

1 Startup

The startup waveforms with input voltages $V_{IN} = 16\text{ V}$, $V_{IN} = 26\text{ V}$, $V_{IN} = 36\text{ V}$ for $V_{OUT} = 3.3\text{ V}$ respective are shown in Figure 1 to Figure 1. The load is set to 1 A. **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.**

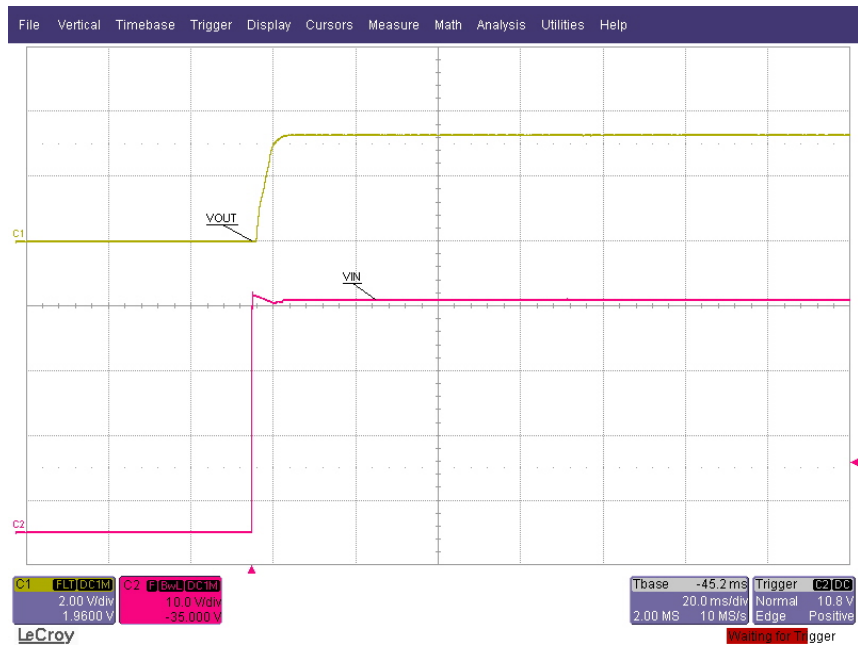


Figure 1: $V_{IN} = 16\text{ V}$, $V_{OUT} = 3.3\text{ V}$

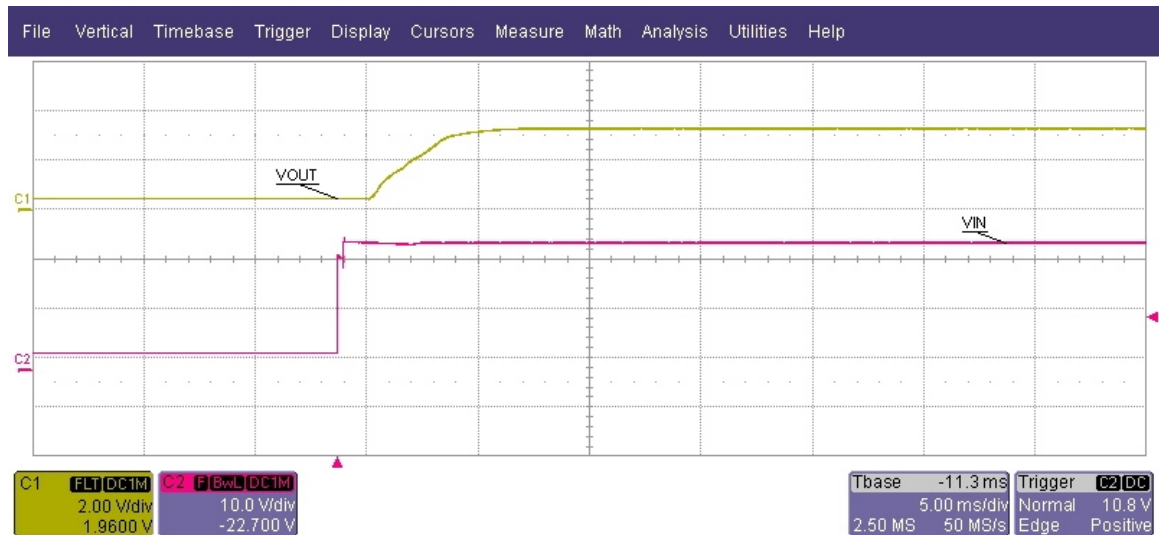
