1 Startup

The startup waveforms with input voltages VIN = 16 V, VIN = 36 V, VIN = 40 V for VOUT = 12 V and VOUT = 3.3 V respective are shown in Figure 1 to Figure 6. The load is set to 1 A. Channel 1 represents the input voltage, channel 2 the output 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.

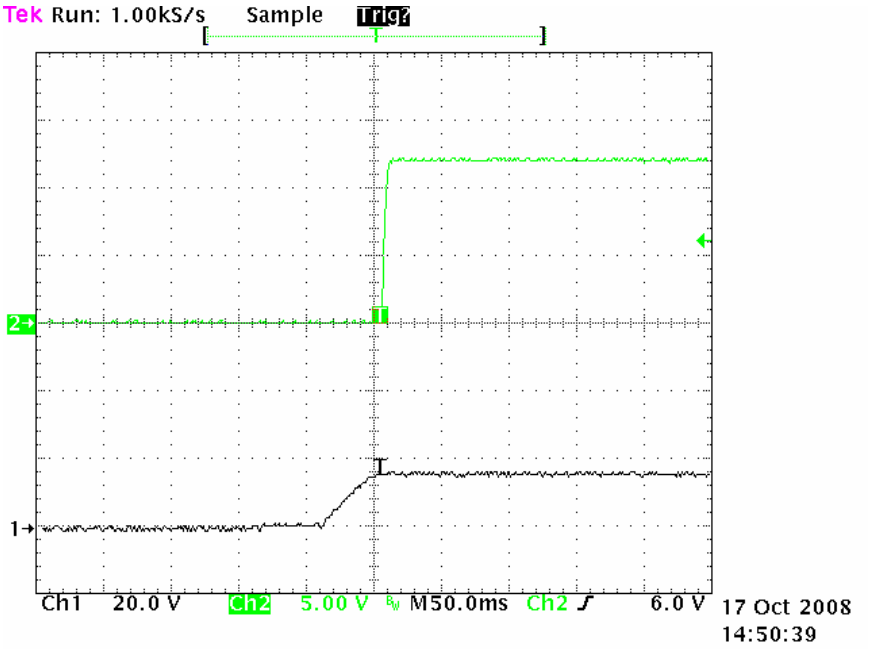

Figure 1: VIN = 16 V, VOUT = 12 V

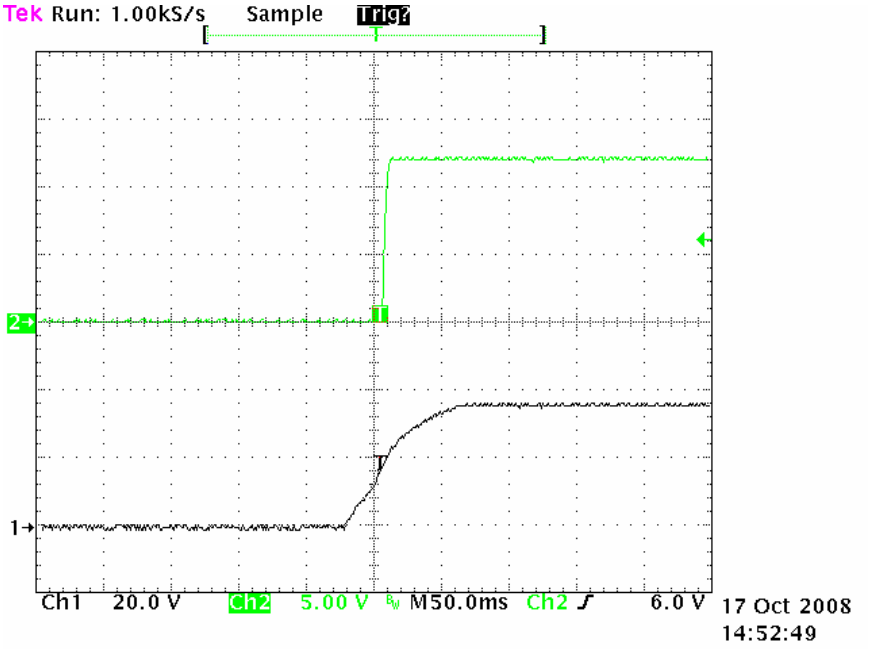

Figure 2: VIN = 36 V, VOUT = 12 V

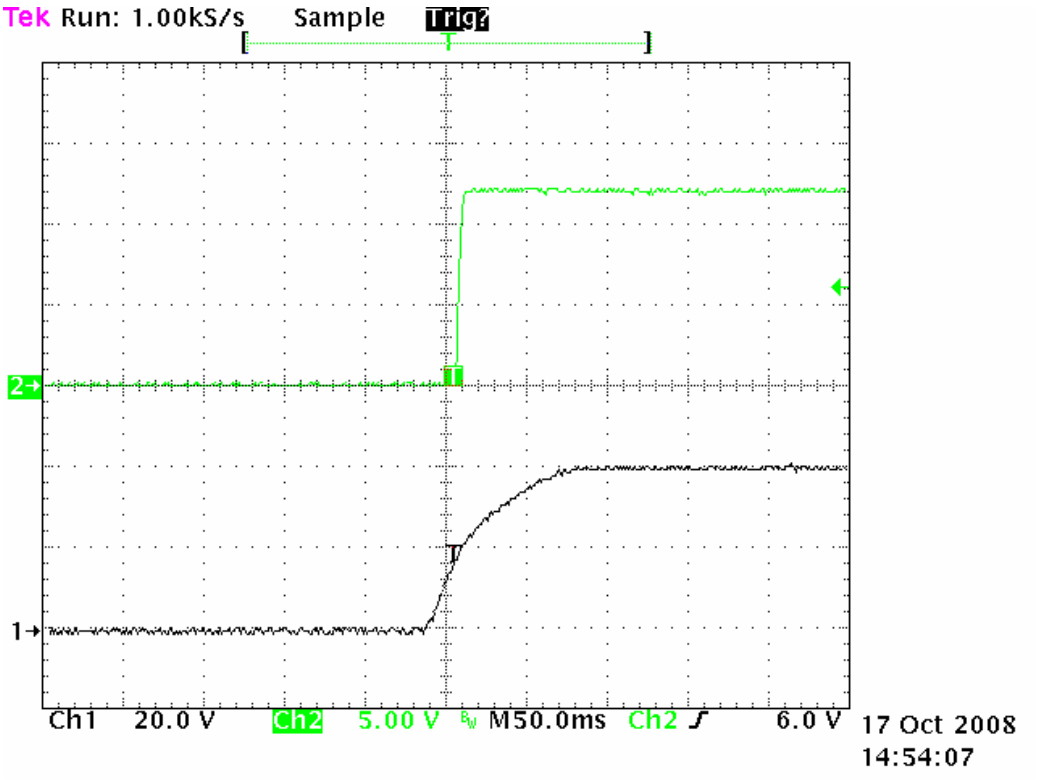

Figure 3: VIN = 40 V, VOUT = 12 V

