

Übung 4, Aufgabe 3

Analyse: Schaltplan des DE1 SOC Boards

Simon Offenberger S2410306027@fhooe.at

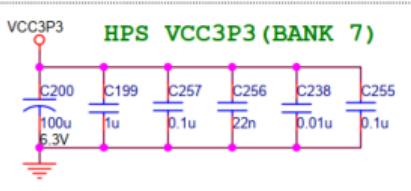
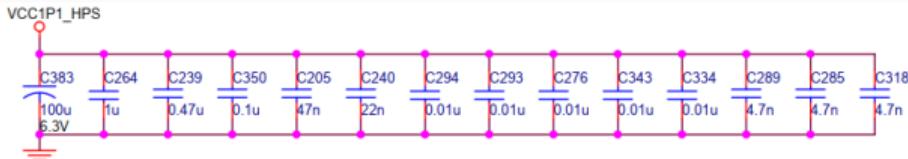
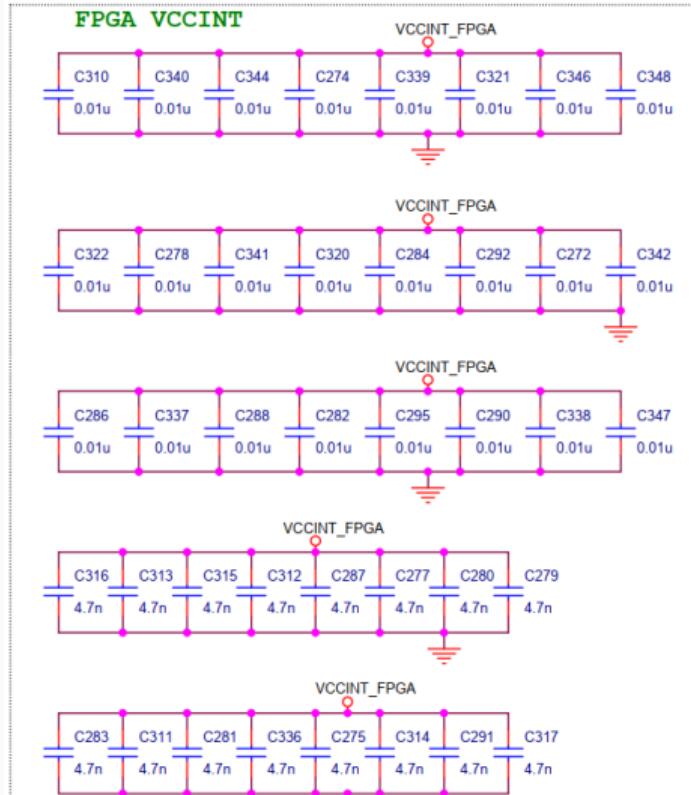
22. Oktober 2025

FH Hagenberg

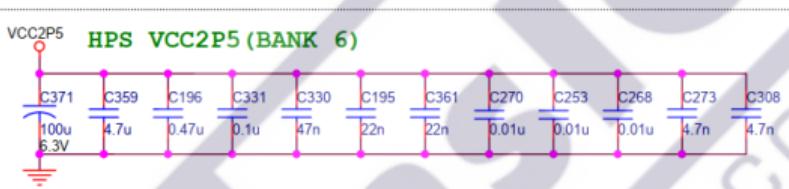
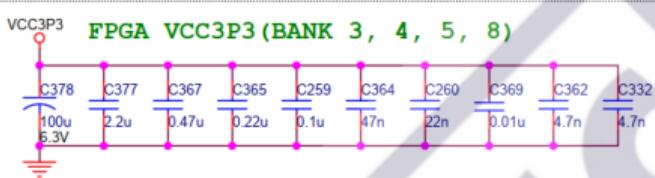
Agenda

