PMP11438 Rev A

Power Design Services Test Report

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PMP11438 REVA is a power evaluation module showcasing three different implementations for a 12V input, 1.2V output power supply at 6-10A. The board contains three non-isolated buck power supplies controlled by TPS54A20, TPS62184 and TPS53515. Each design is optimized for various parameters including size, efficiency, and transient response to name a few. The output filters have been designed to satisfy DC regulation of +/-3% and DC+AC regulation of +/-5%.
# PMP11438 Rev A Test Results

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1 PMP11438 Board Photos

The front and back photos of PMP11438 are shown below. The board measures 3.2” x 1.5” and each circuit lies upon the same amount of PCB copper.
2.1 Board Photos
The top and bottom images of PMP11438 TPS54A20 are shown below.
2.2 Efficiency and Power Loss

The efficiency and power loss of the power supply is shown below at 12Vin with natural convection.

[Graph showing efficiency and power loss]

2.3 Load Regulation

The load regulation of the power supply is shown below at 12Vin.

[Graph showing load regulation]
2.4 Thermal

The thermal image of the power supply is shown at room temperature with 12Vin, 6Aout, and natural convection. The power supply soaked for 10min at 6A before the measurement was taken. The IC, which has integrated MOSFETs, is the hottest component at 59.7°C.

<table>
<thead>
<tr>
<th>Area analysis</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC Max</td>
<td>59.7°C</td>
</tr>
<tr>
<td>Inductors Max</td>
<td>52.3°C</td>
</tr>
</tbody>
</table>
2.5  Startup

The power supply startup at 0A is shown below. The startup time is 500μs.

2.6  Shutdown

The shutdown of the power supply with 1.2Ω constant-resistance load is shown below.
The 1.2V output ripple is shown in red below, DC coupled with offset, for 0A, 6A and 10A, respectively.
2.8 Transient response

The transient response is shown in the plot below where the red trace is the DC offset output voltage. The current step is 1A-6A-1A at 5A/us slew rate.
2.9 Synchronous Rectifier Stress

The voltage stresses on the synchronous MOSFETs are shown below. The image is taken at 12Vin and 6A with 200MHz of bandwidth limit.
2.10 Frequency Characteristics

The switch nodes are shown below in blue and red and measured on the inductor. The first image illustrates the power supply switching frequency of ~2MHz per phase. The second image shows frequency jitter of 12ns. Both images are taken with 12Vin and 6Aout.
2.11 Loop Response

The loop response of the power supply at 12Vin and 6A load current is shown below. The bandwidth is 400kHz with ~45° of phase margin.
3.1 Board Photos

The top and bottom images of PMP11438 TPS62184 are shown below.

![Board Photos](image-url)
3.2 Efficiency and Power Loss

The efficiency and power loss of the power supply is shown below at 12Vin with natural convection.

![TPS62184 Efficiency and Power Loss at 12Vin](image)

3.3 Load Regulation

The load regulation of the power supply is shown below at 12Vin.

![TPS62184 Load Regulation at 12Vin](image)
3.4 Thermal

The thermal image of the power supply is shown at room temperature with 12Vin, 6Aout, and natural convection. The power supply soaked for 10min at 6A before the measurement was taken. The IC, which has integrated MOSFETs, is one of the hottest components at 66.7°C.

<table>
<thead>
<tr>
<th>Area analysis</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC Max</td>
<td>66.7°C</td>
</tr>
<tr>
<td>Ind 13 Max</td>
<td>67.2°C</td>
</tr>
<tr>
<td>Ind 14 Max</td>
<td>80.3°C</td>
</tr>
</tbody>
</table>
3.5  **Startup**

The power supply startup at 0A is shown below. The startup time is 750μs.

---

3.6  **Shutdown**

The shutdown of the power supply with 1.2Ω constant-resistance load is shown below.
3.7 Output Ripple

The 1.2V output ripple is shown in red below, DC coupled with offset, for 0A, 3A and 6A, respectively.
3.8 Transient response

The transient response is shown in the plot below where the red trace is the DC offset output voltage. The current step is 1A-6A-1A at 5A/us slew rate.

3.9 Synchronous Rectifier Stress

The voltage stresses on the synchronous MOSFETs are shown below. The image is taken at 12Vin and 6A with 200MHz of bandwidth limit.
3.10 Frequency Characteristics

The switch nodes are shown below in blue and red and measured on the inductor. The first image illustrates the power supply switching frequency of ~850kHz per phase. The second image shows negligible frequency jitter. Both images are taken with 12Vin and 6Aout.
3.11 Loop Response

The loop response of the power supply at 12Vin and 6A load current is shown below. The bandwidth is 17kHz with ~62° of phase margin.
4.1 Board Photos

The top and bottom images of PMP11438 TPS53515 are shown below.
4.2 Efficiency and Power Loss
The efficiency and power loss of the power supply is shown below at 12Vin with natural convection.

![TPS53515 Efficiency and Power Loss at 12Vin](image)

4.3 Load Regulation
The load regulation of the power supply is shown below at 12Vin.

![TPS53515 Load Regulation at 12Vin](image)
4.4 Thermal

The thermal image of the power supply is shown at room temperature with 12Vin, 6Aout, and natural convection. The power supply soaked for 10min at 6A before the measurement was taken. The IC, which has integrated MOSFETs, is one of the hottest components at 48.1°C.

<table>
<thead>
<tr>
<th>Area analysis</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductor Max</td>
<td>36.6°C</td>
</tr>
<tr>
<td>IC Max</td>
<td>48.1°C</td>
</tr>
</tbody>
</table>
4.5  Startup

The power supply startup at 0A is shown below. The startup time is 750μs.

4.6  Shutdown

The shutdown of the power supply with 1.2Ω constant-resistance load is shown below.
4.7 Output Ripple

The 1.2V output ripple is shown in red below, DC coupled with offset, for 0A, 6A and 10A, respectively.
4.8 Transient response
The transient response is shown in the plot below where the red trace is the DC offset output voltage. The current step is 1A-6A-1A at 5A/us slew rate.

4.9 Synchronous Rectifier Stress
The voltage stresses on the synchronous MOSFETs are shown below. The image is taken at 12Vin and 6A with 200MHz of bandwidth limit.
4.10 Frequency Characteristics

The switch node is shown below in red and measured on the inductor. The first image illustrates the power supply switching frequency of ~500kHz per phase. The second image shows ~200ns of frequency jitter. Both images are taken with 12Vin and 6Aout.
4.11 Loop Response

The loop response of the power supply at 12Vin and 6A load current is shown below. The bandwidth is 140kHz with ~60° of phase margin.
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