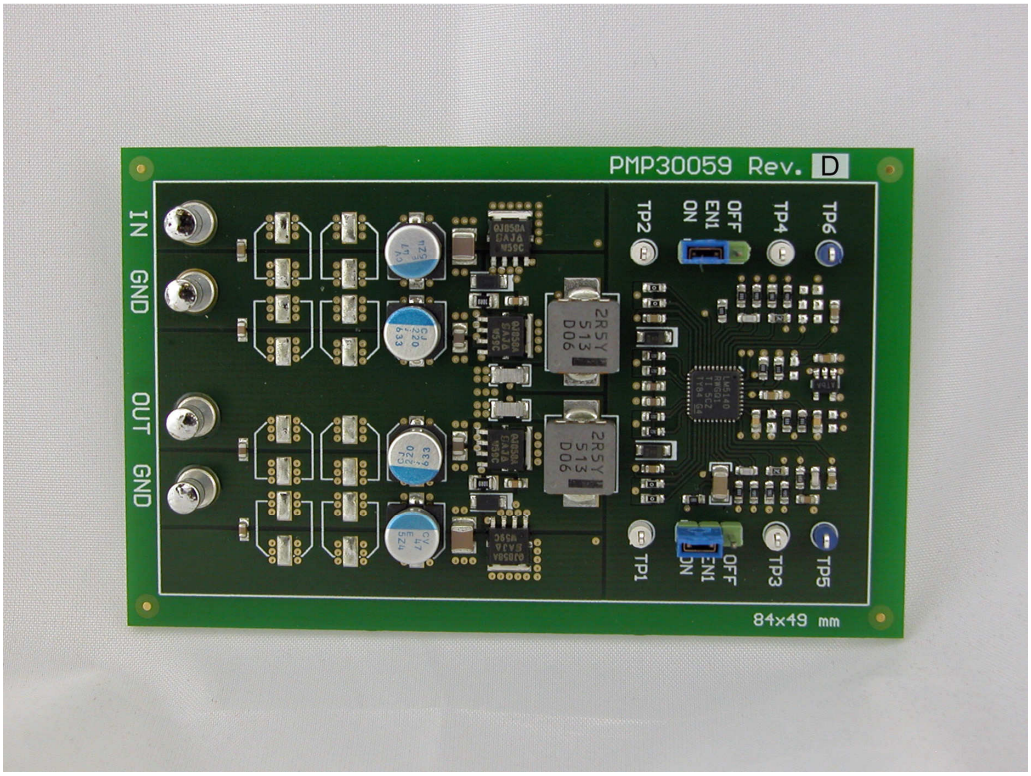
Automotive Interleaved Buck Converter with 3.3V @ 11.2A

- Input 6.0 .. 18.0V, 42V peak
- Output 3.3V @ 16.0A (8.0A continuous without active cooling)
- Free-Running-Switching Frequency of 440 kHz



