Comparison EvalBrd and HeliSourceSC1

Contents

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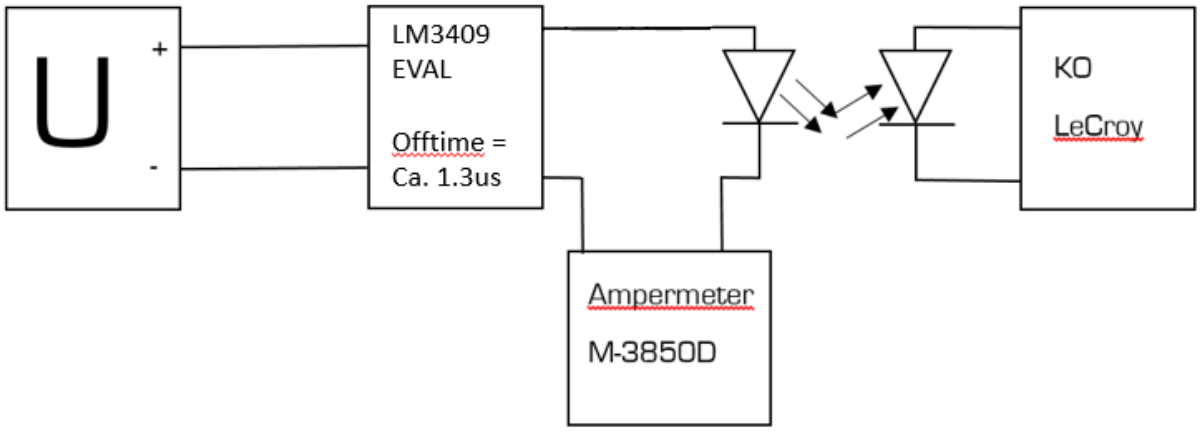
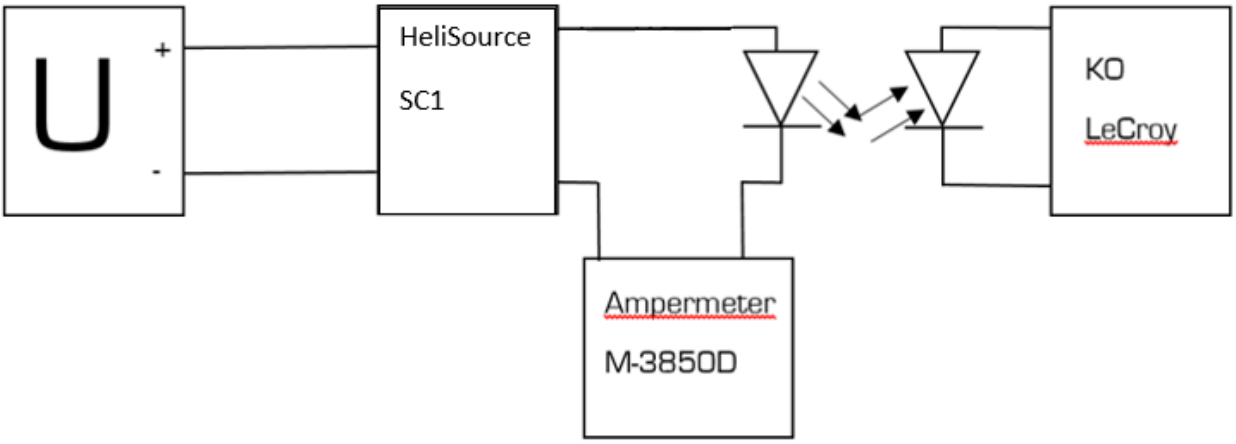
1. Test setup

1.1. EvalBrd



Power supply	Heliotis power supply 24V
Evaluation Board	LM3409EVAL/NOPB-ND
LED	Luminus PT39 blue
Amperemeter	Voltcraft M-3850D
Photodiode	Thorlabs PDA36A, 0dB
KO	LeCroy waveRunner 104MXi

