

Isolated Dual Output Flyback Without Optocoupler (TPS40210)

- Input voltage range: +18..28V (+23V nominal)
- Output voltage: +6.2V @ 1.0A, +12.0V @ 0.6A
- Transformer: Kaschke SP-E 20/6 064003-a
- Built on PMP7024 Rev.C

1 Startup

The startup waveform is shown in Figure 1. The input voltage is set at 23.0V, with no load on the outputs.

- Channel C1: **Input voltage**
5V/div, 20ms/div
- Channel C2: **Output voltage 1, +6.2V rail**
2V/div, 20ms/div
- Channel C3: **Output voltage 2, +12.0V rail**
5V/div, 20ms/div

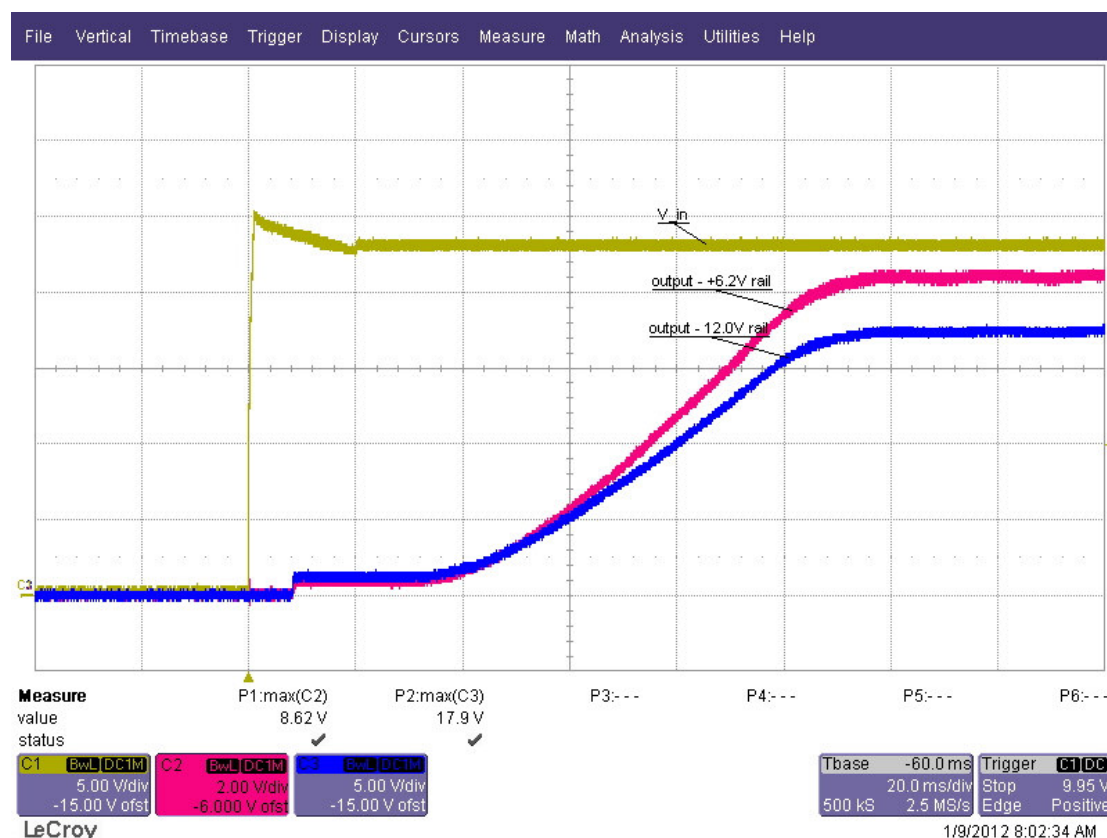


Figure 1

2 Shutdown

The shutdown waveforms are shown in Figure 2. The input voltage is set at 23.0V with a 1.0A load on the +6.2V output and a 0.6A load on the +12.0V output.