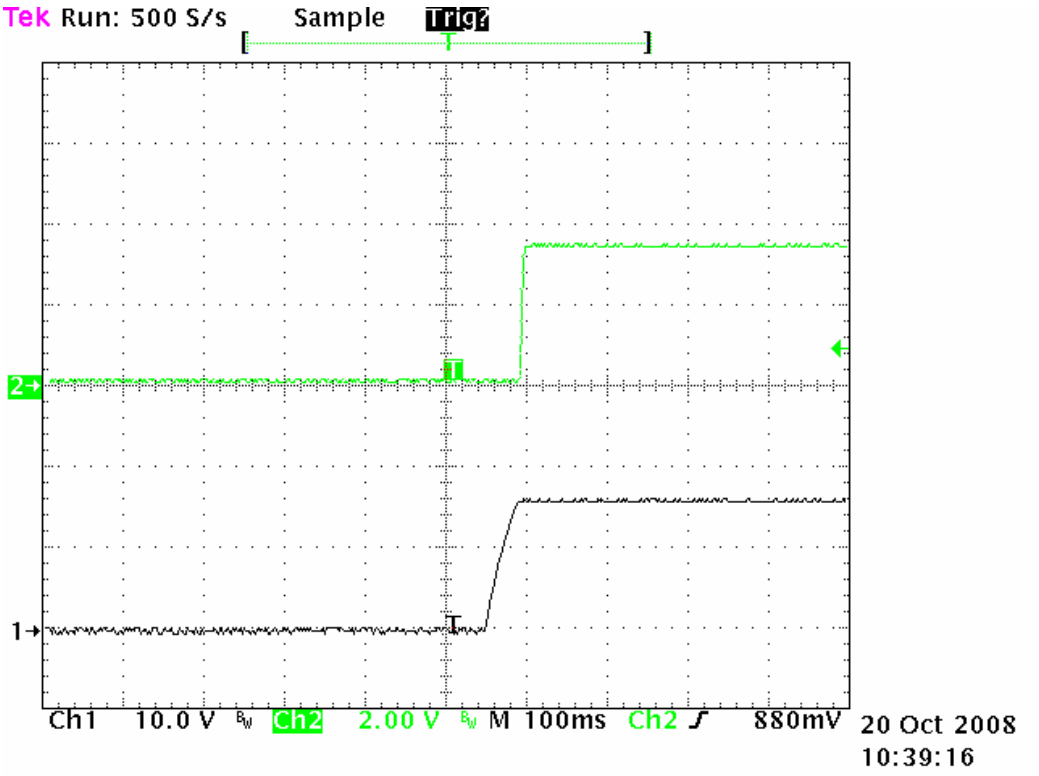

Figure 4: VIN = 16 V, VOUT = 3.3 V

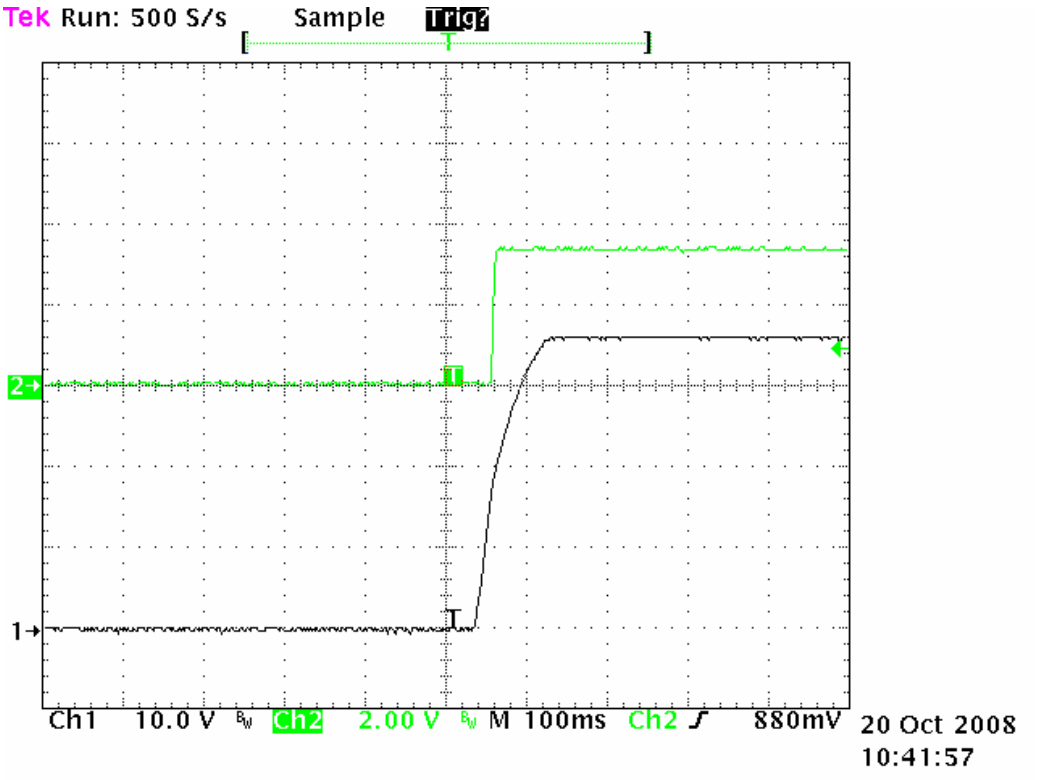

Figure 5: VIN = 36 V, VOUT = 3.3 V

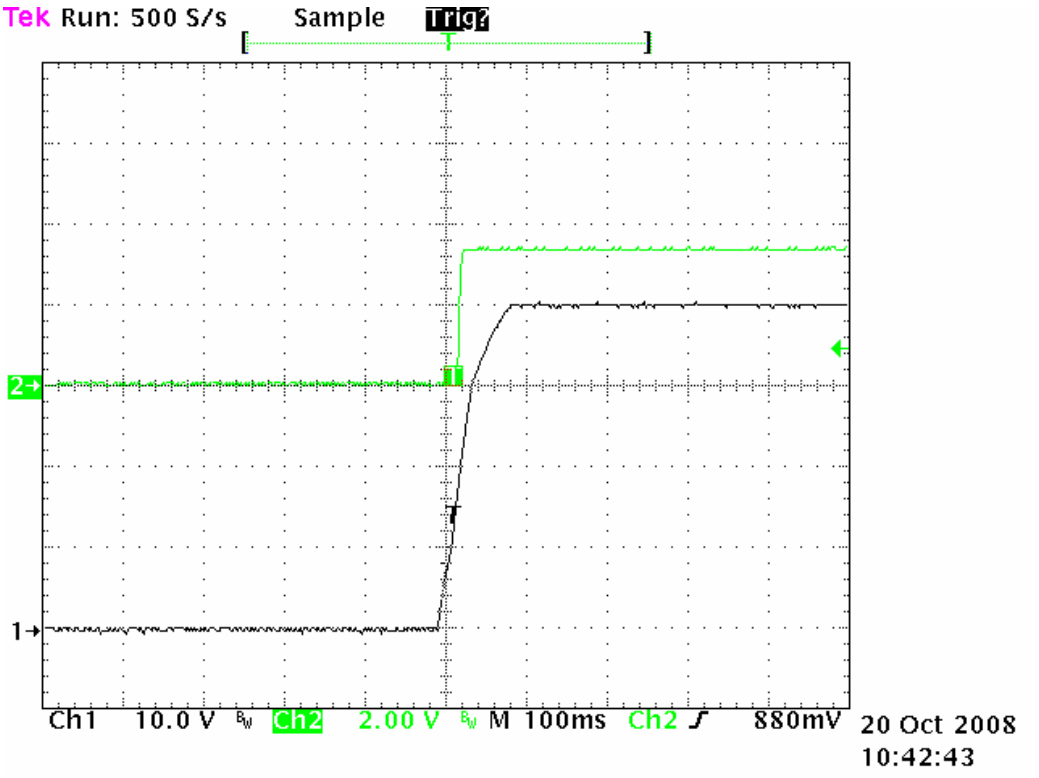

Figure 6: VIN = 40 V, VOUT = 3.3 V

2 Shutdown

The shutdown waveforms with input voltages VIN = 16 V, VIN = 36 V and VIN = 40 V for VOUT = 12 V and VOUT = 3.3 V respective are shown in Figure 7 to Figure 12. The load is set to 1 A. Channel 1 represents the input voltage, channel 2 the output. For switching of the cable was just plugged of the power supply.

