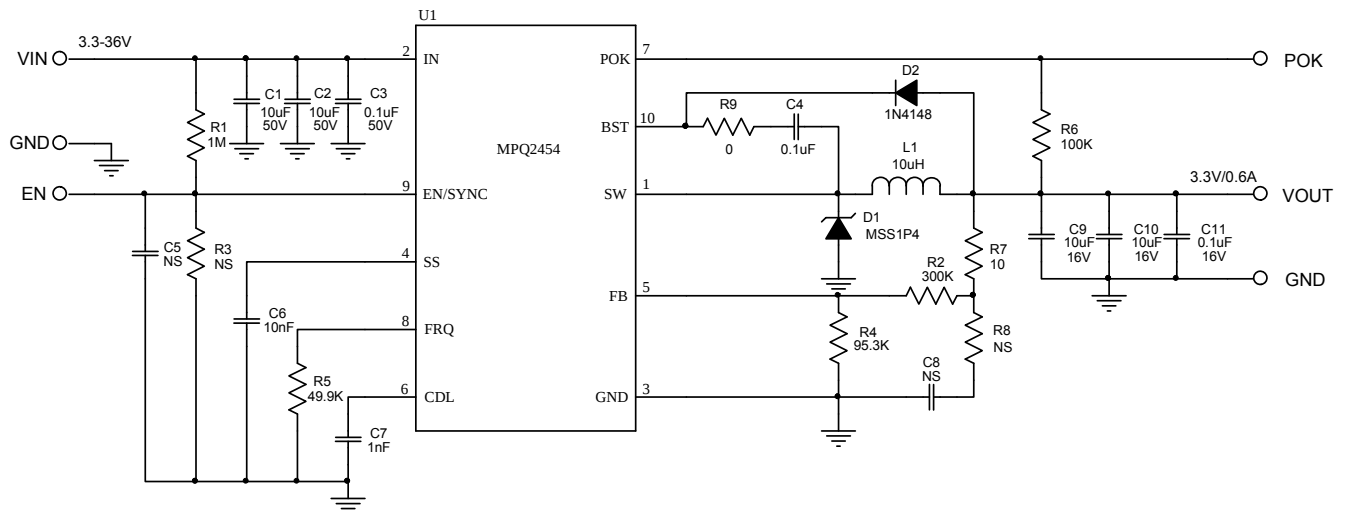


**(L x W x H) 2.5" x 2.5" x 0.2"**  
**(6.35cm x 6.35cm x 0.5cm)**

| Board Number | MPS IC Number |
|--------------|---------------|
| EV2454-Q-00A | MPQ2454GQ     |



