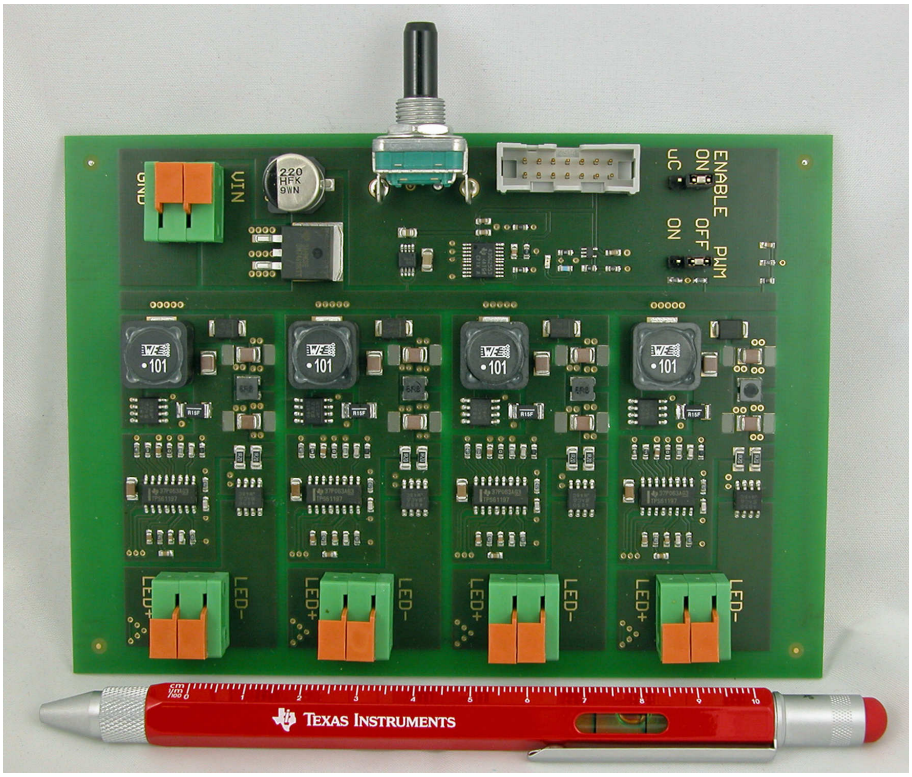
4-Channel Boost LED-Driver with Dimming

- Input 10..30V DC
- Output 4x 500mA @ 40V max.
- Controller TPS61197
- Free-Running switching frequency of 350 kHz
- Working in continuous conduction mode
- Reverse polarity protection with “ideal diode” SM74611
- PWM dimming signal generated by MSP430G2553



1 Startup

The startup waveform of a single converter is shown in Figure 1. The input voltage is set at 20.0V with 500mA @ 30V on the output.