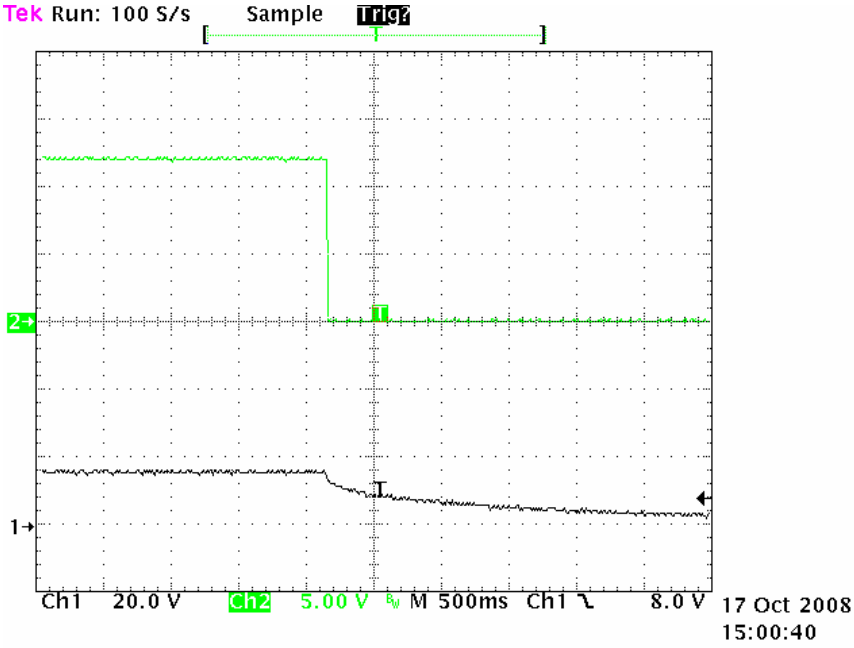

Figure 7: VIN = 16 V, VOUT = 12 V

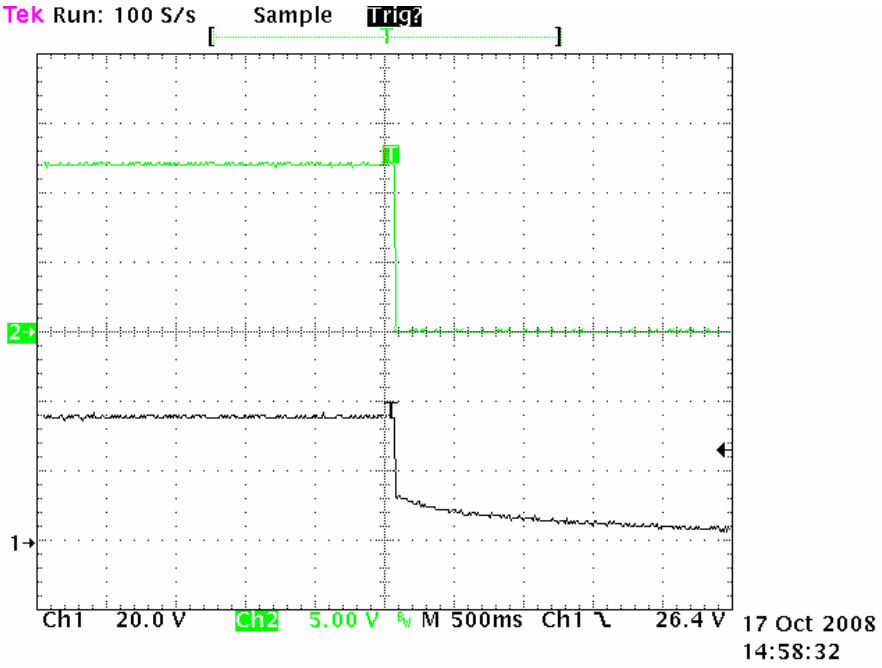

Figure 8: VIN = 36 V, VOUT = 12 V

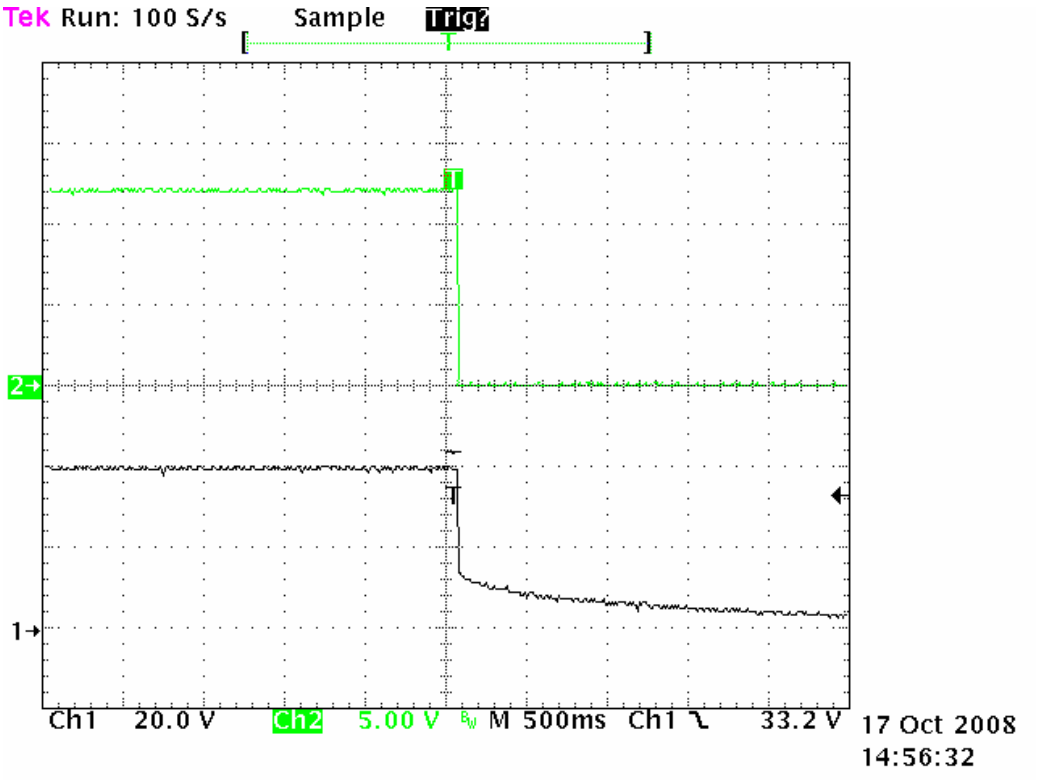

Figure 9: VIN = 40 V, VOUT = 12 V

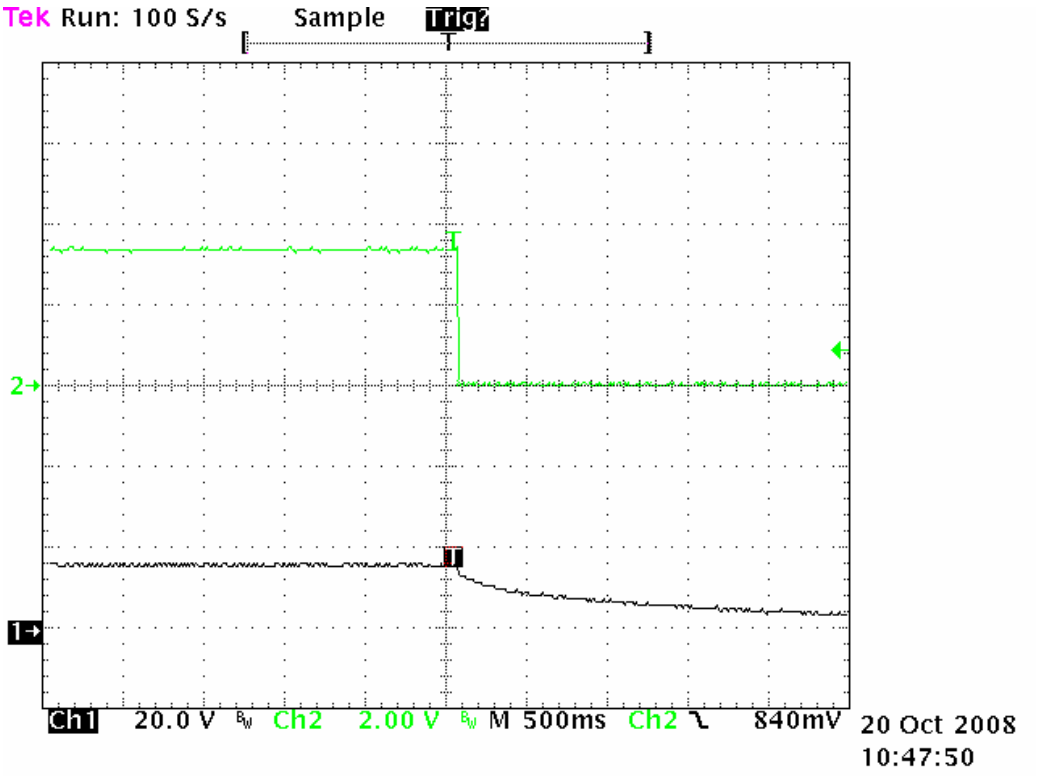

Figure 10: VIN = 16 V, VOUT = 3.3 V

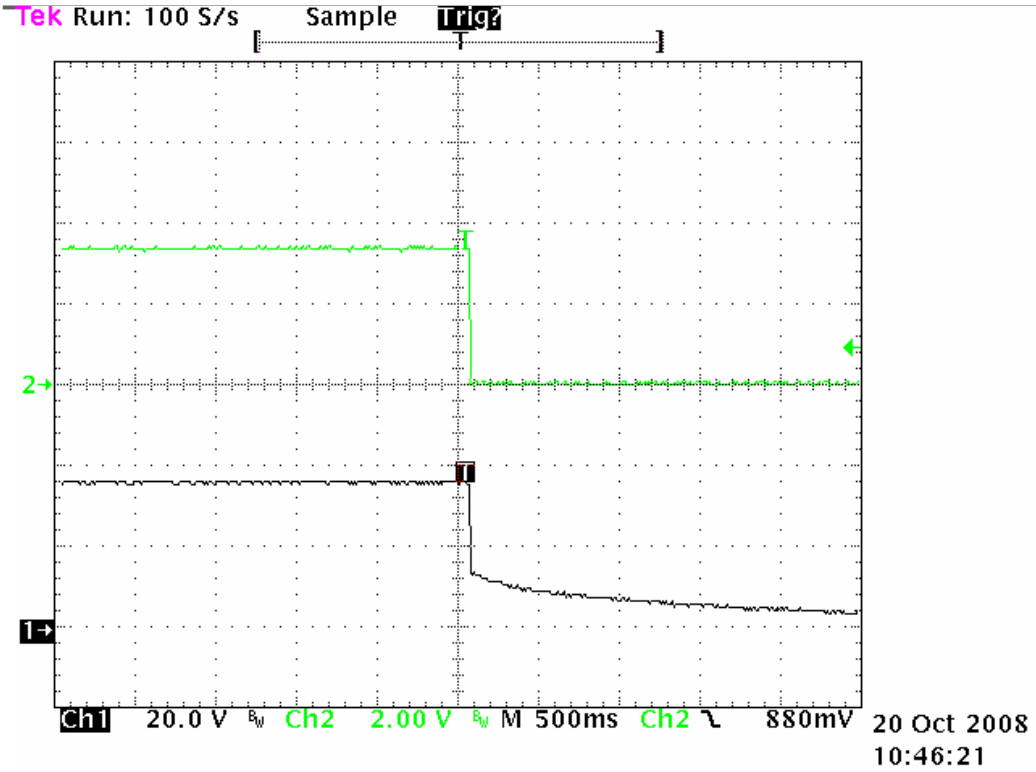

Figure 11: VIN = 36 V, VOUT = 3.3 V

