

1 Startup

The startup waveform with input voltages $V_{IN} = 20V$, $V_{IN} = 24V$, $V_{IN} = 28V$ for $V_{OUT} = 5V$ is shown in Figure 1 to [Error! Reference source not found.3](#). Channel 1 represents the output voltage, channel 2 the input voltage. It is important to switch on the converter with a ramping supply voltage because of the high input voltages which can damage the converter due to possible overshoots.

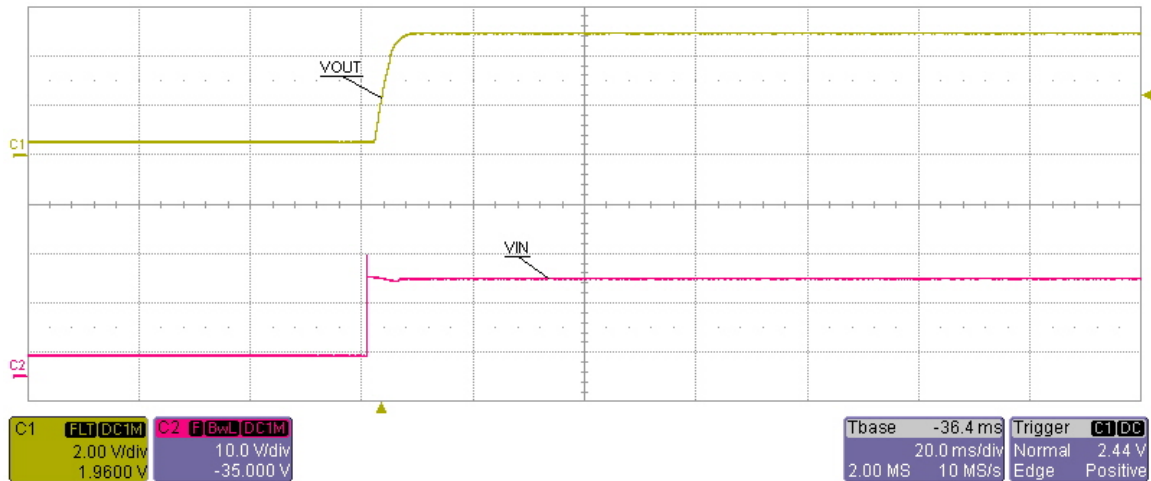


Figure 1: $V_{IN} = 20V$, $V_{OUT} = 5V$