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

Channel C2: **500mA Output current**
200mA/div, 5ms/div

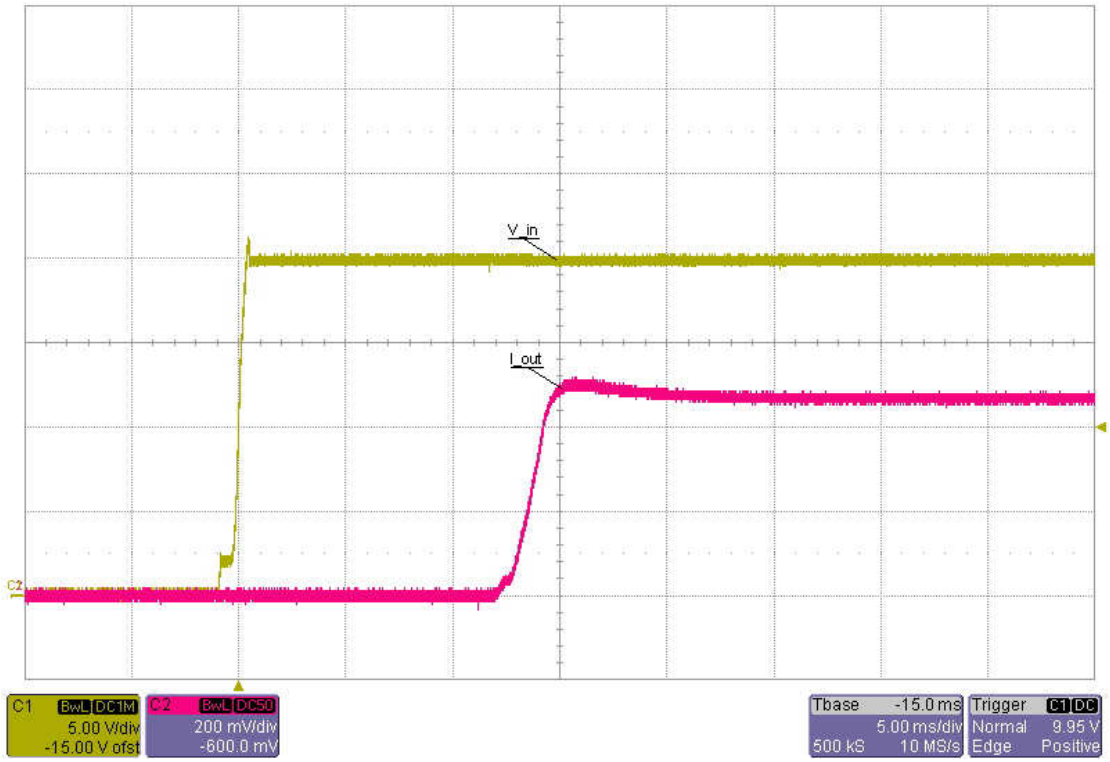


Figure 1

2 Shutdown

The shutdown waveform of a single converter is shown in Figure 2. The input voltage is set at 20.0V with 500mA @ 30V on the output.