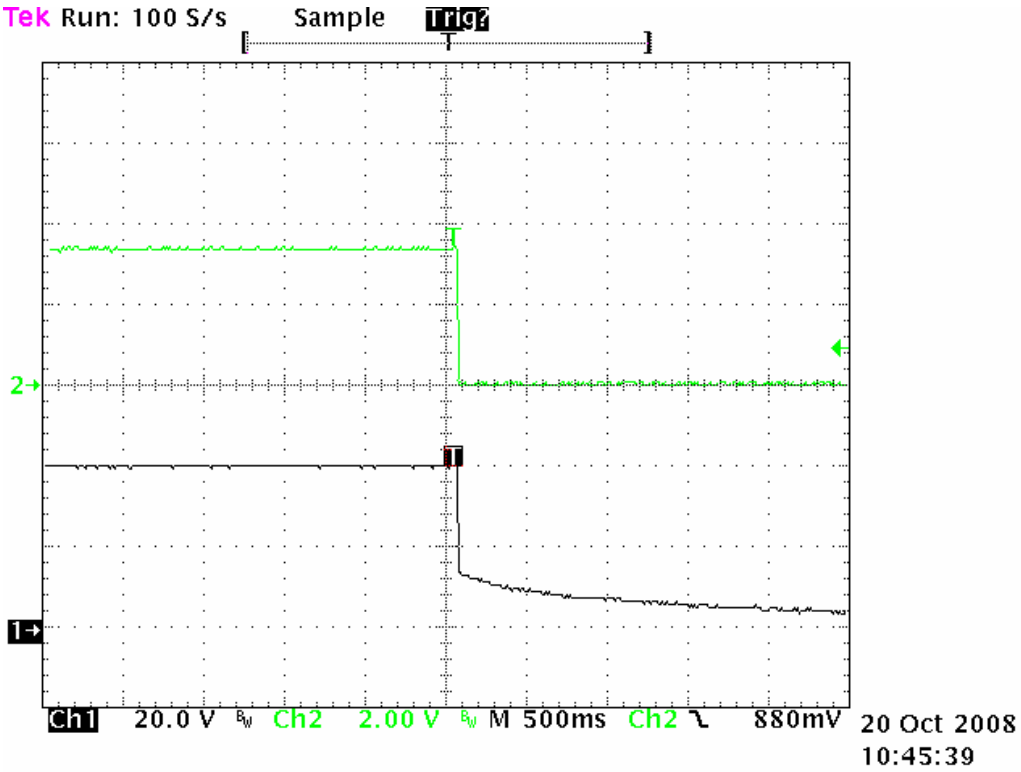

Figure 12: VIN = 40 V, VOUT = 3.3 V

3 Efficiency

The converter efficiency for different input voltages is shown in Figure 13.

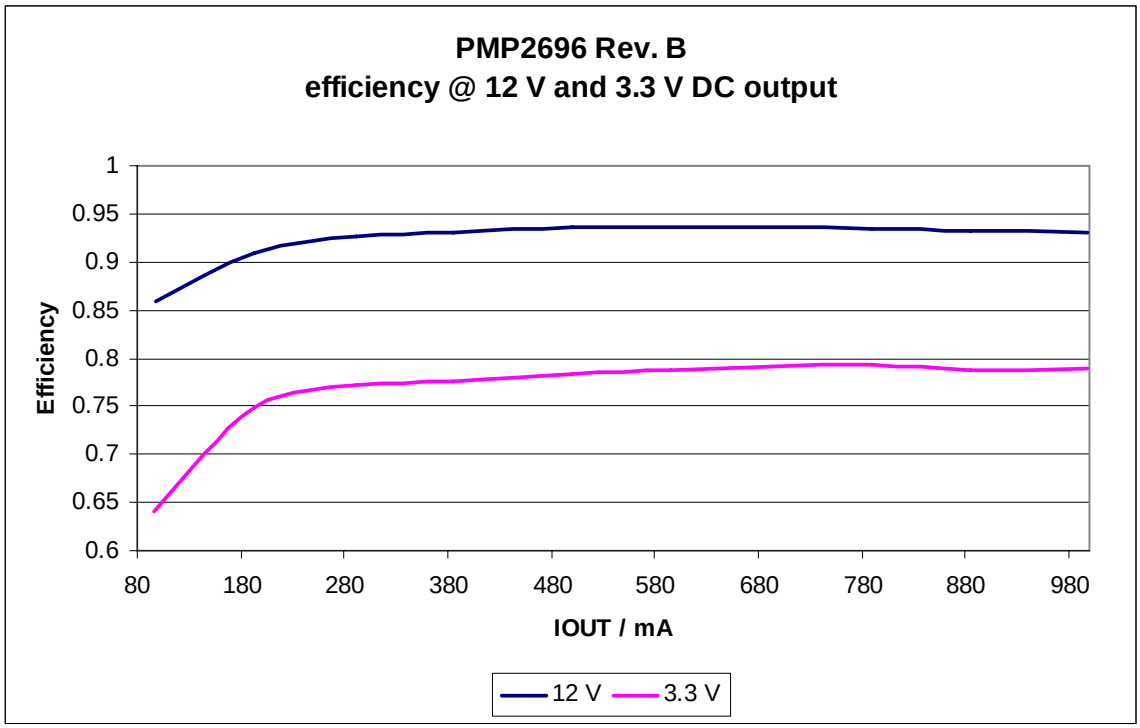

Figure 13: Converter efficiency

4 Load regulation

The voltage regulation curves dependent on the input voltage are shown in Figure 14 and Figure 15.

