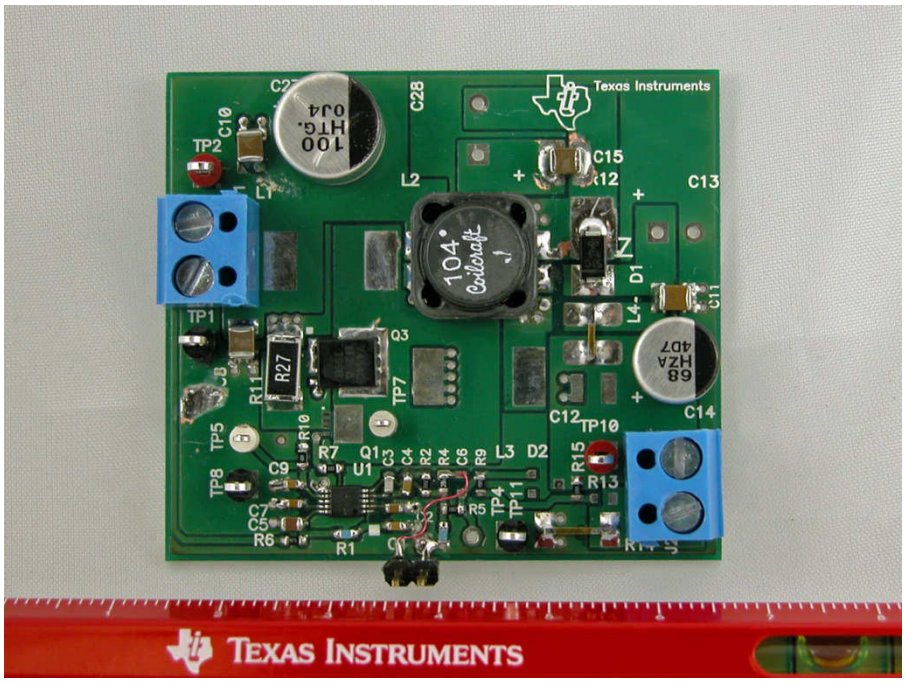
Automotive Adjustable Power Supply

- Input 6.0 .. 18.0V / 32.0V peak
- Output 14.0 .. 48.0V @ 220mA
- Free-Running-Switching Frequency of 300 kHz
- Output voltage adjustable by a 0.0 .. 5.0V signal
  0V → 48V, 5.0V → 14.0V
- Built on PCB PMP2773 Rev.B



1. Startup

The startup waveform at 12.0V input voltage and no load on the 48.0V output is shown in Figure 1.

Channel C1 **12.0V Input Voltage**
5V/div, 20ms/div

Channel C2 **48.0V Output Voltage**
10V/div, 20ms/div

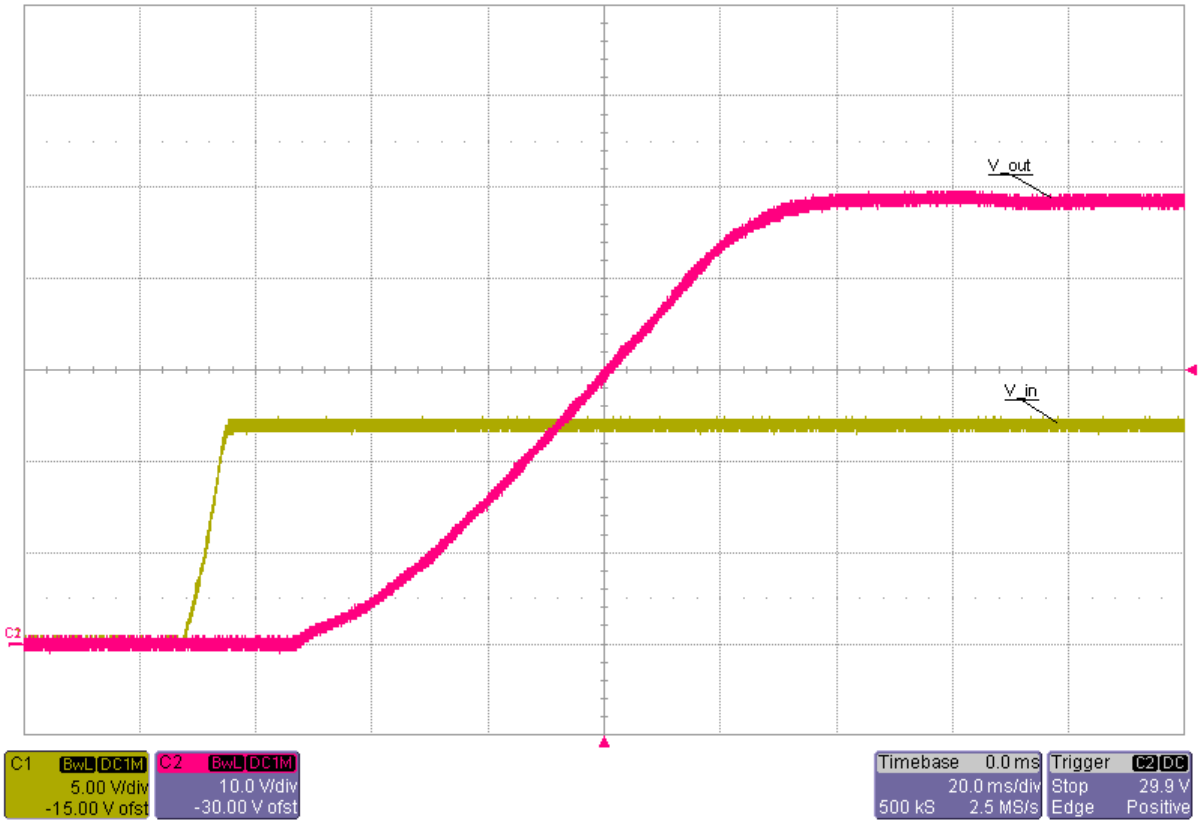


Figure 1

2. Shutdown

The shutdown waveform at 12.0V input voltage and 220mA load at 48.0V output voltage is shown in Figure 2.

