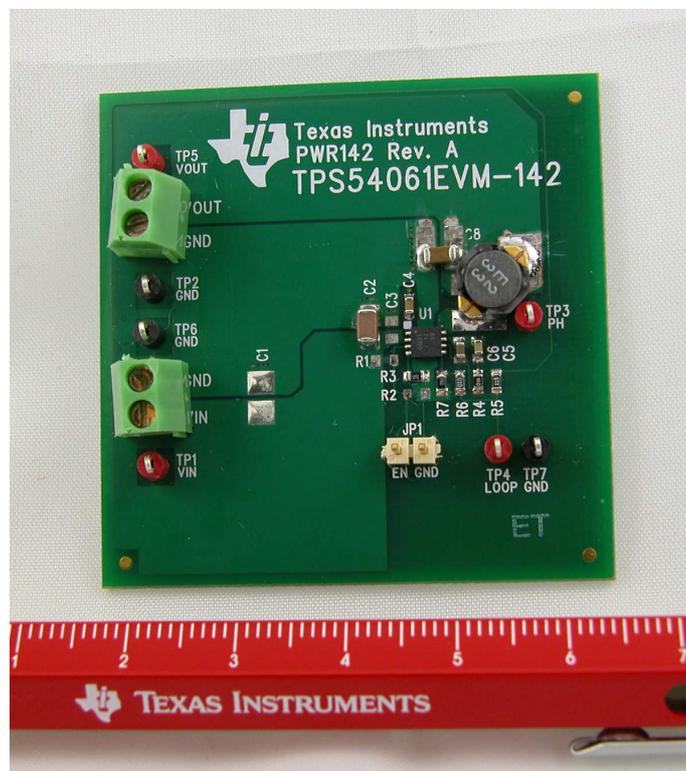


Automotive Synchronous Buck – 9.0V @ 150mA

- Input 10.45V DC / 58V peak
- Output 9.0V @ 150mA
- Converter TPS54061
- Free-Running switching frequency of 1000 kHz
- Working in continuous conduction mode
- Modified TPS54061EVM-142



1 Startup

The startup waveform is shown in Figure 1. The input voltage is set at 20.0V, with no load on the 9.0V output.

- Channel C1: **20.0V Input voltage**
5V/div, 1ms/div
- Channel C2: **9.0V Output voltage**
5V/div, 1ms/div