- Decoupling - Spannungsstabilisierung
- GPIO-Schutzbeschaltung
- IR-Emitter

Decoupling - Spannungsstabilisierung

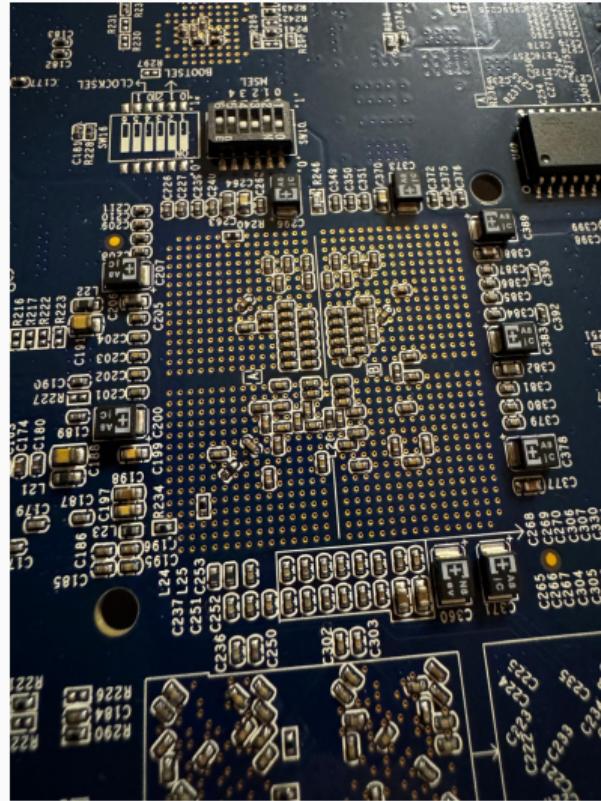


Place C394 close to J20/G23 pin

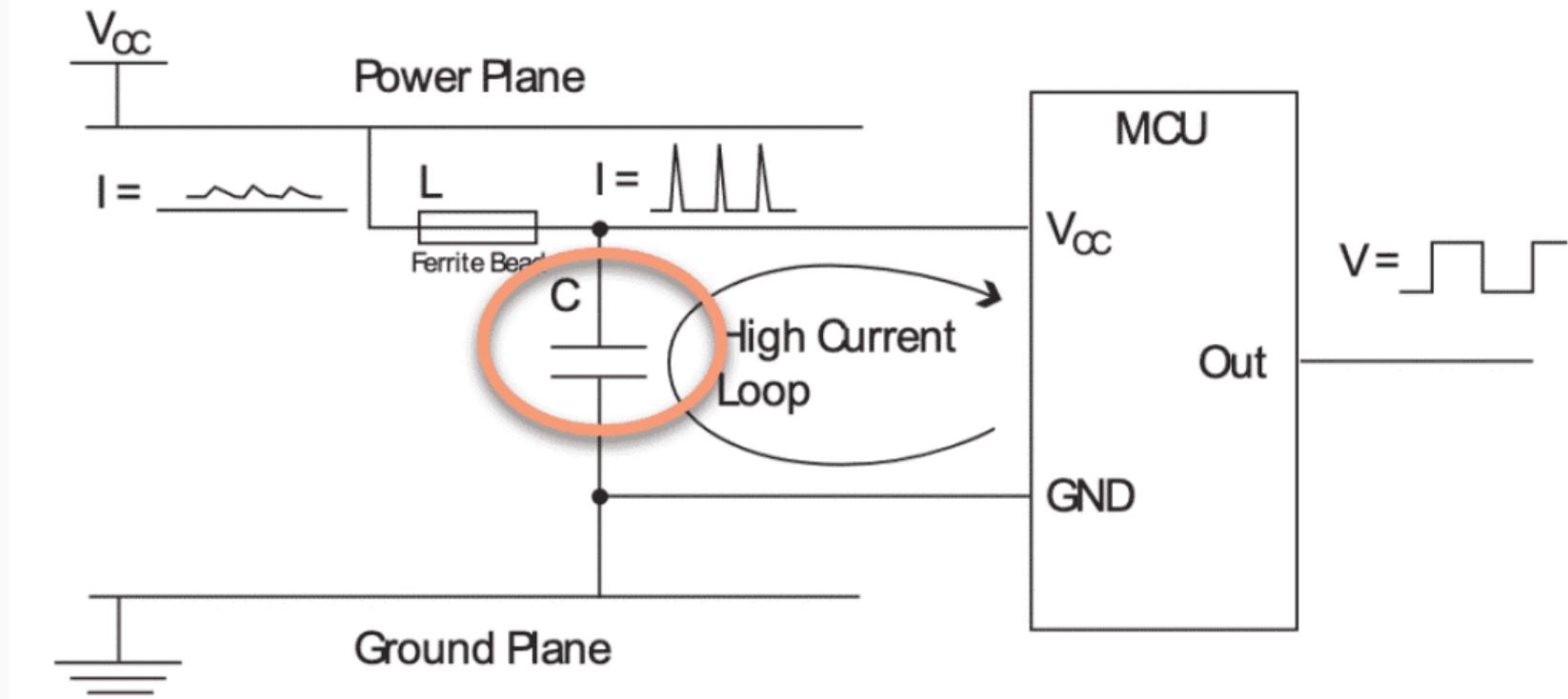


Decoupling - Spannungsstabilisierung

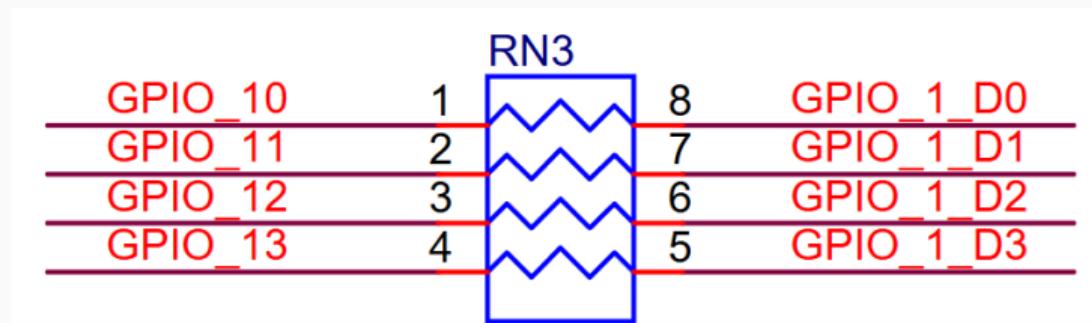