1.2. HeliSourceSC1



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	HeliSourceSC1
LED	Luminus PT39 blue
Amperemeter	Voltcraft M-3850D
Photodiode	Thorlabs PDA36A, 0dB
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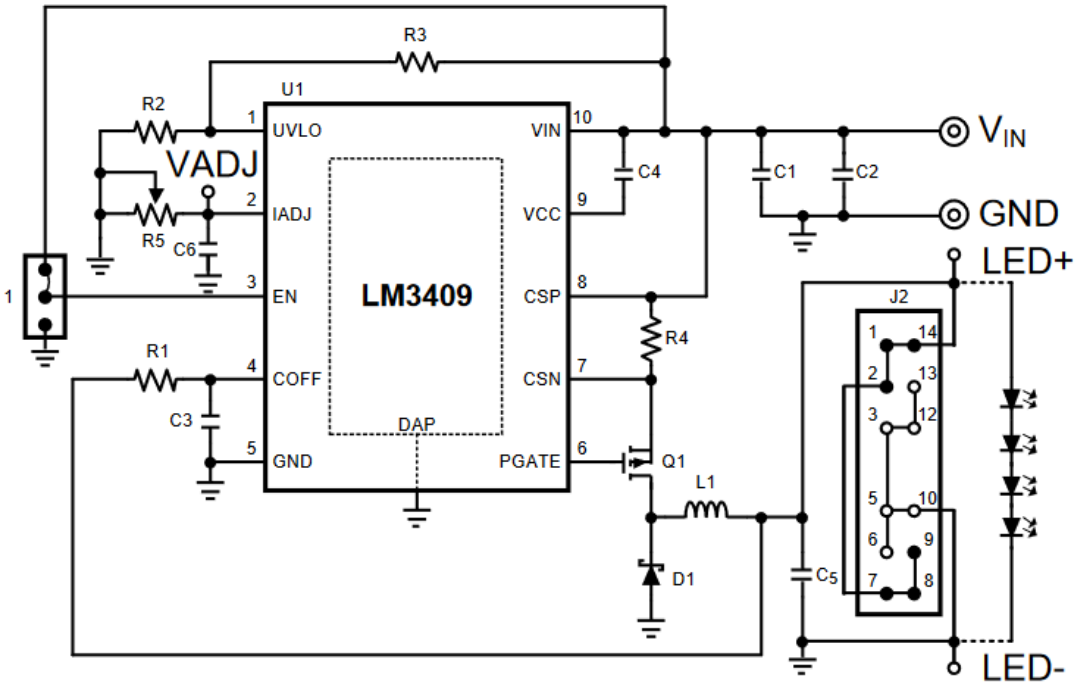
2. Schematic

