# EV8869S-L-00A

## High Efficiency,12A,18V, Synchronous Step-Down Converter with I²C Interface

The Future of Analog IC Technology

## DESCRIPTION

The EV8869S-L-00A is used for demonstrating the performance of MPS's MP8869S. MP8869S is a highly integrated and high frequency synchronous step-down switcher with $I^2C$ control interface. It is optimized to support up to 12A continuous/15A peak output current over an input supply range from 2.85V to 18V with excellent load and line regulation.

COT control operation provides fast transient response and eases loop stabilization. In $I^2C$ control loop, the output voltage level can be controlled, on-the fly through an $I^2C$ 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 $I^2C$ interface. Full protection features include over voltage, over-current protection and thermal shut down.

The MP8869S is available in QFN-14(3mmx4mm) package.

## ELECTRICAL SPECIFICATION

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 2.85– 18 | V |
| Output Voltage | $V_{OUT}$ | 1 | V |
| Continuous Output Current | $I_{OUT}$ | 12 | A |
| Peak Output Current | $I_{OUT}$ | 15 | A |

## FEATURES

- Vout Adjustable up to 5.5V using FB pin
- Wide 2.85V-to-18V Operating Input Range
- 12A Continuous/15A Peak Output Current
- 1% Internal Reference Accuracy
- $I^2C$ 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 $I^2C$
- Selectable PFM/PWM Mode and Adjustable Frequency & Current Limit Through $I^2C$
- 4 Different $I^2C$ 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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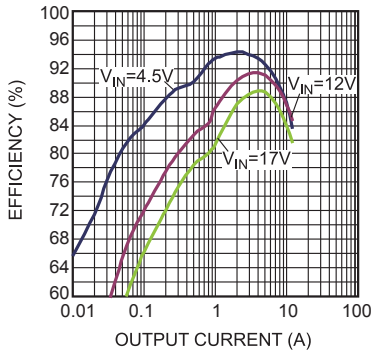
## EV8869S-L-00A EVALUATION BOAR

(4 layer PCB, 8.5cmx8.5cm)

| Board Number | MPS IC Number |
|---|---|
| EV8869S-L-00A | MP8869SGL |

**Efficiency vs. Output Current**

$V_{OUT}$=1V, L=1.5μH, DCR=2.1mΩ





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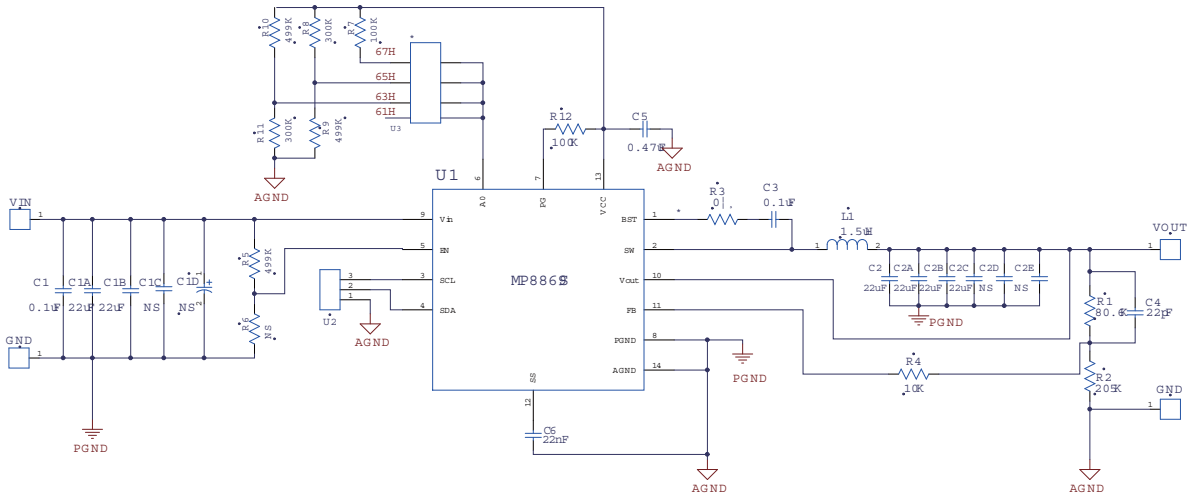
## EVALUATION BOARD SCHEMATIC





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## EV8869S-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, | 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 | Wurth | 7443320150 |
| 1 | U1 | MP8869S | Step-Down Converter with I2C Interface | QFN14 (3*4) | MPS | MP8869SGL |
| 1 | U2 | Jumper | 3 pin jumper | DIP | any | |
| 1 | U3 | Switch-4 | Switch-4 | SMD | Wurth | 416 131 160 804 |