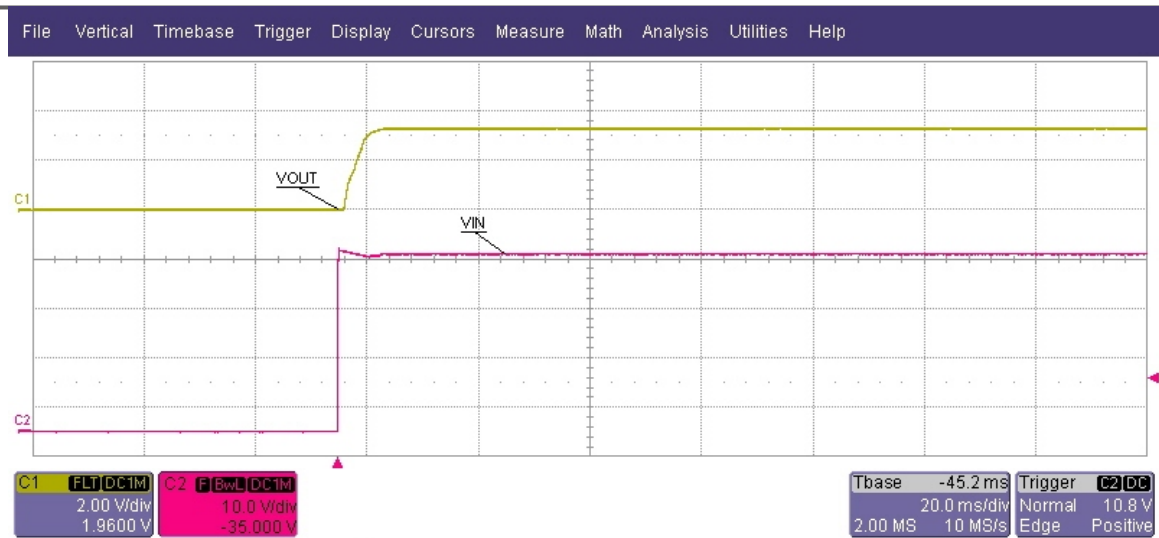


Figure 2: $V_{IN} = 26\text{ V}$, $V_{OUT} = 3.3\text{ V}$

**Figure 3: VIN = 36 V, VOUT = 3.3 V**

2 Shutdown

The shutdown waveforms with input voltages $V_{IN} = 16\text{ V}$, $V_{IN} = 26\text{ V}$ and $V_{IN} = 36\text{ V}$ for $V_{OUT} = 3.3\text{ V}$ respective are shown in Figure 4 to Figure 6. The load is set to 1 A. For switching of the cable was just plugged of the power supply.