2.1. Schematic EvalBrd

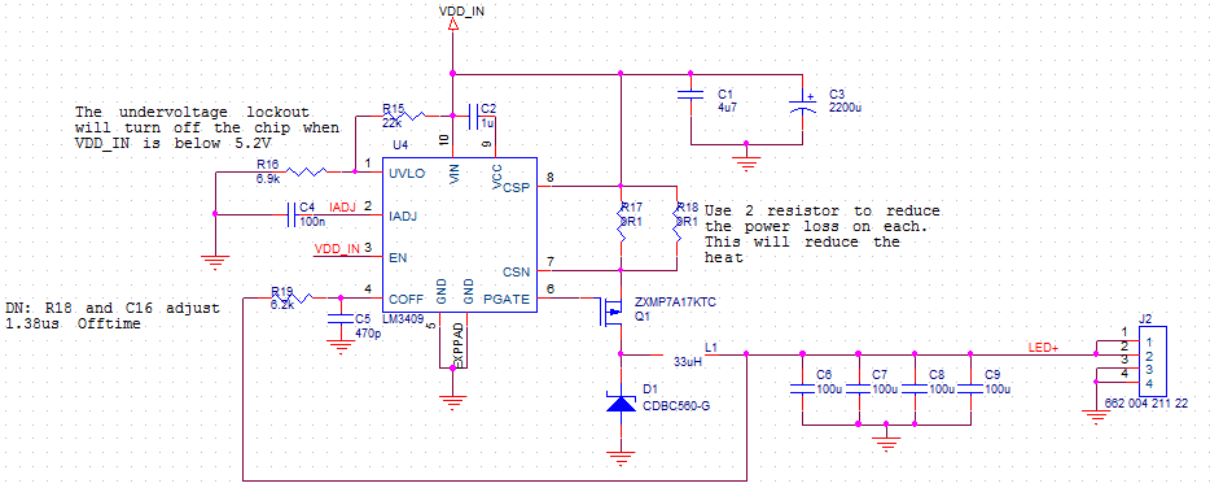


Modifications:

R1	6.2k	L1	33uH, 12A
R2	6.9k	C2	2.2mF, 35V
R3	22k	C5	400uF
R4	0.05, 0.1 or 0.2Ω		

To optimize the ripple on LED current, there is a 100uF capacitor mounted on de LED board between anode and cathode.