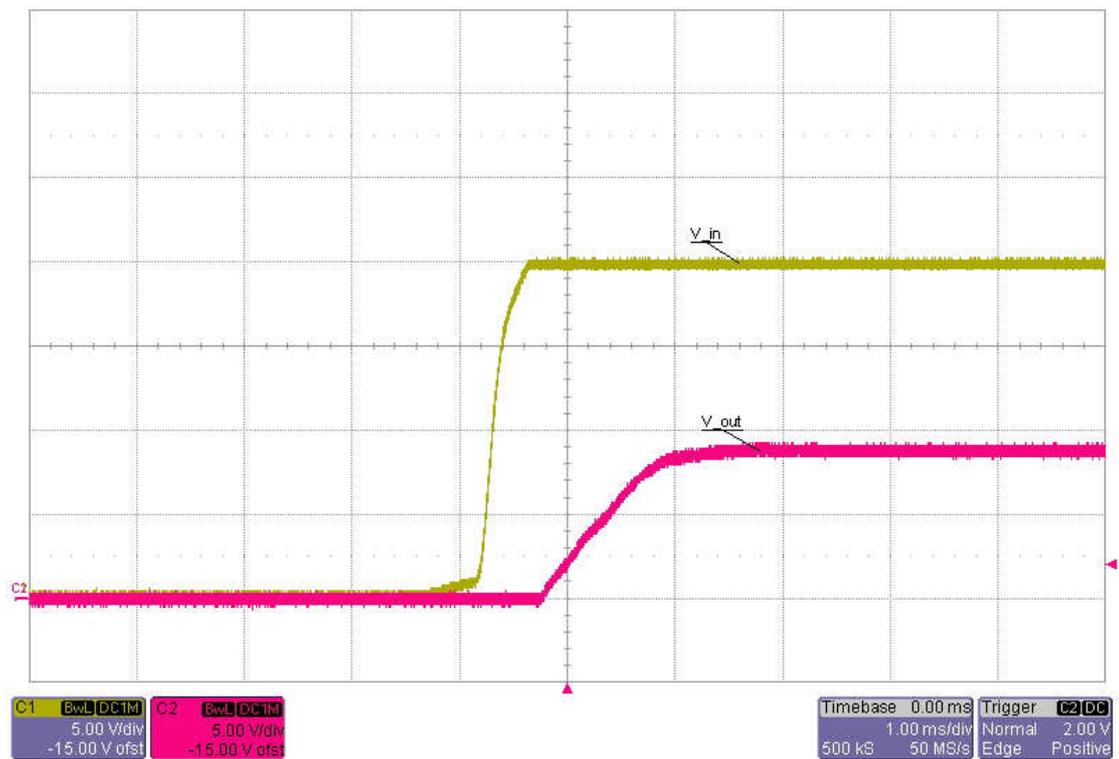


Figure 1

2 Shutdown

The shutdown waveform is shown in Figure 2. The input voltage is set at 20.0V with a 150mA load on the 9.0V output.

