Evaluation Board Report

5V 0.3W ACDC power supply

Design Specs	Value	Unit
Input Voltage	85-265	VAC
Output Voltage	5	VDC
Output Current	60	mA
Isolation	No	
MPS IC	MP103GN	
Application	• Wall Switches and Dimmers • Z-Wave Device and ZigBee Device for Home Automation • Standby Power for General Off-line Applications	
Document Number	EBXXX	
Author	Application Engineering Department	
Date	Nov, 2014	
Revision	1.0	

Design Summary

EV103-N-00A evaluation board provides a reference design for a universal offline inductor-less power supply with 5V, 60mA 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 MP103 is a good efficiency off-line linear regulator that directly steps down the AC line voltage to a regulated DC voltage. It provides a simple solution to provide a bias voltage to any ICs in the off-line application. Off-line linear regulator is designed to replace the conventional switching converter; it features no inductor required, low EMI noise and low BOM cost.

MP103 features as a controller that supports to drive low cost bipolar junction transistor.MP103 integrates an adaptive active VB-VOUT charging window method. The MP103 only works when it is necessary and only when the loss generated on the device is minimal. Such operation can achieve good efficiency and can help the system meet the new standby power specification.

MP103 offers rich protections, such as Thermal Shutdown (TSD), Over Temperature Protection (OTP), VB Over Voltage Protection (OVP), VB Short to GND Protection, Over Load Protection (OLP), Short Circuit Protection (SCP), MP103 is available in the SOIC8E package.

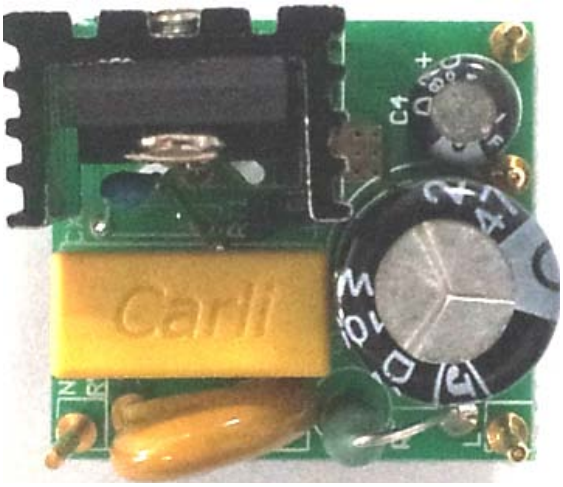
ELECTRICAL SPECIFICATION

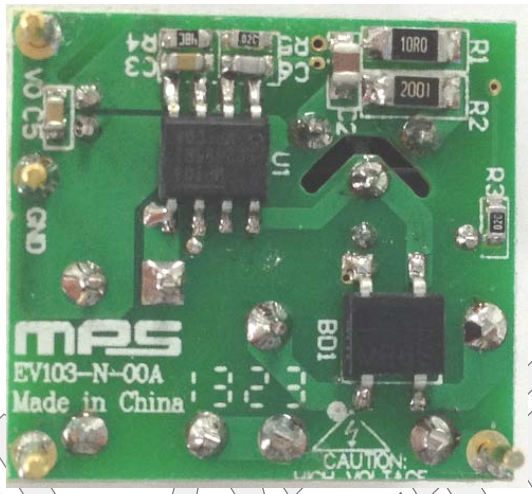
Parameter	Symbol	Value	Units
Supply Voltage	V_{IN}	85~265	VAC
Output Voltage	V_{OUT}	5	V
Output Current	I_{OUT}	60	mA

FEATURES

- Universal AC Input (85Vac-305Vac)
- Inductor-Less
- Less than 100mW Standby Power
- Excellent EMI
- Low BOM Cost
- Smart Control to Maximum Efficiency
- Adjustable Output Voltage from 1.5V to 15V
- Good Line and Load Regulation
- Support to Drive BJT
- Short Circuit Protection
- External Programmable Over Temperature Protection (OTP)