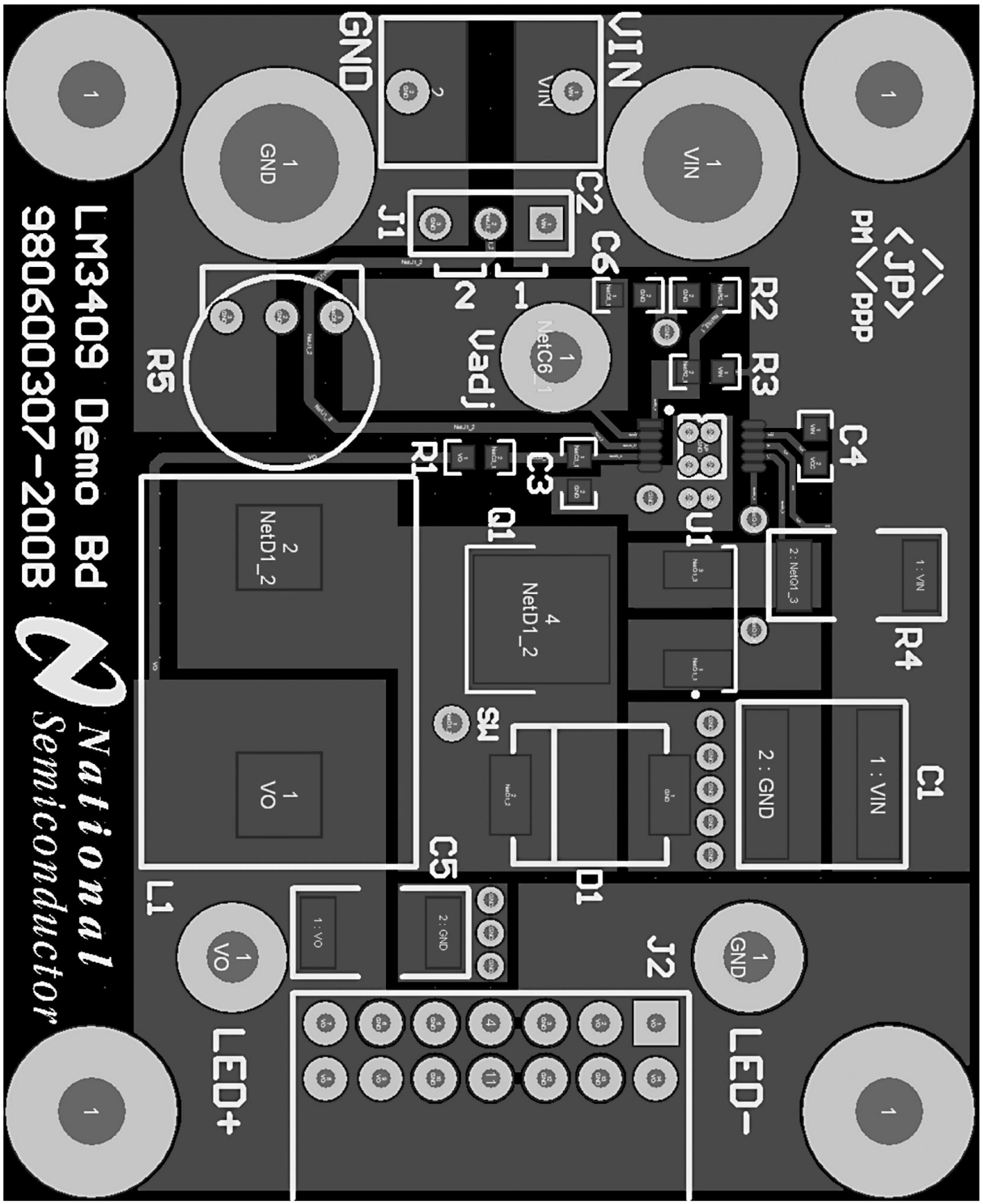
2.2. Schematic HeliSourceSC1



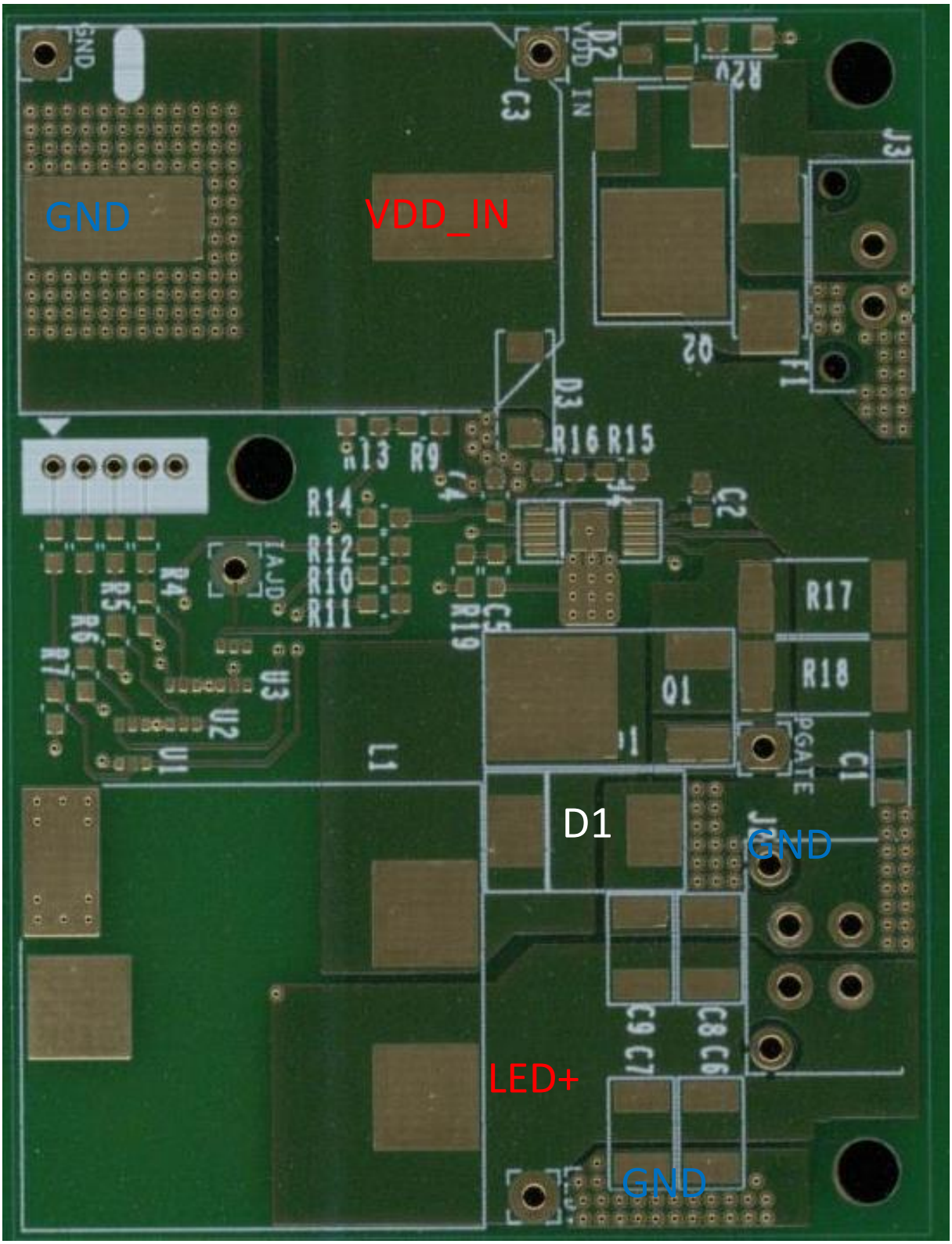
For complete schematic open PDF files in attachment (LED-Driver and Overvoltage-protection)

