Isolated flyback with TPS40210

- Transformer: Payton 54621, Flyback 7.5W, 50uH primary, N=2:1/2:1.25 (5V/12V)
- 6.0 … 16.0V input voltage
- 5V @ 250mA regulated, 12V @ 500mA (coupled)
- Built on PMP4670RevB

1 Startup

The startup waveform is shown in Figure 1. The input voltage is set at 16.0V, with small loads on the outputs (20%: 50mA on 5.0V output / 100mA on 12.0V output).

Channel C1: **input voltage, +16.0V**
5V/div, 5ms/div

Channel C2: **output voltage, +5.0V**
5V/div, 5ms/div

Channel C3: **output voltage, +12.0V**
5V/div, 5ms/div

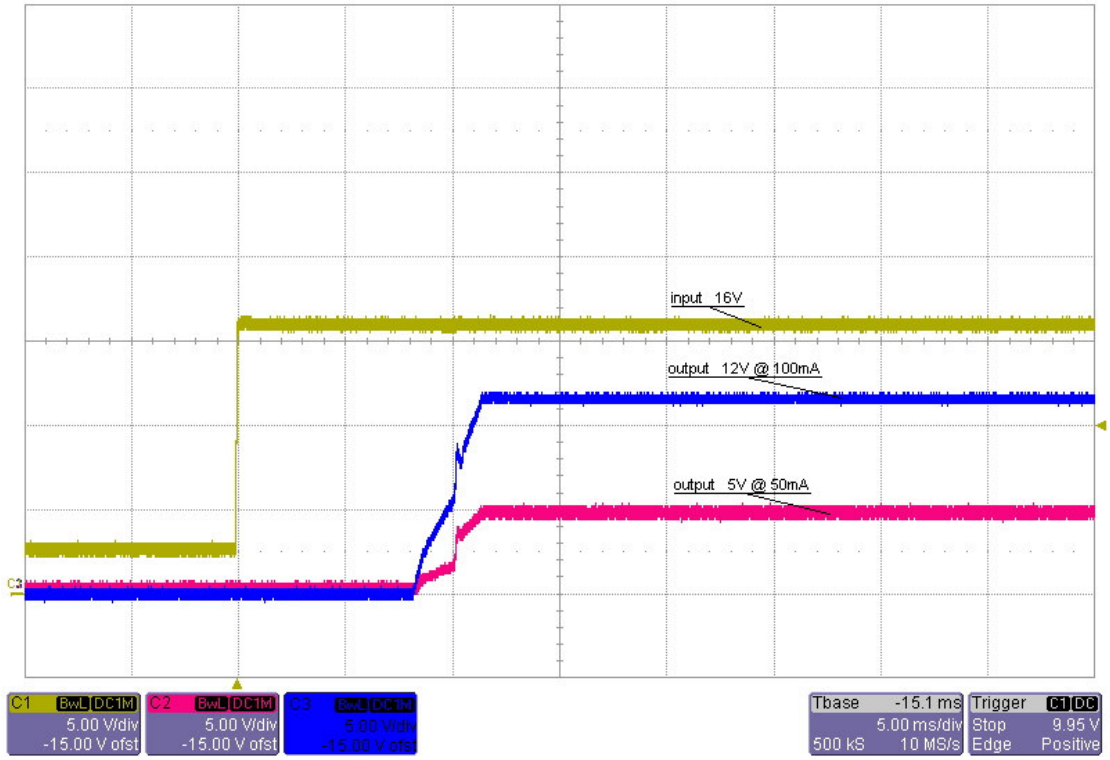

Figure 1

2 Shutdown

The shutdown waveforms are shown in Figure 2. The input voltage is set at 12.0V with a 15.0A load on each output.

