Failure Description Flyback

1. Design Parameters

input voltage: V_{in} = 5.4 to 17 V
output voltage: V_{out} = 6 V ± 1 %
output current: I_{out} = 400 mA
switching frequency: f = 500 kHz

2. Failure Mode

When the output is unloaded the Flyback shows the following failure mode: The control signal for MOSFET Q1 (V_{GS}) is not a continous pulse train, it consists of groups of pulses. The collector-emitter-voltage of the optocoupler (V_{FB}) shows oscillations. With no load the output voltage (V_{out}) is 5.97 V.
When the load increases an audible noise can be heard and V_{out} falls to 0 V once the output current reaches 100 mA.

3. Bode Plot of the Control Loop (no output load!)

The closed loop bode plot with the output loaded could not be measured because of huge measurement errors. The frequency where the gain intersects the 0 dB-line (f_c) is 3,2 kHz. The phase at that point is 97 °.

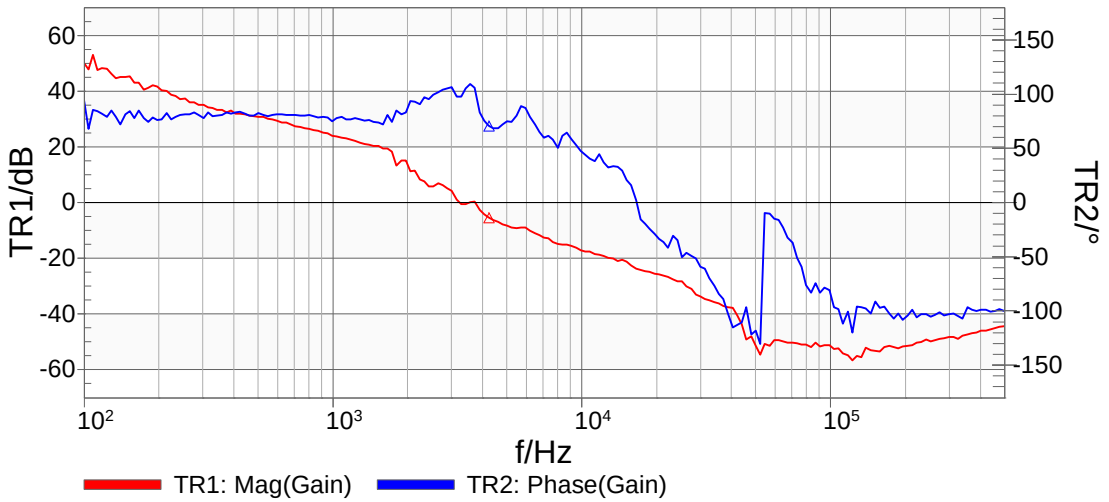

Figure 1 shows the bode plot of the closed loop with no load at the output.

4. Measurements in the Time Domain

The measurements where taken out at V_{in} = 5.4 V and I_{out} = 0 mA:

tespoints of the signals:
V_{DS}: „SW“ and „ISEN“
V_{sense}: „ISEN“ and „TP_GND“
V_{GS}: Gate of Q1 and „TP_GND“
V_{FB}: Collector of U2 and „TP_GND“
V_{in}: „Vin“ and „TP_GND“
V_{out}: „Vout“ and „ISOGND“