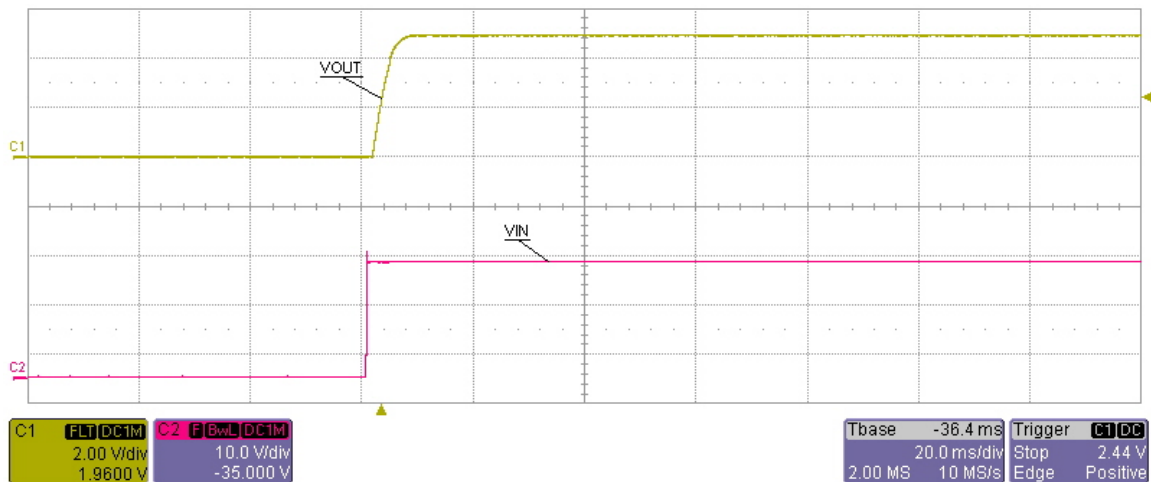


Figure 2: $V_{IN} = 24V$, $V_{OUT} = 5V$

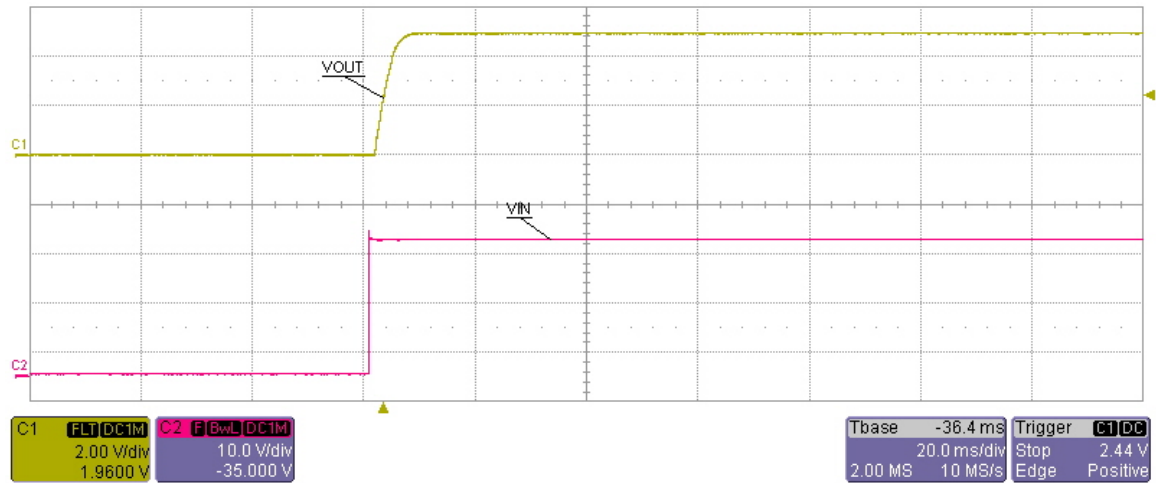


Figure 3: VIN = 28V, VOUT = 5V

2 Shutdown

The shutdown waveforms with input voltages VIN = 20V, VIN = 24V and VIN = 28V for VOUT = 5V is shown in Figure 44 to [Error! Reference source not found.6](#). Channel 1 represents the output voltage, channel 2 the input voltage. For switching of, the cable was just plugged of the power supply.

