



The Future of Analog IC Technology®

**EV155-J-00A**

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

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## 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 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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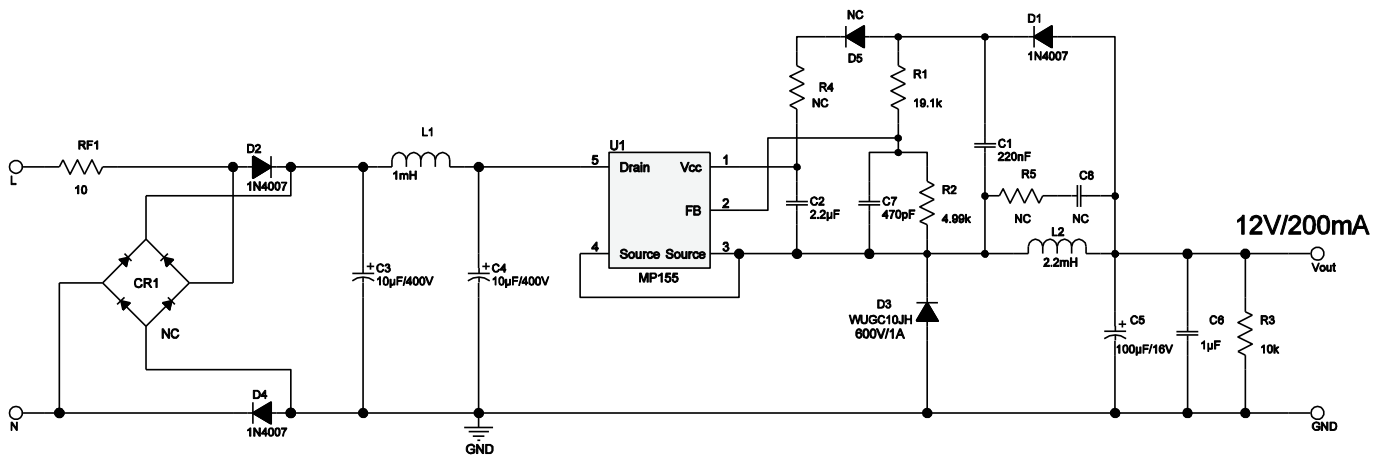
## EV155-J-00A EVALUATION BOARD



( 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



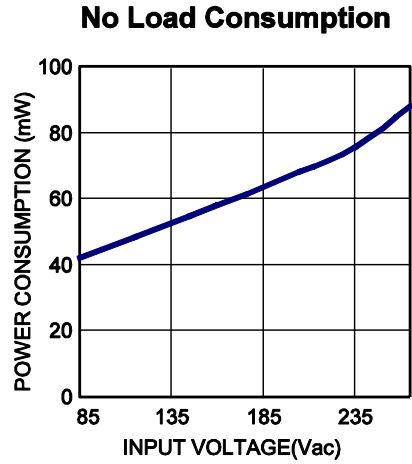
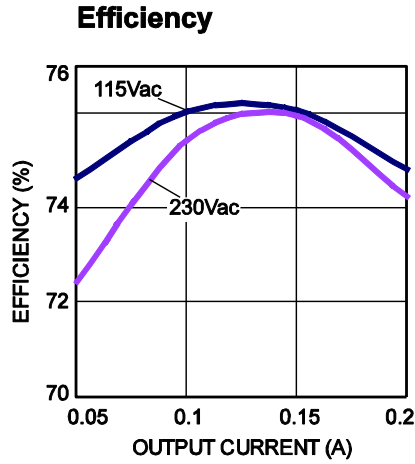
**EV155-J-00A BILL OF MATERIALS**

