Evaluation Board Report

12V 1.8W ACDC power supply

Design Specs	Value	Unit
Input Voltage	85-265	VAC
Output Voltage	12	VDC
Output Current	0.15	A
Isolation	No	
MPS IC	MP156GJ	
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

EV156-J-00A evaluation board provides a reference design for a universal offline power supply with 12V, 0.15A 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

MP156 is a primary-side regulator that provides accurate constant voltage (CV) regulation without opto-coupler, support buck, buck-boost, or flyback topologies. It has an integrated 500V MOSFET to simplify the structure and reduce costs. These features make it a competitive candidate for off-line low power applications, such as home appliances and standby power.

MP156 is a green-mode-operation regulator. Both its the peak current and the switching frequency decrease as the load decreases to provide excellent efficiency at light load, thus improving the overall average efficiency.

MP156 features various protections, including thermal shutdown (TSD), VCC under-voltage lockout (UVLO), overload protection (OLP), short-circuit protection (SCP), and open loop protection.

MP156 is available in the TSOT23-5 and SOIC8 package.

FEATURES

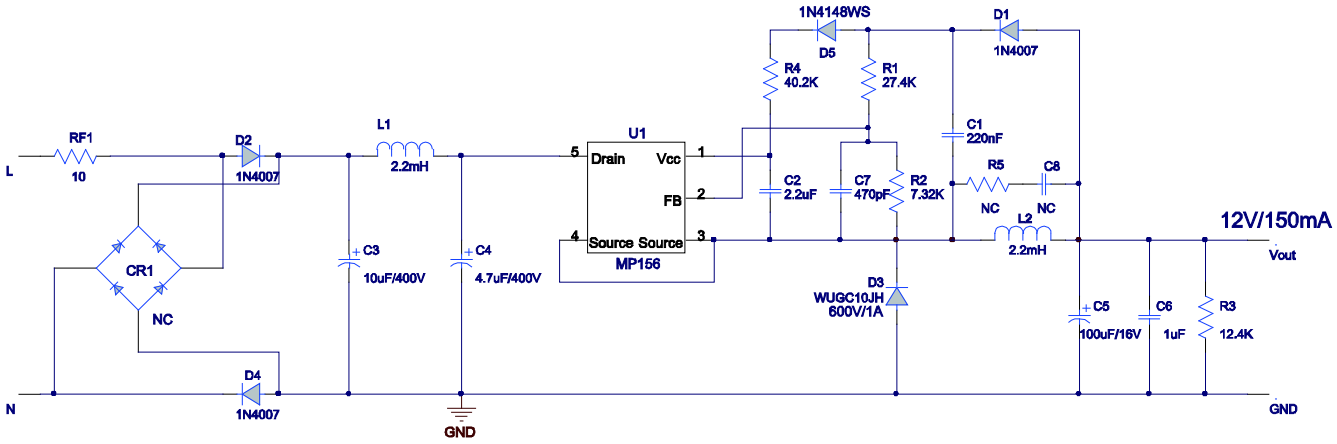
- Primary-Side Constant Voltage (CV) Control, Supporting buck, Buck-Boost and Flyback Topologies
- Integrated 500V/20Ω MOSFET
- <30mW No-Load Power Consumption
- Up to 3W Output Power
- Maximum DCM Output Current Less than 130mA
- Maximum CCM Output Current Less than 220mA
- Low VCC Operating Current
- Frequency Foldback
- Limited Maximum Frequency
- Peak-Current Compression
- Internal High-Voltage Current Source
- Internal 350ns Leading-Edge Blanking
- Thermal Shutdown (Auto Restart)
- VCC Under Voltage Lockout with Hysteresis
- Timer Based Over-Load Protection.
- Short-Circuit Protection
- Open-Loop Protection