1. Startup

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

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

Channel C2 **3.3V Output Voltage**
1V/div, 2ms/div

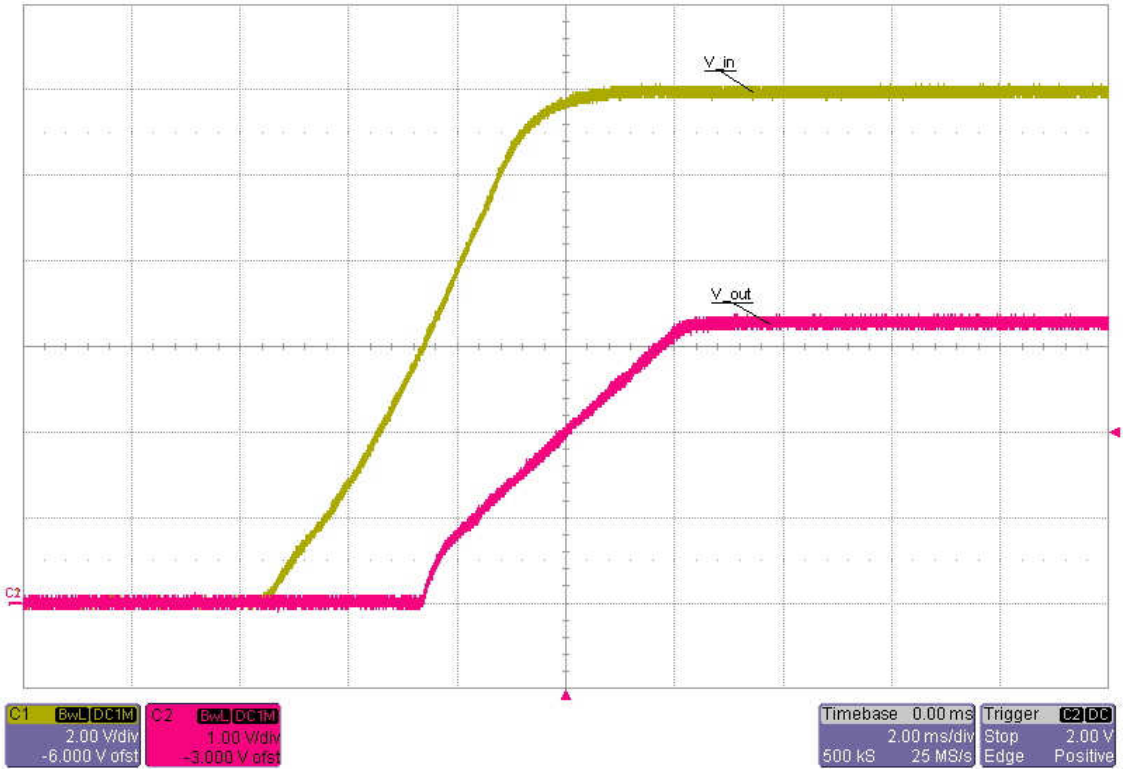


Figure 1

2. Shutdown

The shutdown waveform at 12.0V input voltage and 16.0A load on the output is shown in Figure 2.