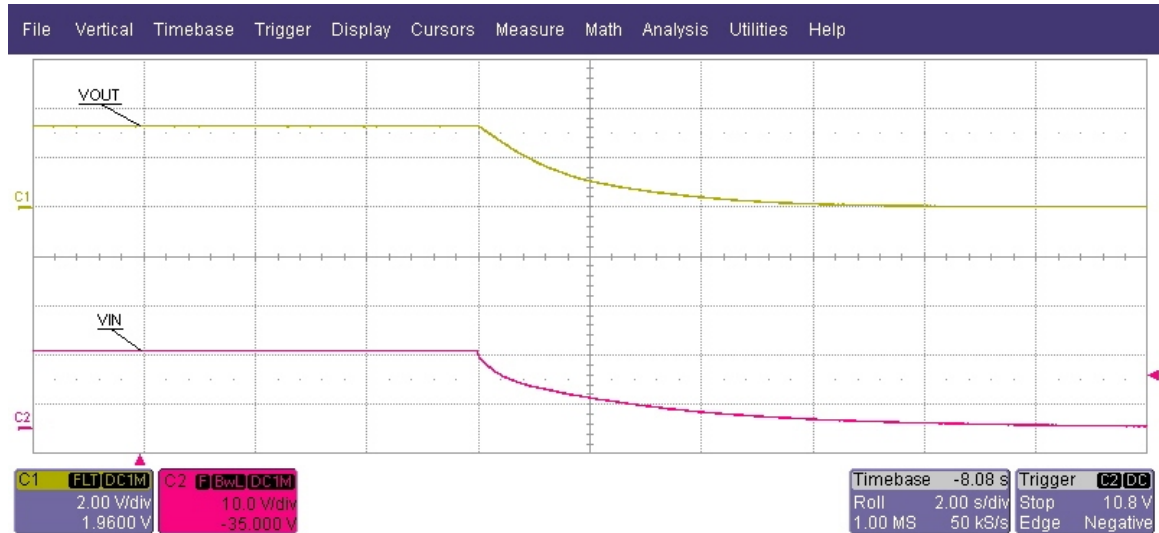


Figure 4: $V_{IN}=16\text{V}$, $V_{OUT}=3.3\text{V}$

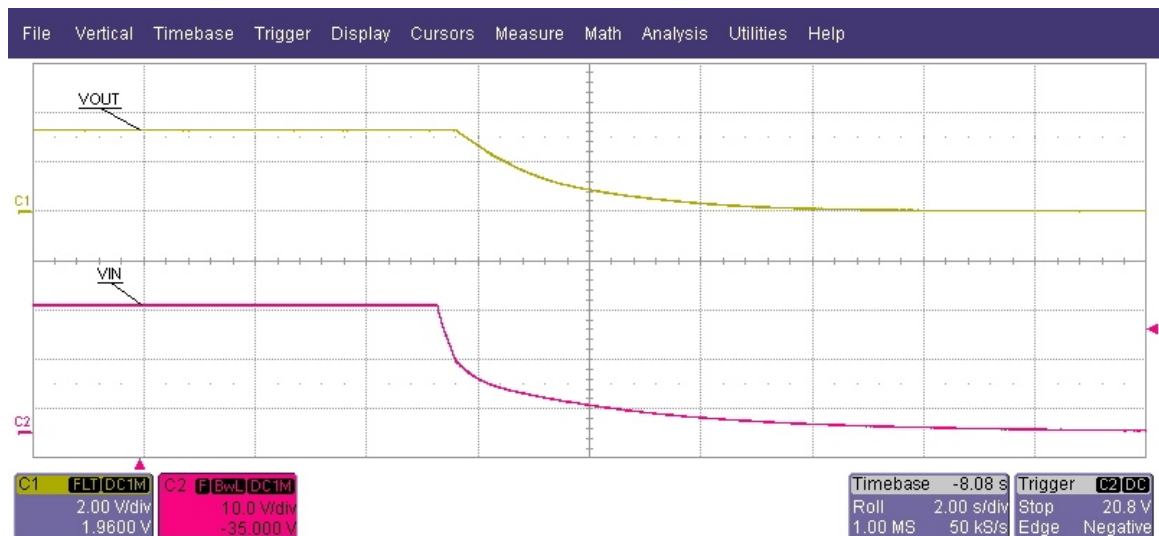
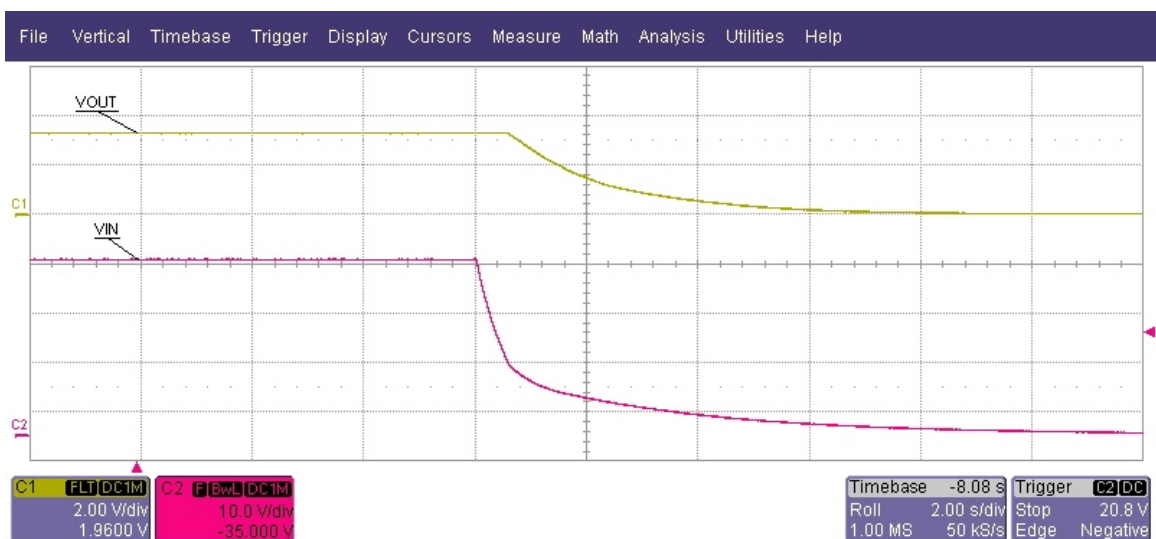


