

DESCRIPTION

The EV2908A-F-02A is an evaluation board for MP2908A/MPQ2908A, a high voltage, synchronous step-down switching regulator controller that can directly step-down voltages from up to 60V.

It uses PWM current control architecture with accurate cycle-by-cycle current limiting and is capable of driving dual N-channel MOSFETs.

Advanced asynchronous mode (AAM) enables non-synchronous operation to optimize light-load efficiency.

The operating frequency of the MP2908A/MPQ2908A can be programmed by an external resistor or synchronized to an external clock for noise-sensitive applications. Full protection features include precision output over-voltage protection (OVP), output over-current protection (OCP), and thermal shutdown.

The EV2908A-F-02A is assembled and tested with TSSOP20-EP package.

ELECTRICAL SPECIFICATION

| Parameter | Symbol | Value | Units |
|----------------|-----------|-------|-------|
| Input Voltage | V_{IN} | 6-60 | V |
| Output Voltage | V_{OUT} | 5 | V |
| Output Current | I_{OUT} | 7 | A |

FEATURES

- Wide 6V to 60V Operating Input Range
- Dual N-Channel MOSFET Driver
- 0.8V Voltage Reference with $\pm 1.5\%$ Accuracy Over Temperature
- Low Dropout Operation: Maximum Duty Cycle at 99.5%
- Programmable Frequency Range: 100kHz - 1000kHz
- External Sync Clock Range: 100kHz-1000kHz
- 180° Out-of-Phase SYNCO
- Programmable Soft Start
- Power Good Output Voltage Monitor
- Selectable Cycle-by-Cycle Current Limit
- Output Over-Voltage Protection (OVP)
- Over-Current Protection (OCP)
- Internal LDO with External Power Supply Option
- Programmable CCM, AAM Mode

All MPS parts are lead-free and adhere to the RoHS directive. For MPS green status, please visit MPS website under Products, Quality Assurance page.

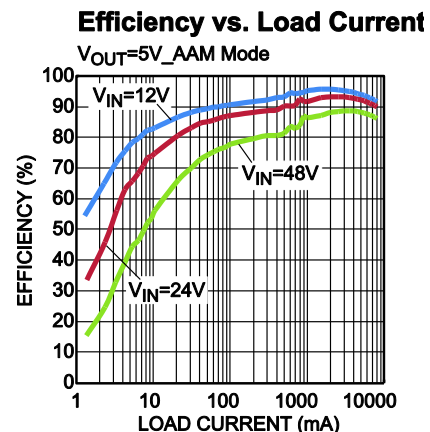
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EV2908A-F-02A EVALUATION BOARD

