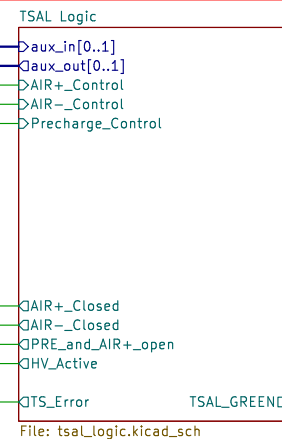
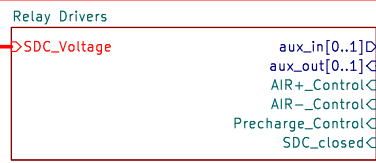
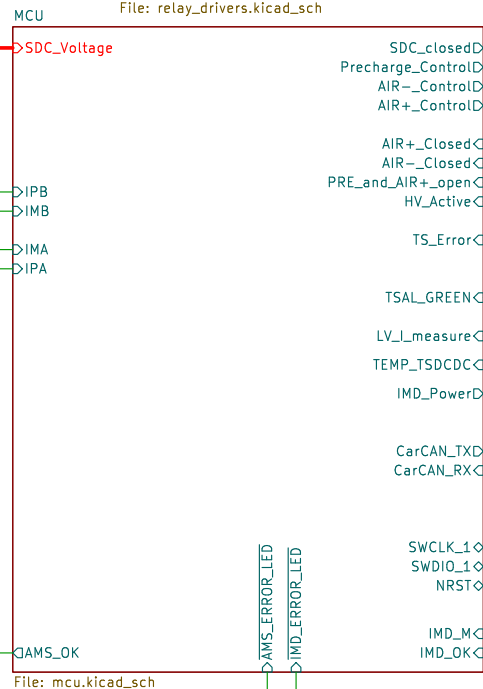
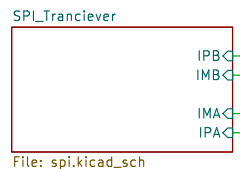
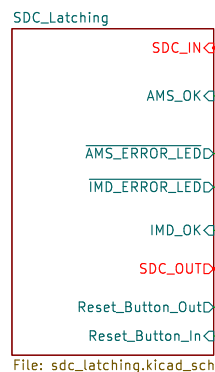
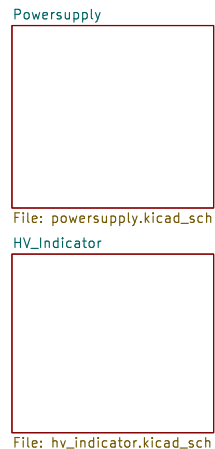


- H1 MountingHole
- H3 MountingHole
- H4 MountingHole
- H5 MountingHole
- FID1 Fiducial
- FID2 Fiducial
- FID3 Fiducial



FT25 V2 or FT26:

TSAL Sheet:

- schaltung im Dischargefall (U14A) vereinfachen
- "Bei USB hast du ja schon PC\_ctl OR AIR+\_ctl, das müsste man nur noch invertieren. Zum invertieren könnte man auch einfach das übrige U1B benutzen ( XOR(a,1) == NOT(a) ). Aber besser natürlich den Pull umdrehen und einfach zwei "closed" Signale vergleichen. " - Oskar

