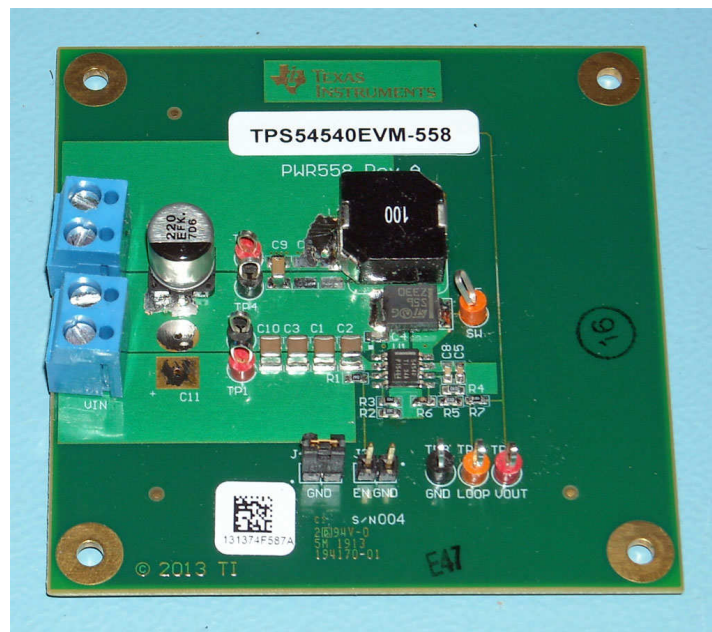


Automotive Non-Synchronous Buck

- Input 16.42V DC, 24V nominal
- Output +14.0V @ 5A
- Converter TPS54540
- Working in continuous conduction mode
- Modified TPS54540EVM-558



1 Startup

The startup waveform is shown in Figure 1. The input voltage is set at 20V, with no load on the 14V output.

