



# EV8862-Q-00A

## 2.8 - 22V $V_{IN}$ , 2A $I_{OUT}$ , 4-Switch, Integrated Buck-Boost Converter with I<sup>2</sup>C Interface

### DESCRIPTION

The EV8862-Q-00A is an evaluation board for MP8862, which is a synchronous, 4-switch, integrated buck-boost converter capable of regulating the output voltage from a 2.8V to 22V wide input voltage range with high efficiency. The integrated output voltage scaling and adjustable output current limit functions meet the USB power delivery (PD) requirement.

The MP8862 uses constant-on-time (COT) control in buck mode and constant-off-time control in boost mode, providing fast load transient response and smooth buck-boost mode transient. The MP8862 provides auto PFM/PWM or forced PWM switching modes, programmable output constant current (CC) current limit, which supports flexible design for different applications.

Full protection features include over-current protection (OCP), over-voltage protection (OVP), under-voltage protection (UVP), programmable soft start, and thermal shutdown.

The MP8862 is available in a 16-pin QFN (3mmx3mm) package.

### ELECTRICAL SPECIFICATION

| Parameter               | Symbol    | Value | Units |
|-------------------------|-----------|-------|-------|
| Operating Input Voltage | $V_{IN}$  | 12    | V     |
| Switching Frequency     | $F_s$     | 500   | kHz   |
| Output Voltage          | $V_{OUT}$ | 5     | V     |
| Output Current          | $I_{OUT}$ | 2     | A     |

### FEATURES

- Wide 2.8V to 22V Operating Input Voltage Range
- 1V <sup>(1)</sup> to 20.47V Output Voltage Range (5V Default) with 10mV Resolution through I<sup>2</sup>C
- 2A Output Current or 4A Input Current
- Four Low  $R_{DS(ON)}$  Internal Buck Power MOSFETs
- Adjustable Accurate CC Output Current Limit with Internal Sensing MOSFET via I<sup>2</sup>C
- 500kHz Switching Frequency
- Output Over-Voltage Protection (OVP) Hiccup
- Output Short-Circuit Protection (SCP) with Hiccup
- Over-Temperature Warning and Shutdown
- I<sup>2</sup>C Interface with ALT Pin
- Four Programmable I<sup>2</sup>C Addresses
- One-Time Programmable (OTP) Non-Volatile Memory
- I<sup>2</sup>C Programmable Line Drop Compensation, PFM/PWM Mode, Soft Start, OCP, etc.
- EN Shutdown Discharge Programmable
- Available in a QFN-16 (3mmx3mm) Package

### APPLICATIONS

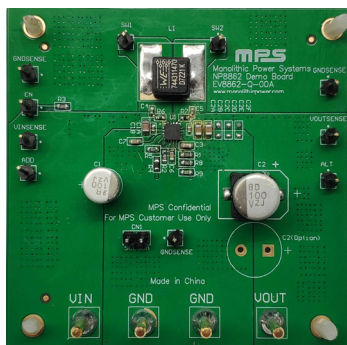
- USB PD Sourcing Ports
- Buck-Boost Bus Supplies

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#### NOTE:

- 1) For  $V_{OUT} < 3V$  applications, the switching frequency decreases.

## EV8862-Q-00A EVALUATION BOARD

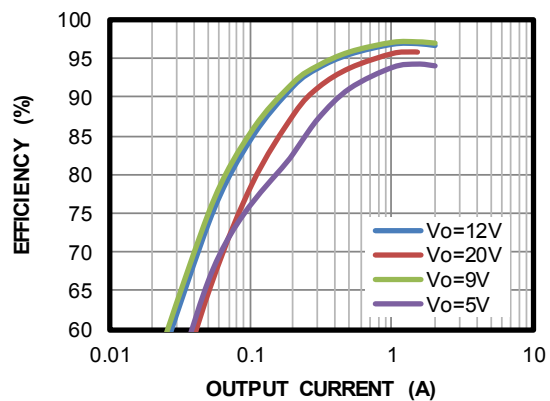


**(L x W) 6.35cm x 6.35cm (Four Layer PCB)**

| Board Number | MPS IC Number |
|--------------|---------------|
| EV8862-Q-00A | MP8862GQ-0000 |