**FASTTUBE**

**Title: AMS Master Rootsheet**

Project: Master\_FT25

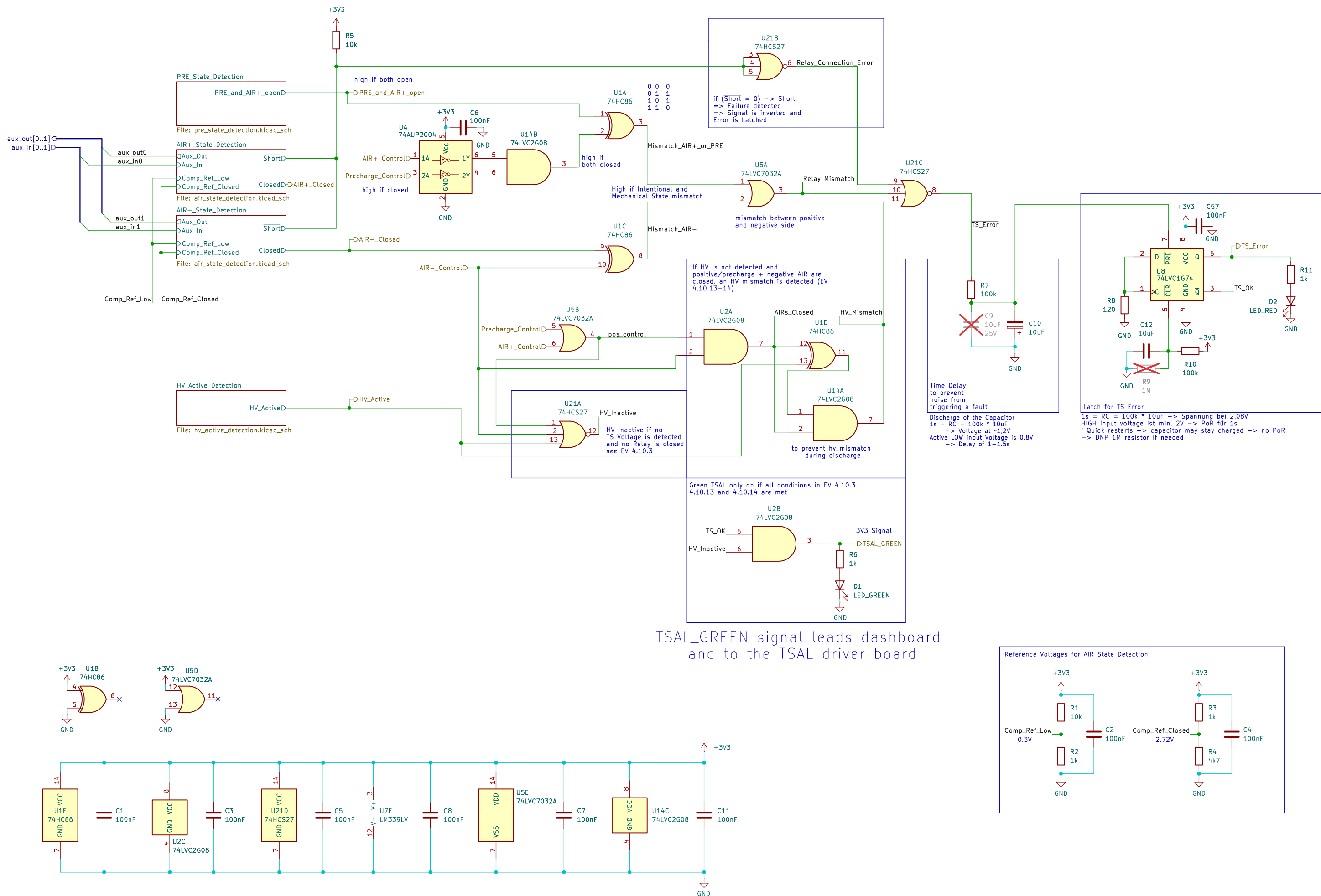
Author: Lene Marquardt

Rev: V1

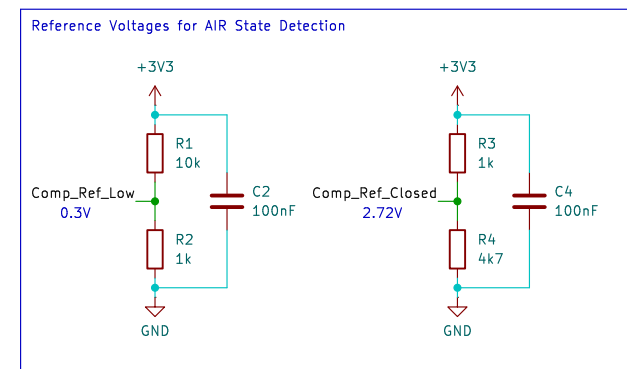
Date: 2025-03-09

Exp. Date: 2025-05-01

Size: A4 Page: 1/15



TSAL\_GREEN signal leads dashboard  
and to the TSAL driver board



**FASTTUBE**

**Title: TSAL Logic**

**Rev: V1**

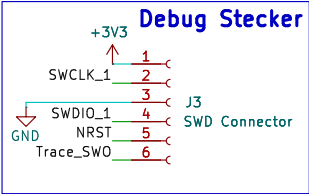
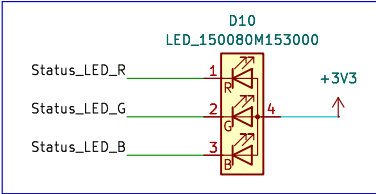
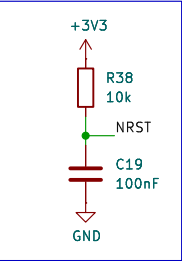
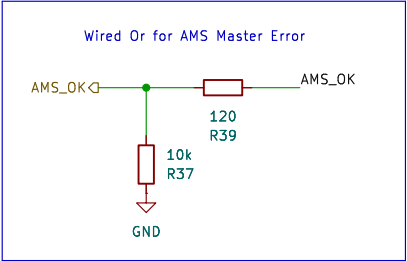
**Date: 2025-03-09**

**Project: Master\_FT25**

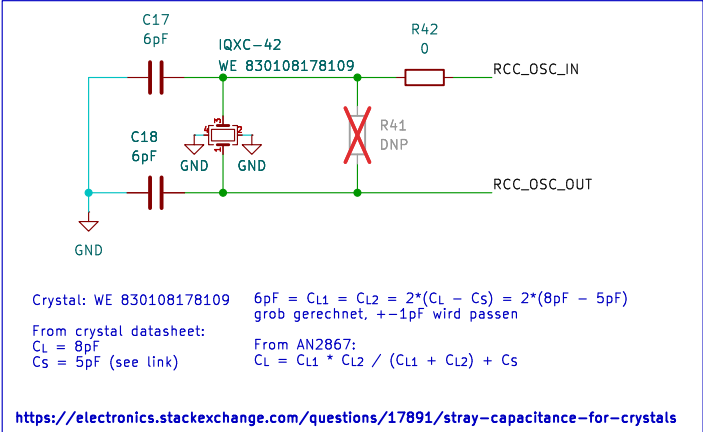
**Exp. Date: 2025-05-01**

**Author: Lene Marquardt**

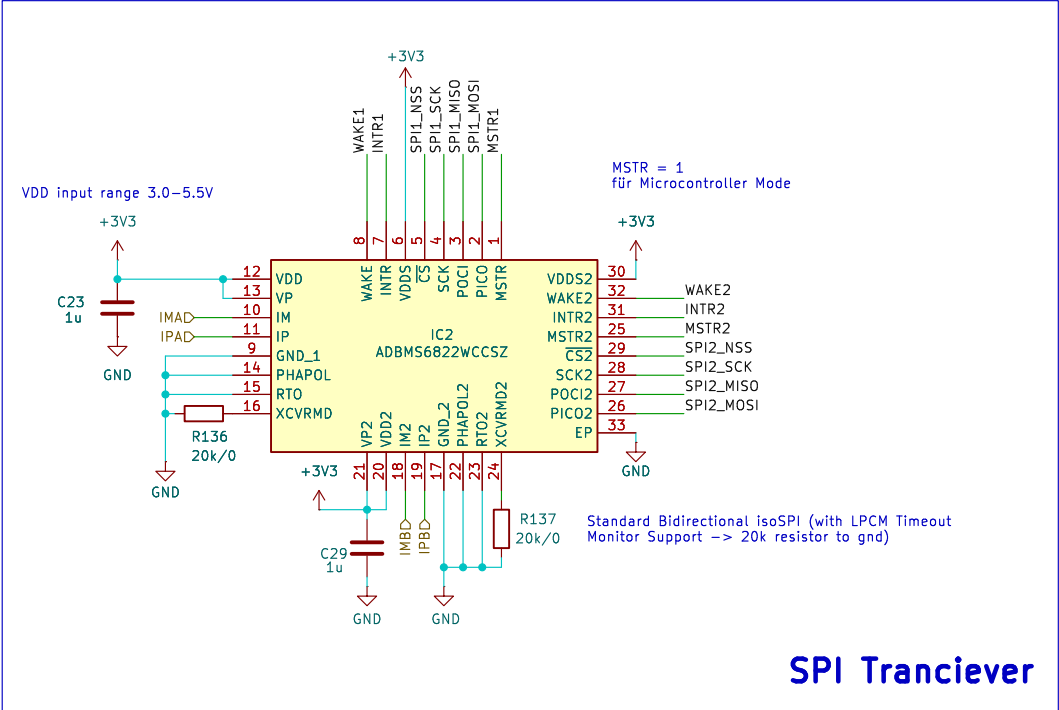
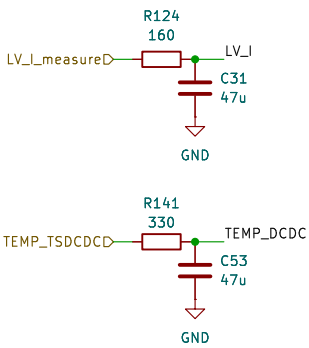
**Size: A3 | Page: 2/15**