EV103-N-00A EVALUATION BOARD

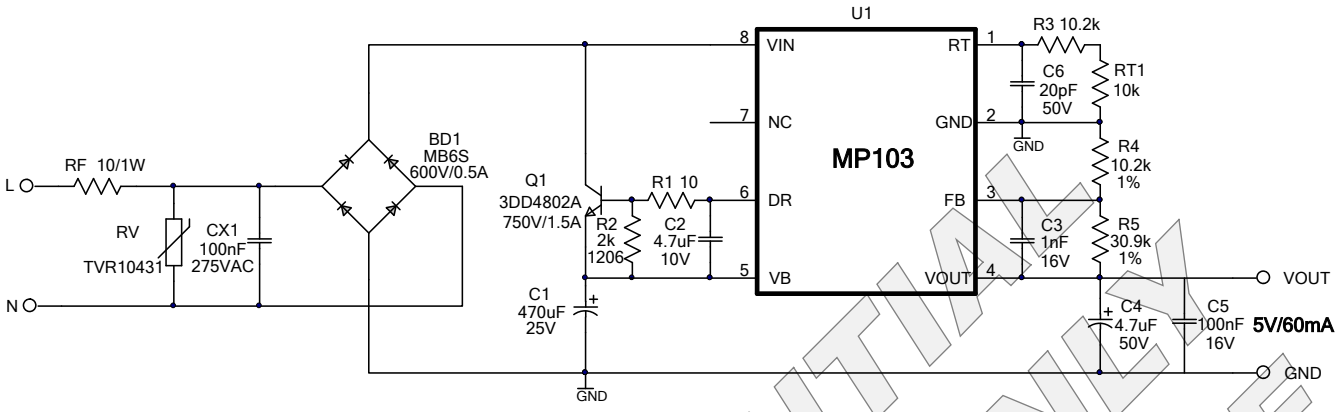




(L x W x H) 22mm x 24mm x 24mm

Board Number	MPS IC Number
EV103-N-00A	MP103GN

EVALUATION BOARD SCHEMATIC



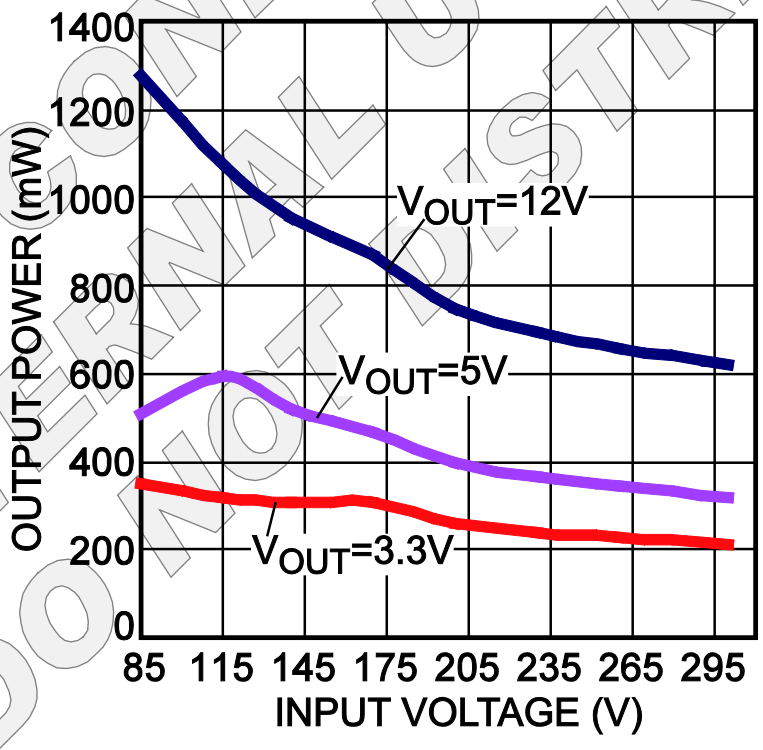
VOUT can be adjusted by choosing the value of R4 and R5, the relationship of them is:

$$VOUT=1.235V*(1+R5/R4)$$

For example, to get 12V output voltage, we can choose, R4=10.2k, R5=90.9k.

The maximum output power (P_{OUT}) of MP103 Vs input voltage (V_{IN}) is depicted by following chart for 12V, 5V and 3.3V output applications respectively.

The test condition is: in open frame, ambient temperature is 25 ^{o}C, the temperature rise of MP103 is less than 60 ^{o}C on the test board.



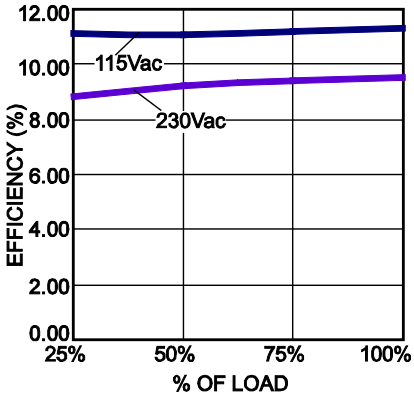
EV103-N-00A BILL OF MATERIAL

Qty	Ref	Value	Description	Package	Manufacture	Manufacturer_PN
1	BD1	MB6S	Diode;600V;0.5A;	SOIC-4	TaiWan Semiconductor	MB6S
1	C1	470µF	Electrolytic Capacitor; 25V;	DIP	Jianghai	CD287-25V470
1	C2	4.7µF	Ceramic Capacitor; 16V;	0805	Murata	GRM21BR61C475KA88L
1	C3	1nF	Ceramic Capacitor; 16V;X7R;	0603	Murata	GRM188R71C102KA01
1	C4	4.7µF	Electrolytic Capacitor; 50V;	DIP	Jianghai	CD287-50V4.7
1	C5	100nF	Ceramic Capacitor; 16V;X7R;	0603	LION	0603B104K160T
1	C6	20pF	Ceramic Capacitor; 50V;NPO;	0603	HHEC	C0603N200J050T
1	CX1	100nF	Film Capacitor; 275V;10%	DIP	Kaili	PX104K3IC39L270D9R
1	Q1	3DD4802A	BJT,750V,1.5A;	TO-220F	Huawei	3DD4802A
1	R1	10Ω	Film Resistor;5%;	1206	Yageo	RC1206JR-0710R
1	R2	2kΩ	Film Resistor;5%;	1206	Royalohm	1206F2001T5E
2	R3, R5	10.2kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0710K2L
1	R4	30.9kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0730K9L
1	RF	10Ω	Resistor;5%;1W	DIP	Bangdayuan	10 Ohm/1W
1	RT1	10kΩ	NTC Resistor;5%;	DIP	Shiheng	MF52A103J3470F
1	RV	275Vac	TVR10431KSY, 430V(1mA);	DIP	TKS	TVR10431KSY
1	U1	MP103	Offline Regulator	SOIC8E	MPS	MP103GN