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

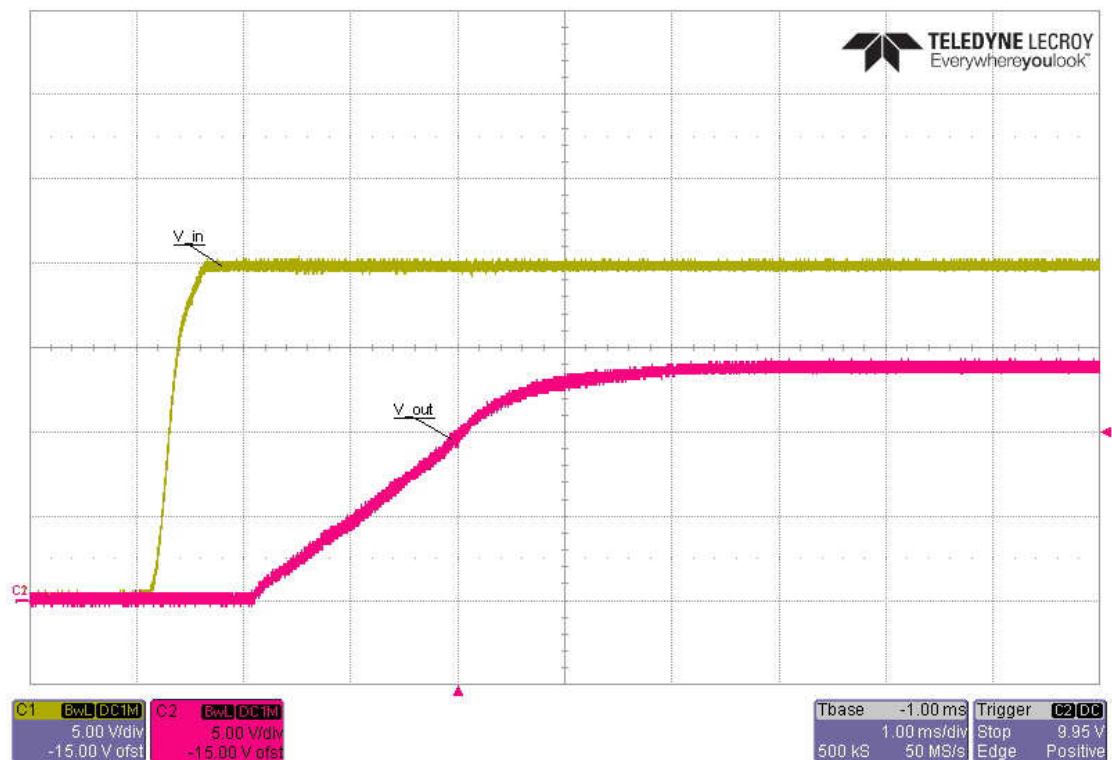


Figure 1

2 Shutdown

The shutdown waveform is shown in Figure 2. The input voltage is set at 20V with a 5.0A load on the 14V output.

- Channel C1: **Input voltage**
5V/div, 500us/div
- Channel C2: **Output voltage**
5V/div, 500us/div

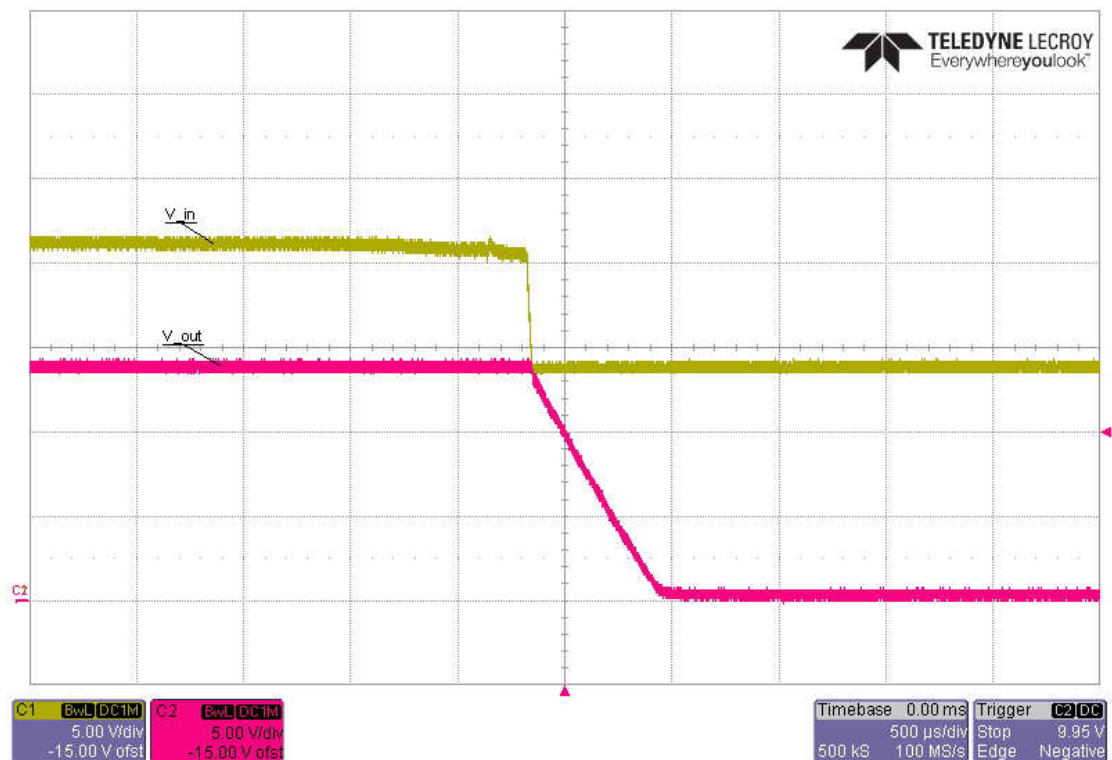


Figure 2

3 Efficiency

The efficiency and load regulation at 16V, 24V and 42V input voltage are shown in Figure 3 and Figure 4.