Channel C1: **input voltage, +16V**
2V/div, 500us/div

Channel C2: **output voltage, +5V**
2V/div, 500us/div

Channel C3: **output voltage, +12V**
2V/div, 500us/div

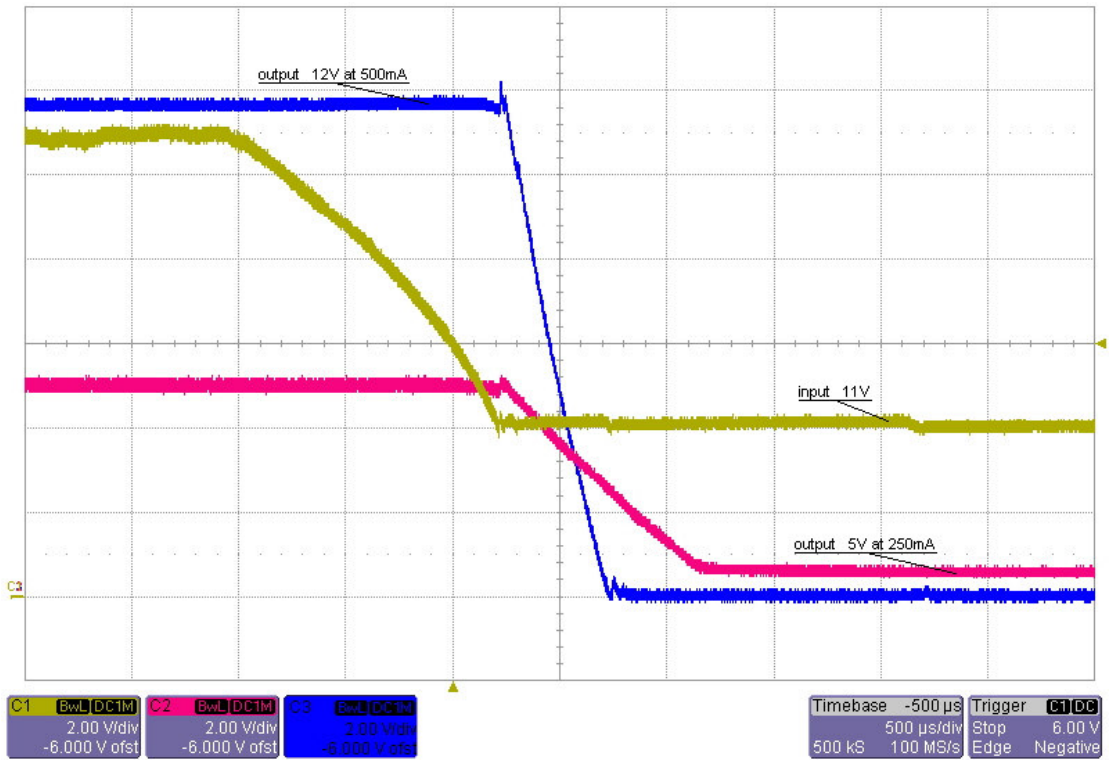

Figure 2

3 Efficiency

The efficiency of the whole converter is shown in Figure 3.