Figure 5: $V_{IN}=26\text{V}$, $V_{OUT}=3.3\text{V}$

**Figure 6: VIN=36V, VOUT=3.3V**

3 Efficiency

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

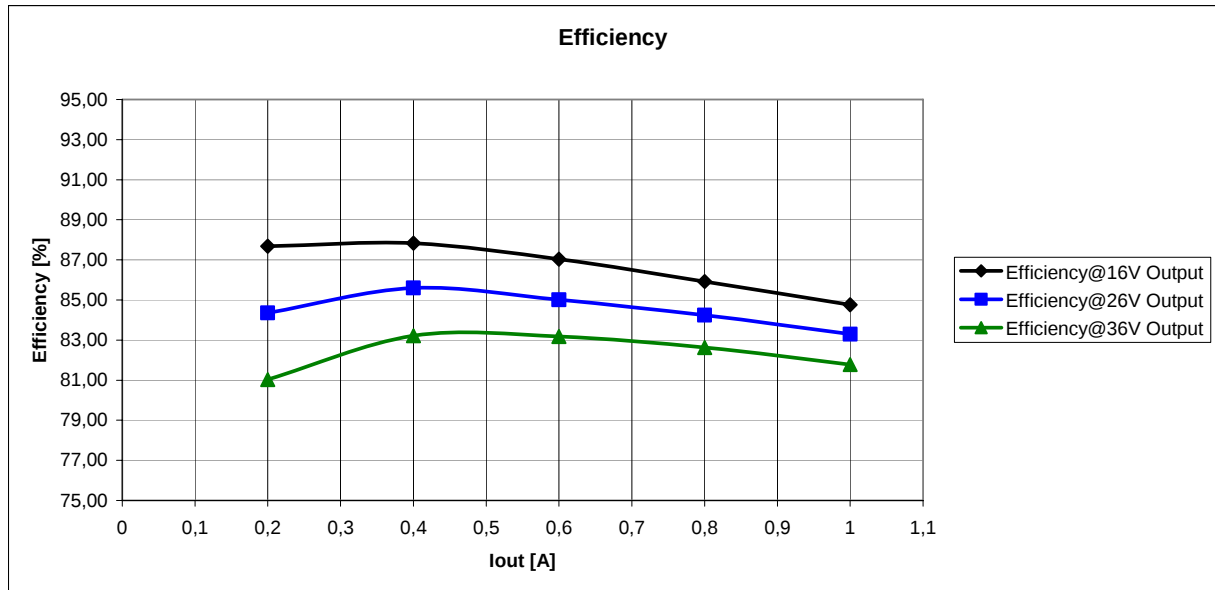


Figure 7: Converter efficiency

4 Load regulation

The voltage regulation curves dependent on the input voltage are shown in [Figure 8](#).