Qty	Ref	Value	Description	Package	Manufacture	Part Number
1	C1	220nF	Ceramic Capacitor; 16V;X7R;0603;	0603	muRata	GRM188R71C224KA01
1	C2	2.2μF	Ceramic Capacitor; 10V;X7R;0603	0603	muRata	GRM188R71A225KE15D
2	C3, C4	10μF/400V	Capacitor;400V;20%	DIP	Any	Any
1	C5	100μF/16V	Electrolytic Capacitor; 16V;Electrolytic;DIP	DIP	Jianghai	CD11C-16V100
1	C6	1μF	Ceramic Capacitor; 50V;X7R;0805;	0805	muRata	GRM21BR71H105KA12L
1	C7	470pF	Ceramic Capacitor;50V;COG	0603	TDK	C1608COG1H471J
3	D1, 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; 250mA	DIP	Würth	7447462102
1	L2	2.2mH	Inductor;2.2mH;4.73; 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

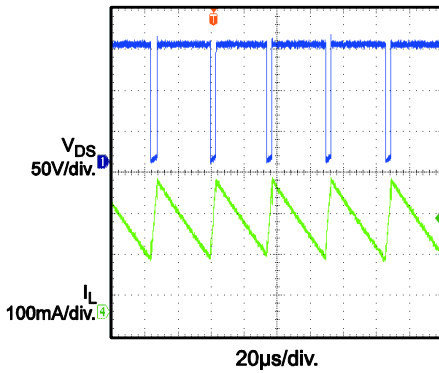
Performance waveforms are tested on the evaluation board.