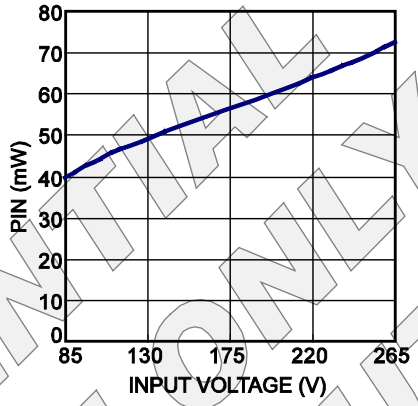
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.
V_{OUT} = 5V, I_{OUT} = 60mA, T_A = 25ºC, unless otherwise noted.

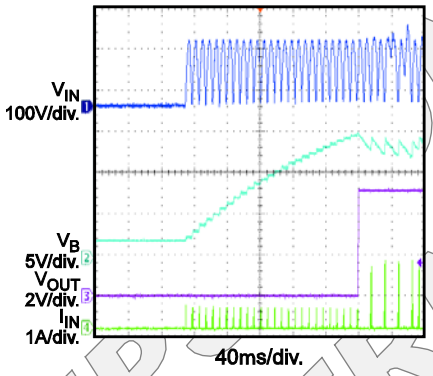
Efficiency vs. Load



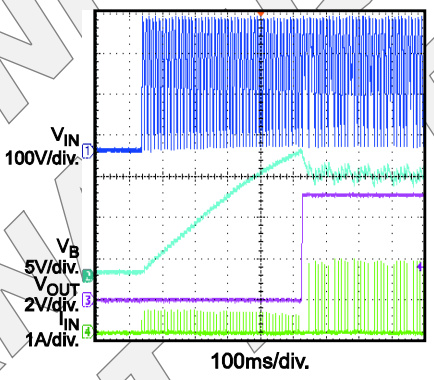
No Load Power vs. Input Voltage



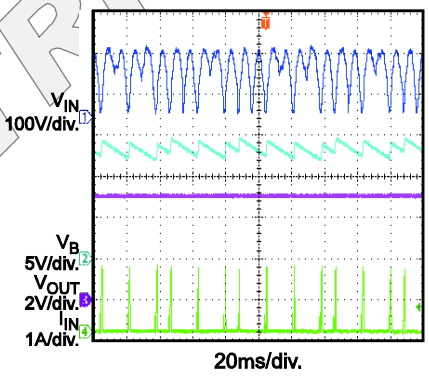
Input Power Startup
115Vac, 5V/60mA



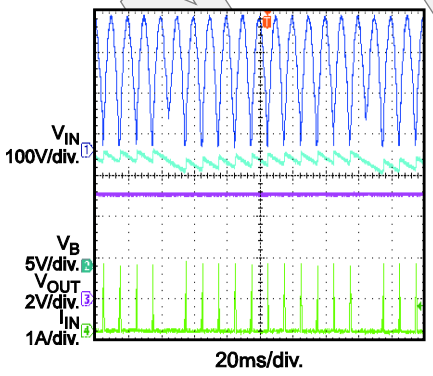
Input Power Startup
230Vac, 5V/60mA



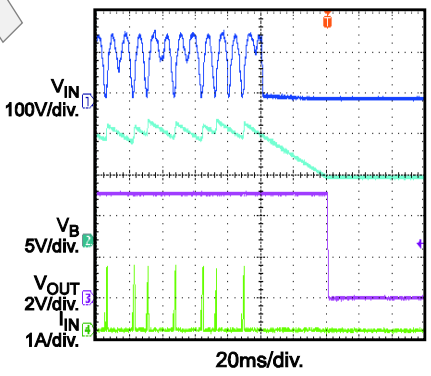
Steady State
115Vac, 5V/60mA



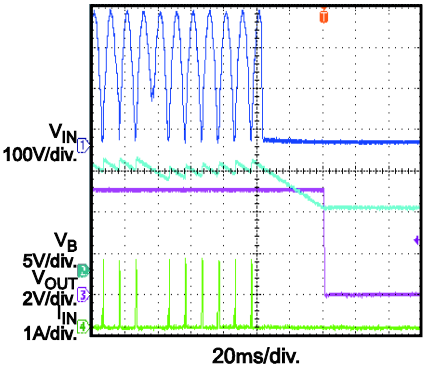
Steady State
230Vac, 5V/60mA



Input Power Shutdown
115Vac, 5V/60mA



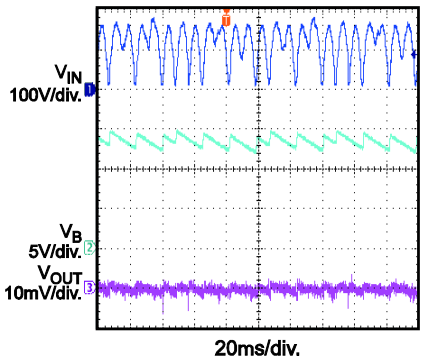
Input Power Shutdown
230Vac, 5V/60mA



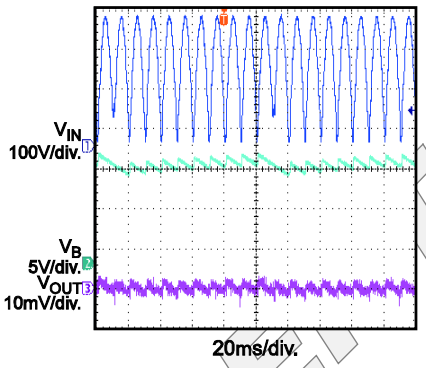
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{OUT} = 5V, I_{OUT} = 60mA, T_A = 25ºC, unless otherwise noted.