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

Channel C2: **500mA Output current**
200mA/div, 5ms/div

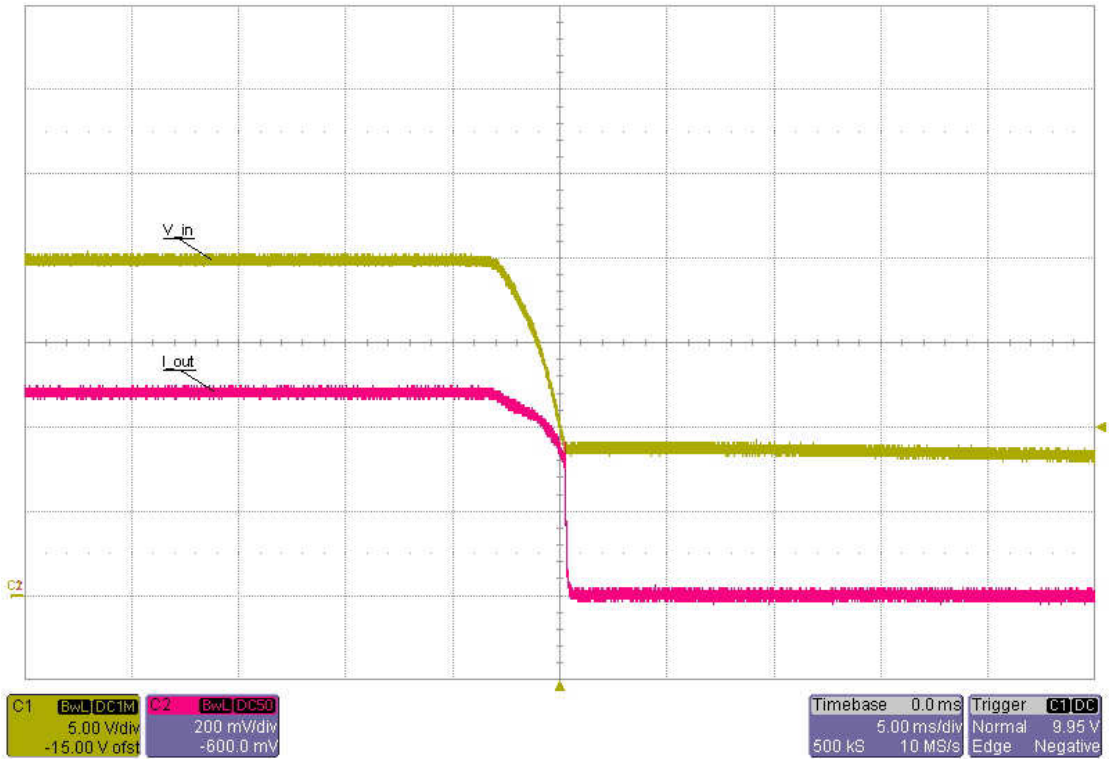


Figure 2

3 Efficiency & Load Regulation

The efficiency and load regulation of a single converter are shown in Figure 3 and Figure 4.