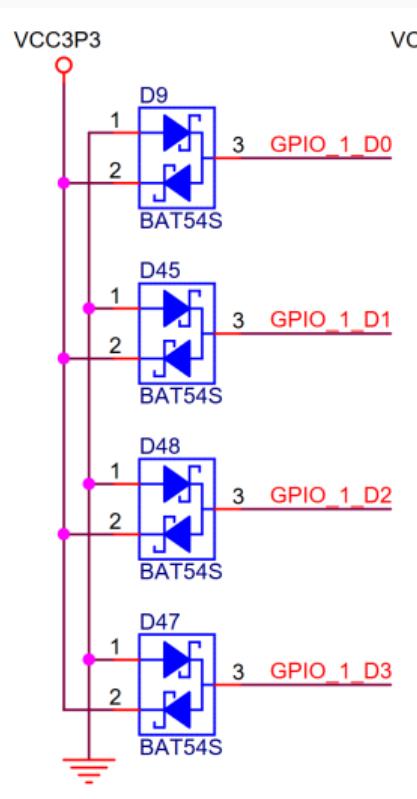
- Warum so viele Kondensatoren parallel?
 - Power Pins sind räumlich getrennt.
- Reicht hier ein großer Kondensator?
 - höherer ESR (Equivalent Series Resistance)
 - höhere ESL (Equivalent Series Inductance)
 - längere Leitungen zu den Power Pins.