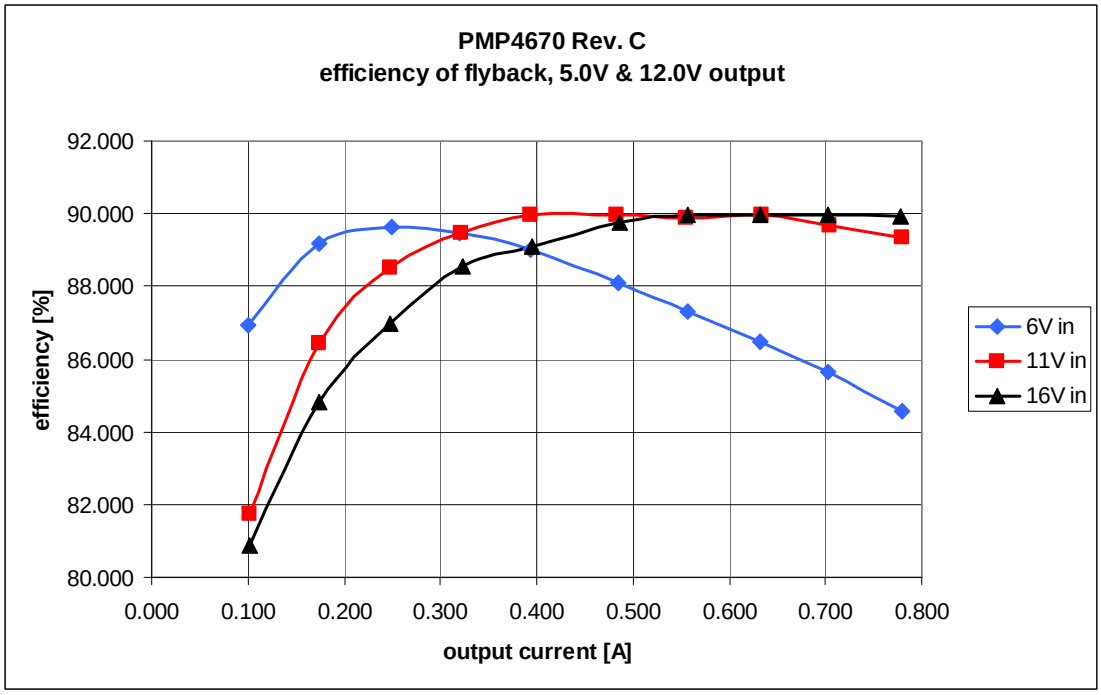

Figure 3

4 Load and cross regulation

The load regulation of both outputs is shown in Figure 4.
The cross regulation is shown in the table below.

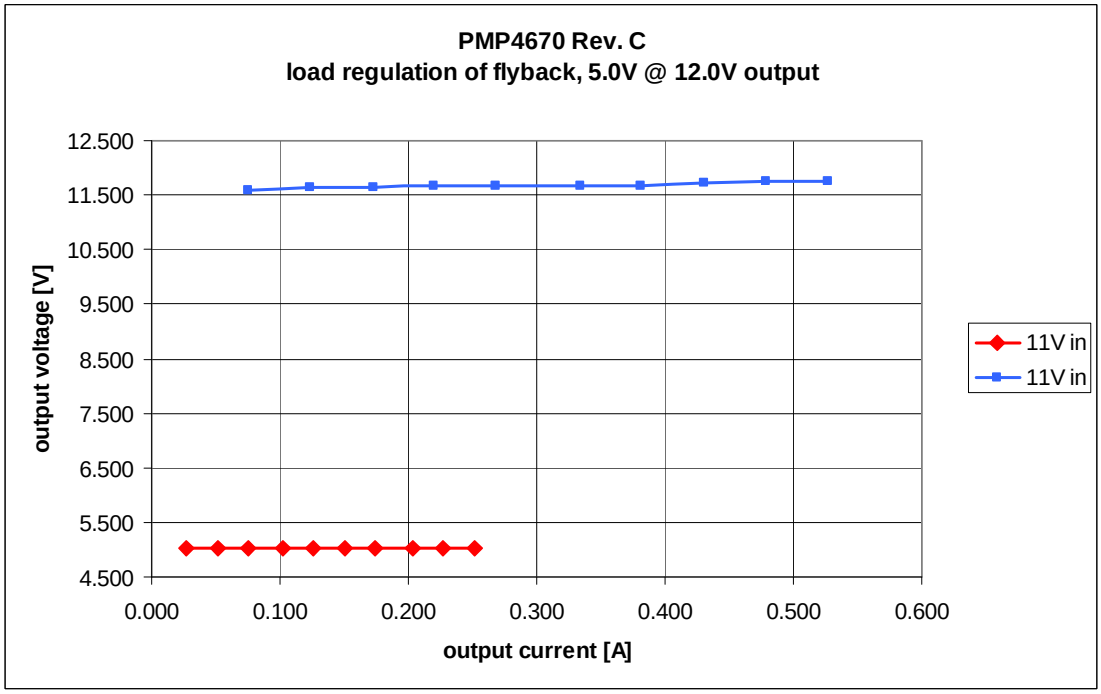

Figure 4

cross regulation		5V			
		10 mA	50 mA	100 mA	250 mA
12V	10 mA	5.021	5.021	5.02	5.02
		11.66	11.79	11.89	12.07
	100 mA	5.02	5.02	5.02	5.02
		11.53	11.63	11.72	11.89
	200 mA	5.02	5.02	5.02	5.02
		11.48	11.58	11.66	11.83
	500mA	5.019	5.019	5.019	5.019
		11.35	11.46	11.54	11.72

5 Output ripple voltage

The output ripple voltage of the **+5.0V** output is shown in Figure 5.