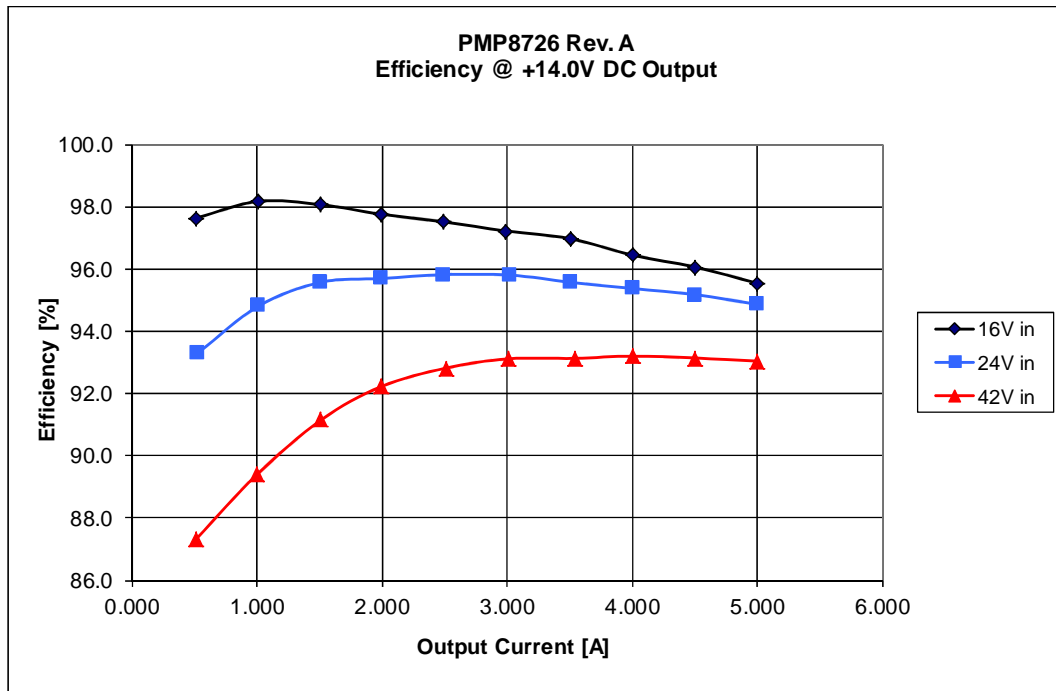


Figure 3

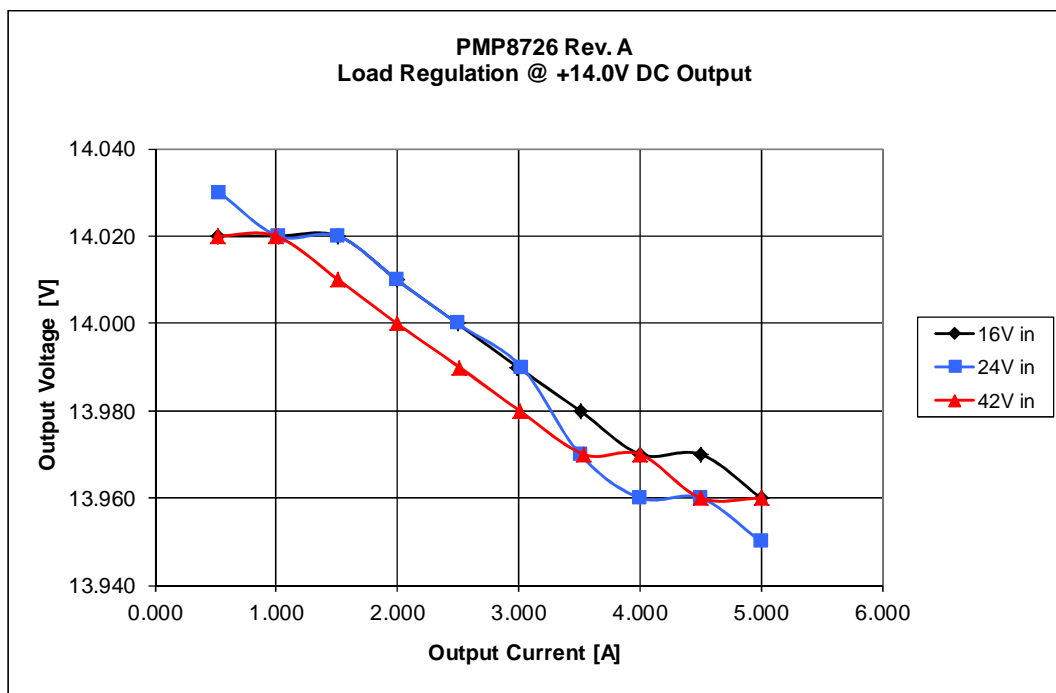


Figure 4

4 Output ripple voltage

The output ripple voltage at 16V, 24V and 42V input voltage are shown in Figure 5.