Channel C1: **20.0V Input voltage**
5V/div, 1ms/div

Channel C2: **9.0V Output voltage**
5V/div, 1ms/div



Figure 2

3 Efficiency & Load Regulation

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

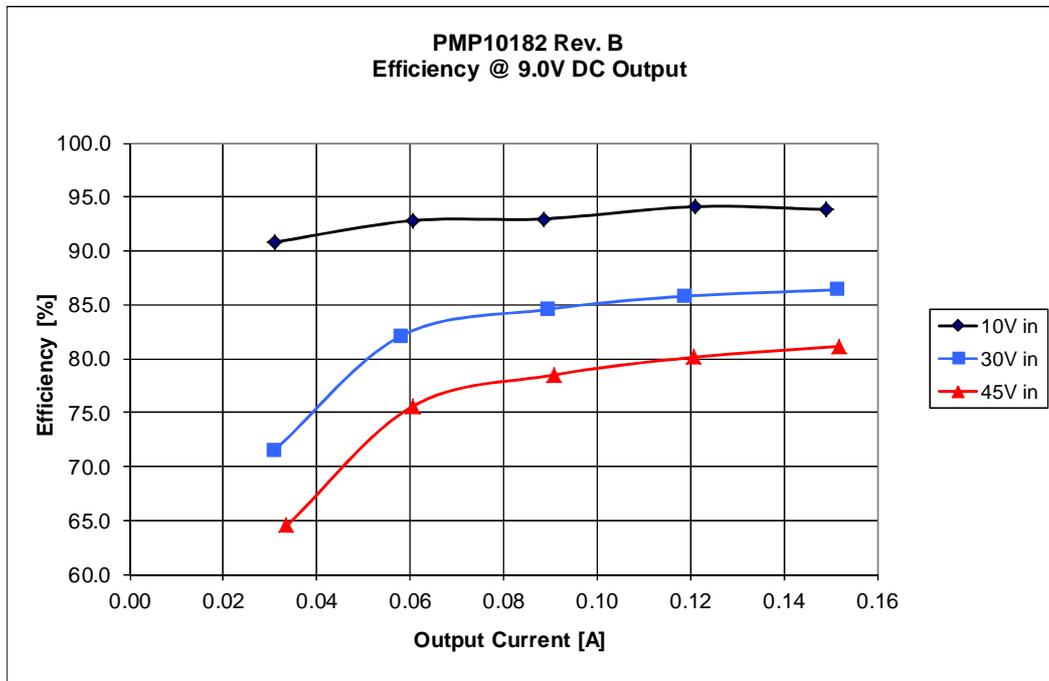


Figure 3

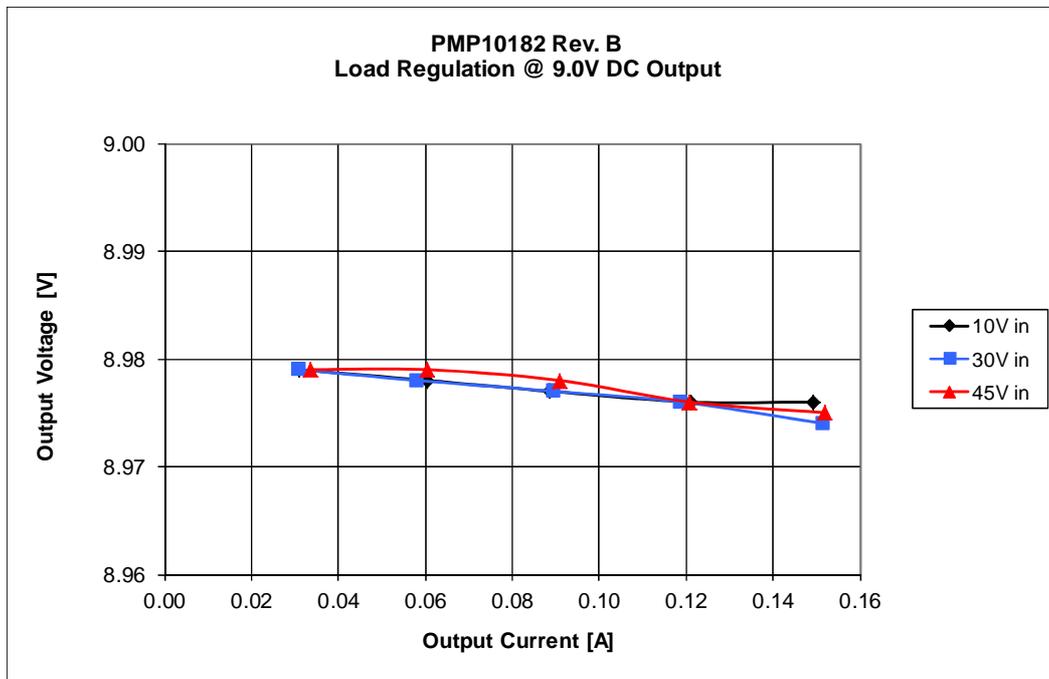


Figure 4

4 Load Step – 4.7 μ F Output Capacitance

The response to a load step and a load dump for the 9.0V output at an input voltage of 30.0V and **4.7 μ F output capacitance** is shown in Figure 5.

Channel C2: **Output voltage**, -140mV undershoot (1.6%), 167mV overshoot (1.9%)
200mV/div, 2ms/div, AC coupled

Channel C1: **Load current**, load step 30mA to 150mA and vice versa
50mA/div, 2ms/div

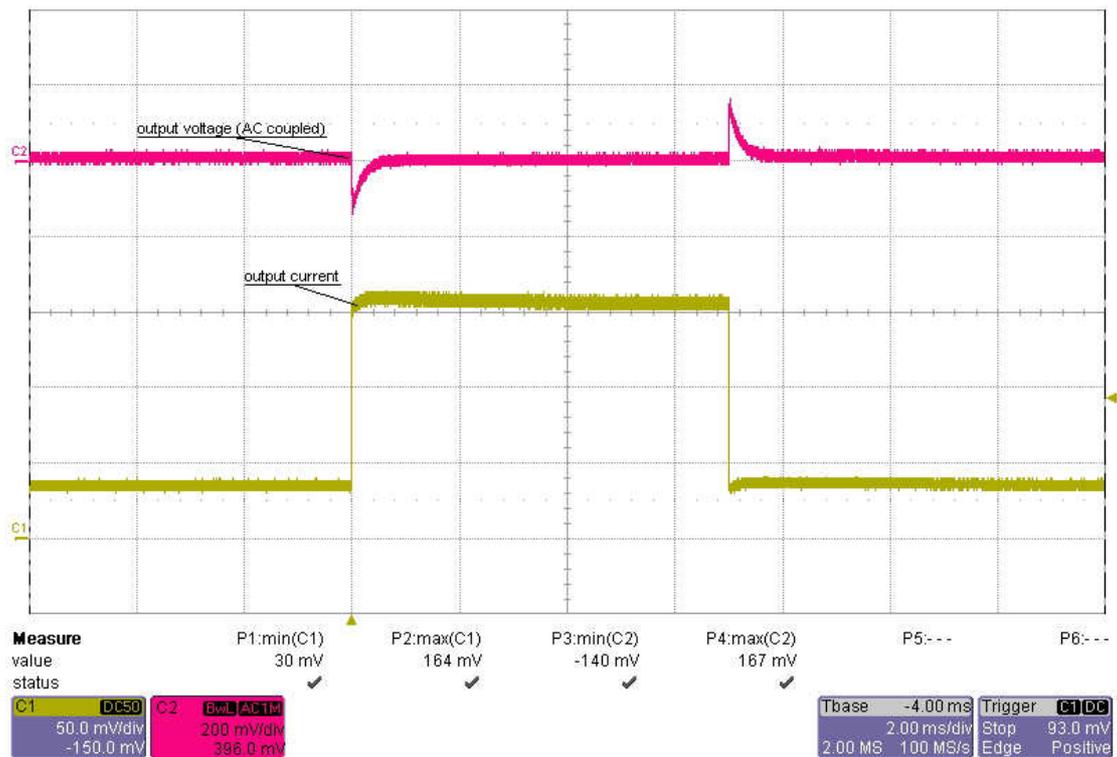


Figure 5

5 Load Step – 10 μ F Output Capacitance

The response to a load step and a load dump for the 9.0V output at an input voltage of 30.0V and **10 μ F output capacitance** is shown in Figure 6.