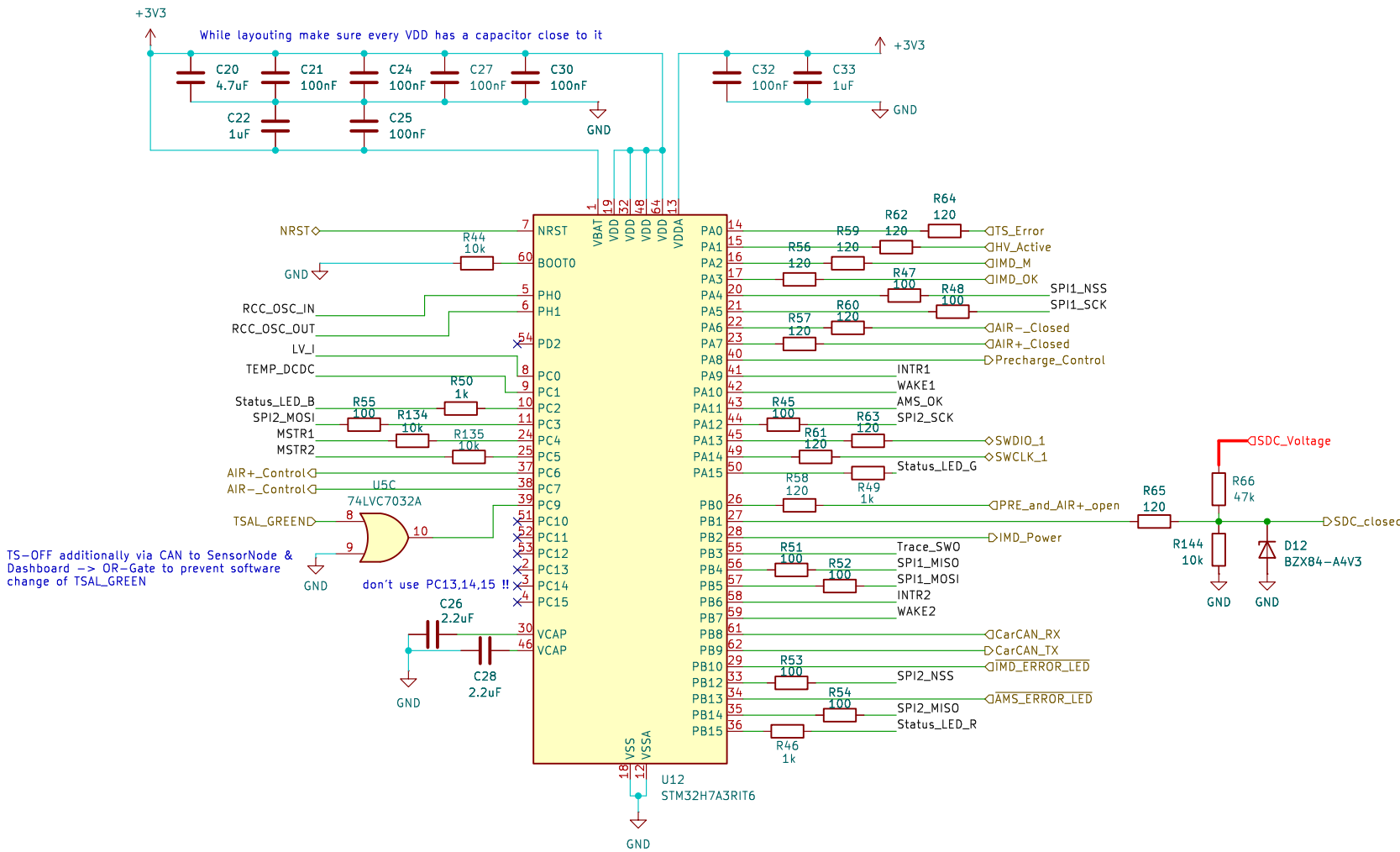
add esd  
siehe slave 24



### Filter Signale von TS\_DCDC



### SPI Transceiver



# FASTTUBE

Title: Microcontroller

Rev: V1

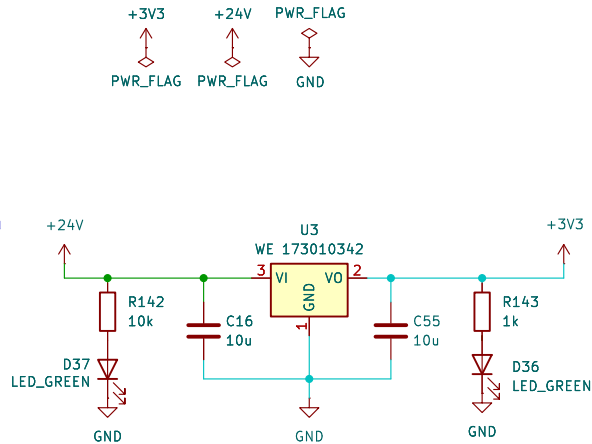
Project: Master\_FT25

Date: 2025-03-09

Author: Lene Marquardt

Exp. Date: 2025-05-01

Size: A3 | Page: 7/15



# FASTTUBE

**Title: Powersupply**

**Rev: V1**

**Date: 2025-03-09**

**Project: Master\_FT25**

**Exp. Date: 2025-05-01**

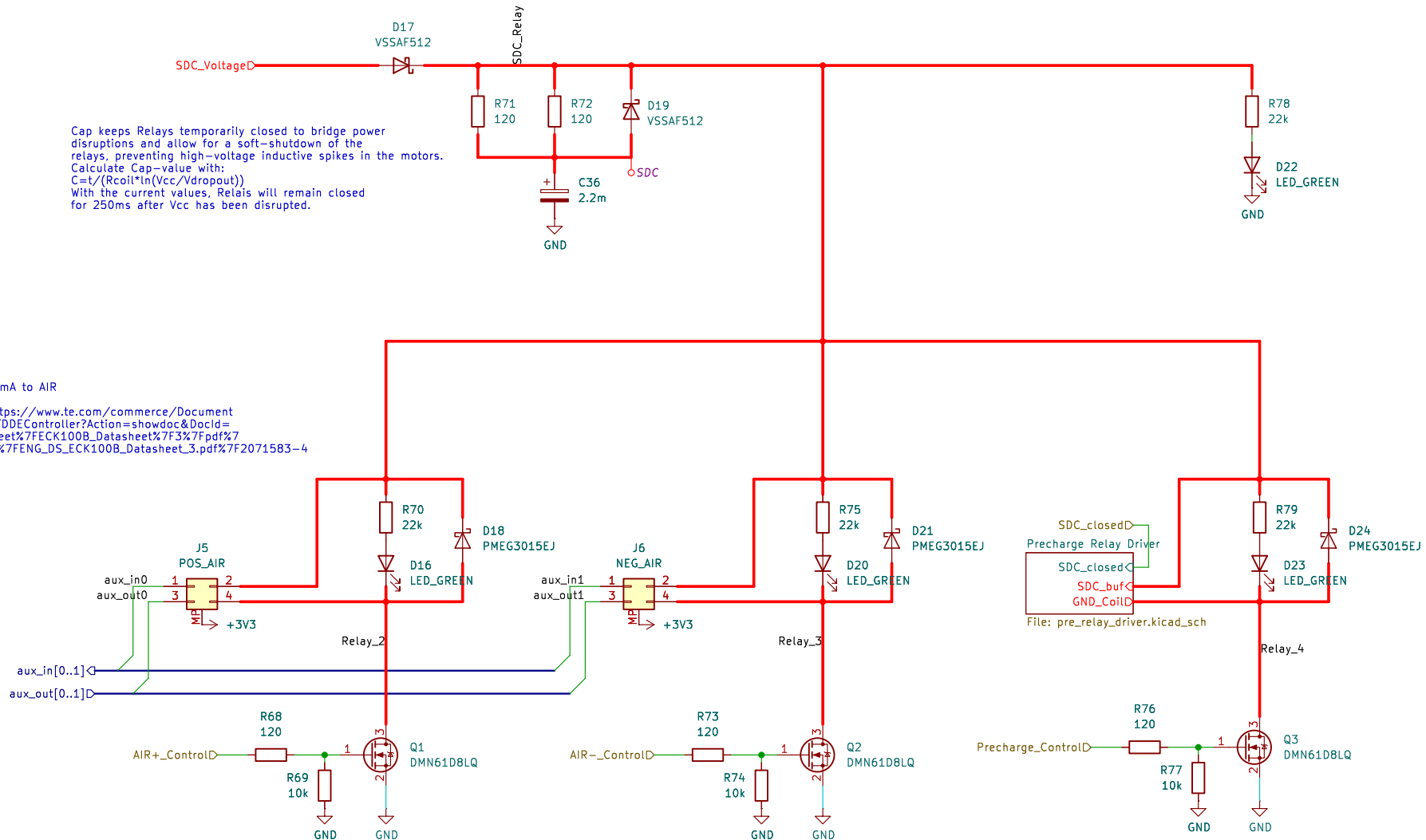
**Author: Lene Marquardt**

**Size: A5 | Page: 8/15**

Cap keeps Relays temporarily closed to bridge power disruptions and allow for a soft-shutdown of the relays, preventing high-voltage inductive spikes in the motors.  
 Calculate Cap-value with:  