Channel M1: **Output voltage**, AC coupled, 53mV peak-peak @ 16V input voltage
100mV/div, 5us/div

Channel M2: **Output voltage**, AC coupled, 151mV peak-peak @ 24V input voltage
100mV/div, 5us/div

Channel M3: **Output voltage**, AC coupled, 194mV peak-peak @ 42V input voltage
100mV/div, 5us/div

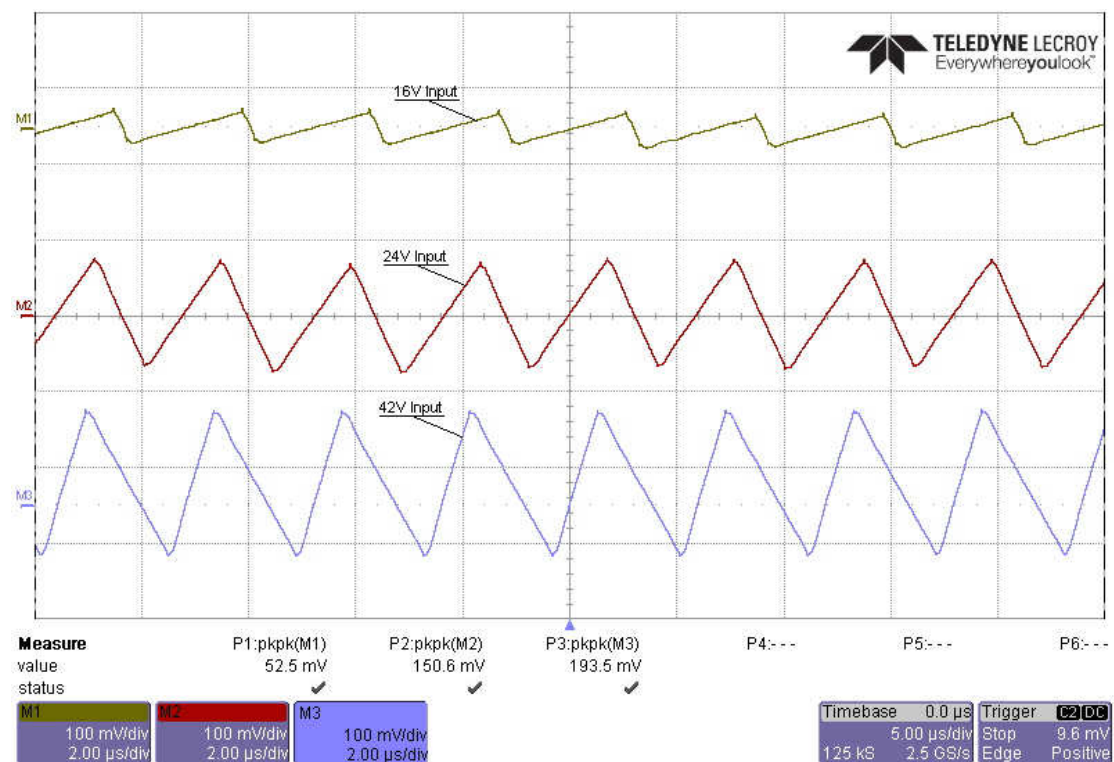


Figure 5

5 Load step

The response to a load step and a load dump at an input voltage of 24V is shown in Figure 6.

