

### DESCRIPTION

The MP8004 is an integrated IEEE 802.3af PoE compliant Powered Device (PD) power supply solution. It includes a PD interface and an isolated/non-isolated flyback converter.

The PD interface includes detection and classification modes as well as a 100V output pass device. Inrush current limit is included to slowly charge the input capacitor.

The DC-DC converter includes a 150V power switch and is capable of delivering 13W output power with high efficiency. It has an internal soft-start, auto-retry, over current, short circuit, and over voltage protection. It can also skip cycles during light load condition.

The MP8004 is available in thermally enhanced 4x6mm QFN20 package.

### ELECTRICAL SPECIFICATIONS

| Parameter      | Symbol           | Value                | Units |
|----------------|------------------|----------------------|-------|
| Input voltage  | V <sub>in</sub>  | 36-57 <sup>(1)</sup> | V     |
| Output voltage | V <sub>out</sub> | 12                   | V     |
| Output current | I <sub>out</sub> | 1                    | A     |
| Frequency      | F <sub>sw</sub>  | 275                  | kHz   |

**Note:**

- It requires higher than 42V input for startup, after startup, it can work down to 36V. Meets IEEE 802.3af Specifications

### FEATURES

- Meets IEEE 802.3af Specifications
- 100V, 1Ω Integrated Pass Switch
- 420mA DC Input Current Limit
- 150V, 0.45Ω Integrated Switch for Power Converter
- Cycle-by-Cycle Switching Current Limit
- Integrated 100V Startup Circuit
- Programmable Switching Frequency
- Duty Cycle Limiting with Line Feed Forward
- Internal Slope Compensation
- OCP, SCP and OTP Protection
- 4x6mm QFN20 Package

### APPLICATIONS

- VoIP Telephones
- Security Camera Systems
- Wireless Access Points/Wireless LAN
- Small-cell Base Stations
- Safety Backup Power
- Remote Internet Power

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.

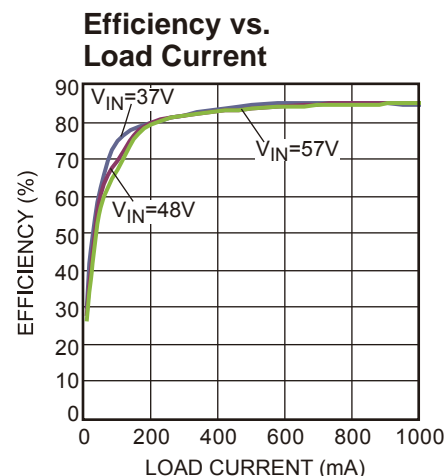
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### EV8004-QW-00A EVALUATION BOARD