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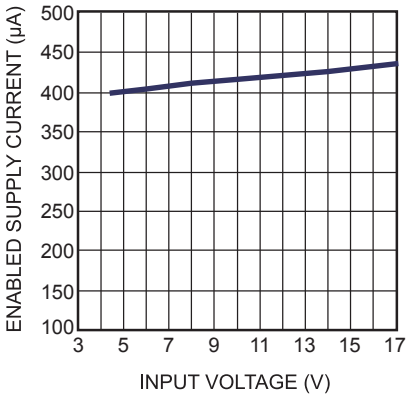
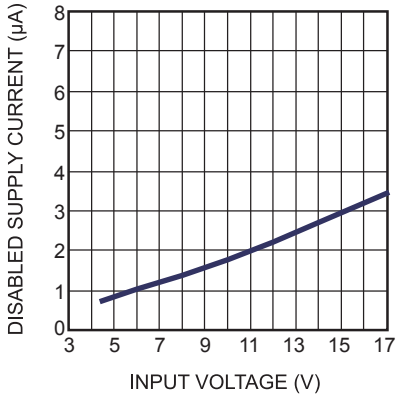
## EVB TEST RESULTS

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 12V, $V_{OUT}$ = 1V, L = 1.5µH, $F_S$ = 500kHz, Auto PFM/PWM mode, $T_A$ = 25°C, unless otherwise noted.**

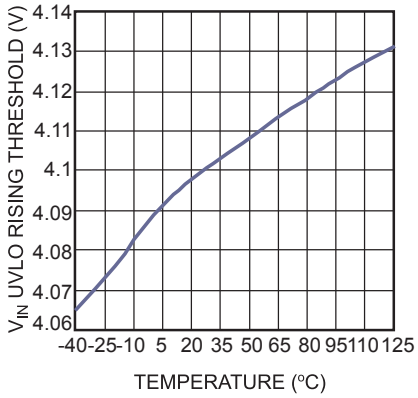
### Enabled Supply Current vs. Input Voltage