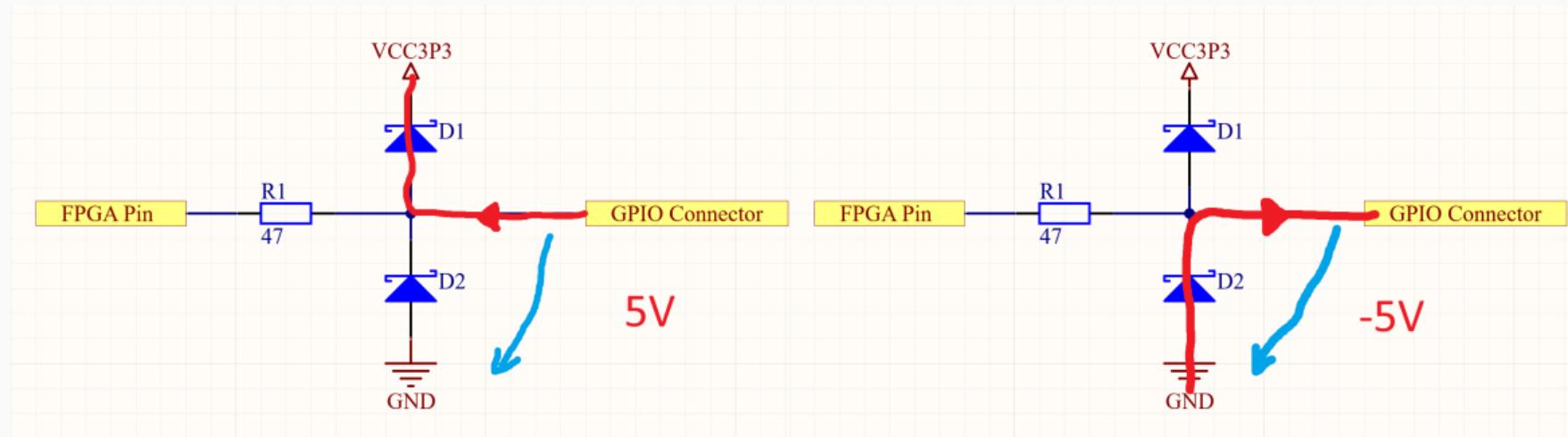
Decoupling - Spannungsstabilisierung



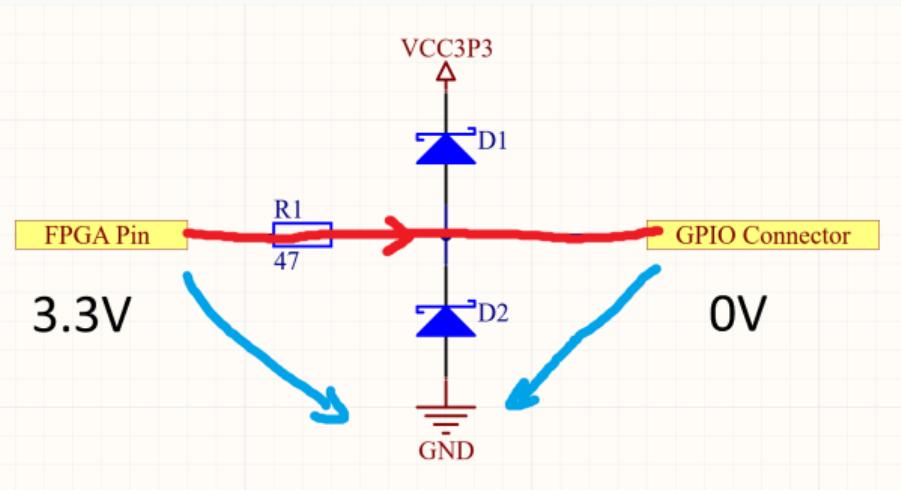
GPIO-Schutzbeschaltung



GPIO-Schutzbeschaltung Schutz vor Über- bzw. negativer Spannung



GPIO-Schutzbeschaltung Schutz vor Überstrom



$$I_k = \frac{3.3 \text{ V}}{47 \Omega} = 70 \text{ mA}$$

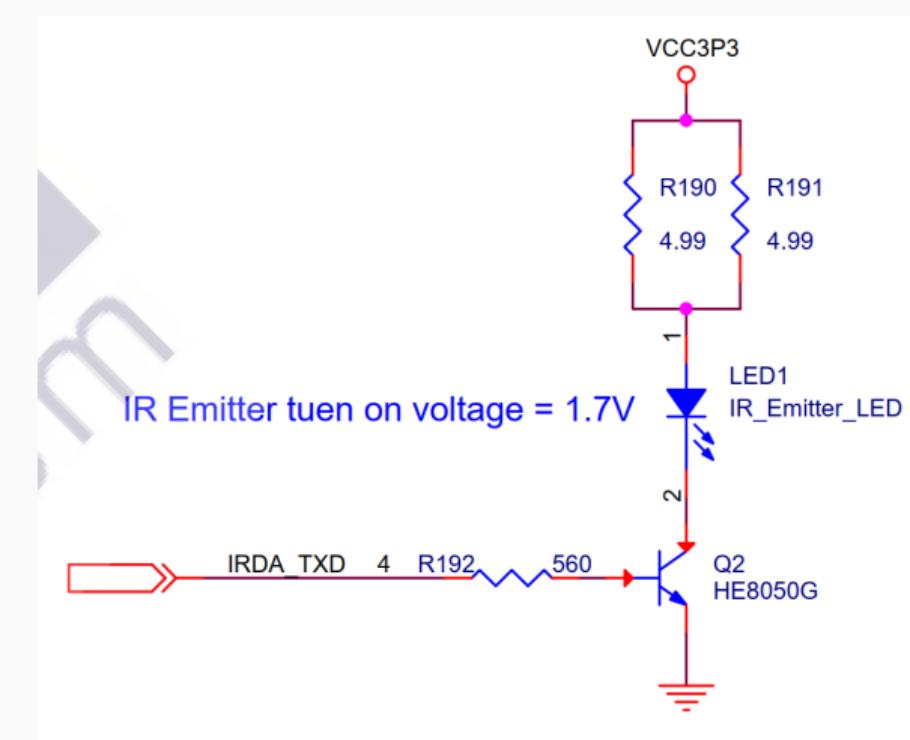
Absolute Maximum Pin Current : -25mA / 40mA