It is not necessary to modify the compensation network.

Channel C2: **Output voltage**, -127mV undershoot (1.4%), 167mV overshoot (1.9%)
200mV/div, 2ms/div, AC coupled

Channel C1: **Load current**, load step 30mA to 150mA and vice versa
50mA/div, 2ms/div

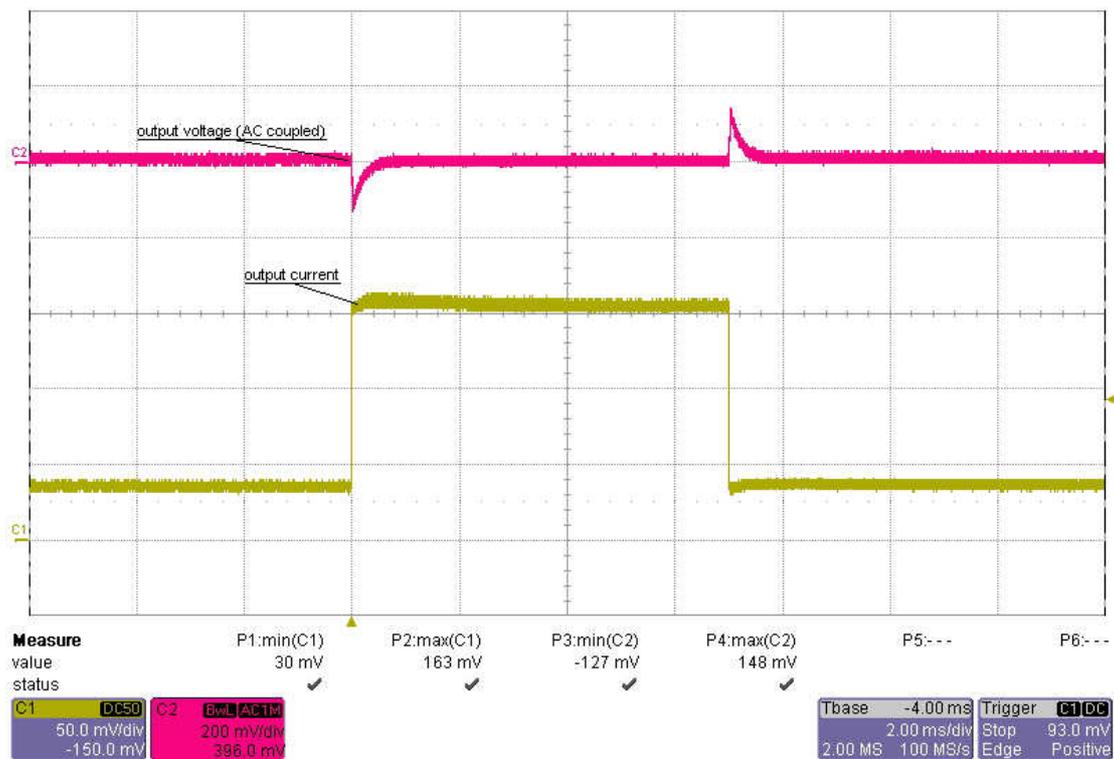


Figure 6

6 Frequency Response – 4.7 μ F Output Capacitance

Figure 7 shows the loop response at 10V, 30V and 40V input voltage, 150mA load and 4.7 μ F output capacitance.