EV156-J-00A EVALUATION BOARD

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

Board Number	MPS IC Number
EV156-J-00A	MP156GJ

EVALUATION BOARD SCHEMATIC



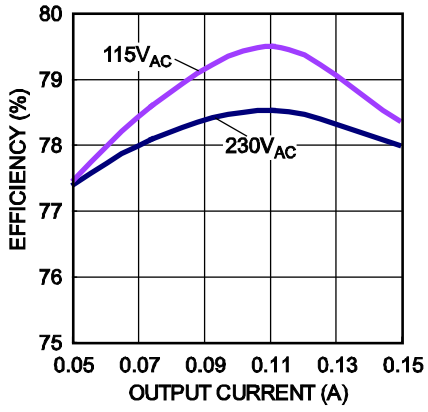
EV156-J-00A BILL OF MATERIALS

Qty	RefDes	Value	Description	Package	Manufacture	Manufacture_PN
1	C1	220nF	Ceramic Capacitor;16V;X7R ;0603;	0603	muRata	GRM188R71C224KA01D
1	C2	2.2uF	Ceramic Capacitor;10V;X7R ;0603	0603	muRata	GRM188R71A225KE15D
1	C3	10uF/400V	Electrolytic Capacitor;400V;20 %	DIP	Any	Any
1	C4	4.7uF/400V	Electrolytic Capacitor;400V;Ele ctrolytic;DIP	DIP	Jianghai	CD263-400V4.7
1	C5	100uF/16V	Electrolytic Capacitor;16V;Elec trolytic;DIP	DIP	Jianghai	CD11C-16V100
1	C6	1uF	Ceramic Capacitor;50V;X7R ;0805;	0805	muRata	GRM21BR71H105KA12L
1	C7	470pF	Ceramic Capacitor;50V;CO G	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	D5	1N4148WS	Diode;75V;0.15A;	SOD-323	Diodes	1N4148WS-7-F
1	L1	2.2mH	Inductor;2.2mH;11; 210mA	DIP	Wurth	744741222
1	L2	2.2mH	Inductor;2.2mH;4.7 3;300mA	DIP	Wurth	7447720222
1	R1	27.4K	Film Resistor;1%	0603	Yageo	RC0603FR-0727K4L
1	R2	7.32K	Film Resistor;1%	0603	Yageo	RC0603FR-077K32L
1	R3	12.4K	Film Resistor;1%;	0603	Yageo	RC0603FR-0712K4L
1	R4	40.2K	Film Resistor;1%;	0603	Yageo	RC0603FR-0740K2L
1	RF1	10	Fuse Resistor;5%;1W	DIP	Any	Any
1	U1	MP156GJ	Primary side regulator	TSOT23-5	MPS	MP156GJ

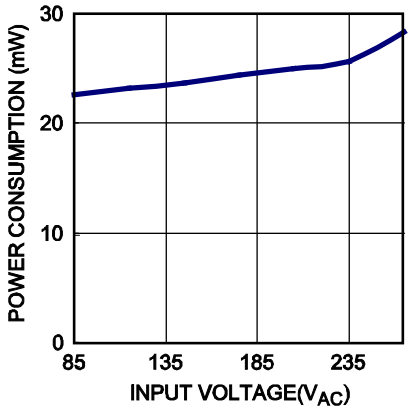
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.
V_{IN} = 85V to 265V_{AC}, V_{OUT} = 12V, I_{OUT} = 150mA, T_A = 25°C, unless otherwise noted.