### Efficiency vs. Output Current

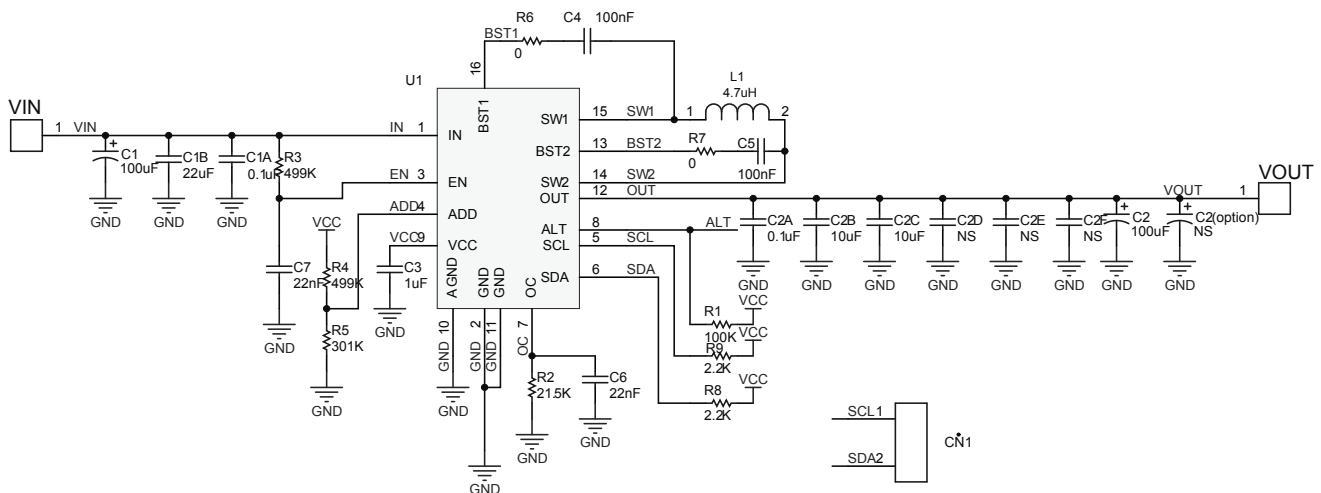
$V_{IN}=12V$ ,  $V_{OUT}=5V$ , Forced PWM Mode



## OTP E-FUSE SELECTION TABLE BY DEFAULT (MP8862GQ-0000)

| OTP Items                     | Default Value                       |
|-------------------------------|-------------------------------------|
| Output voltage                | 5V                                  |
| IOUT_LIMIT                    | 3A (For 21.5k $\Omega$ OC resistor) |
| Switching frequency           | 500kHz                              |
| Mode                          | Forced PWM mode                     |
| Soft start time               | 900 $\mu$ s                         |
| Line drop compensation        | No line drop compensation           |
| Output voltage discharge mode | Enabled                             |
| OCP_OVP protection mode       | Hiccup                              |
| OTP configure code (ID1)      | 0x00                                |

## EVALUATION BOARD SCHEMATIC



**EV8862-Q-00A BILL OF MATERIALS**

| RefDes                                                | Value             | Description                                 | Package             | Manufacturer | Manufacturer P/N   |
|-------------------------------------------------------|-------------------|---------------------------------------------|---------------------|--------------|--------------------|
| C1                                                    | 100μF             | Electrolytic cap, 35V                       | SMD                 | CHEMICON     | EMZJ350ADA101MF80G |
| C1B                                                   | 22μF              | Ceramic Cap.,25V,X5R                        | 0805                | TDK          | C2012X5R1E226M     |
| C2B,C2C                                               | 10μF              | Ceramic Cap.,25V,X5R                        | 0805                | Murata       | GRM21BR61E106MA73L |
| C2                                                    | 100μF             | Electrolytic cap, 35V                       | SMD                 | CHEMICON     | EMZJ350ARA101MHA0G |
| C3                                                    | 1μF               | Ceramic Cap.,16V,X5R                        | 0603                | WE           | 885012106017       |
| C1A, C2A,<br>C4,C5                                    | 100nF             | Ceramic Cap.,50V,X7R                        | 0402                | SAMSUNG      | CL05B104KB5NNNC    |
| C6, C7                                                | 22nF              | Ceramic Capacitor,<br>50V, X5R              | 0603                | Murata       | GRM188R71H223KA01D |
| L1                                                    | 4.7μH             | Inductor,<br>RDC=19.5mOhm,<br>Isat=7A       | SMD                 | WE           | 744311470          |
| R1                                                    | 100k              | Film Res,1%,0603                            | 0603                | YAGEO        | RC0603FR-07100KL   |
| R2                                                    | 21.5k             | Film Res,1%,0603                            | 0603                | YAGEO        | RC0603FR-0721K5L   |
| R3,R4                                                 | 499k              | Film Res,1%,0603                            | 0603                | YAGEO        | RC0603FR-07499KL   |
| R5                                                    | 301k              | Film Res,1%,0603                            | 0603                | YAGEO        | RC0603FR-07301KL   |
| R6,R7                                                 | 0                 | Film Res,1%,0402                            | 0402                | YAGEO        | RC0402FR-070RL     |
| R8,R9                                                 | 2.2k              | Film Res,1%,0603                            | 0603                | YAGEO        | RC0603FR-072K2L    |
| CN1                                                   | test pin          | 1x2pin, 2.54mm                              | DIP                 | WE           | 61300211121        |
| 3*GNDSENSE,<br>ALT, ADD,EN,<br>VOUTSENSE,<br>VINSENSE | test pin          | 1pin, 2.54mm                                | DIP                 | WE           | 61300111121        |
| VIN, VOUT,<br>GND                                     | 2mm<br>copper pin | φ2.0 copper pin                             | DIP                 | N/A          | φ2.0 copper pin    |
| U1                                                    | MP8862            | 4-Switch Integrated<br>Buck-Boost Converter | QFN-16<br>(3mm×3mm) | MPS          | MP8862             |