Channel C1 **12.0V Input Voltage**
5V/div, 20ms/div

Channel C1 **48.0V Output Voltage**
10V/div, 20ms/div

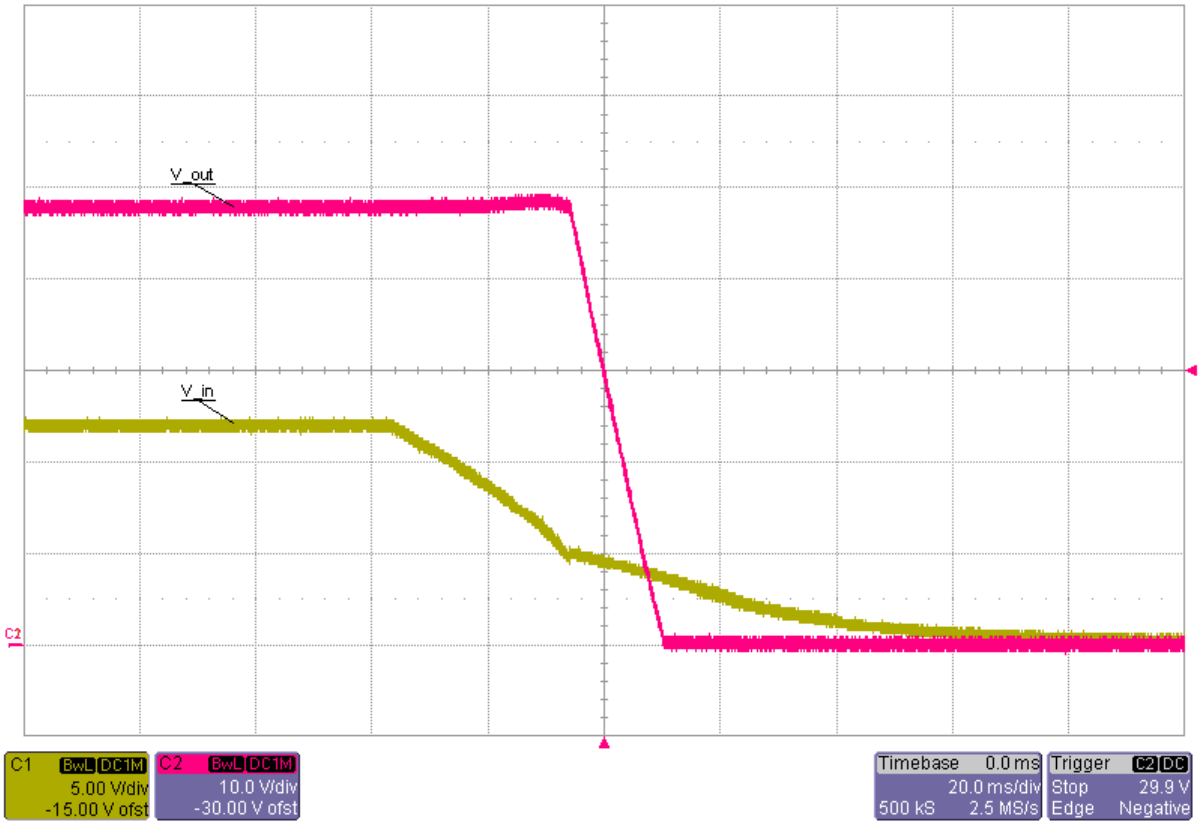


Figure 2

3. Efficiency

The efficiency and load regulation for 30.0V output voltage are shown in Figure 3 and Figure 4.

