Evaluation Board Report

12V 2.4W ACDC power supply

<table>
<thead>
<tr>
<th>Design Specs</th>
<th>Value</th>
<th>Unit</th>
</tr>
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<tbody>
<tr>
<td>Input Voltage</td>
<td>85-265</td>
<td>VAC</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>12</td>
<td>VDC</td>
</tr>
<tr>
<td>Output Current</td>
<td>0.2</td>
<td>A</td>
</tr>
<tr>
<td>Isolation</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>MPS IC</td>
<td>MP155GJ</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Home Appliance, white goods, consumer electronics Industrial Controls Standby Power</td>
<td></td>
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Design Summary

EV155-J-00A evaluation board provides a reference design for a universal offline power supply with 12V, 0.2A 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 MP155 is a primary-side regulator that provides accurate constant voltage regulation without the opto-coupler, and supports buck, buck-boost, and flyback topologies. An integrated 500V MOSFET simplifies the structure and reduces costs. These features make it a competitive candidate for off-line low-power applications, such as home appliances and standby power.

The MP155 is a green-mode-operation regulator. Both the peak current and the switching frequency decrease as the load decreases. As a result, it offers excellent efficiency performance at light load, thus improving the overall average efficiency.

The MP155 features various protections such as thermal shutdown (TSD), VCC under-voltage lockout (UVLO), overload protection (OLP), short-circuit protection (SCP), and open loop protection.

The MP155 is available in the TSOT23-5 package.

FEATURES

- Primary-side constant voltage (CV) control, supporting buck, buck-boost and flyback topologies
- Integrated 500V/20Ω MOSFET
- < 100mW No-load power consumption
- Up to 3W output power
- Maximum DCM output current of 130mA
- Maximum CCM output current of 220mA
- Low VCC operating current
- Frequency foldback
- Maximum frequency limit
- Peak current compression
- Internal high-voltage current source
- Internal 350ns leading-edge blanking
- Thermal shutdown (auto restart)
- VCC under-voltage lockout with hysteresis (UVLO)
- Timer-based overload protection.
- Short circuit protection
- Open loop protection

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EV155-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>EV155-J-00A</td>
<td>MP155GJ</td>
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</tbody>
</table>

EVALUATION BOARD SCHEMATIC
## EV155-J-00A BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Qty</th>
<th>Ref</th>
<th>Value</th>
<th>Description</th>
<th>Package</th>
<th>Manufacture</th>
<th>Part Number</th>
</tr>
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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>GRM188R71C224KA01</td>
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<tr>
<td>1</td>
<td>C2</td>
<td>2.2μF</td>
<td>Ceramic Capacitor; 10V; X7R; 0603</td>
<td>0603</td>
<td>muRata</td>
<td>GRM188R71A225KE15D</td>
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<tr>
<td>2</td>
<td>C3, C4</td>
<td>10μF/400V</td>
<td>Capacitor; 400V; 20%</td>
<td>DIP</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>1</td>
<td>C5</td>
<td>100μF/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>1μF</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</td>
<td>DO-41</td>
<td>Diodes</td>
<td>1N4007</td>
</tr>
<tr>
<td>1</td>
<td>D3</td>
<td>WUGC10JH</td>
<td>Diode; 600V; 1A</td>
<td>SMA</td>
<td>ZOWIE</td>
<td>WUGC10JH</td>
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<tr>
<td>1</td>
<td>L1</td>
<td>1mH</td>
<td>Inductor; 1mH; 6; 250mA</td>
<td>DIP</td>
<td>Wurth</td>
<td>7447462102</td>
</tr>
<tr>
<td>1</td>
<td>L2</td>
<td>2.2mH</td>
<td>Inductor; 2.2mH; 4.73; 300mA</td>
<td>DIP</td>
<td>Wurth</td>
<td>7447720222</td>
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<tr>
<td>1</td>
<td>R1</td>
<td>19.1k</td>
<td>Film Resistor; 1%</td>
<td>0603</td>
<td>Yageo</td>
<td>RC0603FR-0719K1L</td>
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<tr>
<td>1</td>
<td>R2</td>
<td>4.99k</td>
<td>Film Resistor; 1%</td>
<td>0603</td>
<td>Yageo</td>
<td>RC0603FR-074K99L</td>
</tr>
<tr>
<td>1</td>
<td>R3</td>
<td>10k</td>
<td>Resistor; 1%</td>
<td>0603</td>
<td>Yageo</td>
<td>RC0603FR-0710KL</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>10 Ohm/1W</td>
</tr>
<tr>
<td>1</td>
<td>U1</td>
<td>MP155GJ</td>
<td>Buck regulator</td>
<td>TSOT23-5</td>
<td>MPS</td>
<td>MP155GJ</td>
</tr>
</tbody>
</table>
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board. 
$V_{IN} = 85$-265Vac, $V_{OUT} = 12V$, $I_{OUT} = 200mA$, $T_A = 25^\circ C$, unless otherwise noted.