3. Layout

3.1. Layout Evalbrd



3.2. Layout HeliSourceSC1

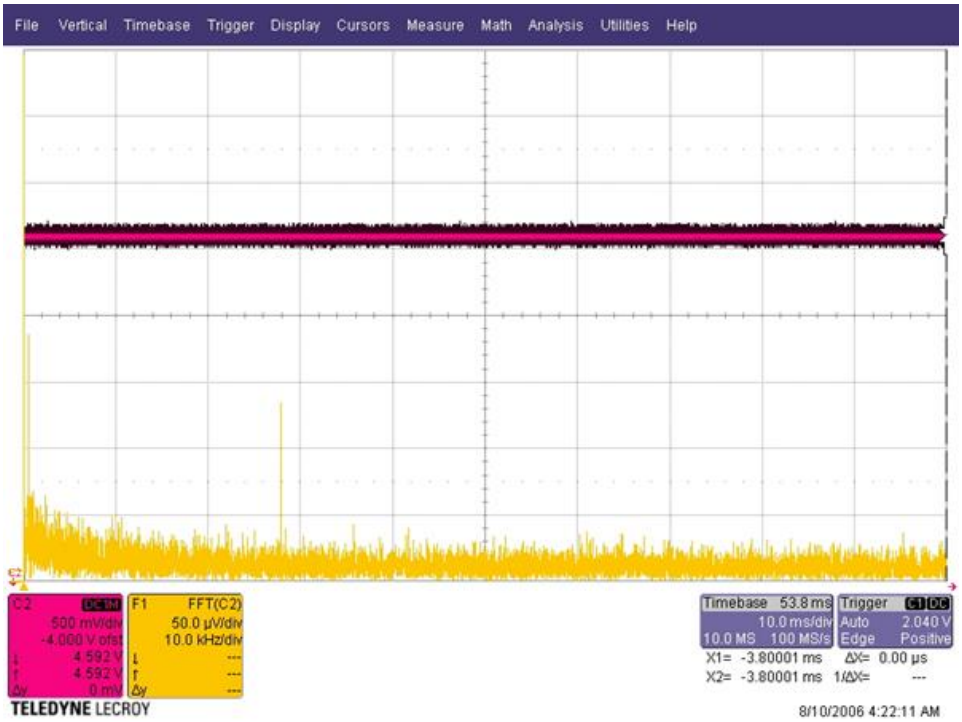


The components on the HeliSource and the Evaluation Board are identical, especially the schottky diode D1, the inductivity L2 and the FET Q1.