Chanel M1: **6.0V input voltage**, 28mV peak-peak
20mV/div, 5us/div, AC coupled

Chanel M2: **11.0V input voltage**, 26mV peak-peak
20mV/div, 5us/div, AC coupled

Channel M3: **16.0V input voltage**, 22mV peak-peak
20mV/div, 5us/div, AC coupled

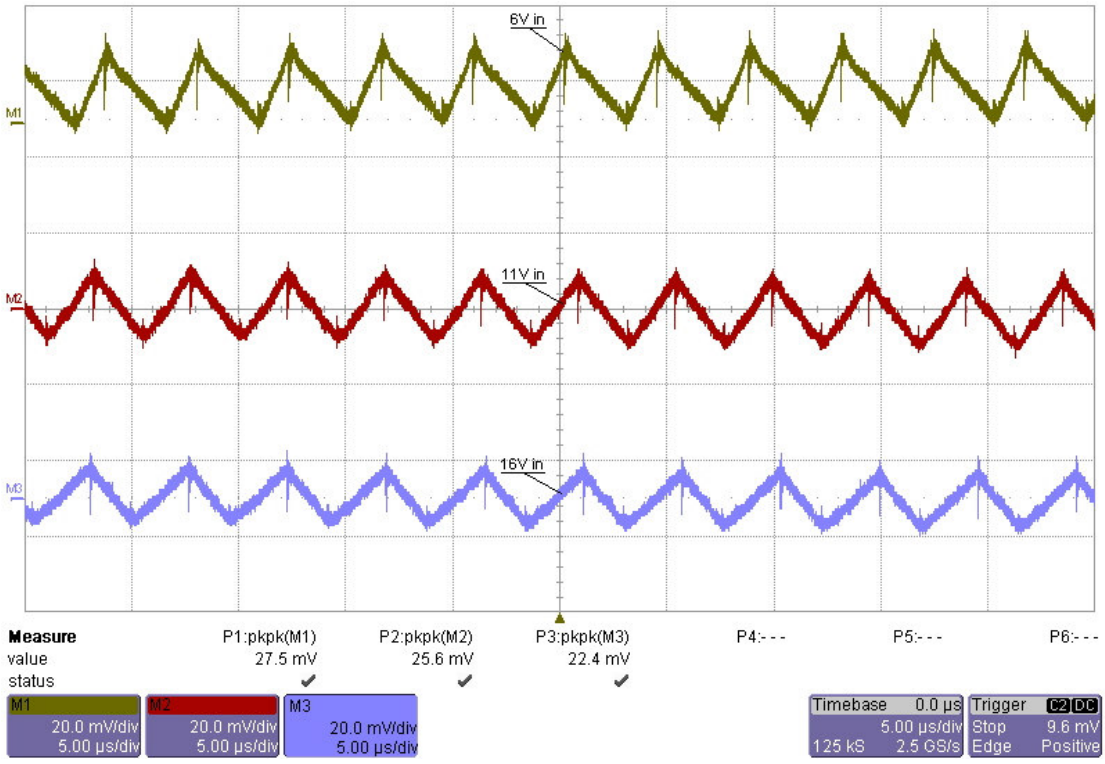

Figure 5

The output ripple voltage of the **+12.0V** output is shown in Figure 6.

Chanel M1: **6.0V input voltage**, 46mV peak-peak
20mV/div, 5us/div, AC coupled

Chanel M2: **11.0V input voltage**, 40mV peak-peak
20mV/div, 5us/div, AC coupled

Channel M3: **16.0V input voltage**, 47mV peak-peak
20mV/div, 5us/div, AC coupled

