1 Photo

The photographs below show the PMP9185 Rev A assembly. This circuit was built on a PMP9185 Rev A PCB.

Top side

Bottom side

*. All tests are performed with J2 pin 1 and 2 shorted.
2 Buck Converters Efficiency

The efficiency data is shown in the tables and graph below. The buck converter controller U1 is supplied from a 15V DC power source. No additional load is applied to 5V except supply current for U3.

The buck converter controller U1 is supplied from a 15V DC power source. No additional load is applied to 5V except supply current for U3.

<table>
<thead>
<tr>
<th>Vin(V)</th>
<th>lin(mA)</th>
<th>Pin(W)</th>
<th>Vo1(V)</th>
<th>Io1(A)</th>
<th>Vo2(V)</th>
<th>Io2(mA)</th>
<th>Vo3(V)</th>
<th>Io3(A)</th>
<th>Vo4(V)</th>
<th>Io4(A)</th>
<th>Pout(W)</th>
<th>Eff.(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.99</td>
<td>0.34</td>
<td>5.15</td>
<td>1.20</td>
<td>0.80</td>
<td>1.81</td>
<td>50.12</td>
<td>3.29</td>
<td>0.20</td>
<td>4.97</td>
<td>0.55</td>
<td>4.42</td>
<td>85.75%</td>
</tr>
<tr>
<td>15.06</td>
<td>0.26</td>
<td>3.85</td>
<td>1.20</td>
<td>0.60</td>
<td>1.81</td>
<td>37.50</td>
<td>3.28</td>
<td>0.15</td>
<td>4.97</td>
<td>0.40</td>
<td>3.29</td>
<td>85.57%</td>
</tr>
<tr>
<td>15.00</td>
<td>0.17</td>
<td>2.62</td>
<td>1.20</td>
<td>0.40</td>
<td>1.81</td>
<td>24.91</td>
<td>3.28</td>
<td>0.10</td>
<td>4.97</td>
<td>0.27</td>
<td>2.22</td>
<td>84.66%</td>
</tr>
<tr>
<td>15.09</td>
<td>0.13</td>
<td>1.99</td>
<td>1.20</td>
<td>0.30</td>
<td>1.81</td>
<td>19.97</td>
<td>3.30</td>
<td>0.07</td>
<td>4.97</td>
<td>0.20</td>
<td>1.65</td>
<td>82.99%</td>
</tr>
<tr>
<td>15.05</td>
<td>0.09</td>
<td>1.38</td>
<td>1.20</td>
<td>0.20</td>
<td>1.80</td>
<td>12.47</td>
<td>3.31</td>
<td>0.05</td>
<td>4.97</td>
<td>0.14</td>
<td>1.11</td>
<td>80.03%</td>
</tr>
<tr>
<td>15.03</td>
<td>0.05</td>
<td>0.73</td>
<td>1.21</td>
<td>0.10</td>
<td>1.80</td>
<td>6.01</td>
<td>3.33</td>
<td>0.03</td>
<td>4.97</td>
<td>0.06</td>
<td>0.51</td>
<td>70.10%</td>
</tr>
<tr>
<td>15.08</td>
<td>0.03</td>
<td>0.45</td>
<td>1.22</td>
<td>0.05</td>
<td>1.80</td>
<td>3.01</td>
<td>3.33</td>
<td>0.01</td>
<td>4.97</td>
<td>0.03</td>
<td>0.26</td>
<td>57.02%</td>
</tr>
<tr>
<td>15.11</td>
<td>0.01</td>
<td>0.17</td>
<td>1.22</td>
<td>0.00</td>
<td>1.80</td>
<td>0.00</td>
<td>3.31</td>
<td>0.00</td>
<td>4.97</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

* All tests are performed with J2 pin 1 and 2 shorted.
3 Flyback Converter Efficiency

The efficiency data is shown in the tables and graph below. Test load is directly connected to capacitor C2.

![Graph showing efficiency data for 120V and 230V inputs]

<table>
<thead>
<tr>
<th>$V_{in}$=120V$_{AC}$/60Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{in}$</td>
</tr>
<tr>
<td>120.04</td>
</tr>
<tr>
<td>120.11</td>
</tr>
<tr>
<td>120.16</td>
</tr>
<tr>
<td>120.2</td>
</tr>
<tr>
<td>120.23</td>
</tr>
<tr>
<td>120.27</td>
</tr>
<tr>
<td>120.31</td>
</tr>
<tr>
<td>120.34</td>
</tr>
<tr>
<td>120.38</td>
</tr>
<tr>
<td>120.38</td>
</tr>
<tr>
<td>120.41</td>
</tr>
</tbody>
</table>

