



The Future of Analog IC Technology®

# EV8861-L-00A

High Efficiency, 6A, 18V, Synchronous Step-Down Converter with I<sup>2</sup>C Interface

## DESCRIPTION

The EV8861-L-00A is used for demonstrating the performance of MPS's MP8861. MP8861 is a highly integrated and high frequency synchronous step-down switcher with I<sup>2</sup>C control interface. It offers a fully integrated solution that achieves 6A of continuous output current with excellent load and line regulation over a wide input supply range.

COT control operation provides fast transient response and eases loop stabilization. In I<sup>2</sup>C control loop, the output voltage level can be controlled, on-the fly through an I<sup>2</sup>C serial interface. Output voltage range can be adjusted from 0.6V to 1.108V in 4mV steps. Voltage scaling slew rate, enable and power saving mode are also selectable through the I<sup>2</sup>C interface. Full protection features include over voltage, over-current protection and thermal shut down.

The MP8861 is available in QFN-14(3mmx4mm) package.

## ELECTRICAL SPECIFICATION

| Parameter                 | Symbol           | Value    | Units |
|---------------------------|------------------|----------|-------|
| Input Voltage             | V <sub>IN</sub>  | 2.85– 18 | V     |
| Output Voltage            | V <sub>OUT</sub> | 1        | V     |
| Continuous Output Current | I <sub>OUT</sub> | 6        | A     |

## FEATURES

- Wide 2.85V-to-18V Operating Input Range
- 6A Continuous Output Current
- 1% Internal Reference Accuracy
- I<sup>2</sup>C Programmable Output Range from 0.6V to 1.108V in 4mV Steps with Slew Rate Control
- 5% Accuracy Output Voltage and Output Current Read Back Via I<sup>2</sup>C
- Selectable PFM/PWM Mode and Adjustable Frequency & Current Limit Through I<sup>2</sup>C
- 4 Different I<sup>2</sup>C Address Selectable
- External Soft Start
- Open Drain Power Good Indication
- Output Over Voltage Protection
- Hiccup/Latch off OCP Protection
- QFN-14(3mmx4mm) Package

## APPLICATIONS

- Solid State Driver (SSD)
- Flat-Panel Television and Monitors
- Digital Set-Top Boxes
- Distributed Power Systems

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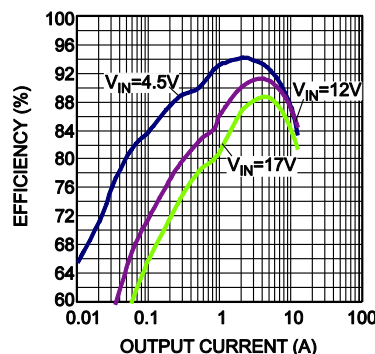
## EV8861-L-00A EVALUATION BOARD



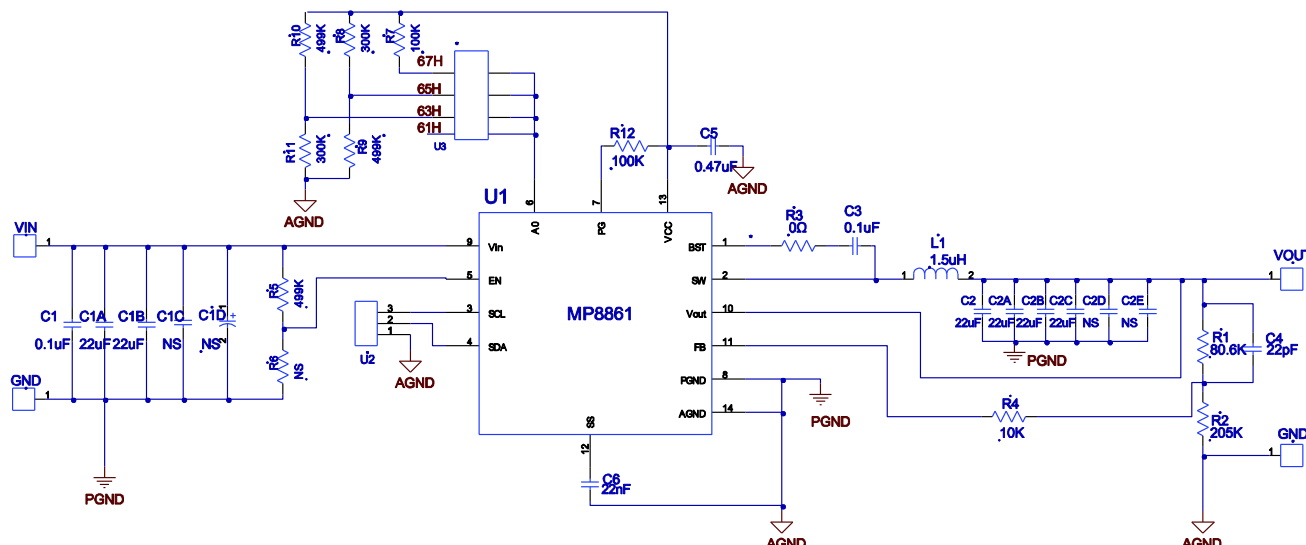
(4 layer PCB, 8.5cmx8.5cm)

