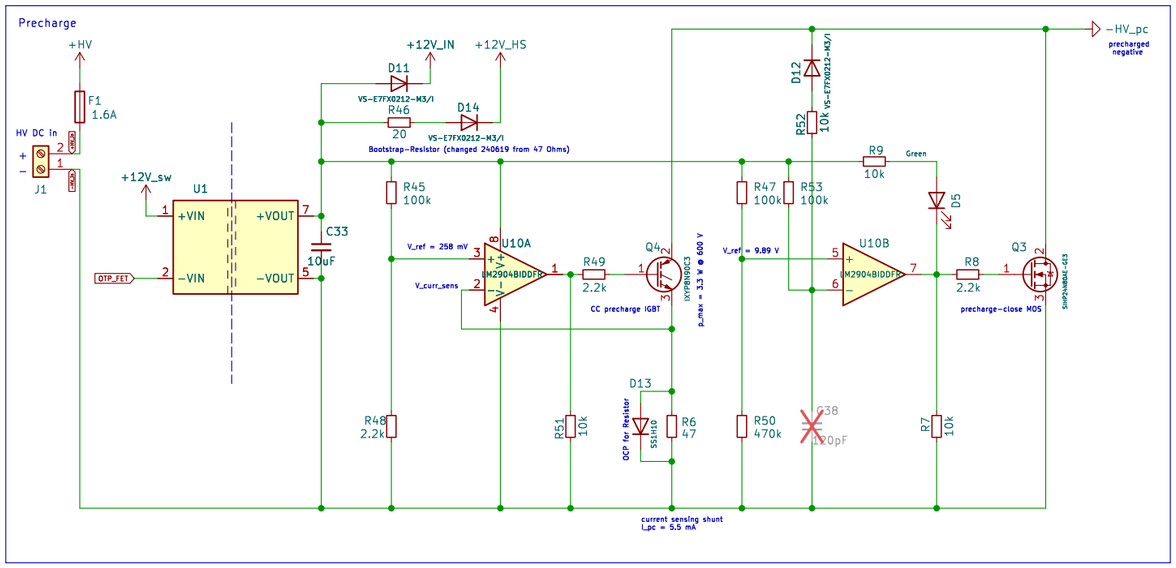


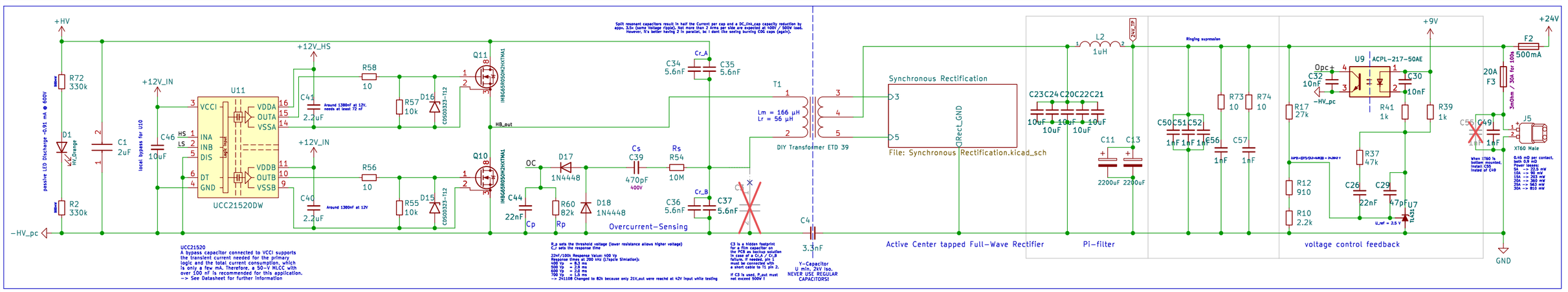


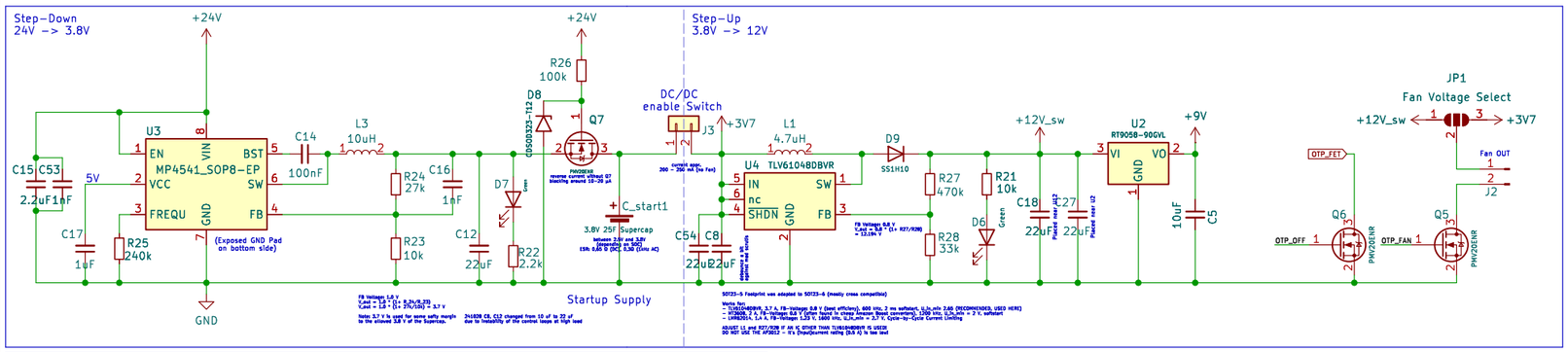


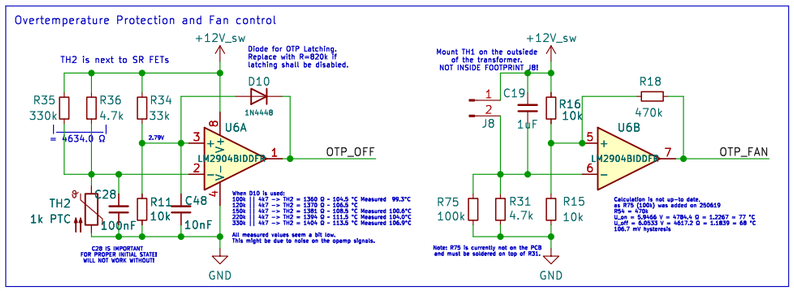


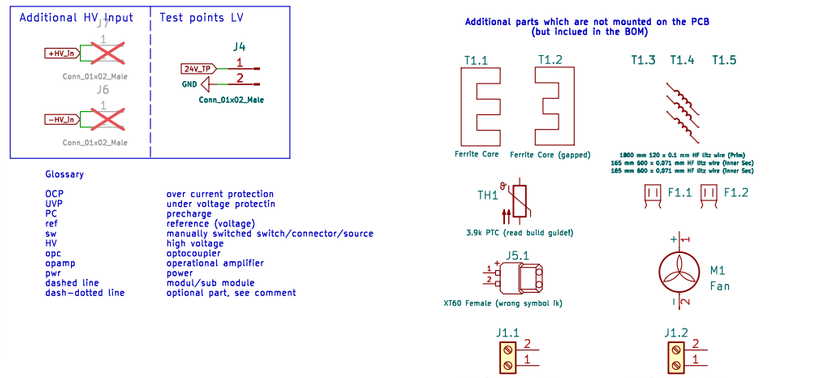


Documentation and other resources can be found on GitHub:
https://github.com/Rootthecause/DCDC