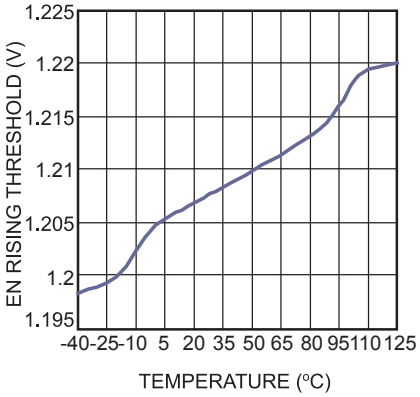

### Disabled Supply Current vs. Input Voltage



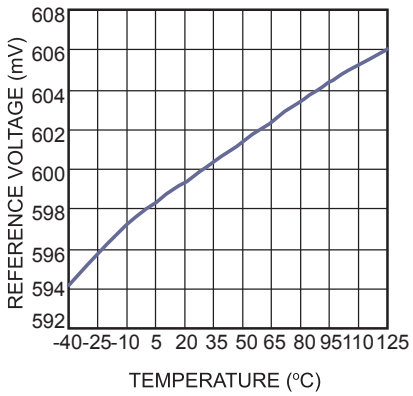

### $V_{IN}$ UVLO Rising Threshold vs. Temperature



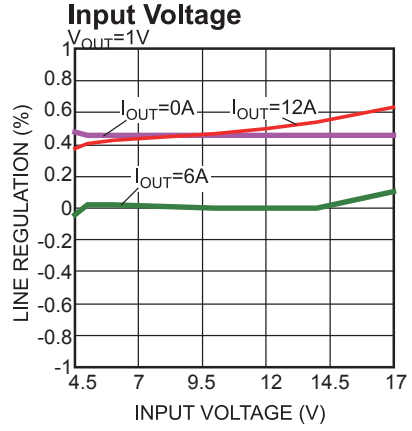

### EN Rising Threshold vs. Temperature




### Reference Voltage vs. Temperature

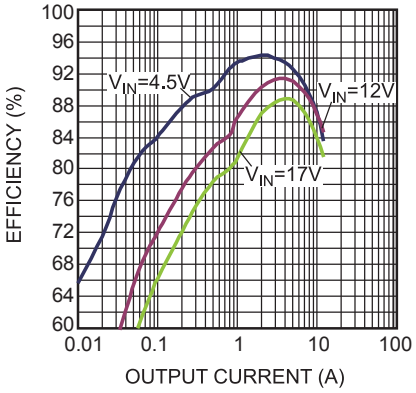



### Line Regulation vs. Input Voltage



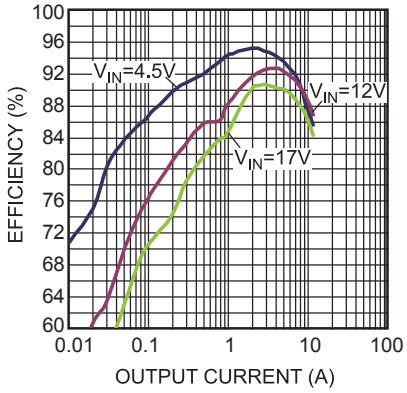

### Efficiency vs. Output Current

$V_{OUT}$=1V, L=1.5µH, DCR=2.1mΩ



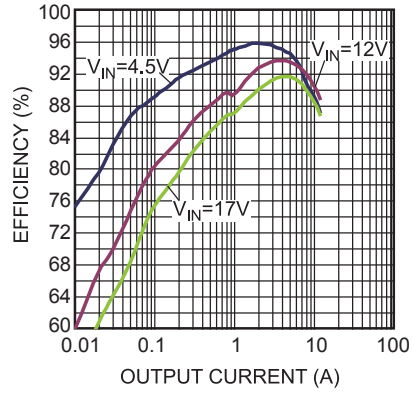

### Efficiency vs. Output Current

$V_{OUT}$=1.2V, L=1.5µH, DCR=2.1mΩ




### Efficiency vs. Output Current

$V_{OUT}$=1.5V, L=1.5µH, DCR=2.1mΩ





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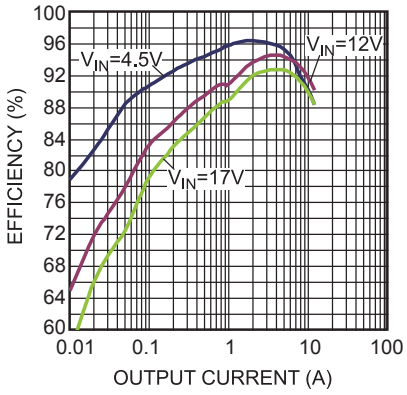
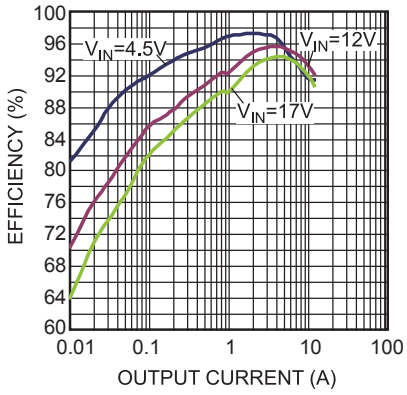
## EVB TEST RESULTS *(continued)*

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 12V, $V_{OUT}$ = 1V, L = 1.5µH, $F_S$ = 500kHz, Auto PFM/PWM mode, $T_A$ = 25°C, unless otherwise noted.**

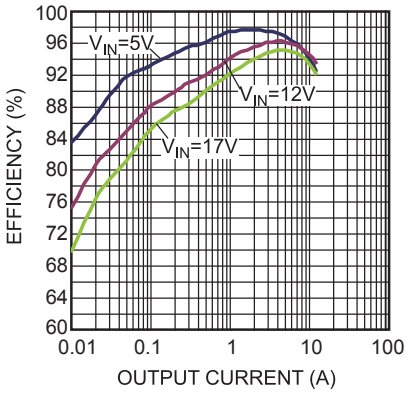
**Efficiency vs. Output Current**
$V_{OUT}$=1.8V, L=1.5µH, DCR=2.1mΩ



