EV163-S-00A

Universal Input, Dual Output Non-Isolated Off-Line Regulator Evaluation Board

The Future of Analog IC Technology

DESCRIPTION

The EV163-S-00A Evaluation Board is designed to demonstrate the capabilities of MP163. The MP163 is a primary-side constant voltage regulator providing accurate constant voltage (CV) regulation without Opto-coupler. It supports Buck, Buck-Boost, Boost and Flyback topologies.

The EV163-S-00A Evaluation Board is designed as Buck application. EV163-S-00A typically drives a 12V/200mA, 5V/50mA output from 85VAC to265VAC, at 60/50Hz.

The EV163-S-00A has an excellent efficiency and meets 1kV IEC61000-4-5 surge immunity and EN55022 conducted EMI requirements. MP163 features various protections, including thermal shutdown (TSD), VCC under-voltage lockout (UVLO), over-load protection (OLP), short- circuit protection (SCP), and open loop protection.

MP163 is available in SOIC8-7B and SOIC16 packages.

This board built with MP163CGS-5. It can be used for evaluation of the whole MP163 SOIC8-7 package family with simple drop in replacement.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	85 to 265	VAC
Output Voltage1	V_{OUT1}	12	V
Output Current1	I_{OUT1}	200	mA
Output Voltage2	V_{OUT2}	5	V
Output Current2	I_{OUT2}	50	mA

FEATURES

- Primary-Side non-isolated Constant Voltage (CV) Control
- Integrated 700V MOSFET
- < 30mW No-load power consumption
- Peak-Current Control with Peak Current Compression
- Low Vcc operating current
- Limited Maximum Frequency
- Frequency Foldback
- Multiple Protections: SCP, OCP, OTP, and VCC UVLO
- Low Cost and Simple External circuit
- Internal high-voltage current source
- Built in LDO

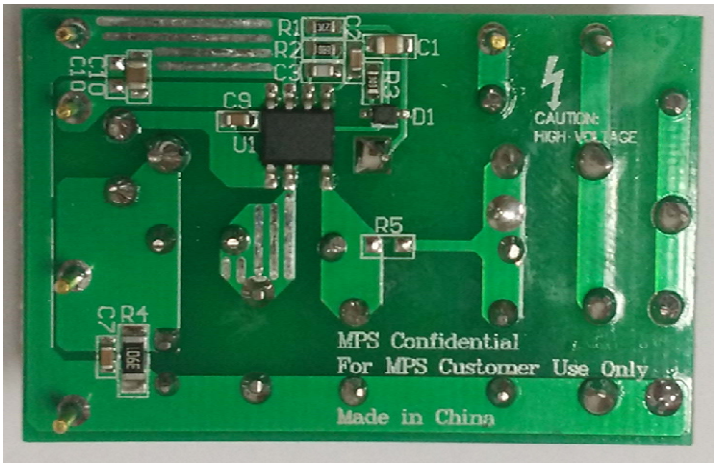
APPLICATIONS

- Home Appliance, white goods and consumer electronics
- Industrial Controls
- Standby Power

Warning: Although this board is designed to satisfy safety requirements, the engineering prototype has not been agency approved. Therefore, all testing should be performed using an isolation transformer to provide the AC input to the prototype board.