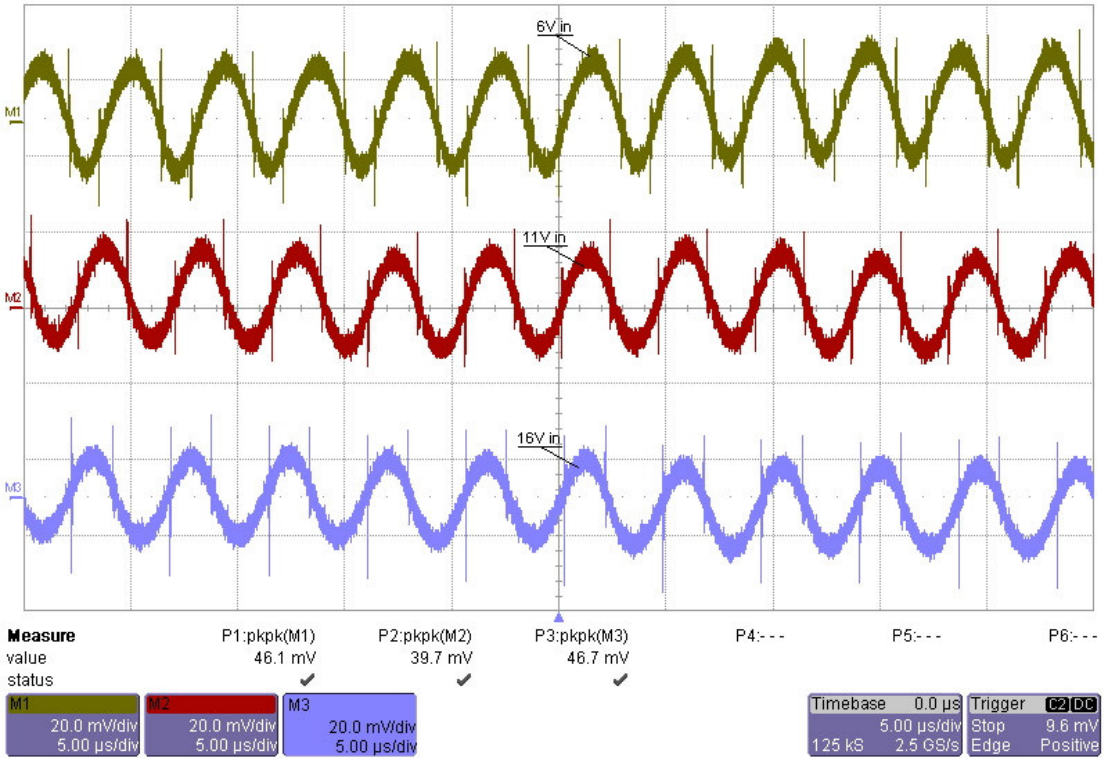

Figure 6

6 Load transients

The response to a load step and a load dump of the +5.0V output at an input voltage of 11.0V is shown in Figure 7.

Channel C2: **output voltage**, -139mV undershoot, 130mV overshoot
100mV/div, 10ms/div, AC coupled

Channel C1: **load current**, load step 150mA to 250mA and vice versa
200mA/div, 10ms/div