| Board Number | MPS IC Number |
|--------------|---------------|
| EV8861-L-00A | MP8861GL      |

Efficiency vs. Output Current  
V<sub>OUT</sub>=1V, L=1.5μH, DCR=2.1mΩ



## EVALUATION BOARD SCHEMATIC



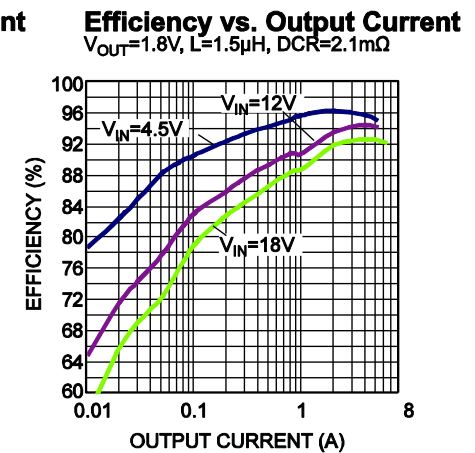
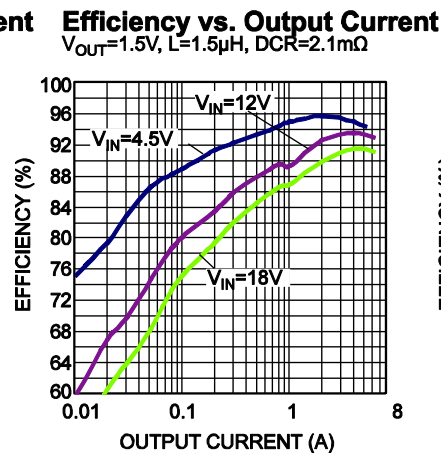
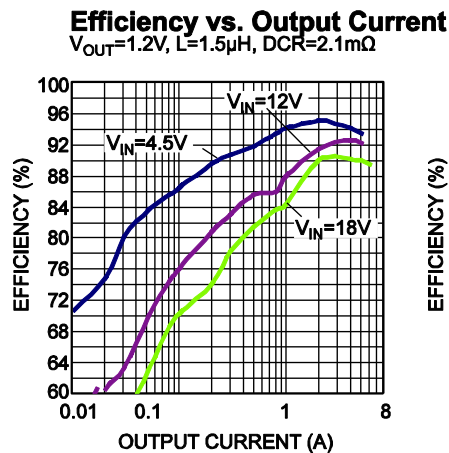
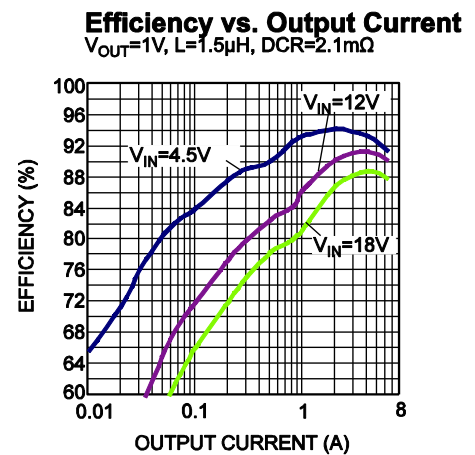
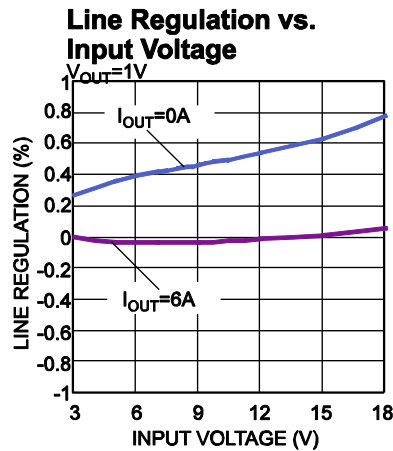
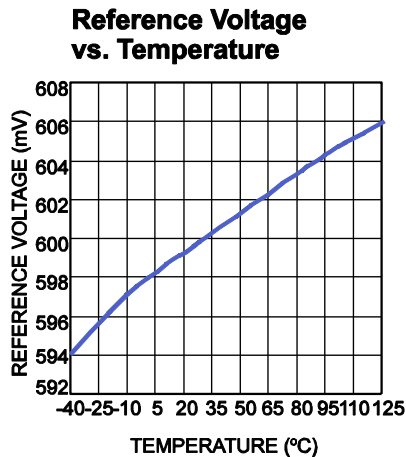
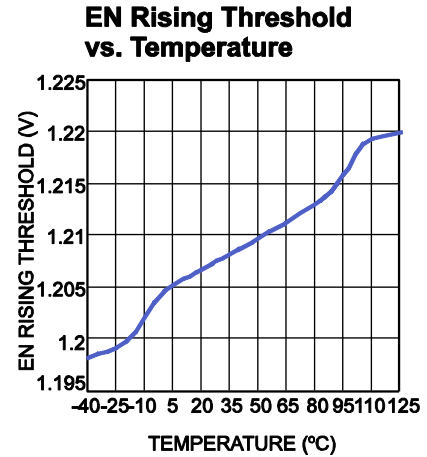
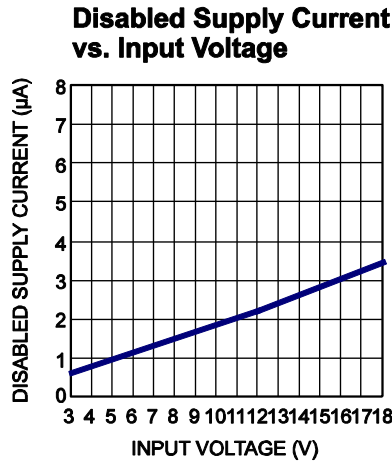
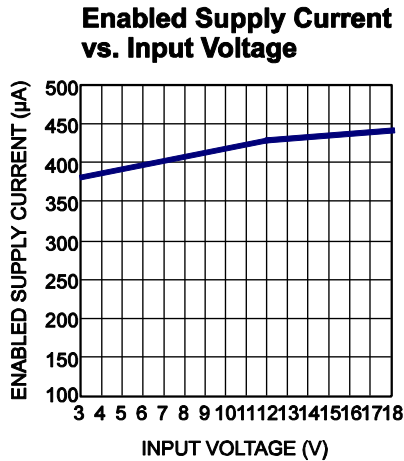
## EV8861-L-00A BILL OF MATERIALS