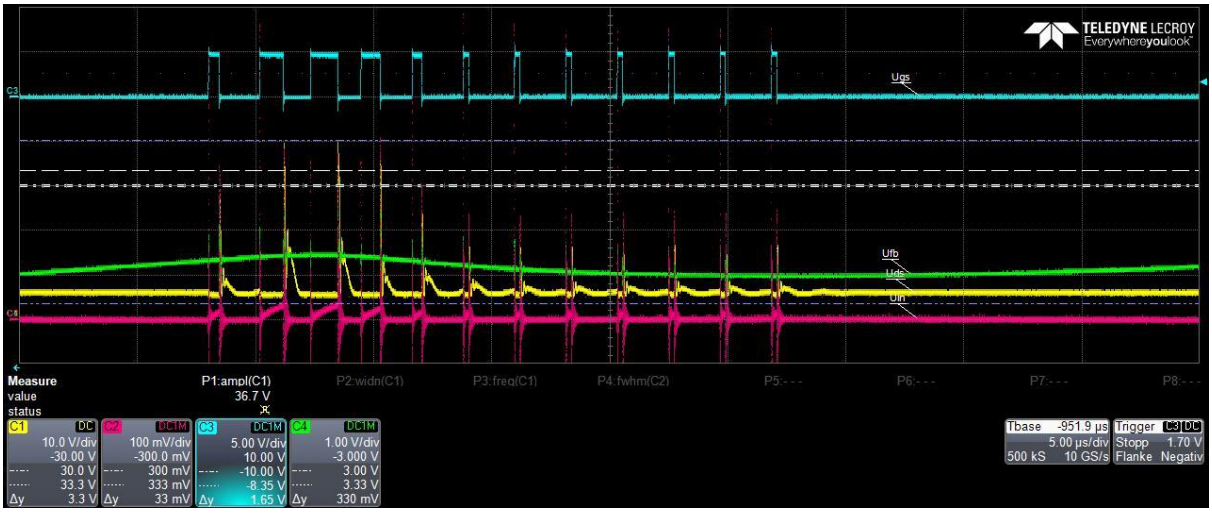

Figure 2 shows the following signals: V_{DS} of Q1 (CH1), V_{SENSE} at R9 (CH2), V_{GS} of Q1 (CH3), V_{FB} (CH4).

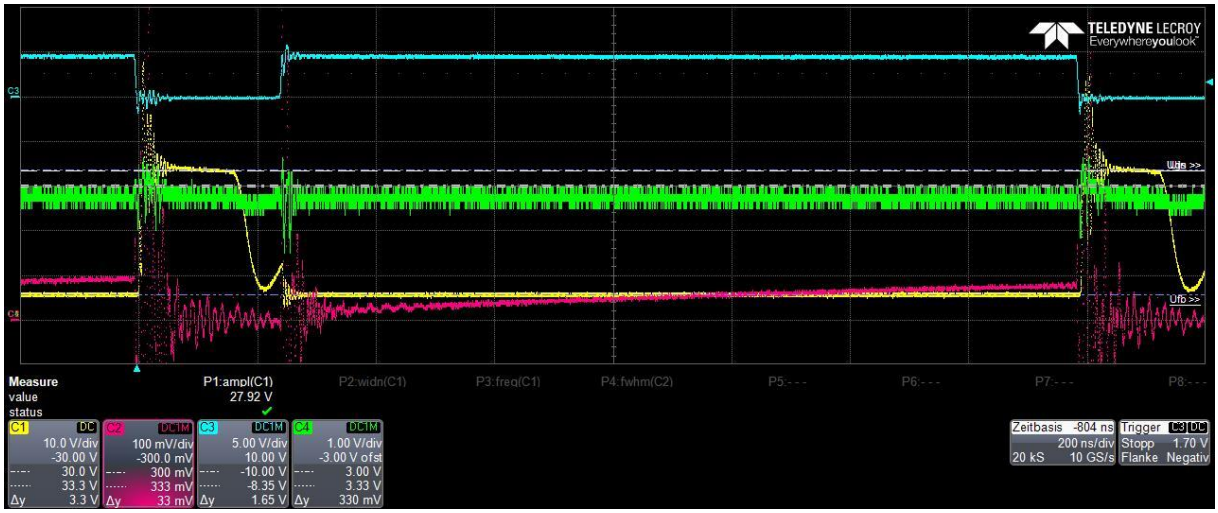

Figure 3 shows the same assignment of the signals as Figure 2.