EV163-S-00A EVALUATION BOARD

TOP VIEW



BOTTOM VIEW

(L x W x H) 47mm x 30mm x 17mm

Board Number	MPS IC Number
EV163-S-00A	MP163CGS-5

EVALUATION BOARD SCHEMATIC

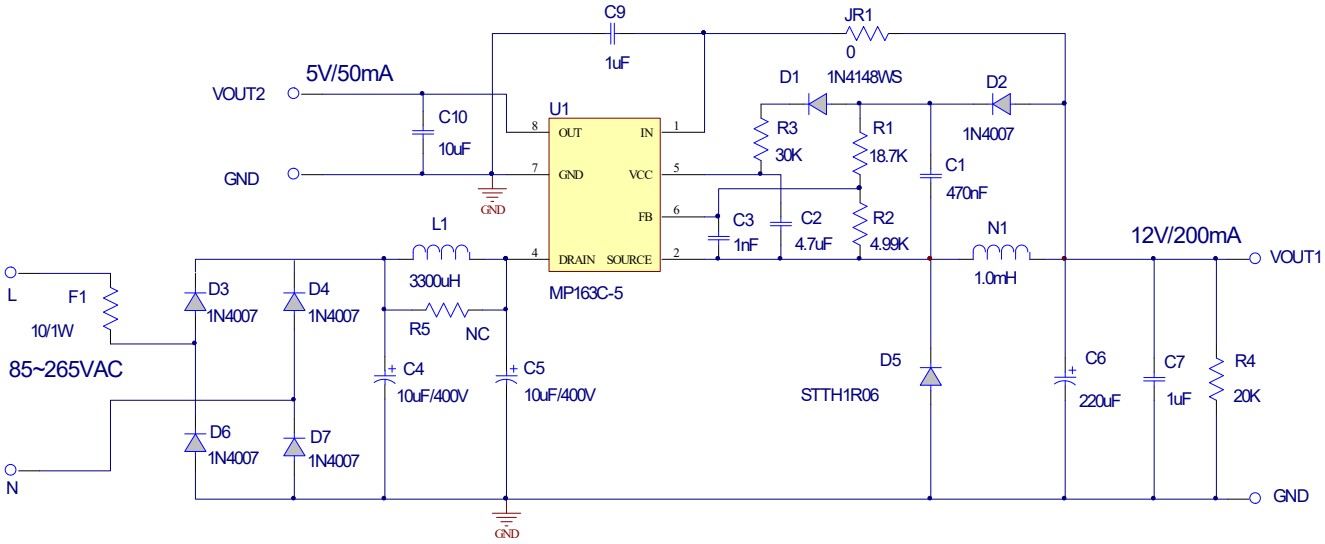


Figure 1—Schematic

PCB LAYOUT (SINGLE-SIDED)

