Description
This reference design generates two isolated +12-V rails at 100 mA each from a 12-V DC input voltage. The design is optimized for a small footprint by employing a primary resonant LLC topology with a single UCC25800 driver and a transformer with reinforced insulation. This design is well-suited for an application where bias power is needed across a high-voltage isolation barrier.

Features
- Small size with simplified LLC design
- High efficiency: 85% at full load
- Dual output for high-side (HS) and low-side (LS) drivers
- Employs small and low-cost transformer
- Reinforced insulation for bias supplies crossing high-voltage isolation barriers

Applications
- GaN, IGBT and SiC gate transformer driver bias supply
- Automotive onboard charger (OBC)
- Automotive DC/DC converter
- Automotive traction inverter and motor control
1 Design Information

1.1 Voltage and Current Specifications

Table 1-1. Voltage and Current Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{IN}}$</td>
<td>12 V</td>
</tr>
<tr>
<td>$V_{\text{OUT HS}}, V_{\text{OUT LS}}$</td>
<td>12 V, ±10%</td>
</tr>
<tr>
<td>$I_{\text{OUT LS}}, I_{\text{OUT HS}}$</td>
<td>100 mA</td>
</tr>
</tbody>
</table>

1.2 Dimensions

The dimensions of the board are 32 mm × 27 mm × 10 mm.

1.3 System Schematic

The following image illustrates the simplified schematic.

![PMP23216 Schematic](image.png)

Figure 1-1. PMP23216 Schematic
2 Testing and Results

2.1 Output Voltage Regulation

![Figure 2-1. Open Loop Output Voltage vs Output Current](image)

2.2 Efficiency Graphs

Efficiency and power loss are shown in the following figures.

![Figure 2-2. Efficiency Graph – HS and LS Rail Current Split Evenly](image)
Figure 2-3. Power Loss Graph – HS and LS Rail Current Split Evenly

2.3 Efficiency Data

Efficiency data is shown in the following table.

<table>
<thead>
<tr>
<th>V_IN (V)</th>
<th>I_IN (A)</th>
<th>V_OUT_HS (V)</th>
<th>I_OUT_HS (A)</th>
<th>V_OUT_LS (V)</th>
<th>I_OUT_LS (A)</th>
<th>P_IN (W)</th>
<th>P_OUT (W)</th>
<th>P_loss (W)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.09</td>
<td>0.013</td>
<td>15.48</td>
<td>0</td>
<td>15.48</td>
<td>0</td>
<td>0.15717</td>
<td>0</td>
<td>0.15717</td>
<td>0.00%</td>
</tr>
<tr>
<td>12.08</td>
<td>0.033</td>
<td>13.51</td>
<td>0.010</td>
<td>13.52</td>
<td>0.010</td>
<td>0.39864</td>
<td>0.2703</td>
<td>0.12834</td>
<td>67.81%</td>
</tr>
<tr>
<td>12.08</td>
<td>0.055</td>
<td>13.28</td>
<td>0.020</td>
<td>13.27</td>
<td>0.020</td>
<td>0.6644</td>
<td>0.531</td>
<td>0.1334</td>
<td>79.92%</td>
</tr>
<tr>
<td>12.06</td>
<td>0.101</td>
<td>12.98</td>
<td>0.040</td>
<td>12.99</td>
<td>0.040</td>
<td>1.21806</td>
<td>1.0388</td>
<td>0.17926</td>
<td>85.28%</td>
</tr>
<tr>
<td>12.05</td>
<td>0.147</td>
<td>12.74</td>
<td>0.060</td>
<td>12.75</td>
<td>0.060</td>
<td>1.77135</td>
<td>1.5294</td>
<td>0.24195</td>
<td>86.34%</td>
</tr>
<tr>
<td>12.04</td>
<td>0.193</td>
<td>12.51</td>
<td>0.080</td>
<td>12.52</td>
<td>0.080</td>
<td>2.32372</td>
<td>2.0024</td>
<td>0.32132</td>
<td>86.17%</td>
</tr>
<tr>
<td>12.02</td>
<td>0.239</td>
<td>12.29</td>
<td>0.100</td>
<td>12.3</td>
<td>0.100</td>
<td>2.87278</td>
<td>2.459</td>
<td>0.41378</td>
<td>85.60%</td>
</tr>
</tbody>
</table>
2.4 Thermal Images

All images were captured with the DUT at 25°C ambient, after a 30-minute warm up. The output was loaded with 100 mA on both HS and LS rails.

![Figure 2-4. Front](image)

![Figure 2-5. Back](image)
3 Waveforms

3.1 Switching

Switching behavior is shown in the following figure.

![Switching behavior graph](image)

**Figure 3-1.** Switch Node: 12-V Input, 100 mA on Both HS and LS Rails
3.2 Output Voltage Ripple

Output voltage ripple waveforms are shown in the following figures.

![Figure 3-2. Output Voltage Ripple of HS Rail](image1)

![Figure 3-3. Output Voltage Ripple of LS Rail](image2)
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