Evaluation Board Report

5V 0.3W ACDC power supply

<table>
<thead>
<tr>
<th>Design Specs</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>85-265</td>
<td>VAC</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>5</td>
<td>VDC</td>
</tr>
<tr>
<td>Output Current</td>
<td>60</td>
<td>mA</td>
</tr>
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</table>

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

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Author: Application Engineering Department

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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.

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)

ELECTRICAL SPECIFICATION

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Units</th>
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<tbody>
<tr>
<td>Supply Voltage</td>
<td>V_{IN}</td>
<td>85~265</td>
<td>VAC</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>V_{OUT}</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Output Current</td>
<td>I_{OUT}</td>
<td>60</td>
<td>mA</td>
</tr>
</tbody>
</table>

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EV103-N-00A EVALUATION BOARD

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

<table>
<thead>
<tr>
<th>Board Number</th>
<th>MPS IC Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV103-N-00A</td>
<td>MP103GN</td>
</tr>
</tbody>
</table>
VOUT can be adjusted by choosing the value of R4 and R5, the relationship of them is:

\[ V_{OUT} = 1.235V \times (1 + \frac{R5}{R4}) \]

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 °C, the temperature rise of MP103 is less than 60 °C on the test board.
### EV103-N-00A BILL OF MATERIAL

<table>
<thead>
<tr>
<th>Qty</th>
<th>Ref</th>
<th>Value</th>
<th>Description</th>
<th>Package</th>
<th>Manufacture</th>
<th>Manufacturer_PN</th>
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<tbody>
<tr>
<td>1</td>
<td>BD1</td>
<td>MB6S</td>
<td>Diode; 600V/0.5A;</td>
<td>SOIC-4</td>
<td>TaiWan Semiconductor</td>
<td>MB6S</td>
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<tr>
<td>1</td>
<td>C1</td>
<td>470μF</td>
<td>Electrolytic Capacitor; 25V;</td>
<td>DIP</td>
<td>Jianghai</td>
<td>CD287-25V470</td>
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<tr>
<td>1</td>
<td>C2</td>
<td>4.7μF</td>
<td>Ceramic Capacitor; 16V;</td>
<td>0805</td>
<td>Murata</td>
<td>GRM21BR61C475KA88L</td>
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<tr>
<td>1</td>
<td>C3</td>
<td>1nF</td>
<td>Ceramic Capacitor; 16V;X7R;</td>
<td>0603</td>
<td>Murata</td>
<td>GRM188R71C102KA01</td>
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<tr>
<td>1</td>
<td>C4</td>
<td>4.7μF</td>
<td>Electrolytic Capacitor; 50V;</td>
<td>DIP</td>
<td>Jianghai</td>
<td>CD287-50V4.7</td>
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<td>1</td>
<td>C5</td>
<td>100nF</td>
<td>Ceramic Capacitor; 16V;X7R;</td>
<td>0603</td>
<td>LION</td>
<td>0603B104K160T</td>
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<tr>
<td>1</td>
<td>C6</td>
<td>20pF</td>
<td>Ceramic Capacitor; 50V;NPO;</td>
<td>0603</td>
<td>HHEC</td>
<td>C0603N200J050T</td>
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<tr>
<td>1</td>
<td>CX1</td>
<td>100nF</td>
<td>Film Capacitor; 275V;10%;</td>
<td>DIP</td>
<td>Kaili</td>
<td>PX104K3I39L270D9R</td>
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<tr>
<td>1</td>
<td>Q1</td>
<td>3DD4802A</td>
<td>BJT, 750V, 1.5A;</td>
<td>TO-220F</td>
<td>Huawei</td>
<td>3DD4802A</td>
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<tr>
<td>1</td>
<td>R1</td>
<td>10Ω</td>
<td>Film Resistor; 5%;</td>
<td>1206</td>
<td>Yageo</td>
<td>RC1206JR-0710R</td>
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<tr>
<td>1</td>
<td>R2</td>
<td>2kΩ</td>
<td>Film Resistor; 5%;</td>
<td>1206</td>
<td>Royalohm</td>
<td>1206F2001T5E</td>
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<td>2</td>
<td>R3, R5</td>
<td>10.2kΩ</td>
<td>Film Resistor; 1%;</td>
<td>0603</td>
<td>Yageo</td>
<td>RC0603FR-0710K2L</td>
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<td>1</td>
<td>R4</td>
<td>30.9kΩ</td>
<td>Film Resistor; 1%;</td>
<td>0603</td>
<td>Yageo</td>
<td>RC0603FR-0730K9L</td>
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<tr>
<td>1</td>
<td>RF</td>
<td>10Ω</td>
<td>Resistor; 5%; 1W;</td>
<td>DIP</td>
<td>Bangdayuan</td>
<td>10 Ohm/1W</td>
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<tr>
<td>1</td>
<td>RT1</td>
<td>10kΩ</td>
<td>NTC Resistor; 5%;</td>
<td>DIP</td>
<td>Shiheng</td>
<td>MF52A103J3470F</td>
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<tr>
<td>1</td>
<td>RV</td>
<td>275Vac</td>
<td>TVR10431KSY, 430V(1mA);</td>
<td>DIP</td>
<td>TKS</td>
<td>TVR10431KSY</td>
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<tr>
<td>1</td>
<td>U1</td>
<td>MP103</td>
<td>Offline Regulator;</td>
<td>SOIC8E</td>
<td>MPS</td>
<td>MP103GN</td>
</tr>
</tbody>
</table>
EVB TEST RESULTS
Performance waveforms are tested on the evaluation board. 
\( V_{\text{OUT}} = 5V, I_{\text{OUT}} = 60mA, T_A = 25^\circ C \), unless otherwise noted.
EVB TEST RESULTS (continued)

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

Output Ripple
115Vac, 5V/60mA
230Vac, 5V/60mA

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

Over Load Protection Entry
115Vac
230Vac

Short Circuit Protection Entry
115Vac
EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board. 
\( V_{\text{OUT}} = 5V, I_{\text{OUT}} = 60mA, T_A = 25^\circ C \), unless otherwise noted.
EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board.

\[ V_{\text{OUT}} = 5V, I_{\text{OUT}} = 60mA, T_A = 25^\circ\text{C}, \text{unless otherwise noted.} \]
EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board. 
V_{OUT} = 5V, I_{OUT} = 60mA, T_{A} = 25^\circ C, unless otherwise noted.
PRINTED CIRCUIT BOARD LAYOUT

Figure 1 — Top Silk Layer

Figure 2 — Top Layer
QUICK START GUIDE

1. Preset Power Supply to $85V \leq V_{\text{IN}} \leq 265V$.
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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MPS semiconductors are typically used in power supplies in which high voltages are present during operation. High voltage safety precautions should be observed in design and operation to minimize the chance of injury.