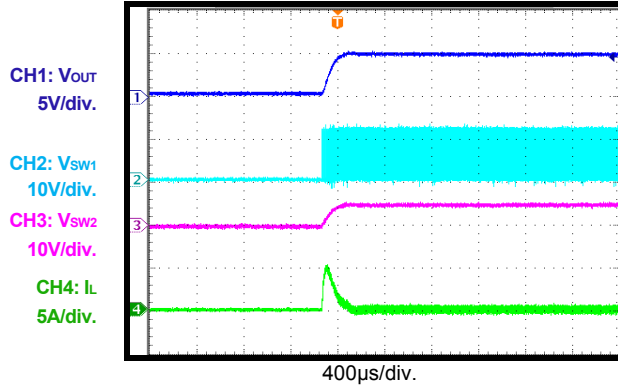
## TYPICAL PERFORMANCE CHARACTERISTICS

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ ,  $T_A = 25^{\circ}C$ , unless otherwise noted.

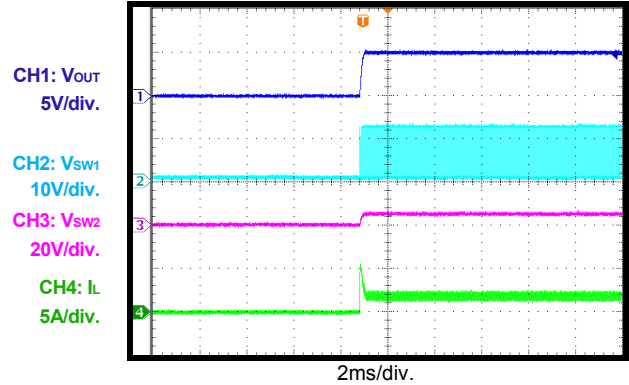
### ENPWR Bit Enable through I<sup>2</sup>C Command

Load = 0A



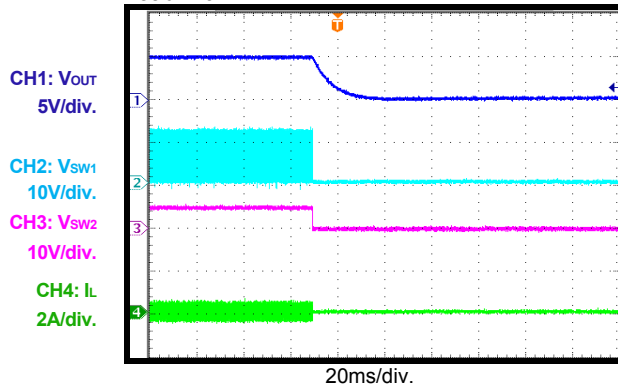
### ENPWR Bit Enable through I<sup>2</sup>C Command

Load = 2A



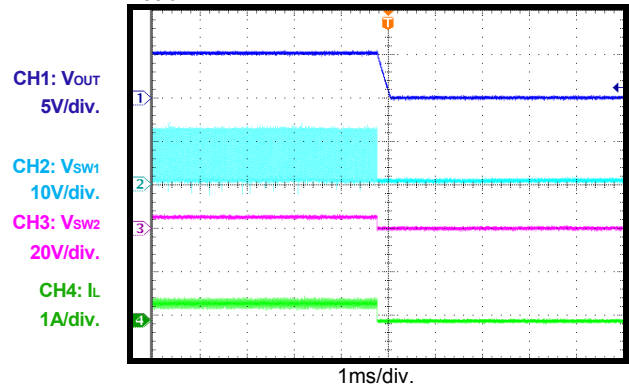
### ENPWR Bit Disable through I<sup>2</sup>C Command