IR-Emitter Leistung an den Widerständen

$$I = \frac{V_{CC3P3} - V_f - V_{CE}}{R}$$
$$= \frac{3.3 \text{ V} - 1.7 \text{ V} - 0.2 \text{ V}}{2.5 \Omega}$$
$$= 560 \text{ mA}$$

$$P_R = R \cdot I^2$$
$$= 2.5 \Omega \times (0.56 \text{ A})^2$$
$$= 0.784 \text{ W}$$

$$P_{R190} = P_{R191} = \frac{P_R}{2} = 0.392 \text{ W}$$



IR-Emitter Leistung an den Widerständen

- Darf die LED dauerhaft eingeschaltet sein?

Tabelle 1: Typische Nennleistungen von SMD-Widerständen

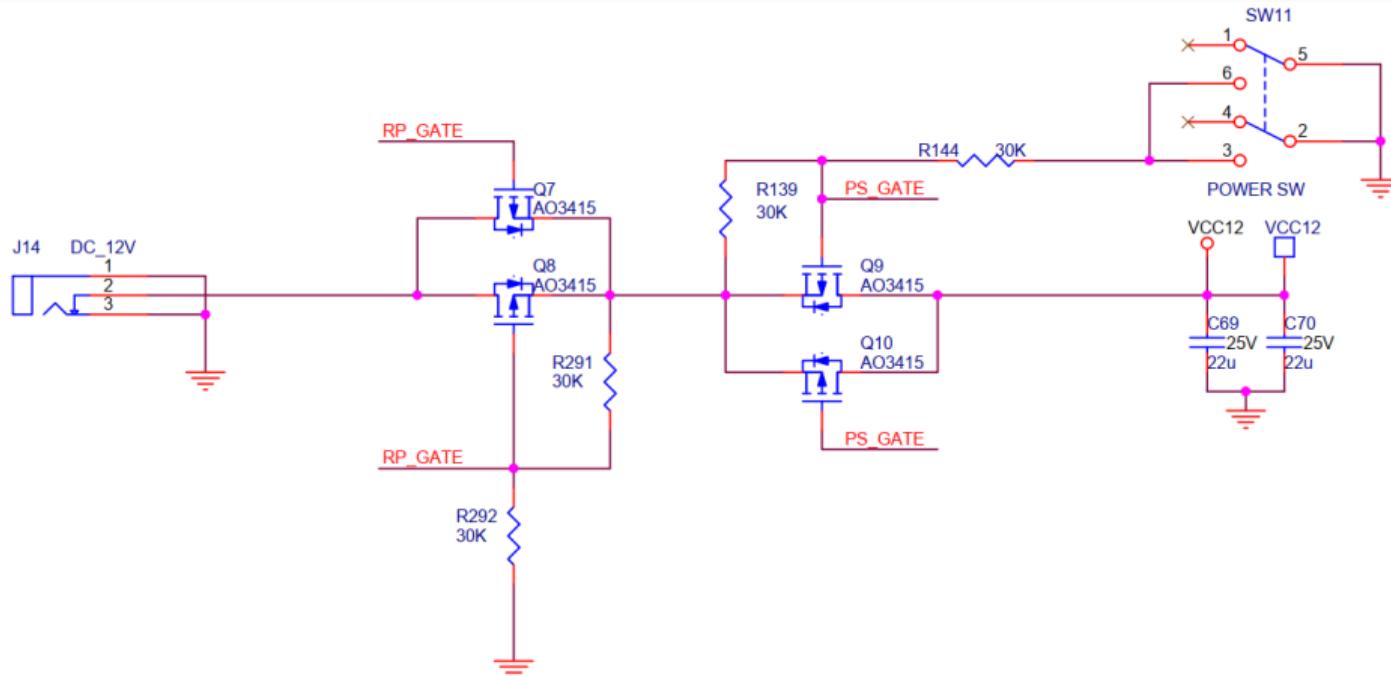
Baugröße (imperial)	Nennleistung [W]
0201	0.05
0402	0.063
0603	0.10
0805	0.125
1206	0.25
1210	0.33
2010	0.50
2512	1.00