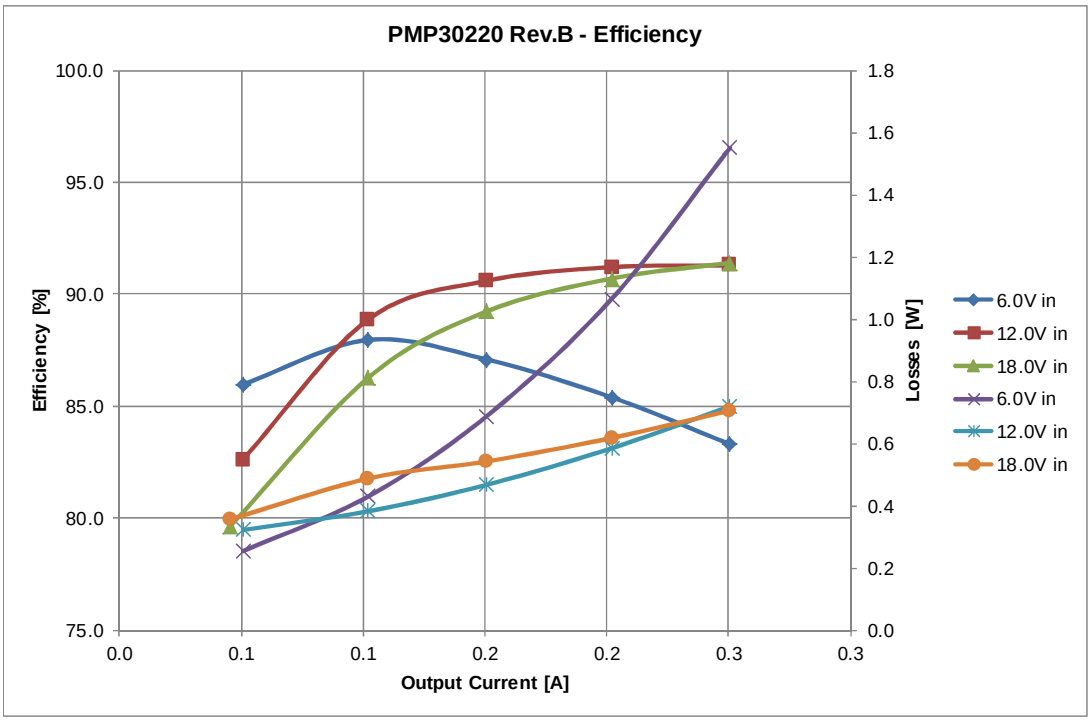


Figure 3

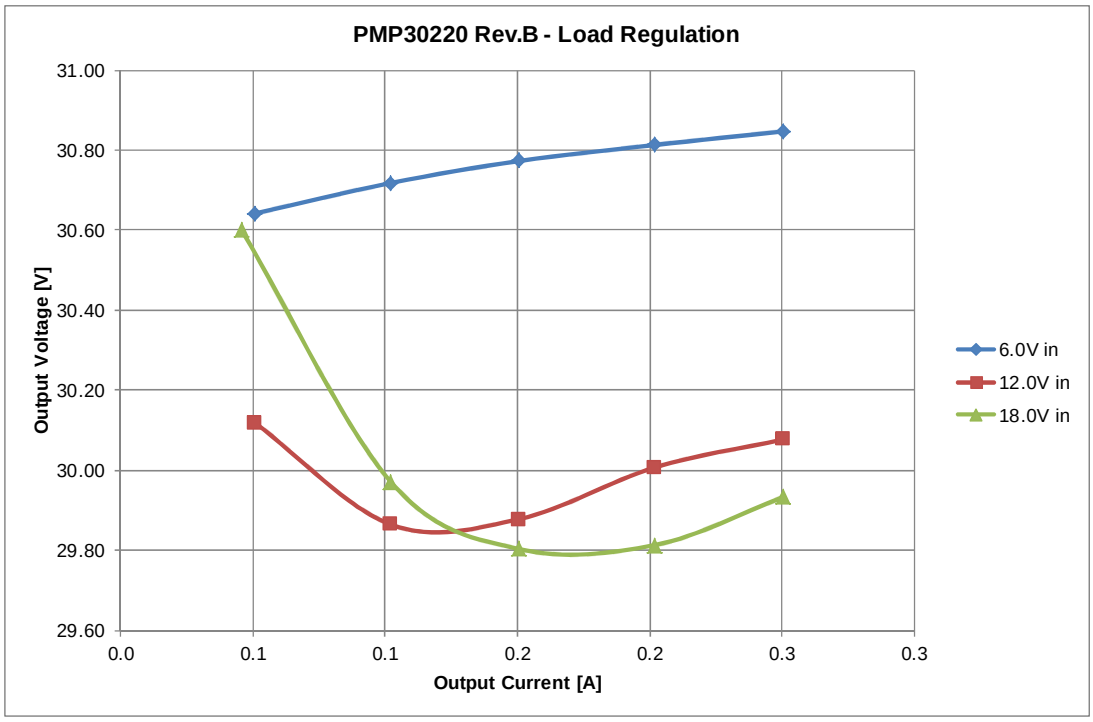


Figure 4

4. Transient Response

The response to a load step at 12.0V output voltage is shown in Figure 5.

Channel C1 **Output Current**, Load Step 100mA to 200mA
100mA/div, 2ms/div

Channel C2 **Output Voltage**, -734mV undershoot (1.5%), 594mV overshoot (1.2%)
500mV/div, 2ms/div, AC coupled