Load = 0A



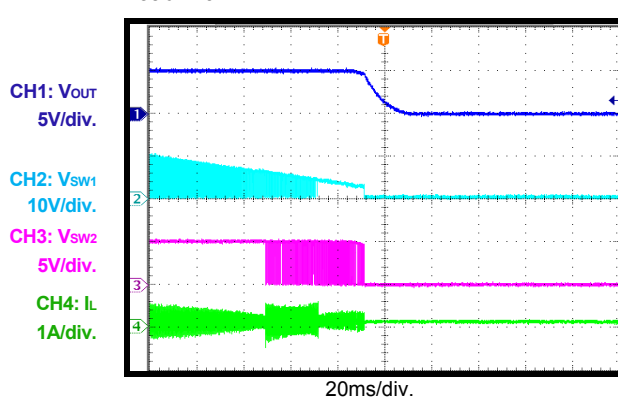
### ENPWR Bit Disable through I<sup>2</sup>C Command

Load = 2A



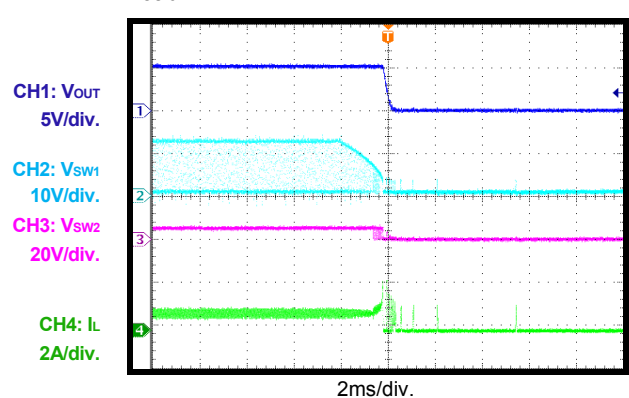
### $V_{IN}$ Power Off

Load = 0A



### $V_{IN}$ Power Off

Load = 2A



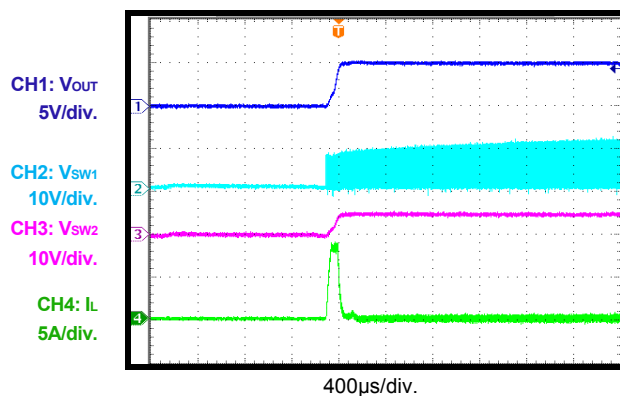
# TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ ,  $T_A = 25^{\circ}C$ , unless otherwise noted.

