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**EV155-J-00A**

**Energy Efficient Off-line Regulator  
EV Board**

## Evaluation Board Report

### 12V 2.4W ACDC power supply

| Design Specs   | Value                                                                                  | Unit |
|----------------|----------------------------------------------------------------------------------------|------|
| Input Voltage  | 85-265                                                                                 | VAC  |
| Output Voltage | 12                                                                                     | VDC  |
| Output Current | 0.2                                                                                    | A    |
| Isolation      | No                                                                                     |      |
| MPS IC         | MP155GJ                                                                                |      |
| Application    | Home Appliance, white goods, consumer electronics<br>Industrial Controls Standby Power |      |

|                 |                                    |
|-----------------|------------------------------------|
| Document Number | EBXXX                              |
| Author          | Application Engineering Department |
| Date            | Nov, 2014                          |
| Revision        | 1.0                                |

### Design Summary

EV155-J-00A evaluation board provides a reference design for a universal offline power supply with 12V, 0.2A output. It contains the complete specification of the power supply, a detailed circuit diagram, the entire bill of materials required to build the power supply, drawing of the power inductors and transformers, and test data of the most important performance.

## DESCRIPTION

The MP155 is a primary-side regulator that provides accurate constant voltage regulation without the opto-coupler, and supports buck, buck-boost, and flyback topologies. An integrated 500V MOSFET simplifies the structure and reduces costs. These features make it a competitive candidate for off-line low-power applications, such as home appliances and standby power.

The MP155 is a green-mode-operation regulator. Both the peak current and the switching frequency decrease as the load decreases. As a result, it offers excellent efficiency performance at light load, thus improving the overall average efficiency.

The MP155 features various protections such as thermal shutdown (TSD), VCC under-voltage lockout (UVLO), overload protection (OLP), short-circuit protection (SCP), and open loop protection.

The MP155 is available in the TSOT23-5 package.

## FEATURES

- Primary-side constant voltage (CV) control, supporting buck, buck-boost and flyback topologies
- Integrated 500V/20Ω MOSFET
- < 100mW No-load power consumption
- Up to 3W output power
- Maximum DCM output current of 130mA
- Maximum CCM output current of 220mA
- Low VCC operating current
- Frequency foldback
- Maximum frequency limit
- Peak current compression
- Internal high-voltage current source
- Internal 350ns leading-edge blanking
- Thermal shutdown (auto restart)
- VCC under-voltage lockout with hysteresis (UVLO)
- Timer-based overload protection.
- Short circuit protection
- Open loop protection

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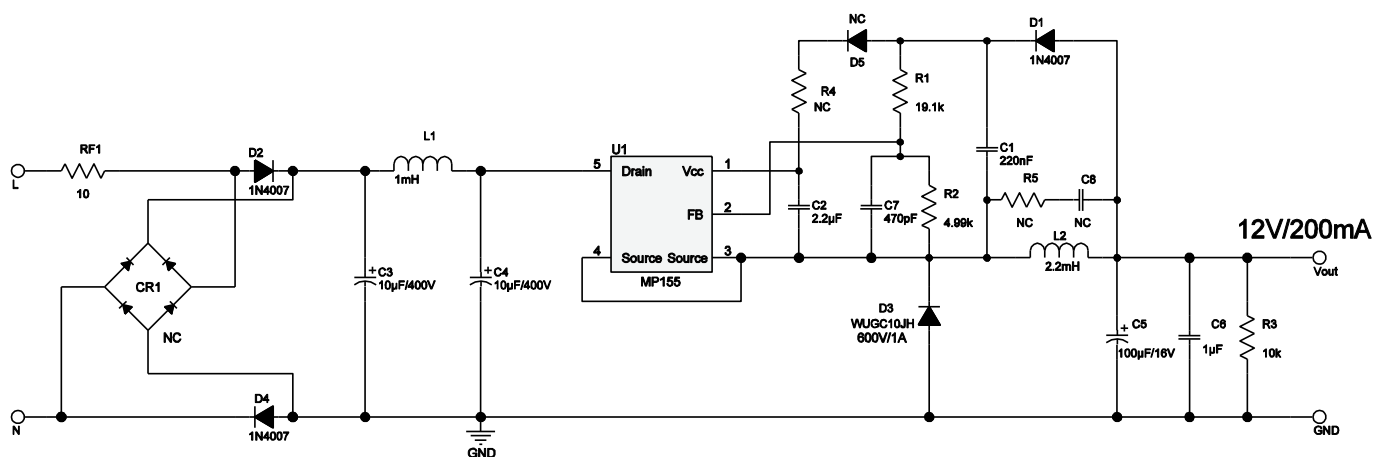
## EV155-J-00A EVALUATION BOARD