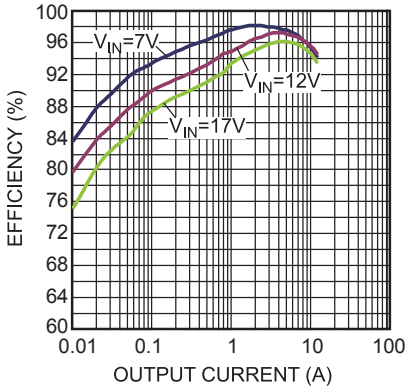

**Efficiency vs. Output Current**
$V_{OUT}$=2.5V, L=2.2µH, DCR=3mΩ



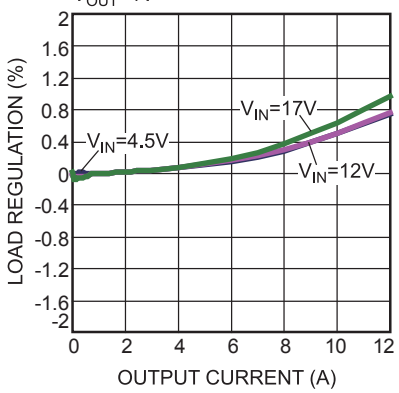

**Efficiency vs. Output Current**
$V_{OUT}$=3.3V, L=2.2µH, DCR=3mΩ



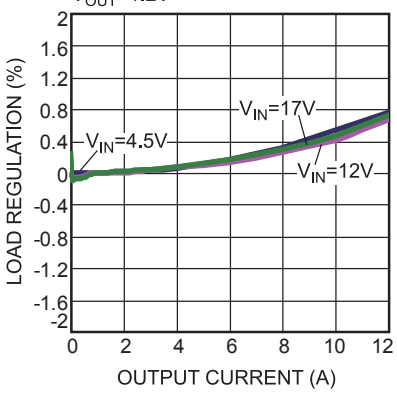

**Efficiency vs. Output Current**
$V_{OUT}$=5V, L=3.3µH, DCR=4.4mΩ



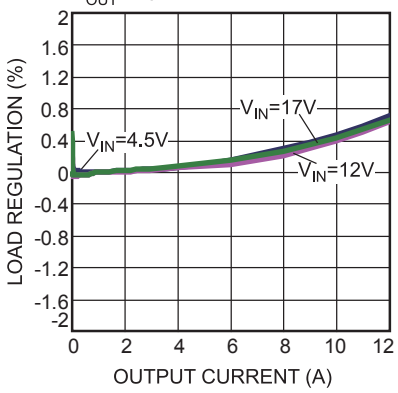

**Load Regulation vs. Output Current**
$V_{OUT}$=1V



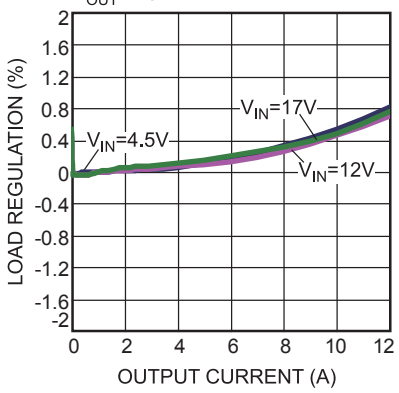

**Load Regulation vs. Output Current**
$V_{OUT}$=1.2V



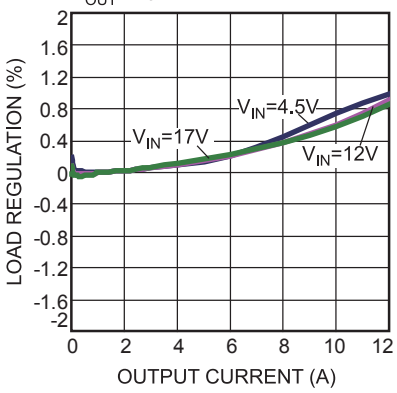

**Load Regulation vs. Output Current**
$V_{OUT}$=1.5V




**Load Regulation vs. Output Current**
$V_{OUT}$=1.8V




**Load Regulation vs. Output Current**
$V_{OUT}$=2.5V





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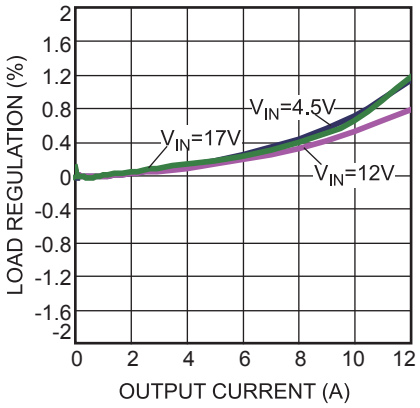
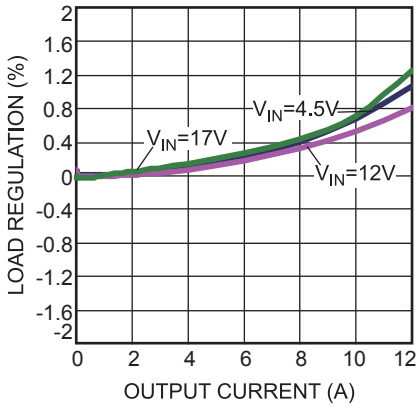
## EVB TEST RESULTS *(continued)*

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 12V, $V_{OUT}$ = 1V, L = 1.5µH, $F_S$ = 500kHz, Auto PFM/PWM mode, $T_A$ = 25°C, unless otherwise noted.**

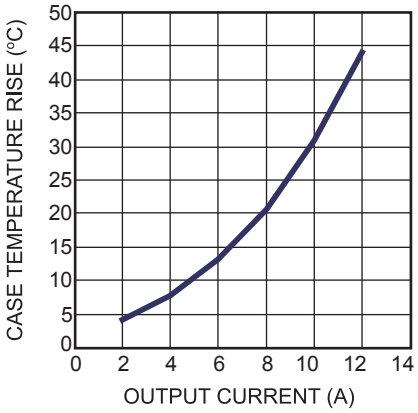
**Load Regulation vs. Output Current**
$V_{OUT}$=3.3V