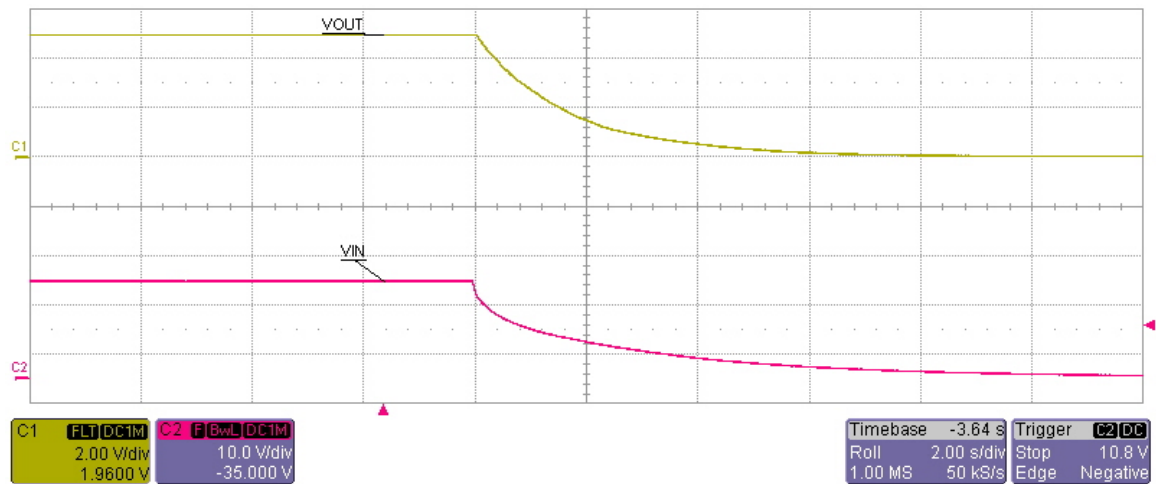
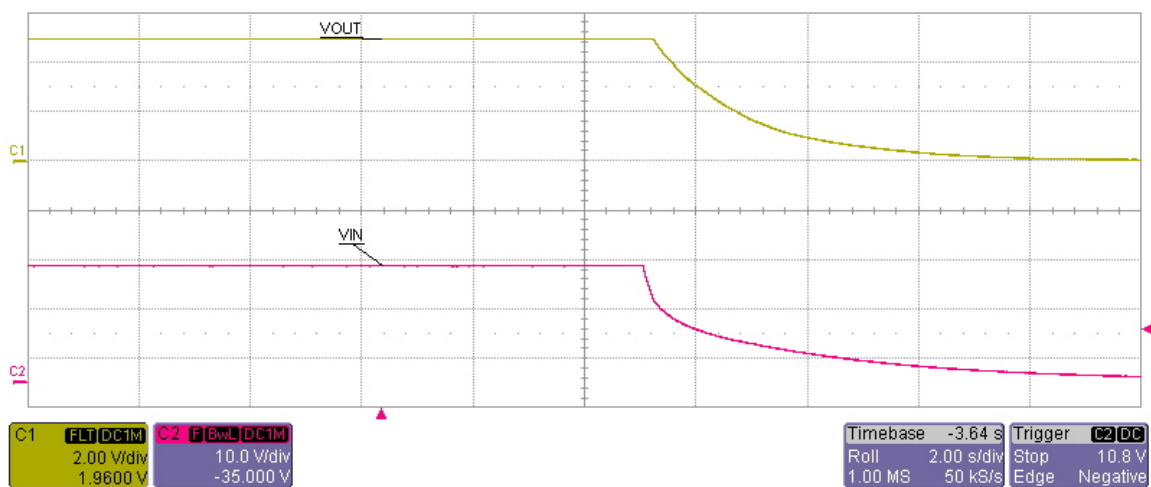
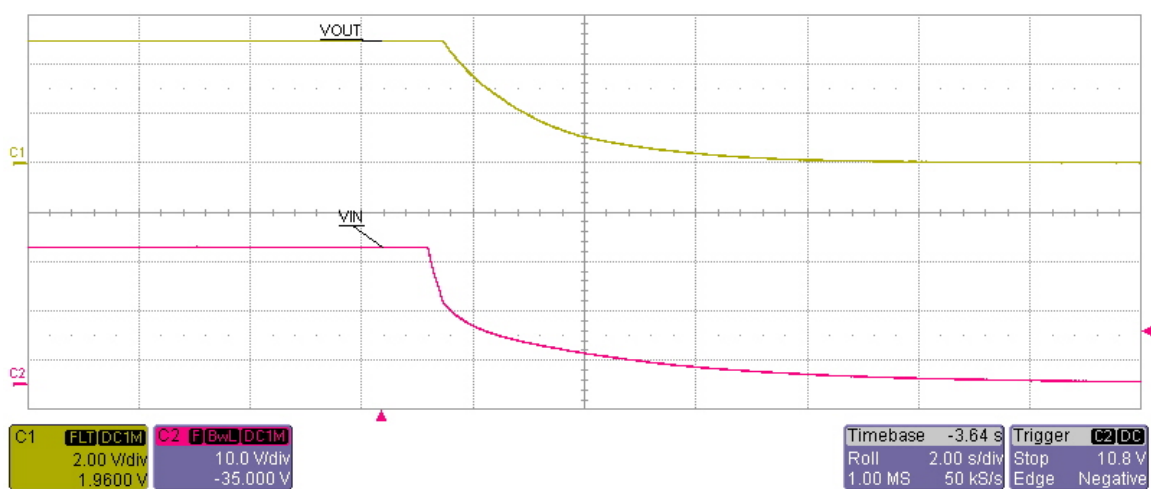


Figure 4: VIN = 20V, VOUT = 5V

**Figure 5: VIN = 24V, VOUT = 5V****Figure 6: VIN = 28V, VOUT = 5V**

3 Efficiency

The converter efficiency for different input voltages is shown in [Figure 7](#).