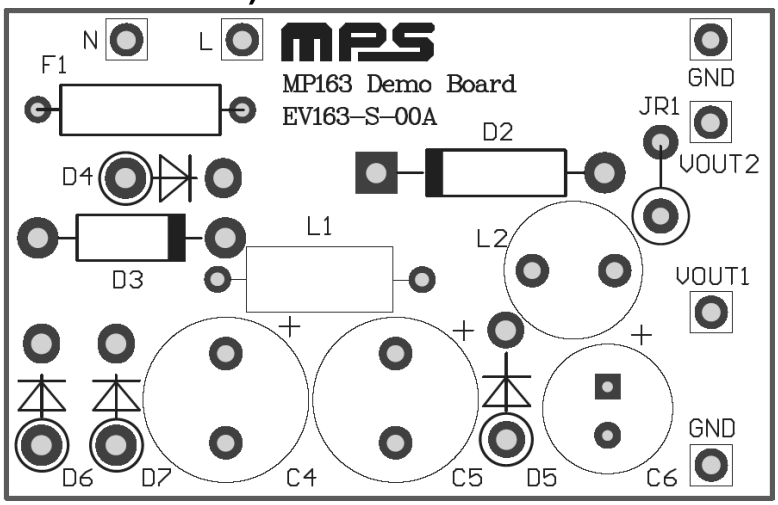


Figure 2—Top Layer

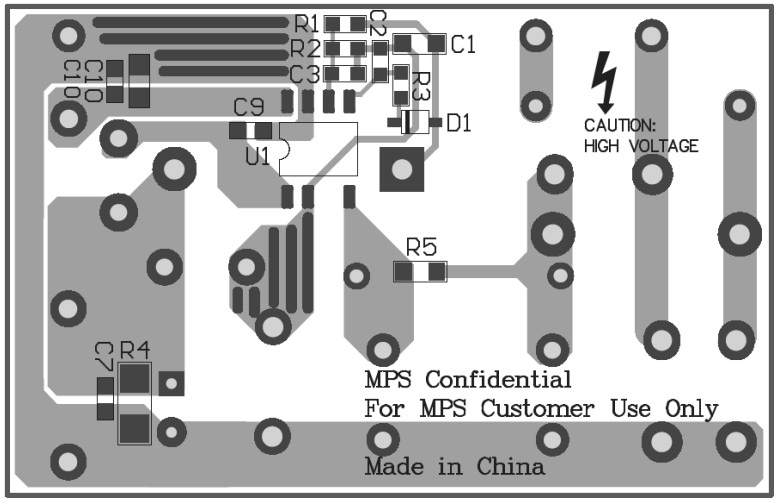


Figure 3—Bottom Layer

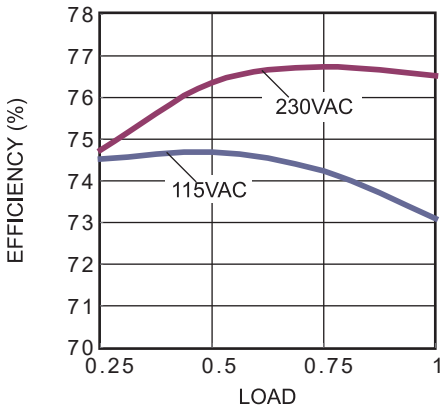
EV163-S-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacture	Manufacture_PN
1	C1	470nF	Ceramic Capacitor; 25V;X7R	0805	TDK	C2012X7R1E474K
1	C2	4.7μF	Ceramic Capacitor; 10V;X7R	0603	muRata	GRM188R71A475KE15D
1	C3	1nF	Ceramic Capacitor; 50V;X7R	0603	muRata	GRM188R71H102KA01D
2	C4, C5	10μF	Electrolytic Capacitor; 400V;20%	DIP	Chengxing	400V 10μF
1	C6	220μF	Electrolytic Capacitor; 25V	DIP	Jianghai	CD110-25V220
2	C7,C9	1μF	Ceramic Capacitor; 25V;X7R	0603	muRata	GRM188R71E105KA12D
1	C10	10μF	Ceramic Capacitor; 10V;X5R	0805	muRata	GRM21BR1A106KE19L
1	D1	1N4148WS	Diode;75V;0.15A	SOD-323	Diodes	1N4148WS-7-F
5	D2, D3, D4, D6, D7	1N4007	Diode;1000V;1A	DO-41	Diodes	1N4007
1	D5	STTH1R06	Diode;600V;1A	DO-41	ST	STTH1R06
1	F1	10	Resistor;5%;1W	DIP	Any	Any
1	L1	3.3mH	Inductor;3300μH;27Ω; 40mA	DIP	Any	Any
1	L2	1mH	Inductor;1mH;2.08Ω; 500mA	DIP	Wurth	768772102
1	R1	18.7k	Film Resistor;1%	0603	Yageo	RC0603FR-0718K7L
1	R2	4.99k	Film Resistor;1%	0603	Yageo	RC0603FR-074K99L
1	R3	30k	Film Resistor;1%	0603	Yageo	RC0603FR-0730KL
1	R4	20k	Film Resistor;1%	1206	Yageo	RC1206FR-0720KL
1	R5	NC				
1	JR1	Jumper				
1	U1	MP163C-5	Primary side regulator	SOIC8-7B	MPS	MP163CGS-5

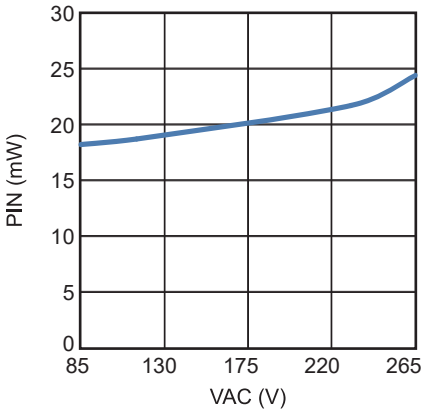
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board with MP163CGS-5.
V_{IN} = 85~265VAC, V_{OUT1} = 12V, I_{OUT1} = 200mA, V_{OUT2} = 5V, I_{OUT2} = 50mA, T_A = 27ºC, unless otherwise noted.