## EVALUATION BOARD SCHEMATIC



## EV2454-Q-00A BILL OF MATERIALS

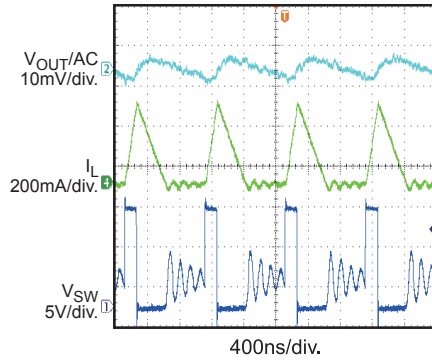
| Qty | RefDes             | Value    | Description                      | Package  | Manufacture | Manufacture_PN     |
|-----|--------------------|----------|----------------------------------|----------|-------------|--------------------|
| 2   | C1, C2             | 10uF     | Ceramic Capacitor;50V;X7R; 1210; | 1210     | muRata      | GRM32ER71H106KA12L |
| 3   | C3, C4, C11        | 0.1uF    | Ceramic Capacitor;50V;X7R; 0603; | 0603     | muRata      | GRM188R71H104KA93D |
| 1   | C6                 | 10nF     | Ceramic Capacitor;50V;X7R; 0603; | 0603     | muRata      | GRM188R71H103KA01D |
| 1   | C7                 | 1nF      | Ceramic Capacitor;50V;C0G 0603;  | 0603     | muRata      | GRM1885C1H102JA01D |
| 2   | C9, C10            | 10uF     | Ceramic Capacitor;16V;X7R; 1210  | 1210     | muRata      | GRM32DR71C106KA01L |
| 2   | C5, C8             | NS       |                                  | 0603     |             |                    |
| 1   | D1                 | MSS1P4   | Schottky Diode;40V;1A;           | MicroSMP | Vishay      | MSS1P4             |
| 1   | D2                 | 1N4148WS | Diode; 75V; 0.15A;               | SOD-323  | Diodes      | 1N4148WS           |
| 1   | L1                 | 10uH     | Inductor;10uH; 53mΩ; 2.3 A       | SMD      | ABC         | DM5028100ML        |
|     |                    |          | Inductor;10uH; 52.8mΩ;1.5A       | SMD      | SUMIDA      | CDRH6D26NP-100NC   |
| 1   | R1                 | 1M       | Film Resistor;5%;                | 0603     | Yageo       | RC0603JR-071ML     |
| 1   | R2                 | 300k     | Film Resistor;1%;                | 0603     | Yageo       | RC0603FR-07300KL   |
| 1   | R4                 | 95.3k    | Film Resistor;1%;                | 0603     | Yageo       | RC0603FR-0795K3L   |
| 1   | R5                 | 49.9k    | Film Resistor;1%;                | 0603     | Yageo       | RC0603FR-0749K9L   |
| 1   | R6                 | 100k     | Film Resistor;1%;                | 0603     | Yageo       | RC0603FR-07100KL   |
| 1   | R7                 | 10       | Film Resistor;1%;                | 0603     | Yageo       | RC0603FR-0710RL    |
| 1   | R9                 | 0        | Film Resistor;5%;                | 0603     | Yageo       | RC0603JR-070RL     |
| 2   | R3, R8             | NS       |                                  | 0603     |             |                    |
| 1   | U1                 |          | Step-Down Regulator              | QFN-10   | MPS         | MPQ2454GQ          |
| 4   | VIN, GND VOUT, GND |          | 2.0 Golden Pin                   |          | HZ          |                    |
| 3   | EN,POK ,GND        |          | 1.0 Golden Pin                   |          | HZ          |                    |