Channel C2: **Output voltage**, -606mV undershoot, 402mV overshoot
 500mV/div, 1ms/div, AC coupled

Channel C1: **Load current**, load step 0.0A to 5.0A
 2A/div, 1ms/div

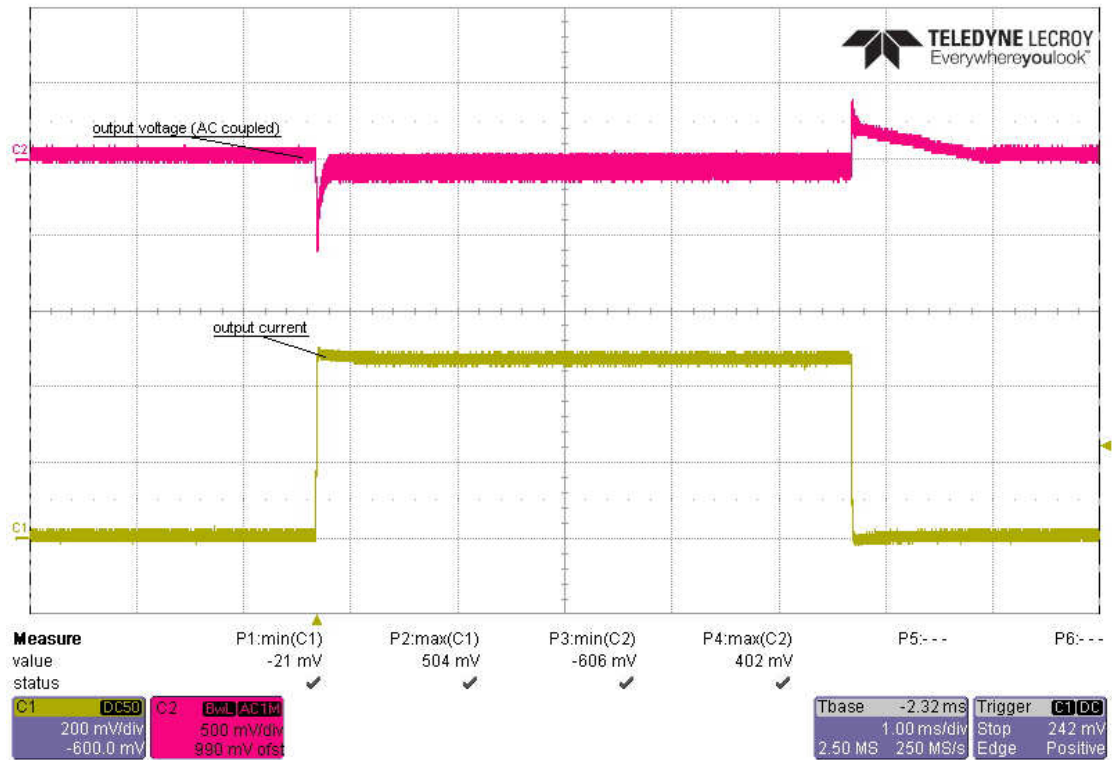


Figure 6

6 Frequency response

Figure 7 shows the loop response of the 14V output with 16V, 24V and 42V input voltage and a 5.0A load.