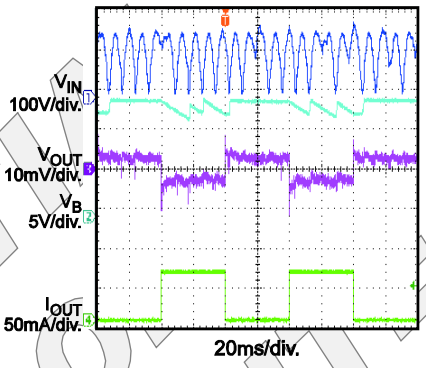
Output Ripple
115Vac, 5V/60mA



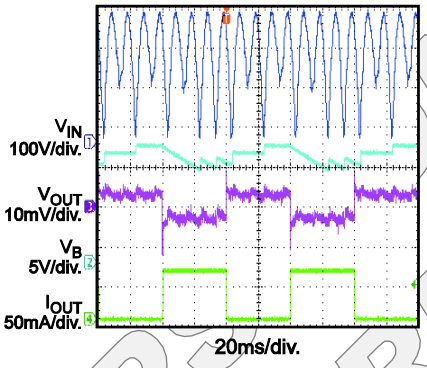
Output Ripple
230Vac, 5V/60mA



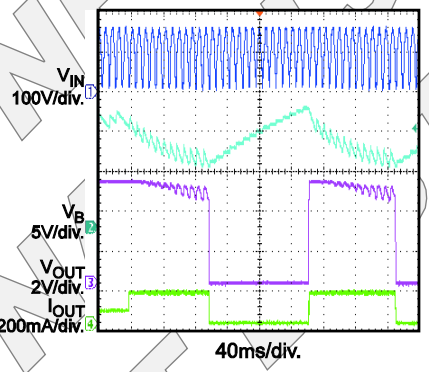
Load Transient
115Vac, 5V, 0 to 60mA



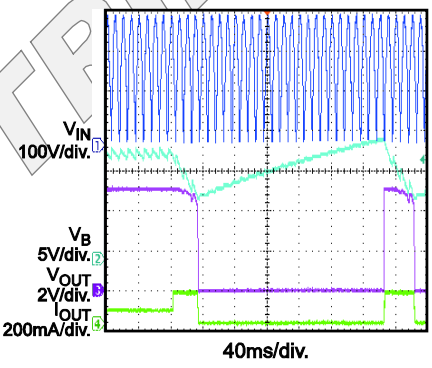
Load Transient
230Vac, 5V, 0 to 60mA



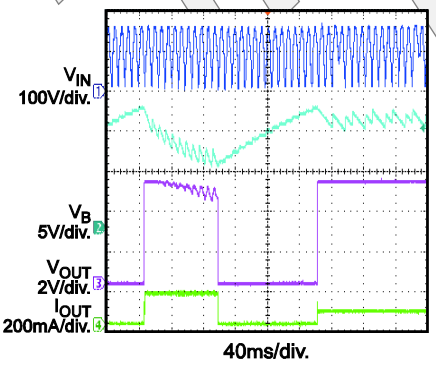
Over Load Protection Entry
115Vac



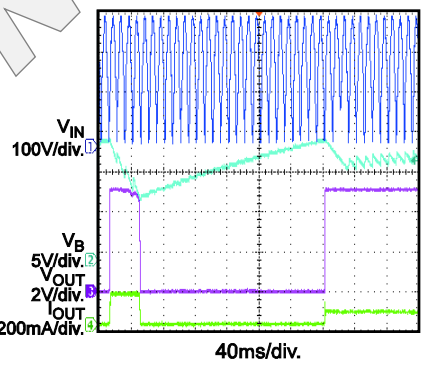
Over Load Protection Entry
230Vac



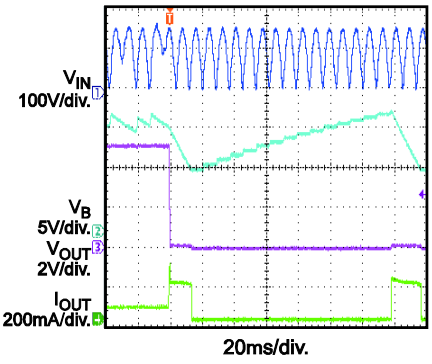
Over Load Protection Recovery