- Channel C1: **Input voltage**
5V/div, 1ms/div
- Channel C2: **Output voltage 1, +6.2V rail**
2V/div, 1ms/div
- Channel C3: **Output voltage 2, +12.0V rail**
5V/div, 1ms/div

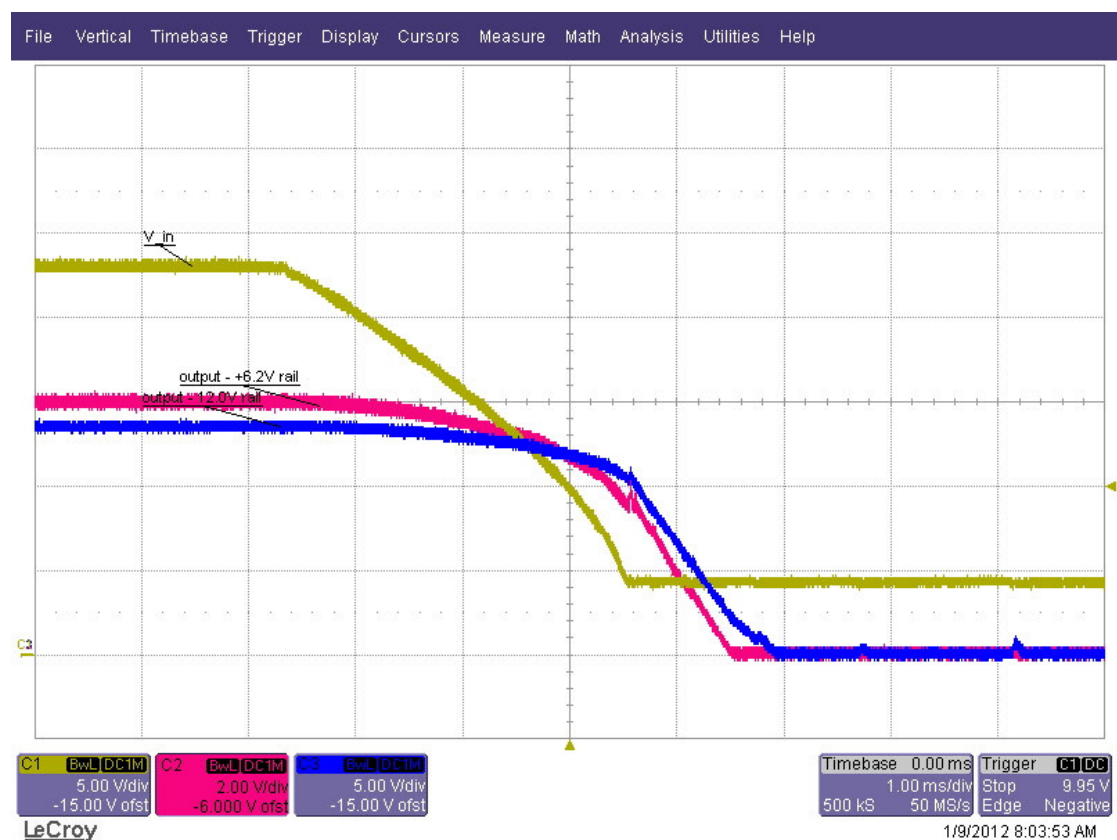


Figure 2

3 Efficiency

The efficiency of the whole converter (+6.2V & +12.0V output) is shown in Figure 3. Both outputs have the same load in percentage on each measurement point.