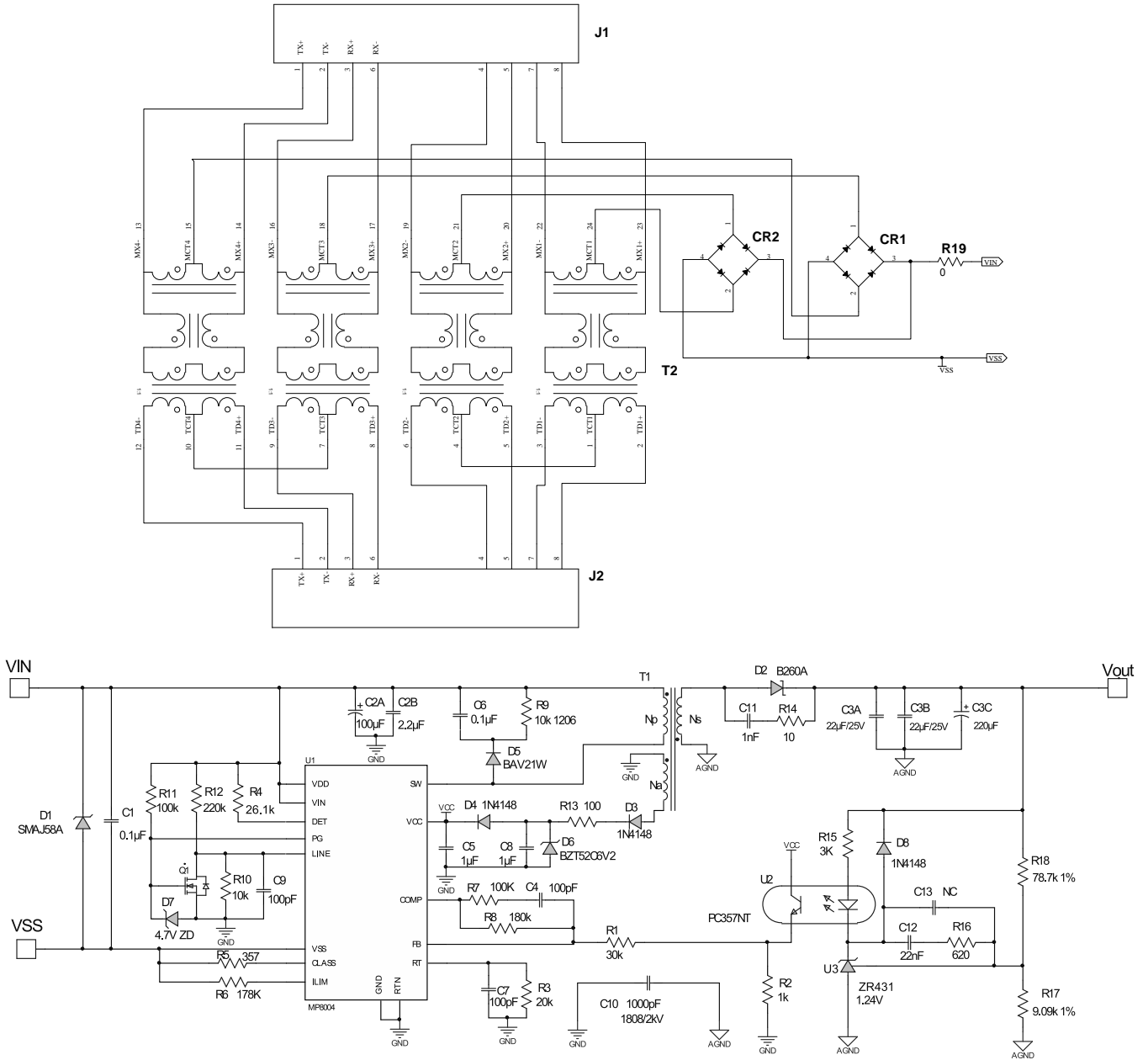


(L x W x H) (12.5cm x 4cm x 1.5cm)

| Board Number  | MPS IC Number |
|---------------|---------------|
| EV8004-QW-00A | MP8004GQW     |