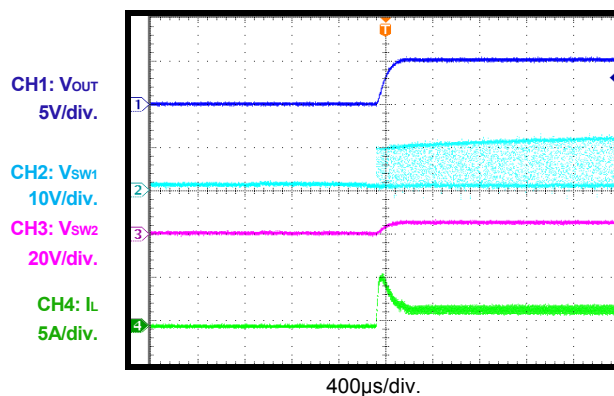
## $V_{IN}$ Start-Up

Load = 10mA



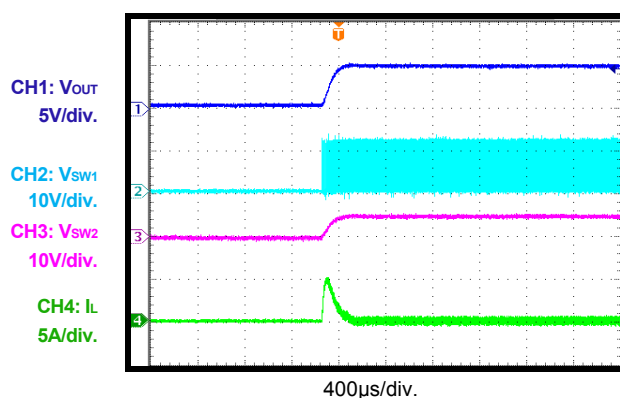
## $V_{IN}$ Start-Up

Load = 2A



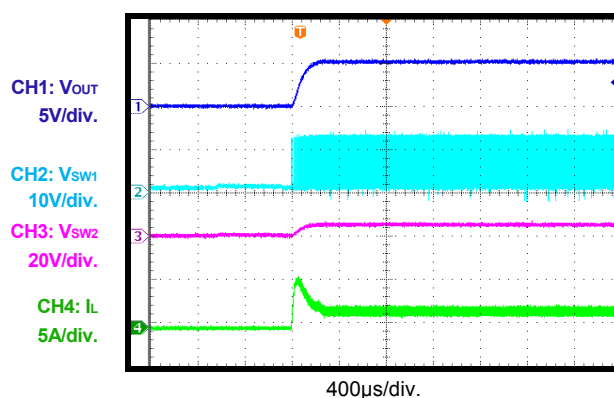
## EN Pin Enable

Load = 0A



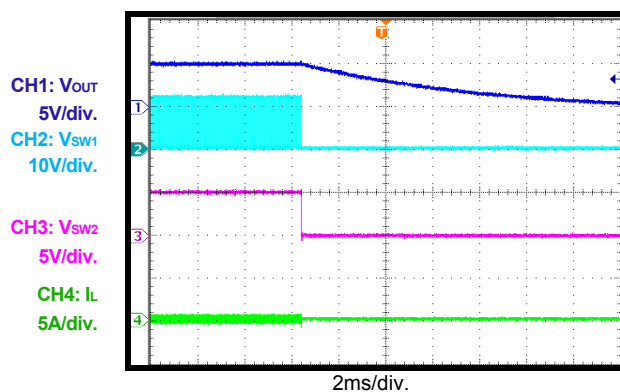
## EN Pin Enable

Load = 2A



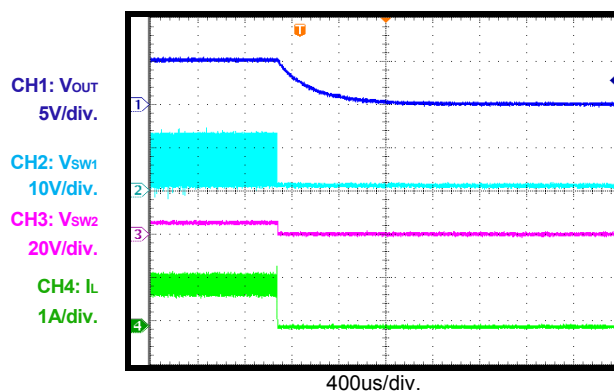
## EN Pin Disable

Load = 0A



## EN Pin Disable

Load = 2A



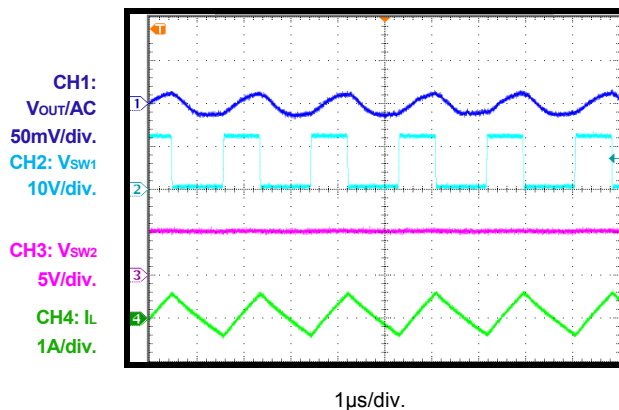
## TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