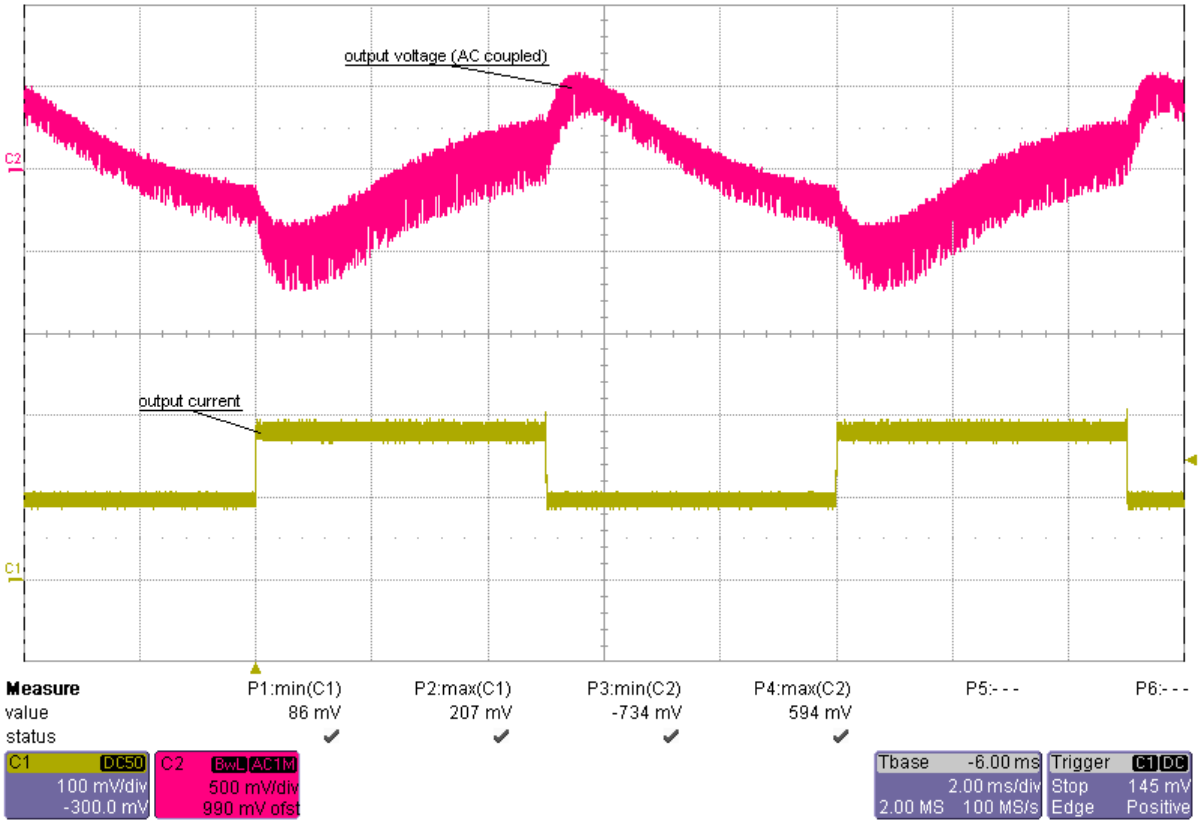


Figure 5

5. Frequency Response

The frequency response for 14.0V output voltage is shown in Figure 6.

6.0V Input, 220mA Load	368 Hz Bandwidth, 90 deg Phase Margin, -27 dB Gain Margin
12.0V Input, 220mA Load	555 Hz Bandwidth, 93 deg Phase Margin, -33 dB Gain Margin
18.0V Input, 220mA Load	587 Hz Bandwidth, 96 deg Phase Margin, -35 dB Gain Margin

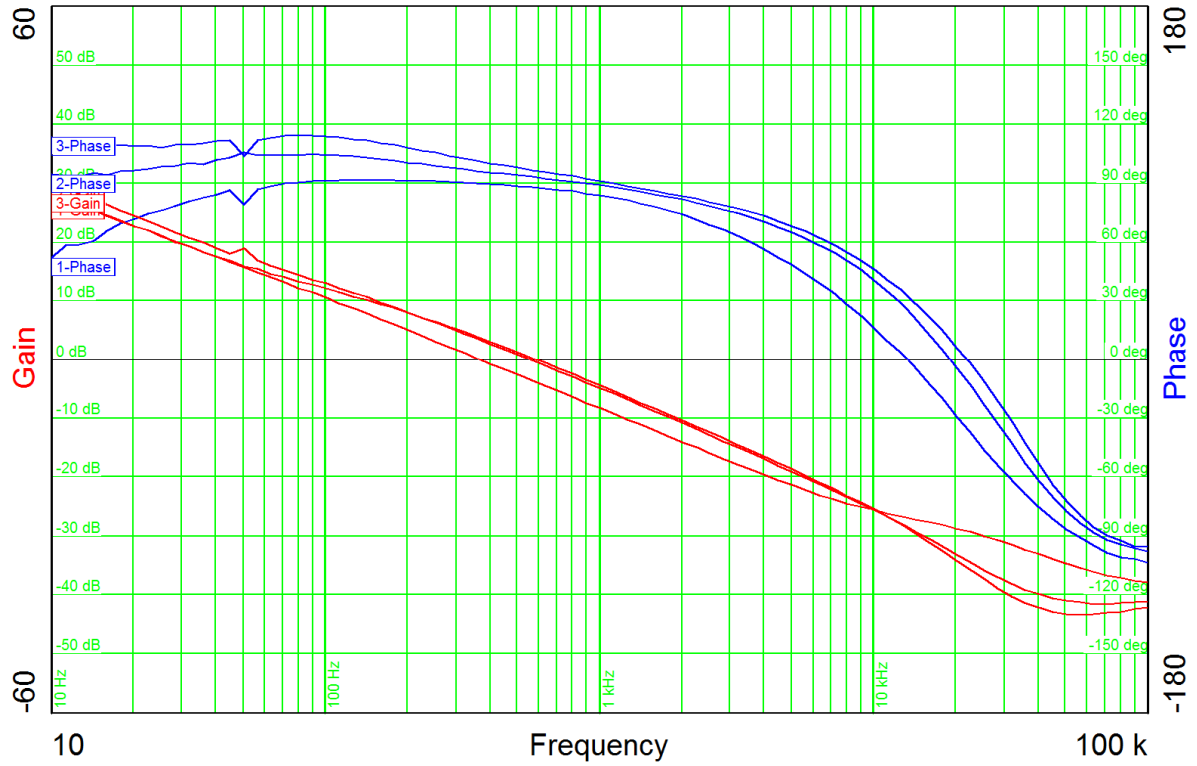


Figure 6

The frequency response for 30.0V output voltage is shown in Figure 7Figure 6.

6.0V Input, 220mA Load	190 Hz Bandwidth, 78 deg Phase Margin, -27 dB Gain Margin
12.0V Input, 220mA Load	396 Hz Bandwidth, 85 deg Phase Margin, -32 dB Gain Margin
18.0V Input, 220mA Load	785 Hz Bandwidth, 85 deg Phase Margin, -32 dB Gain Margin