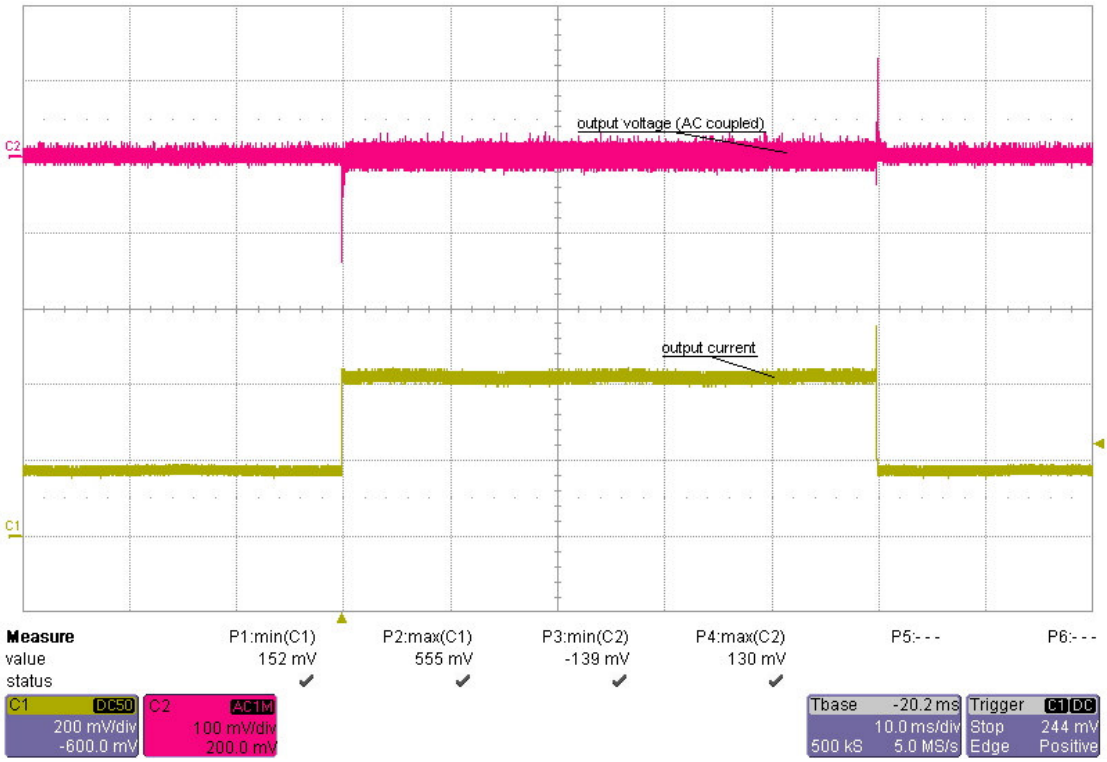

Figure 7

The response to a load step and a load dump of the +12.0V output at an input voltage of 11.0V is shown in Figure 8.

Channel C2: **output voltage**, -472mV undershoot, 472mV overshoot
500mV/div, 1ms/div, AC coupled

Channel C1: **load current**, load step 250mA to 500mA and vice versa
200mA/div, 1ms/div

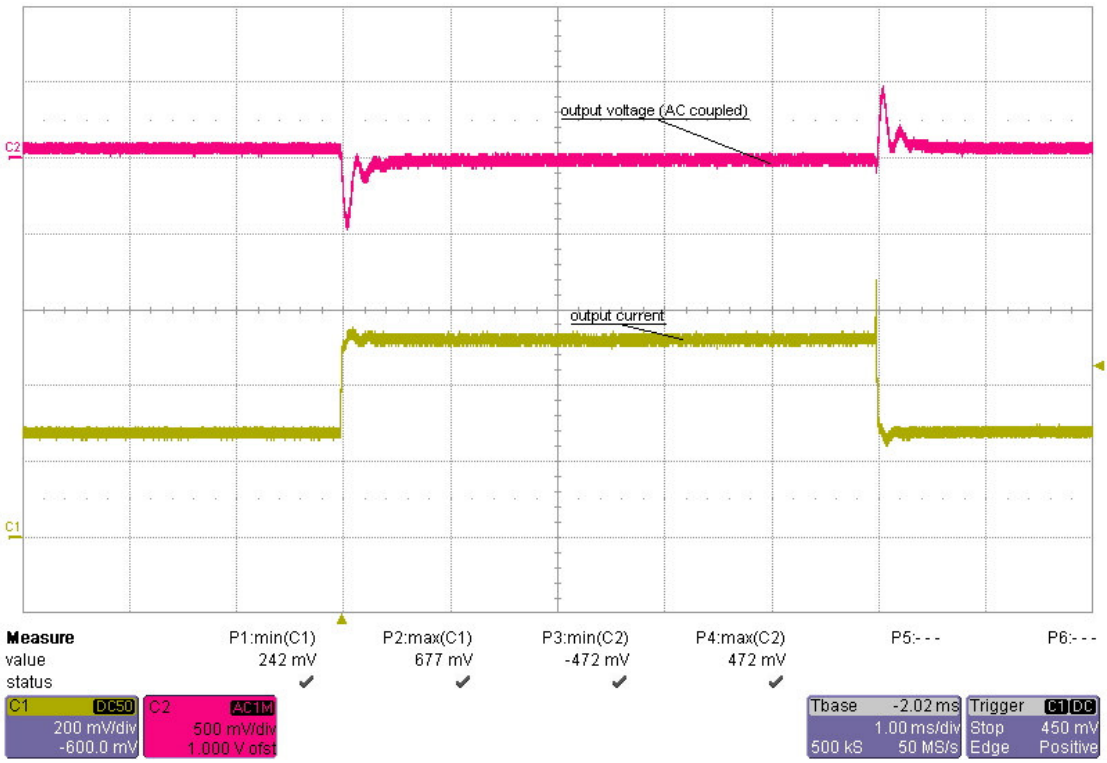

Figure 8

7 Frequency response

Figure 9 shows the loop response with 6.0, 11.0 and 16.0V input and full load on each output (5V @ 250mA, 12V 500mA).