( L x W x H ) 3.4cm x 2.2cm x 1.6cm

| Board Number | MPS IC Number |
|--------------|---------------|
| EV155-J-00A  | MP155GJ       |

## EVALUATION BOARD SCHEMATIC



**EV155-J-00A BILL OF MATERIALS**

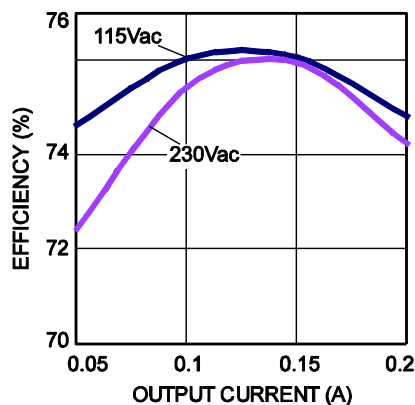
| Qty | Ref           | Value     | Description                                     | Package  | Manufacture | Part Number        |
|-----|---------------|-----------|-------------------------------------------------|----------|-------------|--------------------|
| 1   | C1            | 220nF     | Ceramic Capacitor;<br>16V;X7R;0603;             | 0603     | muRata      | GRM188R71C224KA01  |
| 1   | C2            | 2.2μF     | Ceramic Capacitor;<br>10V;X7R;0603              | 0603     | muRata      | GRM188R71A225KE15D |
| 2   | C3, C4        | 10μF/400V | Capacitor;400V;20%                              | DIP      | Any         | Any                |
| 1   | C5            | 100μF/16V | Electrolytic Capacitor;<br>16V;Electrolytic;DIP | DIP      | Jianghai    | CD11C-16V100       |
| 1   | C6            | 1μF       | Ceramic Capacitor;<br>50V;X7R;0805;             | 0805     | muRata      | GRM21BR71H105KA12L |
| 1   | C7            | 470pF     | Ceramic<br>Capacitor;50V;COG                    | 0603     | TDK         | C1608COG1H471J     |
| 3   | D1,<br>D2, D4 | 1N4007    | Diode;1000V;1A                                  | DO-41    | Diodes      | 1N4007             |
| 1   | D3            | WUGC10JH  | Diode;600V;1A                                   | SMA      | ZOWIE       | WUGC10JH           |
| 1   | L1            | 1mH       | Inductor;1mH;6;<br>250mA                        | DIP      | Würth       | 7447462102         |
| 1   | L2            | 2.2mH     | Inductor;2.2mH;4.73;<br>300mA                   | DIP      | Würth       | 7447720222         |
| 1   | R1            | 19.1k     | Film Resistor;1%                                | 0603     | Yageo       | RC0603FR-0719K1L   |
| 1   | R2            | 4.99k     | Film Resistor;1%;                               | 0603     | Yageo       | RC0603FR-074K99L   |
| 1   | R3            | 10k       | Resistor;1%                                     | 0603     | Yageo       | RC0603FR-0710KL    |
| 1   | RF1           | 10        | Fuse Resistor;5%;1W                             | DIP      | Any         | 10 Ohm/1W          |
| 1   | U1            | MP155GJ   | Buck regulator                                  | TSOT23-5 | MPS         | MP155GJ            |

## EVB TEST RESULTS

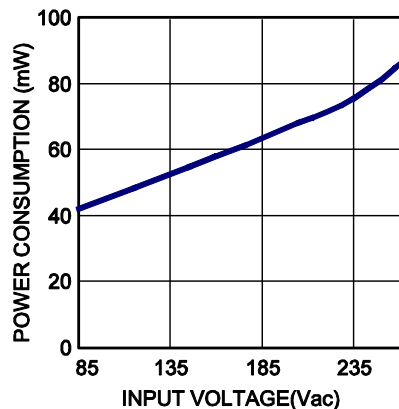
Performance waveforms are tested on the evaluation board.