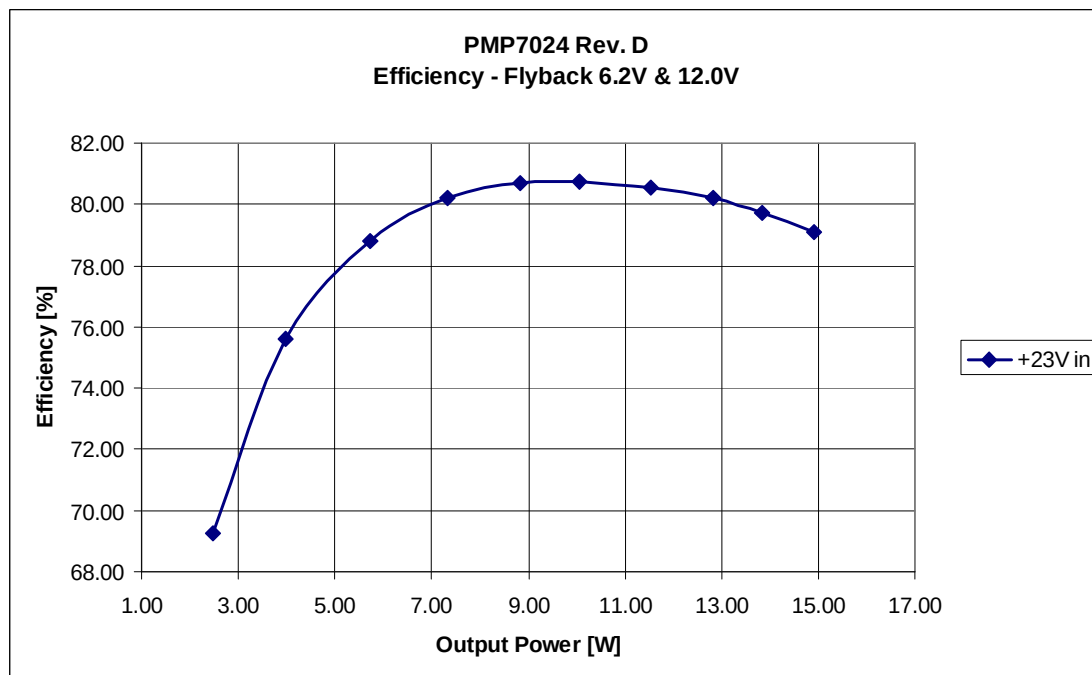


Figure 3

4 Load regulation

The load regulation of both outputs is shown in Figure 4.

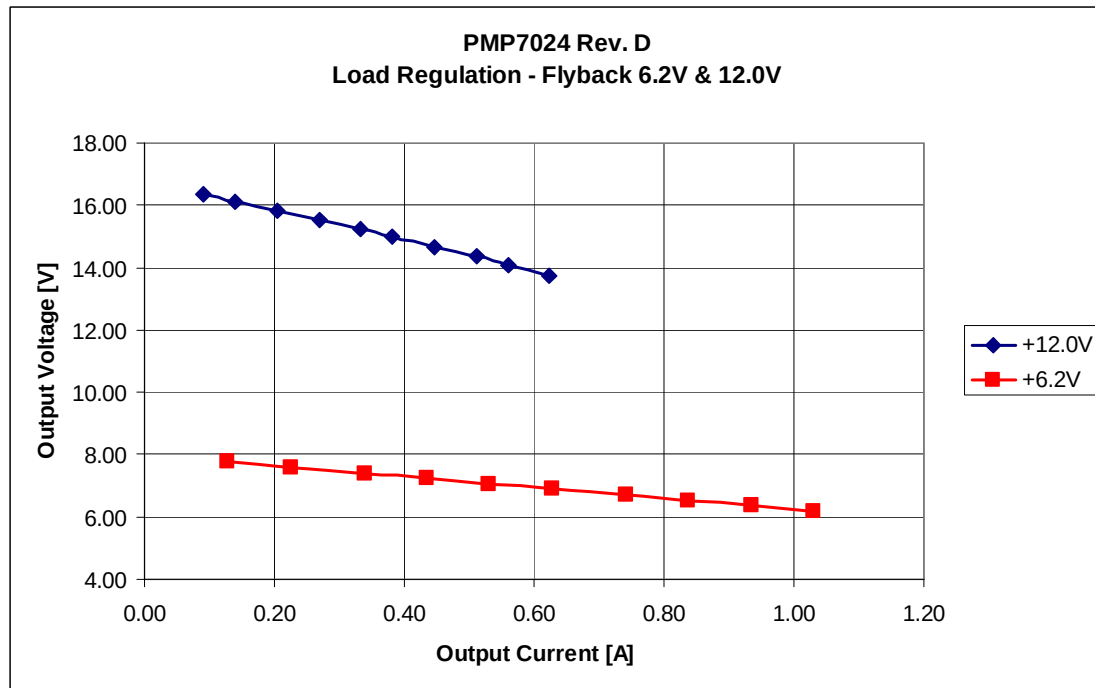


Figure 4

5 Output ripple voltage

The output ripple voltage of the two outputs at maximum load (1.0A @ +6.2V and 0.6A @ +12.0V) is shown in Figure 5.