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

Channel C2 **3.3V Output Voltage**
1V/div, 10ms/div

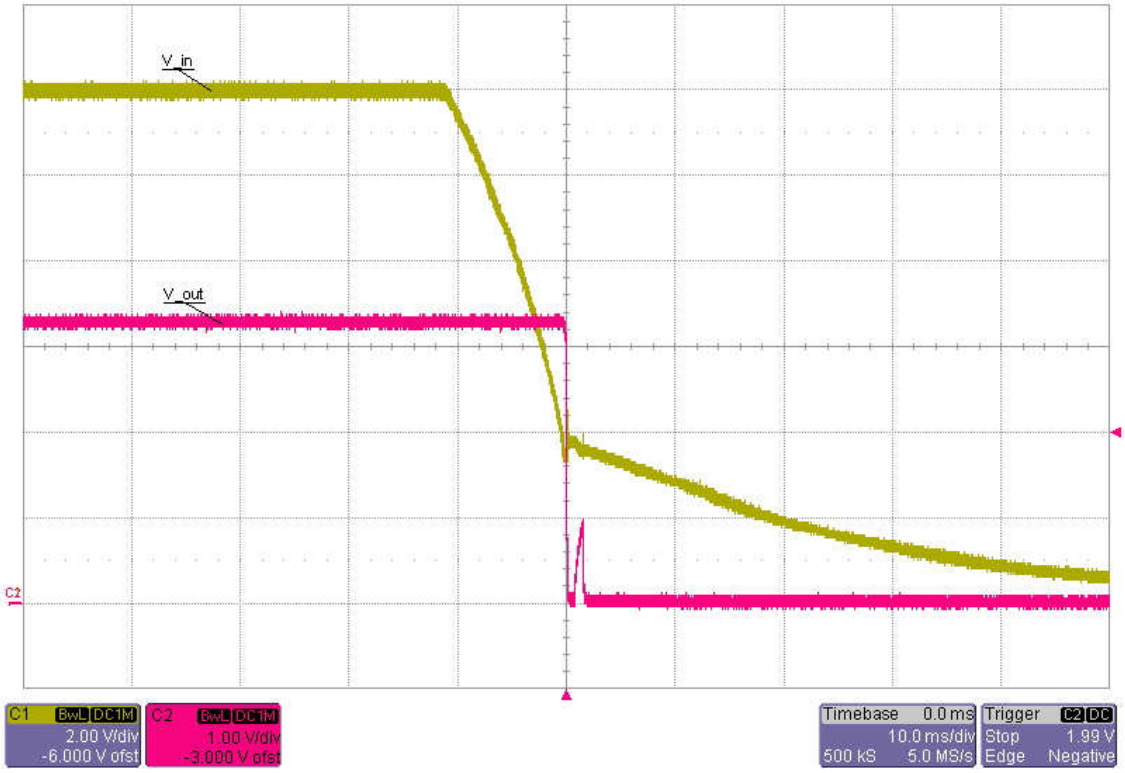


Figure 2

3. Efficiency

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

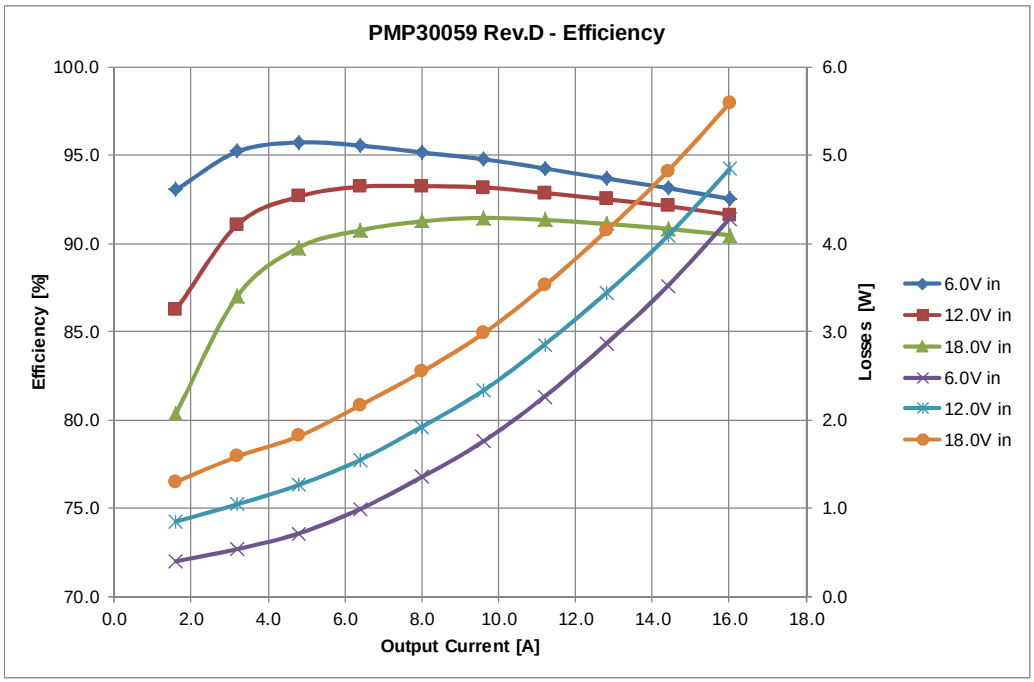


Figure 3

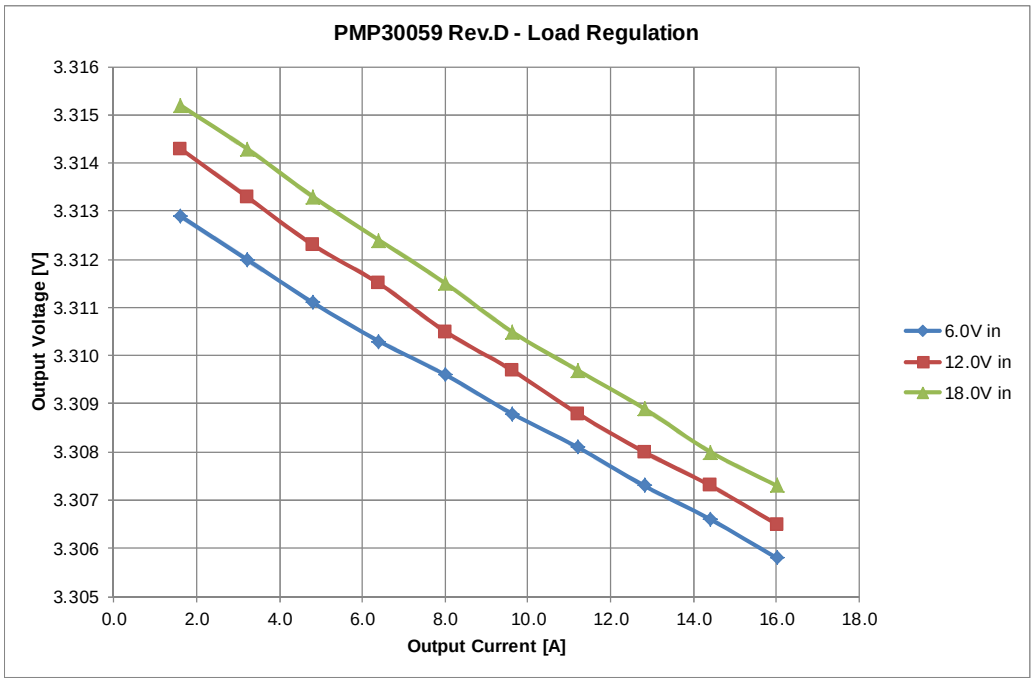


Figure 4

4. Transient Response

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

Channel C1 **Output Current**, Load Step 8.0A to 16.0A
10A/div, 1ms/div

Channel C2 **Output Voltage**, -51mV undershoot (1.5%), 51mV overshoot (1.5%)
50mV/div, 1ms/div, AC coupled