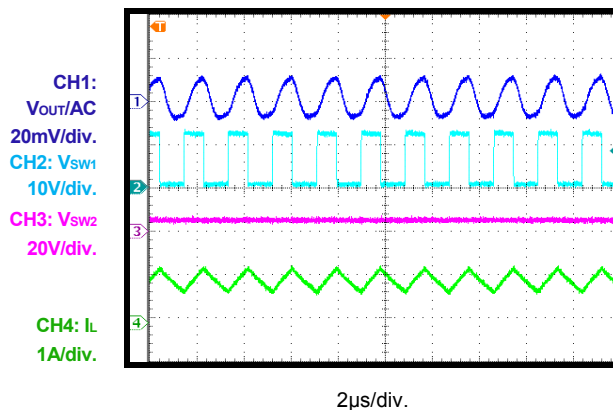
### Steady State

$V_{OUT} = 5V$ , Load = 0A



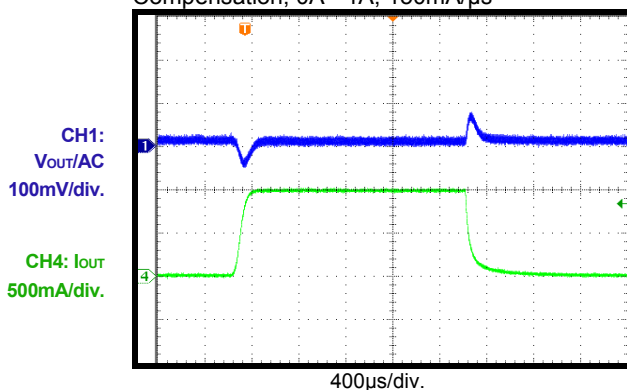
### Steady State

$V_{OUT} = 5V$ , Load = 2A



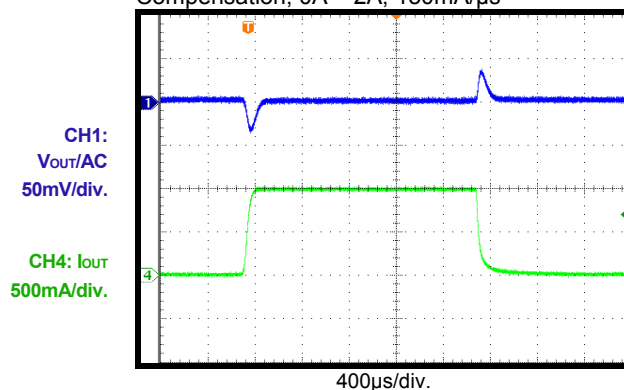
### Load Transient

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , No Line Drop Compensation, 0A - 1A, 150mA/µs



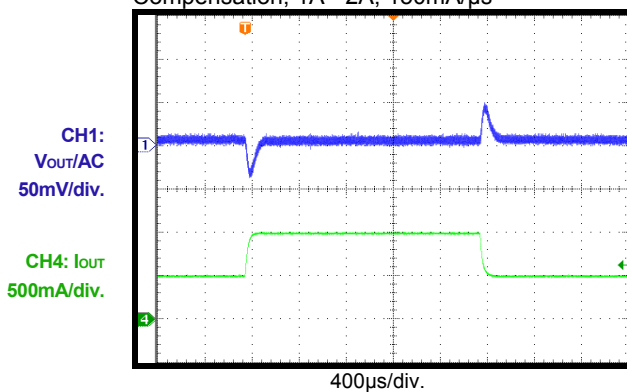
### Load Transient

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , No Line Drop Compensation, 0A - 2A, 150mA/µs



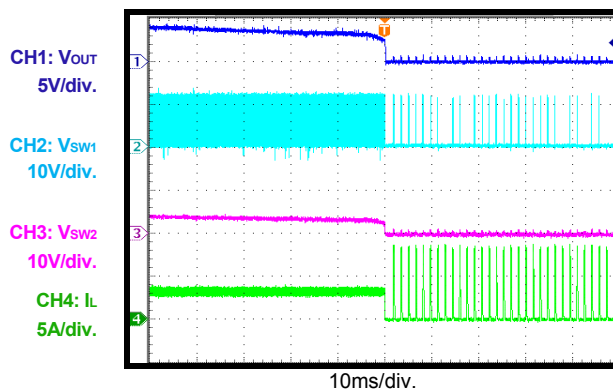
### Load Transient

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , No Line Drop Compensation, 1A - 2A, 150mA/µs



### OCP Entry

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , Hiccup Mode



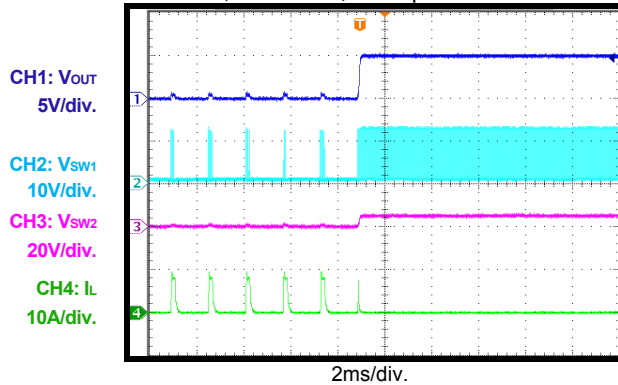
## TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