## EVB TEST RESULTS

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

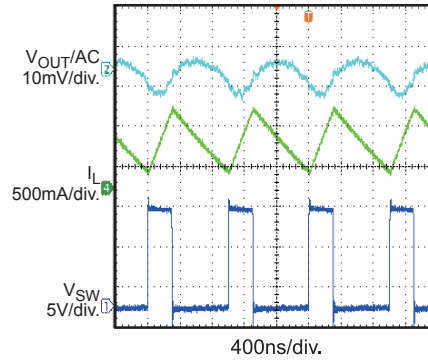
**Steady State**

$I_{OUT} = 0.1A$



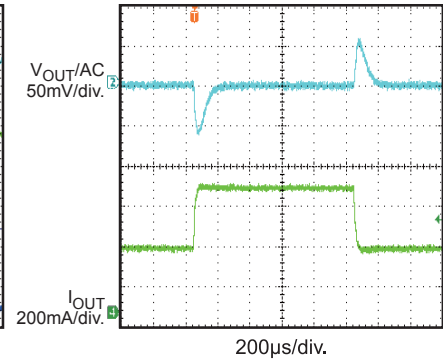
**Steady State**

$I_{OUT} = 0.6A$



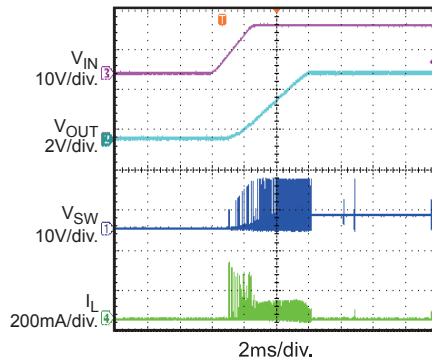
**Load Transient**

$I_{OUT} = 0.3A-0.6A, 1.6A/\mu s$



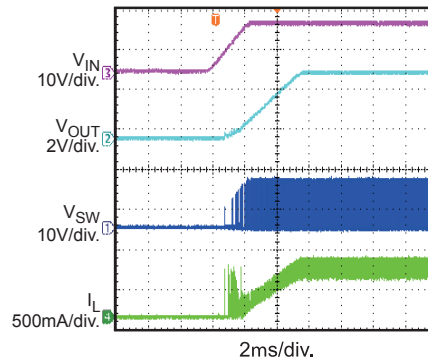
**Startup through  $V_{IN}$**

$I_{OUT} = 0A$



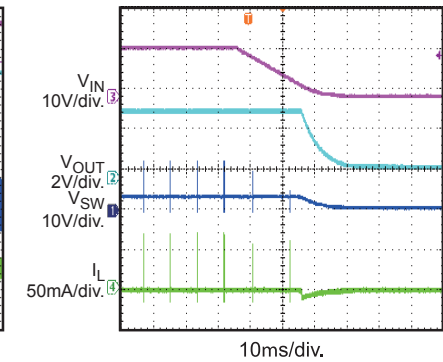
**Startup through  $V_{IN}$**

$I_{OUT} = 0.6A$



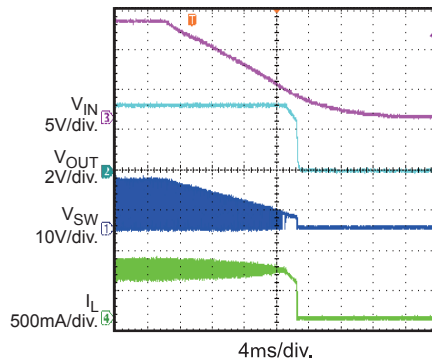
**Shutdown through  $V_{IN}$**

$I_{OUT} = 0A$



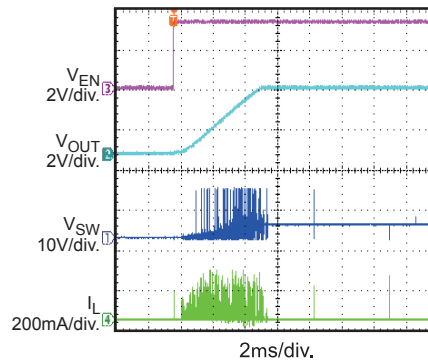
**Shutdown through  $V_{IN}$**

$I_{OUT} = 0.6A$



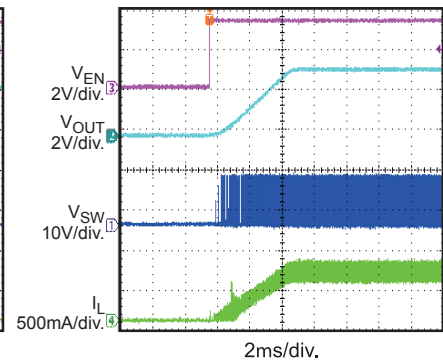
**Startup through EN**

$I_{OUT} = 0A$



**Startup through EN**

$I_{OUT} = 0.6A$

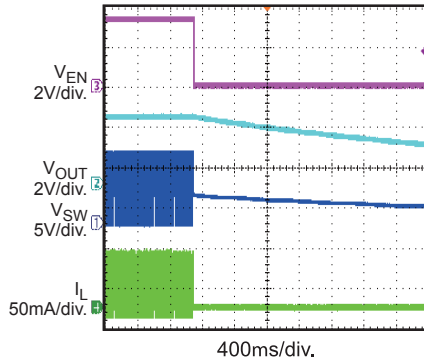


## EVB TEST RESULTS *(continued)*

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

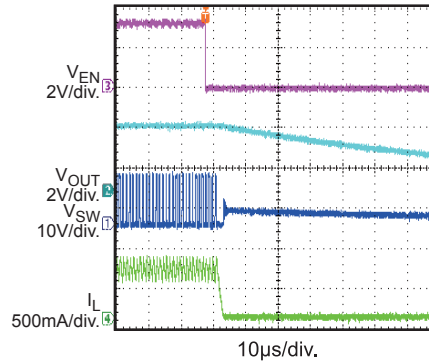
**Shutdown through EN**

$I_{OUT} = 0A$