## EVALUATION BOARD SCHEMATIC



**EV8004-QW-00A BILL OF MATERIALS**

| Qty | Ref        | Value   | Description               | Package | Manufacturer | Part Number           |
|-----|------------|---------|---------------------------|---------|--------------|-----------------------|
| 2   | C1,C6      | 0.1µF   | Ceramic Cap. 100V, X7R    | 1206    | Murata       | GRM319R72A104KA01D    |
| 1   | C2A        | 100µF   | 100V Electrolytic         | DIP     | Rubycon      | 100YXG100MEFC10X23    |
| 2   | C2B        | 2.2µF   | Ceramic Cap. 100V, X7R    | 1210    | Murata       | GRM32ER72A225KA35L    |
| 2   | C3A,C3B    | 22µF    | Ceramic Cap, 25V, X5R     | 1210    | Murata       | GRM32ER61E226KE15L    |
| 1   | C3C        | 220µF   | 35V Electrolytic          | DIP     | Chemi-con    | EKY-350EC3221MH15D-ND |
| 3   | C4,C7,C9   | 100pF   | Ceramic Cap,50V,C0G       | 0603    | muRata       | GRM1885C1H101JA01D    |
| 2   | C5, C8     | 1µF     | Ceramic Cap,16V,X7R       | 0603    | muRata       | GRM188R71C105KA12D    |
| 1   | C10        | 1000pF  | Ceramic Cap, 2000V X7R    | 1808    | muRata       | GR442QR73D102KW01L    |
| 1   | C11        | 1nF     | Ceramic Cap, 50V, C0G     | 0603    | muRata       | GRM1885C1H102JA01D    |
| 1   | C12        | 22nF    | Ceramic Cap, 25V, X7R     | 0603    | muRata       | GRM188R71E223KA01D    |
| 0   | C13        | NC      |                           |         |              |                       |
| 1   | R1         | 30kΩ    | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-0730KL       |
| 1   | R2         | 1kΩ     | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-071KL        |
| 1   | R3         | 20kΩ    | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-0720KL       |
| 1   | R4         | 26.1kΩ  | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-0726K1L      |
| 1   | R5         | 357Ω    | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-07357RL      |
| 1   | R6         | 178kΩ   | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-07178KL      |
| 2   | R7, R11    | 100kΩ   | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-07100KL      |
| 1   | R8         | 180kΩ   | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-07180KL      |
| 1   | R9         | 10kΩ    | Film Res, 1%              | 1206    | YAGEO        | RC1206FR-0710KL       |
| 1   | R10        | 10kΩ    | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-0710KL       |
| 1   | R12        | 220kΩ   | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-07220KL      |
| 1   | R13        | 100Ω    | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-07100RL      |
| 1   | R14        | 10Ω     | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-0710RL       |
| 1   | R15        | 3kΩ     | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-03KL         |
| 1   | R16        | 620Ω    | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-07620RL      |
| 1   | R17        | 9.09kΩ  | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-079K09L      |
| 1   | R18        | 78.7kΩ  | Film Res, 1%              | 0603    | YAGEO        | RC0603FR-0778K7L      |
| 1   | R19        | 0Ω      | Film Res, 1%              | 1206    | YAGEO        | 1821CR06T05NN0R       |
| 1   | D1         | SMAJ58A | TVS                       | SMA     | Littelfuse   | SMAJ58A               |
| 1   | D2         | B260A   | Diode Schottky, 60V, 2A   | SMA     | Diodes Inc   | B260A                 |
| 3   | D3, D4, D8 | 1N4148  | Diode Switch, 75V, 200mW  | SOD-323 | Diodes Inc   | 1N4148WS-7-F          |
| 1   | D5         | BAV21W  | Diode Switch, 200V, 250mW | SOD-123 | Diodes Inc   | BAV21W-7-F            |

**EV8004-QW-00A BILL OF MATERIALS (continued)**

| Qty | Ref               | Value       | Description  | Package          | Manufacturer        | Part Number  |
|-----|-------------------|-------------|--|------------------|---------------------|--------------|
| 1   | D6                | 6.2V        | Diode Zener, 6.2V, 500mW   | SOD-123          | Diodes Inc          | BZT52C6V2-7  |
| 1   | D7                | 4.7V        | Diode Zener, 4.7V 500mW  | SOD-123          | Diodes Inc          | BZT52C4V7-13 |
| 1   | Q1                | 2N7002      | N-FET  | SOT-23           | Diodes Inc          | 2N7002-7-F   |
| 1   | U1                | MP8004      | PD Controller  | QFN20            | MPS                 | MP8004GQW-Z  |
| 1   | U2                | PC357       | Photocoupler, 1-Ch   | 4-SMD            | Sharp               | PC357NT      |
| 1   | U3                | ZR431       | REG VLT ADJ 1.24V  | SOT-23           | ZETEX               | ZR431LF01    |
| 1   | T1 <sup>(2)</sup> | Transformer | Core=EE13,<br>Np:Ns:Na=22:9:6, Lp=90uH   | DIP              | Emei                |              |
|     |                   |             | Würth 12V/1A transformer<br>Lp=100µH,<br>Np: Ns: Na=4.5:1.5:1                            | SMD              | Würth<br>Elektronik | 750311424    |
| 1   | T2                | 749020011A  | LAN-Transformer WE-LAN   | SMD              | Würth<br>Elektronik | 749020011A   |
| 2   | J1,J2             | RJ45-8N4-B  | RJ Jack / Signal Line<br>EMI/RFI Filters 6 TRMN<br>BRD/CBLE GRND 8 PIN<br>BLOCK INDUCTOR | RJ45-TAB<br>DOWN | Tyco<br>Electronics | RJ45-8N4-B   |
| 2   | CR1,<br>CR2       | DF02S       | 1.0A SURFACE MOUNT<br>GLASS PASSIVATED<br>BRIDGE RECTIFIER                               | DF-S             | Diodes Inc          | DF02S        |