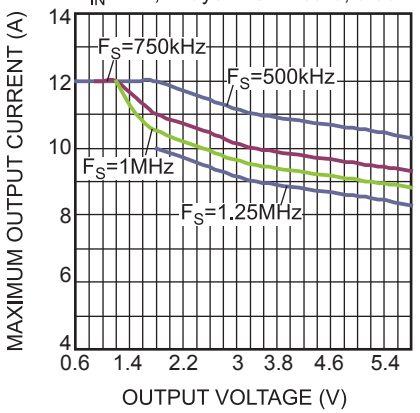

**Load Regulation vs. Output Current**
$V_{OUT}$=5V




**Case Temperature Rise vs. Output Current**




**Output Current Derating vs. Frequency and Output Voltage**
$V_{IN}$=12V, 4Layer PCB Board, 8.5cm x 8.5cm





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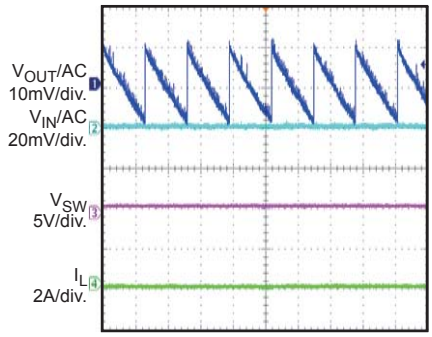
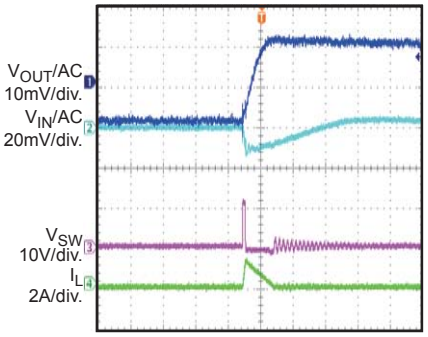
## EVB TEST RESULTS *(continued)*

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 12V, $V_{OUT}$ = 1V, L = 1.5µH, $F_S$ = 500kHz, Auto PFM/PWM mode, $T_A$ = 25°C, unless otherwise noted.**