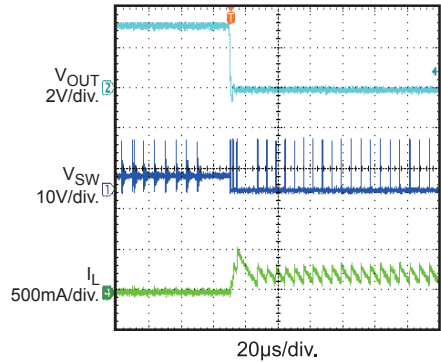
**Shutdown through EN**

$I_{OUT} = 0.6A$



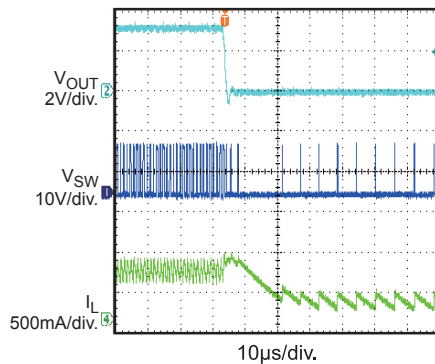
**SCP Entry**

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

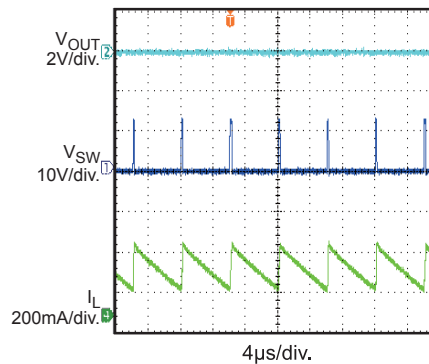


**SCP Entry**

$I_{OUT} = 0.6A$  to Short Circuit

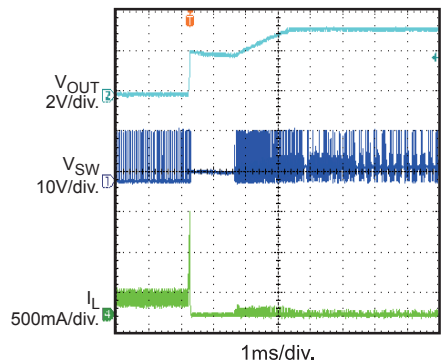


**SCP Steady State**



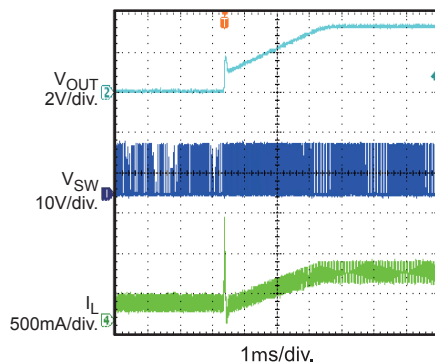
**SCP Recovery**

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

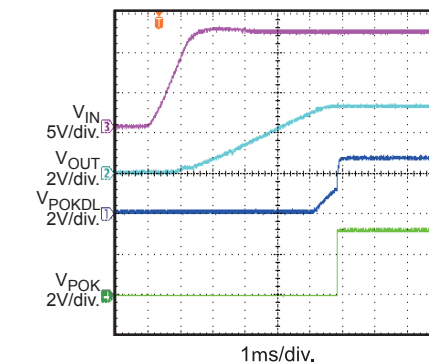


**SCP Recovery**

Short Circuit to  $I_{OUT} = 0.6A$

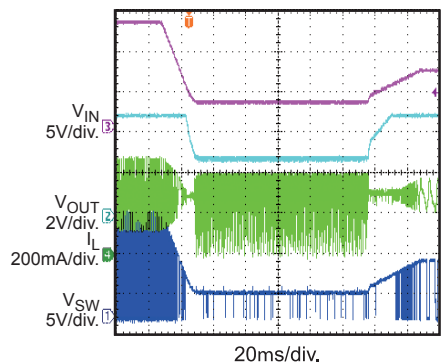


**POK through Power On**



**Cold-Crank**

$V_{OUT} = 5V$ ,  $I_{OUT} = 0.3A$



## PRINTED CIRCUIT LAYOUT

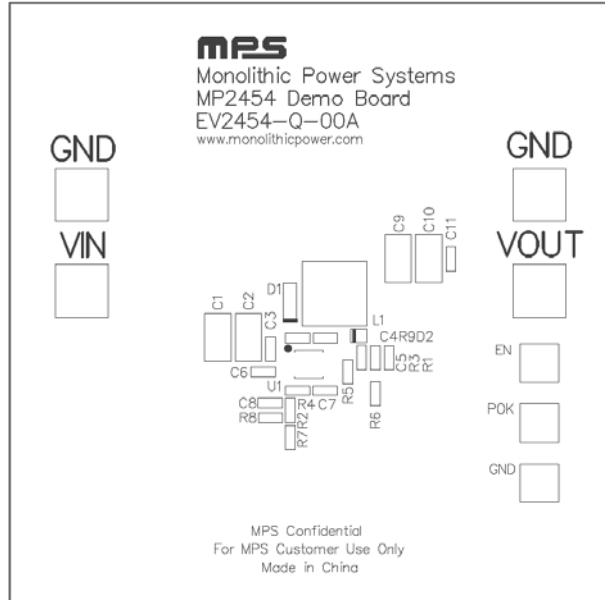


Figure1 – Top Silk Layer

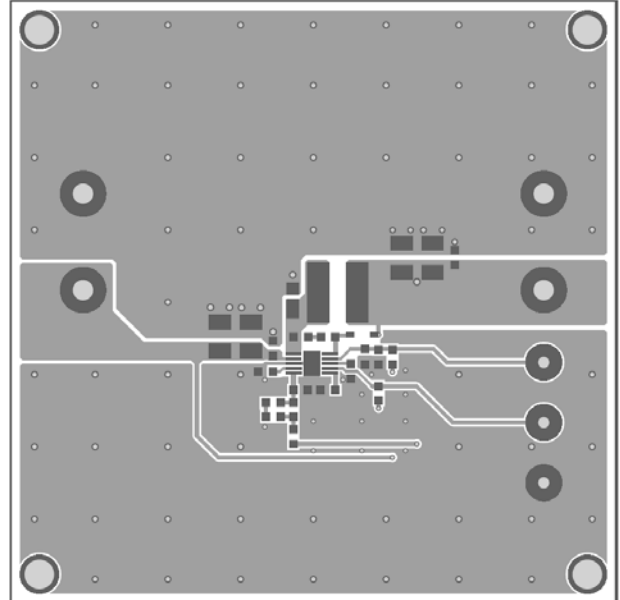


Figure 2 – Top Layer

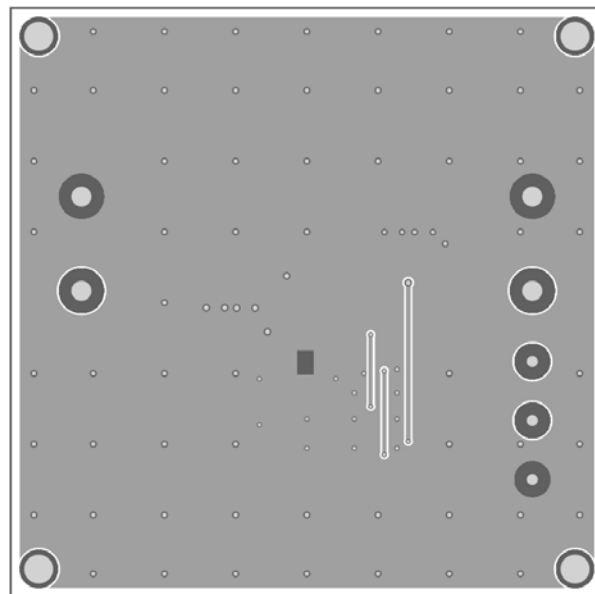


Figure3 – Bottom Layer

## 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 3.3V to 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 MP2454/MPQ2454 will automatically startup.
5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.8V for longer than 200ns to turn on the regulator, drive EN less than 1 V for longer than 2 $\mu$ s to turn it off. There is an internal 1.2M $\Omega$  resistor between EN and GND, so floating this pin shuts chip down.
6. Connect the EN input pin through a pull-up resistor to any voltage connected to the VIN pin—the pull-up resistor is selected to limit the EN input current to less than 150 $\mu$ A to prevent damaging internal Zener diode. For example, with 12V connected to VIN,  $R_{PULLUP} \geq (12V - 7.5V) \div (150+7.5/1.2)\mu A = 28.8k\Omega$ .
7. Connect the EN pin directly to a voltage source without any pull-up resistor requires limiting voltage amplitude to  $\leq 7.5V$  to prevent damage to the internal Zener diode.
8. Connect the EN input pin with an external clock with a range of 350kHz to 2.3MHz after output voltage is set to synchronize the internal clock rising edge to the external clock rising edge.

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