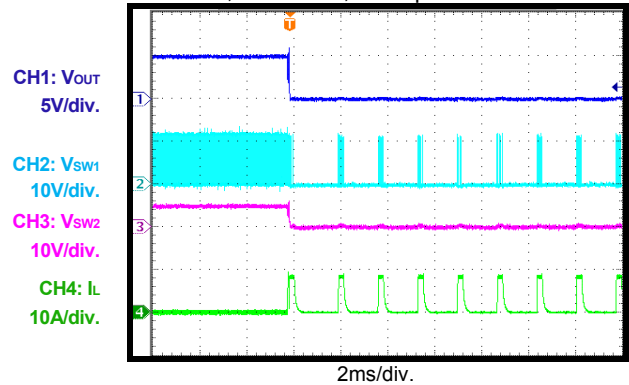
### OCF Recovery

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , Hiccup Mode



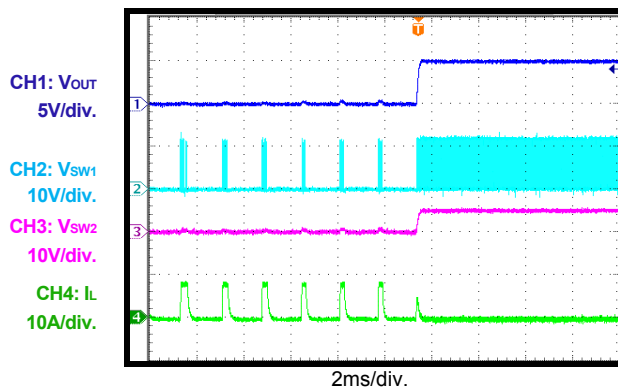
### SCP Entry

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , Hiccup Mode



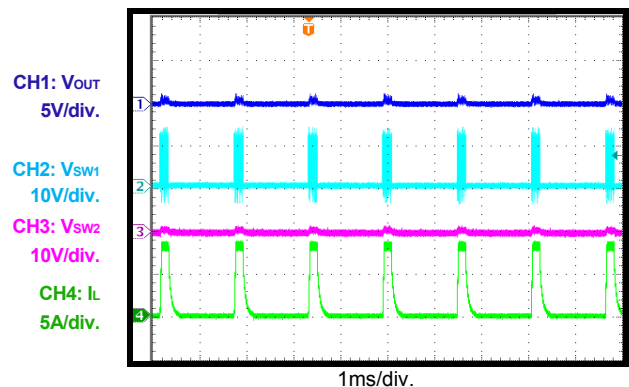
### SCP Recovery

$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , Hiccup Mode

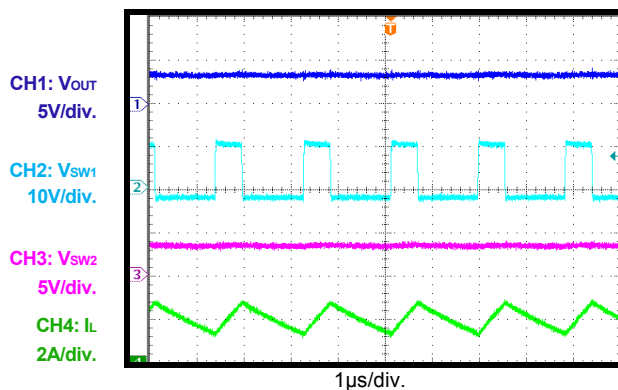


### SCP Steady

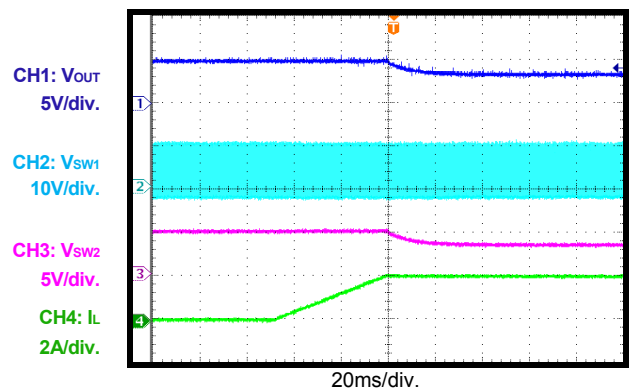
$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ , Hiccup Mode