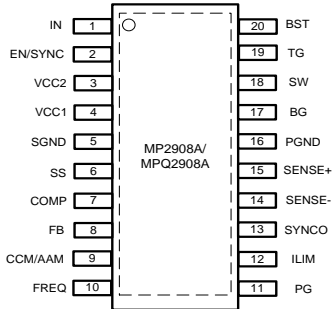
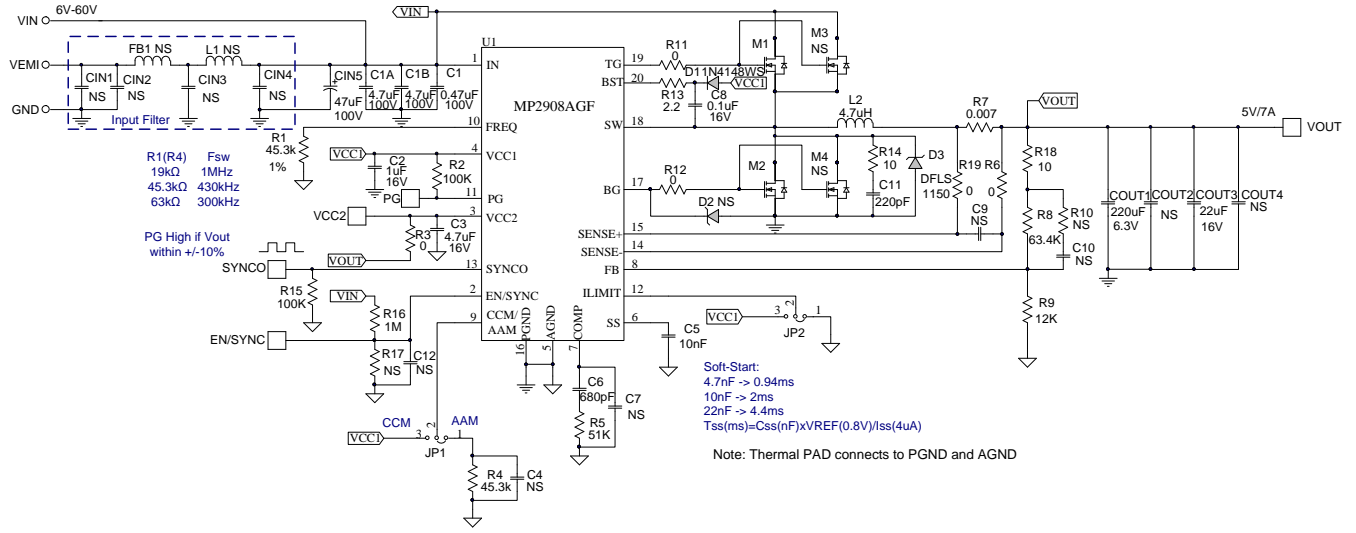


(L x W x H) 8.36cm x 8.36cm x 1.18cm

| Board Number | MPS IC Number |
|---------------|---------------|
| EV2908A-F-02A | MPQ2908AGF |



EVALUATION BOARD SCHEMATIC


TSSOP20-EP

| V _{OUT} (V) | R8 (kΩ) | R9 (kΩ) |
|----------------------|-----------|---------|
| 3.3 | 37.4 (1%) | 12 (1%) |
| 5 | 63.4 (1%) | 12 (1%) |
| 12 | 169 (1%) | 12 (1%) |

EV2908A-F-02A BILL OF MATERIALS

| Qty | Ref | Value | Description | Package | Manufacturer | Part Number |
|-----|-------------------------|--------|---|---------|--------------|--------------------|
| 4 | CIN1,CIN2, CIN3,CIN4 | NS | | | | |
| 1 | CIN5 | 47μF | Electrolytic Cap; 100V;10*10.5; 2000H;105°C | SMD | Jiang Hai | VZ2-100V47 |
| 2 | C1A, C1B | 4.7μF | Ceramic Cap; 100V;X7S | 1210 | TDK | C3225X7S2A475K |
| 1 | C1 | 0.47μF | Ceramic Cap; 100V;X7R | 0805 | muRata | GRM21BR72A474KA73L |
| 1 | C2 | 1μF | Ceramic Cap; 16V;X7R | 0603 | muRata | GRM188R71C105KA12D |
| 1 | C3 | 4.7μF | Ceramic Cap; 16V;X7R | 0805 | muRata | GRM21BR71C475KA73L |
| 5 | C4,C7,C9, C10,C12 | NS | | | | |

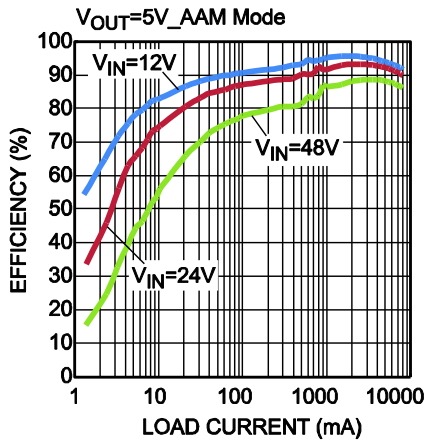
EV2908A-F-02A BILL OF MATERIALS (continued)