 $C = t / (R_{coil} * \ln(V_{cc} / V_{dropout}))$   
 With the current values, Relais will remain closed for 250ms after Vcc has been disrupted.

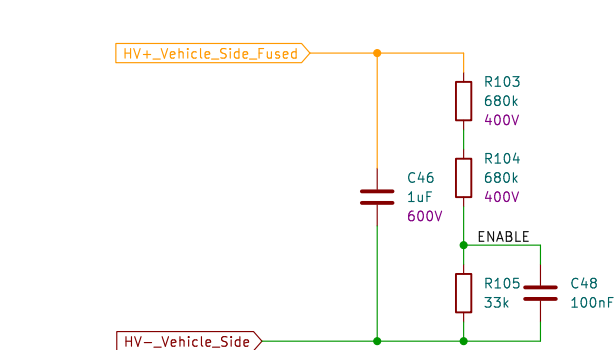
max 500mA to AIR

siehe: [https://www.te.com/commerce/DocumentDelivery/DDEController?Action=showdoc&DocId=Data+Sheet%7FECK100B\\_Datasheet%7F3%7Fpdf%7FEnglish%7FENG\\_DS\\_ECK100B\\_Datasheet\\_3.pdf%7F2071583-4](https://www.te.com/commerce/DocumentDelivery/DDEController?Action=showdoc&DocId=Data+Sheet%7FECK100B_Datasheet%7F3%7Fpdf%7FEnglish%7FENG_DS_ECK100B_Datasheet_3.pdf%7F2071583-4)



The MOSFETs act as a low-side switch for the Power-relais used. The diodes protect the MOSFETs from inductive voltage spikes caused by the Relais-coils when powered off.