Channel C2 @ +6.2V: **Output voltage**, 103mV peak-peak
20mV/div, 5 μ s/div, AC coupled

Channel C2 @ +12.0V: **Output voltage**, 176mV peak-peak
50mV/div, 5 μ s/div, AC coupled

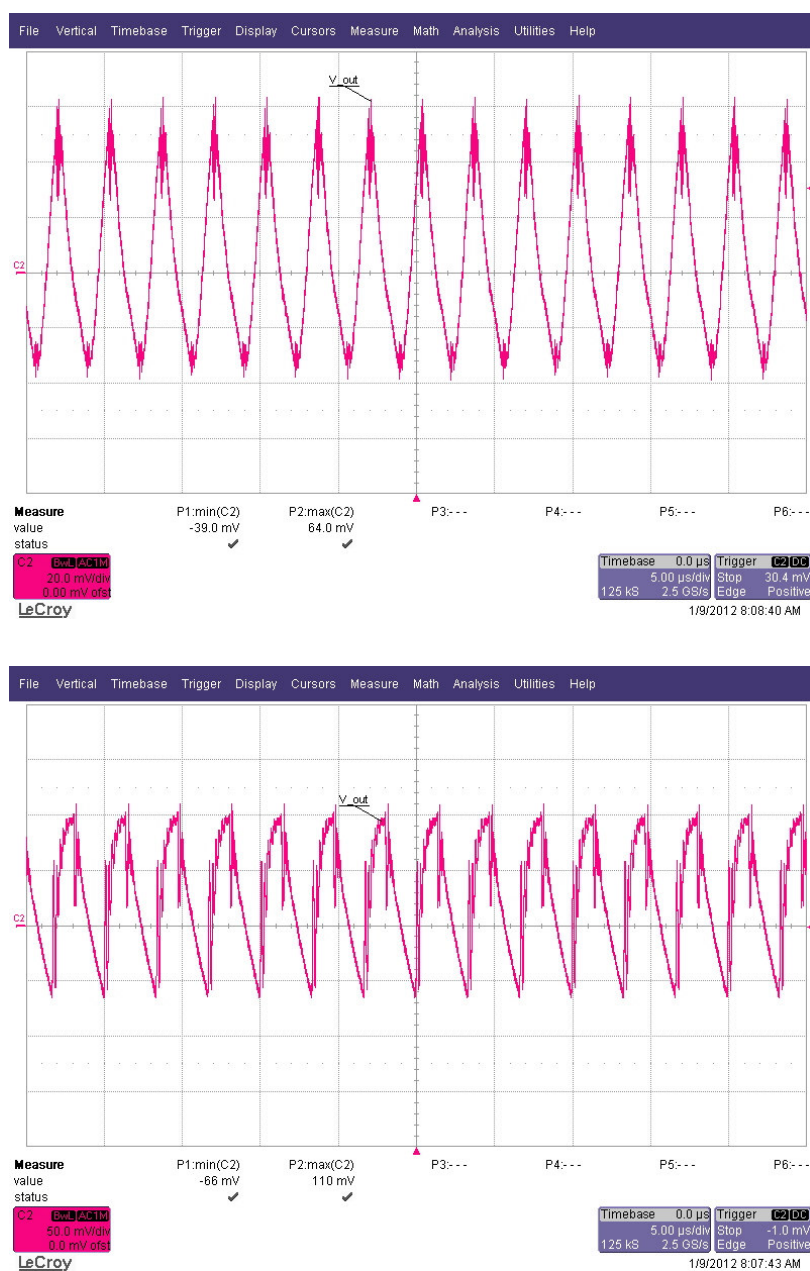


Figure 5

6 Load transients

The response to a load step and a load dump of the +6.2V output at an input voltage of 23.0V is shown in Figure 6.