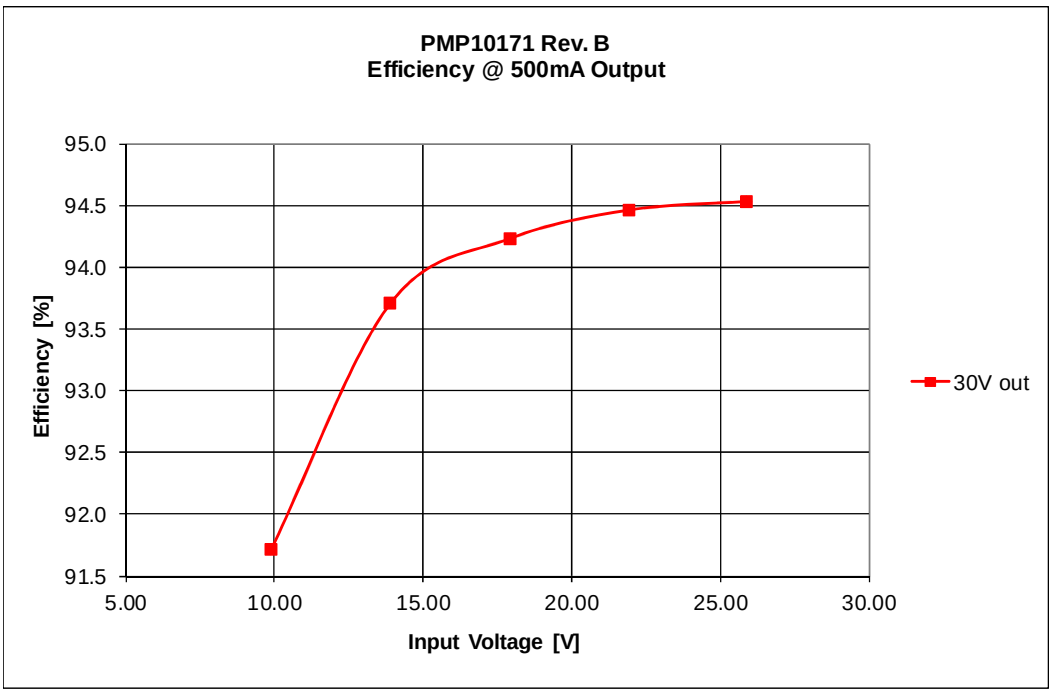


Figure 3

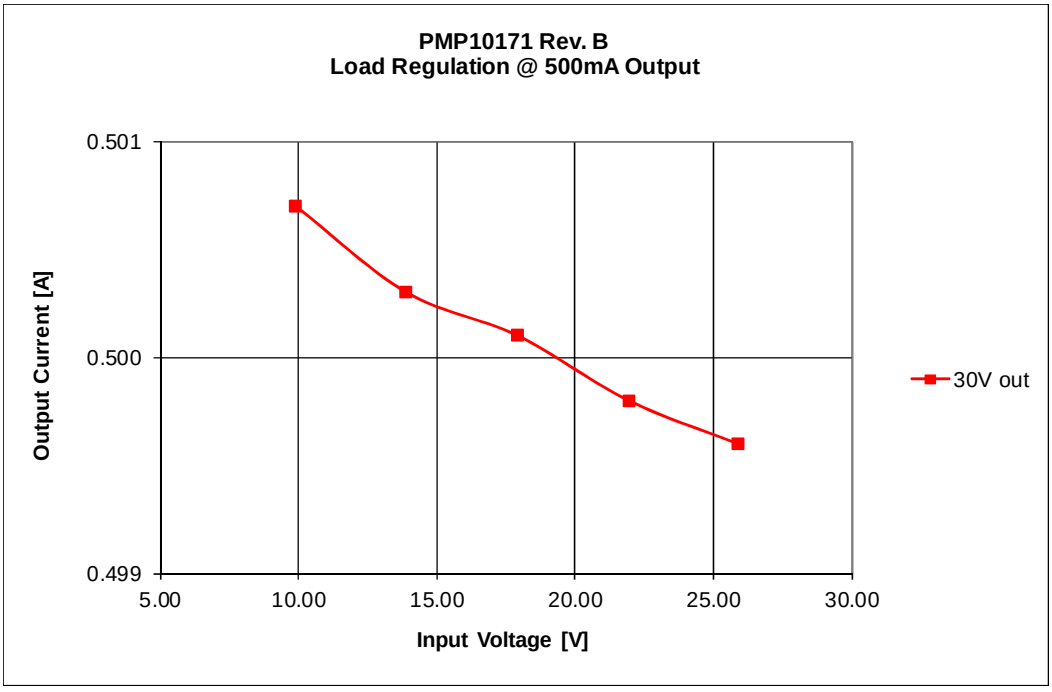


Figure 4

4 Input Ripple

The input ripple voltage for a single converter at 500mA @ 30V load is shown in Figure 5.

Channel M1: **Input voltage @ 10V input**, 30mV peak-peak (0.3%)
20mV/div, 2us/div, AC coupled

Channel M2: **Input voltage @ 24V input**, 25mV peak-peak (0.1%)
20mV/div, 2us/div, AC coupled