| Qty | Ref | Value | Description | Package | Manufacturer | Part Number |
|-----|---------------------------|----------|---------------------------------------|--------------------|--------------|--------------------|
| 1 | C5 | 10nF | Ceramic Cap; 50V;X7R | 0603 | muRata | GRM188R71H103KA01 |
| 1 | C6 | 680pF | Ceramic Cap; 50V;X7R | 0603 | muRata | GRM188R71H681KA01D |
| 1 | C8 | 0.1µF | Ceramic Cap; 16V;X7R | 0603 | muRata | GRM188R71C104KA01D |
| 1 | C11 | 220pF | Ceramic Cap; 100V;X7R | 0805 | muRata | GRM21BR72A221KA01L |
| 1 | COU1 | 220µF | POSCAP;6.3V; | D2 | SANYO | 6TPE220MI |
| 1 | COU3 | 22µF | Ceramic Cap; 16V;X7R | 1210 | muRata | GRM32ER71C226KE79 |
| 2 | COU2, COU4 | NS | | | | |
| 1 | D1 | 1N4148WS | Diode;75V;0.15A; | SOD-323 | Diodes | 1N4148WS-7-F |
| 1 | D2 | NS | | | | |
| 1 | D3 | DFLS1150 | Diode;150V;1A; | | DIODES | DFLS1150 |
| 1 | FB1 | NS | | | | |
| 1 | L1 | NS | | | | |
| 1 | L2 | 4.7µH | Inductor;4.7µH; 7.7mOhm;15A | SMD | Wurth | 7443551470 |
| 2 | M1, M2 | SQJ850EP | N-Channel Mosfet; 60V;24A;0.023Ohm | PowerPA K SO-8L | Vishay | SQJ850EP |
| 2 | M3, M4 | NS | | | | |
| 2 | R1, R4 | 45.3k | Film Resistor;1% | 0603 | Yageo | RC0603FR-0745K3L |
| 2 | R2, R15 | 100k | Film Resistor;1% | 0603 | Yageo | RC0603FR-07100KL |
| 5 | R3,R6,R 11,R12, R19 | 0 | Film Resistor;5% | 0603 | Yageo | RC0603JR-070RL |
| 1 | R5 | 51k | Film Resistor;1% | 0603 | Yageo | RC0603FR-0751KL |
| 1 | R7 | 0.007 | Film Resistor;1%;1W | 2512 | CYNTEC | RL3264-6-R007-FN |
| 1 | R8 | 63.4k | Film Resistor;1% | 0603 | Yageo | RC0603FR-0763K4L |
| 1 | R9 | 12k | Film Resistor;1% | 0603 | Yageo | RC0603FR-0712KL |
| 1 | R13 | 2.2 | Film Resistor;1% | 0603 | Yageo | RC0603FR-072R2L |
| 1 | R14 | 10 | Film Resistor;1% | 0805 | Yageo | RC0805FR-0710RL |
| 1 | R16 | 1M | Film Resistor;1% | 0603 | Yageo | RC0603FR-071ML |
| 1 | R18 | 10 | Film Resistor;1% | 0603 | Yageo | RC0603FR-0710RL |
| 2 | R10, R17 | NS | | 0603 | | |
| 1 | U1 | | Synchronous Step- Down Controller | TSSOP20 -EP | MPS | MPQ2908AGF |

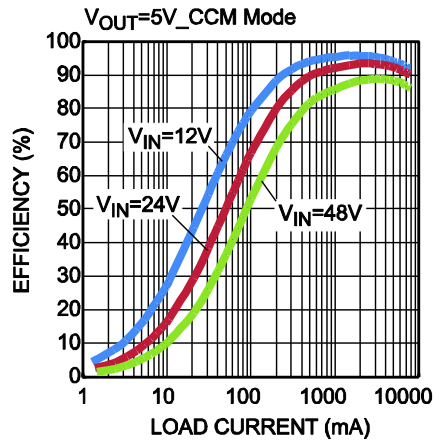
TYPICAL PERFORMANCE CHARACTERISTICS

$V_{IN} = 24V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, $T_A = +25^\circ C$, AAM, unless otherwise noted.