Channel C2: **Output voltage**, -240mV undershoot, 253mV overshoot
200mV/div, 1ms/div, AC coupled

Channel C1: **Load current**, load step 0.5A to 1.0A
500mA/div, 1ms/div

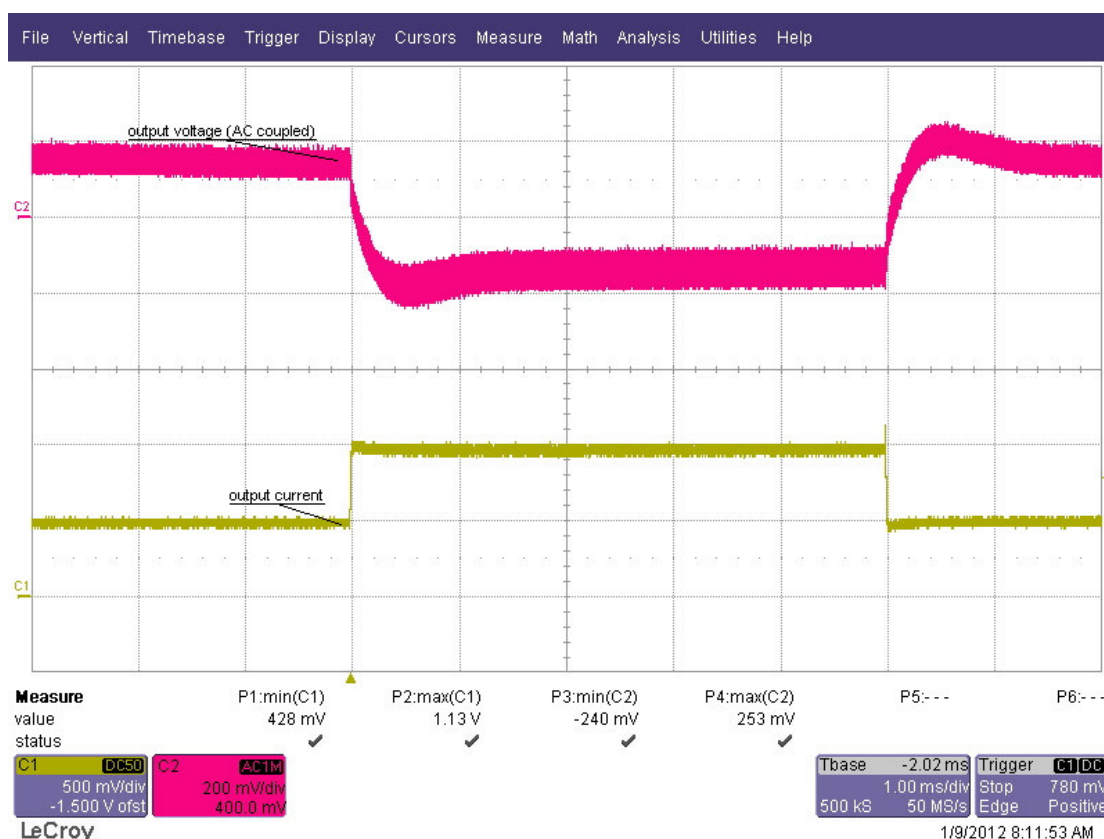


Figure 6

The response to a load step and a load dump of the +12.0V output at an input voltage of 23.0V is shown in Figure 7.