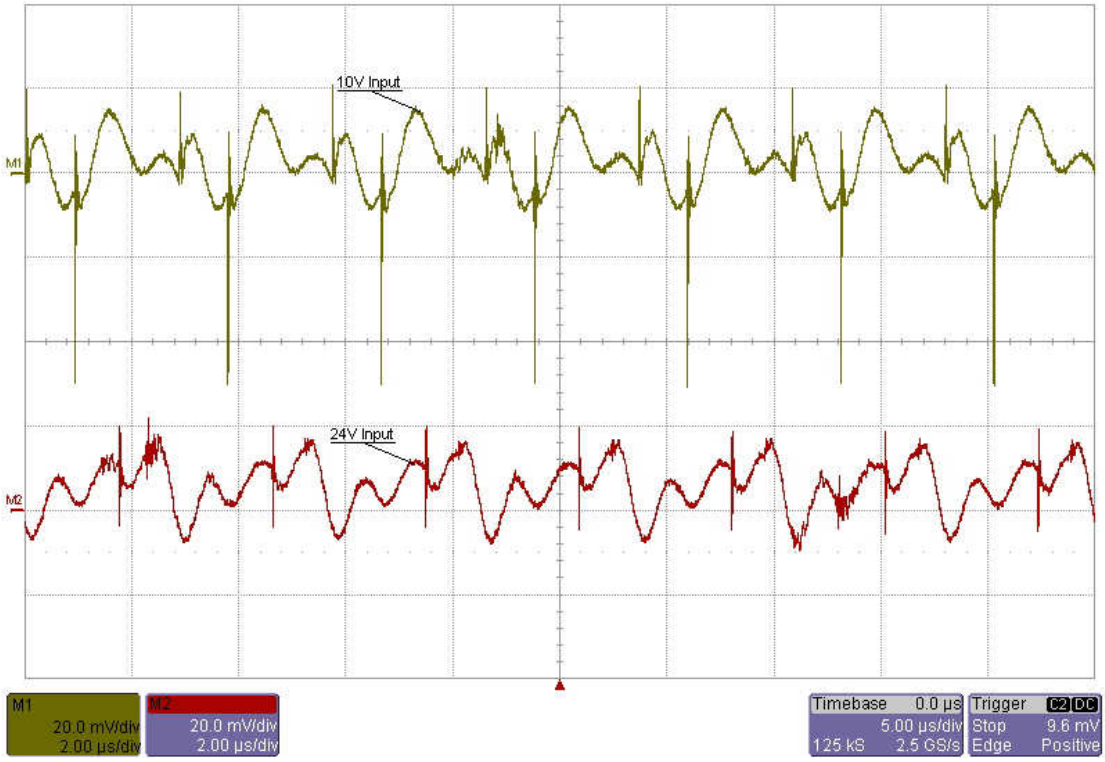


Figure 5

5 Output Ripple – Before Filter

The output ripple voltage for a single converter at 500mA @ 30V load before the post-filter is show in Figure 6.

Channel M1: **Output voltage @ 10V input**, 385mV peak-peak (1.2%)
100mV/div, 5us/div, AC coupled

Channel M2: **Output voltage @ 24V input**, 129mV peak-peak (0.4%)
100mV/div, 5us/div, AC coupled

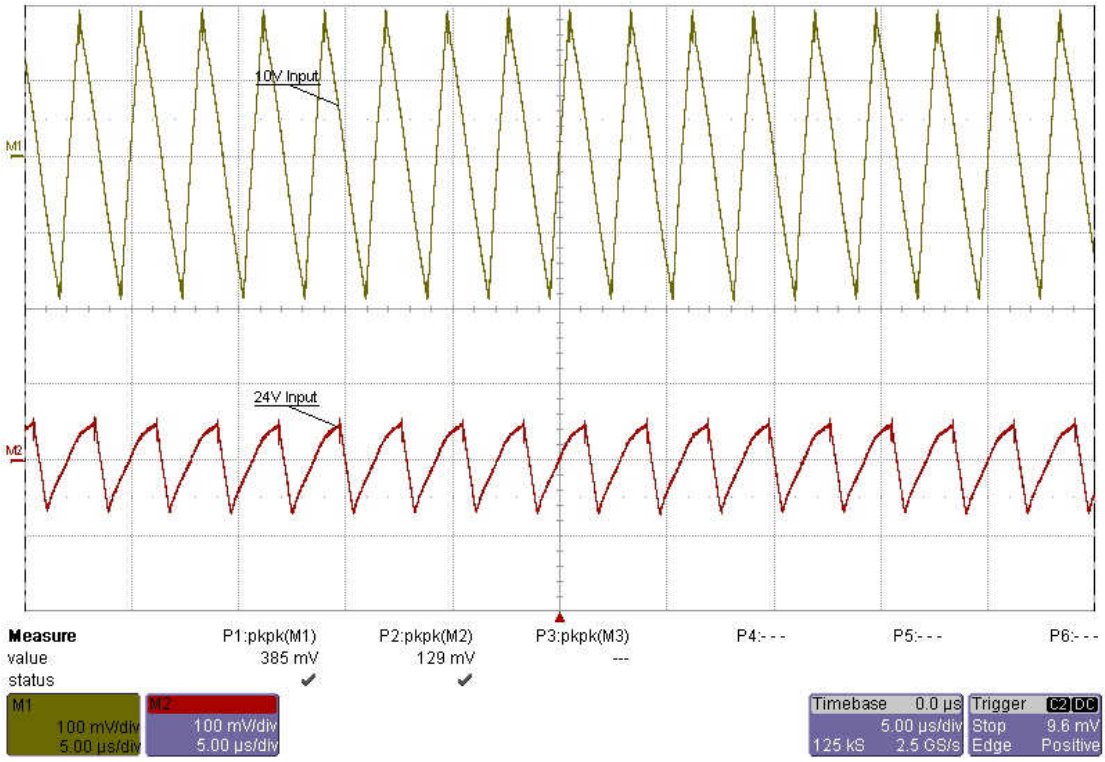


Figure 6

6 Output Ripple – After Filter

The output ripple voltage for a single converter at 500mA @ 30V load after the post-filter is show in Figure 7.