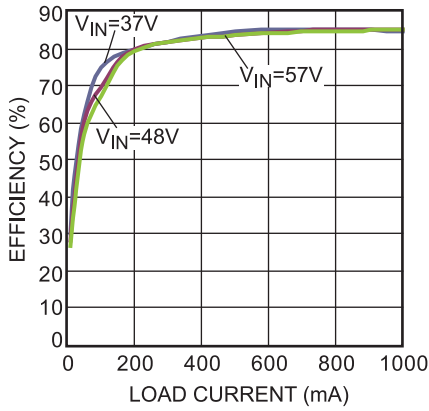
**Note:**

2) On standard EVB, the transformer is from Emei. There is one layout option for 750311424 transformer on EVB.

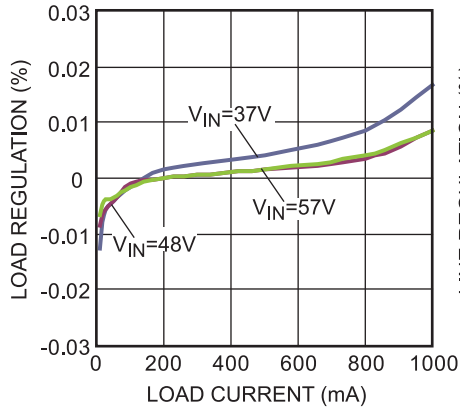
## EVB TEST RESULTS

$V_{IN}=48V$ ,  $V_{OUT}=12V$ ,  $I_{OUT}=1A$ ,  $T_A=25^{\circ}C$ , unless otherwise noted.

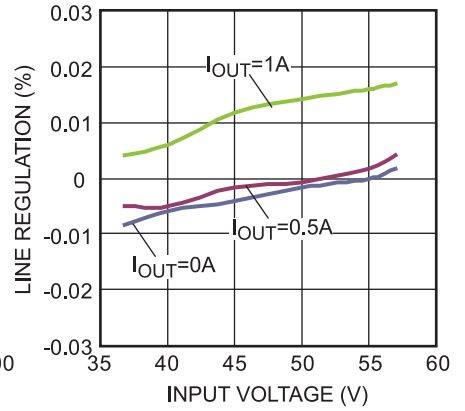
**Efficiency vs. Load Current**



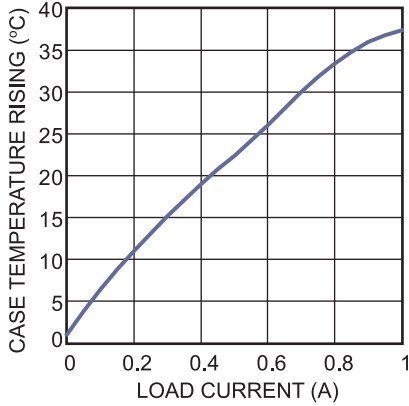
**Load Regulation**



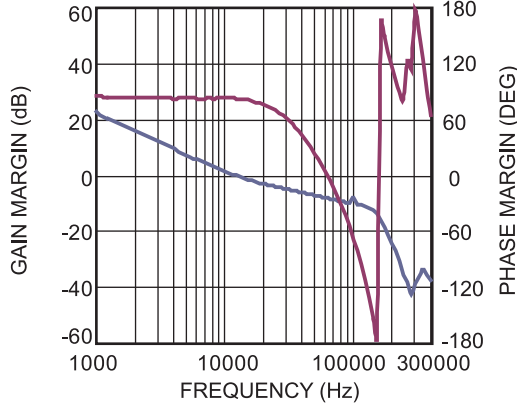
**Line Regulation**



**Case Temperature Rising vs. Load Current**



**Magnitude and Phase vs. Frequency**

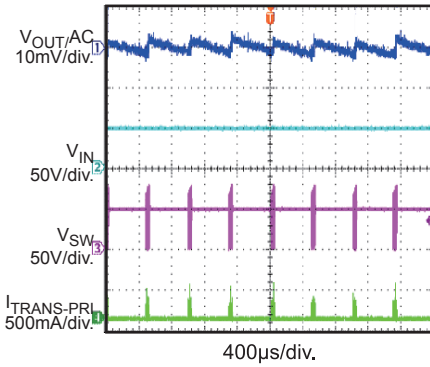


**EVB TEST RESULTS (continued)**

$V_{IN}=48V$ ,  $V_{OUT}=12V$ ,  $I_{OUT}=1A$ ,  $T_A=25^{\circ}C$ , unless otherwise noted.