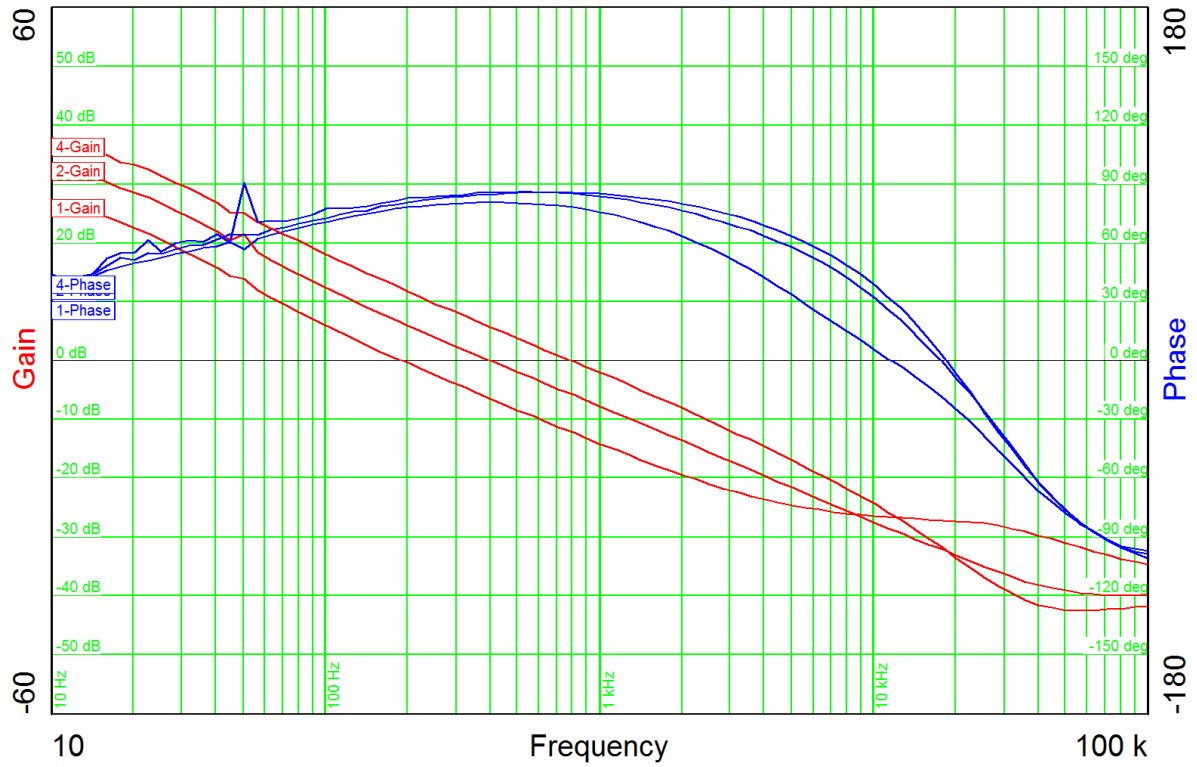


Figure 7

The frequency response for 48.0V output voltage is shown in Figure 8Figure 7Figure 6.

6.0V Input, 220mA Load 84 Hz Bandwidth, 67 deg Phase Margin, -28 dB Gain Margin

12.0V Input, 220mA Load 228 Hz Bandwidth, 80 deg Phase Margin, -34 dB Gain Margin

18.0V Input, 220mA Load 577 Hz Bandwidth, 81 deg Phase Margin, -32 dB Gain Margin

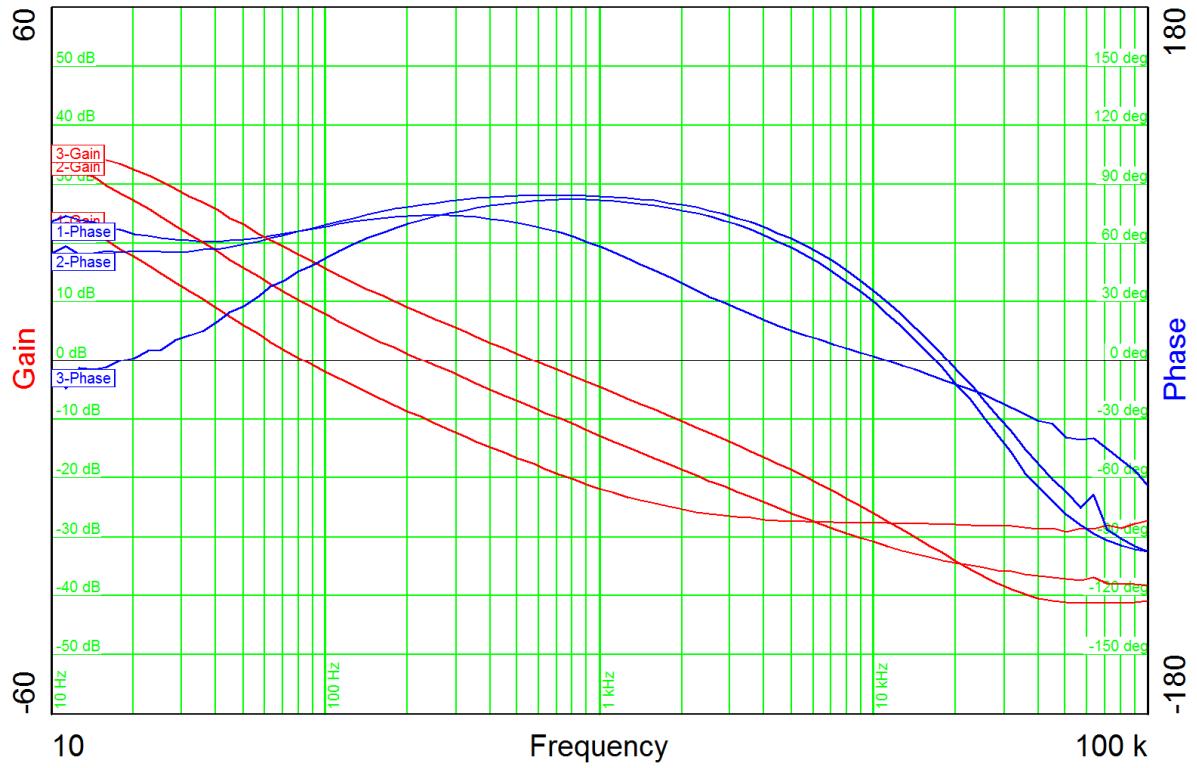


Figure 8

6. Output Ripple

The output ripple voltage at 14.0V output voltage is shown in Figure 9.