Channel C2: **Output voltage**, -408mV undershoot, 488mV overshoot
500mV/div, 1ms/div, AC coupled

Channel C1: **Load current**, load step 0.3A to 0.6A
200mA/div, 1ms/div

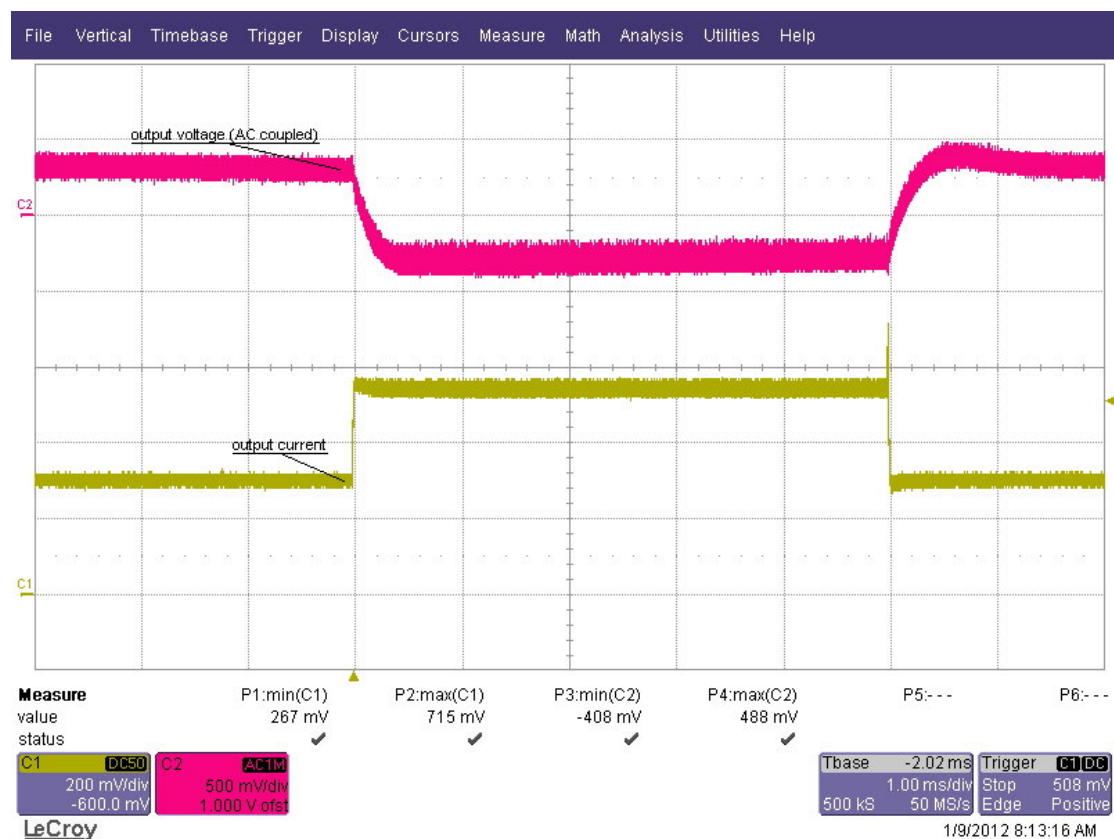


Figure 7

7 Frequency response

Figure 8 shows the loop response with 18.0V input and maximum load on each output.

- 66 deg phase margin @ crossover frequency 1.4 kHz
- -28 dB gain margin @ 30.5 kHz