10V input

- 150mA load 62 deg phase margin, 32.6 kHz bandwidth, -16 dB gain margin

30V input

- 150mA load 67 deg phase margin, 33.5 kHz bandwidth, -16 dB gain margin

45V input

- 150mA load 69 deg phase margin, 33.5 kHz bandwidth, -17 dB gain margin

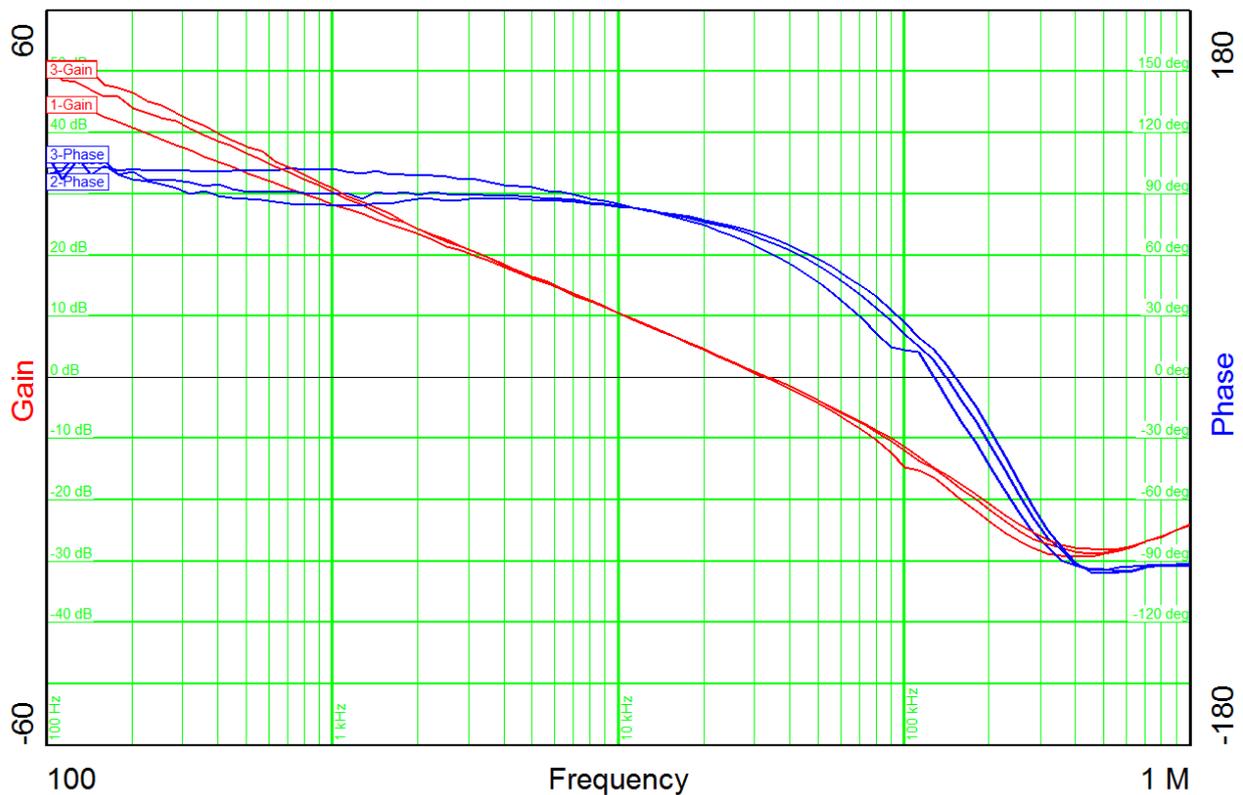


Figure 7

7 Frequency Response – 10uF Output Capacitance

Figure 8 shows the loop response at 10V, 30V and 40V input voltage, 150mA load and 10uF output capacitance.

It is not necessary to modify the compensation network.