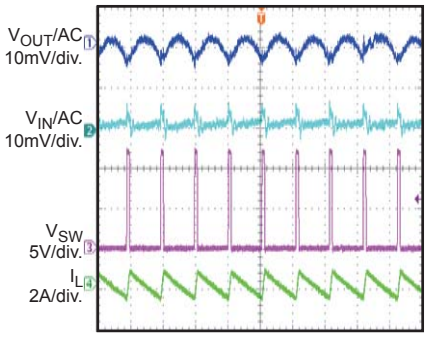
### Input/Output Ripple
$I_{OUT}$ = 0A



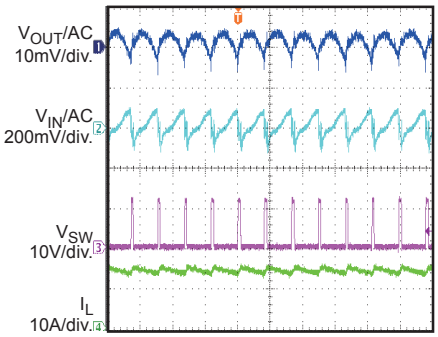

### Input/Output Ripple
$I_{OUT}$ = 0A



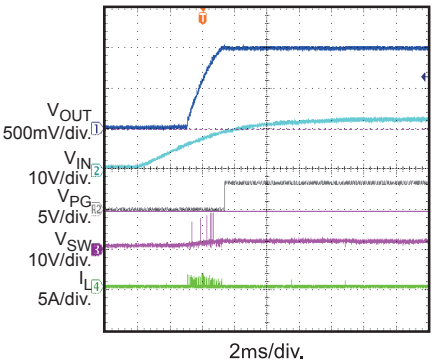

### Input/Output Ripple
$I_{OUT}$ = 0A, Forced PWM Mode



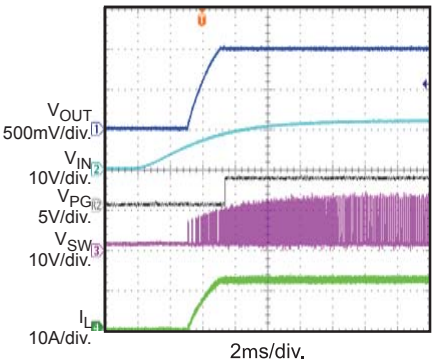

### Input/Output Ripple
$I_{OUT}$ = 12A



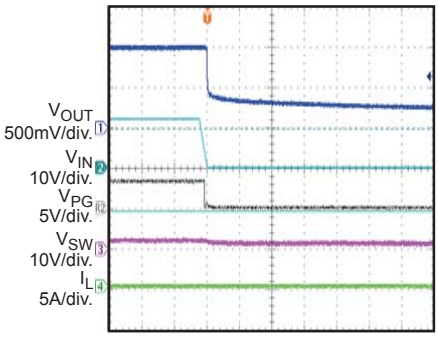

### Start-Up through Input Voltage
$I_{OUT}$ = 0A



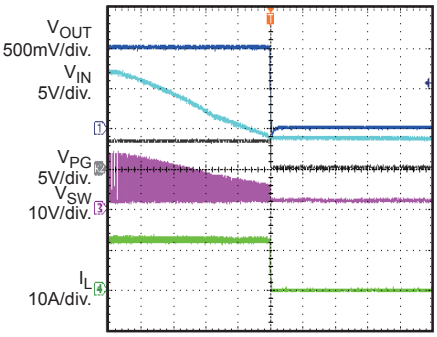

### Start-Up through Input Voltage
$I_{OUT}$ = 12A



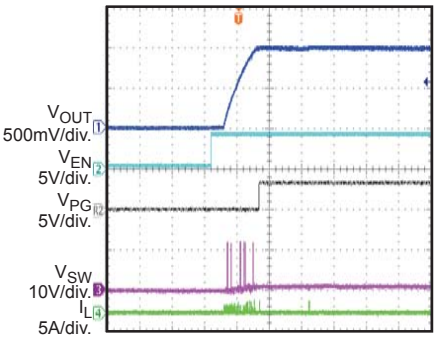

### Shutdown through Input Voltage
$I_{OUT}$ = 0A




### Shutdown through Input Voltage
$I_{OUT}$ = 12A




### Start-Up through EN
$I_{OUT}$ = 0A





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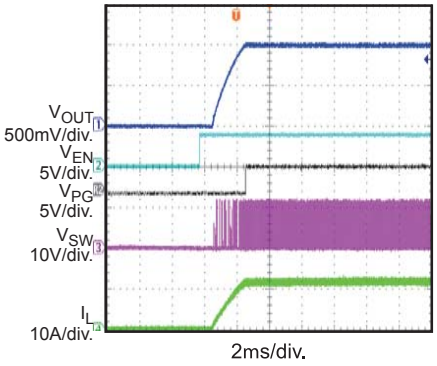
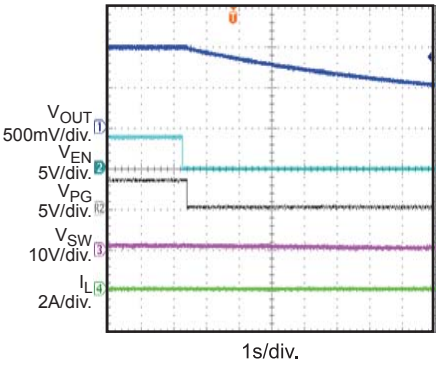
## EVB TEST RESULTS *(continued)*

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 12V, $V_{OUT}$ = 1V, L = 1.5µH, $F_S$ = 500kHz, Auto PFM/PWM mode, $T_A$ = 25°C, unless otherwise noted.**