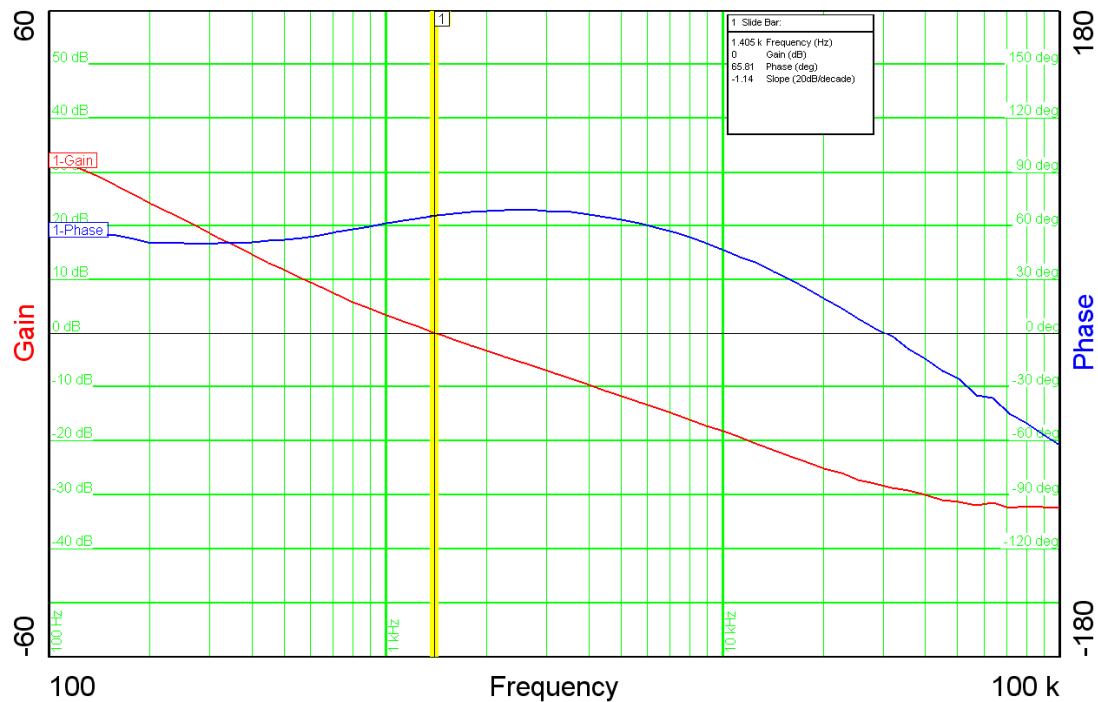


Figure 8

8 Switching node

The voltage on the switching node is shown in Figure 9. The image was captured with a 28.0V input and maximum load on each output

Channel C2: **Switching node**, -4.0V minimum voltage, 118.9V maximum voltage
20V/div, 1us/div