HV Indicator nicht verändert, wie FT24

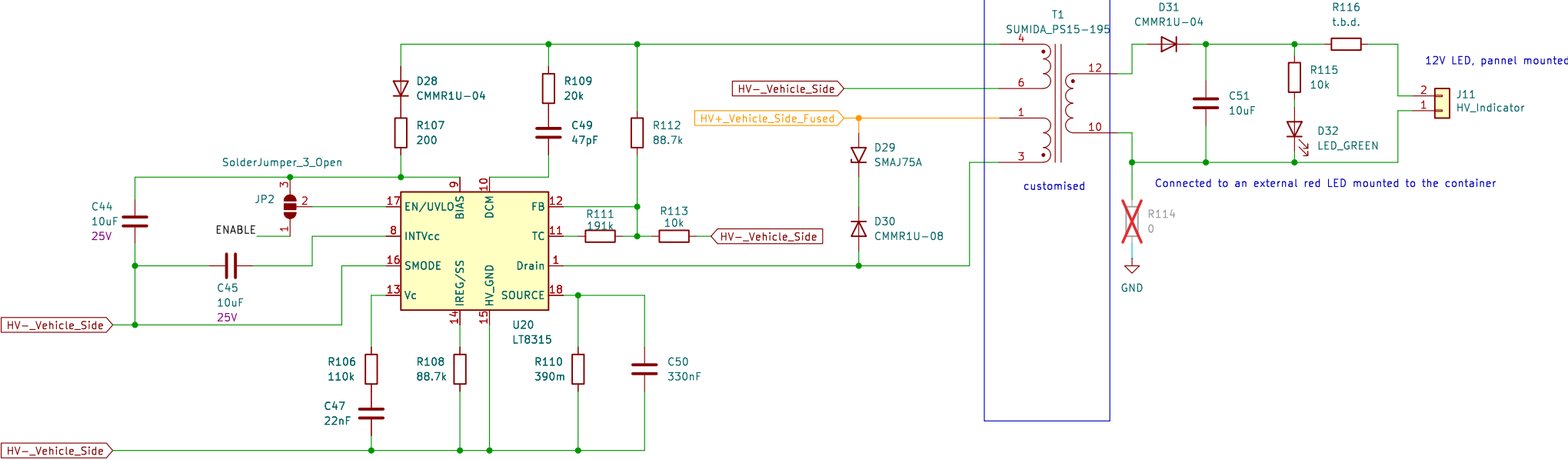


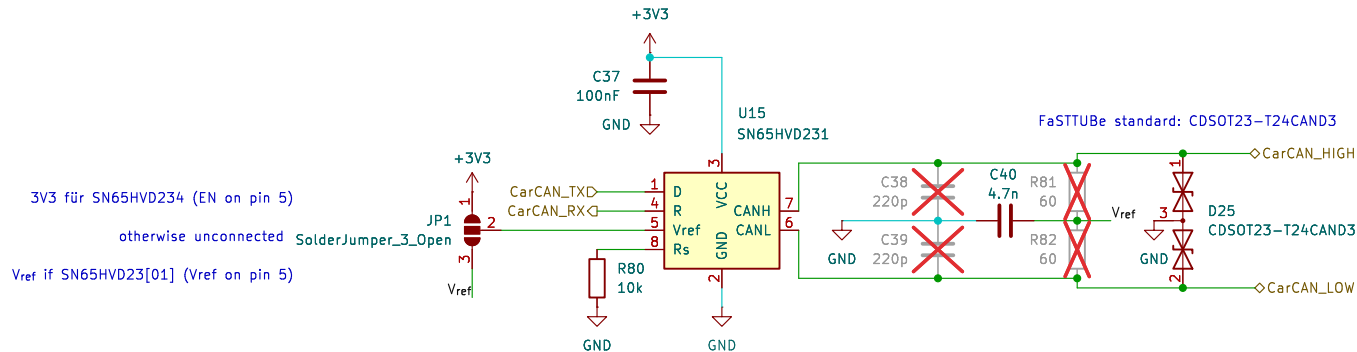
The Enable threshold of the LT8315 is 1.22V  
with the given resistor divider the following threshold voltage can be calculated:  
 $1.22V \cdot (1360k\Omega + 33k\Omega) / 33k\Omega = 51.5V$   
Considering the hysteresis of 65mV mentioned in the datasheet,  
the following are the maximum turn-on/off levels:  
turn-on: 54.2V  
turn-off: 48.7V