### CC Steady



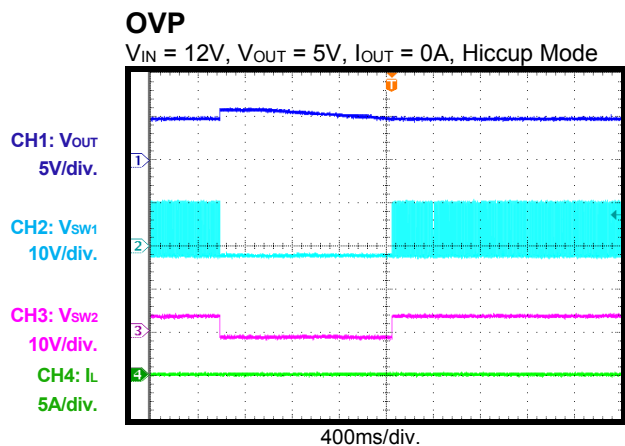
### CC Entry



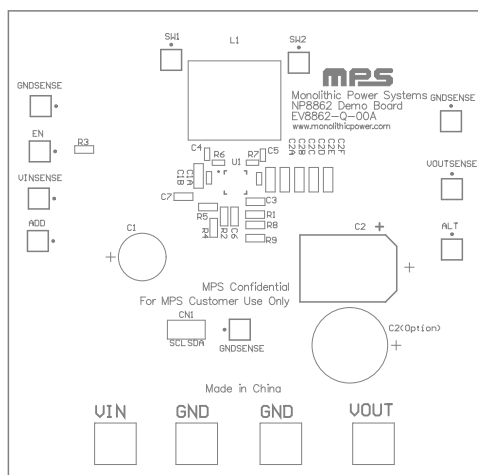
## TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

Performance waveforms are tested on the evaluation board.

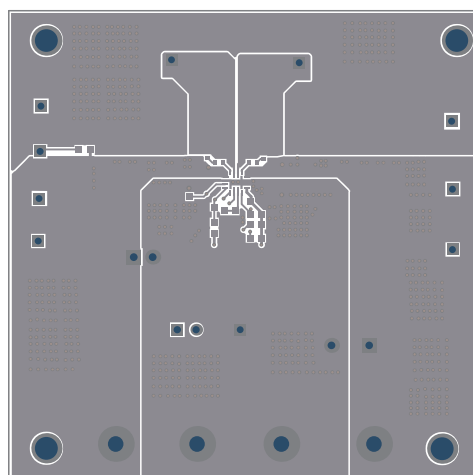
$V_{IN} = 12V$ ,  $V_{OUT} = 5V$ ,  $T_A = 25^{\circ}C$ , unless otherwise noted.



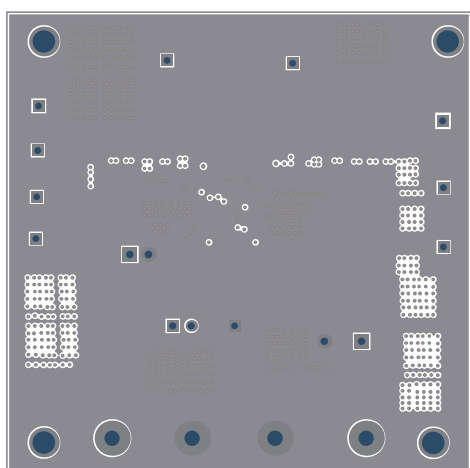
## PRINTED CIRCUIT BOARD LAYOUT



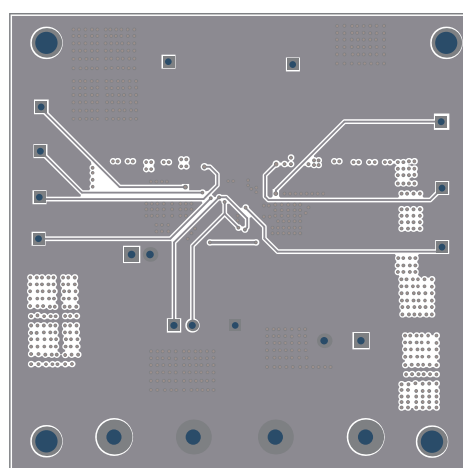
**Figure 1—Top Silk Layer**



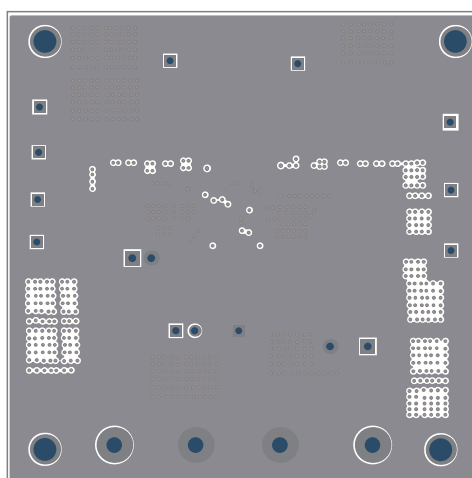
**Figure 2—Top Layer**



**Figure 3—Mid 1 Layer**



**Figure 4—Mid 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 12V, 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 with default settings. The related parameters (refer to datasheet) can be changed by I2C connection.

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