Efficiency

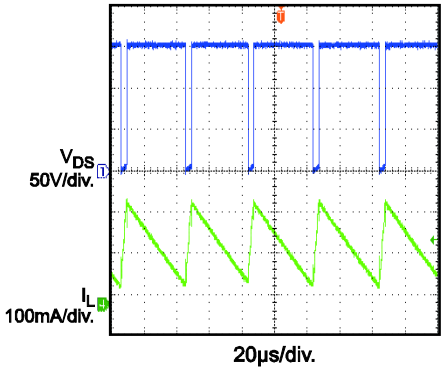


No Load Consumption



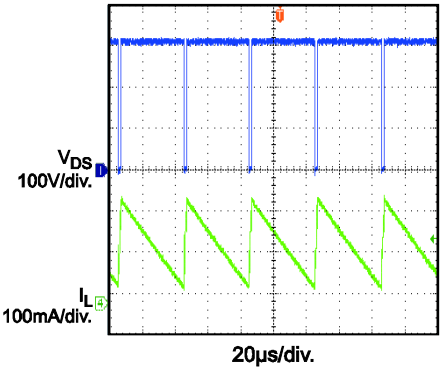
Normal Operation

V_{IN} = 115V_{AC}, Full Load



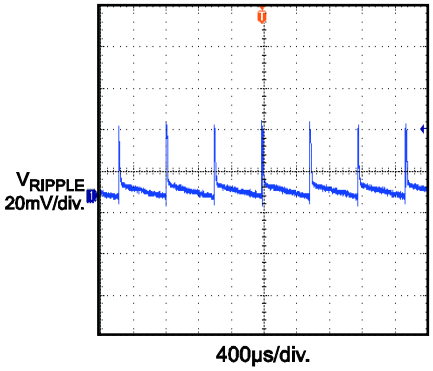
Normal Operation

V_{IN} = 230V_{AC}, Full Load



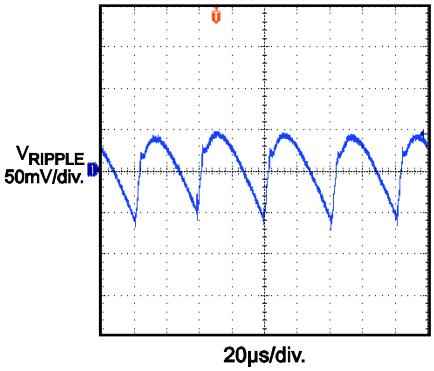
Output Ripple

V_{IN} = 115V_{AC}, No Load



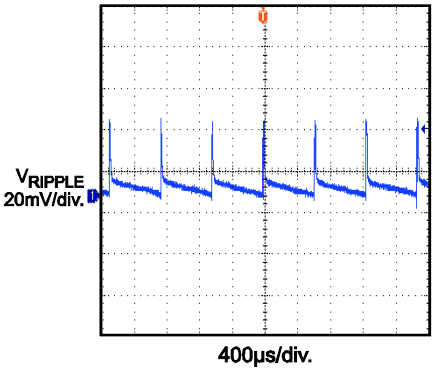
Output Ripple

V_{IN} = 115V_{AC}, Full Load



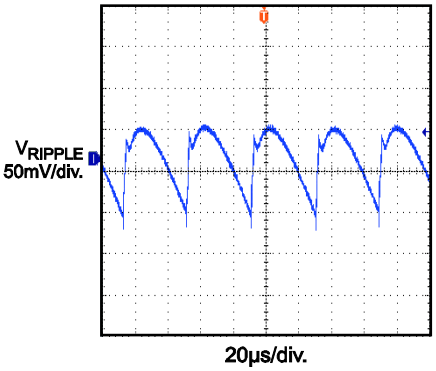
Output Ripple

V_{IN} = 230V_{AC}, No Load



Output Ripple

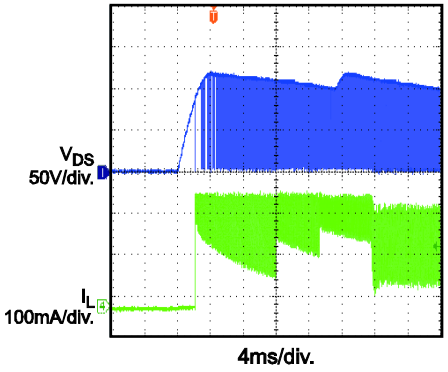
V_{IN} = 230V_{AC}, Full Load



