Automotive Synchronous Buck Converter
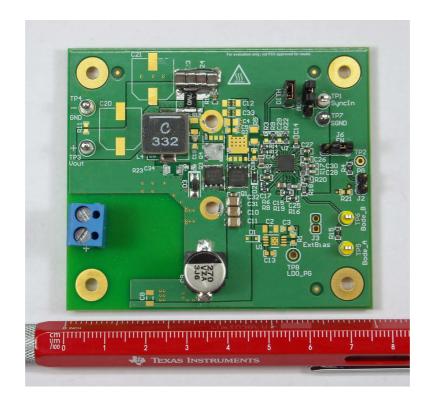
- Input   8.0 .. 16.0V nominal, 32.0V peak

- Output   3.3V @ 6.0A

- Controller   LM25141-Q1

- Free-Running-Switching Frequency of 400 kHz

- Built on PCB PMP20387 Rev.A

PMP30249 Rev.B – Test Report

1. Startup

The startup waveform at 12.0V input voltage and no load on the 3.3V output is shown in Figure 1.

Channel C1   **12.0V Input Voltage**
                   2V/div, 5ms/div

Channel C2   **3.3V Output Voltage**
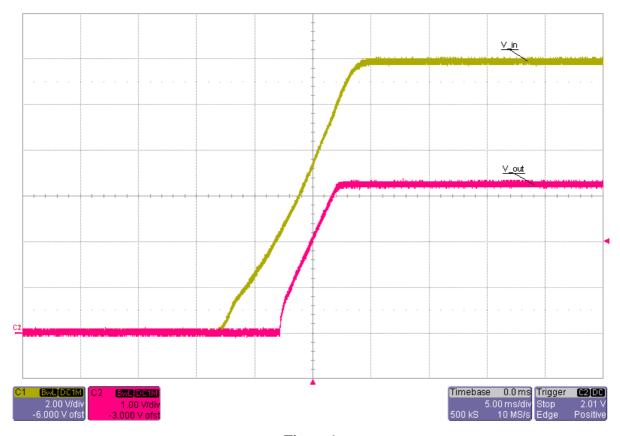   1V/div, 5ms/div

Figure 1

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2. Shutdown

The shutdown waveform at 12.0V input voltage and 6.0A load at 3.3V output voltage is shown in Figure 2.

Channel C1   **12.0V Input Voltage**
              2V/div, 10ms/div

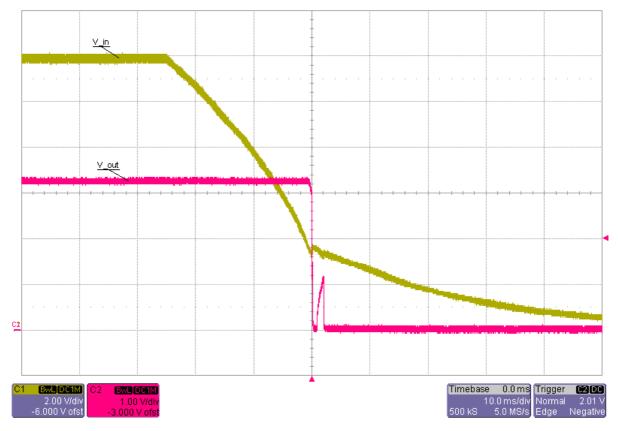Channel C1   **3.3V Output Voltage**
              1V/div, 10ms/div

Figure 2

3. Efficiency

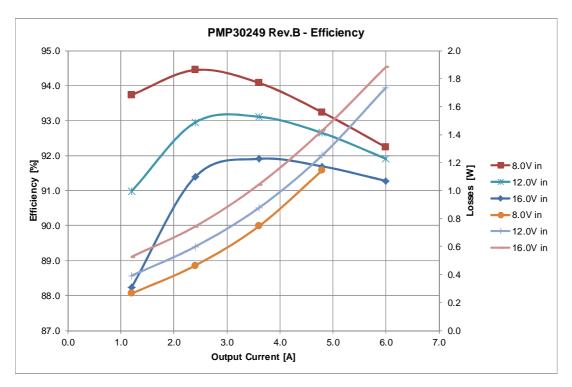The efficiency and load regulation are shown in Figure 3 and Figure 4.