| Qty | Ref              | Value    | Description                            | Package     | Manufacturer | Manufacturer P/N   |
|-----|------------------|----------|----------------------------------------|-------------|--------------|--------------------|
| 1   | R1               | 80.6k    | Film Res,1%                            | 0603        | ROYAL        | RC0603FR-0780K6L   |
| 1   | R2               | 205k     | Film Res,1%                            | 0603        | ROYAL        | RL0603FR-07205KL   |
| 1   | R3               | 0 Ω      | Film Res,1%                            | 0603        | ROYAL        | RC0603FR-070RL     |
| 1   | R4               | 10k      | Film Res,1%                            | 0603        | ROYAL        | RL0603FR-0710KL    |
| 3   | R5, R9, R10      | 499k     | Film Res,1%                            | 0603        | ROYAL        | RL0603FR-07499KL   |
| 0   | R6               | NS       |                                        |             |              |                    |
| 2   | R7,R12           | 100k     | Film Res,1%                            | 0603        | ROYAL        | RL0603FR-07100KL   |
| 2   | R8,R11           | 300k     | Film Res,1%                            | 0603        | ROYAL        | RL0603FR-07300KL   |
| 2   | C1, C3           | 0.1µF    | Ceramic Cap, 25V,X7R                   | 0603        | muRata       | GRM188R71E104KA01D |
| 2   | C1A,C1B, C1C,C1D | 22µF     | Ceramic Cap,25V,X5R                    | 1206        | muRata       | GRM31CR61E226KE15L |
| 4   | C2,C2A, C2B,C2C  | 22µF     | Ceramic Cap , 25V,X5R                  | 0805        | muRata       | GRM21BR61E226ME44L |
| 0   | C1C,C1D, C2D,C2E | NS       |                                        |             |              |                    |
| 1   | C4               | 22pF     | Ceramic Cap, 50V, X7R                  | 0603        | muRata       | GRM1885C1H220JA01D |
| 1   | C5               | 0.47µF   | Ceramic Cap,16V,X7R                    | 0603        | muRata       | GRM188R71C474KA88D |
| 1   | C6               | 22nF     | Ceramic Cap,16V,X7R                    | 0603        | muRata       | GRM188R71C223KA01D |
| 1   | L1               | 1.5µH    | Inductor, DCR=2.1mΩ                    | SMD         | Würth        | 7443320150         |
| 1   | U1               | MP8861   | Step-Down Converter with I2C Interface | QFN14 (3*4) | MPS          | MP8861GL           |
| 1   | U2               | Jumper   | 3 pin jumper                           | DIP         | any          |                    |
| 1   | U3               | Switch-4 | Switch-4                               | SMD         | Würth        | 416 131 160 804    |

## EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 1V$ ,  $L = 1.5\mu H$ ,  $F_S = 500kHz$ , Auto PFM/PWM mode,  $T_A = 25^\circ C$ , unless otherwise noted.



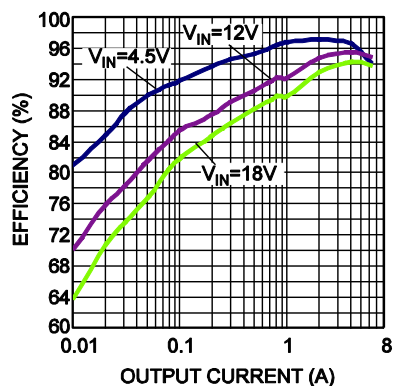
## EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 1V$ ,  $L = 1.5\mu H$ ,  $F_S = 500kHz$ , Auto PFM/PWM mode,  $T_A = 25^\circ C$ , unless otherwise noted.

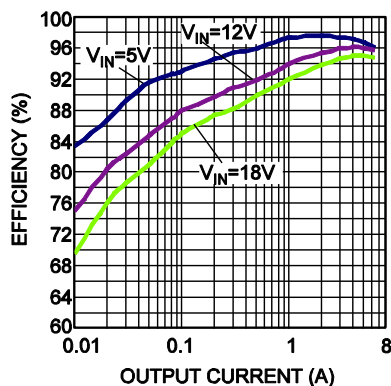
**Efficiency vs. Output Current**

$V_{OUT}=2.5V$ ,  $L=2.2\mu H$ ,  $DCR=3m\Omega$



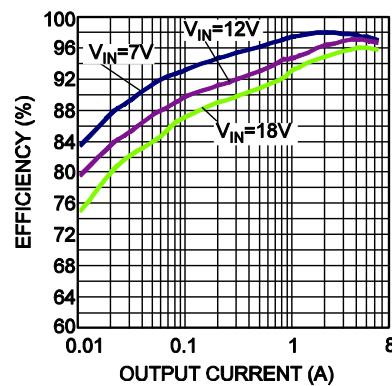
**Efficiency vs. Output Current**

$V_{OUT}=3.3V$ ,  $L=2.2\mu H$ ,  $DCR=3m\Omega$



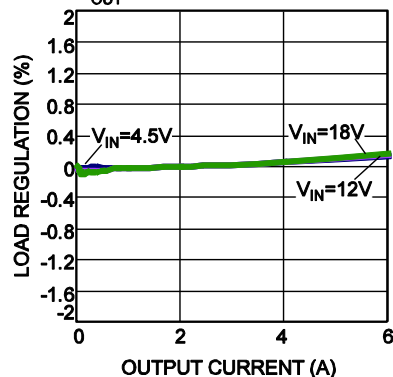
**Efficiency vs. Output Current**

$V_{OUT}=5V$ ,  $L=3.3\mu H$ ,  $DCR=4.4m\Omega$



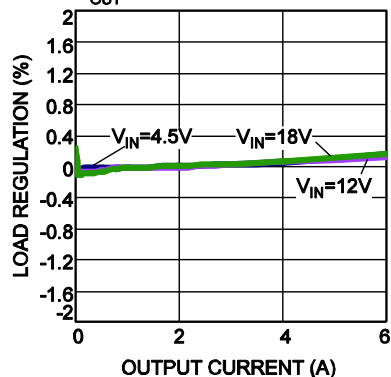
**Load Regulation vs. Output Current**

$V_{OUT}=1V$