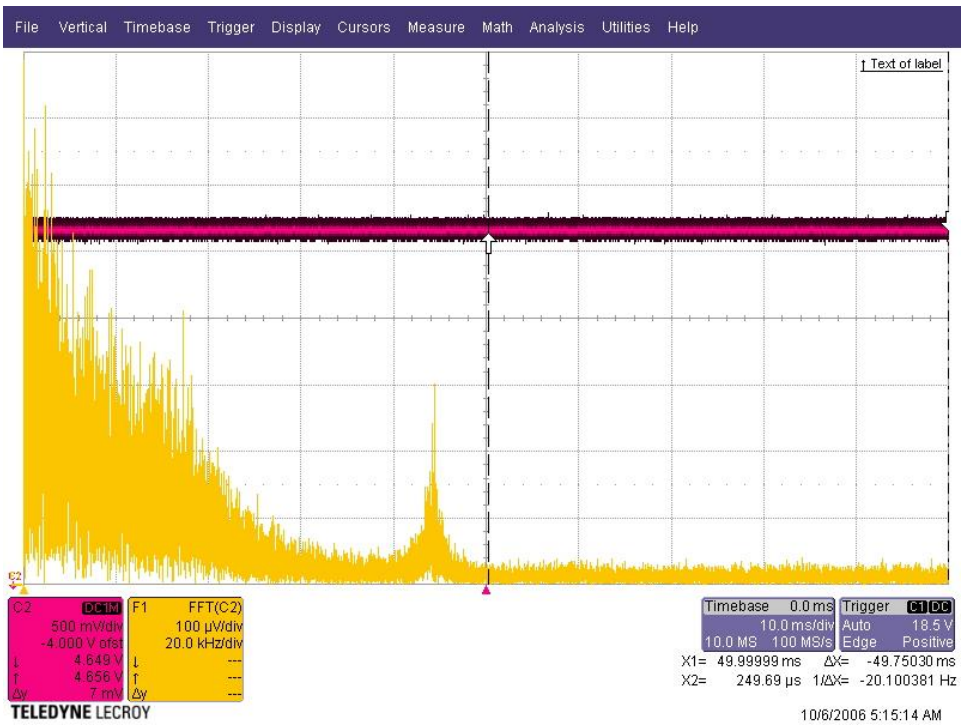
4. Measurements

4.1. Ripple Measurements

4.1.1. EvalBrd Imax = 4.9A, ILED = 4A 0-100kHz



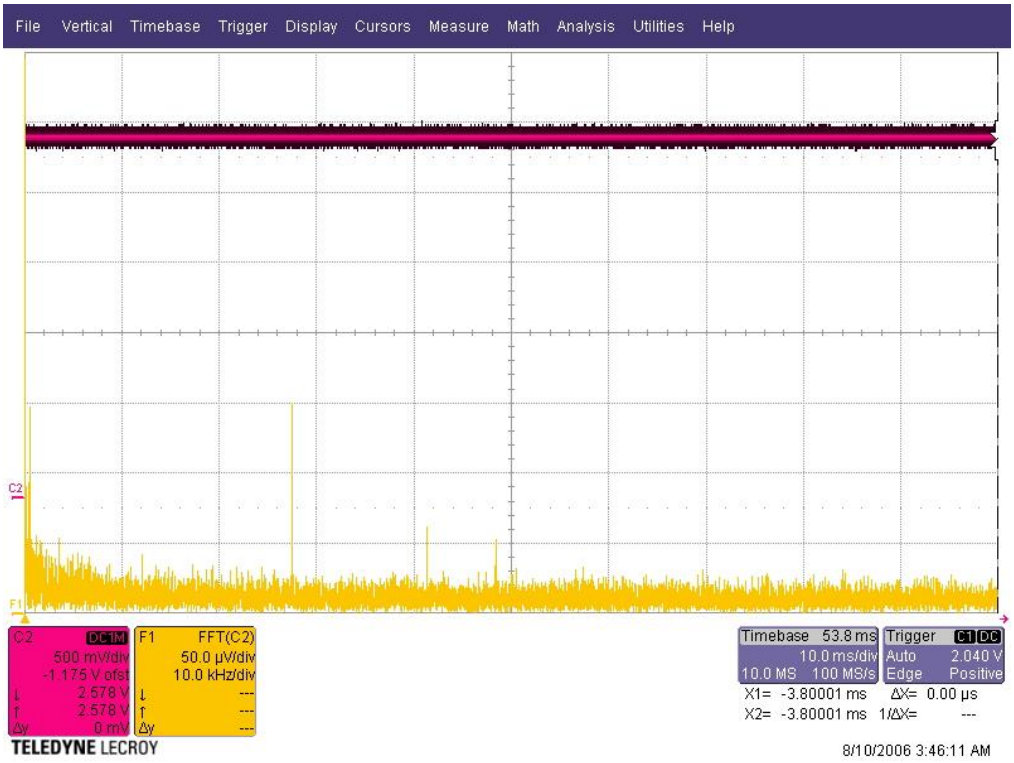
4.1.2. HeliSourceSC1 Imax 4.9A, ILED = 4A 0-100kHz