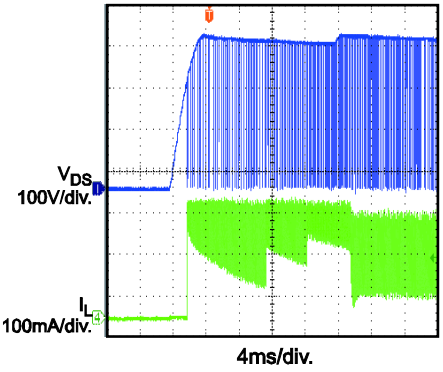
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 85V to 265V_{AC}, V_{OUT} = 12V, I_{OUT} = 150mA, T_A = 25ºC, unless otherwise noted.

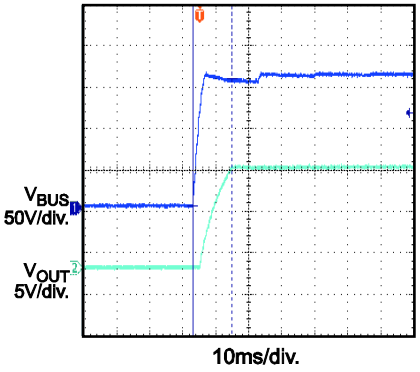
Soft Start
V_{IN} = 85V_{AC}, Full Load



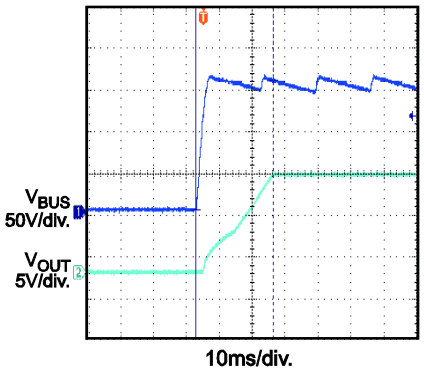
Soft Start
V_{IN} = 265V_{AC}, Full Load



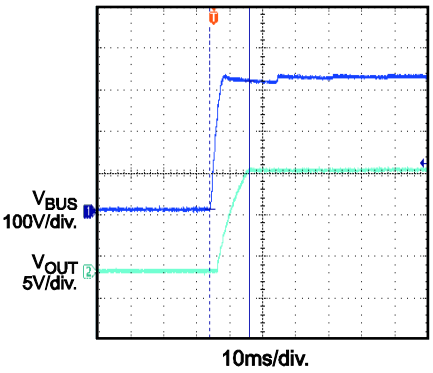
Turn-on Delay
V_{IN} = 115V_{AC}, No Load



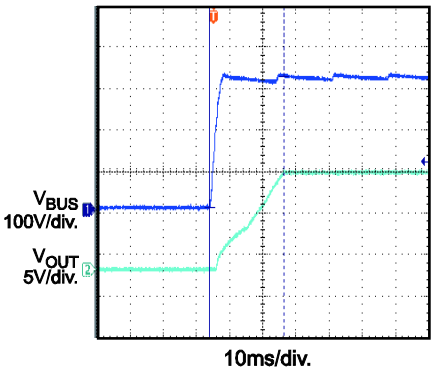
Turn-on Delay
V_{IN} = 115V_{AC}, Full Load



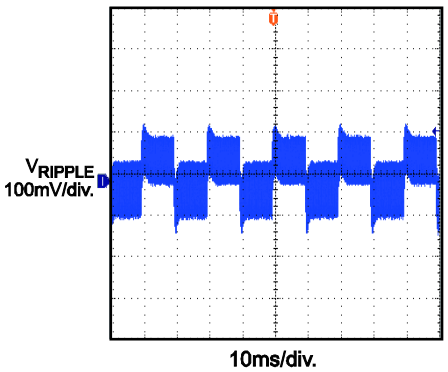
Turn-on Delay
V_{IN} = 230V_{AC}, No Load