IR-Emitter Leistung an der LED

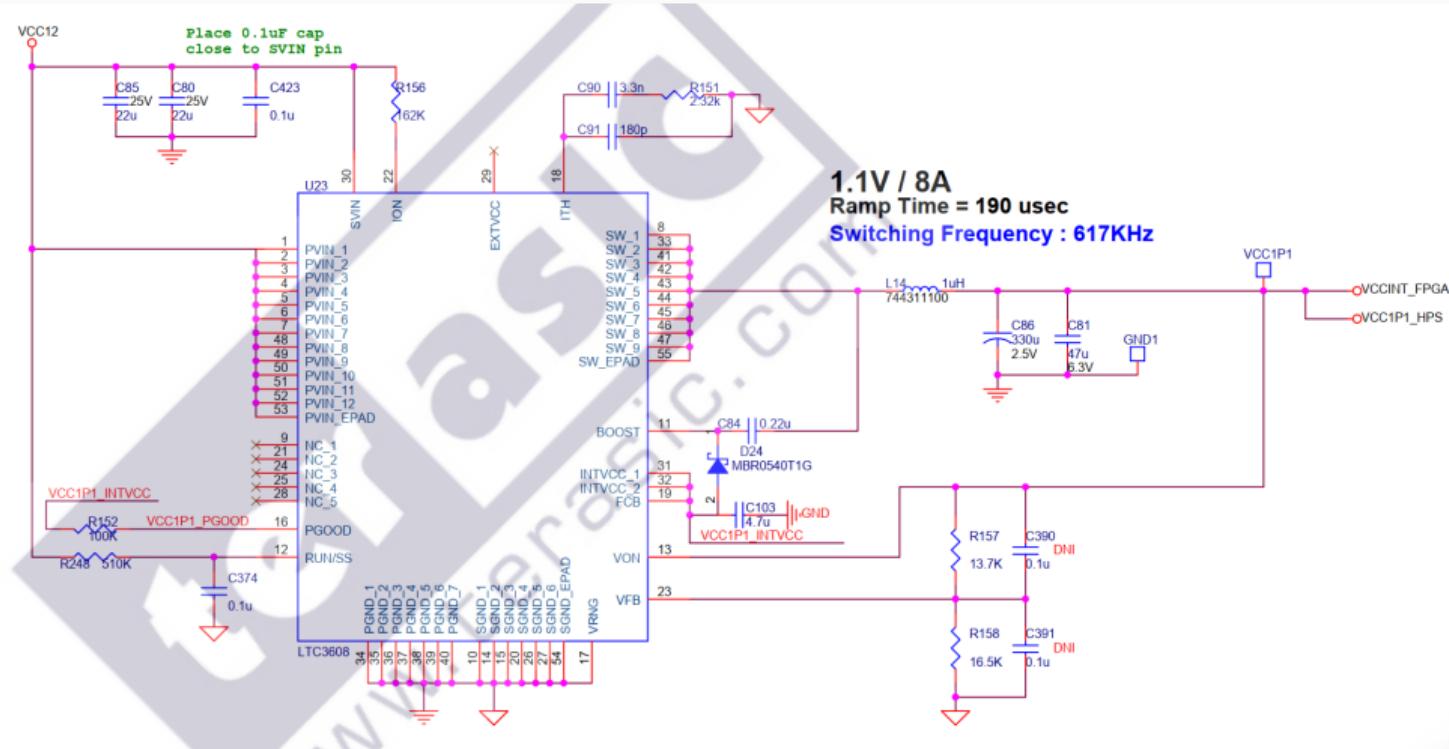
$$P_D = V_f \cdot I = 1.7 \text{ V} \times 560 \text{ mA} = 0.952 \text{ W}$$