10V input

- 150mA load 72 deg phase margin, 21.0 kHz bandwidth, -21 dB gain margin

30V input

- 150mA load 75 deg phase margin, 21.6 kHz bandwidth, -20 dB gain margin

45V input

- 150mA load 76 deg phase margin, 21.7 kHz bandwidth, -21 dB gain margin

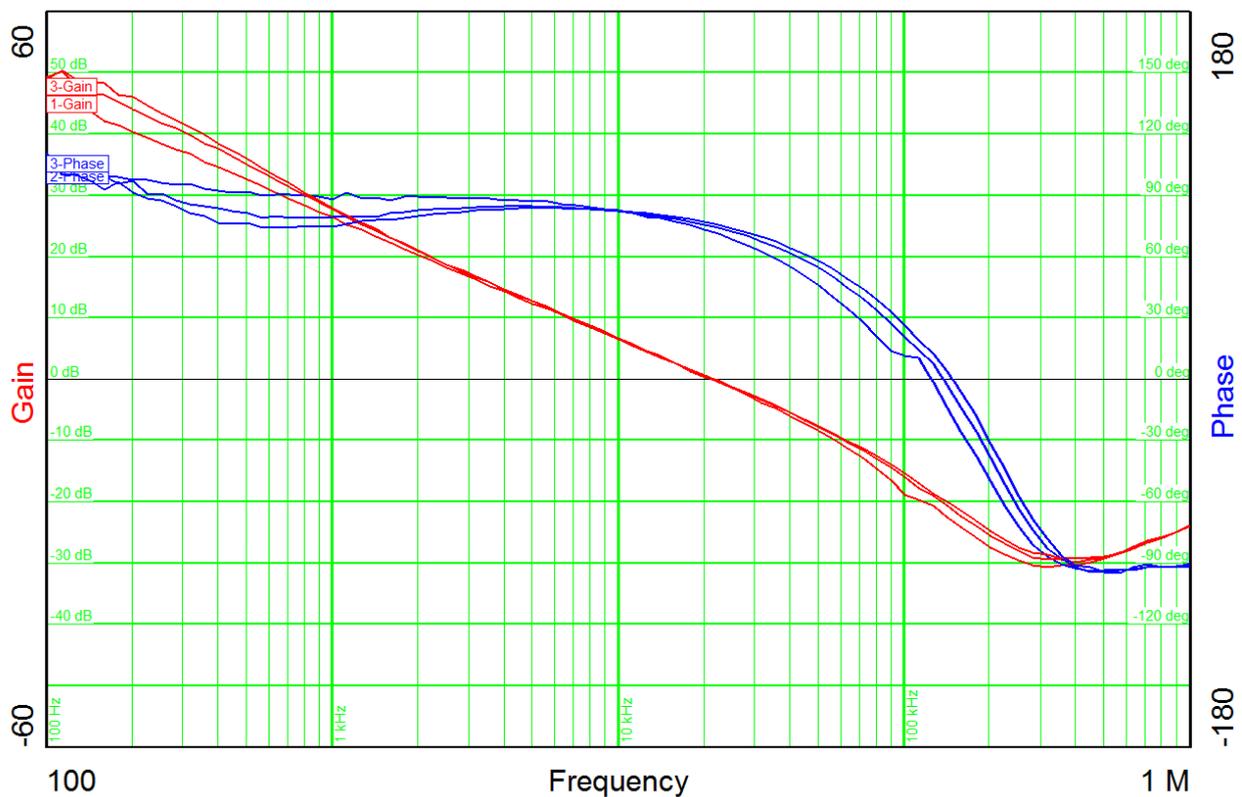


Figure 8

8 Switching Node

The drain-source voltage on the switching node is shown in Figure 9. The image was captured with 45V input and 150mA load.

Channel C2: **Drain-source voltage**, -2.0V minimum voltage, 47.0V maximum voltage
10V/div, 1us/div

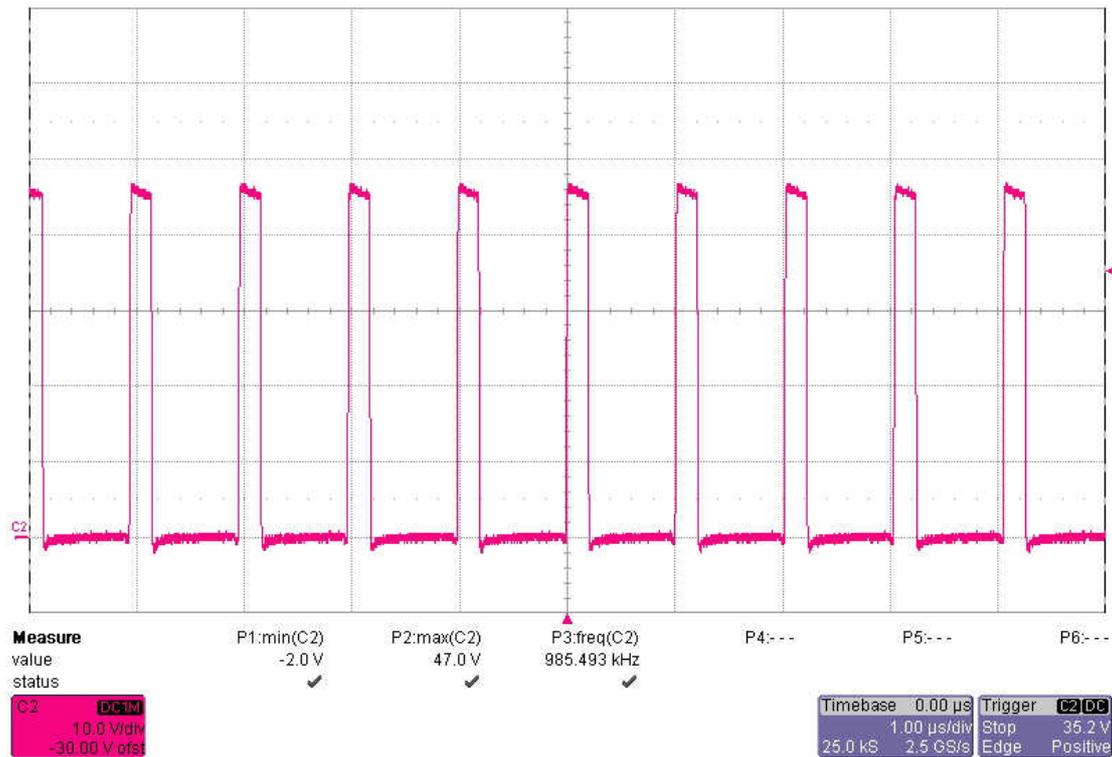


Figure 9

9 Output Ripple Voltage

The output ripple voltage at 150mA load and 10V, 30V and 45V input voltage is shown in Figure 10.