Efficiency



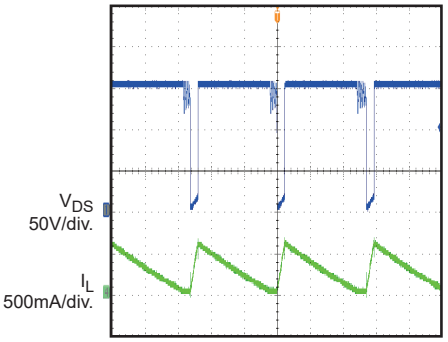
No Load Consumption



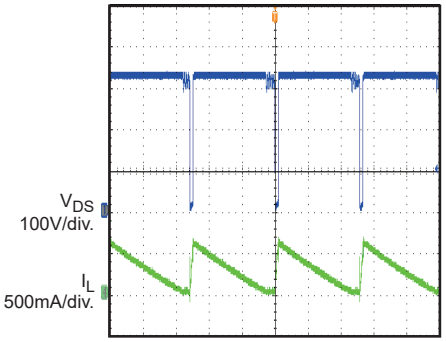
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board with MP163CGS-5.
V_{IN} = 85~265VAC, V_{OUT1} = 12V, I_{OUT1} = 200mA, V_{OUT2} = 5V, I_{OUT2} = 50mA, T_A = 27ºC, unless otherwise noted.