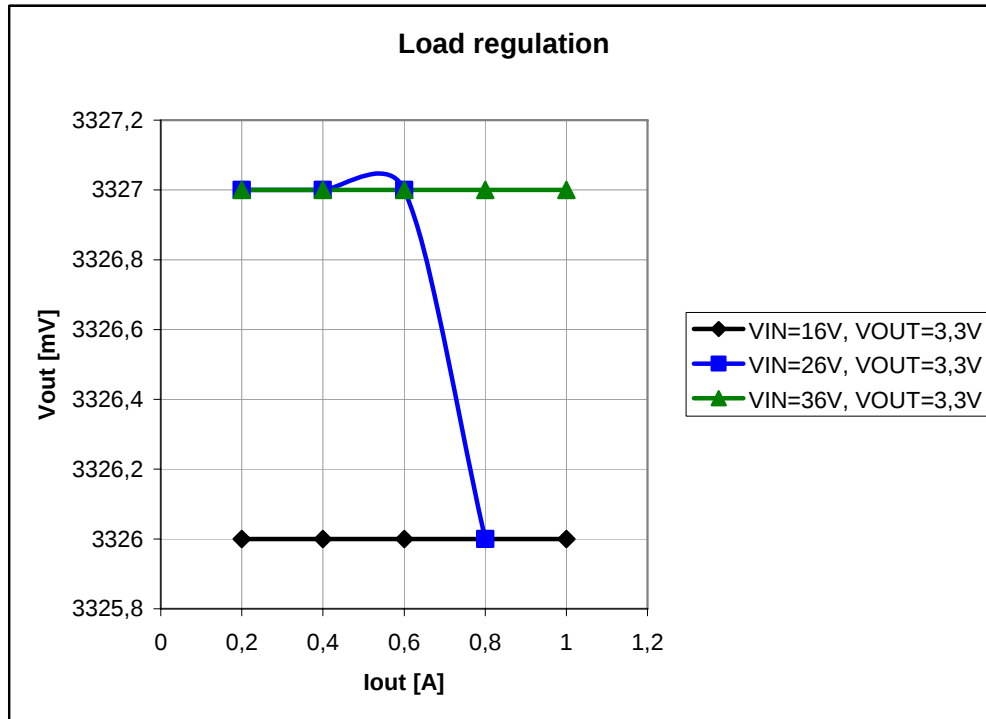


Figure 8: Load regulation $V_{OUT} = 3.3V$

5 Output and Input Ripple Voltage

The output and input ripple voltages for $V_{IN}=26V$ are shown in Figure 9 and Figure 10. The output is loaded with 1 A.