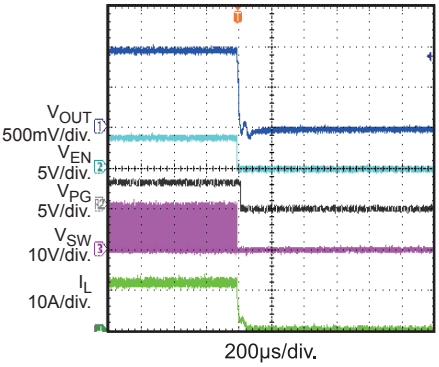
### Start-Up through EN
$I_{OUT}$ = 12A



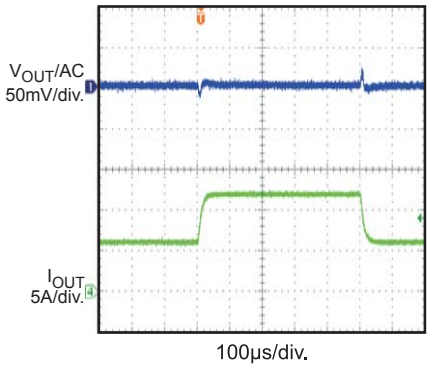

### Shutdown through EN
$I_{OUT}$ = 0A



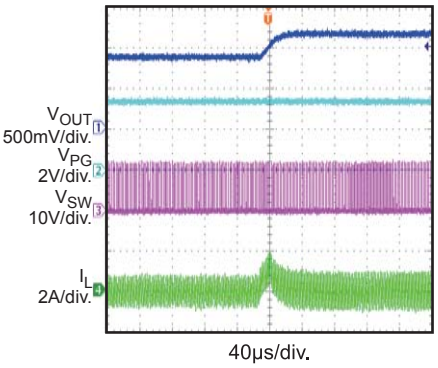

### Shutdown through EN
$I_{OUT}$ = 12A



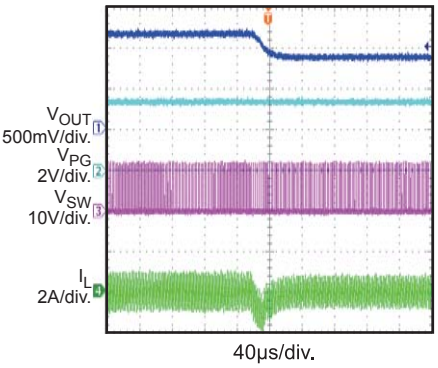

### Load Transient
$I_{OUT}$ = 6A-12A



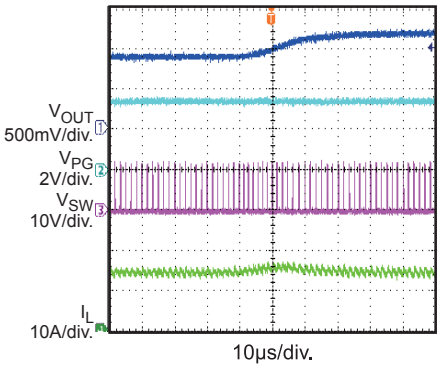

### $I^2C$ Control Slew Rate
$I_{OUT}$=0A, Slew Rate=20mV/µs,
PWM Mode, Output from 0.9V to 1.2V



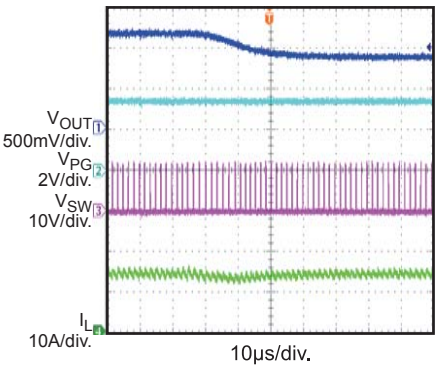

### $I^2C$ Control Slew Rate
$I_{OUT}$=0A, Slew Rate=20mV/µs,
PWM Mode, Output from 1.2V to 0.9V



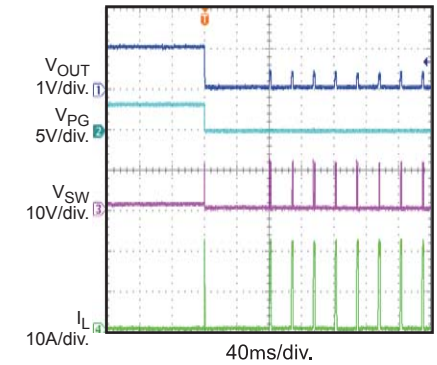

### $I^2C$ Control Slew Rate
$I_{OUT}$=12A, Slew Rate=20mV/µs,
PWM Mode, Output from 0.9V to 1.2V




### $I^2C$ Control Slew Rate
$I_{OUT}$=12A, Slew Rate=20mV/µs,
PWM Mode, Output from 1.2V to 0.9V




### Short-Circuit Protection Entry
$I_{OUT}$ = 0A





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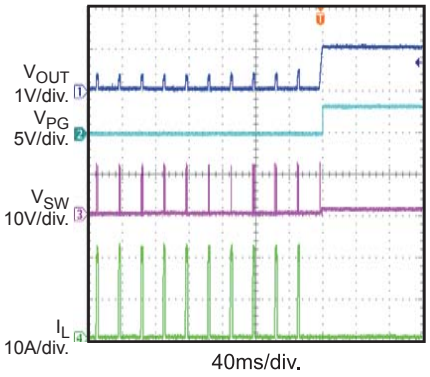
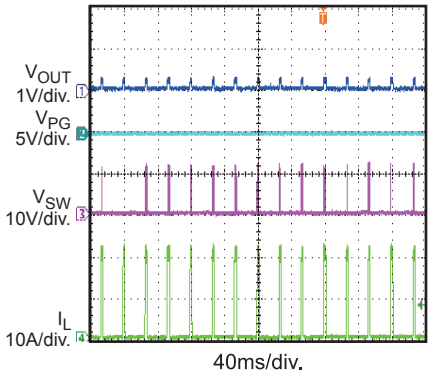
## EVB TEST RESULTS *(continued)*

**Performance waveforms are tested on the evaluation board.**
**$V_{IN}$ = 12V, $V_{OUT}$ = 1V, L = 1.5µH, $F_S$ = 500kHz, Auto PFM/PWM mode, $T_A$ = 25°C, unless otherwise noted.**

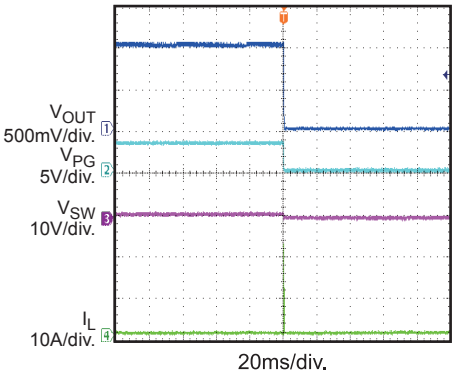
**Short-Circuit Protection Recovery**
$I_{OUT}$ = 0A