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



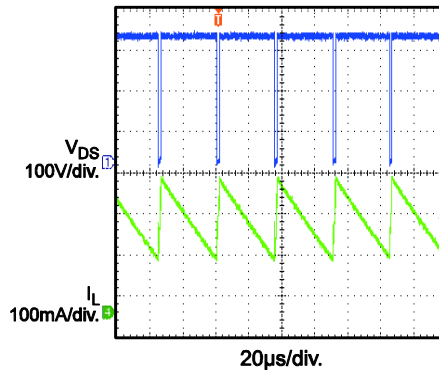
### Normal Operation

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



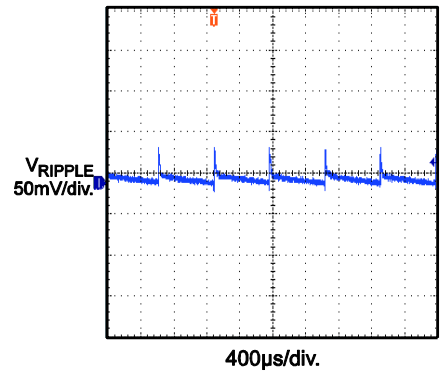
### Normal Operation

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



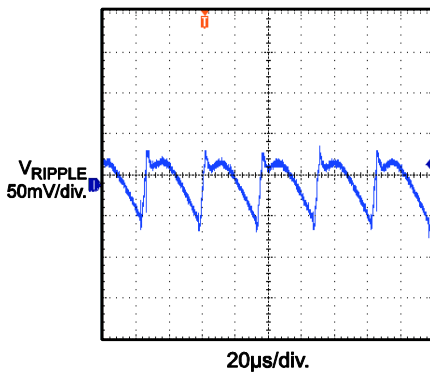
### Output Ripple

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



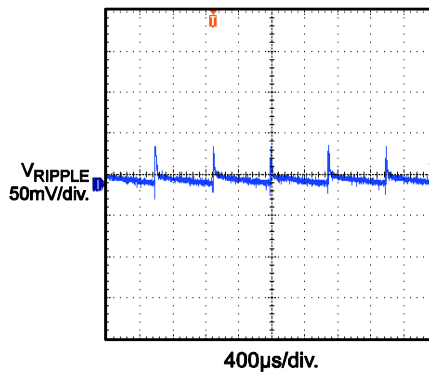
### Output Ripple

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