Channel M1: **Output voltage @ 10V input**, 8mV peak-peak (0.03%)
20mV/div, 5us/div, AC coupled

Channel M2: **Output voltage @ 24V input**, 5mV peak-peak (0.02%)
20mV/div, 5us/div, AC coupled

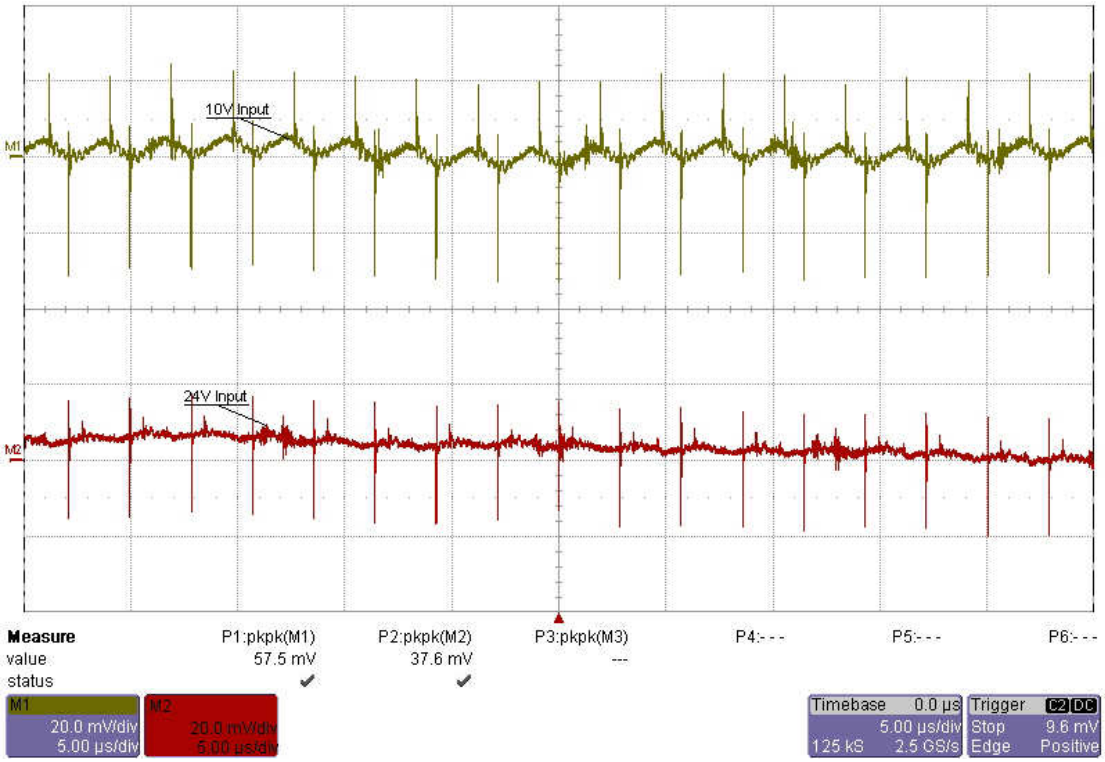


Figure 7

7 Dimming

Figure 8 shows dimming of the output current with 1 kHz and 40% duty cycle. The input voltage is set to 24V.

