Evaluation Board Report

12V 1.8W ACDC power supply

<table>
<thead>
<tr>
<th>Design Specs</th>
<th>Value</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Input Voltage</td>
<td>85-265 VAC</td>
<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td>12 VDC</td>
<td></td>
</tr>
<tr>
<td>Output Current</td>
<td>0.15 A</td>
<td></td>
</tr>
<tr>
<td>Isolation</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>MPS IC</td>
<td>MP156GJ</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Home Appliance, white goods, consumer electronics, Industrial Controls Standby Power</td>
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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

<table>
<thead>
<tr>
<th>Board Number</th>
<th>MPS IC Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV156-J-00A</td>
<td>MP156GJ</td>
</tr>
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</table>
EVALUATION BOARD SCHEMATIC
## EV156-J-00A BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Qty</th>
<th>RefDes</th>
<th>Value</th>
<th>Description</th>
<th>Package</th>
<th>Manufacture</th>
<th>Manufacture_PN</th>
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<tbody>
<tr>
<td>1</td>
<td>C1</td>
<td>220nF</td>
<td>Ceramic Capacitor; 16V; X7R; 0603;</td>
<td>0603</td>
<td>muRata</td>
<td>GRM188R71C224KA01D</td>
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<tr>
<td>1</td>
<td>C2</td>
<td>2.2uF</td>
<td>Ceramic Capacitor; 10V; X7R; 0603</td>
<td>0603</td>
<td>muRata</td>
<td>GRM188R71A225KE15D</td>
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<tr>
<td>1</td>
<td>C3</td>
<td>10uF/400V</td>
<td>Electrolytic Capacitor; 400V; 20%</td>
<td>DIP</td>
<td>Any</td>
<td>Any</td>
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<tr>
<td>1</td>
<td>C4</td>
<td>4.7uF/400V</td>
<td>Electrolytic Capacitor; 400V; Electrolytic; DIP</td>
<td>DIP</td>
<td>Jianghai</td>
<td>CD263-400V4.7</td>
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<tr>
<td>1</td>
<td>C5</td>
<td>100uF/16V</td>
<td>Electrolytic Capacitor; 16V; Electrolytic; DIP</td>
<td>DIP</td>
<td>Jianghai</td>
<td>CD11C-16V100</td>
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<tr>
<td>1</td>
<td>C6</td>
<td>1uF</td>
<td>Ceramic Capacitor; 50V; X7R; 0805;</td>
<td>0805</td>
<td>muRata</td>
<td>GRM21BR71H105KA12L</td>
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<tr>
<td>1</td>
<td>C7</td>
<td>470pF</td>
<td>Ceramic Capacitor; 50V; COG</td>
<td>0603</td>
<td>TDK</td>
<td>C1608COG1H471J</td>
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<tr>
<td>3</td>
<td>D1, D2, D4</td>
<td>1N4007</td>
<td>Diode; 1000V; 1A; DO-41</td>
<td>Diodes</td>
<td>1N4007</td>
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<tr>
<td>1</td>
<td>D3</td>
<td>WUGC10JH</td>
<td>Diode; 600V; 1A; SMA</td>
<td>ZOWIE</td>
<td>WUGC10JH</td>
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<tr>
<td>1</td>
<td>D5</td>
<td>1N4148WS</td>
<td>Diode; 75V; 0.15A; SOD-323</td>
<td>Diodes</td>
<td>1N4148WS-7-F</td>
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<tr>
<td>1</td>
<td>L1</td>
<td>2.2mH</td>
<td>Inductor; 2.2mH; 11; 210mA</td>
<td>DIP</td>
<td>Wurth</td>
<td>744741222</td>
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<tr>
<td>1</td>
<td>L2</td>
<td>2.2mH</td>
<td>Inductor; 2.2mH; 4.7 3; 300mA</td>
<td>DIP</td>
<td>Wurth</td>
<td>7447720222</td>
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<tr>
<td>1</td>
<td>R1</td>
<td>27.4K</td>
<td>Film Resistor; 1%; 0603</td>
<td>Yageo</td>
<td>RC0603FR-0727K4L</td>
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<tr>
<td>1</td>
<td>R2</td>
<td>7.32K</td>
<td>Film Resistor; 1%; 0603</td>
<td>Yageo</td>
<td>RC0603FR-077K32L</td>
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<tr>
<td>1</td>
<td>R3</td>
<td>12.4K</td>
<td>Film Resistor; 1%; 0603</td>
<td>Yageo</td>
<td>RC0603FR-0712K4L</td>
<td></td>
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<tr>
<td>1</td>
<td>R4</td>
<td>40.2K</td>
<td>Film Resistor; 1%; 0603</td>
<td>Yageo</td>
<td>RC0603FR-0740K2L</td>
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<tr>
<td>1</td>
<td>RF1</td>
<td>10</td>
<td>Fuse Resistor; 5%; 1W</td>
<td>DIP</td>
<td>Any</td>
<td>Any</td>
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<tr>
<td>1</td>
<td>U1</td>
<td>MP156GJ</td>
<td>Primary side regulator</td>
<td>TSOT23-5</td>
<td>MPS</td>
<td>MP156GJ</td>
</tr>
</tbody>
</table>
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^\circ C, unless otherwise noted.

**Efficiency**

**No Load Consumption**

**Normal Operation**
- V_{IN} = 115V_{AC}, Full Load
- V_{IN} = 230V_{AC}, Full Load

**Output Ripple**
- V_{IN} = 115V_{AC}, No Load
- V_{IN} = 230V_{AC}, No Load
- V_{IN} = 230V_{AC}, Full Load

V_{IN} 50mA/div. 
I_{O} 100mA/div. 
V_{OP} 100mV/div. 
V_{OP} 100mV/div. 
V_{Ripple} 20mV/div. 
V_{Ripple} 80mV/div. 

20\mu s/div. 
20\mu s/div. 
400\mu s/div. 
20\mu s/div.
EVB TEST RESULTS (continued)
Performance waveforms are tested on the evaluation board.
\( V_{\text{IN}} = 85\text{V to 265V}_{\text{AC}}, V_{\text{OUT}} = 12\text{V}, I_{\text{OUT}} = 150\text{mA}, T_A = 25^\circ\text{C}, \) unless otherwise noted.
EVB TEST RESULTS (continued)

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

- **Load Transient**: $V_{\text{IN}} = 230\text{V}_{\text{AC}}$, 50% Load to 75% Load
- **OLP Protection**: $V_{\text{IN}} = 230\text{V}_{\text{AC}}$
- **SCP Protection**: $V_{\text{IN}} = 230\text{V}_{\text{AC}}$

- **Thermal Down**
- **Open Loop**
  - Full Load
  - No Load

- **Conducted EMI**
  - Two-Wire Input, $V_{\text{IN}} = 230\text{V}_{\text{AC}}$
  - N Line

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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

<table>
<thead>
<tr>
<th>Surge Voltage</th>
<th>500V</th>
<th>1000V</th>
<th>2000V</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3</td>
<td>1µF</td>
<td>10µF</td>
<td>22µF</td>
</tr>
<tr>
<td>C4</td>
<td>1µF</td>
<td>4.7µF</td>
<td>10µF</td>
</tr>
</tbody>
</table>

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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