77 … 83 deg phase margin @ crossover frequency 860 Hz

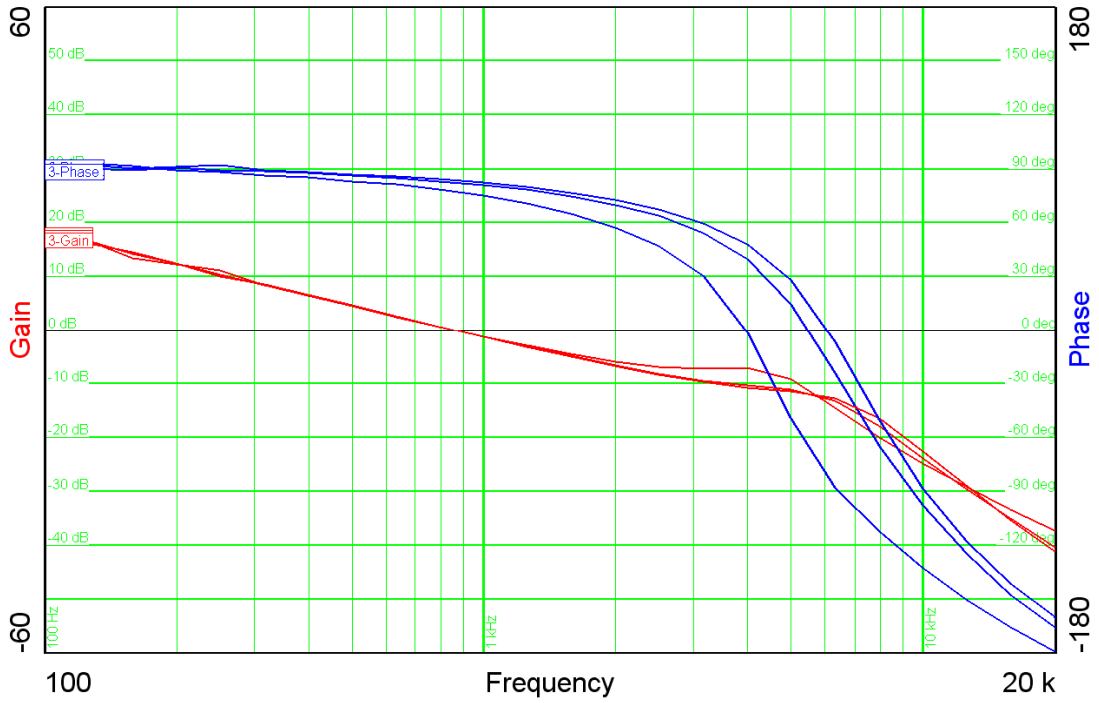

Figure 9

8 Miscellaneous waveforms

The voltage on the switch node is shown in Figure 10. The image was captured with a 16.0V input and full load on each output (5V @ 250mA, 12V 500mA).

Channel C2: **switch node voltage**, -1.4V minimum voltage, 38.6V maximum voltage 10V/div, 2us/div