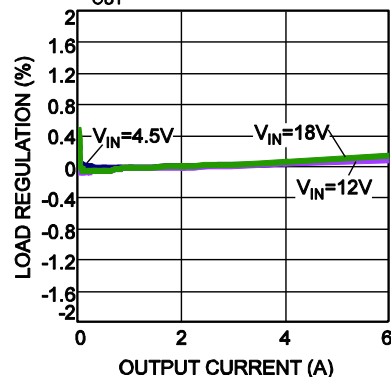
**Load Regulation vs. Output Current**

$V_{OUT}=1.2V$



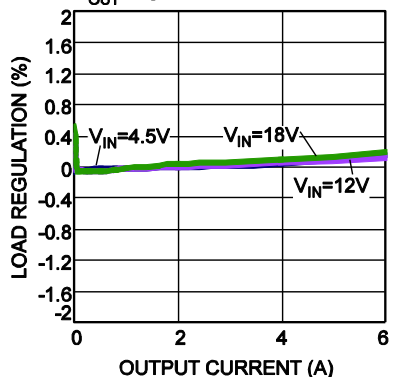
**Load Regulation vs. Output Current**

$V_{OUT}=1.5V$



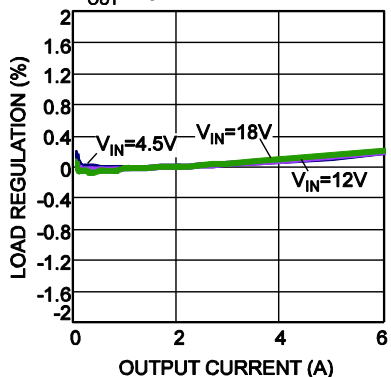
**Load Regulation vs. Output Current**

$V_{OUT}=1.8V$



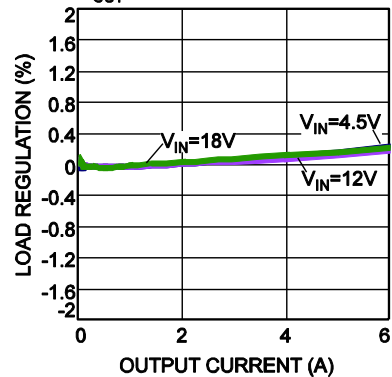
**Load Regulation vs. Output Current**

$V_{OUT}=2.5V$



**Load Regulation vs. Output Current**

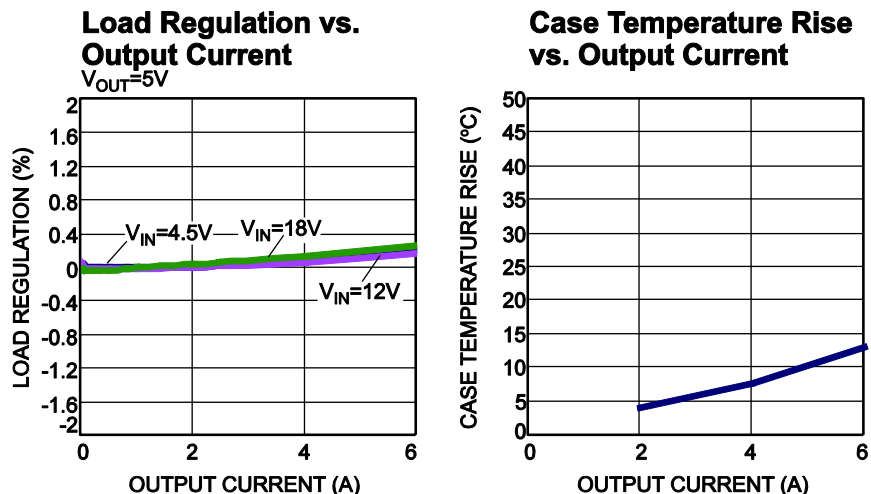
$V_{OUT}=3.3V$



## EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 1V$ ,  $L = 1.5\mu H$ ,  $F_S = 500kHz$ , Auto PFM/PWM mode,  $T_A = 25^\circ C$ , unless otherwise noted.



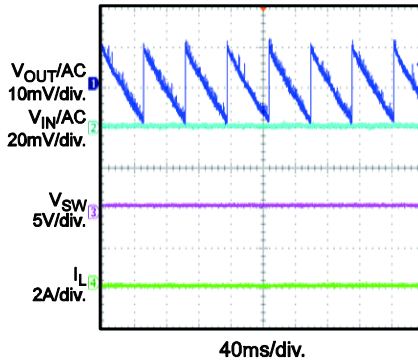
## EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 1V$ ,  $L = 1.5\mu H$ ,  $F_S = 500kHz$ , Auto PFM/PWM mode,  $T_A = 25^\circ C$ , unless otherwise noted.