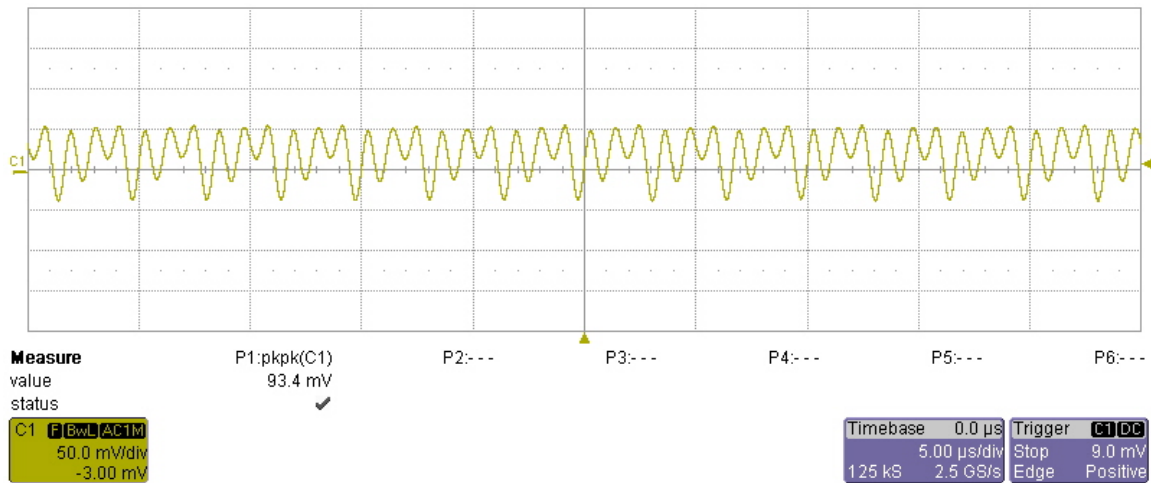


Figure 9: Input ripple, $V_{IN}=26V$, $V_{OUT}=3.3V$

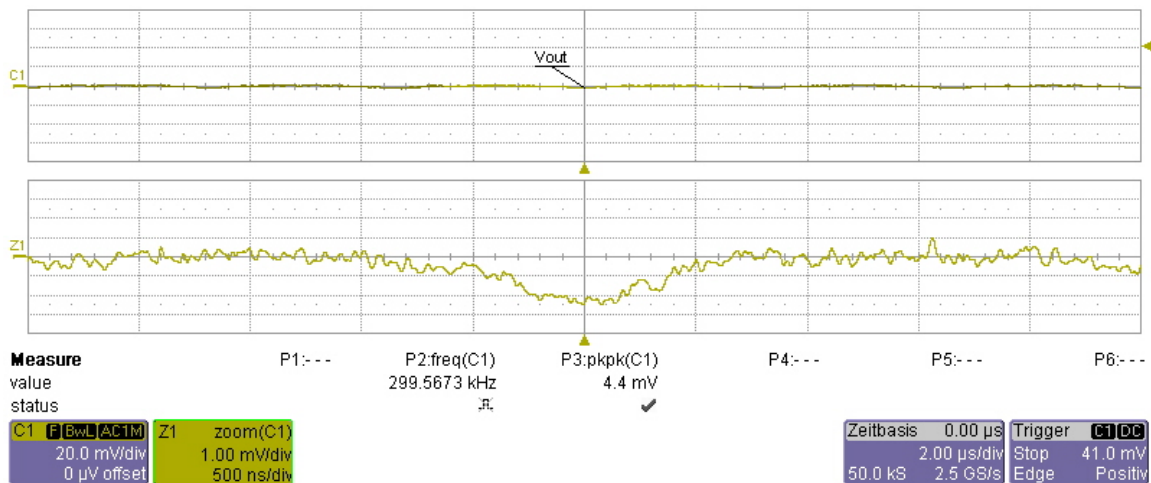


Figure 10: Output ripple, $V_{IN}=26V$, $V_{OUT} = 3.3V$

6 Load Transients

The response 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.