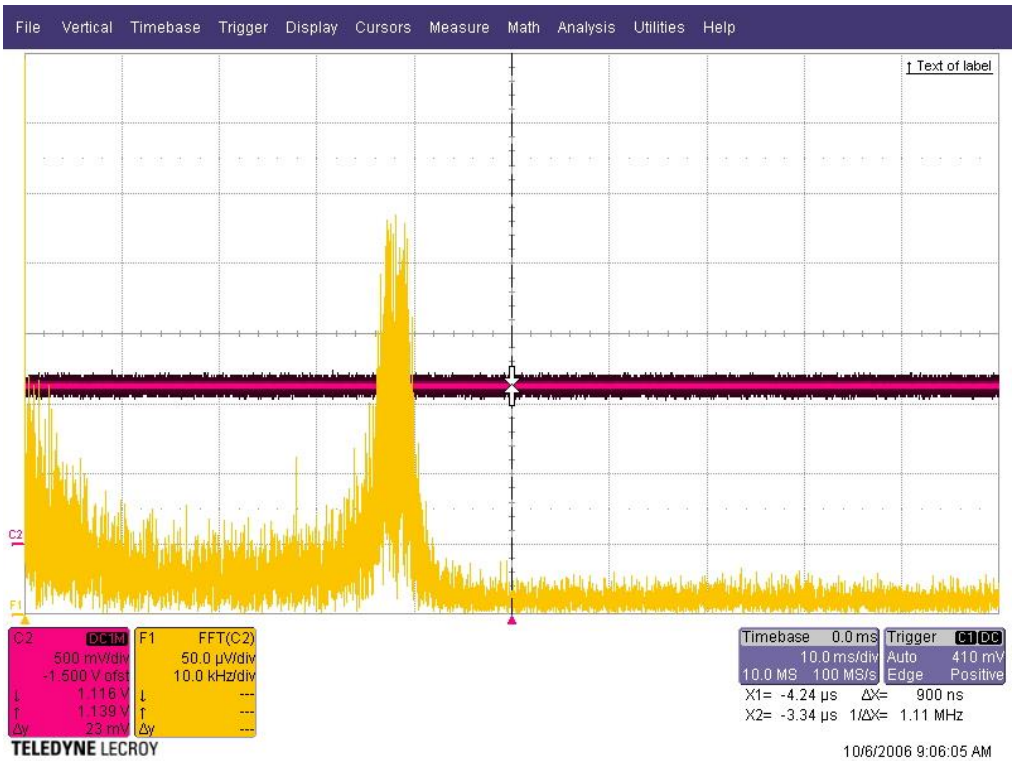
On the first picture, you can see the photo diode voltage and the FFT of this voltage by using the EvalBrd. There is almost no noise between a frequency of 0 and 100kHz. Just a peak of 150uV by 38kHz, which is also existing, if the LED is turned off. (look at “HeliSorce SC1 Evaluation of the TI LM3409”)

On the second picture, you can see the photo diode voltage and the FFT of this voltage by using the HeliSource SC1. There is a massive noise between 0 and 60kHz (up to factor 10) and a peak at 90kHz. (600uV)