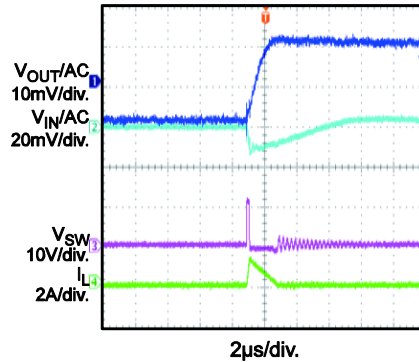
**Input/Output Ripple**

$I_{OUT} = 0A$



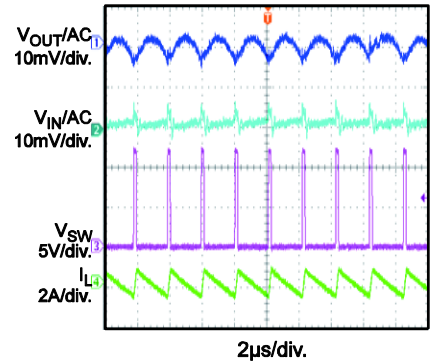
**Input/Output Ripple**

$I_{OUT} = 0A$



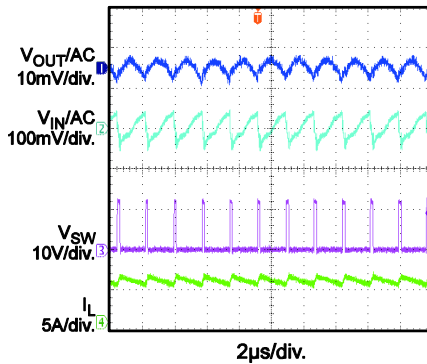
**Input/Output Ripple**

$I_{OUT} = 0A$ , Forced PWM Mode



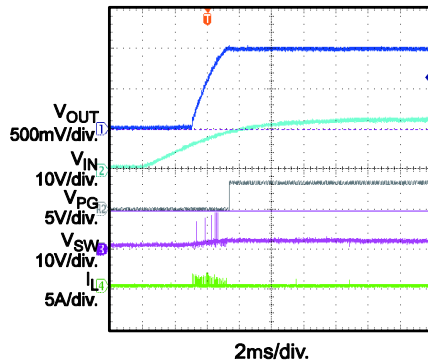
**Input/Output Ripple**

$I_{OUT} = 6A$



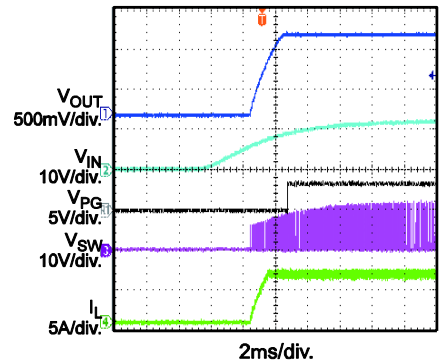
**Start-Up through Input Voltage**

$I_{OUT} = 0A$



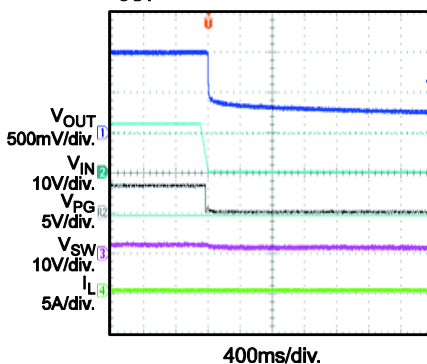
**Start-Up through Input Voltage**

$I_{OUT} = 6A$



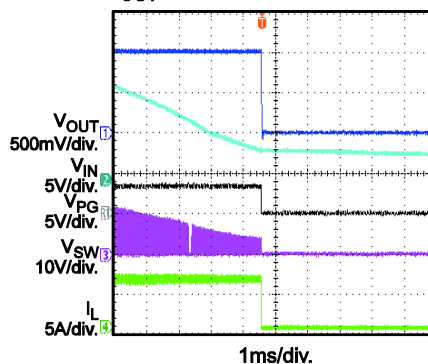
**Shutdown through Input Voltage**

$I_{OUT} = 0A$



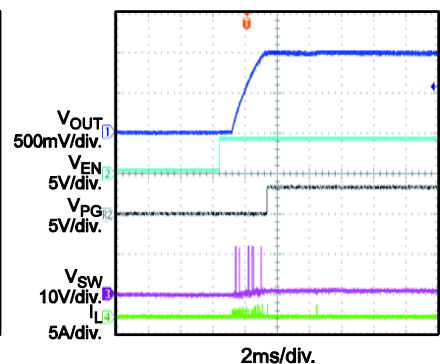
**Shutdown through Input Voltage**

$I_{OUT} = 6A$



**Start-Up through EN**

$I_{OUT} = 0A$





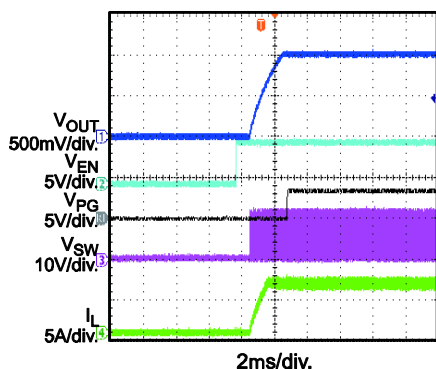
## EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 1V$ ,  $L = 1.5\mu H$ ,  $F_S = 500kHz$ , Auto PFM/PWM mode,  $T_A = 25^\circ C$ , unless otherwise noted.