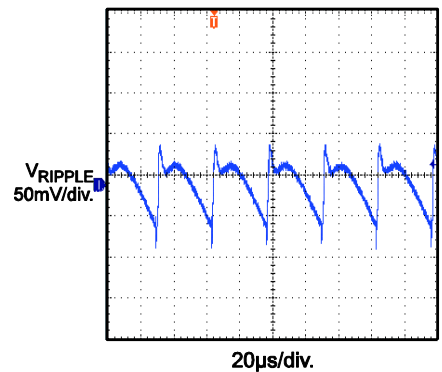
### Output Ripple

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



### Output Ripple

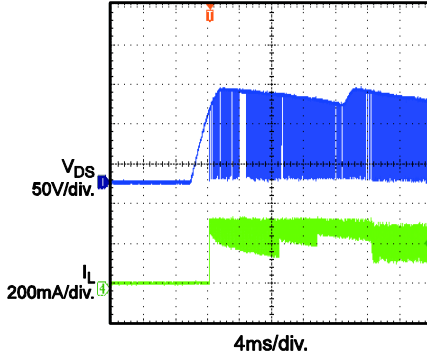
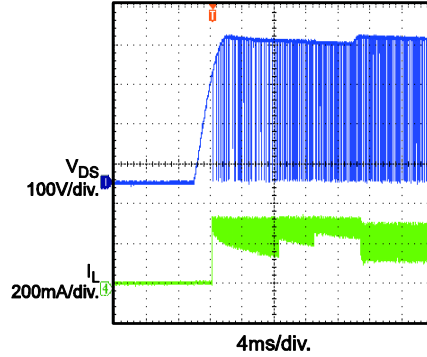
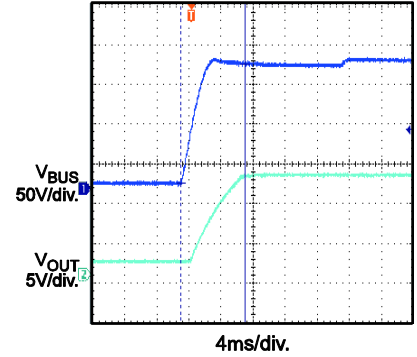
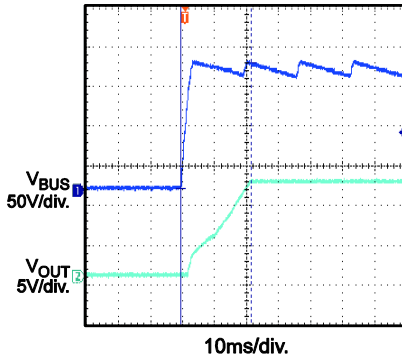
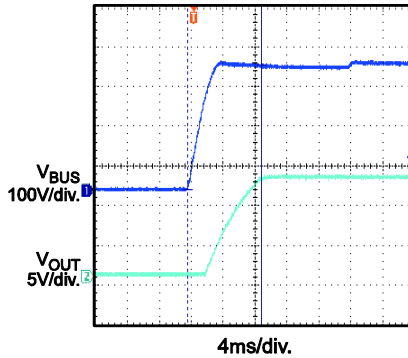
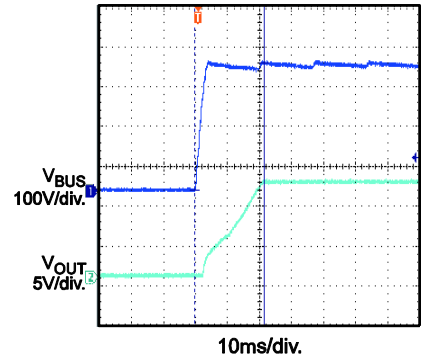
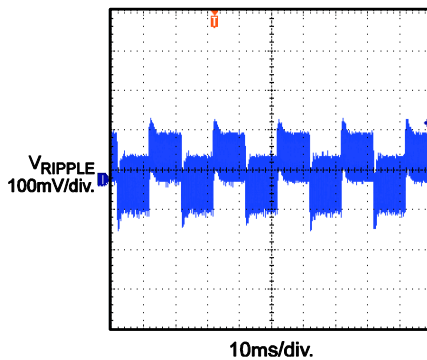
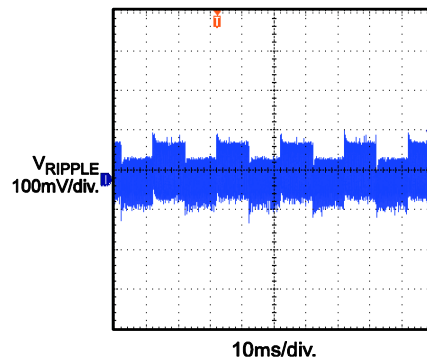
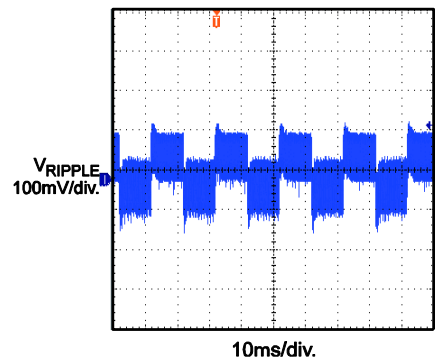
$V_{IN} = 230\text{Vac}$ , Full Load