$V_{IN} = 85\text{-}265\text{Vac}$ ,  $V_{OUT} = 12\text{V}$ ,  $I_{OUT} = 200\text{mA}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

**Efficiency**

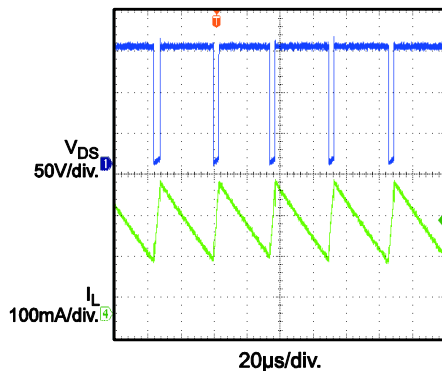


**No Load Consumption**



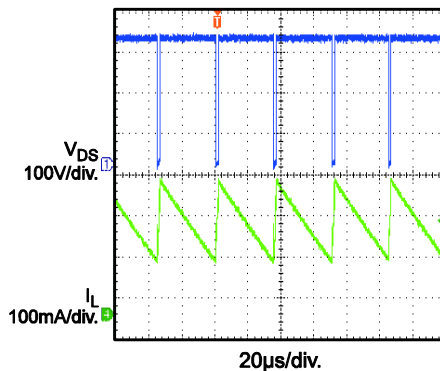
**Normal Operation**

$V_{IN} = 115\text{Vac}$ , Full Load



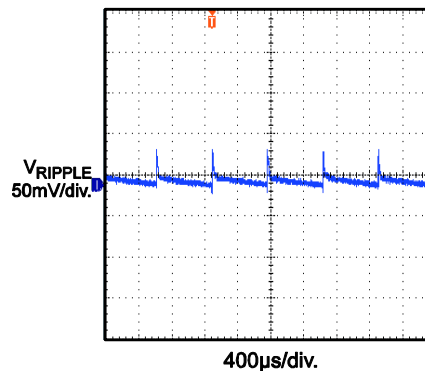
**Normal Operation**

$V_{IN} = 230\text{Vac}$ , Full Load



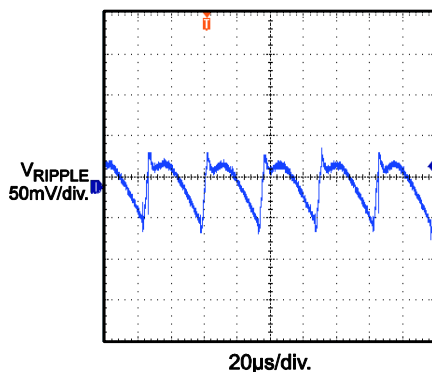
**Output Ripple**

$V_{IN} = 115\text{Vac}$ , No Load



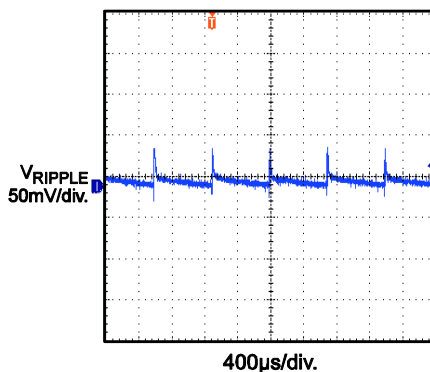
**Output Ripple**

$V_{IN} = 115\text{Vac}$ , Full Load



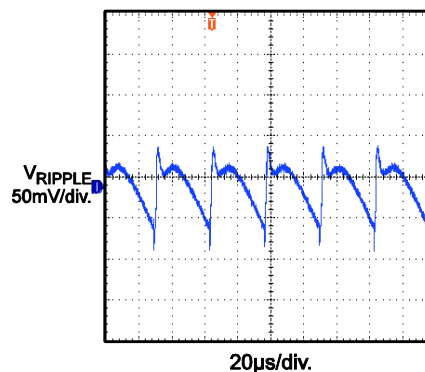
**Output Ripple**

$V_{IN} = 230\text{Vac}$ , No Load



**Output Ripple**

$V_{IN} = 230\text{Vac}$ , Full Load



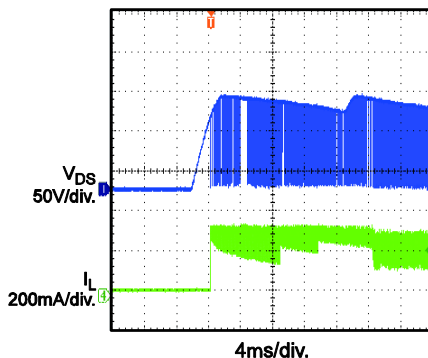
# EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 85\text{-}265\text{Vac}$ ,  $V_{OUT} = 12\text{V}$ ,  $I_{OUT} = 200\text{mA}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