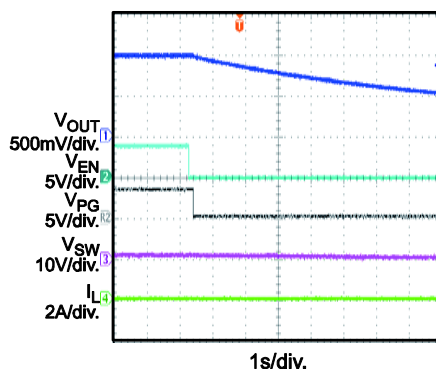
### Start-Up through EN

$I_{OUT} = 6A$



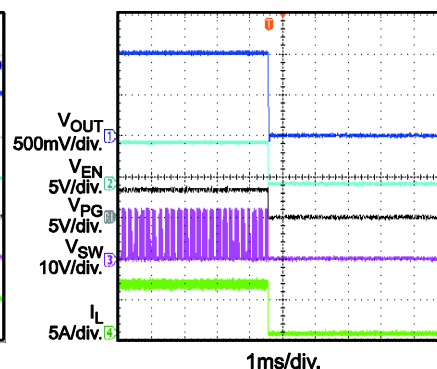
### Shutdown through EN

$I_{OUT} = 0A$



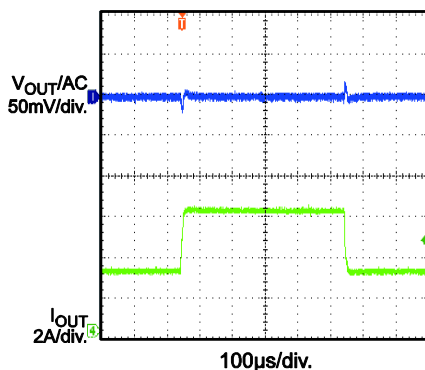
### Shutdown through EN

$I_{OUT} = 6A$



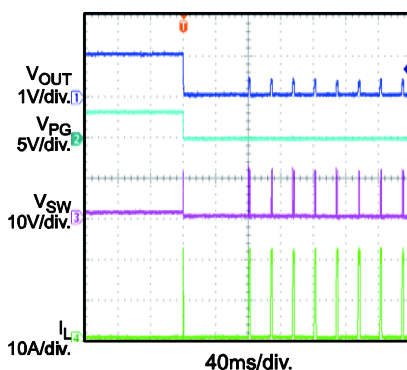
### Load Transient

$I_{OUT} = 3A-6A$



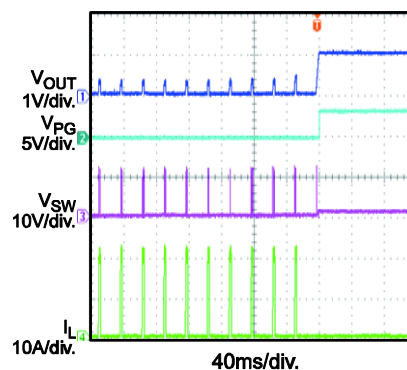
### Short-Circuit Protection Entry

$I_{OUT} = 0A$



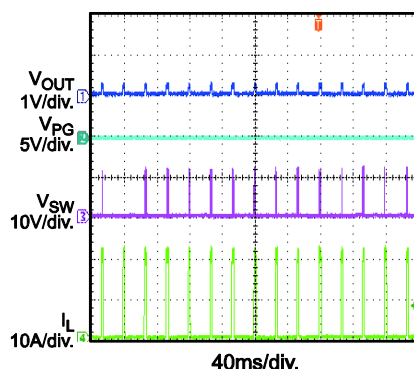
### Short-Circuit Protection Recovery

$I_{OUT} = 0A$



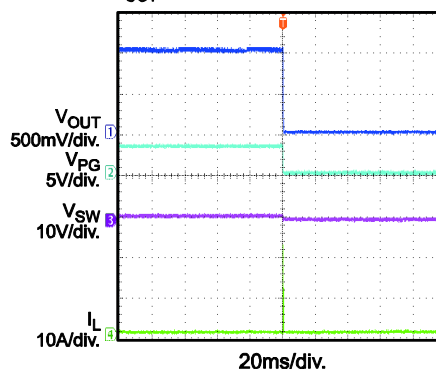
### Short-Circuit Protection Steady State