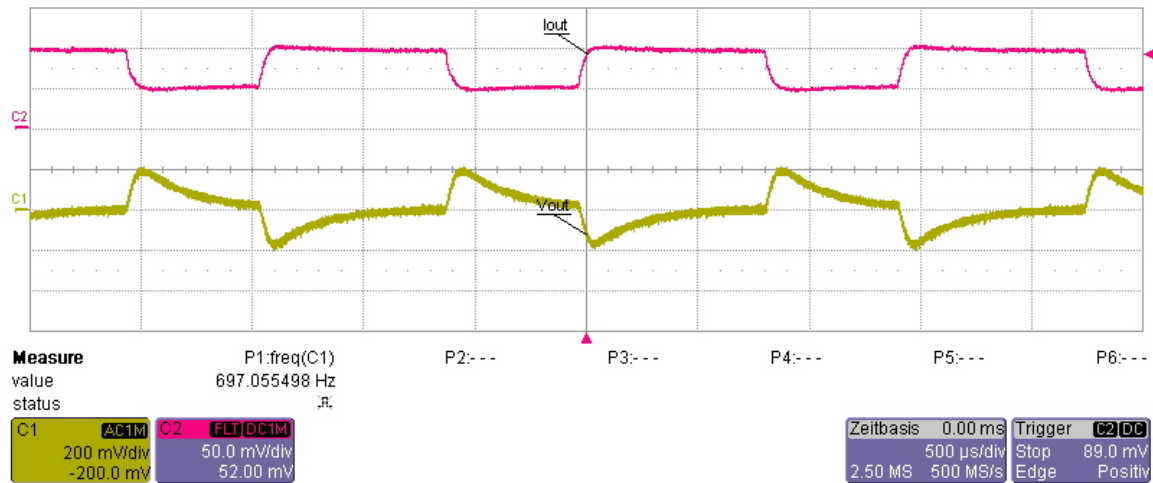


Figure 11: VIN=26V, VOUT=3.3V

Frequency response

Figure 12 shows the loop response of the converter with 16 V, 26 V and 36 V input voltages under a 1 A load and 3.3 V output voltage. Phase margin is at least 60 degrees. The gain margin is at least 20 dB.

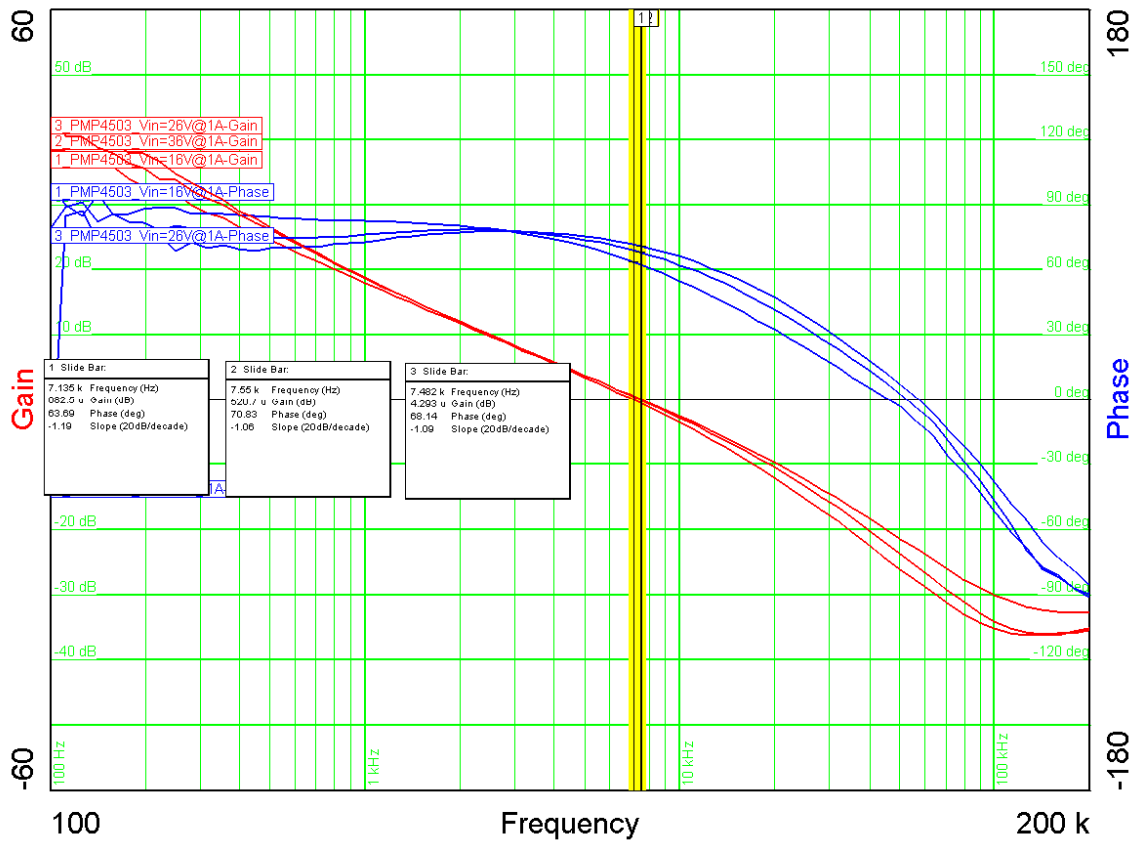


Figure 12: Bode plots for VIN=16V, VIN=26V, VIN=36V, VOUT=3.3V

7 Miscellaneous waveforms

The drain-source voltage at the switch node is shown in [Figure 13](#). The image was captured with a 26 V input voltage and a 1 A load for 3.3 V respectively.