Figure 3

Figure 4

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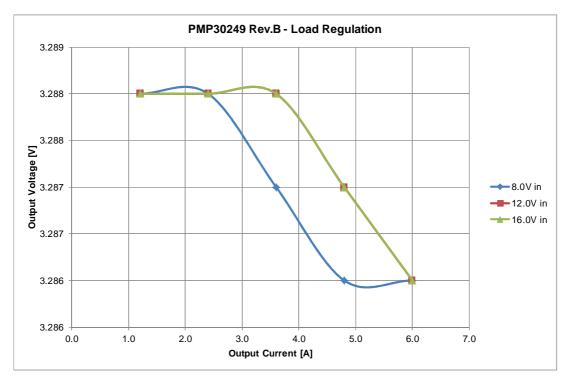
4. Transient Response

The response to a load step at 3.3V output voltage is shown in Figure 5.

Channel C1   **Output Current**, Load Step 3.0A to 6.0A
2A/div, 1ms/div

Channel C2   **Output Voltage**, -99mV undershoot (3.0%), 76mV overshoot (2.3%)
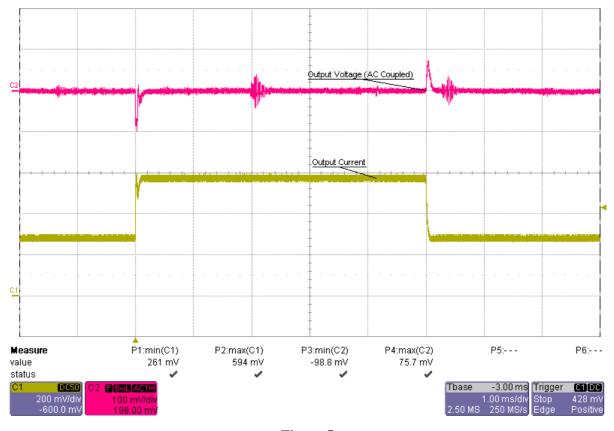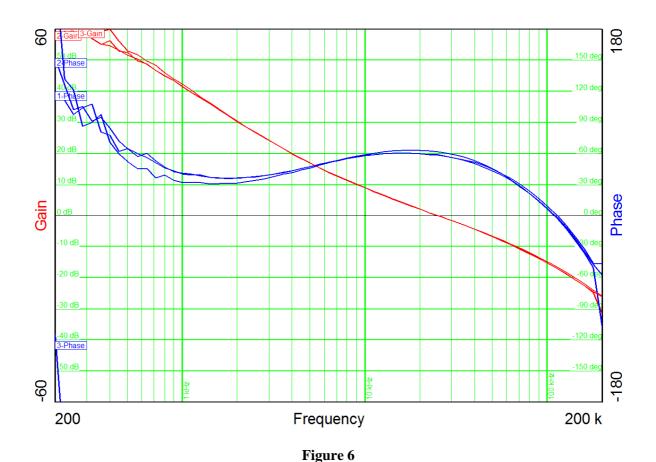100mV/div, 1ms/div, AC coupled

Figure 5

5. Frequency Response

The frequency response is shown in Figure 6.

8.0V Input, 6.0A Load   25.3 kHz Bandwidth, 59 deg Phase Margin, -16 dB Gain Margin

12.0V Input, 6.0A Load   25.4 kHz Bandwidth, 58 deg Phase Margin, -17 dB Gain Margin

16.0V Input, 6.0A Load   25.5 kHz Bandwidth, 62 deg Phase Margin, -17 dB Gain Margin

Figure 6

6. Input Ripple

The input ripple is shown in Figure 7.

Channel M1   **Input Voltage @ 8.0V Input / 6.0A Load**, 106mV peak-peak (1.3%)
100mV/div, 2us/div, AC coupled

Channel M2   **Input Voltage @ 12.0V Input / 6.0A Load**, 126mV peak-peak (1.1%)
100mV/div, 2us/div, AC coupled