115Vac



Over Load Protection Recovery
230Vac



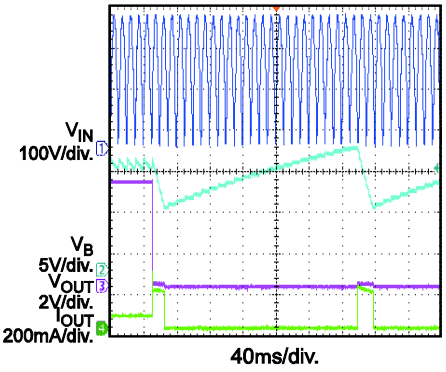
Short Circuit Protection Entry
115Vac



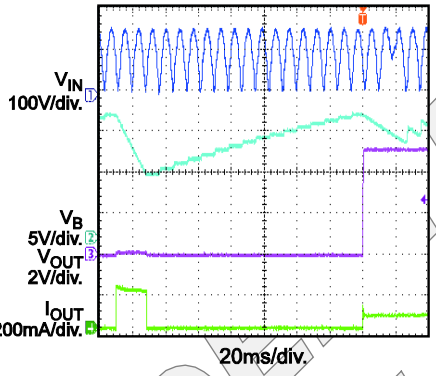
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{OUT} = 5V, I_{OUT} = 60mA, T_A = 25ºC, unless otherwise noted.

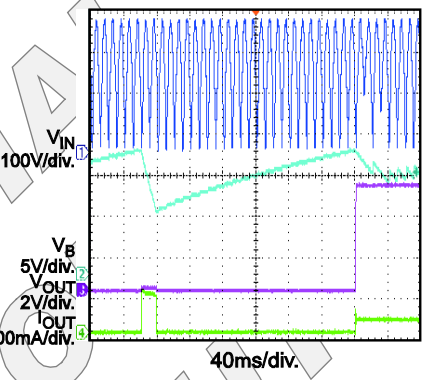
Short Circuit Protection Entry
230Vac



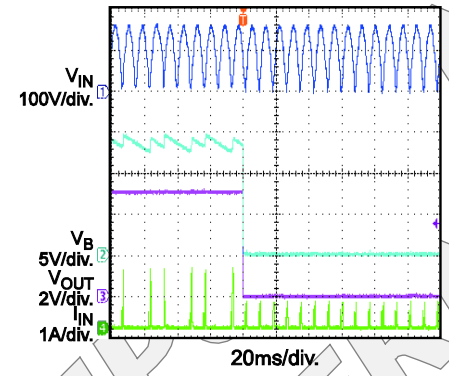
Short Circuit Protection Recovery
115Vac



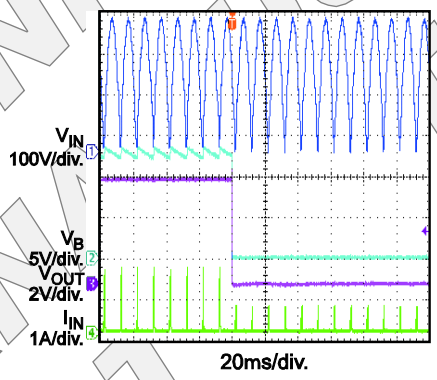
Short Circuit Protection Recovery
230Vac