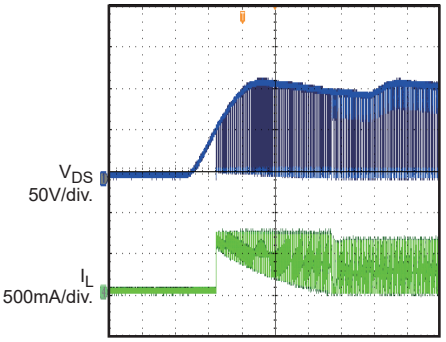
Normal Opration
V_{IN}=115VAC,Full Load



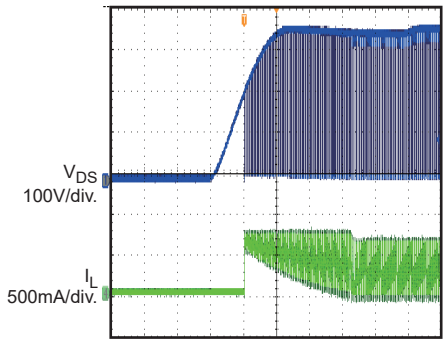
Normal Opration
V_{IN}=230VAC,Full Load



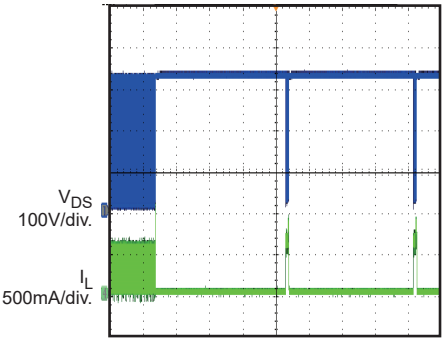
Soft Start
V_{IN}=85VAC



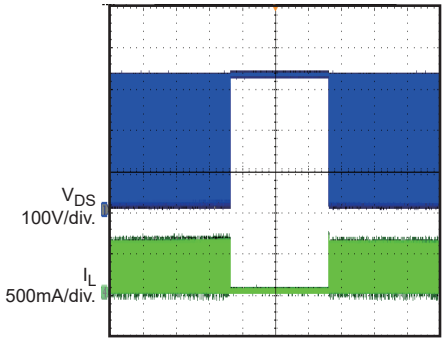
Soft Start
V_{IN}=265VAC



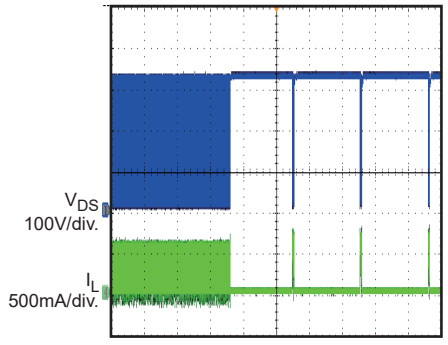
SCP Protection
V_{IN}=230VAC



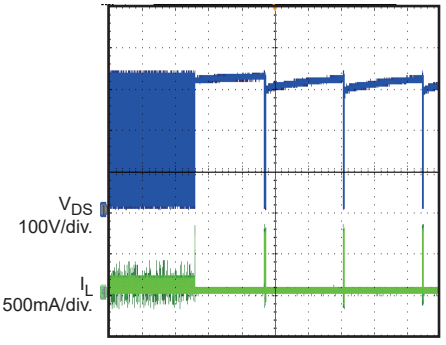
Thermal Down
V_{IN}=230VAC



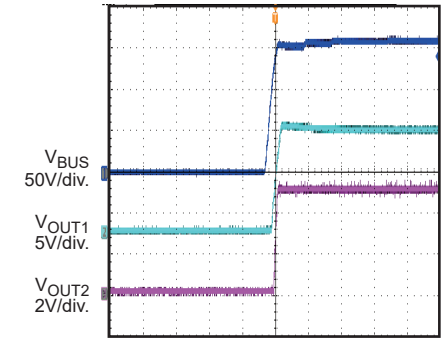
Open Loop
V_{IN}=230VAC,Full Load



Open Loop
V_{IN}=230VAC,No Load



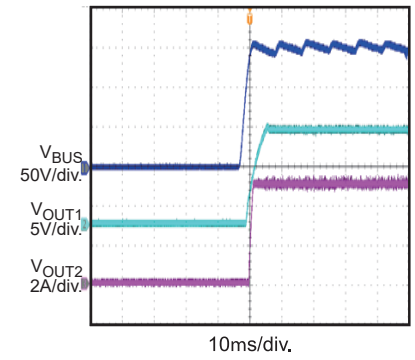
Turn-On Delay
V_{IN}=115VAC,No Load



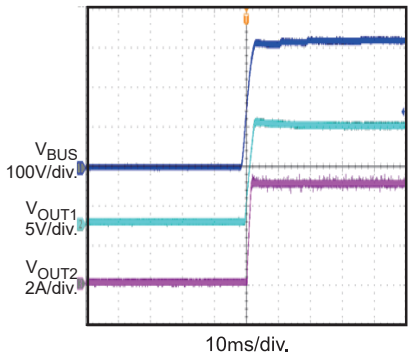
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board with MP163CGS-5.
V_{IN} = 85~265VAC, V_{OUT1} = 12V, I_{OUT1} = 200mA, V_{OUT2} = 5V, I_{OUT2} = 50mA, T_A = 27ºC, unless otherwise noted.

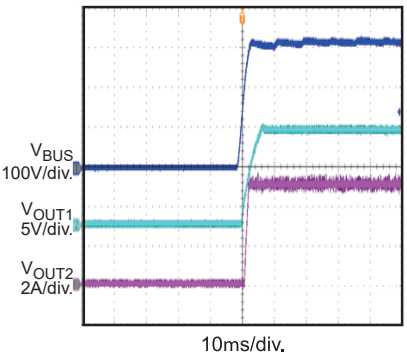
Turn-On Delay
V_{IN} = 115VAC, Full Load