*. All tests are performed with J2 pin 1 and 2 shorted.
### Test Results

Vin(V) | lin(mA) | Pin(W) | Vout(V) | Iout(A) | Pout(W) | Losses(W) | Efficiency (%)
--- | --- | --- | --- | --- | --- | --- | ---
230 | 202.5 | 21.16 | 15.08 | 1.202 | 18.12616 | 3.03384 | 85.66%
230 | 171.79 | 17.671 | 15.06 | 1.002 | 15.09012 | 2.58088 | 85.39%
230 | 141.25 | 14.177 | 15.05 | 0.802 | 12.0701 | 2.1069 | 85.14%
230.1 | 111.86 | 10.657 | 15.02 | 0.6 | 9.012 | 1.645 | 84.56%
230.1 | 98.27 | 8.961 | 15.01 | 0.5 | 7.505 | 1.456 | 83.75%
230.1 | 84.89 | 7.253 | 15 | 0.4 | 6 | 1.253 | 82.72%
230.1 | 71.85 | 5.534 | 14.99 | 0.3 | 4.497 | 1.037 | 81.26%
230.1 | 60.9 | 3.819 | 14.98 | 0.2 | 2.996 | 0.823 | 78.45%
230.2 | 51.4 | 2.151 | 14.97 | 0.1 | 1.497 | 0.654 | 69.60%
230.2 | 47.83 | 1.223 | 14.97 | 0.05 | 0.7485 | 0.4745 | 61.20%
230.2 | 46.21 | 0.3034 | 17.23 | 0 | 0 | 0.3034 | 0.00%

* All tests are performed with J2 pin 1 and 2 shorted.
4 Thermal Images

The thermal images below show a top view and bottom view of the board. The ambient temperature was 20°C with no forced air flow. The outputs were at full load: 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A.

\[ V_{\text{in}} = 120\text{V}_{\text{AC}}/60\text{Hz} \]

**Top Side**

![Thermal Image Top Side](image)

**Bottom Side**

![Thermal Image Bottom Side](image)

* All tests are performed with J2 pin 1 and 2 shorted.
V\textsubscript{in}=230V\textsubscript{AC}/50Hz

*All tests are performed with J2 pin 1 and 2 shorted.*
5 Startup

The output voltages at startup are shown in the images below with 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A loads.

5.1 120V_{ac}/60Hz: CH1: 15V output, CH2: 5V output

5.2 120V_{ac}/60Hz: CH1: 15V_{out}, CH2: 3.3V_{out}, CH3: 1.8V_{out}, CH4: 1.2V_{out}

*. All tests are performed with J2 pin 1 and 2 shorted.
5.3 230V<sub>ac</sub>/50Hz: CH1: 15V output, CH2: 5V output

5.4 230V<sub>ac</sub>/50Hz: CH1: 15V<sub>out</sub>, CH2: 3.3V<sub>out</sub>, CH3: 1.8V<sub>out</sub>, CH4: 1.2V<sub>out</sub>

*. All tests are performed with J2 pin 1 and 2 shorted.
6 Turn off

The output voltages at turn off transient are shown in the images below with 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A loads.

6.1 120V\textsubscript{ac}/60Hz: CH1: 15V\text{ output}, CH2: 5V\text{ output}

![Graph showing test results for 120V\textsubscript{ac}/60Hz with CH1 at 15V output and CH2 at 5V output.

6.2 120V\textsubscript{ac}/60Hz: CH1: 15V\text{ out}, CH2: 3.3V\text{ out}, CH3: 1.8V\text{ out}, CH4: 1.2V\text{ out}

![Graph showing test results for 120V\textsubscript{ac}/60Hz with CH1 at 15V output, CH2, CH3, and CH4 at respective outputs.

*. All tests are performed with J2 pin 1 and 2 shorted.
6.3 230V<sub>ac</sub>/50Hz: CH1: 15V output, CH2: 5V output

6.4 230V<sub>ac</sub>/50Hz: CH1: 15V<sub>out</sub>, CH2: 3.3V<sub>out</sub>, CH3: 1.8V<sub>out</sub>, CH4: 1.2V<sub>out</sub>

*. All tests are performed with J2 pin 1 and 2 shorted.
7 Output Ripple Voltages

The output ripple voltages are shown in the plots below with 15V/0.6A, 5V/0.55A, 3.3V/0.2A, 1.8V/0.05A, 1.2V/0.8A loads and 120Vac/60Hz input.

7.1 15V<sub>out</sub>

![15Vout waveform]

7.2 5V<sub>out</sub>

![5Vout waveform]

*. All tests are performed with J2 pin 1 and 2 shorted.
7.3  **3.3V\textsubscript{out}**

*All tests are performed with J2 pin 1 and 2 shorted.*
7.5 1.2V<sub>out</sub>

* All tests are performed with J2 pin 1 and 2 shorted.
8 Switching Waveforms

The images below show key switching waveforms of PMP9185RevA. The waveforms are measured with 15V/1.2A load.

8.1 $V_{DS}$ of MOSFET $Q_1$ @ 85V$_{AC}$/60Hz

8.2 $V_{DS}$ of MOSFET $Q_1$ @ 265V$_{AC}$/50Hz

*. All tests are performed with J2 pin 1 and 2 shorted.
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