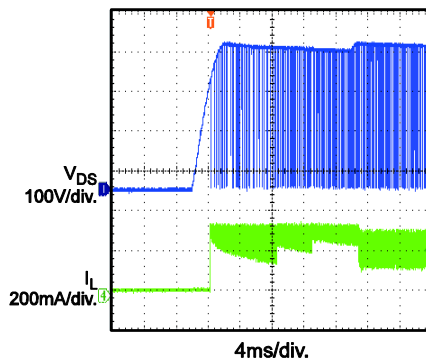
## Soft Start

$V_{IN} = 85\text{Vac}$



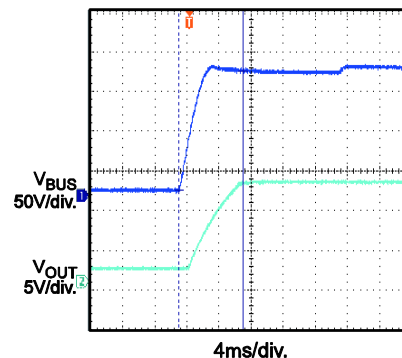
## Soft Start

$V_{IN} = 265\text{Vac}$



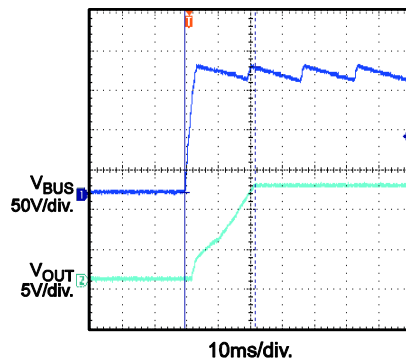
## Turn-on Delay

$V_{IN} = 115\text{Vac}$ , No Load



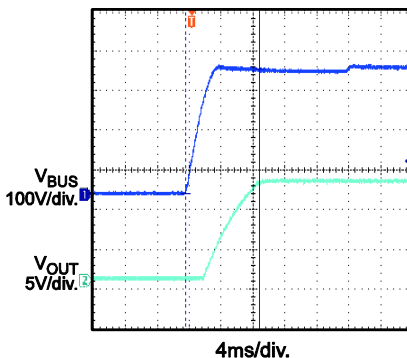
## Turn-on Delay

$V_{IN} = 115\text{Vac}$ , Full Load



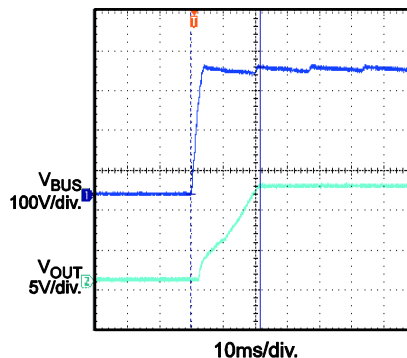
## Turn-on Delay

$V_{IN} = 230\text{Vac}$ , No Load



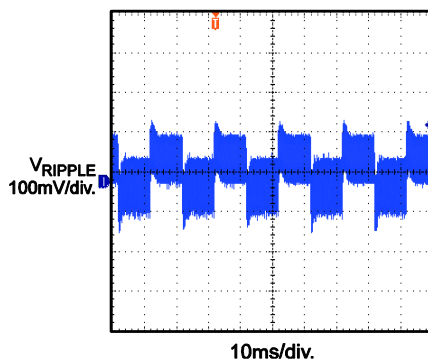
## Turn-on Delay

$V_{IN} = 230\text{Vac}$ , Full Load



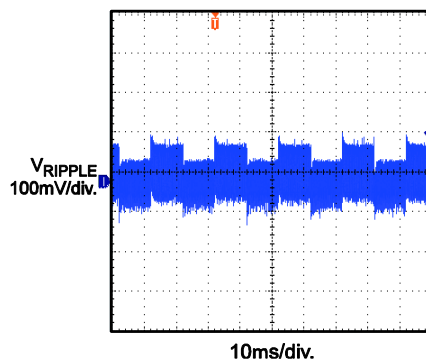
## Load Transient

$V_{IN} = 115\text{Vac}$ ,  
25% Load to 50% Load



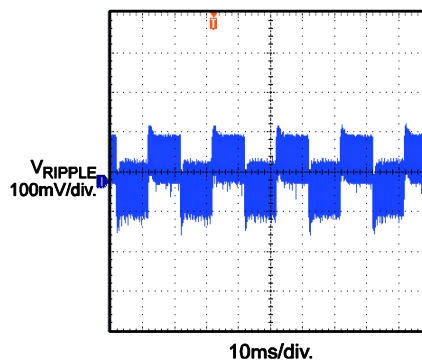
## Load Transient

$V_{IN} = 115\text{Vac}$ ,  
50% Load to 75% Load



## Load Transient

$V_{IN} = 230\text{Vac}$ ,  
25% Load to 50% Load



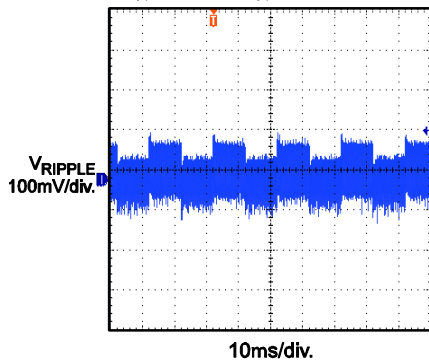
## EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 85\text{-}265\text{VAC}$ ,  $V_{OUT} = 12\text{V}$ ,  $I_{OUT} = 200\text{mA}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