Channel M1 **Output Voltage @ 6.0V Input / 220mA Load**
100mV/div, 2us/div

Channel M2 **Output Voltage @ 12.0V Input / 220mA Load**
100mV/div, 2us/div

Channel M3 **Output Voltage @ 18.0V Input / 220mA Load**
100mV/div, 2us/div

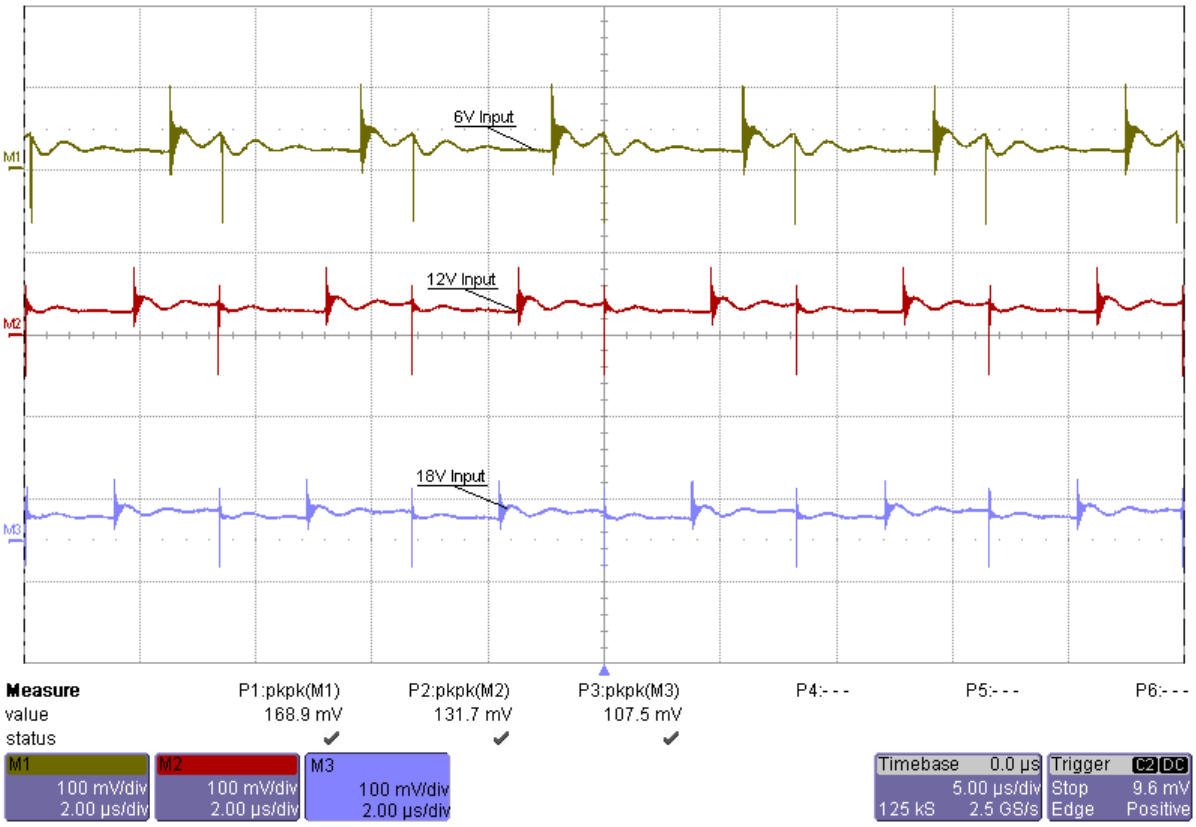


Figure 9

The output ripple voltage at 48.0V output voltage is shown in Figure 9.