Channel M1: **Output voltage @ 10V input**, 9mV peak-peak
20mV/div, 5us/div, AC coupled

Channel M2: **Output voltage @ 30V input**, 6mV peak-peak
20mV/div, 5us/div, AC coupled

Channel M3: **Output voltage @ 45V input**, 7mV peak-peak
20mV/div, 5us/div, AC coupled

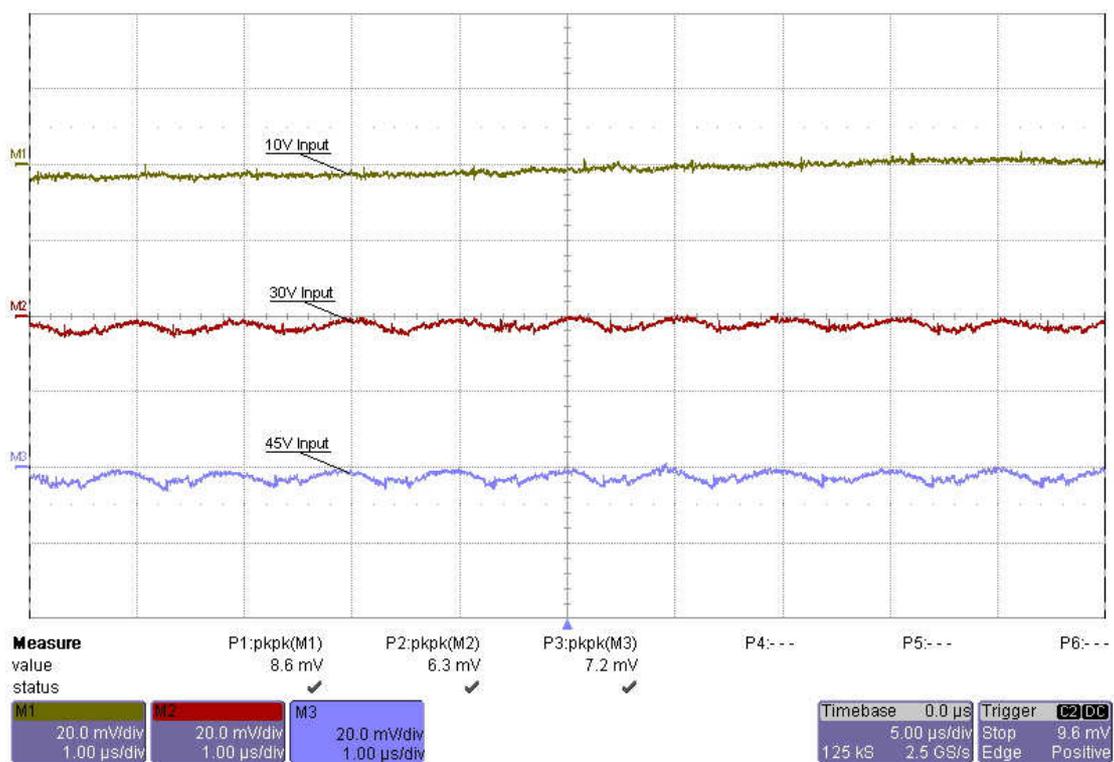


Figure 10

10 Input Ripple Voltage

The input ripple voltage at 150mA load and 10V, 30V and 45V input voltage is shown in Figure 11.

- Channel M1: **Input voltage @ 10V input**, 45mV peak-peak
50mV/div, 5us/div, AC coupled
- Channel M2: **Input voltage @ 30V input**, 57mV peak-peak
50mV/div, 5us/div, AC coupled
- Channel M3: **Input voltage @ 45V input**, 57mV peak-peak
50mV/div, 5us/div, AC coupled