**Short-Circuit Protection Steady State**
Short Output to GND




**Short-Circuit Protection Entry, Latch Off Mode**
$I_{OUT}$=0A





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# PRINTED CIRCUIT BOARD LAYER

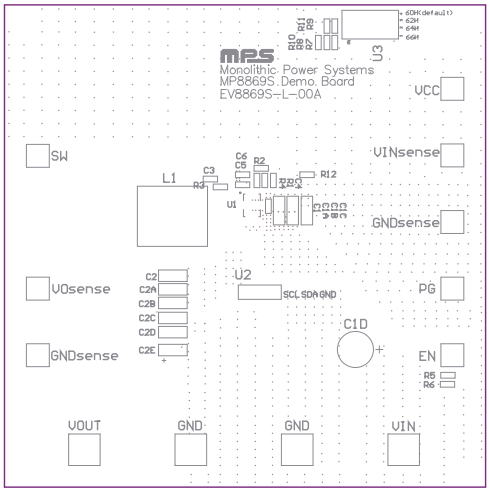


**Figure 1: Top Silk Layer**

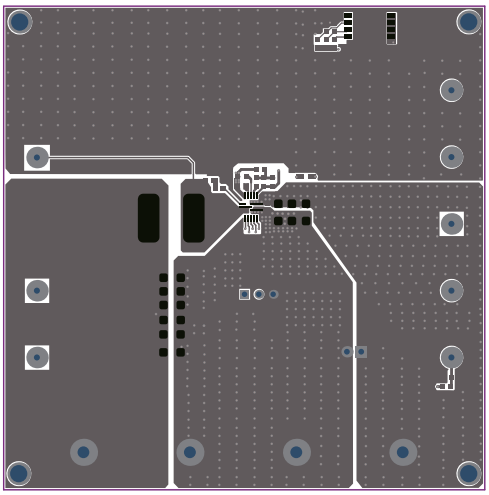

**Figure 2: Top Layer**

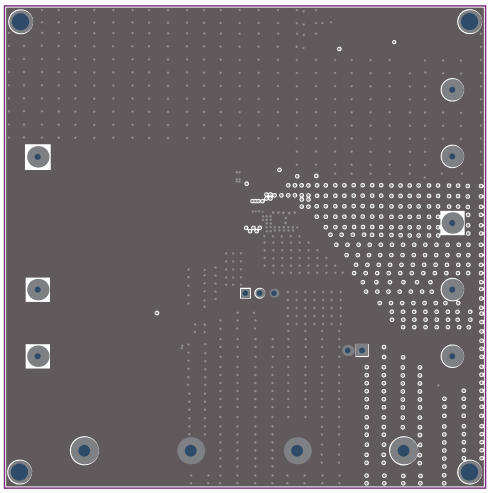

**Figure 3: Inner 1 Layer**

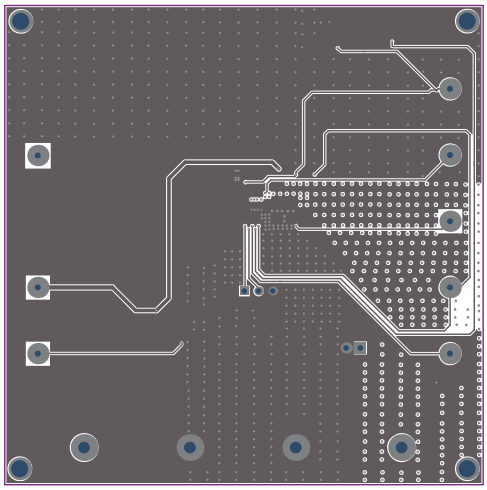

**Figure 4: Inner 2 Layer**

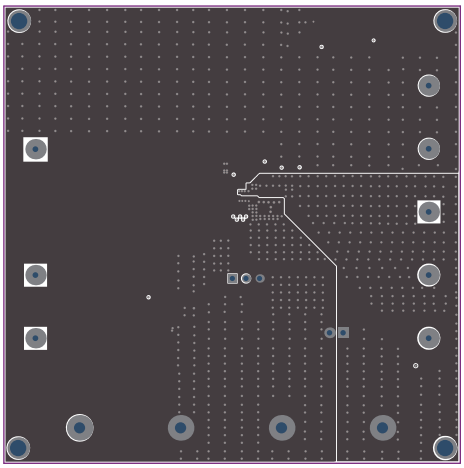

**Figure 5: Bottom Layer**


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## 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 $I^2C$ function, connect SCL, SDA and GND to $I^2C$ start kit board. Connect $I^2C$ start kit board to computer and run MP8869S GUI software to program MP8869S $I^2C$ register.

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