The connections go directly to the vehicle side contacts of the AIR+ and AIR-

TS

LV





# FASTTUBE

**Title: CAN Transceiver**

**Project: Master\_FT25**

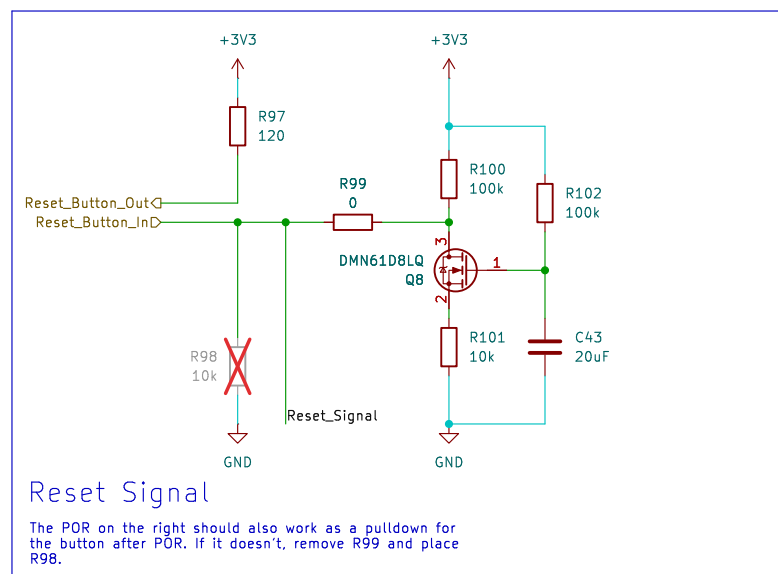
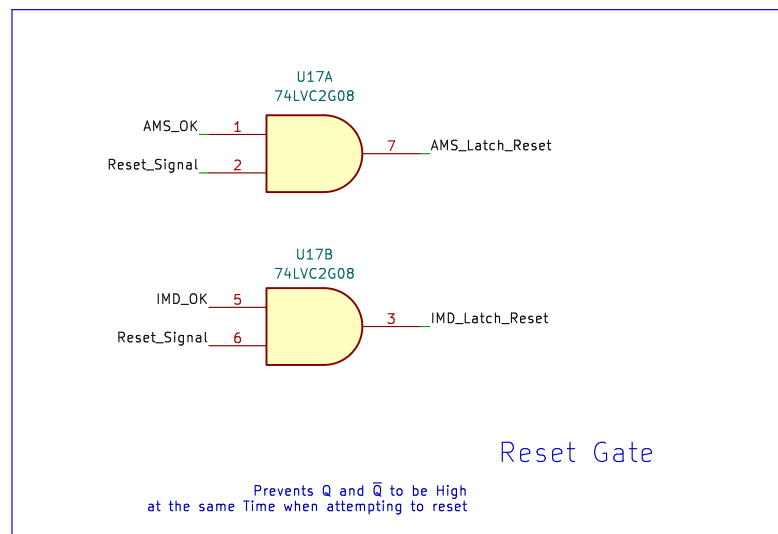
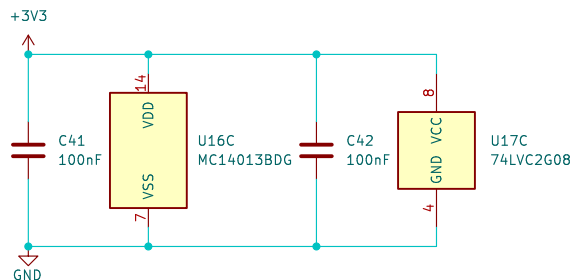
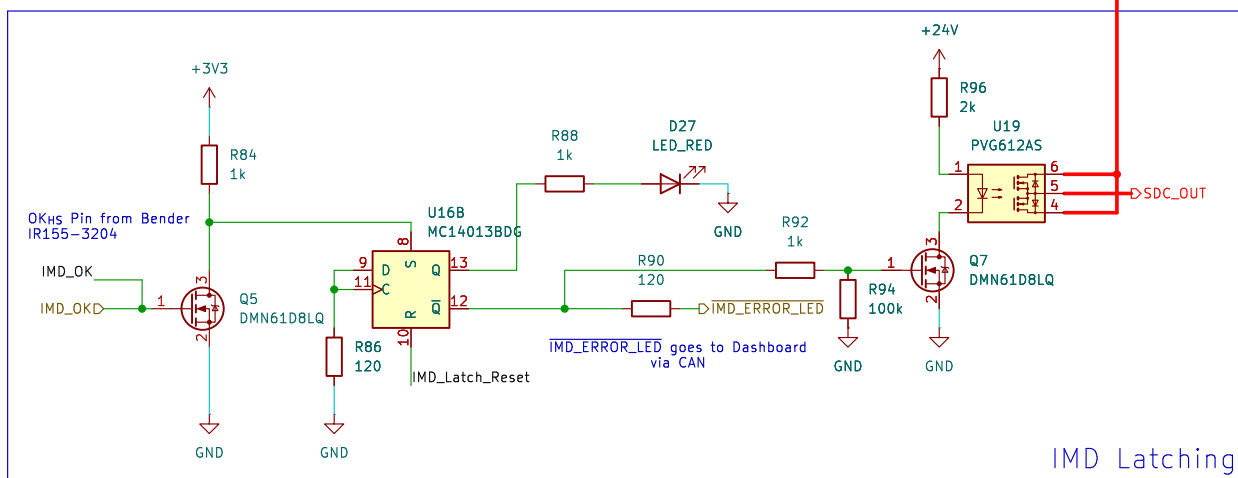
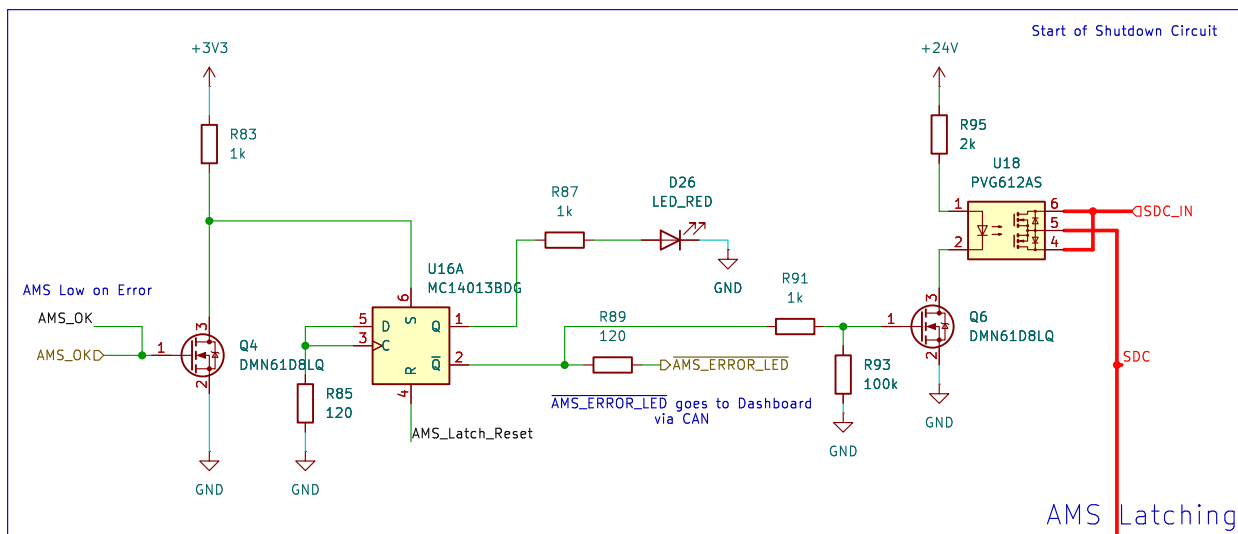
**Author: Lene Marquardt**