Channel M1 **Output Voltage @ 6.0V Input / 220mA Load**
200mV/div, 2us/div

Channel M2 **Output Voltage @ 12.0V Input / 220mA Load**
200mV/div, 2us/div

Channel M3 **Output Voltage @ 18.0V Input / 220mA Load**
200mV/div, 2us/div

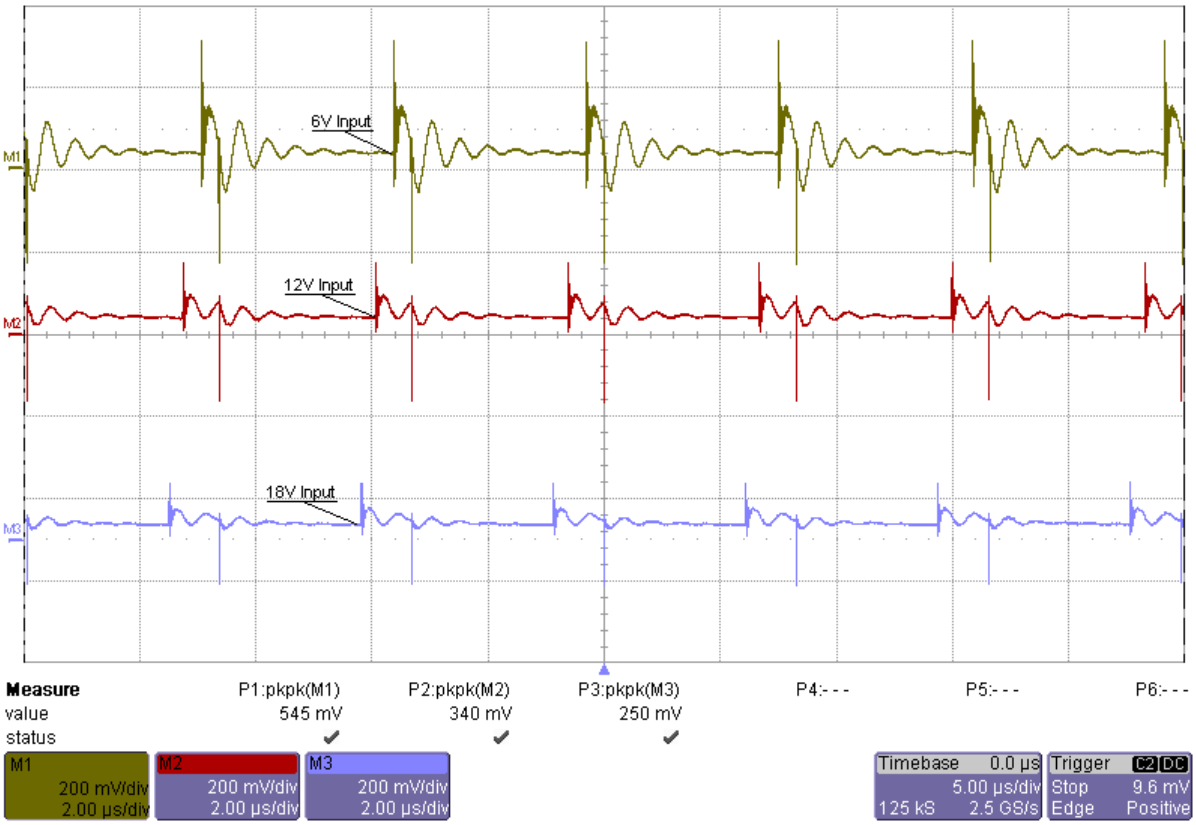


Figure 10

7. Low-Side FET (Switching Node)

The drain-source voltage of the low-side FET at 18.0V input voltage and 220mA load on the output is shown in Figure 11.

Channel C1 **Drain-Source Voltage**, -2.7V minimum, 72.2V maximum
20V/div, 1us/div

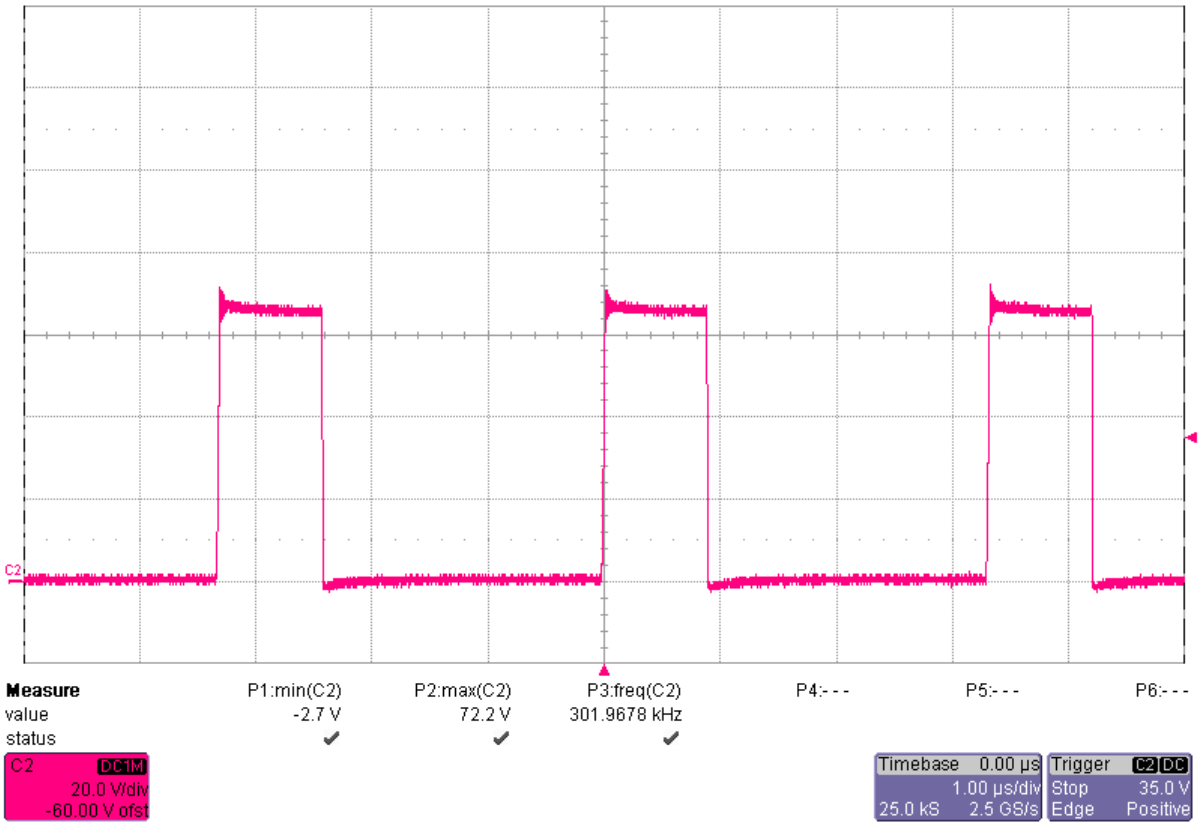


Figure 11

8. Diode

The voltage on the diode at 18.0V input voltage and 220mA load on the output is shown in Figure 12.