Channel M3   **Input Voltage @ 16.0V Input / 6.0A Load**, 133mV peak-peak (0.8%)
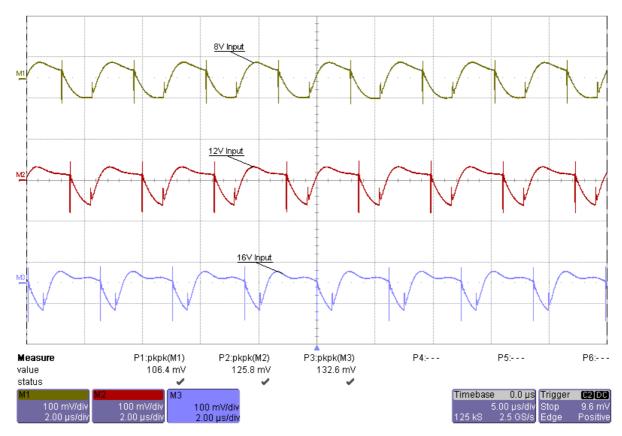100mV/div, 2us/div, AC coupled

Figure 7

7. Output Ripple

The output ripple voltage is shown in Figure 8.

Channel M1 **Output Voltage @ 8.0V Input / 6.0A Load**, 7mV peak-peak (0.2%)
5mV/div, 2us/div, AC coupled

Channel M2 **Output Voltage @ 12.0V Input / 6.0A Load**, 8mV peak-peak (0.2%)
5mV/div, 2us/div, AC coupled

Channel M3 **Output Voltage @ 16.0V Input / 6.0A Load**, 10mV peak-peak (0.3%)
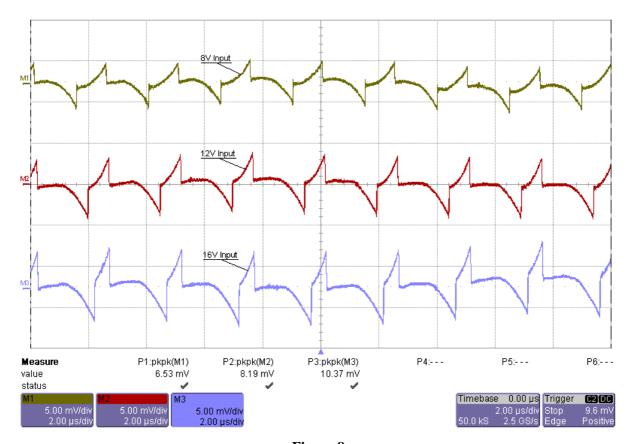5mV/div, 2us/div, AC coupled

Figure 8

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8. Low-Side FET (Switching Node)

The drain-source voltage of the low-side FET at 12.0V input voltage and 6.0A load on the output is shown in Figure 9.

Channel C2   **Drain-Source Voltage**, -1.0V minimum, 20.1V maximum
                  5V/div, 1us/div
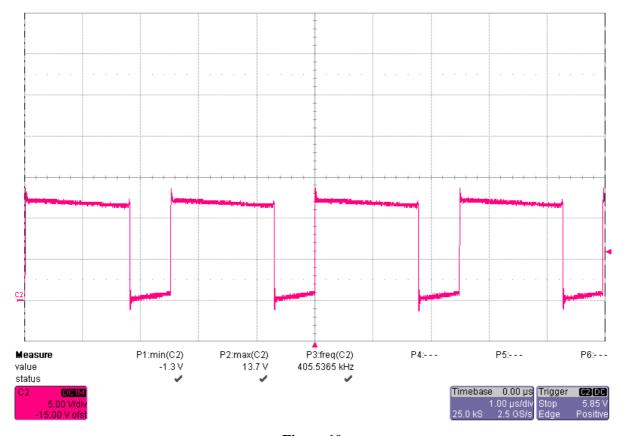

Figure 9

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9. High-Side FET

The drain-source voltage of the high-side FET at 12.0V input voltage and 6.0A load on the output is shown in Figure 10**Figure 9**.

Channel C2   **Drain-Source Voltage**, -1.3V minimum, 13.7V maximum
                5V/div, 1us/div

Figure 10

10. Thermal Image

The thermal image (Figure 11) shows the circuit at an ambient temperature of 20°C with an input voltage of 12.0V and 6.0A load on the output.

Figure 11

Name	Temperature	Emissivity	Background
R10	54.3°C	0.95	20.0°C
L4	50.0°C	0.95	20.0°C
Q3	48.4°C	0.95	20.0°C
Q1	46.2°C	0.95	20.0°C
D3	45.6°C	0.95	20.0°C
U2	41.8°C	0.95	20.0°C

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