Channel M2: **Output current @ 24V input**
200mA/div, 500us/div, AC coupled

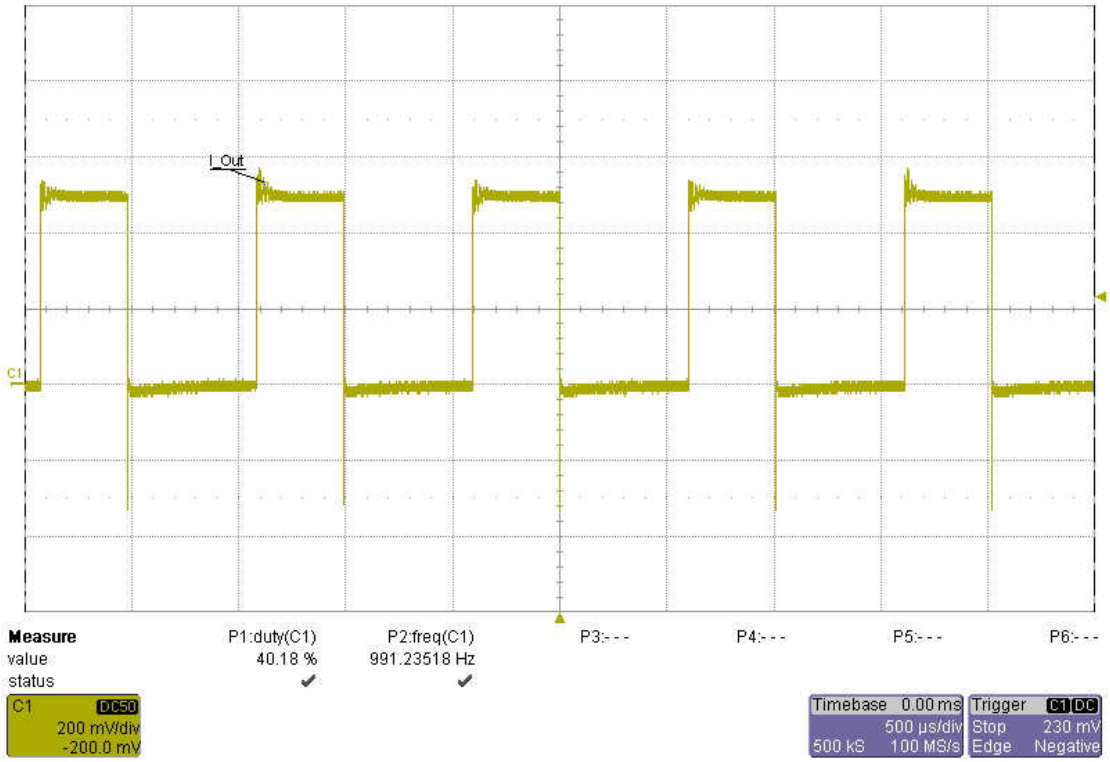


Figure 8

8 Switching Node

The drain-source voltage on the switching node is shown in Figure 9. The image was captured with 24V input and 500mA @ 30V load.

Channel C2: **Drain-source voltage**, -1.3V minimum voltage, 33.2V maximum voltage 5V/div, 2us/div