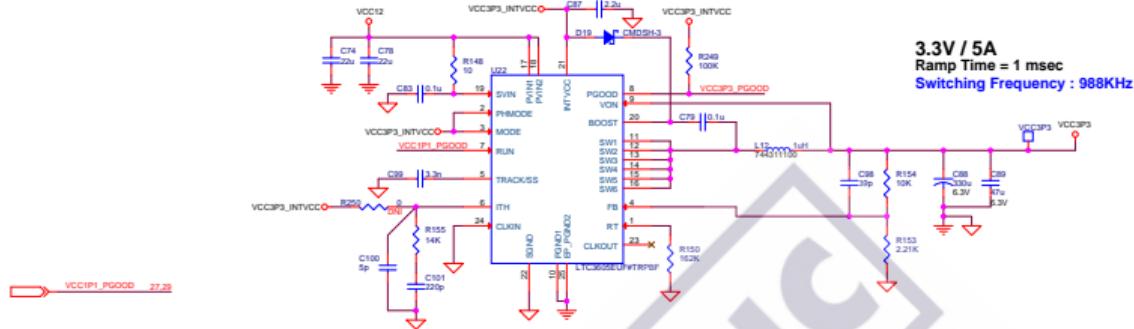
- Warum überhitzt die LED nicht?
- pulsartige Ansteuerung -> meist für Datenübertragung
- Wirkungsgrad von etwa 30% -> Verlustleistung ca. 0.7W
- Effiziente Wärmeableitung über Kupferfläche