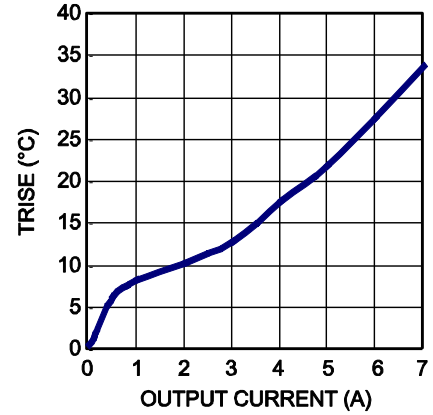
Efficiency vs. Load Current



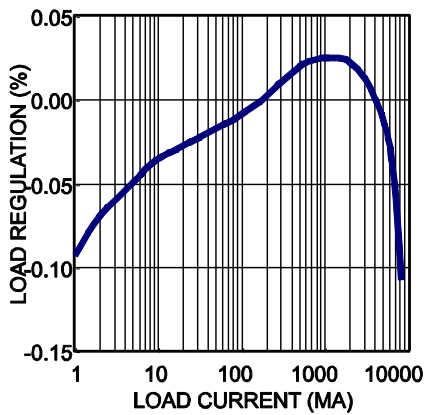
Efficiency vs. Load Current



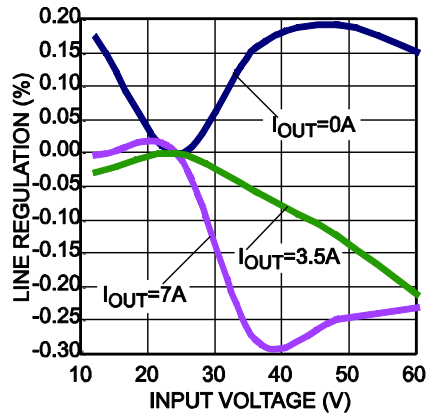
IC Thermal Rise



Load Regulation