16V input

- 71 deg phase margin @ crossover frequency 11.3 kHz
- -25 dB gain margin

24V input

- 73 deg phase margin @ crossover frequency 10.8 kHz
- -28 dB gain margin

42V input

- 72 deg phase margin @ crossover frequency 10.0 kHz
- -28 dB gain margin

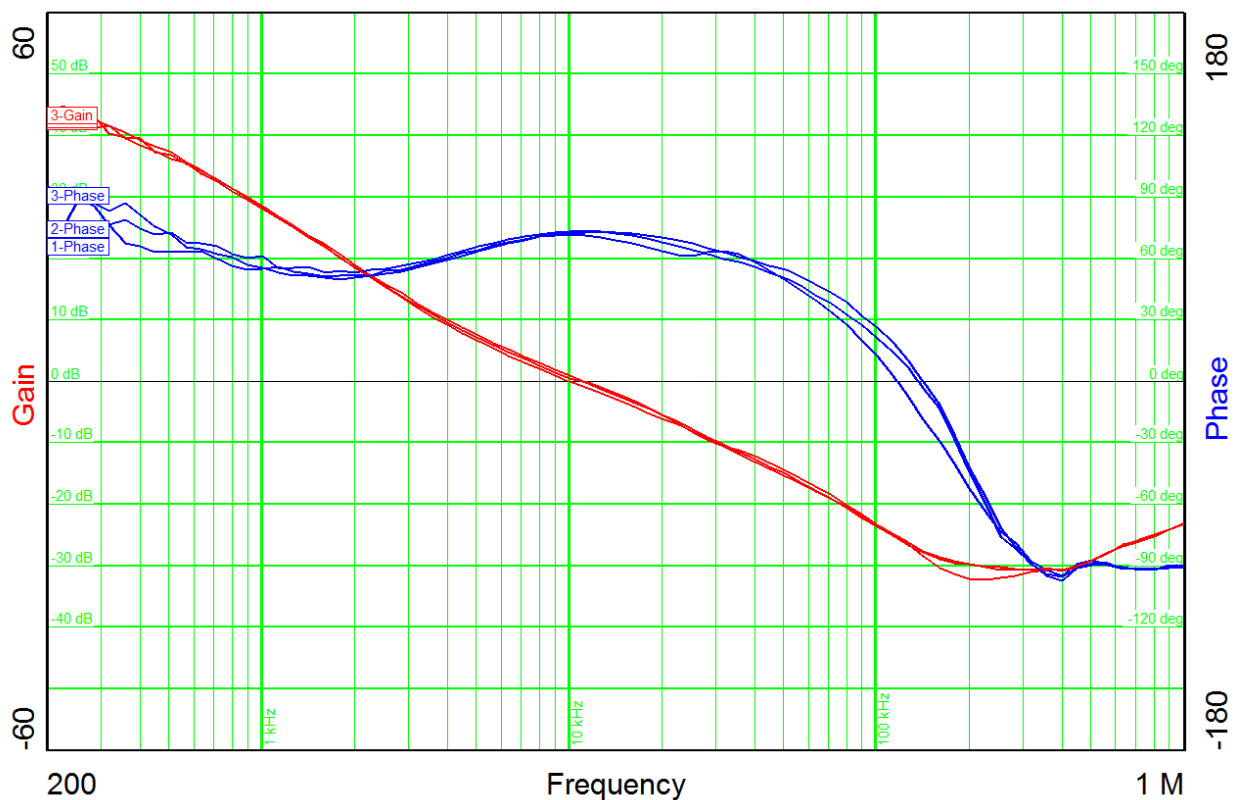


Figure 7

7 Switching Node

The drain-source voltage on the switching node is shown in Figure 8. The image was captured with 42V input and 5.0A load.

Channel C2: **Drain-source voltage**, -3.9V minimum voltage, 43.4V maximum voltage
10V/div, 1us/div