Spannungsversorgung - Verpolungsschutz

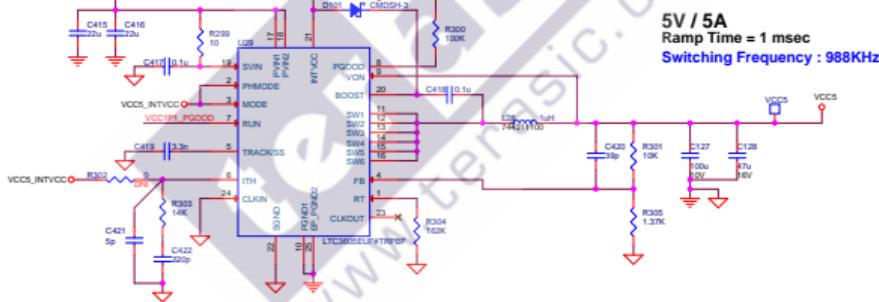


Spannungsversorgung



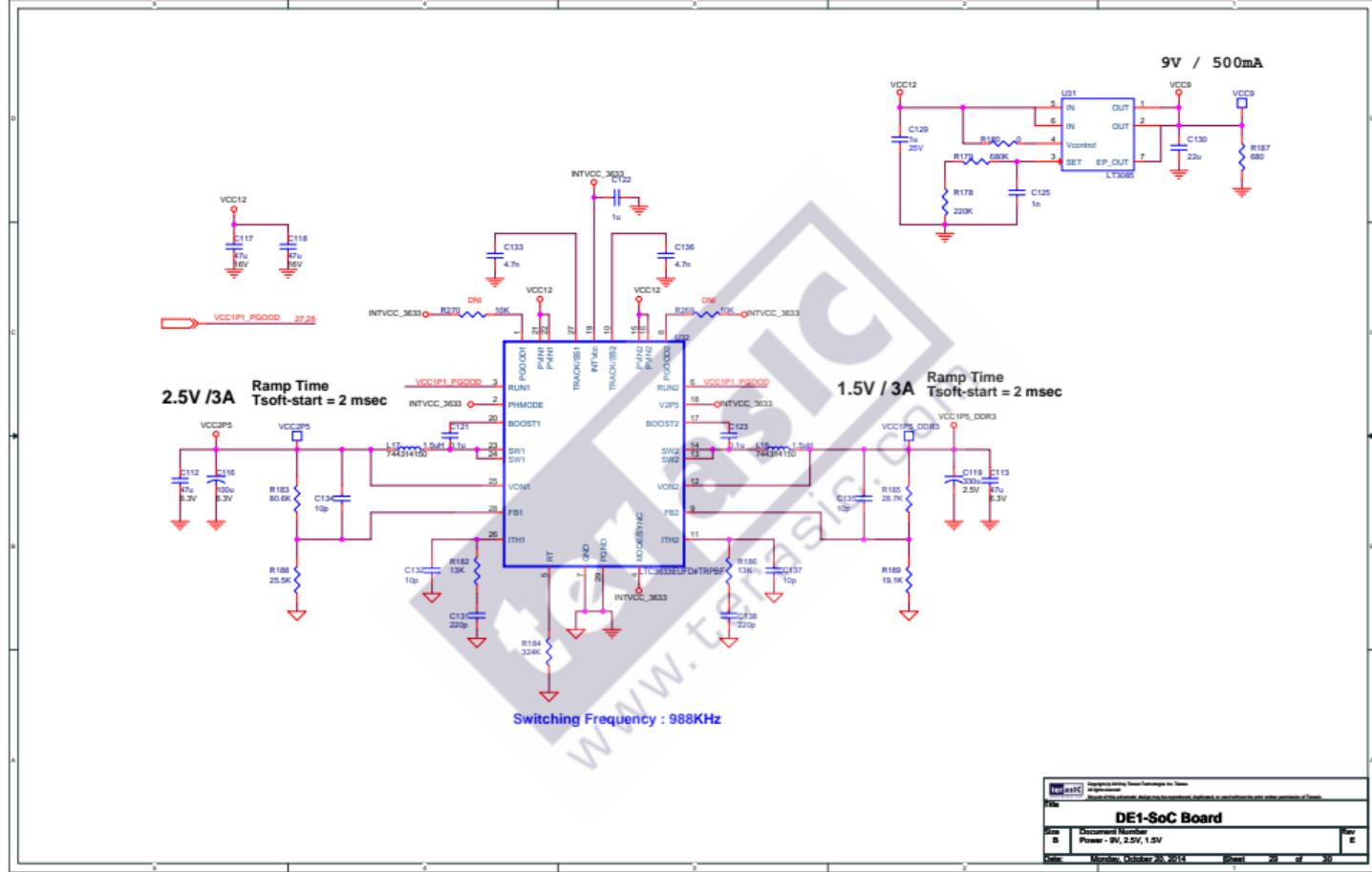


3.3V / 5A
Ramp Time = 1 msec
Switching Frequency : 988KHz

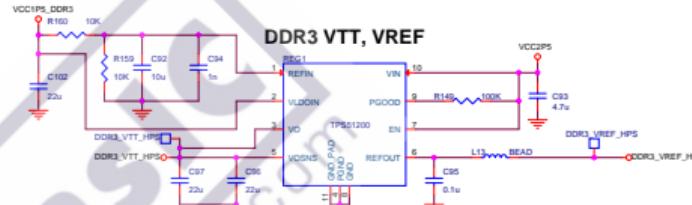
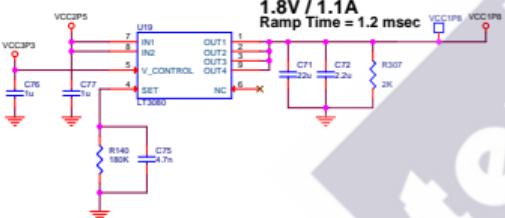
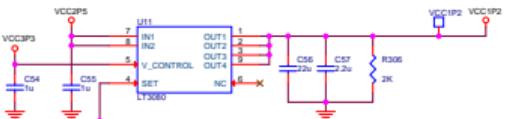


5V / 5A
Ramp Time = 1 msec
Switching Frequency : 988KHz

DE1-SoC Board	
Document Number B	Power - 5V, 3.3V
Date Monday, October 20, 2014	Page 20 of 30



1.2V / 1.1A
Ramp Time = 0.8msec



Spannungsebenen am Board

- 1.1V / 8A
- 3.3V / 5A
- 2.5V / 3A
- 1.5V / 3A
- 9V / 0.5A
- 1.2V / 1.1A
- 1.8V / 1.1A
- 1.5V -> DDR3

Fragen?