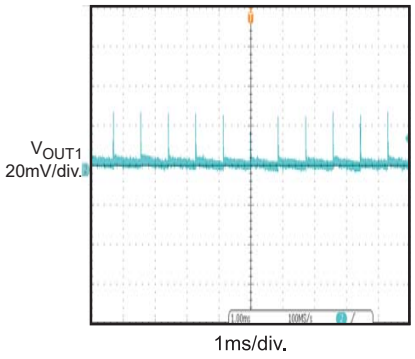
Turn-On Delay
V_{IN} = 230VAC, No Load



Turn-On Delay
V_{IN} = 230VAC, Full Load



Output1 Ripple
V_{IN} = 115VAC, No Load



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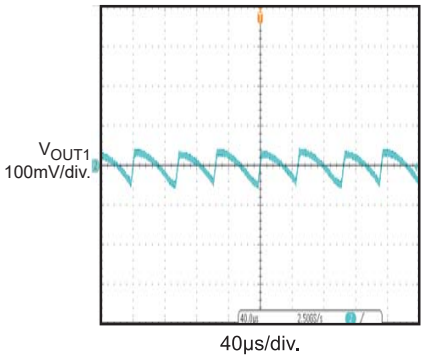
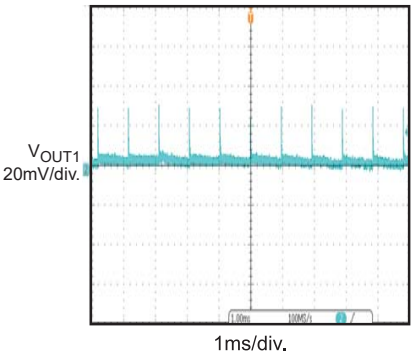
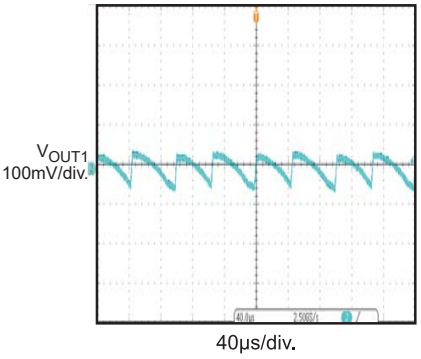


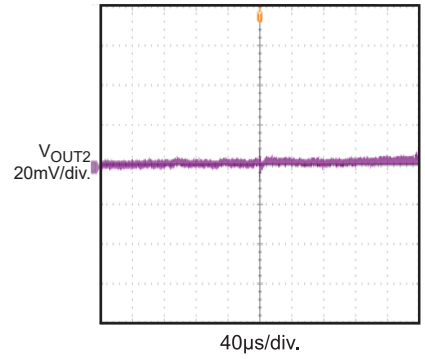
Output1 Ripple
V_{IN} = 230VAC, No Load



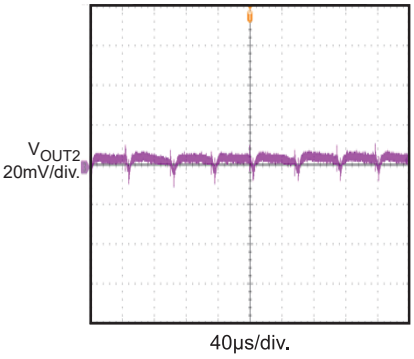
Output1 Ripple
V_{IN} = 230VAC, Full Load



Output2 Ripple
V_{IN} = 115VAC, No Load



Output2 Ripple
V_{IN} = 115VAC, Full Load



EVB TEST RESULTS *(continued)*

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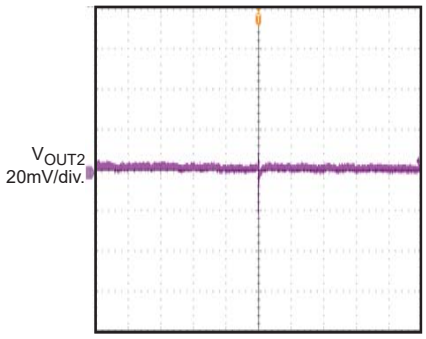
Output2 Ripple
V_{IN} = 230VAC, No Load



Output2 Ripple
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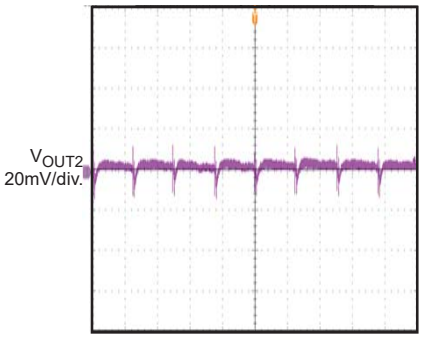
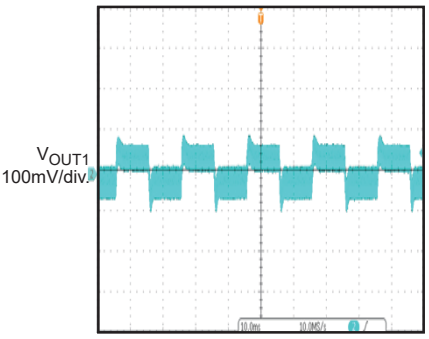
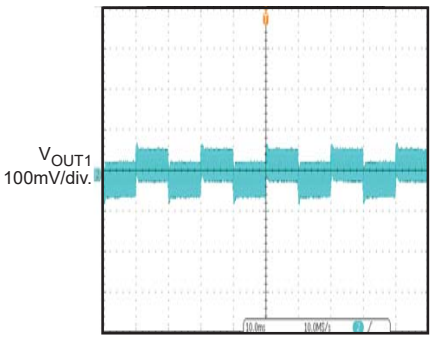