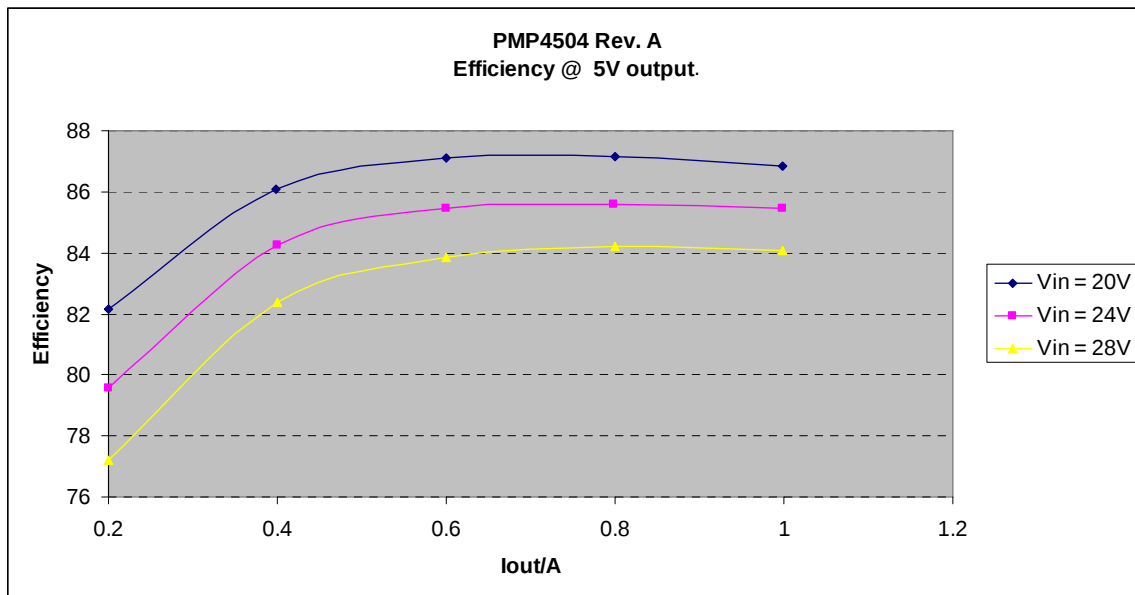


Figure 7: Converter efficiency @ Vout = 5V

4 Load regulation

The voltage regulation curve dependent on the input voltages is shown in [Figure 8](#).

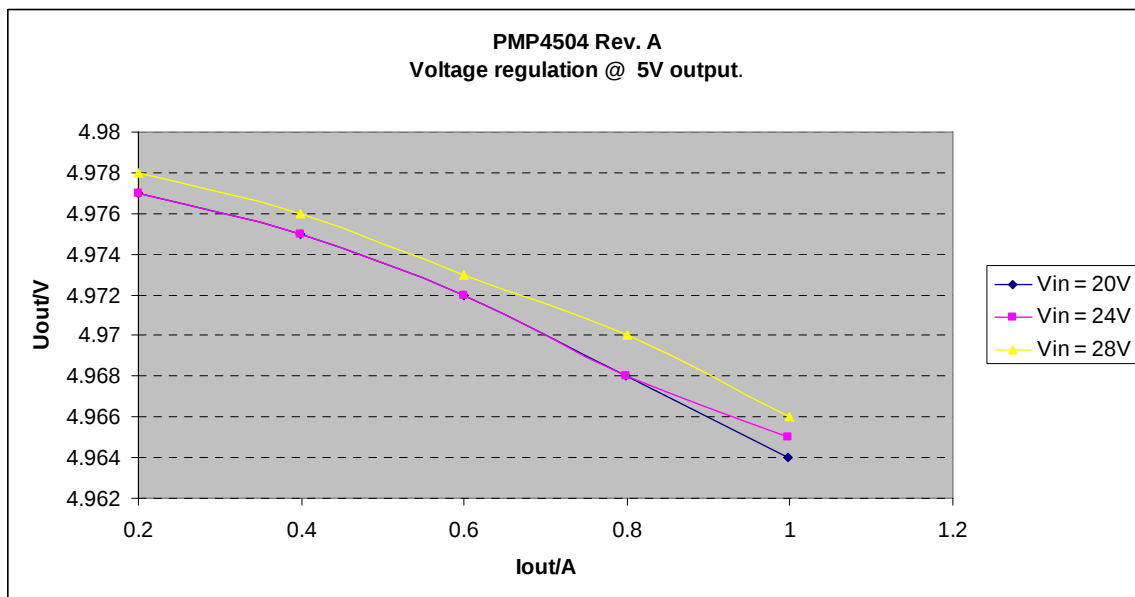


Figure 8: Load regulation @ VOUT = 5V

5 Output and Input Ripple Voltage

The output and input ripple voltage is shown in [Figure 9](#) to [Error! Reference source not found.0](#). The output is loaded with 1 A.