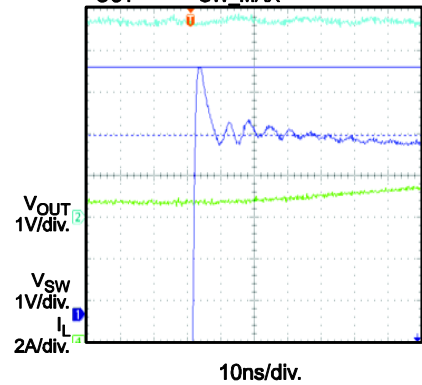


Line Regulation



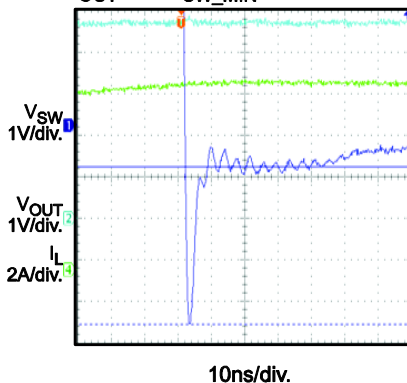
Positive Spike

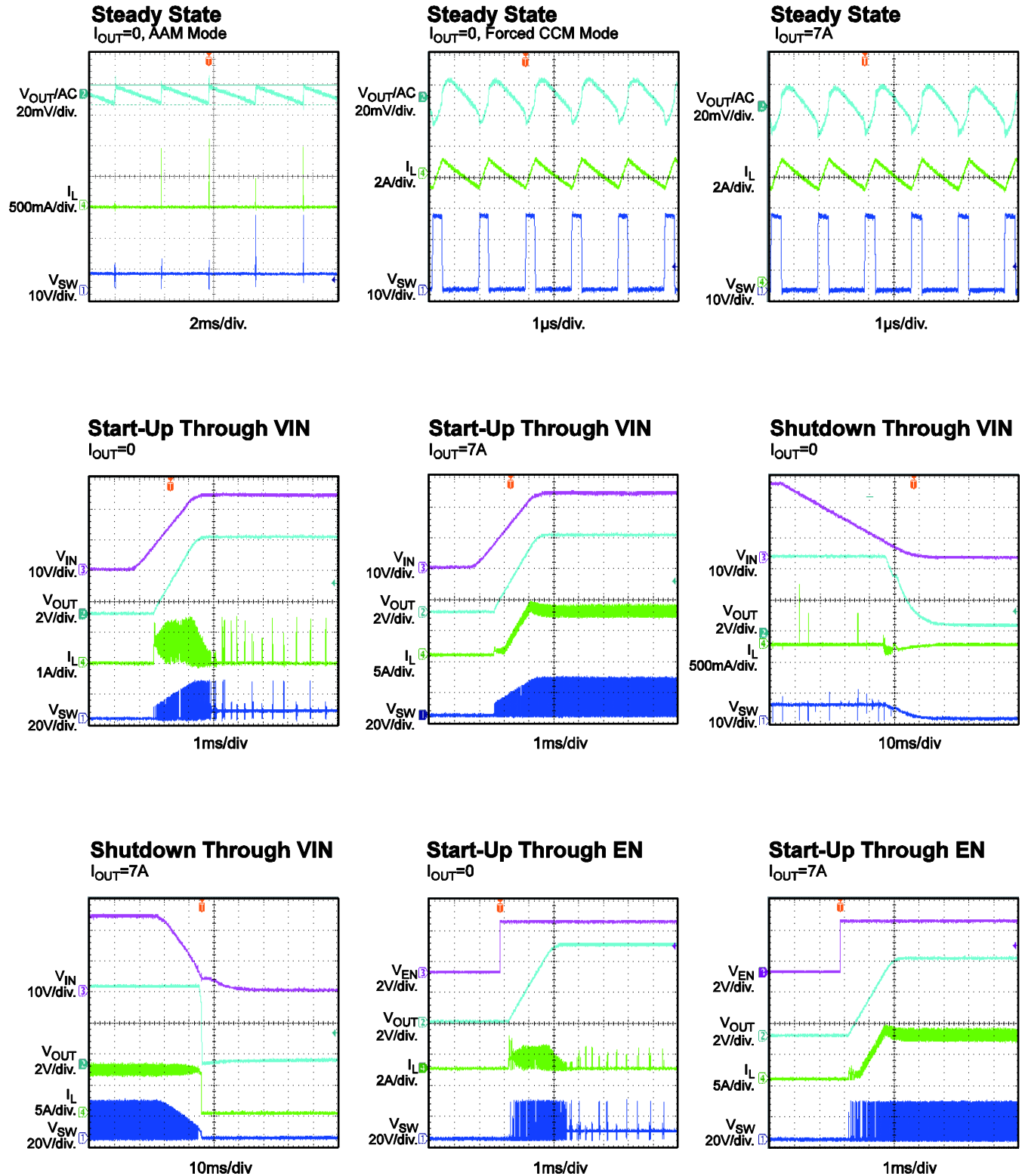
$V_{IN}=60V$, $V_{OUT}=5V$,
 $I_{OUT}=7A$, $V_{SW_MAX}=61.8V$