Short Output to GND



### Short-Circuit Protection Entry, Latch Off Mode

$I_{OUT} = 0A$



## PRINTED CIRCUIT BOARD LAYER

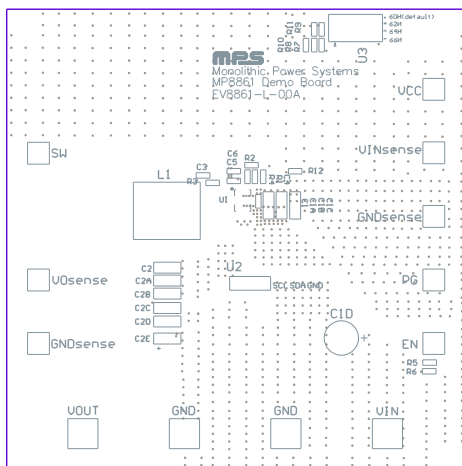


Figure 1: Top Silk Layer

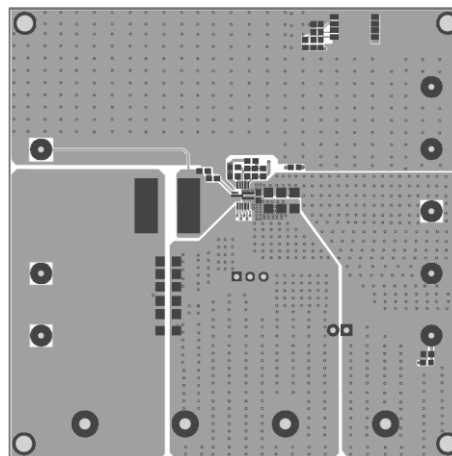


Figure 2: Top Layer

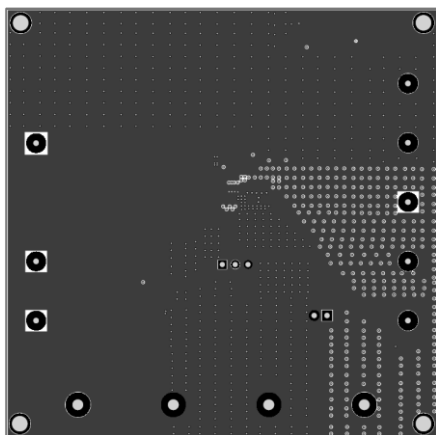


Figure 3: Inner 1 Layer

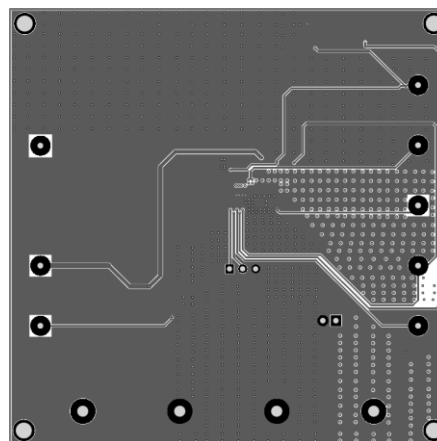


Figure 4: Inner 2 Layer

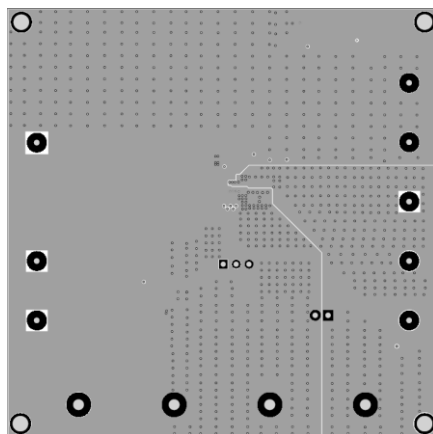


Figure 5: Bottom Layer



## 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 between 2.85V and 18V, and then turn off the power supply.
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 board will automatically start up.
5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.3V to turn on the regulator, or less than 0.99V to turn it off.
6. To program I<sup>2</sup>C function, connect SCL, SDA and GND to I<sup>2</sup>C start kit board. Connect I<sup>2</sup>C start kit board to computer and run MP8861 GUI software to program MP8861 I<sup>2</sup>C register.

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