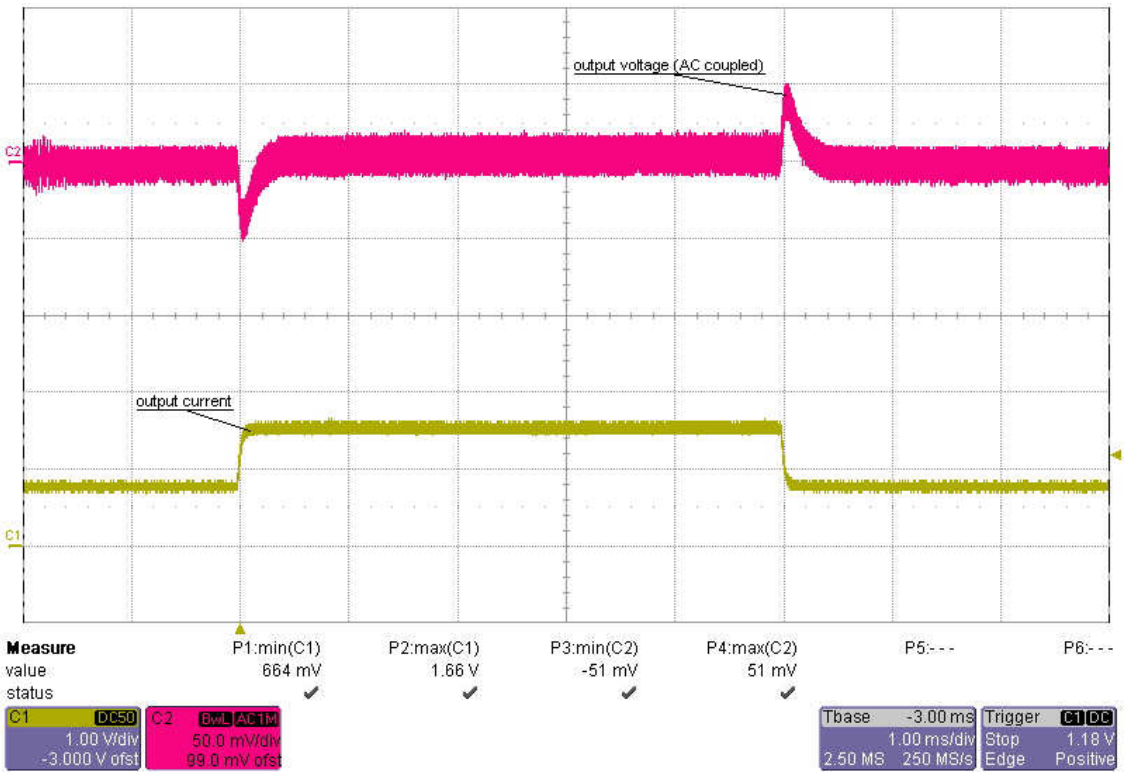


Figure 5

5. Frequency Response

The frequency response at 16.0A load is shown in Figure 6.

6.0V Input	47.6 kHz Bandwidth, 77 deg Phase Margin, -15 dB Gain Margin
12.0V Input	50.6 kHz Bandwidth, 77 deg Phase Margin, -13 dB Gain Margin
18.0V Input	53.4 kHz Bandwidth, 81 deg Phase Margin, -11 dB Gain Margin