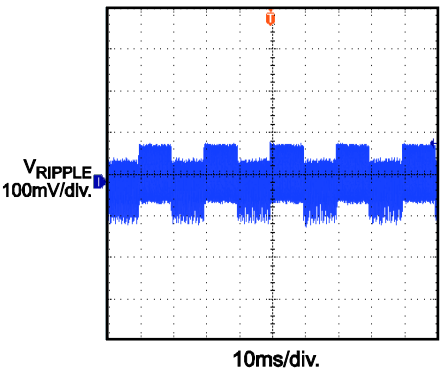
Turn-on Delay
V_{IN} = 230V_{AC}, Full Load



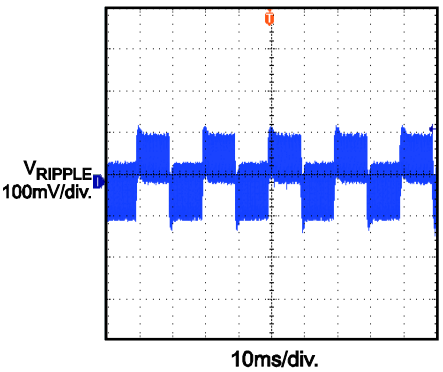
Load Transient
V_{IN} = 115V_{AC},
25% Load to 50% Load



Load Transient
V_{IN} = 115V_{AC},
50% Load to 75% Load



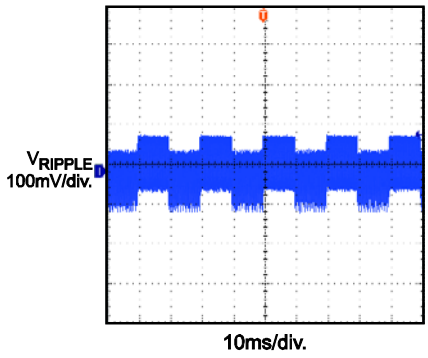
Load Transient
V_{IN} = 230V_{AC},
25% Load to 50% Load



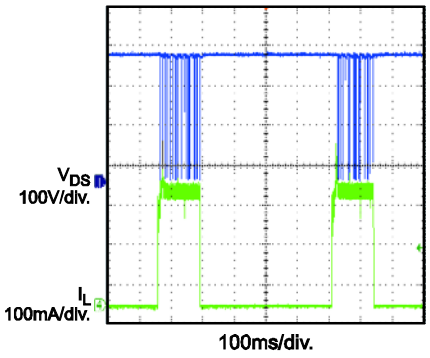
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 85V to 265V_{AC}, V_{OUT} = 12V, I_{OUT} = 150mA, T_A = 25°C, unless otherwise noted.

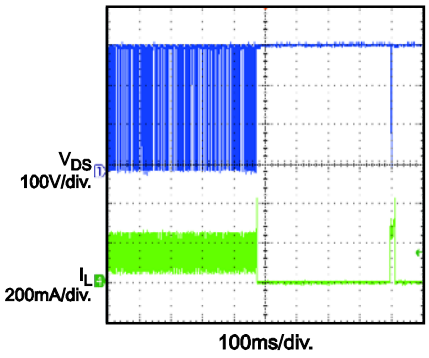
Load Transient
V_{IN} = 230V_{AC},
50% Load to 75% Load



