Description
This reference design generates two isolated +12-V rails at 100 mA each from a 12-V\textsubscript{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 functional insulation.

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

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

1.2 Dimensions

The dimensions of the board are 32 mm × 27 mm × 6.5 mm.

1.3 System Schematic

The following image illustrates the simplified schematic.

![Figure 1-1. PMP23209 Schematic](image-url)
2 Testing and Results

2.1 Output Voltage Regulation

Figure 2-1. Open Loop Output Voltage vs Output Current

2.2 Efficiency Graphs

Efficiency and power loss are shown in the following figures.

Figure 2-2. Efficiency – 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>12.06</td>
<td>0.014</td>
<td>15.64</td>
<td>0</td>
<td>15.52</td>
<td>0</td>
<td>0.16884</td>
<td>0</td>
<td>0.16884</td>
<td>0.00%</td>
</tr>
<tr>
<td>12.05</td>
<td>0.033</td>
<td>13.11</td>
<td>0.010</td>
<td>13.12</td>
<td>0.010</td>
<td>0.39765</td>
<td>0.2623</td>
<td>0.13535</td>
<td>65.96%</td>
</tr>
<tr>
<td>12.05</td>
<td>0.056</td>
<td>12.86</td>
<td>0.021</td>
<td>12.87</td>
<td>0.020</td>
<td>0.6748</td>
<td>0.52746</td>
<td>0.14734</td>
<td>78.17%</td>
</tr>
<tr>
<td>12.04</td>
<td>0.1</td>
<td>12.58</td>
<td>0.040</td>
<td>12.58</td>
<td>0.040</td>
<td>1.204</td>
<td>1.0064</td>
<td>0.1976</td>
<td>83.59%</td>
</tr>
<tr>
<td>12.03</td>
<td>0.145</td>
<td>12.33</td>
<td>0.060</td>
<td>12.35</td>
<td>0.060</td>
<td>1.74435</td>
<td>1.4808</td>
<td>0.26355</td>
<td>84.89%</td>
</tr>
<tr>
<td>12.02</td>
<td>0.19</td>
<td>12.11</td>
<td>0.080</td>
<td>12.13</td>
<td>0.081</td>
<td>2.2838</td>
<td>1.95133</td>
<td>0.33247</td>
<td>85.44%</td>
</tr>
<tr>
<td>12.01</td>
<td>0.234</td>
<td>11.89</td>
<td>0.100</td>
<td>11.91</td>
<td>0.100</td>
<td>2.81034</td>
<td>2.38</td>
<td>0.43034</td>
<td>84.69%</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

Figure 2-5. Back
3 Waveforms

3.1 Switching

The following waveform is the switch node at 12-V input, and 100 mA on both HS and LS rails.

![Waveform 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

Figure 3-3. Output Voltage Ripple of LS Rail