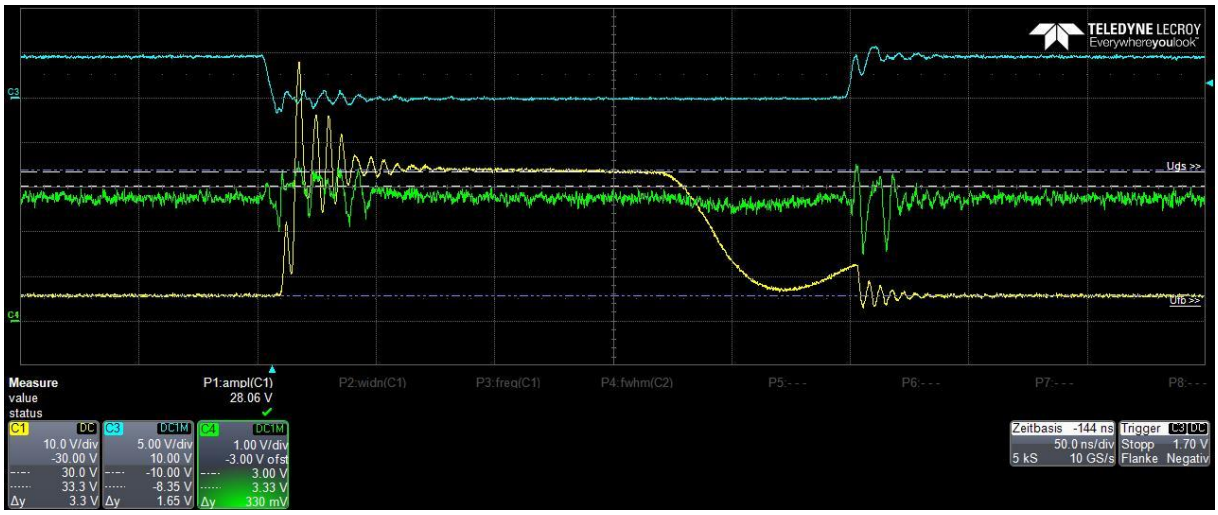

Figure 4 shows V_{DS} of Q1 (CH1), V_{GS} of Q1 (CH3), V_{FB} (CH4).

The progression of V_{out}, V_{in}, V_{GS} and V_{FB} at power up shows figure 5.

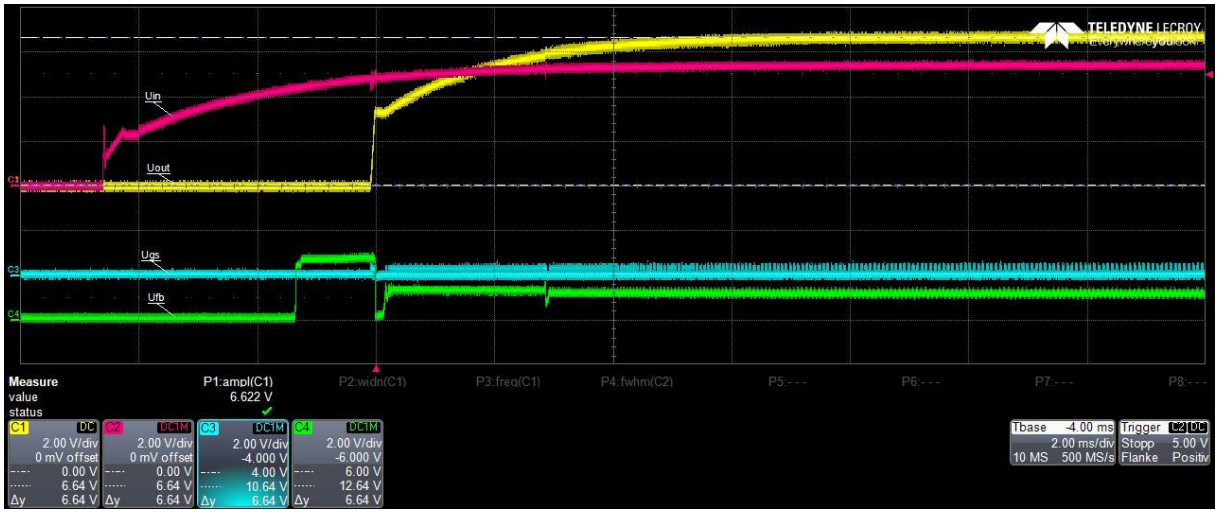

Figure 5 shows V_{out} (CH1), V_{in} (CH2), V_{GS} of Q1 (CH3), V_{FB} (CH4).