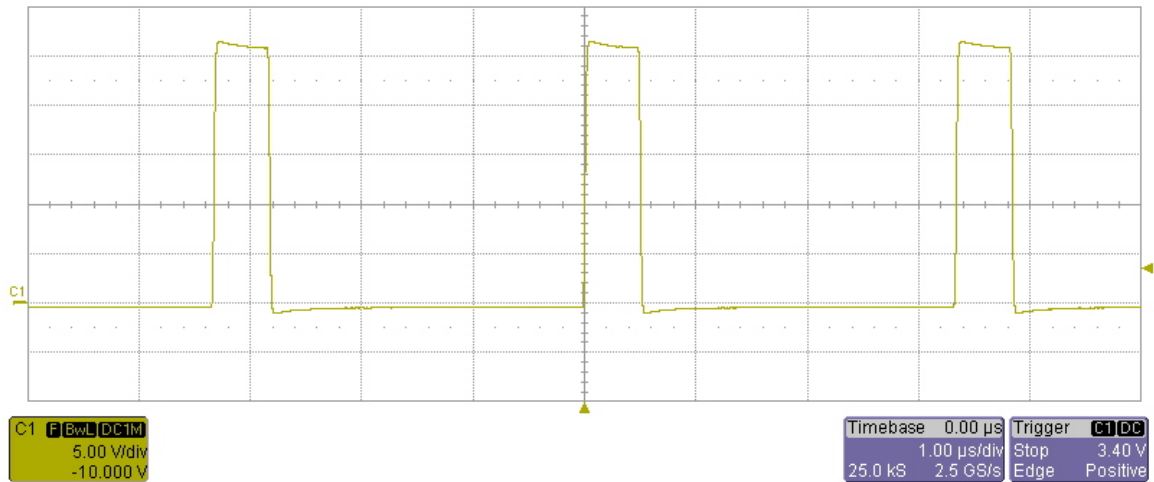


Figure 13: Switch node at VIN=26V, VOUT=3.3V, IOUT=1A

Thermal images

Figure 14 shows the thermal image of the board after more than half of an hour running at $V_{IN} = 36\text{ V}$, $V_{OUT} = 3.3\text{ V}$, $I_{OUT} = 1\text{ A}$. The ambient is at room temperature and the converter running for more than half an hour. The comparison corresponds to the efficiency measurements of part 3.

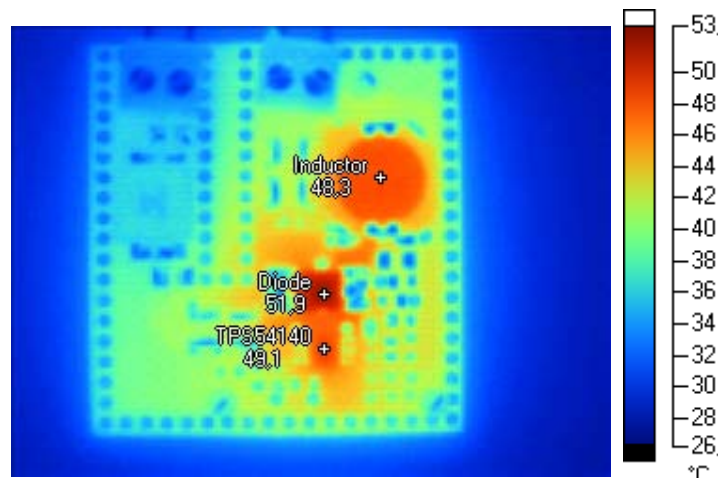


Figure 14: Thermal image for $V_{IN}=36\text{V}$, $V_{OUT}=3.3\text{V}$

Markers

Label	Temperature	Emissivity	Background
Diode	51,9 °C	0,95	20,0 °C
Inductor	48,3 °C	0,95	20,0 °C
TPS54140	49,1 °C	0,95	20,0 °C

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