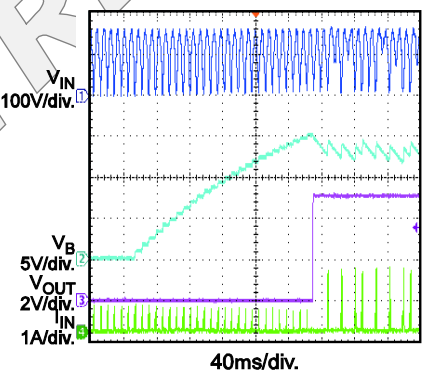
VB Short to GND Protection Entry
115Vac



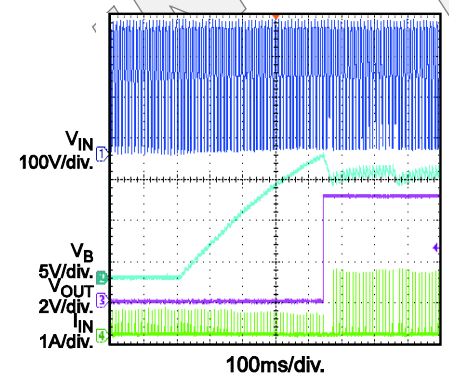
VB Short to GND Protection Entry
230Vac



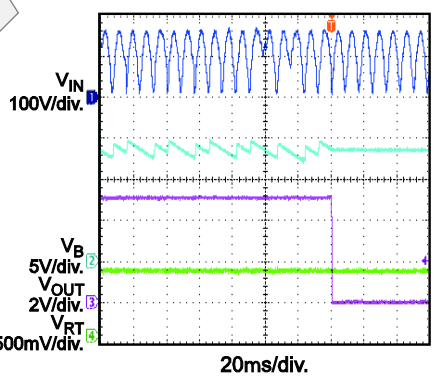
VB Short to GND Protection Recovery
115Vac



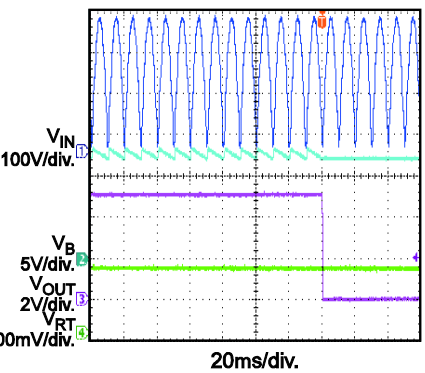
VB Short to GND Protection Recovery
230Vac



RT Protection Entry
115Vac



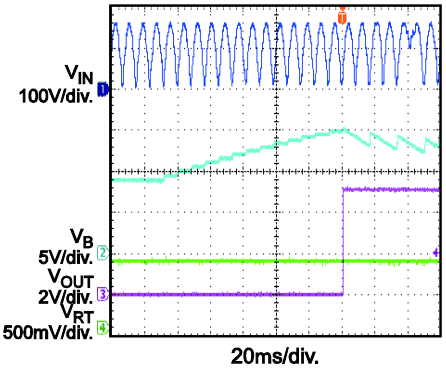
RT Protection Entry
230Vac



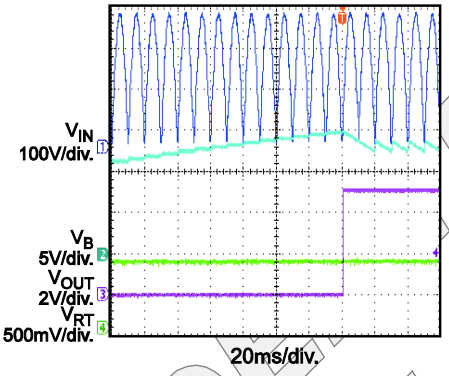
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{OUT} = 5V, I_{OUT} = 60mA, T_A = 25ºC, unless otherwise noted.

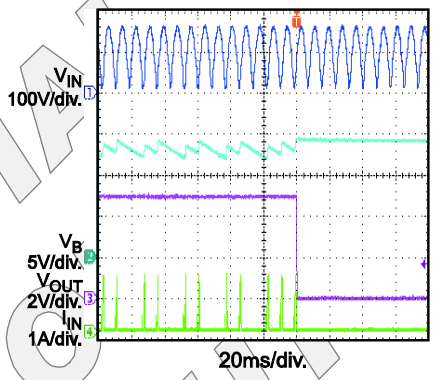
RT Protection Recovery
115Vac



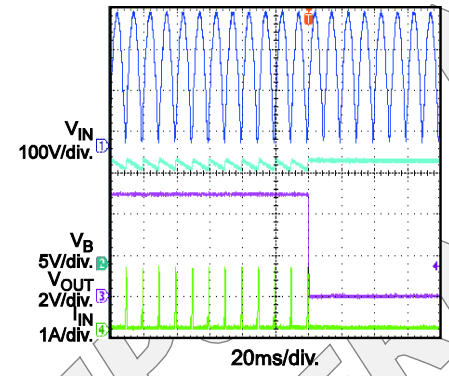
RT Protection Recovery
230Vac



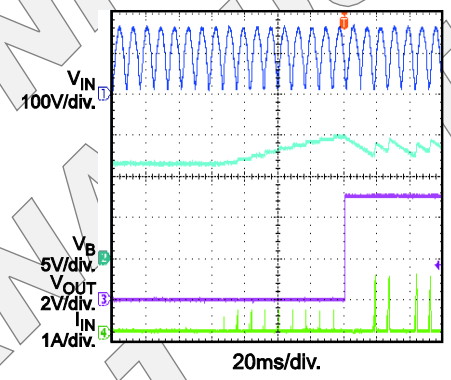
Thermal Shutdown Protection Entry
115Vac



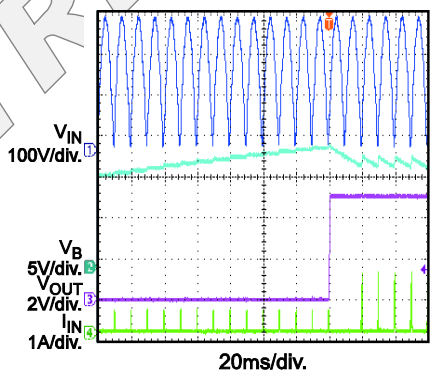
Thermal Shutdown Protection Entry
230Vac