4.1.3. EvalBrd Imax = 4.9A, ILED = 2A, 0-100kHz



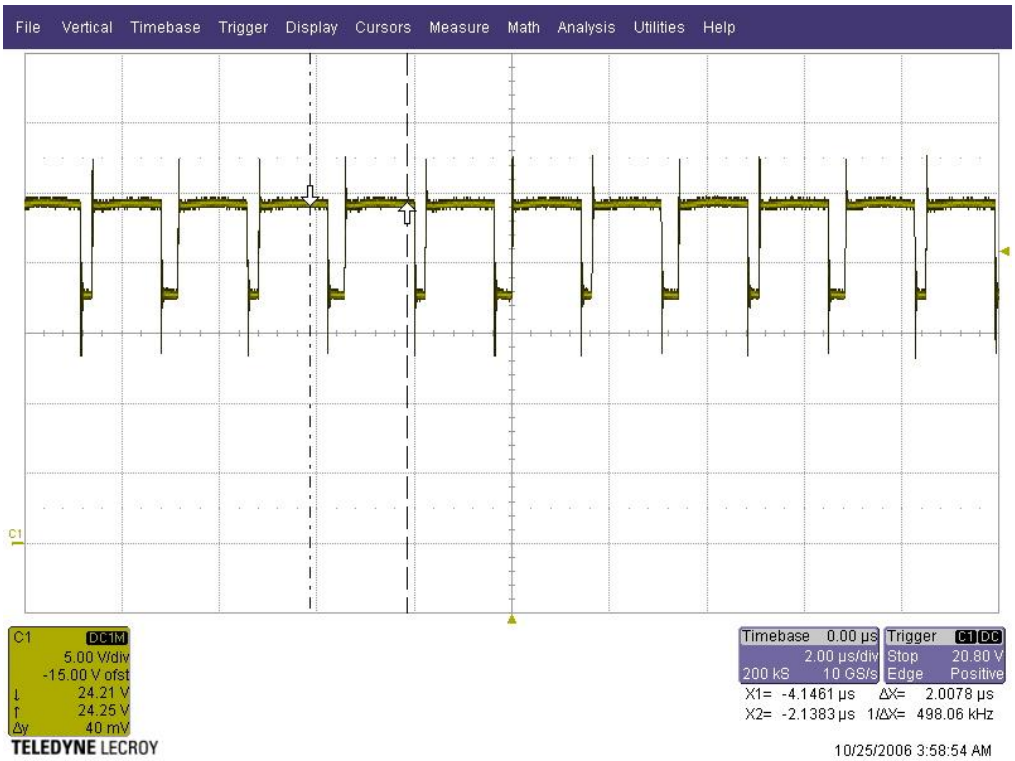
4.1.4. HeliSourceSC1 Imax = 4.9A, ILED = 2A, 0-100kHz



If ILED = 2A, the problem is still the same. There is much noise between 0-and 50kHz (factor 2-3 comparing to EvalBrd). The peak at 40kHz doesn't exist on the EvalBrd.

4.2. Voltage measurements at PGATE

4.2.1. EvalBrd Iout = 4A



4.2.2. HeliSourceSC1 Iout = 4A

On the first picture, you see the switching behavior of the PGATE on the Evaluation Board. The High signal (24V) is equal to the Off time, which is adjusted by COFF. During the Low signal (17.5V), the FET (Q1) is conductive. This duty cycle is almost constant.

On the second picture, you see the switching behavior of the PGATE on the HeliSourceSC1. The High signal (24V) is also equal to the Off time, but the Low signal is not constant. You can see 7 very short Low signals and then follows one unusual long Low signal.

By reducing the output current (ILED) or the Input Voltage(Vin), the number of the short Low signals is reduced as well. According to this, the frequency of the noise on ILED is rising.

5. Unsuccessful Modifications

To get the HeliSourceSC1 similar to the EvalBrd, we removed step by step, these components, which doesn't exist on the EvalBrd.

- The first step was to remove the transient protection diode D3.
- The second step was to remove the reverse voltage protection (F1, R20, Q2, D2)
- The third step was to replace the IADJ circuit (R9-R14, U1-U3) by a potentiometer. We tried to find any current between 0A and 4A, which would have a constant switching behavior.
- Finally, we replaced LM3409, the schottky diode and die FET Q1 by new components