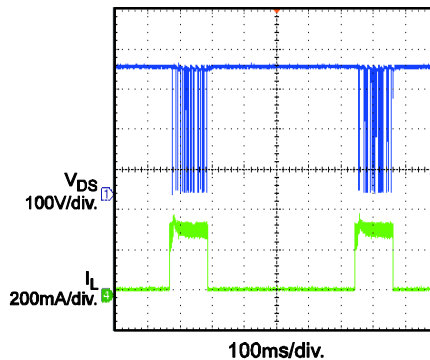
### Load Transient

$V_{IN} = 230\text{Vac}$ ,  
50% Load to 75% Load



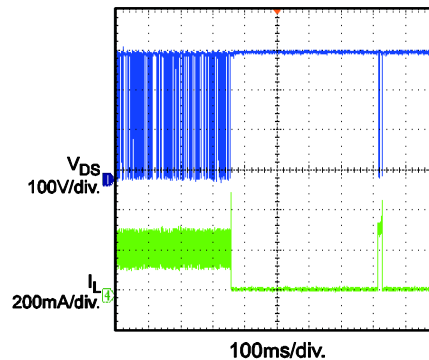
### OLP Protection

$V_{IN} = 230\text{Vac}$

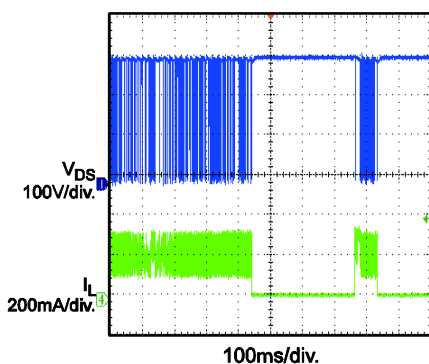


### SCP Protection

$V_{IN} = 230\text{Vac}$

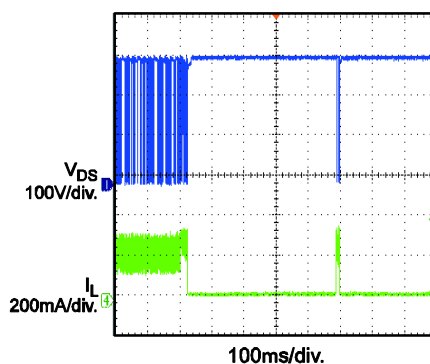


### Thermal Down



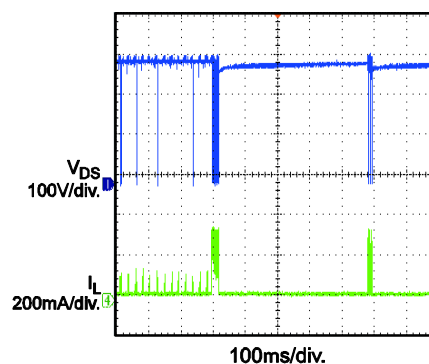
### Open Loop

Full Load



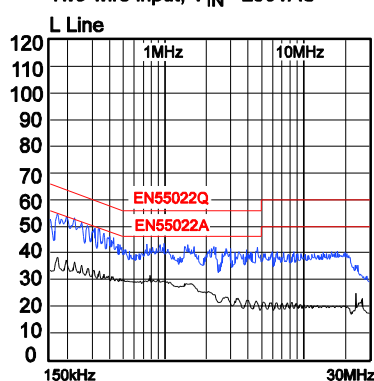
### Open Loop

No Load



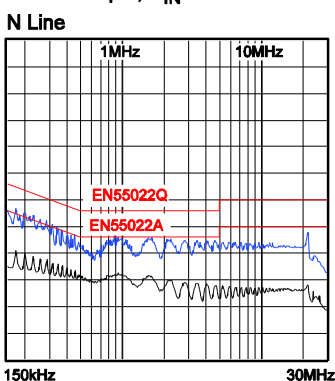
### Conducted EMI

Two-wire input,  $V_{IN} = 230\text{VAC}$



### Conducted EMI

Two-wire input,  $V_{IN} = 230\text{VAC}$



## SURGE PERFORMANCE

With the input capacitors C3 (10 $\mu$ F) and C4 (10 $\mu$ F), the board can pass 1kV surge test. Table 1 shows the capacitance required under normal condition for different surge voltage.

**Table 1: Recommended Capacitor Values**

| Surge Voltage | 500V      | 1000V       | 2000V      |
|---------------|-----------|-------------|------------|
| C3            | 1 $\mu$ F | 10 $\mu$ F  | 22 $\mu$ F |
| C4            | 1 $\mu$ F | 4.7 $\mu$ F | 10 $\mu$ F |