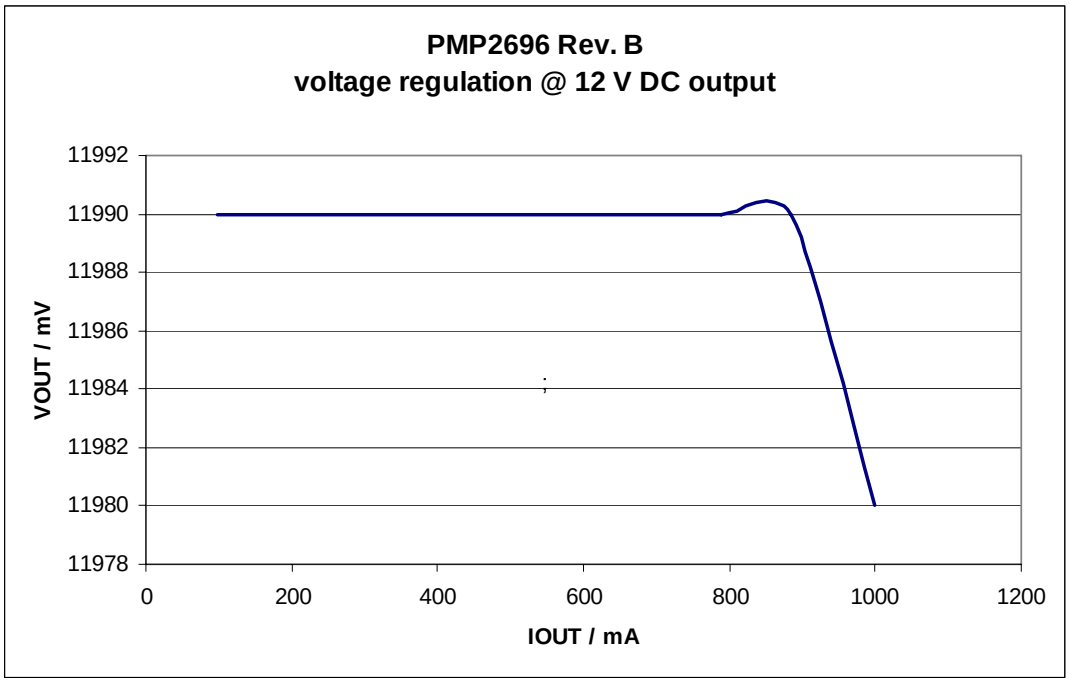

Figure 14: Load regulation VOUT = 12 V

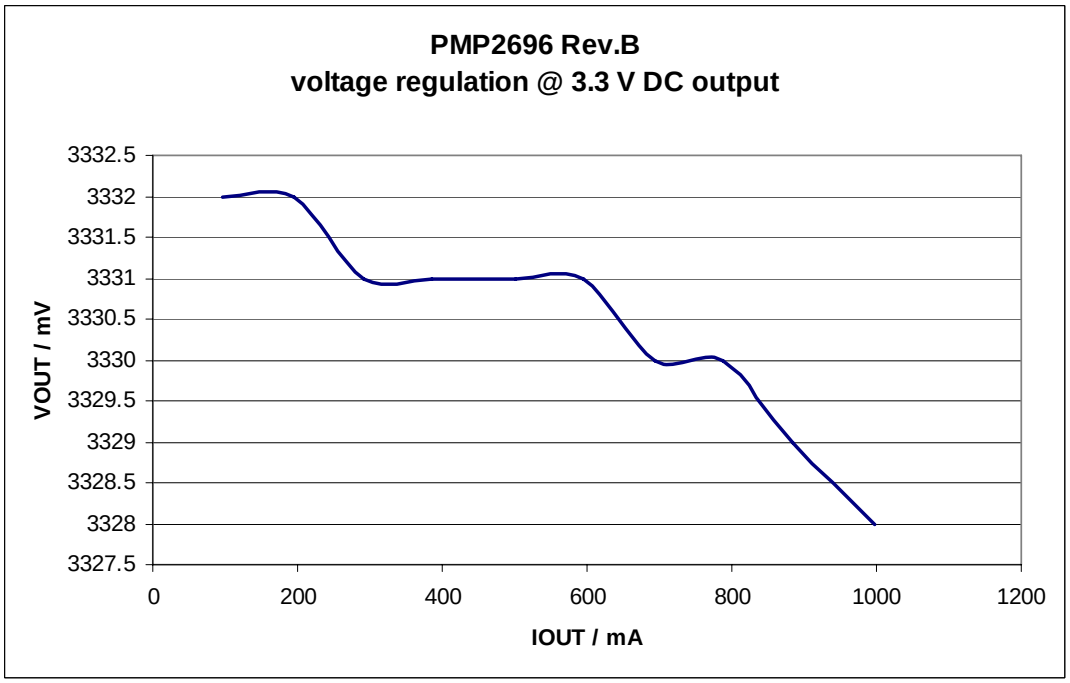

Figure 15: Load regulation VOUT = 3.3 V

5 Output and Input Ripple Voltage

The output and input ripple voltages for different input voltages are shown in Figure 16 to Figure 19. The output is loaded with 1 A.