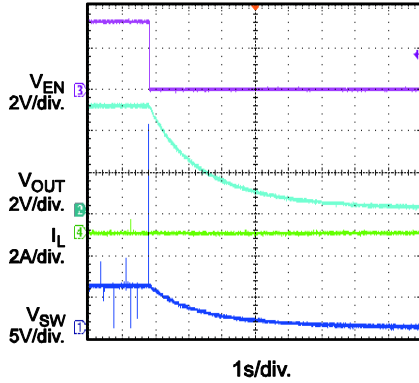
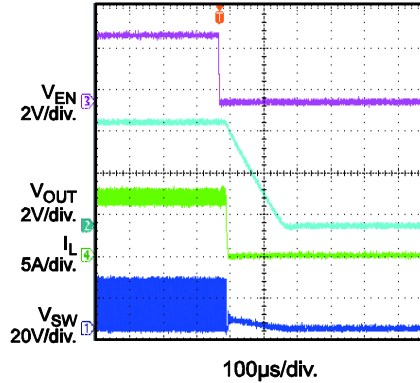
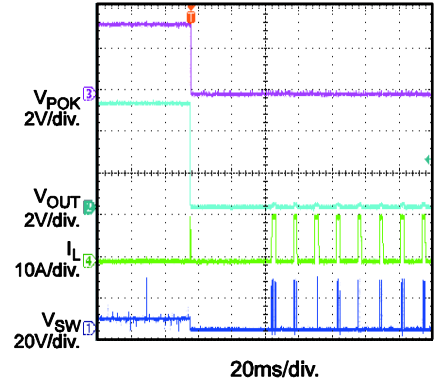
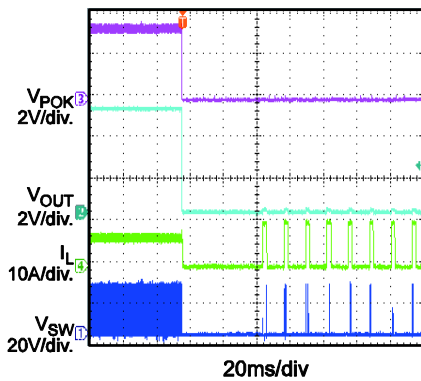
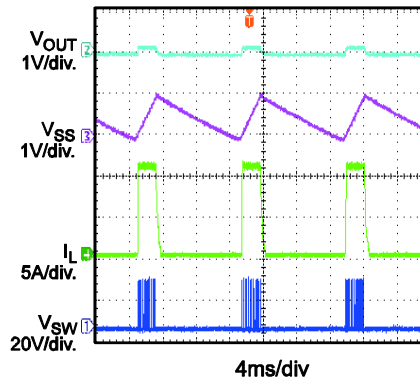
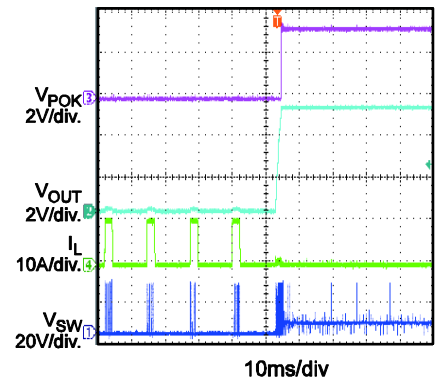
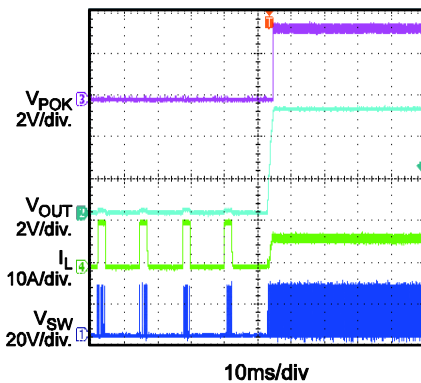
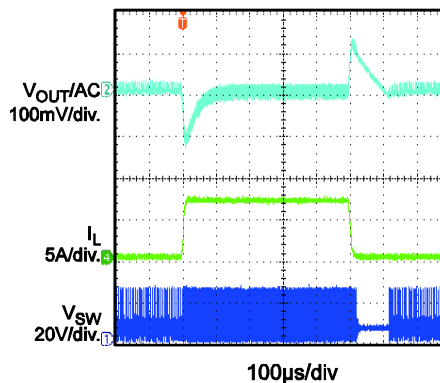
Negative Kick

$V_{IN}=60V$, $V_{OUT}=5V$,
 $I_{OUT}=7A$, $V_{SW_MIN}=4.78V$



TYPICAL PERFORMANCE CHARACTERISTICS (continued)
 $V_{IN} = 24V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, $T_A = +25^\circ C$, AAM, unless otherwise noted.