**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


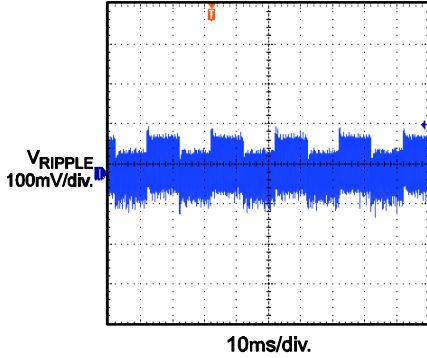
### EVB TEST RESULTS *(continued)*

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.

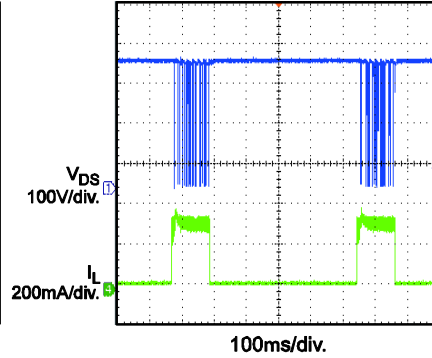
#### Load Transient

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



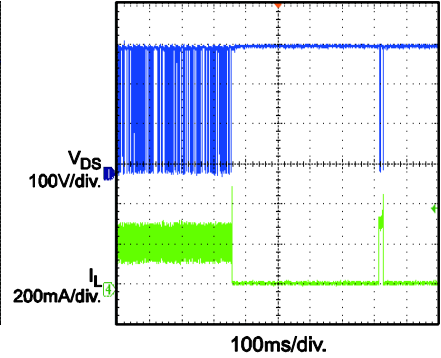
#### OLP Protection

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

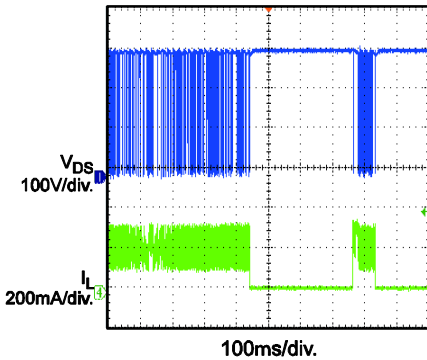


#### SCP Protection

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

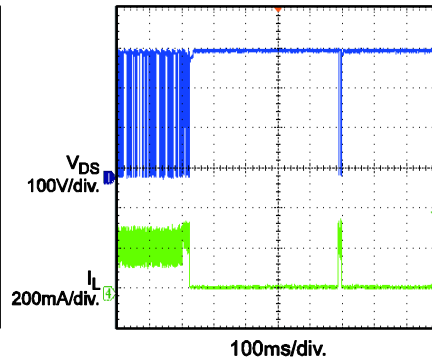


#### Thermal Down



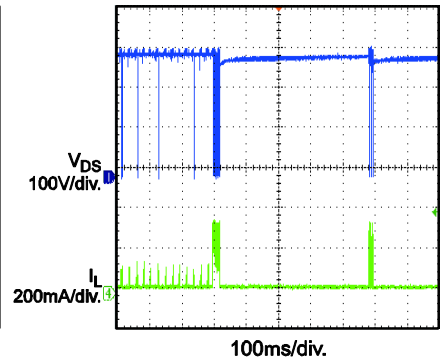
#### Open Loop

Full Load