This design is published as open-source hardware under the CERN-OHL-W license

Und wenn die FETs noch nicht gestorben sind, dann leben sie noch heute.

**Author: Rootthecause**

Sheet: /
File: DCDCv9-3.kicad_sch

**Title: DC/DC v9-3r1**

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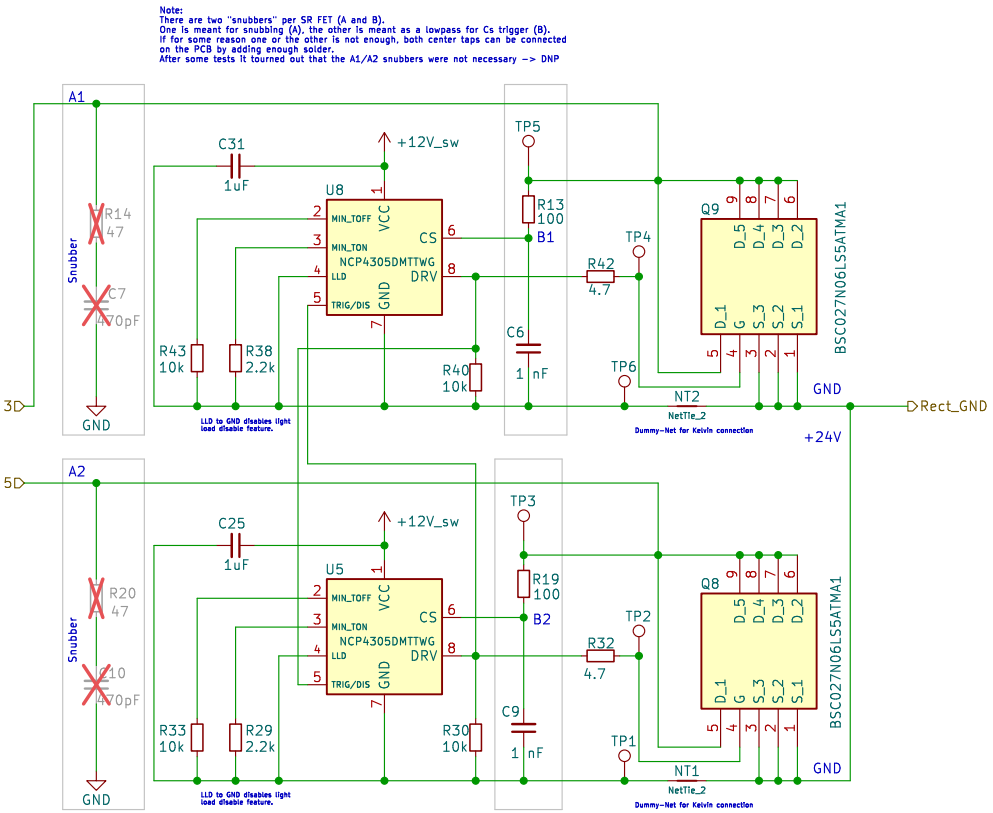