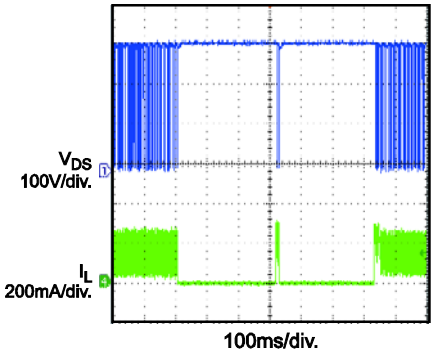
OLP Protection
V_{IN} = 230V_{AC}



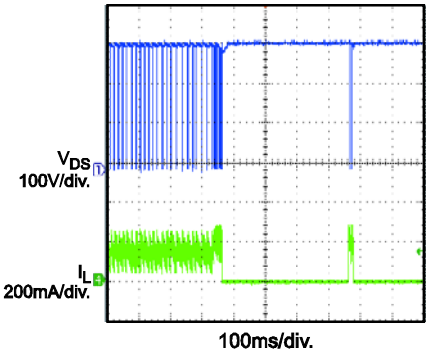
SCP Protection
V_{IN} = 230V_{AC}



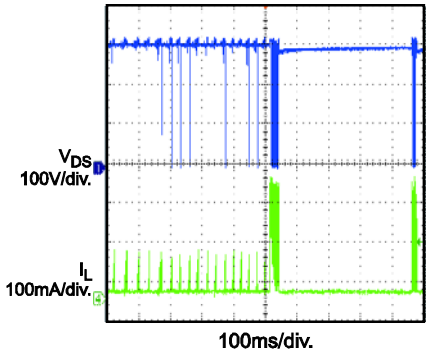
Thermal Down



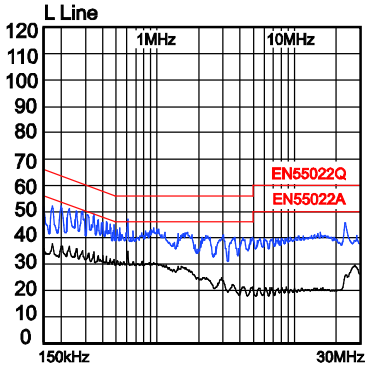
Open Loop
Full Load



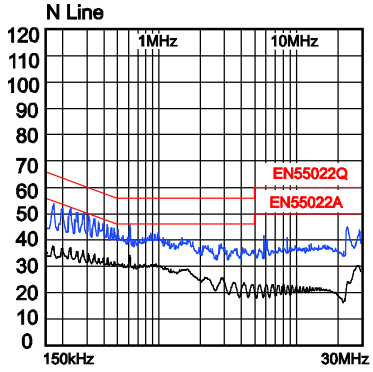
Open Loop
No Load



Conducted EMI
Two-Wire Input, V_{IN} =230V_{AC}
L Line



Conducted EMI
Two-Wire Input, V_{IN} =230V_{AC}
N Line



SURGE PERFORMANCE

With the input capacitors C3 (10μF) and C4 (4.7μF), 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	1μF	10μF	22μF
C4	1μF	4.7μF	10μF