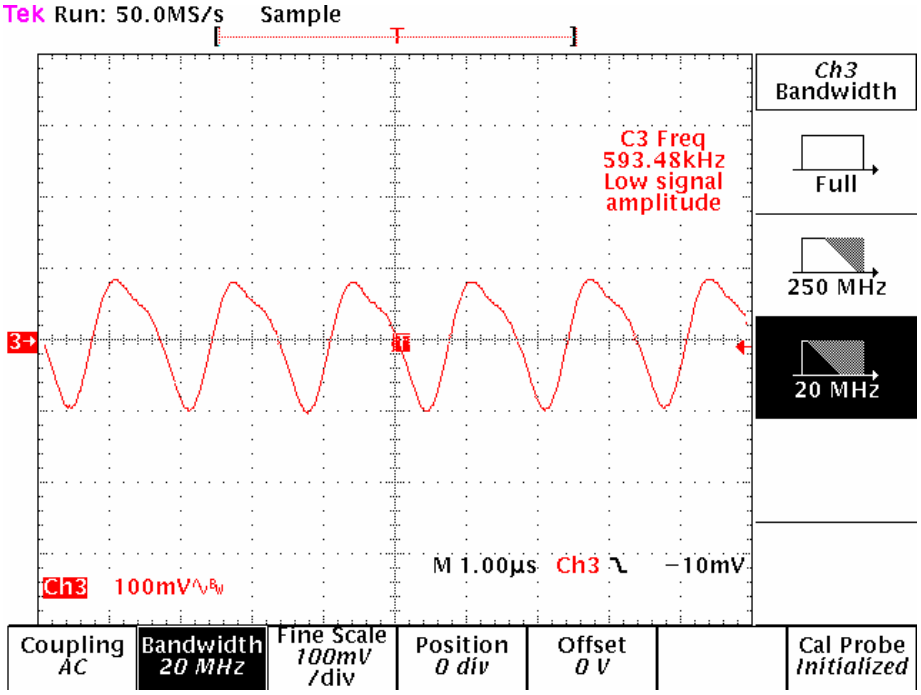

Figure 16: VIN = 36 V, input ripple, VOUT = 12 V

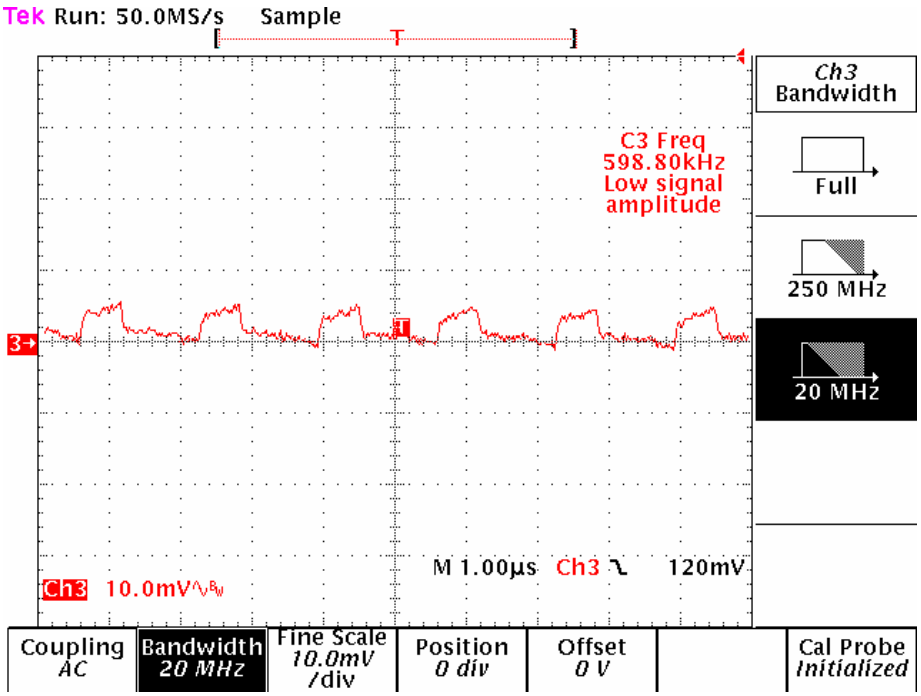

Figure 17: VIN = 36 V, output ripple, VOUT = 12V

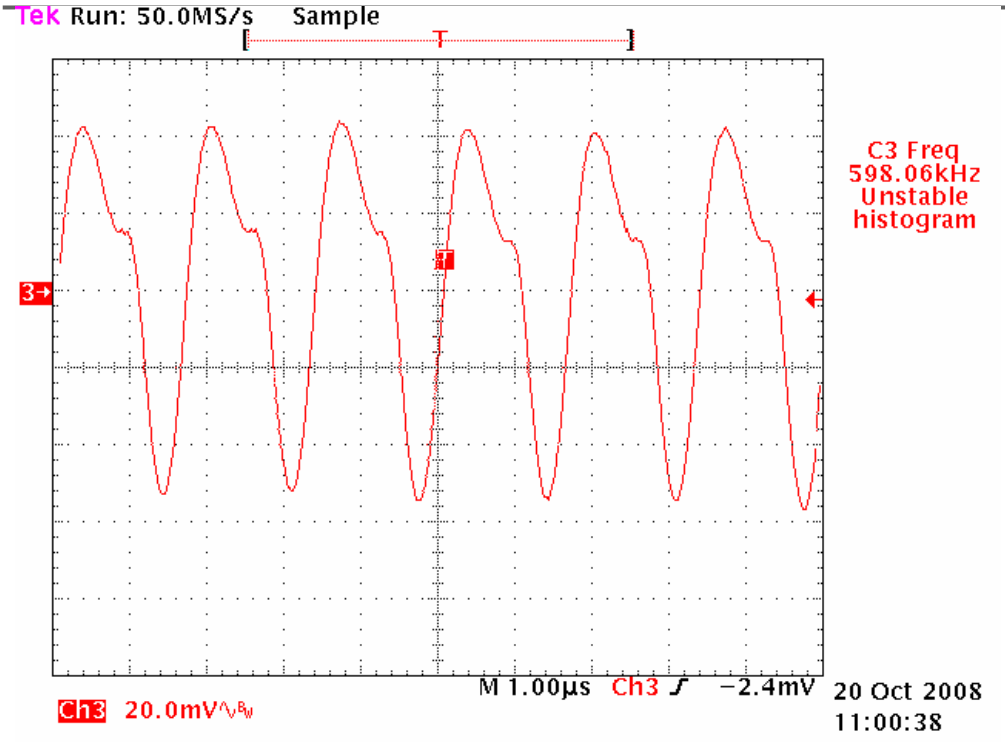

Figure 18: VIN = 36 V, input ripple, VOUT = 3.3 V

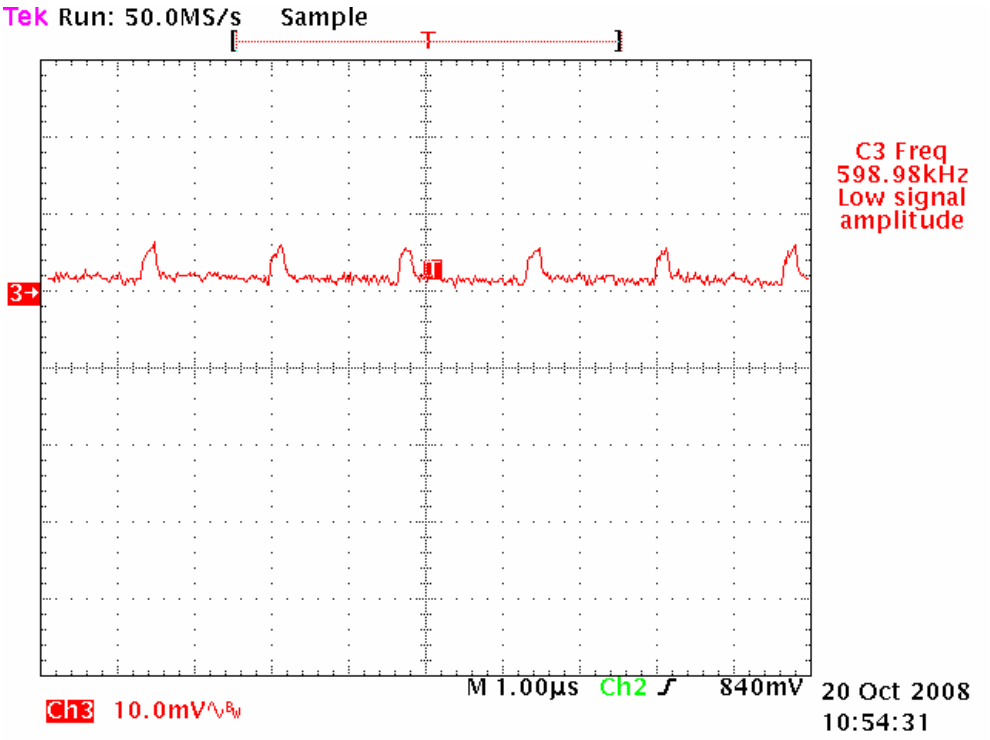

Figure 19: VIN = 36 V, output ripple, VOUT = 3.3 V

6 Load Transients

The responses to a load step and dump are shown in Figure 20 to Figure 21 for different input voltages and a load step between 0.5 A and 1 A. Channel 3 represents the output voltage change and channel 4 the output current.