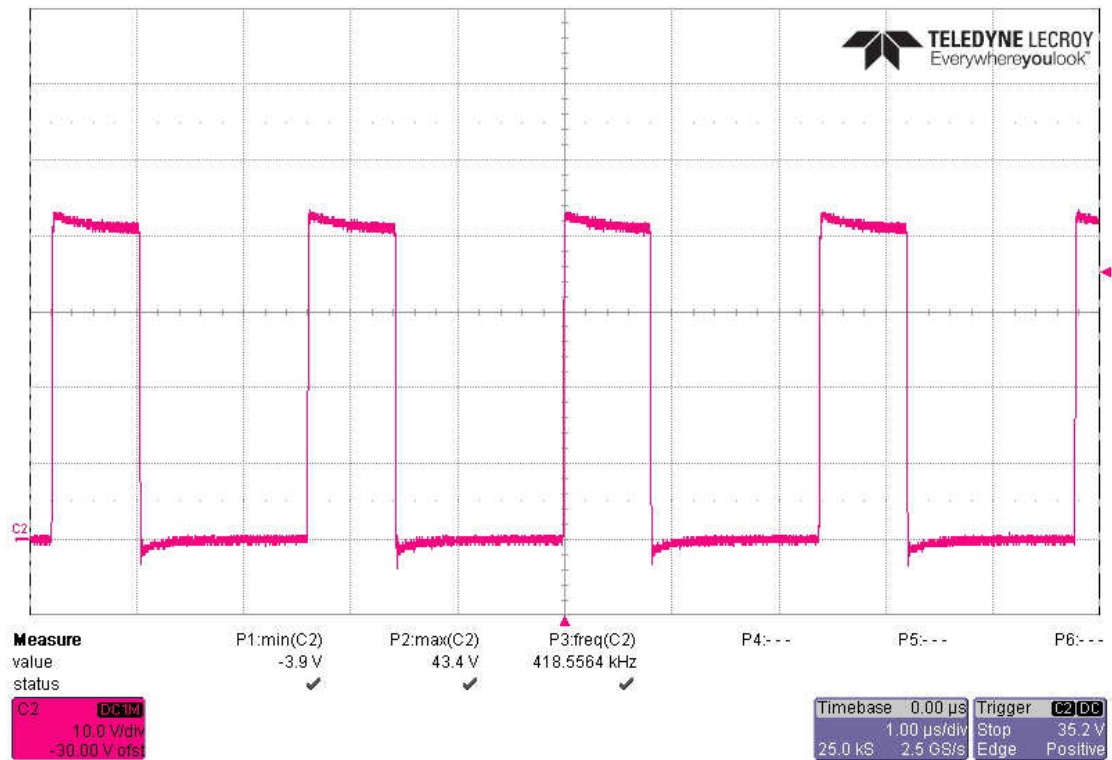


Figure 8

8 Thermal measurement

The thermal image (Figure 9) shows the circuit at an ambient temperature of 21 °C with an input voltage of 24.0V.

The load is 5.0A with a frequency of 0.25 Hz and a duty cycle of 19%. This equals the average current stress like in the application (7s @ 5.0A, 30s @ 0.0A).

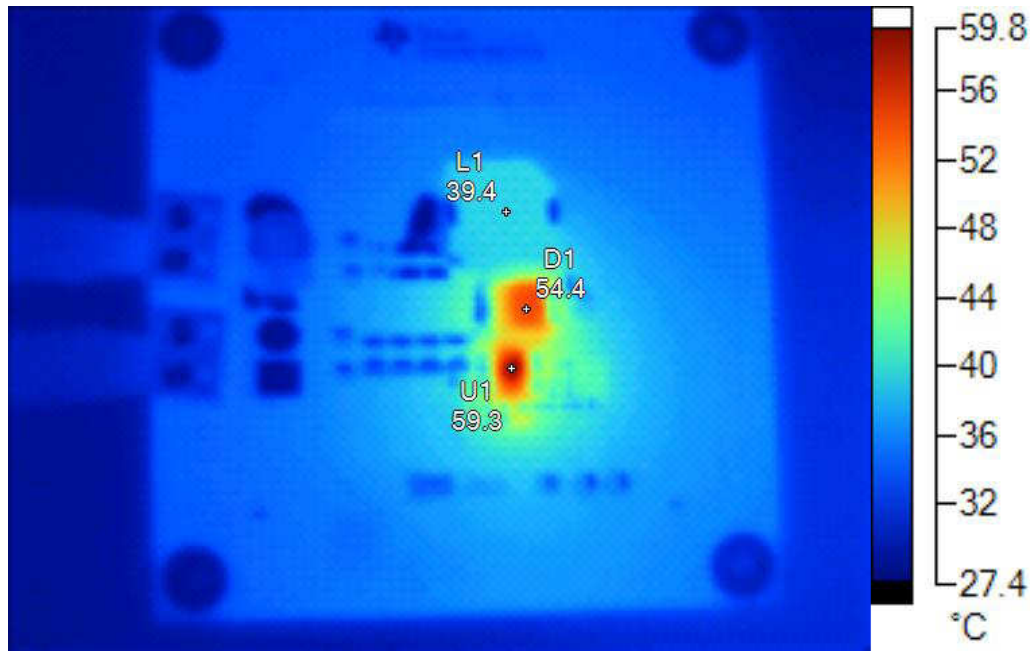


Figure 9

Markers

Label	Temperature	Emissivity	Background
L1	39.4 °C	0.95	21.0 °C
D1	54.4 °C	0.95	21.0 °C
U1	59.3 °C	0.95	21.0 °C

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