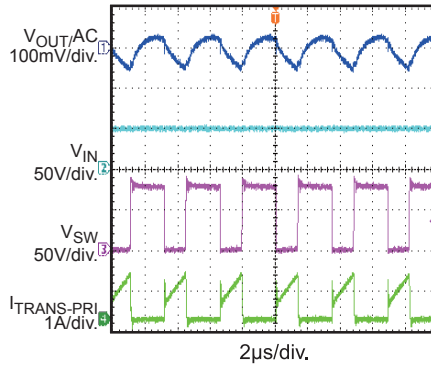
**Steady State**

$I_{OUT} = 0A$



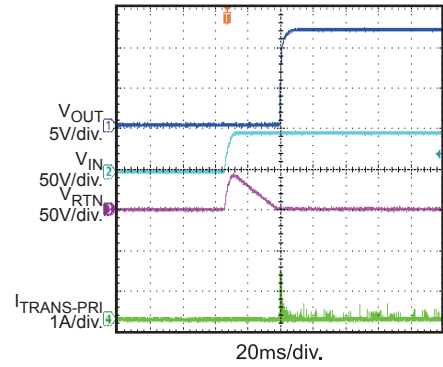
**Steady State**

$I_{OUT} = 1A$



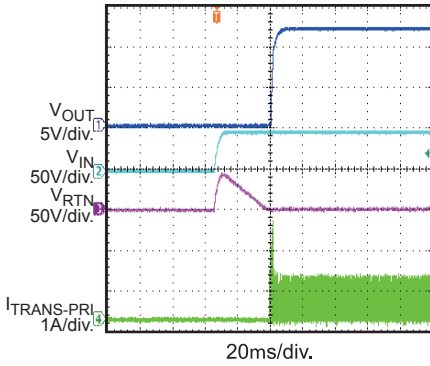
**VIN Startup**

$I_{OUT} = 0A$



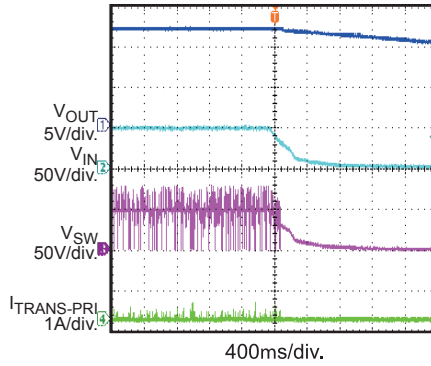
**VIN Startup**

$I_{OUT} = 1A$



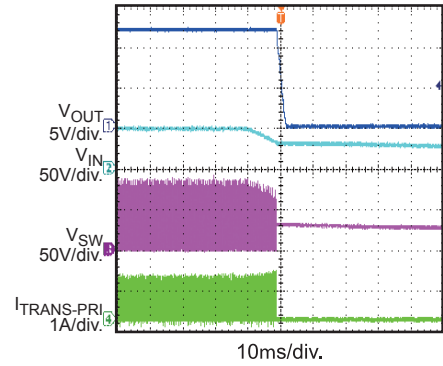
**VIN Shutdown**

$I_{OUT} = 0A$



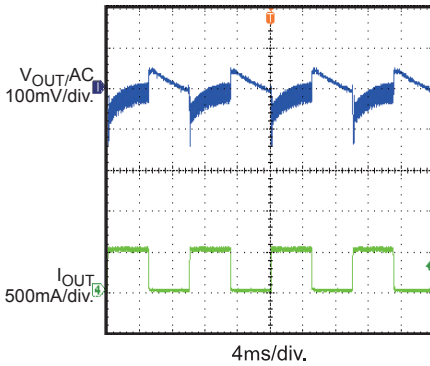
**VIN Shutdown**

$I_{OUT} = 1A$



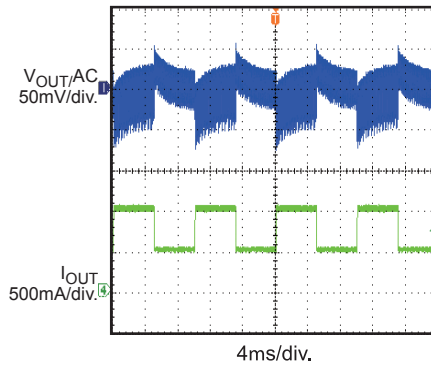
**Load Transient**

$I_{OUT} = 0A \rightarrow 0.5A$ ,  
 $I_{RAMP} = 800mA/\mu s$



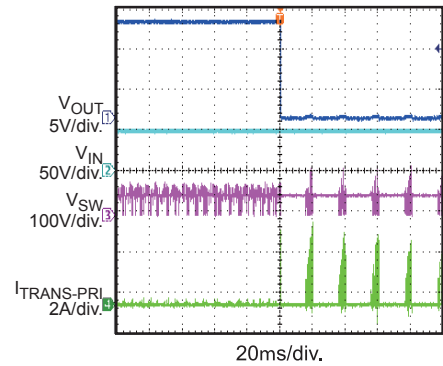
**Load Transient**

$I_{OUT} = 0.5A \rightarrow 1A$ ,  
 $I_{RAMP} = 800mA/\mu s$



**SCP Entry**

$I_{OUT} = 0A$  to short

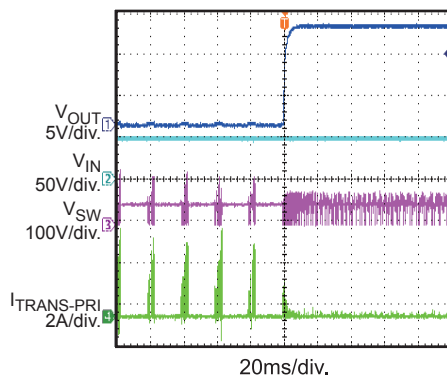


### EVB TEST RESULTS *(continued)*

$V_{IN}=48V$ ,  $V_{OUT}=12V$ ,  $I_{OUT}=1A$ ,  $T_A=25^{\circ}C$ , unless otherwise noted.