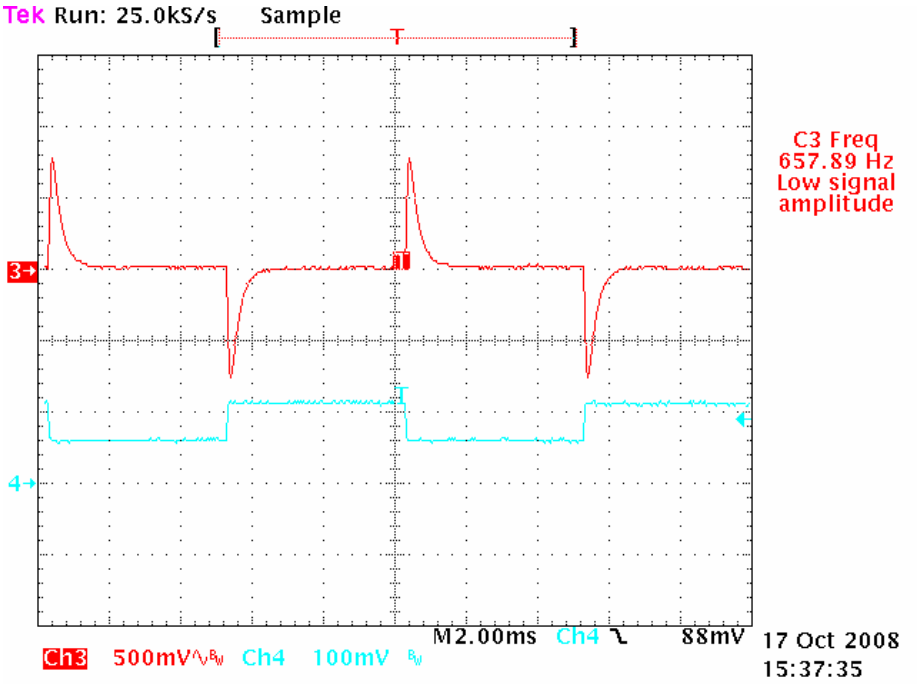

Figure 20: VIN = 36 V, VOUT = 12 V

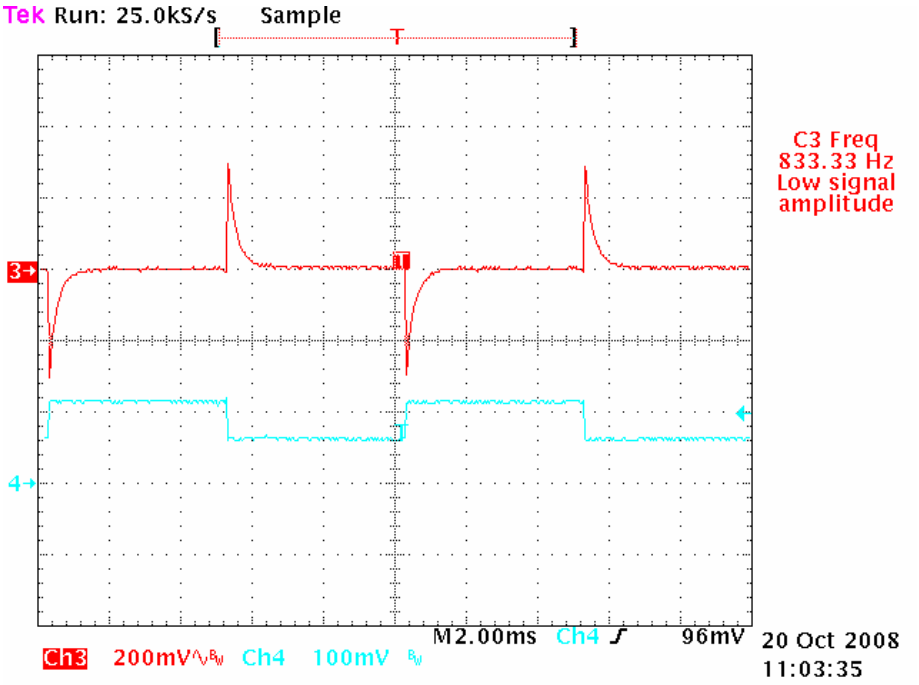

Figure 21: VIN = 36 V, VOUT = 3.3 V

7 Frequency response

Figure 22 and Figure 23 show the loop response of the converter with 16 V, 36 V and 40 V input voltages under a 1 A load and 12 V respective 3.3 V output voltage. Phase margin is at least 60 degrees. The gain margin is at least 20 dB.

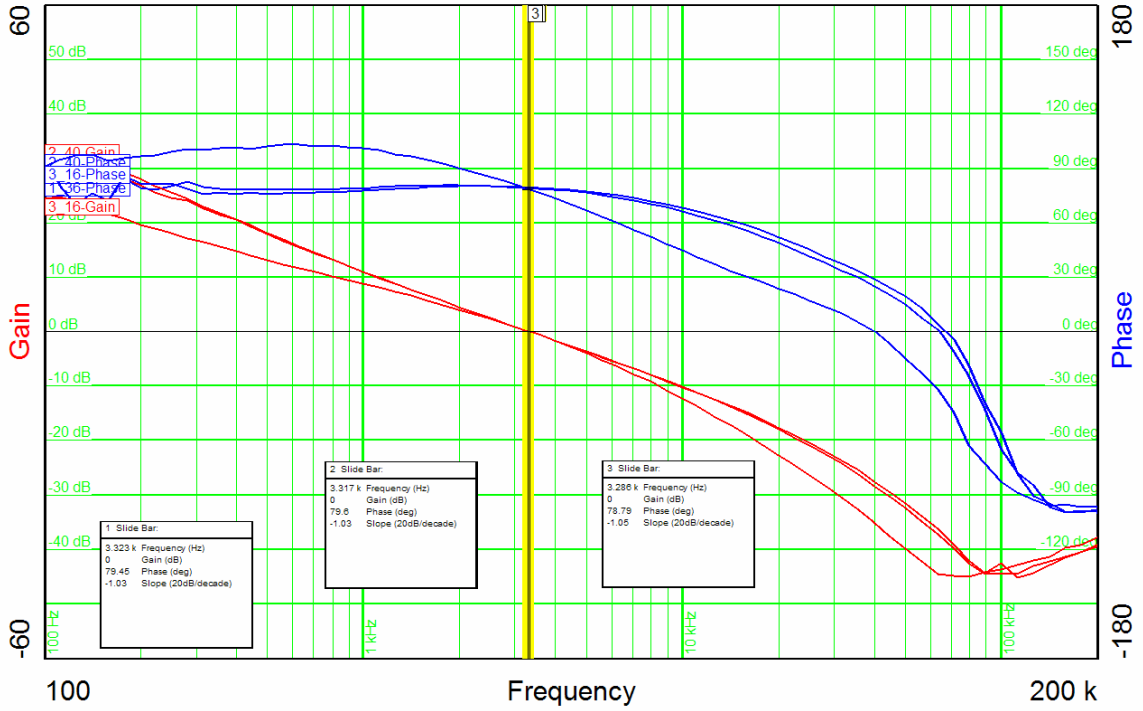

Figure 22: Bode plots for VIN = 16 V, VIN = 36 V, VIN = 40 V, VOUT = 12 V

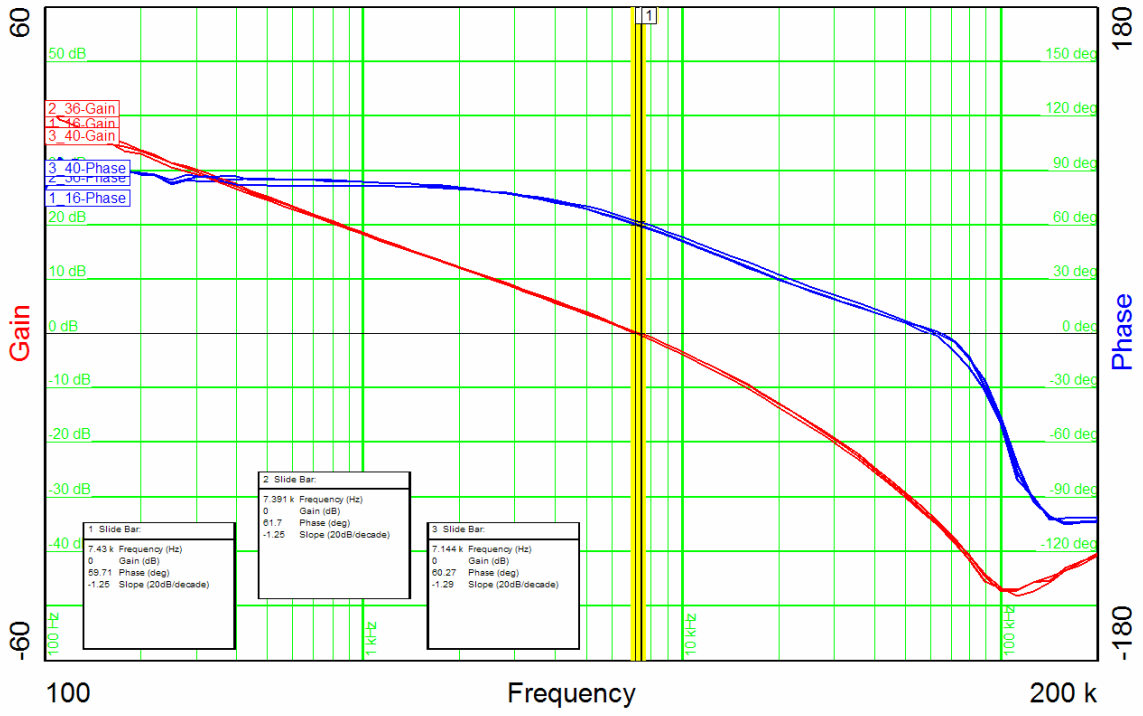

Figure 23: Bode plots for VIN = 16 V, VIN = 36 V, VIN = 40 V, VOUT = 3.3 V

8 Miscellaneous waveforms

The drain-source voltage at the switch node is shown in Figure 24 and Figure 25. The image was captured with a 36 V input voltage and a 1 A load for 12 V and 3.3 V respectively.