Thermal Shutdown Protection Recovery
115Vac



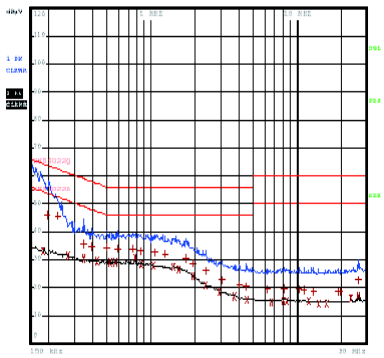
Thermal Shutdown Protection Recovery
230Vac



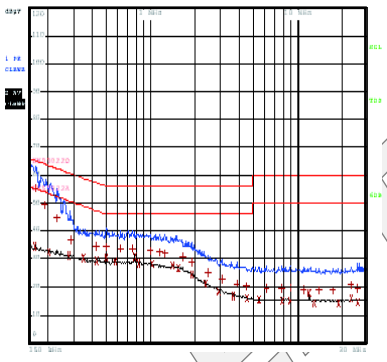
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{OUT} = 5V, I_{OUT} = 60mA, T_A = 25ºC, unless otherwise noted.

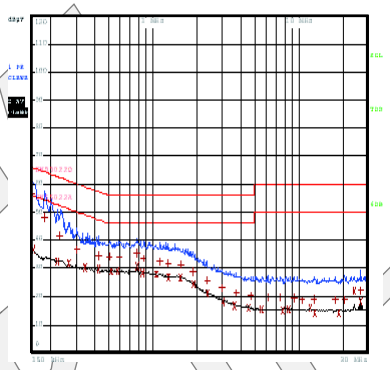
EMI Performance
115Vac, L Line



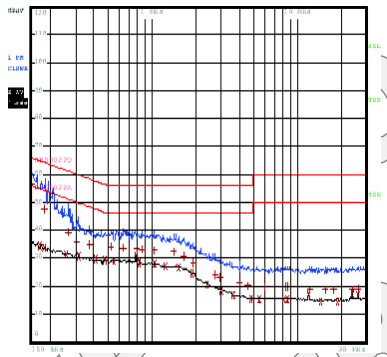
EMI Performance
115Vac, N Line



EMI Performance
230Vac, L Line



EMI Performance
230Vac, N Line