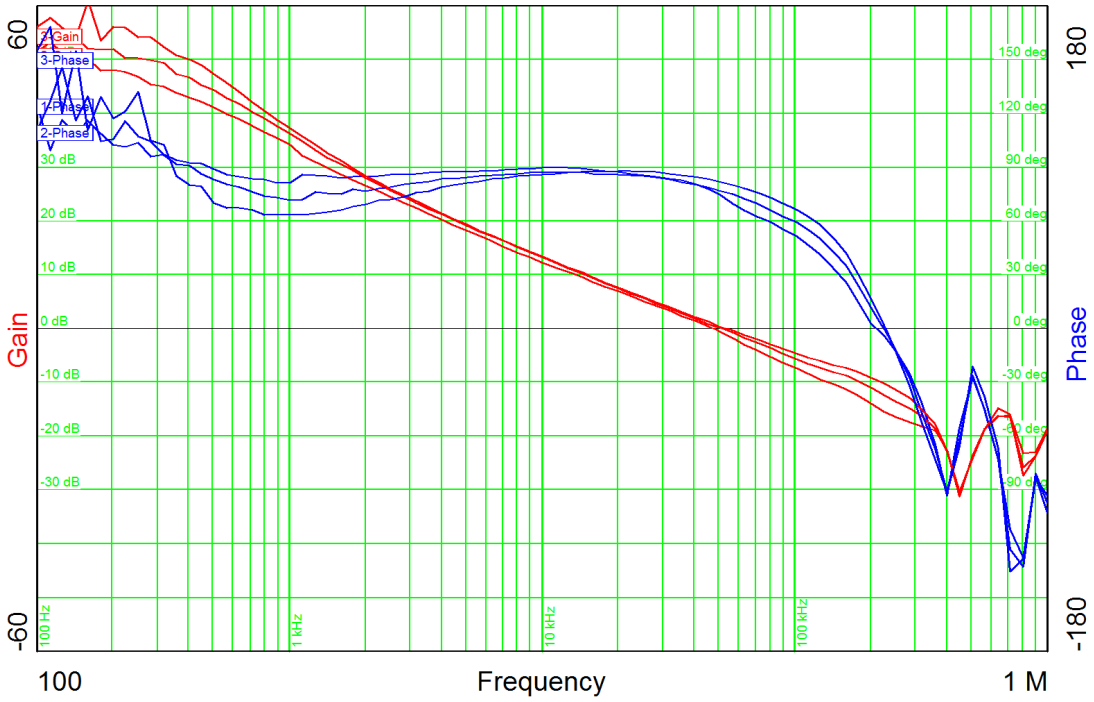


Figure 6

6. Input Ripple

The input ripple voltage at 16.0A load is shown in Figure 7

Channel M1 **Input Voltage @ 6.0V Input**, 431mV peak-peak
200mV/div, 2us/div

Channel M2 **Input Voltage @ 12.0V Input**, 349mV peak-peak
200mV/div, 2us/div

Channel M3 **Input Voltage @ 18.0V Input**, 360mV peak-peak
200mV/div, 2us/div

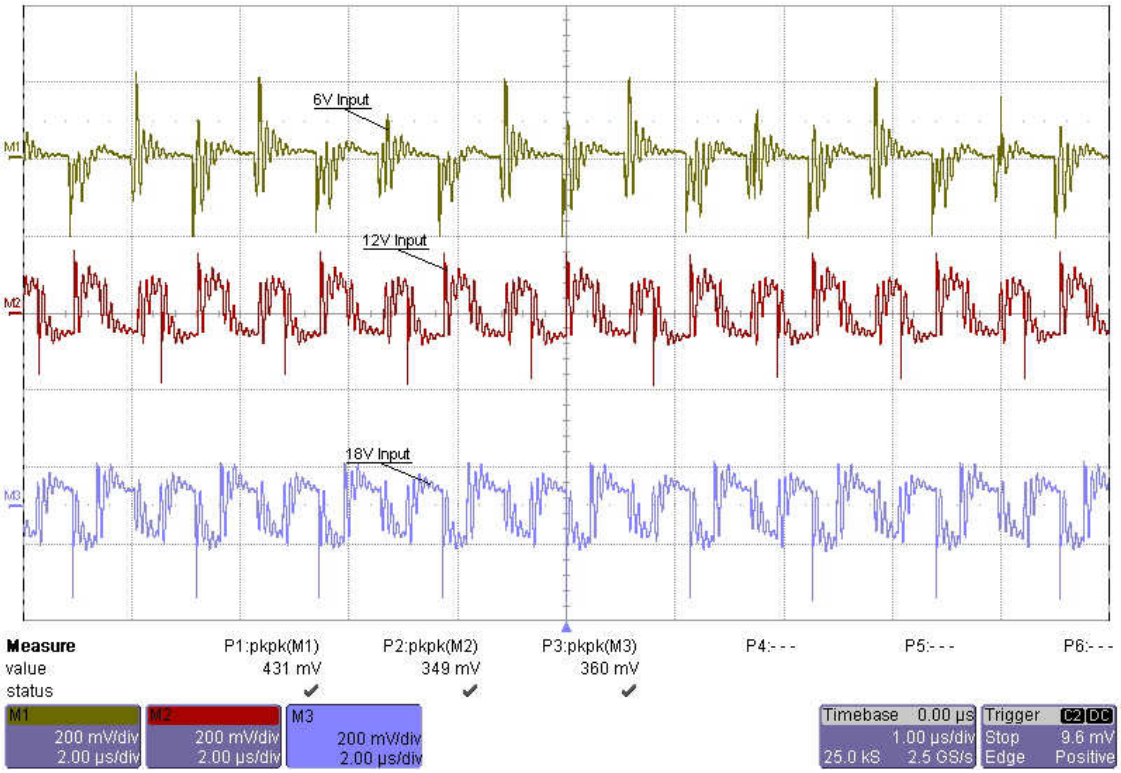


Figure 7

7. Output Ripple

The output ripple voltage at 16.0A load is shown in Figure 8.Figure 7