PRINTED CIRCUIT BOARD LAYOUT

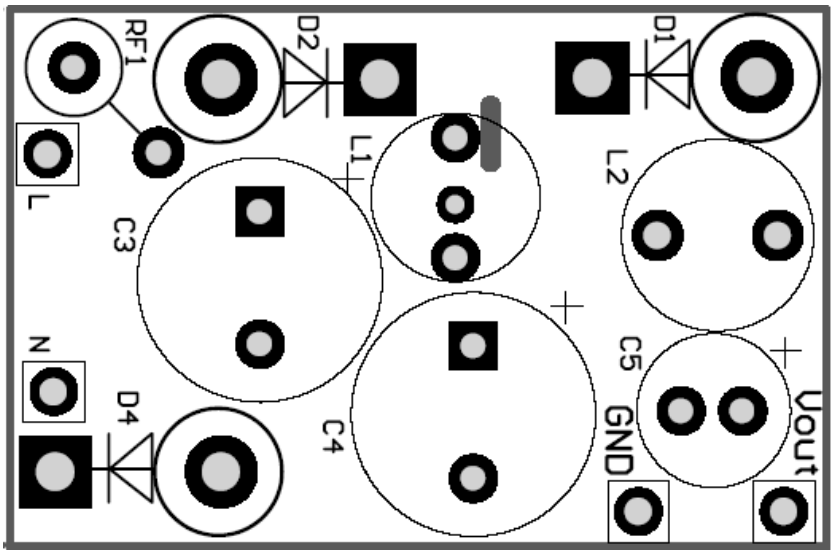


Figure 1 — Top Silk Layer

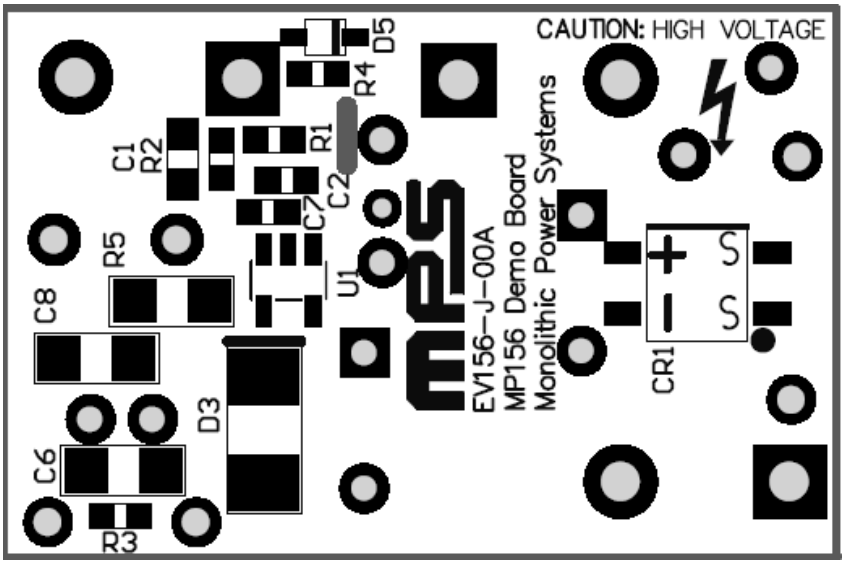


Figure 2 — Bottom Silk Layer

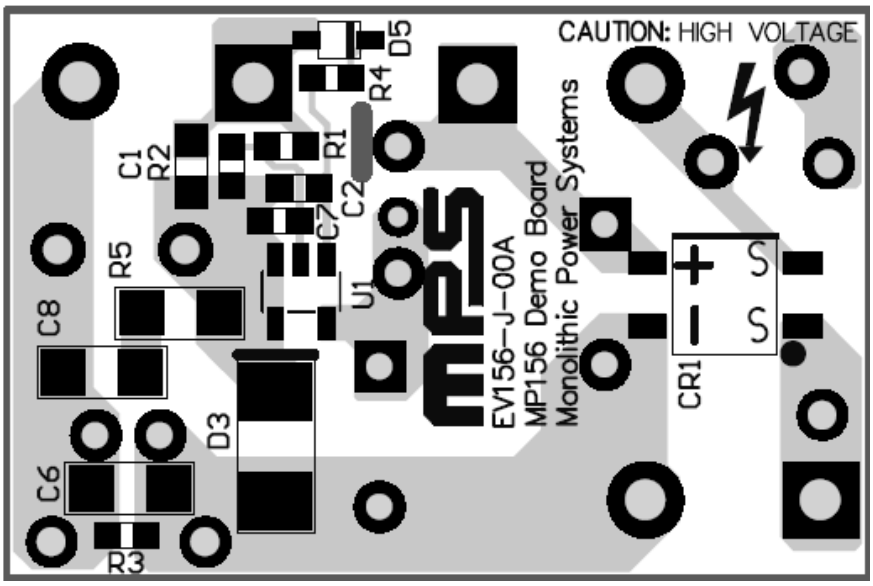


Figure 3 — Bottom Layer

QUICK START GUIDE

1. Preset Power Supply to 85V ≤ V_{IN} ≤ 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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