PRINTED CIRCUIT BOARD LAYOUT

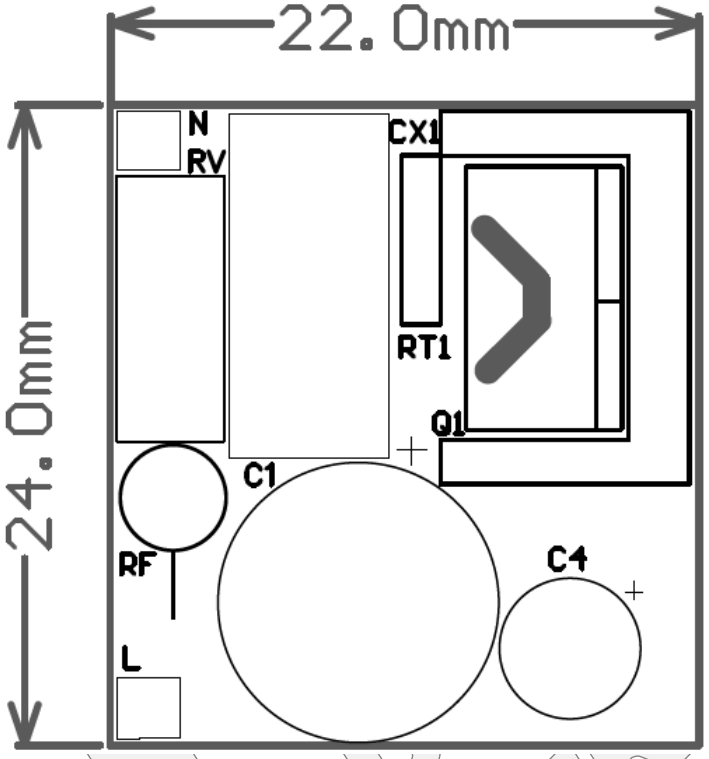


Figure 1 — Top Silk Layer

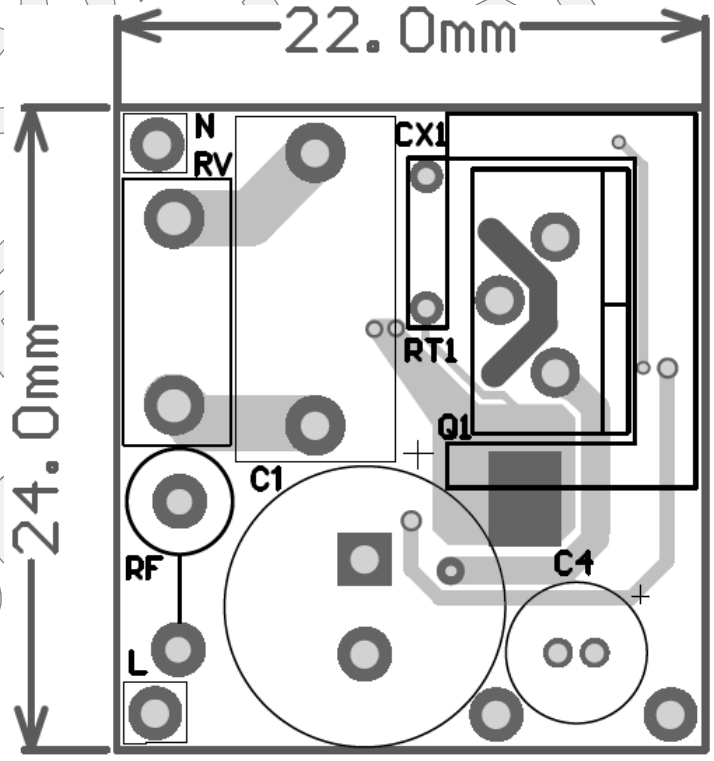


Figure 2 — Top Layer

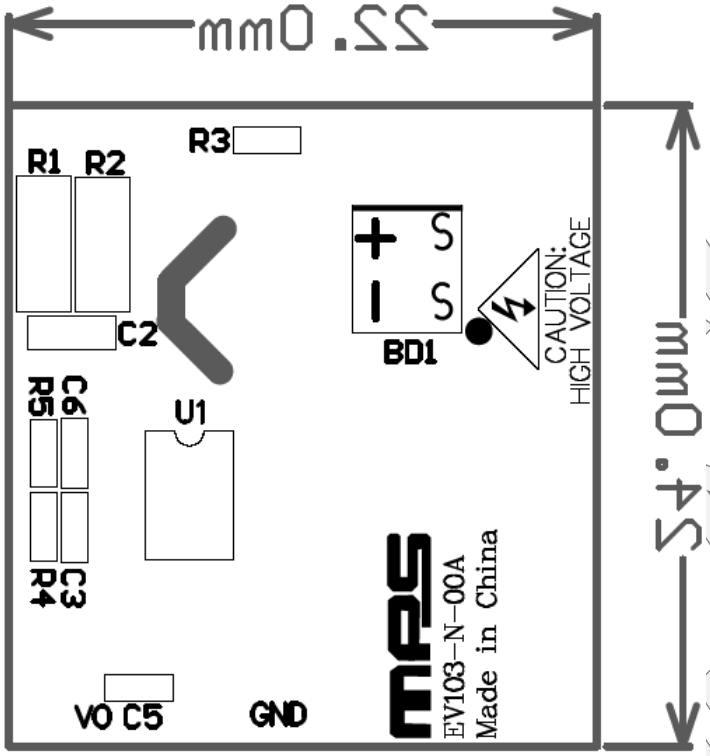


Figure 3 — Bottom Silk

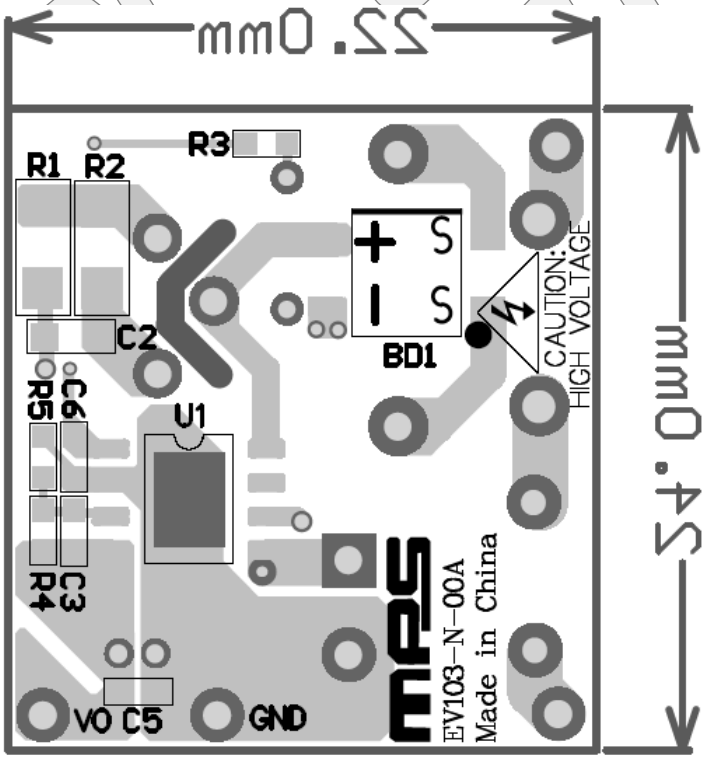


Figure 4 — Bottom Layer

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 ports.
4. Connect Load to VO and GND ports.
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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