#### SCP Recovery

$I_{OUT}$  = short to 0A



## PRINTED CIRCUIT BOARD LAYOUT

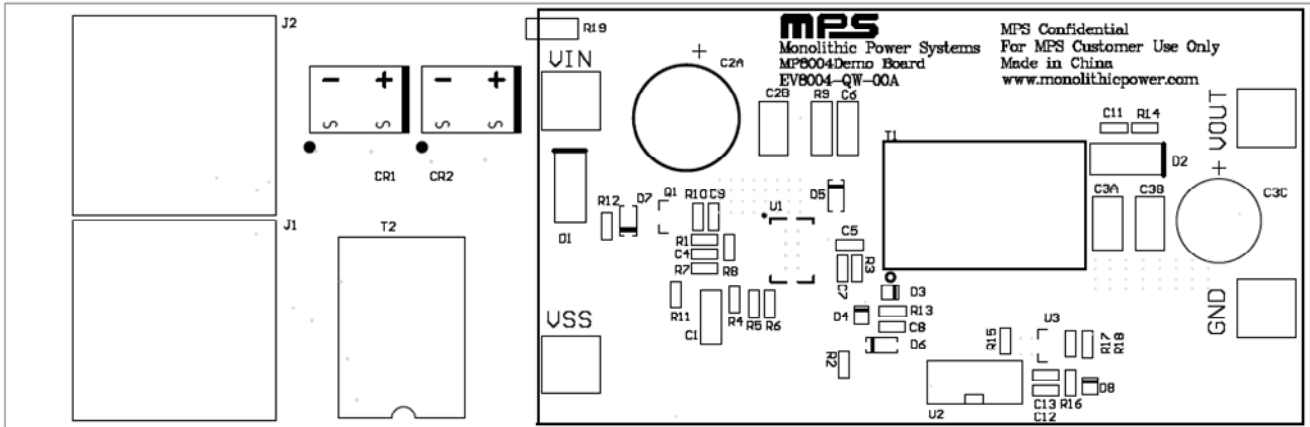


Figure 1: Top Silk Layer

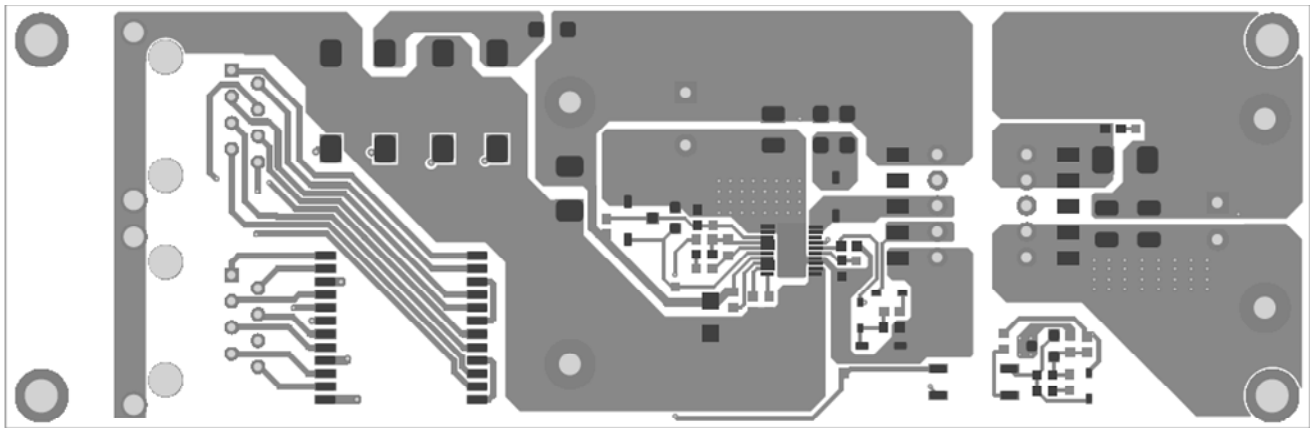


Figure 2: Top Layer

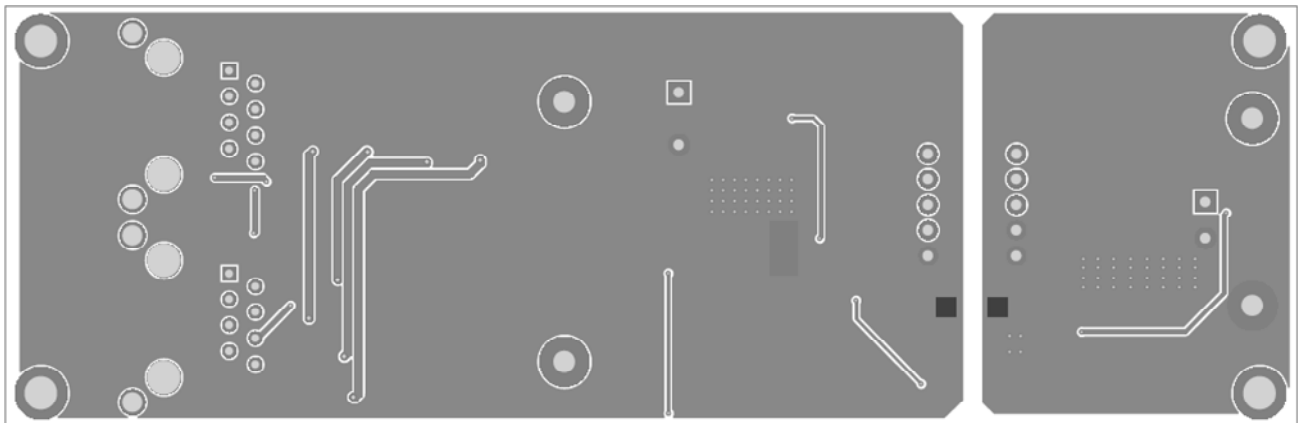


Figure 3: Bottom Layer



## QUICK START GUIDE

1. Connect the load between VOUT (positive) and GND (negative) terminals.
2. Plug the cable coming from the PSE, carrying the input voltage for the PD, into the Ethernet Jack J1. The board will automatically startup.
3. External DC supply can also be used to evaluate EV8004-QW-00A. Preset the power supply output to 42V – 57V and turn off the power supply. Connect the positive terminal of the power supply output to the VIN pin and the negative terminal of the power supply output to the VSS pin. Turn the power supply on. The board will automatically startup.

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