Channel C1 **Anode-Cathode Voltage**, -3.4V minimum, 70.2V maximum
20V/div, 1us/div

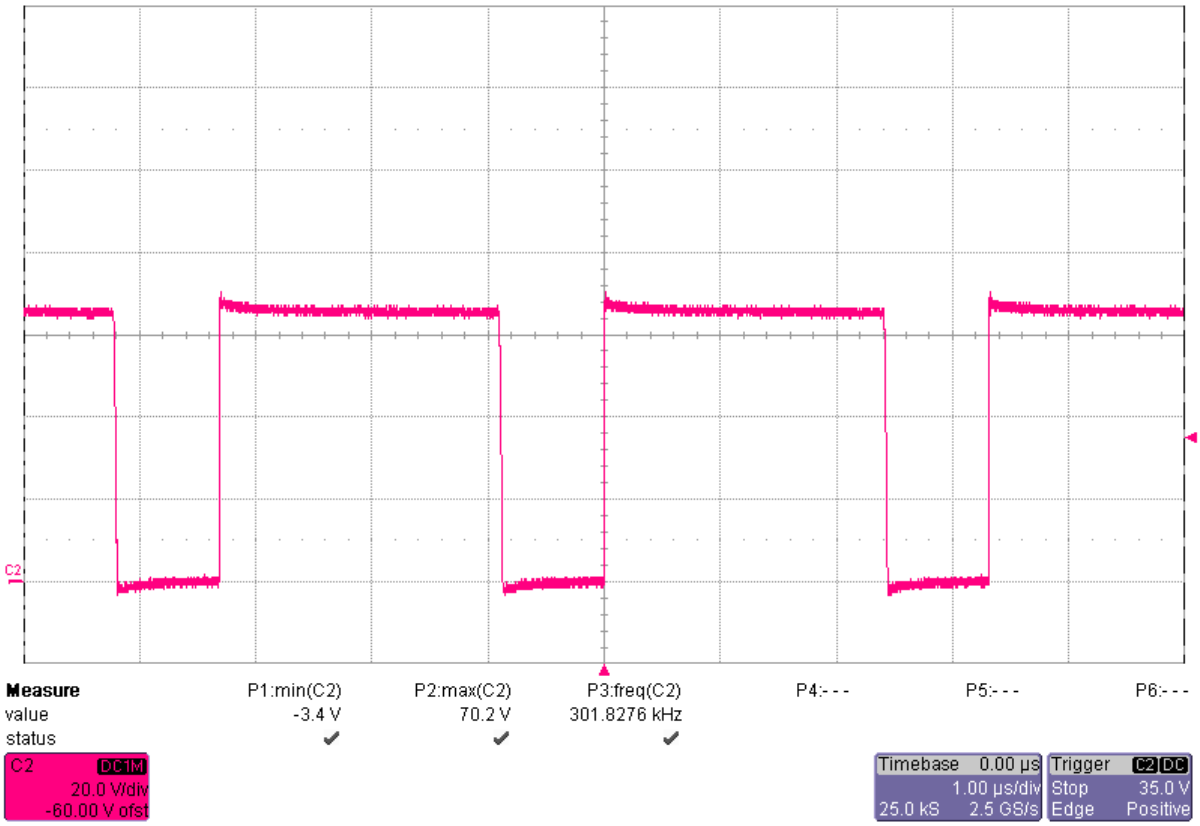


Figure 12

9. Thermal Image

The thermal image (Figure 13) shows the circuit at an ambient temperature of 20°C with an input voltage of 12.0V, an output voltage of 30.0V and 220mA load on the output.

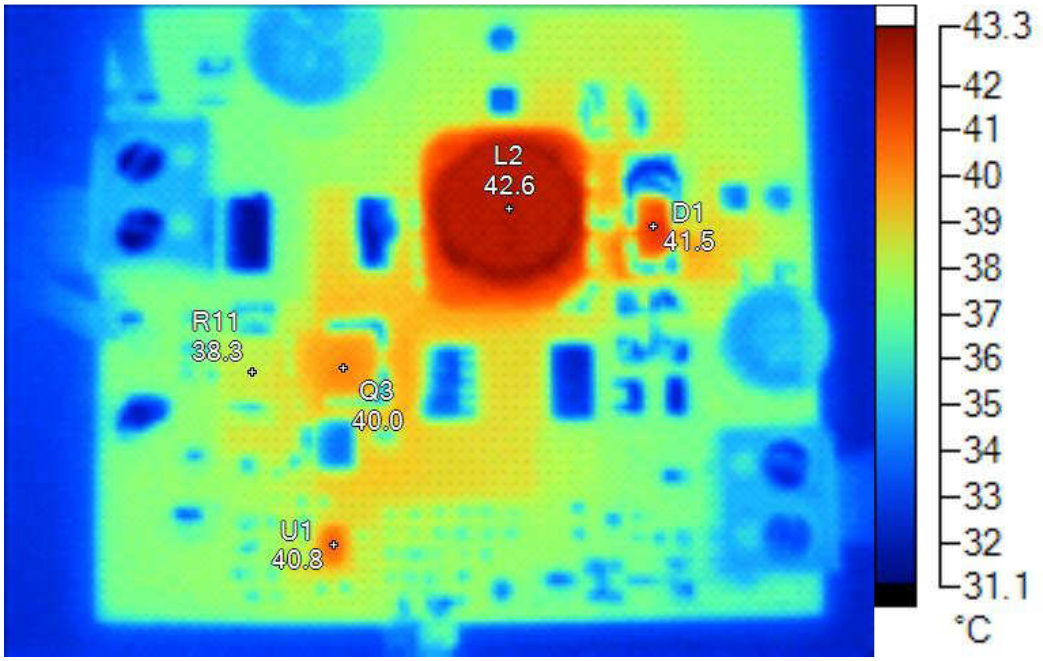


Figure 13

Name	Temperature	Emissivity	Background
L2	42.6°C	0.95	21.0°C
D1	41.5°C	0.95	21.0°C
Q3	40.0°C	0.95	21.0°C
R11	38.3°C	0.95	21.0°C
U1	40.8°C	0.95	21.0°C

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