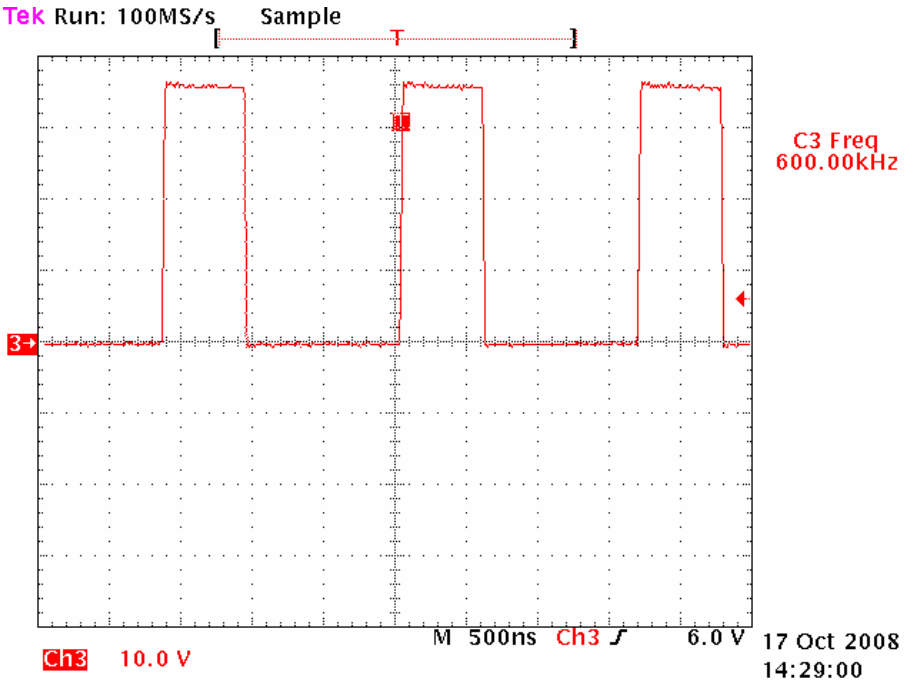

Figure 24: Switch node at VIN = 36 V, VOUT = 12 V, IOUT = 1 A

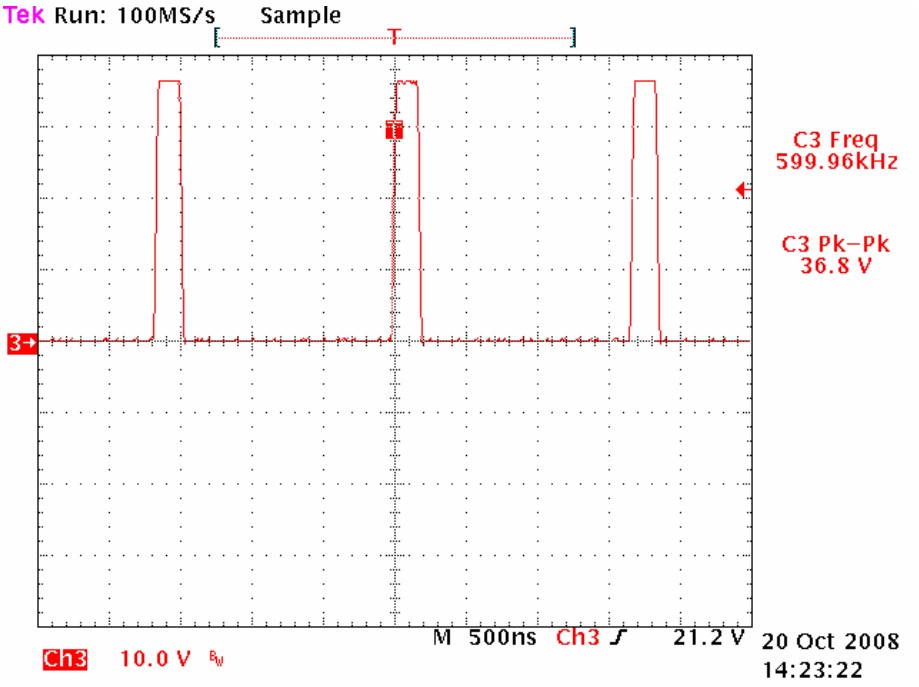

Figure 25: Switch node at VIN = 36 V, VOUT = 3.3 V, IOUT = 1 A

9 Thermal images

Figure 26 shows the thermal image of the board after more than half of an hour running at VIN = 36 V, VOUT = 12 V, IOUT = 1 A. Figure 27 shows the thermal image of the board with VIN = 36 V, VOUT = 3.3 V, IOUT = 1 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.

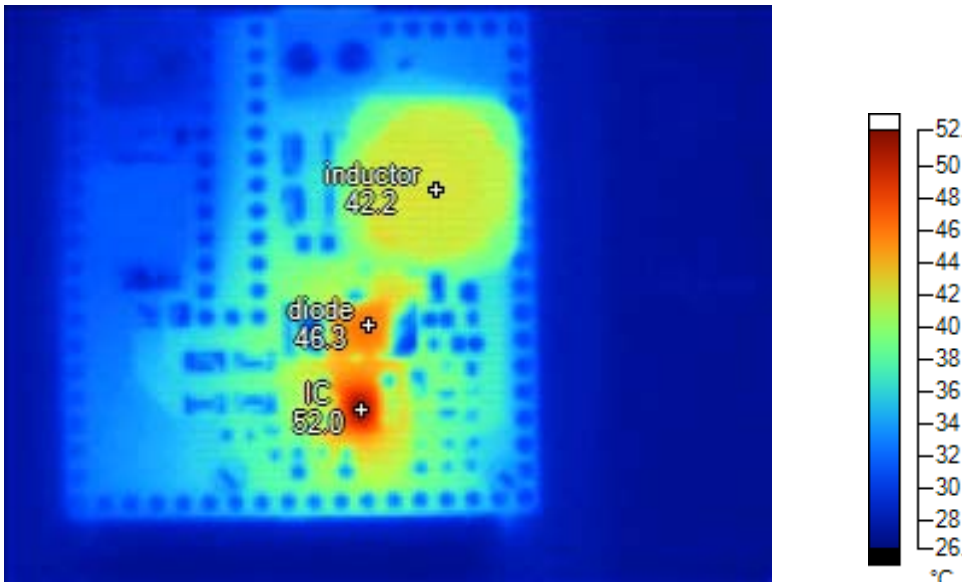

Figure 26: Thermal image for VIN = 36 V, VOUT = 12 V

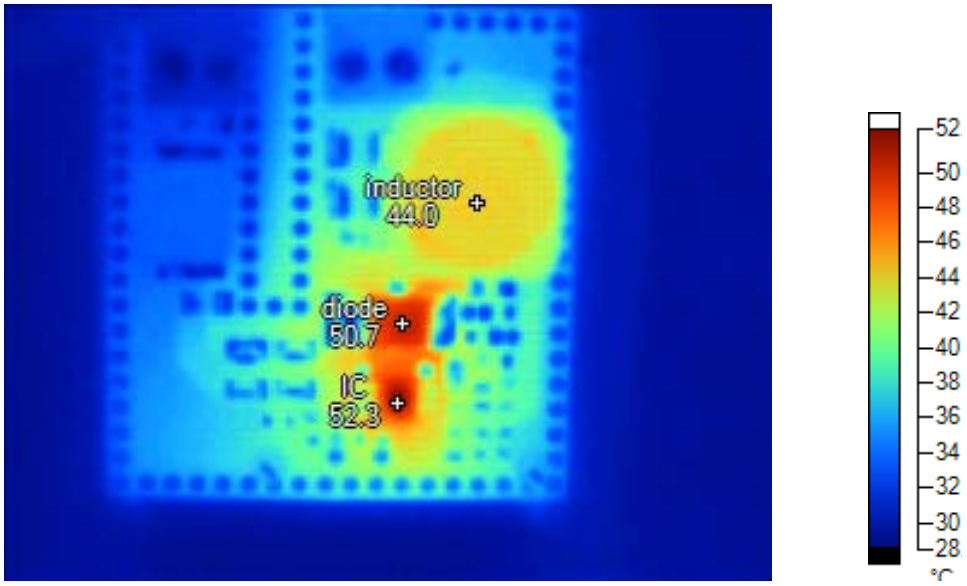

Figure 27: Thermal image for VIN = 36 V, VOUT = 3.3 V

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