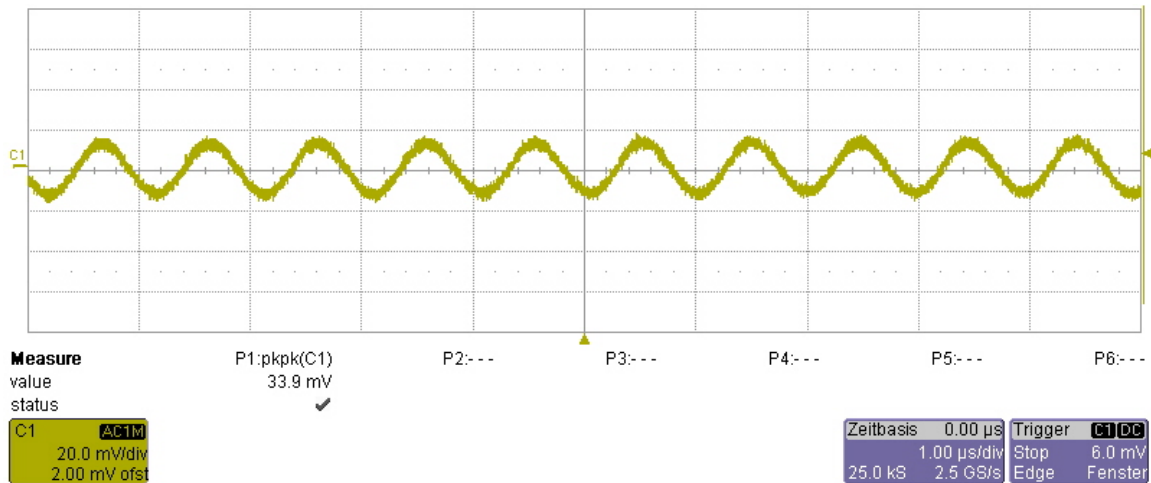


Figure 9: VIN = 20V, input ripple, VOUT = 5V

Output ripple not measurable due to low impedance at fsw = 1000kHz.
See Figure 10.

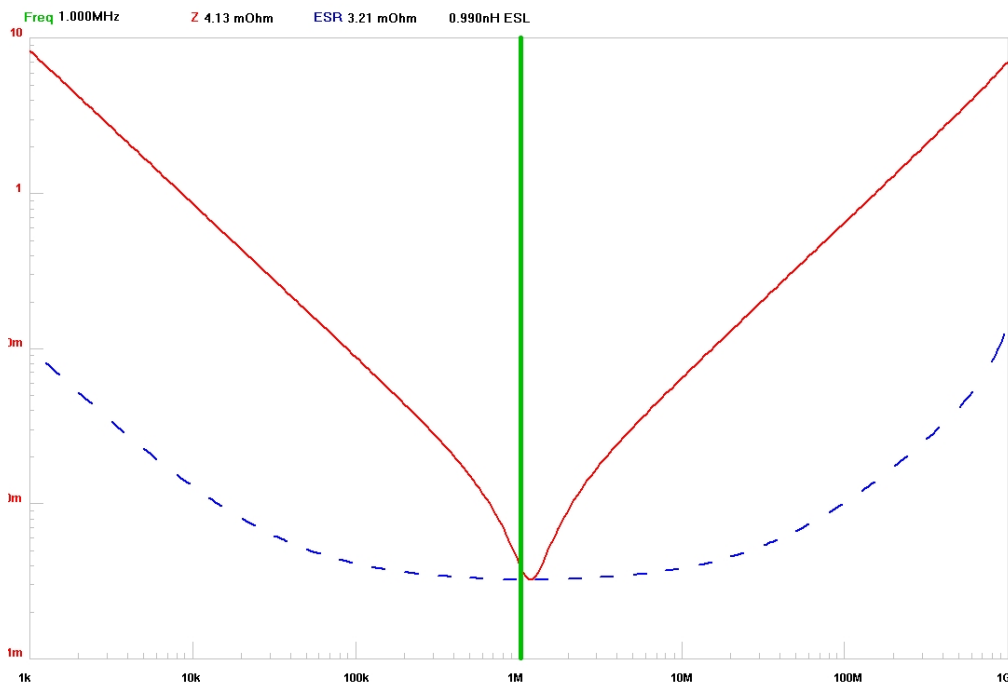


Figure 10: Impedance and ESR vs. Freq.