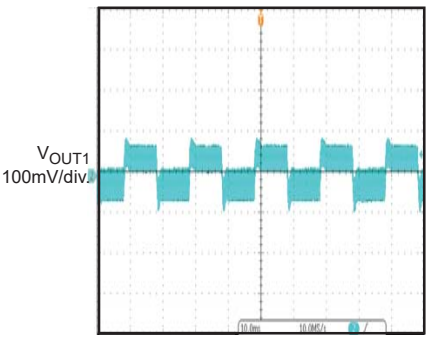
Output1 Load Transient
V_{IN} = 115VAC, 25% Load to 50% Load



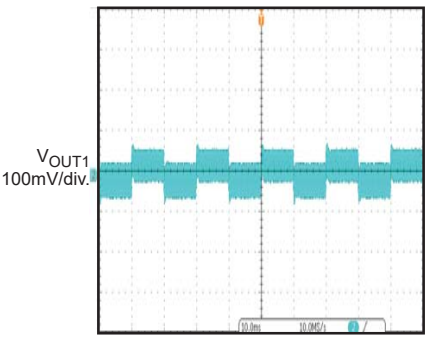
Output1 Load Transient
V_{IN} = 115VAC, 50% Load to 75% Load



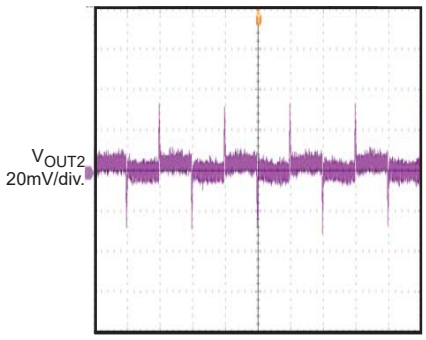
Output1 Load Transient
V_{IN} = 230VAC, 25% Load to 50% Load



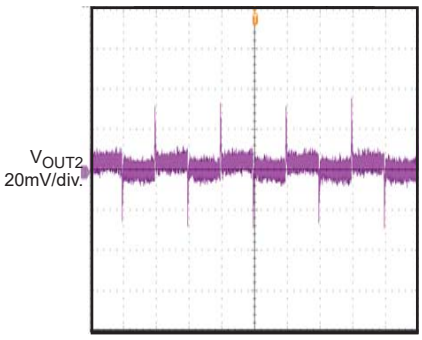
Output1 Load Transient
V_{IN} = 230VAC, 50% Load to 75% Load



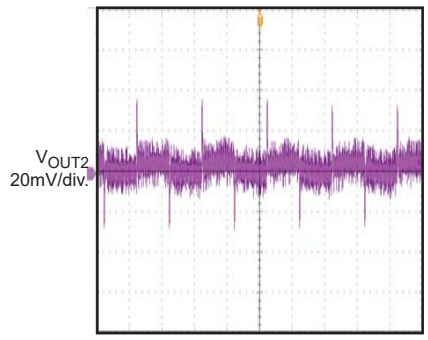
Output2 Load Transient
V_{IN} = 115VAC, 25% Load to 50% Load