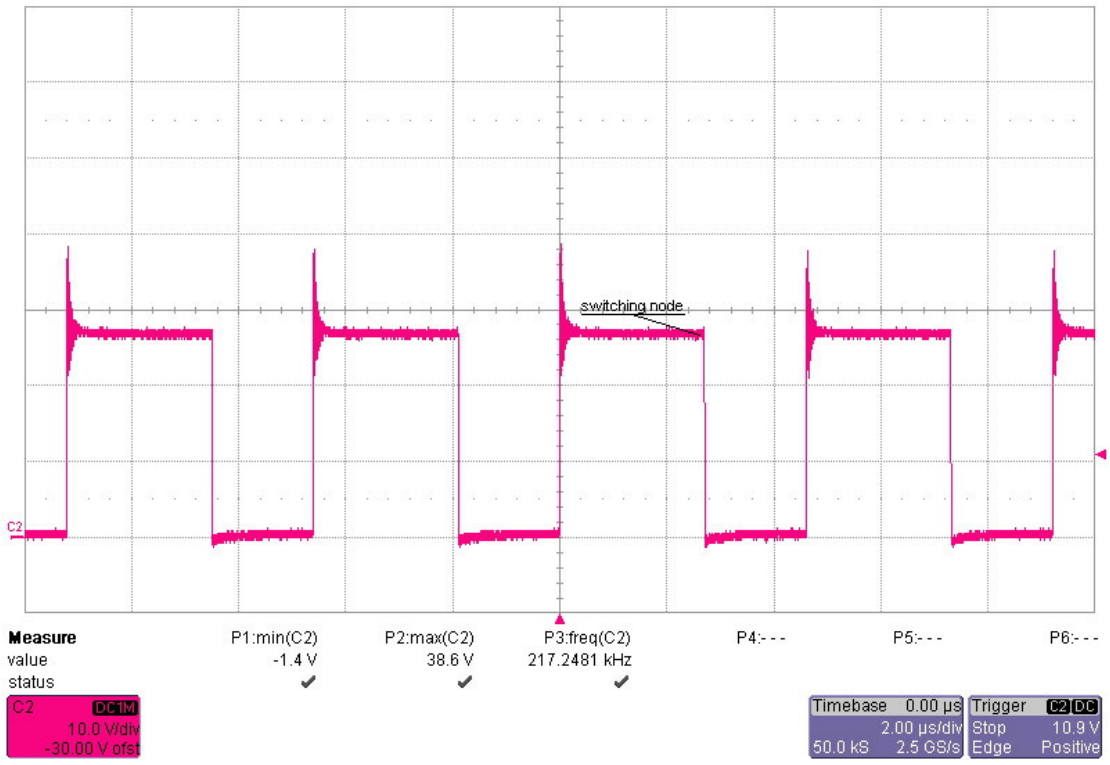

Figure 10

9 Thermal measurement

The thermal image (Figure 11) shows the circuit at an ambient temperature of 21 °C with an input voltage of 12.0V and full load on each output (5V @ 250mA, 12V 500mA).

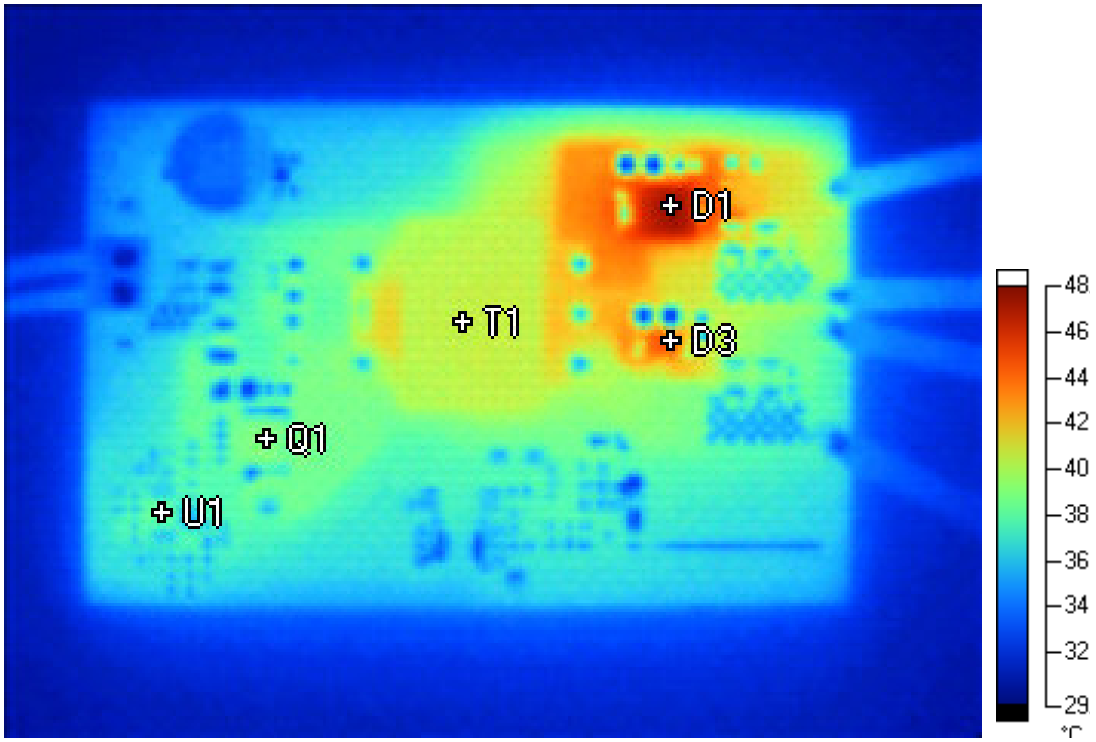

Figure 11

device	max. temperature	measured temp. @ 21 °C
U1	125 °C	38.5
Q1	150 °C	38.9
T1	125 °C	40.5
D1	150 °C	47.6
D3	150 °C	44.4

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