TYPICAL PERFORMANCE CHARACTERISTICS (continued)
 $V_{IN} = 24V$, $V_{OUT} = 5V$, $L = 4.7\mu H$, $T_A = +25^\circ C$, AAM, unless otherwise noted.

Shutdown Through EN
 $I_{OUT} = 0$

Shutdown Through EN
 $I_{OUT} = 7A$

SCP Entry
 $I_{OUT} = 0$ to short circuit

SCP Entry
 $I_{OUT} = 7A$ to short circuit

SCP Steady State

SCP Recovery
 short circuit to $I_{OUT} = 0$

SCP Recovery
 short circuit to $I_{OUT} = 7A$

Load Transient
 $I_{OUT} = 0.2A \leftrightarrow 7A$, $1.6A/\mu s$


PRINTED CIRCUIT BOARD LAYOUT

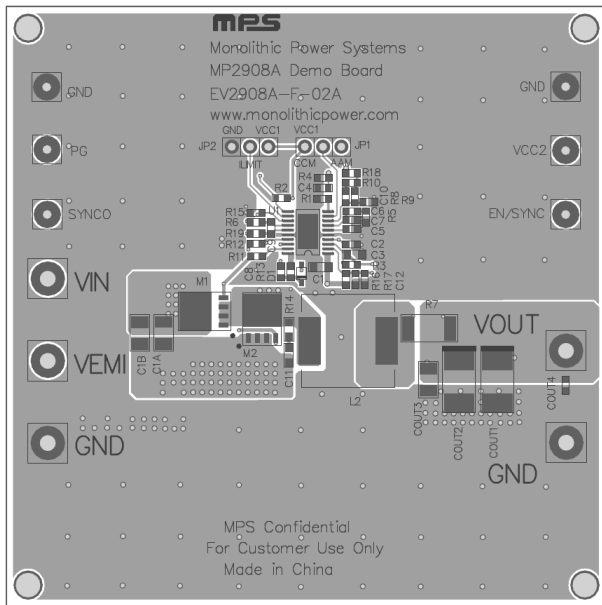


Figure 1—Top Silk & Top Layer

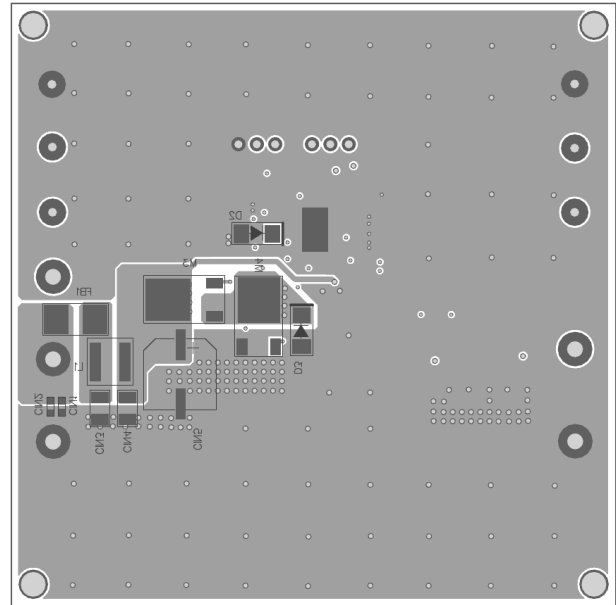


Figure 2—Bottom Silk & Bottom Layer

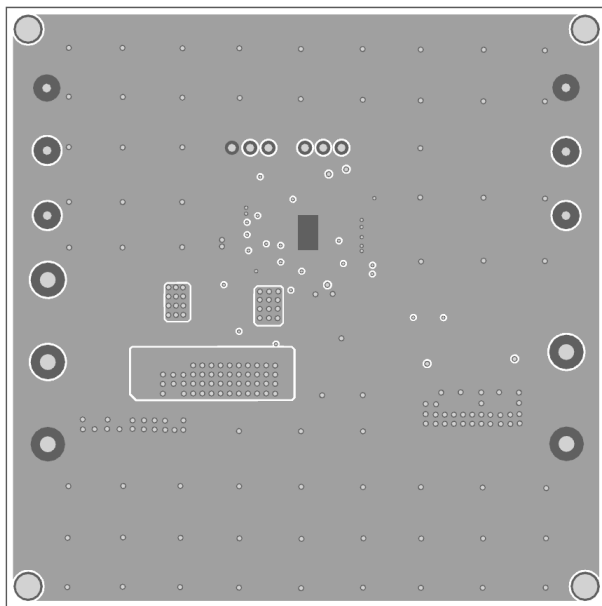


Figure 3—Inner Layer 1

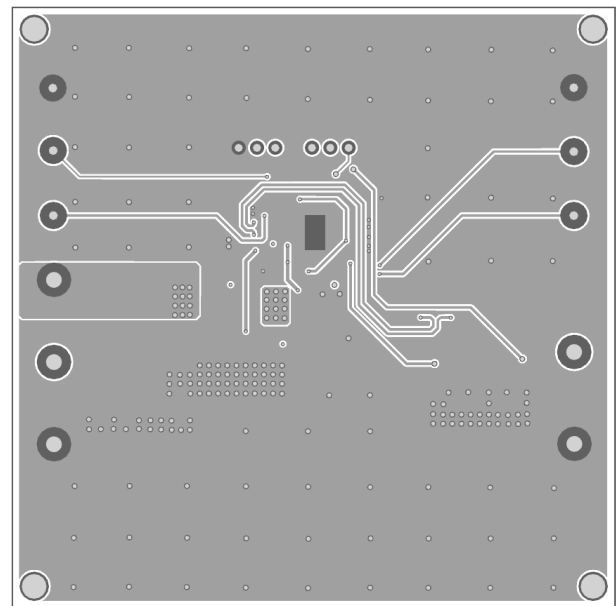
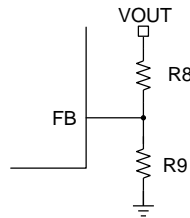


Figure 4—Inner Layer 2

QUICK START GUIDE

1. Connect the positive and negative terminals of the load to the VOUT and GND pins, respectively. Set load current between 0-7A. Be aware that electronic loads represent a negative impedance to the regulator and if set to a too high current will trigger over-current-protection or short-current-protection.
2. Preset the power supply output between 6V and 60V, and then 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 $V_{IN} \geq 24V$.
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. The default V_{OUT} is 5V.
5. The external resistor divider R8 and R9 are used to set the output voltage.



If R8 is known, then R9 can be calculated with below Equation:

$$R_9 = \frac{R_8}{\frac{V_{OUT}}{0.8V} - 1}$$

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

| V_{OUT} (V) | R8 (k Ω) | R9 (k Ω) |
|---------------|------------------|------------------|
| 3.3 | 37.4 (1%) | 12 (1%) |
| 5 | 63.4 (1%) | 12 (1%) |
| 12 | 169 (1%) | 12 (1%) |

6. To get better EMI performance, add the EMI components at bottom layer of the board and connect the input power supply between VEMI and GND.
7. To use EN turning on/off MP2908A, remove R16 first. Then give a voltage between EN and GND higher than 1.22V to turn on, lower than 1.09V to turn off. To use the SYNC function, connect an external clock with a range of 100 kHz to 1000 kHz to synchronize the internal clock rising edge to the external clock rising edge.
8. SYNCO can output an out of phase 180°C clock when part works at CCM mode for dual channel co-pack.
9. Note that if part works at high Vin and high Fsw condition, please make sure that Trise of HS MOS no higher than 175°C.

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