B1 / B2 Lowpass
V_RSHIFT_CS = R_SHIFT_CV * (−100 µA)

R_ds_on (Q8, Q9, 60°C) ≈ 2.7 mΩ
Body Diode: 0.6 V @ 10A
-> From measurements assuming 5A passive rectification (both Body diodes) seem thermally okay (3W total / 1.5 W per device)
5A would be the lower limit where we want to trigger active rectification.
5 A * 2.7 mΩ = 13.5 mV (V_RSHIFT_CS)
V_RSHIFT_CS / 100 µA = R_SHIFT_CV (max.) = 135 Ω

f_ring = 4.48 MHz / 223 ns
Note: There is a Snubber calculator available http://paulorenato.com/index.php/197
However I ended up testing values from experience.

-> 1 nF and 100 Ω could be okay (0.115 W_loss @ 200 kHz / 24 V)
-> 2.2 nF and 47 Ω -> less voltage drop, better triggering (0.23 W_loss @ 200 kHz / 24 V)

Edit: 241118 1 nF and 100 Ω tested to trigger better than 2.2 nF and 47 Ω for unknown reasons.
The 2.2 nF / 47 Ω variant also gets too hot.
Untested till now: 470 pF and 200 Ω might be okay too -> Even fewer losses

Current through the MIN_TON adjust resistor can be calculated as:

$$I_{R\_MIN\_TON} = \frac{V_{ref}}{R_{Ton\_min}} \quad \text{(eq. 5)}$$

If the internal current mirror creates the same current through $R_{MIN\_TON}$ as used the internal timing capacitor (Ct) charging, then the minimum on−time duration can be calculated using this equation.

$$t_{MIN\_TON} = C_t \frac{V_{ref}}{I_{R\_MIN\_TON}} = C_t \frac{V_{ref}}{\frac{V_{ref}}{R_{MIN\_TON}}} = C_t \cdot R_{MIN\_TON} \quad \text{(eq. 6)}$$

The internal capacitor size would be too large if $I_{R\_MIN\_TON}$ was used. The internal current mirror uses a proportional current, given by the internal current mirror ratio. One can then calculate the MIN_TON and MIN_TOFF blanking periods using below equations:

$$t_{MIN\_TON} = 1.00 * 10^{-4} * R_{MIN\_TON}\ [\mu s] \quad \text{(eq. 7)}$$

$$t_{MIN\_TOFF} = 1.00 * 10^{-4} * R_{MIN\_TOFF}\ [\mu s] \quad \text{(eq. 8)}$$

Note that the internal timing comparator delay affects the accuracy of Equations 7 and 8 when MIN_TON/ MIN_TOFF times are selected near to their minimum possible values. Please refer to Figures 69 and 70 for measured minimum on and off time charts.

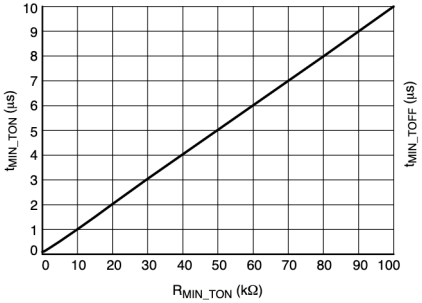


**Figure 69. MIN_TON Adjust Characteristics**

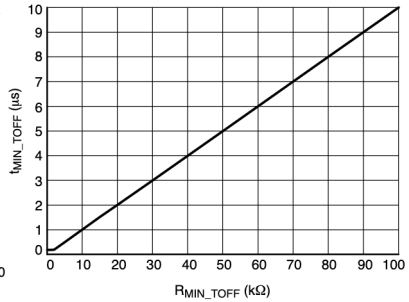


**Figure 70. MIN_TOFF Adjust Characteristics**

**Author: Rootthecause**
Sheet: /Synchronous Rectification/
File: Synchronous Rectification.kicad_sch

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