#### Open Loop

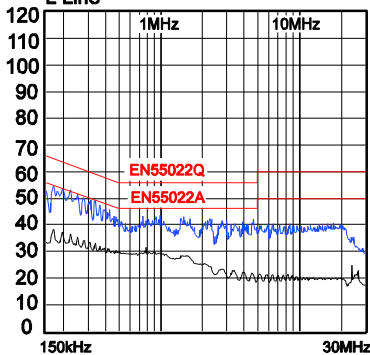
No Load



#### Conducted EMI

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

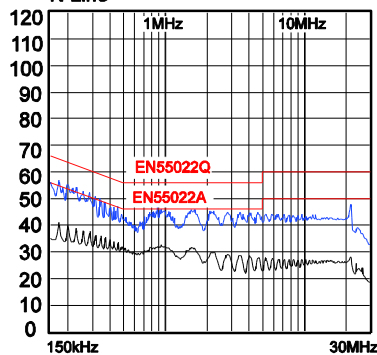
L Line



#### Conducted EMI

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

N Line



## 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

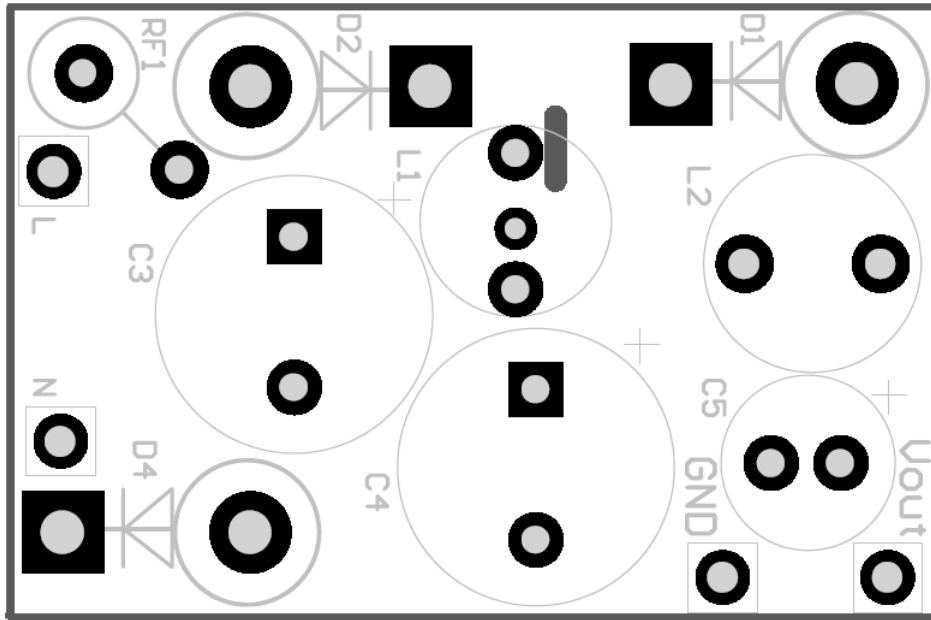


Figure 1 — Top Silk Layer

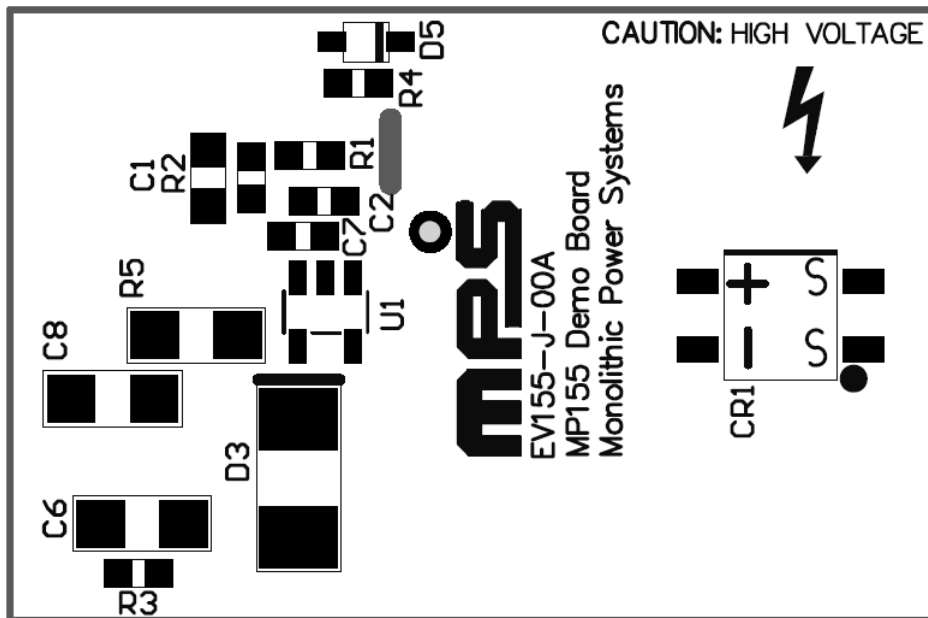


Figure 2 — Bottom Silk Layer

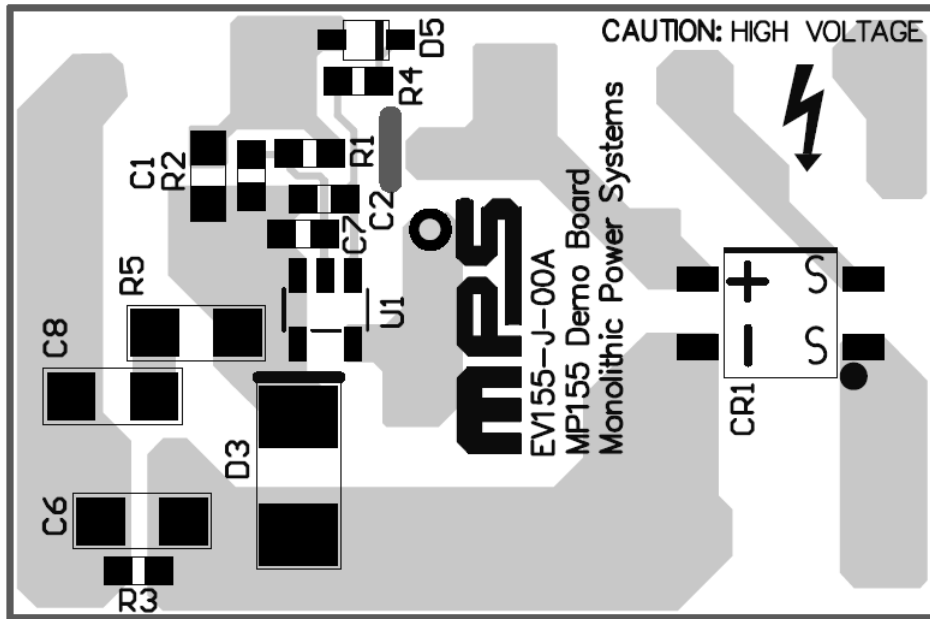


Figure 3 — Bottom Layer

## 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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