Channel M1 **Output Voltage @ 6.0V Input**, 36mV peak-peak
20mV/div, 1us/div

Channel M2 **Output Voltage @ 12.0V Input**, 34mV peak-peak
20mV/div, 1us/div

Channel M3 **Output Voltage @ 18.0V Input**, 40mV peak-peak
20mV/div, 1us/div

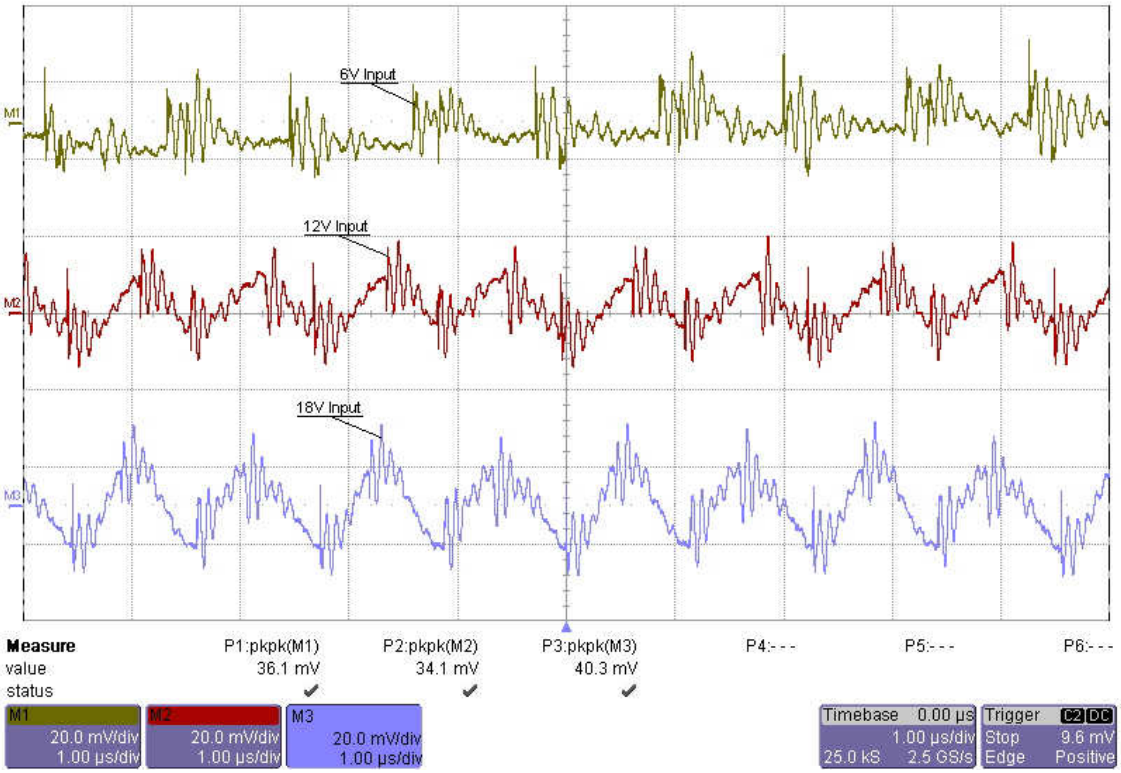


Figure 8

8. Low-Side FET (Switching Node)

The drain-source voltage of the low-side FET at 12.0V input voltage and 16.0A load on the output is shown in Figure 9.