**Rev: V1**

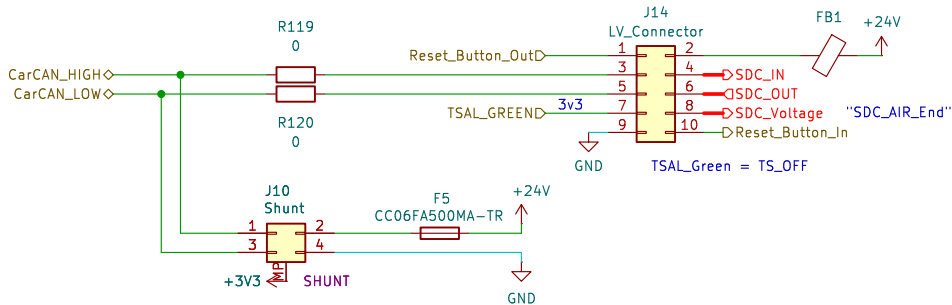
**Date: 2025-03-09**

Exp. Date: 2025-05-01

Size: A5 | Page: 11/15







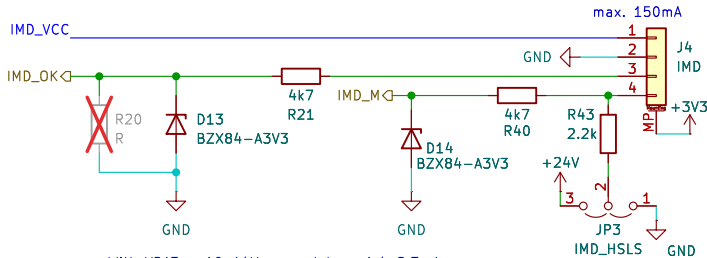
SHUNT:  
IVT-S-300-U3-I-CAN1-12/24  
max. 80mA  
Datasheet  
<https://www.isabellenhuettenusa.com/wp-content/uploads/2022/07/Datasheet-IVT-S-V1.03.pdf>

Main Connector

IMD - Datasheet

[https://www.bender.de/fileadmin/content/Products/d/e/IR155-32xx-V004\\_D00115\\_D\\_XXEN.pdf](https://www.bender.de/fileadmin/content/Products/d/e/IR155-32xx-V004_D00115_D_XXEN.pdf)

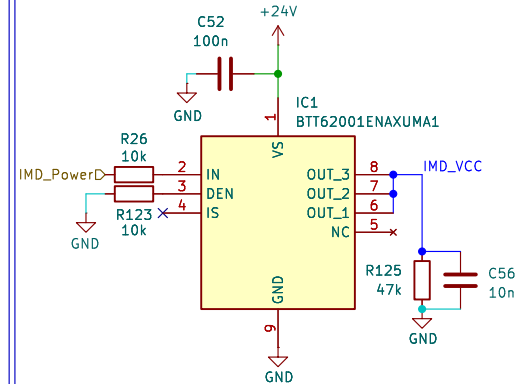
IMD Connector



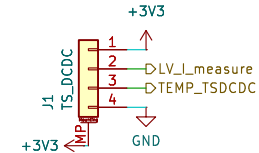
With VBAT = 10..14V, we get  $I_R = 1.4..2.3mA$ .  
This should™ put the Zener at -3V.

Connect to GND for -3204  
Connect to +24V for -3203

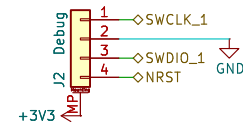
IMD Supply



TSDCDC Connector



Debug Connector



# FASTTUBE

Title: Input/Output

Project: Master\_FT25

Author: Lene Marquardt

Rev: V1

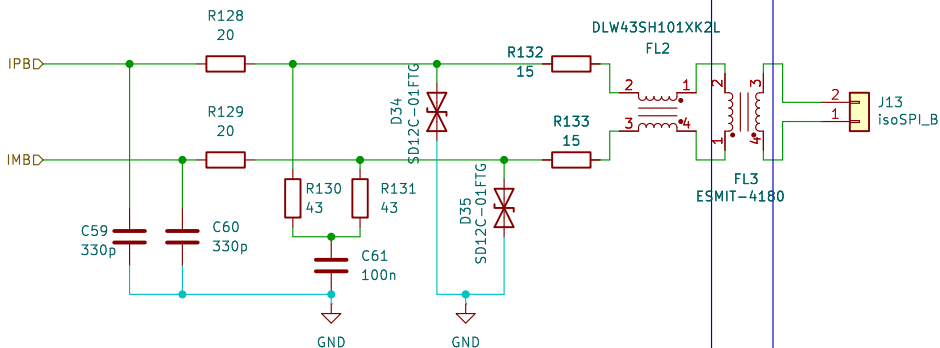
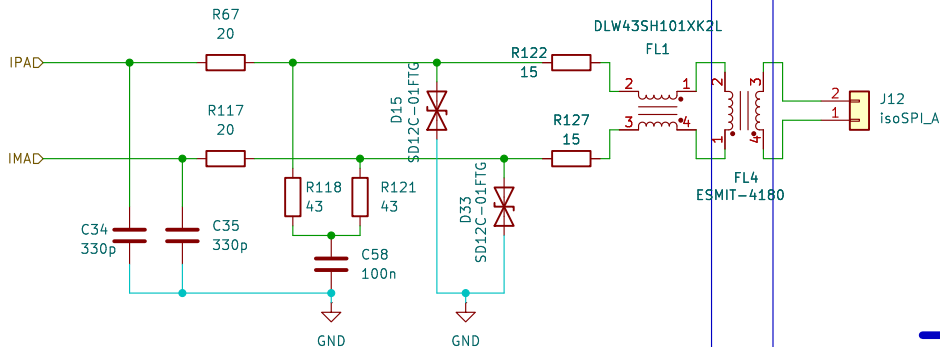
Date: 2025-03-09