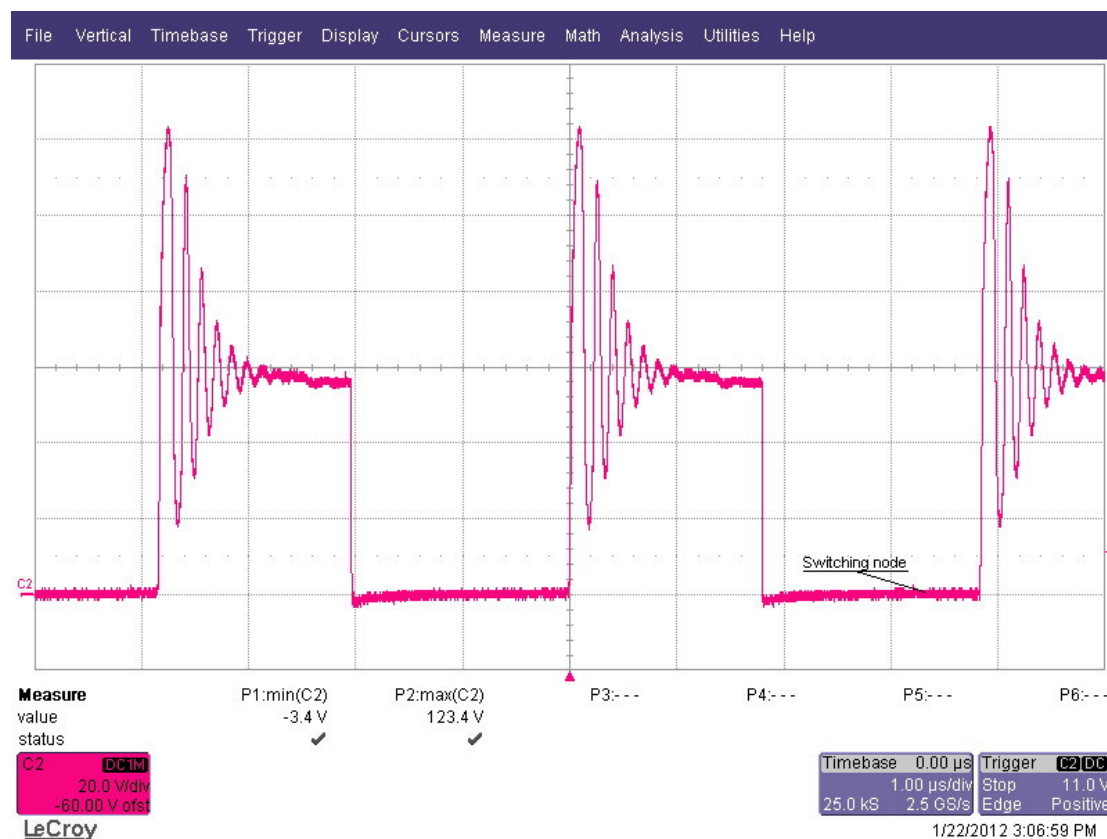


Figure 9

9 Thermal measurement

The thermal image (Figure 10) shows the circuit at an ambient temperature of 21 °C with an input voltage of 23.0V and maximum load on each output.

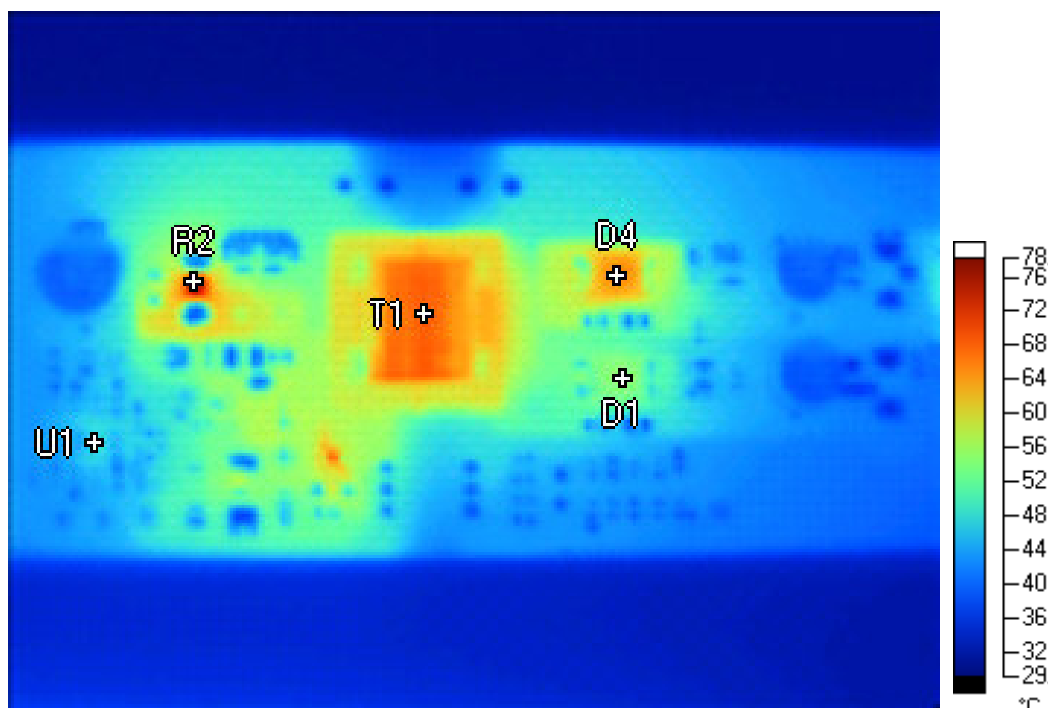


Figure 10

Markers

Label	Temperature	Emissivity	Background
D4	65.4 °C	0.95	21.0 °C
D1	54.7 °C	0.95	21.0 °C
T1	68.4 °C	0.95	21.0 °C
R2	74.6 °C	0.95	21.0 °C
U1	47.6 °C	0.95	21.0 °C

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