6 Load Transients

The responses to a load step and dump is shown in [Error! Reference source not found.](#) with a load step between 0.5 A and 1 A. Channel 1 represents the output voltage change and channel 2 the output current.

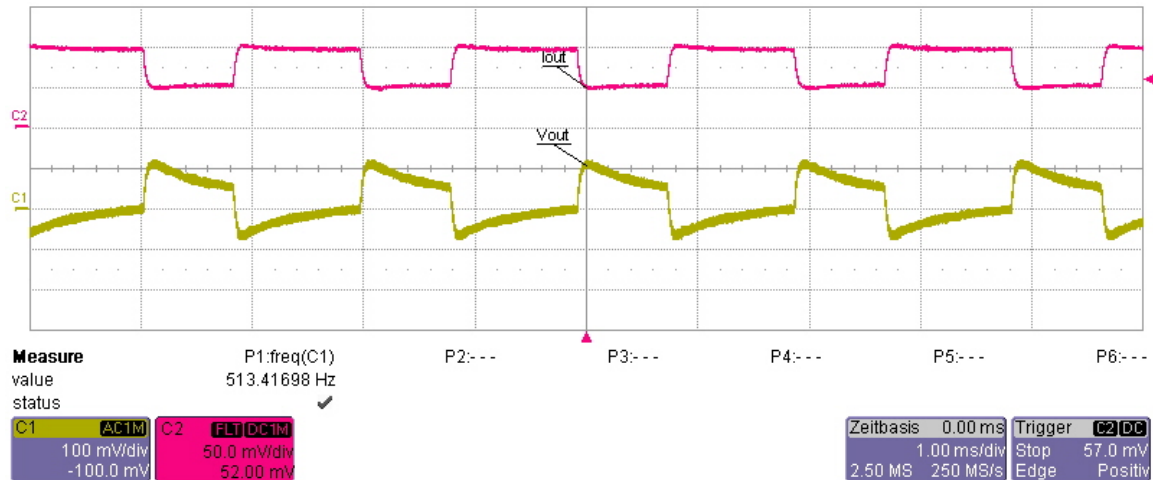


Figure 11: VIN = 28V, VOUT = 5V

7 Frequency response

Figure 12 shows the loop response of the converter with 20V, 24V and 28V input voltages under a 1 A load and 5V output voltage. Phase margin is at least 75 degrees. The gain margin is at least 23 dB.

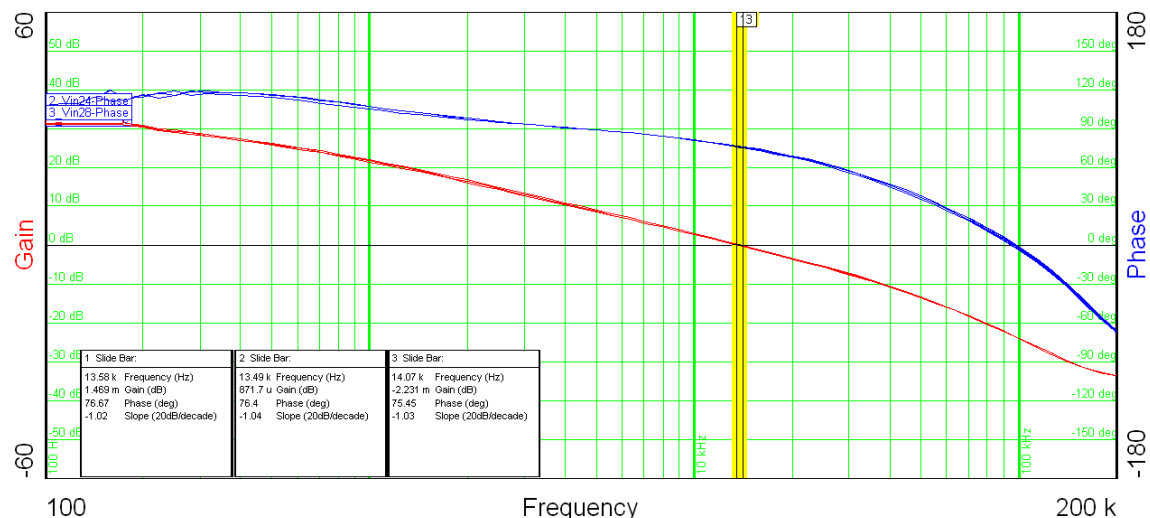


Figure 12: Bode plots for VIN = 20V, VIN = 24V, VIN = 28V, VOUT = 5V

8 Miscellaneous waveforms

The drain-source voltage at the switch node is shown in [Figure 13](#). The image was captured with a 28V input voltage and a 1 A load for 5V.