Exp. Date: 2025-05-01

Size: A5 | Page: 13/15

LV

TS



**FASTTUBE**

**Title: Isolated SPI Transciever**

**Project: Master\_FT25**

**Author: Lene Marquardt**

**Rev: V1**

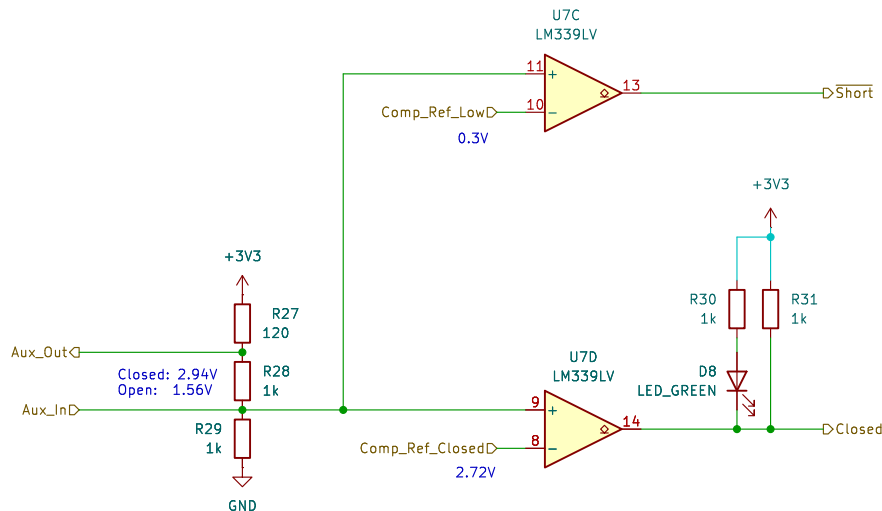
**Date: 2025-03-09**

**Exp. Date: 2025-05-01**

**Size: A5 | Page: 14/15**



# Accumulator TSAL – Relay state detection



## FASTTUBE

**Title: AIR Relay State Detection**

**Project: Master\_FT25**

**Author: Lene Marquardt**

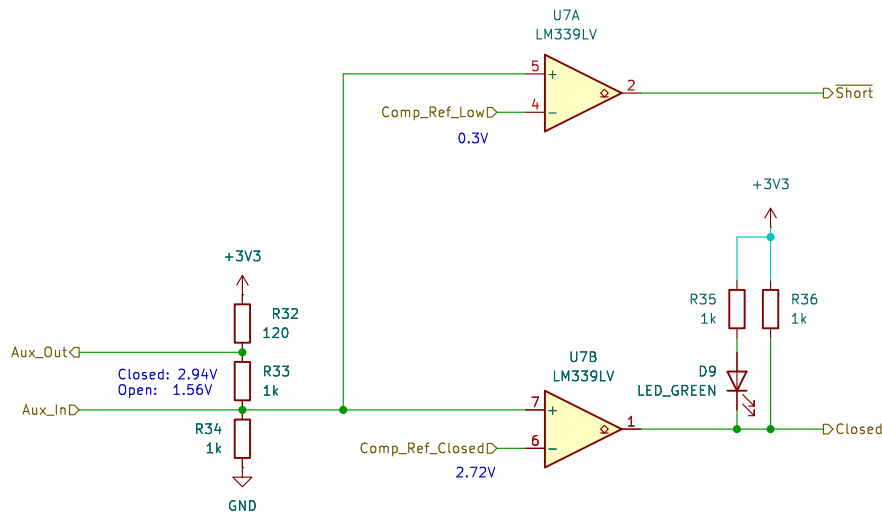
**Rev: V1**

**Date: 2025-03-09**

**Exp. Date: 2025-05-01**

**Size: A5 | Page: 4/15**

# Accumulator TSAL – Relay state detection



## FASTTUBE

**Title: AIR Relay State Detection**

**Project: Master\_FT25**

**Author: Lene Marquardt**

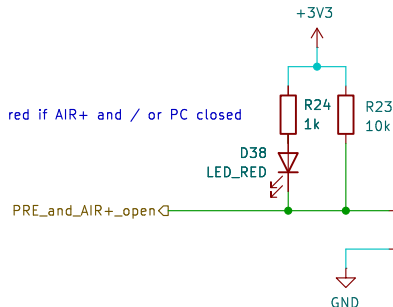
**Rev: V1**

**Date: 2025-03-09**

**Exp. Date: 2025-05-01**

**Size: A5 | Page: 5/15**

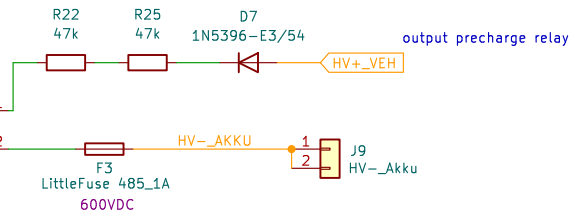
# LV



Detects if Precharge or Positive AIR are closed:  
 PRE\_AIR+\_open = 3V3 if both Relays are Open  
 PRE\_AIR+\_open = 0V if one or both are Closed

opto diode current:  
 @ maximum TS Voltage 403V = 4,27 mA  
 @ minimum TS Voltage 240V = 2,55 mA

# TS



# FASTTUBE

**Title: Precharge State Detection**

**Project: Master\_FT25**

**Author: Lene Marquardt**

**Rev: V1**

**Date: 2025-03-09**

**Exp. Date: 2025-05-01**

**Size: A5 | Page: 6/15**

TS



"Regarding your questions about our testing process, we perform high voltage tests at 5.5 kV DC/AC Peak (switch-to-switch and switch-to-coil) for the 104-1-A-24/5D relay."

- Ahmet Turan (Assistant Reed Relay Product Manager)

# FASTTUBE

## Title: Precharge Relay Driver

Project: Master\_FT25

**Author: Lene Marquardt**

Rev: V1

Date: 2025-03-09

Exp. Date: 2025-05-01

Size: A5 Page: 10/15