Output2 Load Transient
V_{IN} = 115VAC, 50% Load to 75% Load



Output2 Load Transient
V_{IN} = 230VAC, 25% Load to 50% Load



EVB TEST RESULTS *(continued)*

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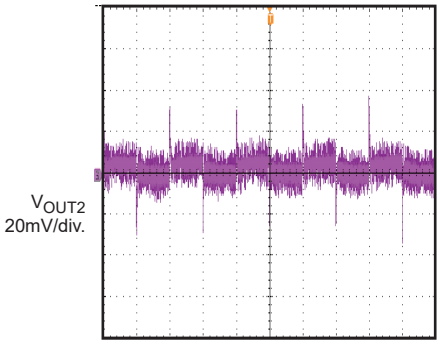
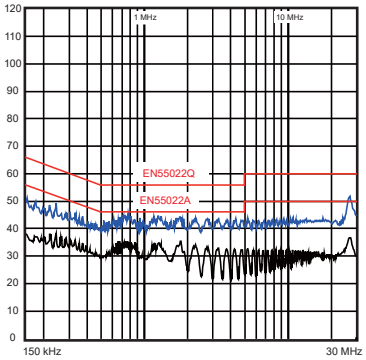
Output2 Load Transient

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



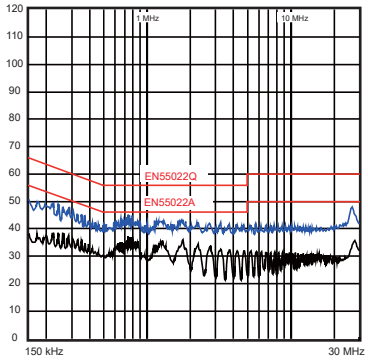
Conducted EMI

Two-Wire Input,V_{IN}=230VAC



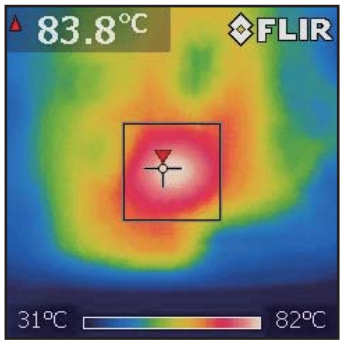
Conducted EMI

Two-Wire Input,V_{IN}=230VAC



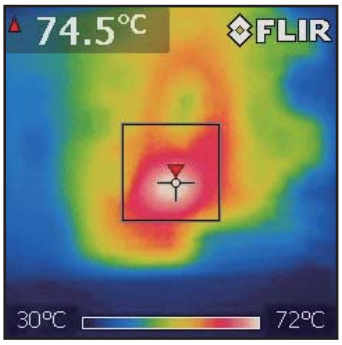
Thermal

V_{IN}=115VAC, Full Load, Open Frame



Thermal

V_{IN}=230VAC, Full Load, Open Frame



CIRCUIT DESCRIPTION

The EV163-S-00A is configured in a buck regulator topology, it uses primary-side-control which can mostly simplify the schematic and get a cost effective BOM. It can also achieve accurate constant voltage and acceptable cross regulation.

F1 is used to protect circuit from component failure or some excessive short events; also it can restrain the inrush current.

C4, L1 and C5 compose π filter to guarantee the conducted EMI meet standard EN55022. C2 and C3 are also used for energy storage and protecting against line surge.

R2, C2, and D1 are used as VCC power supply. Though MP163 is equipped with an internal high voltage current source, using this circuit can achieve better efficiency.

C1 is the sample-hold capacitor, used for reflecting output voltage. R1 and R4 are resistor divider for detecting output voltage by sampling voltage on C1.

D5 is the freewheeling diode. For universal voltage applications, use a diode with a 600V reverse block voltage. Ultra-fast recovery diode is recommended for better efficiency.

C6 and C7 are output capacitors for 12V output. C6 should be low ESR electrolytic capacitor for better output ripple. C7 is ceramic capacitor to reduce high frequency voltage ripple. R6 is dummy load to lower the output voltage of 12V rail at no load condition.

C9 is the input decoupling capacitor of built in LDO. And C10 is the output capacitor of LDO.

QUICK START GUIDE

1. Preset power supply to 85VAC ≤ V_{IN} ≤ 265VAC.
2. Turn power supply off.
3. Connect the Line and Neutral terminals of the power supply output to L and N port.
4. Connect different loads to corresponding outputs :
    a. Positive (+): VOUT1, VOUT2
    b. Negative (–): GND
5. Turn power supply on after making connections.
6. When MP163A or MP163B is dropped in for evaluation, power inductor (L2) should be replaced accordingly to get excellent overall performance. The recommended values are 2.2mH and 1.8mH for MP163A and MP163B respectively.