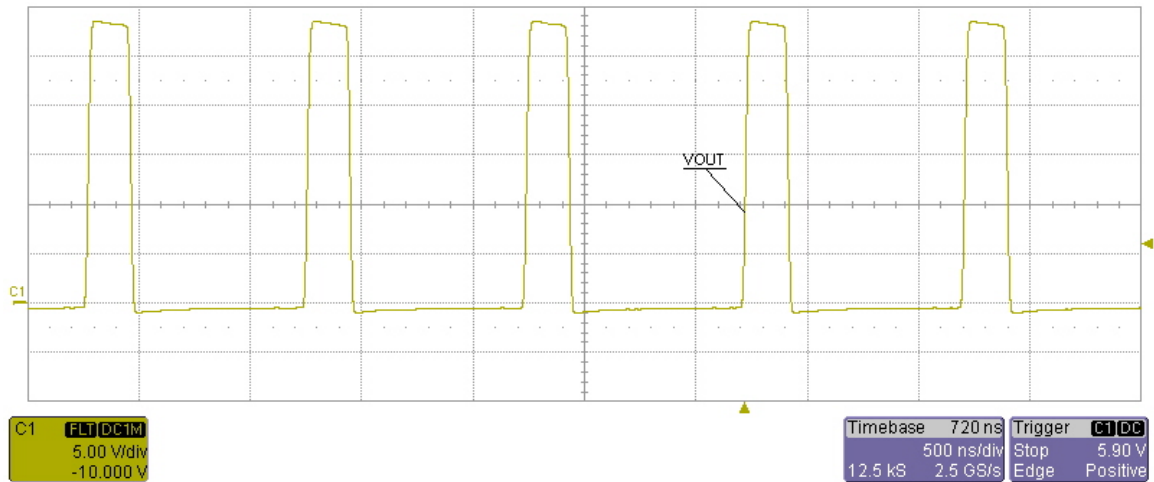


Figure 13: Switch node at $V_{in} = 28V$, $V_{out} = 5V$, $I_{out} = 1 A$

9 Thermal images

Figure 14 shows the thermal image of the board after more than half of an hour running at $V_{IN} = 28V$, $V_{OUT} = 5V$, $I_{OUT} = 1A$. The ambient is at room temperature and the converter running for more than one hour. The comparison corresponds to the efficiency measurements of part 3.

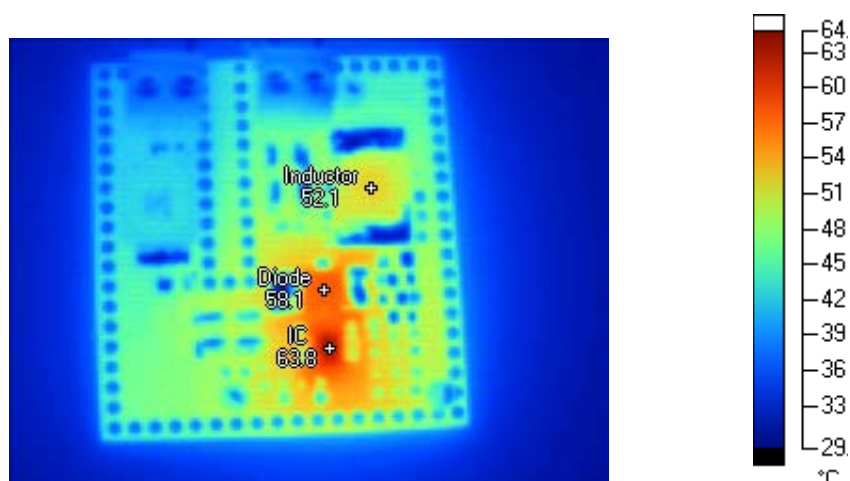


Figure 14: Thermal image for $V_{IN} = 28V$, $V_{OUT} = 5V$

Markers

Label	Temperature	Emissivity	Background
IC	63.8 °C	0.95	20.0 °C
Diode	58.1 °C	0.95	20.0 °C
Inductor	52.1 °C	0.95	20.0 °C

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