Channel C1 **Drain-Source Voltage**, -1.5V minimum, 19.5V maximum
5V/div, 1us/div

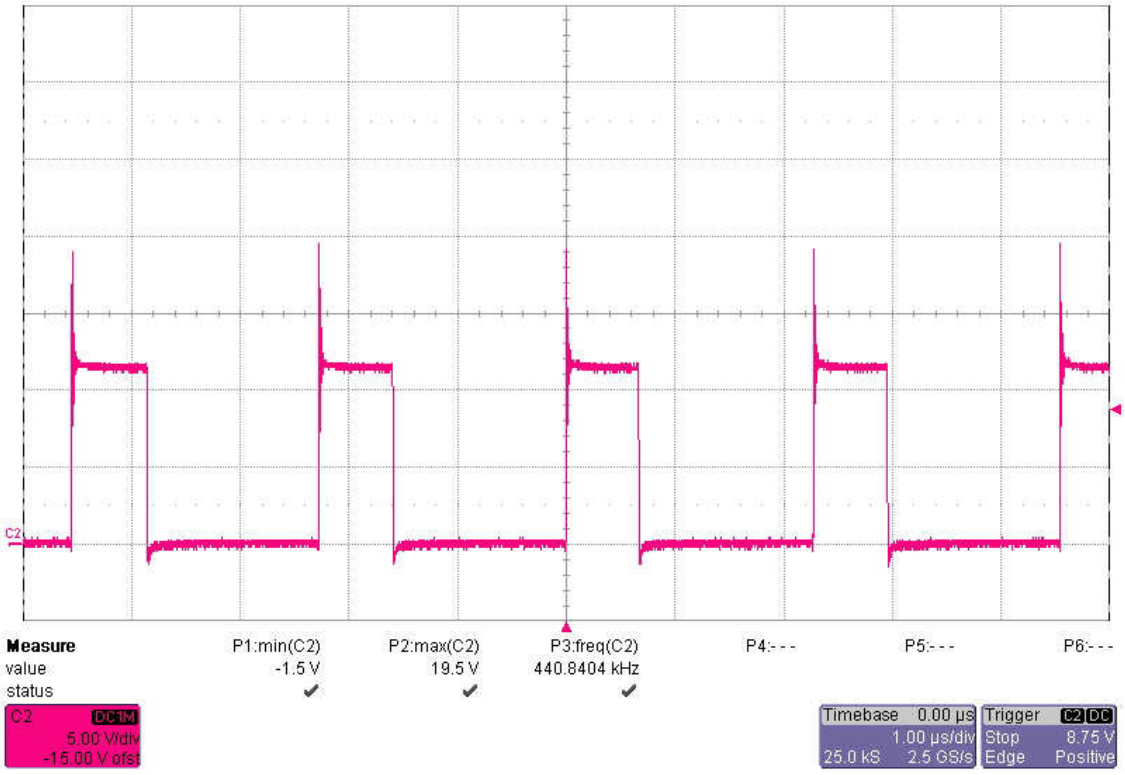


Figure 9

9. High-Side FET

The drain-source voltage of the high-side FET at 12.0V input voltage and 16.0A load on the output is shown in Figure 10.

Channel C1 **Drain-Source Voltage**, -1.3V minimum, 19.8V maximum
5V/div, 1us/div