**Efficiency**

- **115Vac**
- **230Vac**

<table>
<thead>
<tr>
<th>OUTPUT CURRENT (A)</th>
<th>EFFICIENCY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>76</td>
</tr>
<tr>
<td>0.1</td>
<td>74</td>
</tr>
<tr>
<td>0.15</td>
<td>72</td>
</tr>
<tr>
<td>0.2</td>
<td>70</td>
</tr>
</tbody>
</table>

**No Load Consumption**

<table>
<thead>
<tr>
<th>INPUT VOLTAGE(Vac)</th>
<th>POWER CONSUMPTION (mW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>0</td>
</tr>
<tr>
<td>135</td>
<td>20</td>
</tr>
<tr>
<td>185</td>
<td>40</td>
</tr>
<tr>
<td>235</td>
<td>60</td>
</tr>
</tbody>
</table>

**Normal Operation**

- $V_{IN} = 115Vac$, Full Load
- $V_{IN} = 230Vac$, Full Load

**Output Ripple**

- $V_{IN} = 115Vac$, No Load
- $V_{IN} = 230Vac$, No Load

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EVP TEST RESULTS

Performance waveforms are tested on the evaluation board. 
$V_{IN} = 85$-265Vac, $V_{OUT} = 12V$, $I_{OUT} = 200mA$, $T_A = 25^\circ C$, unless otherwise noted.
EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board.

\( V_{IN} = 85-265\text{Vac}, \ V_{OUT} = 12\text{V}, \ I_{OUT} = 200\text{mA}, \ T_A = 25^\circ\text{C} \), unless otherwise noted.

**Soft Start**
\( V_{IN} = 85\text{Vac} \)

**Soft Start**
\( V_{IN} = 265\text{Vac} \)

**Turn-on Delay**
\( V_{IN} = 110\text{Vac} \), No Load

**Turn-on Delay**
\( V_{IN} = 230\text{Vac} \), No Load

**Turn-on Delay**
\( V_{IN} = 230\text{Vac} \), Full Load

**Turn-on Delay**
\( V_{IN} = 115\text{Vac} \), Full Load

**Load Transient**
\( V_{IN} = 115\text{Vac} \), 25% Load to 50% Load

**Load Transient**
\( V_{IN} = 115\text{Vac} \), 50% Load to 75% Load

**Load Transient**
\( V_{IN} = 230\text{Vac} \), 25% Load to 50% Load
EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board. $V_{IN} = 85$-$265$VAC, $V_{OUT} = 12$V, $I_{OUT} = 200$mA, $T_A = 25^\circ$C, unless otherwise noted.

**Load Transient**
$V_{IN} = 230$Vac, 50% Load to 75% Load

**OLP Protection**
$V_{IN} = 230$Vac

**SCP Protection**
$V_{IN} = 230$Vac

**Thermal Down**

**Open Loop**
Full Load
No Load

**Conducted EMI**
Two-wire input, $V_{IN} = 230$VAC

L Line

N Line
SURGE PERFORMANCE

With the input capacitors C3 (10μF) and C4 (10μF), 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 $85 \leq V_{IN} \leq 265V$.
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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