# PRINTED CIRCUIT BOARD LAYOUT

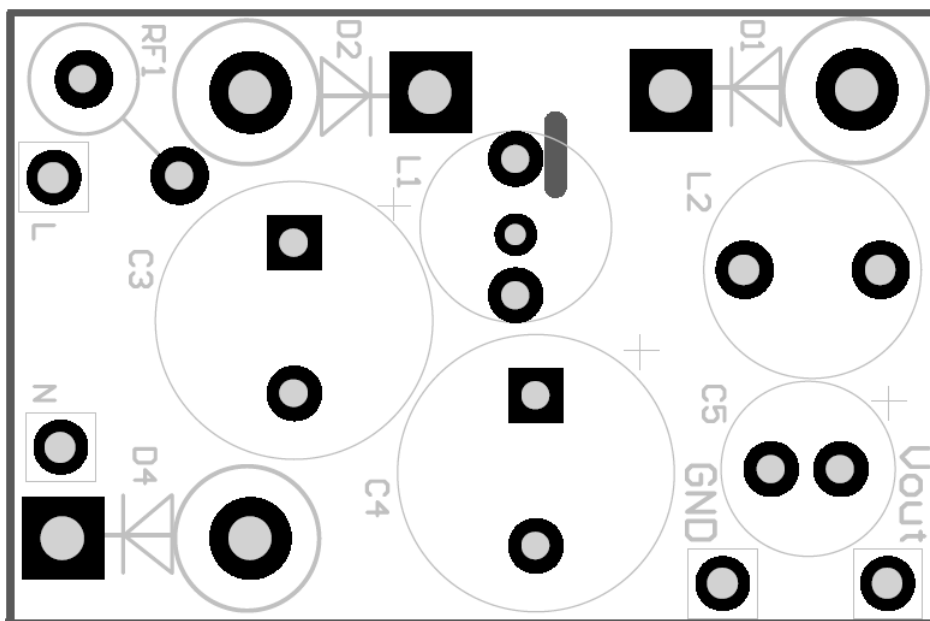


Figure 1 — Top Silk Layer

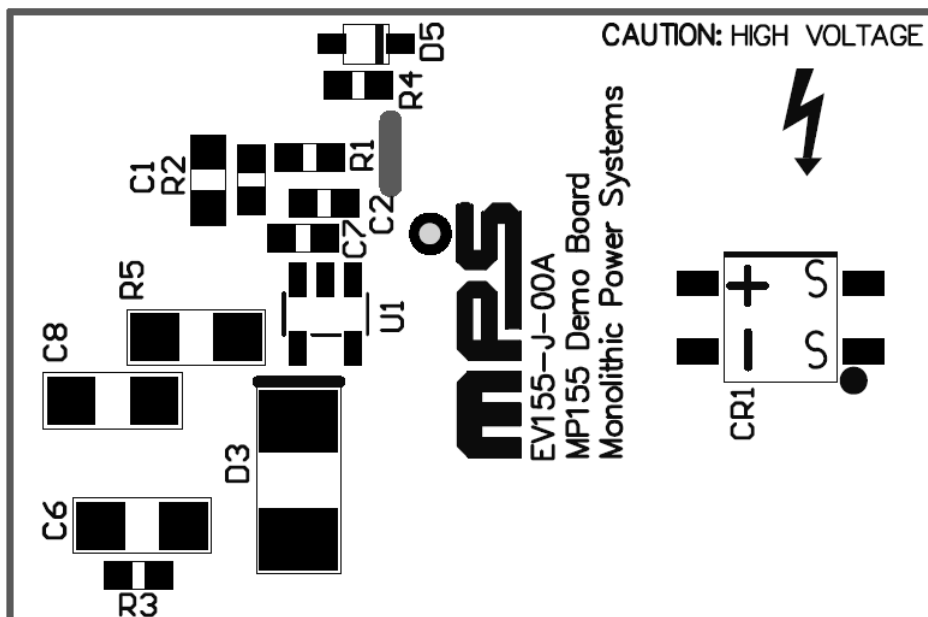


Figure 2 — Bottom Silk Layer

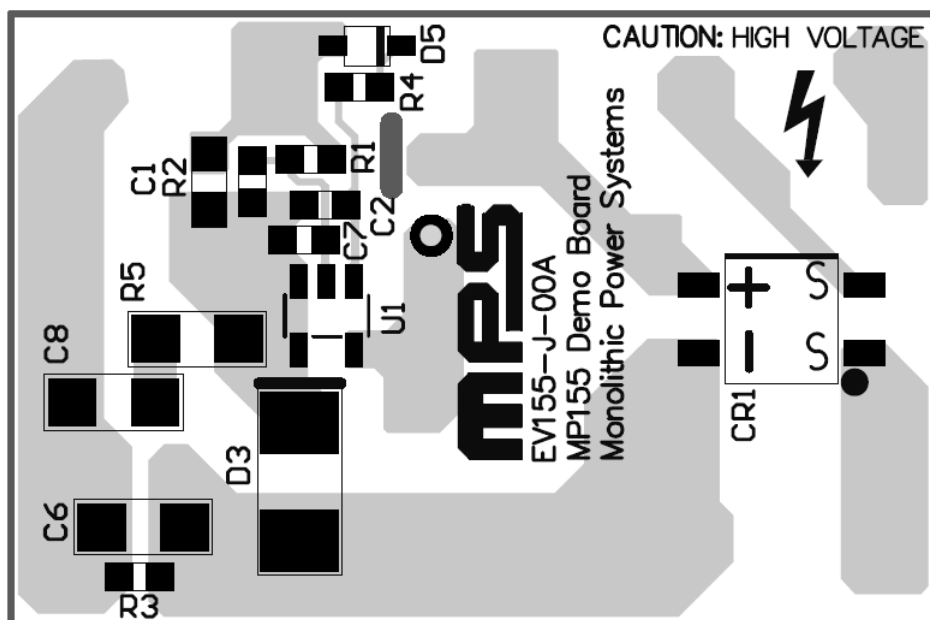


Figure 3 — Bottom Layer

## QUICK START GUIDE

1. Preset Power Supply to  $85V \leq V_{IN} \leq 265V$ .
2. Turn Power Supply off.
3. Connect the Line and Neutral terminals of the power supply output to L and N port.
4. Connect the positive terminal of the load to  $V_{OUT}$  port, and connect the negative terminal of the load to GND port.
5. Turn Power Supply on after making connections.

## Contact Information

To request this evaluation board, please refer to your local sales offices which can be found from:

<http://www.monolithicpower.com/Company/Contact-Us>

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