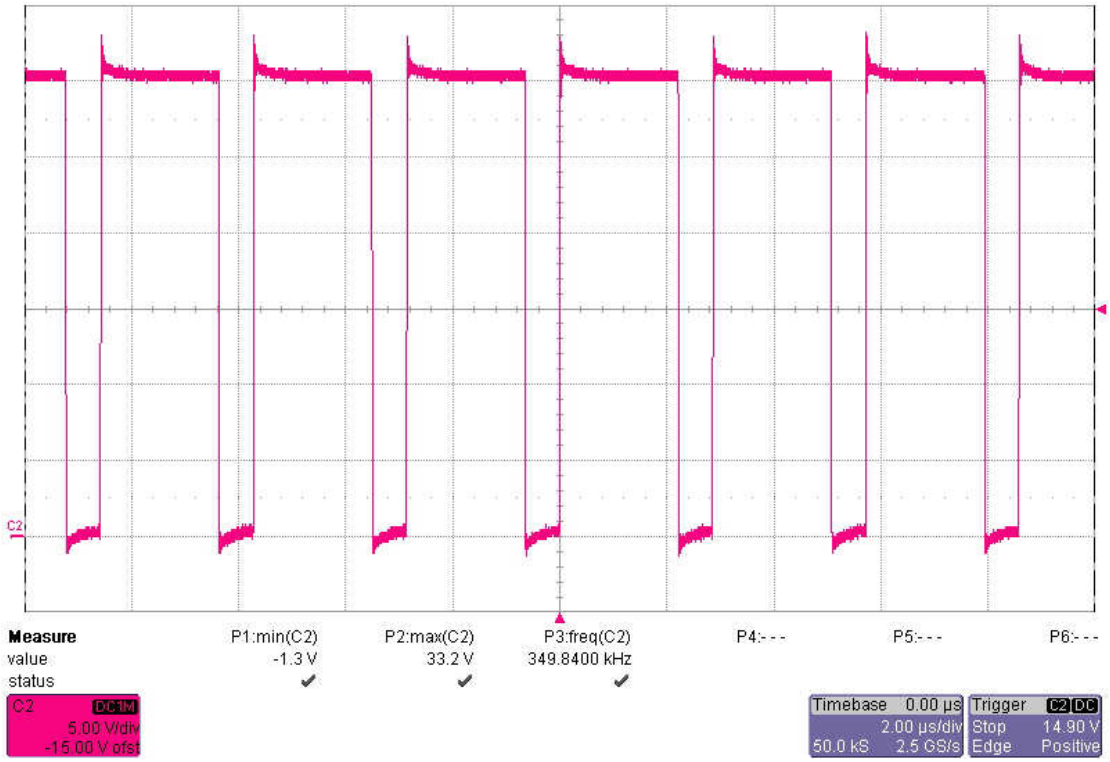


Figure 9

9 Thermal Measurement

The thermal image (Figure 10) shows the circuit at an ambient temperature of 21 °C with an input voltage of 24.0V and a load of 500mA @ 31V on each channel.

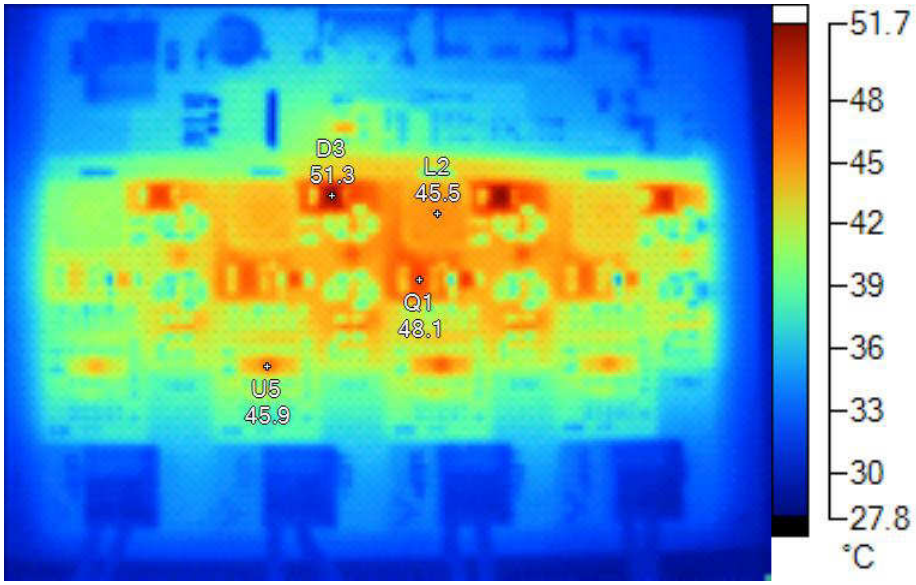


Figure 10

Markers

Label	Temperature	Emissivity	Background
U5	45.9 °C	0.95	21.0 °C
D3	51.3 °C	0.95	21.0 °C
Q1	48.1 °C	0.95	21.0 °C
L2	45.5 °C	0.95	21.0 °C

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