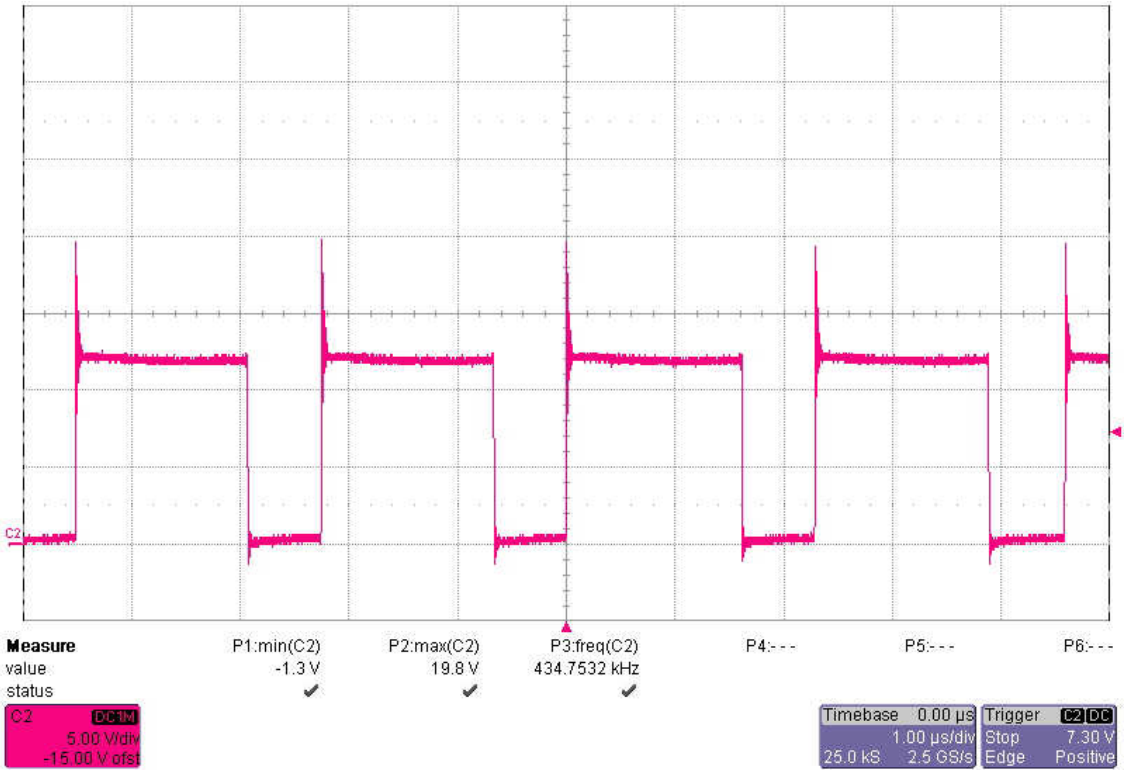


Figure 10

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 8.0A load on the output.

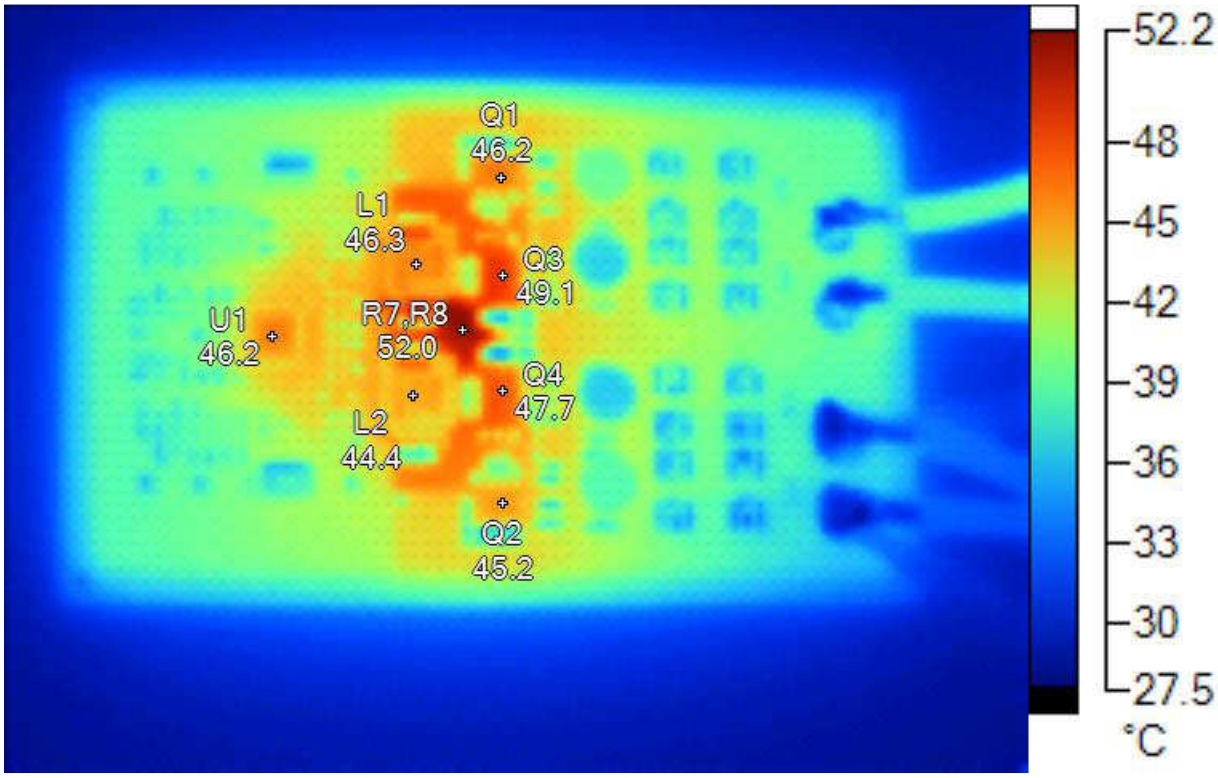


Figure 11

Name	Temperature	Emissivity	Background
U1	46.2°C	0.95	20.0°C
Q1	46.2°C	0.95	20.0°C
Q2	45.2°C	0.95	20.0°C
Q3	49.1°C	0.95	20.0°C
Q4	47.7°C	0.95	20.0°C
L2	44.4°C	0.95	20.0°C
L1	46.3°C	0.95	20.0°C
R7,R8	52.0°C	0.95	20.0°C

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