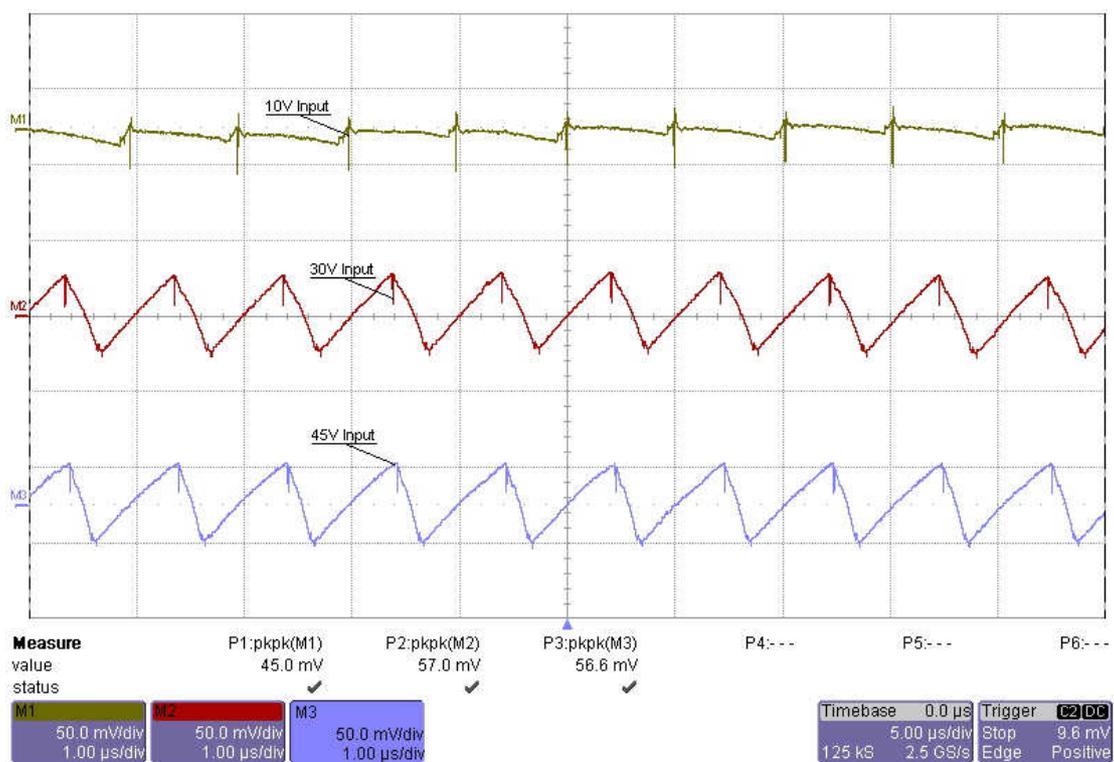


Figure 11

11 Thermal measurement

The thermal image (Figure 12) shows the circuit at an ambient temperature of 21 °C with an input voltage of 30.0V and a load of 150mA.

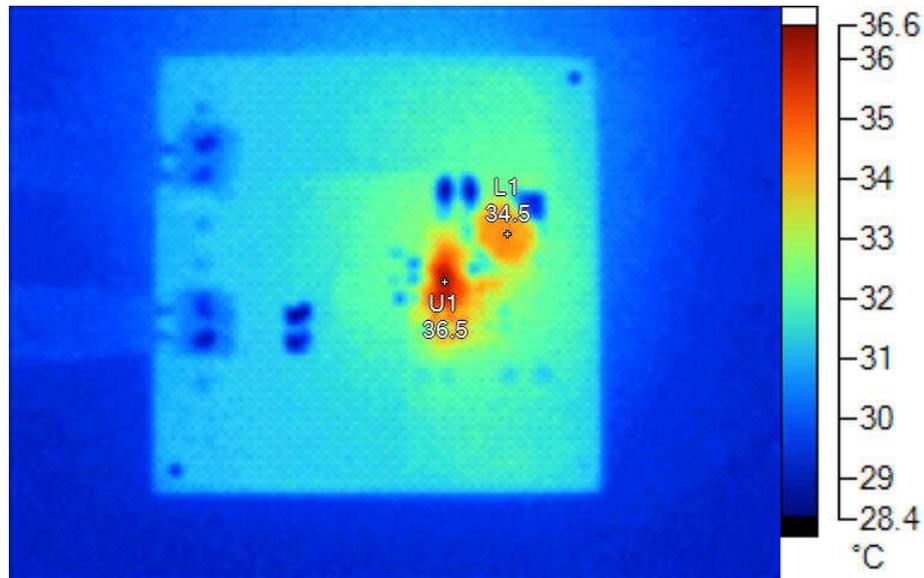


Figure 12

Markers

Label	Temperature	Emissivity	Background
U1	36.5 °C	0.95	21.0 °C
L1	34.5 °C	0.95	21.0 °C

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