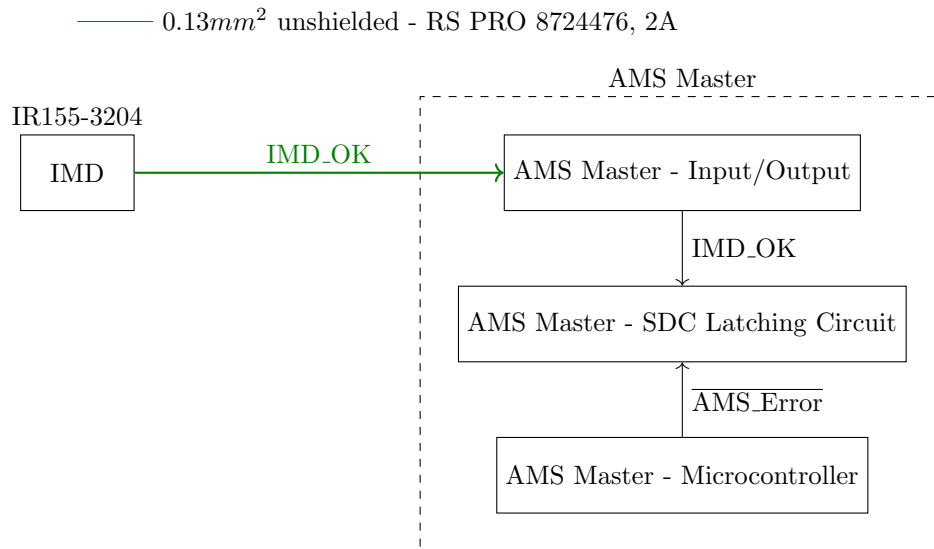


# 1 AMS und IMD Error Latching



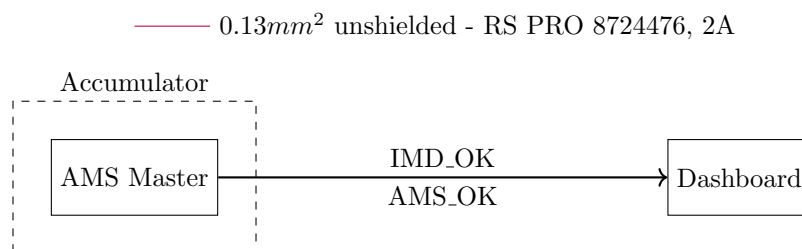
## 1.1 IMD Latching

- The IMD\_OK signal is pulled high approximately 1.5 seconds after startup for the IR155-3204 IMD.
- Therefore the Power-on Reset (PoR) lasts approximately 2 seconds.

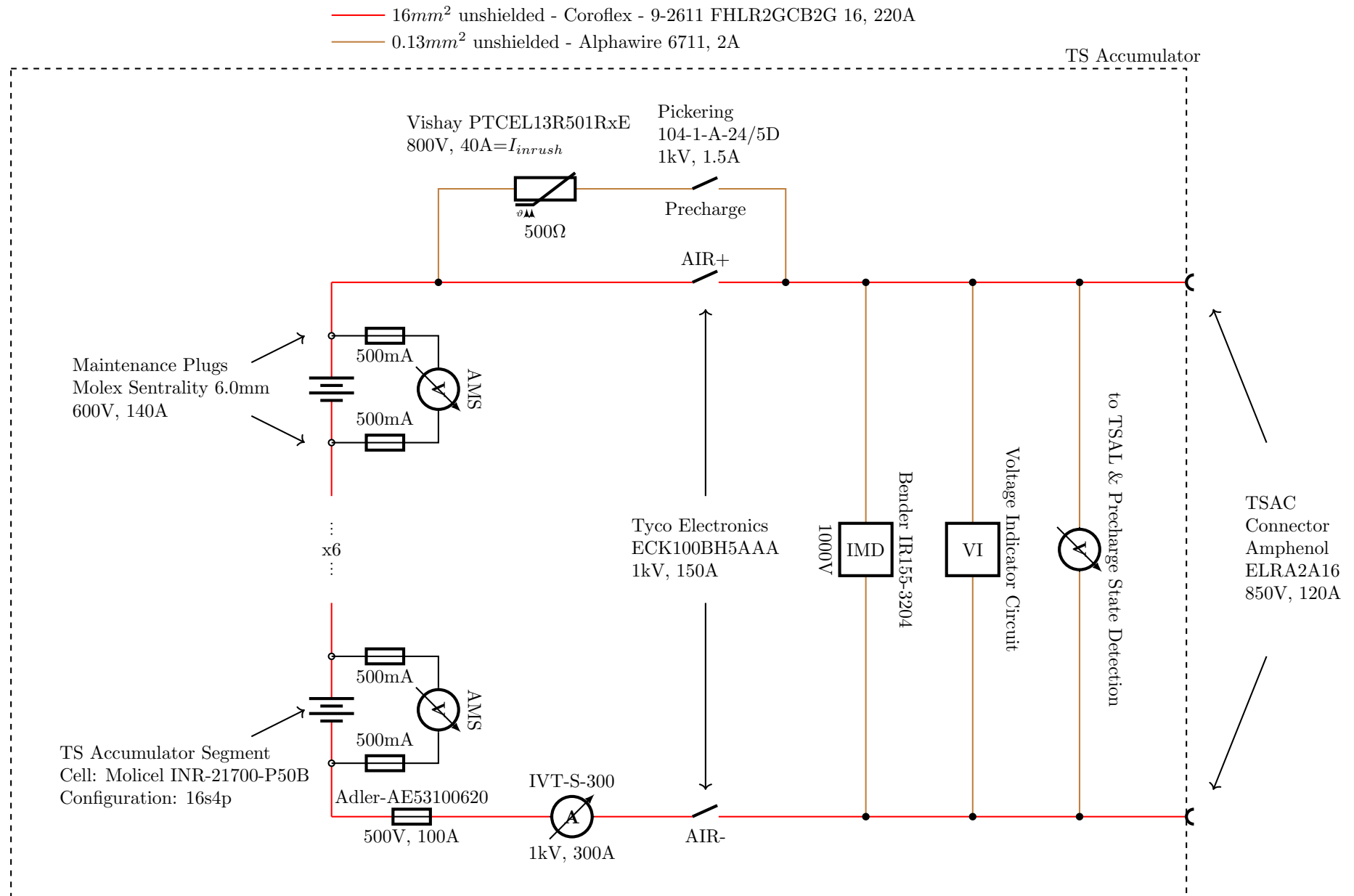
## 1.2 AMS Latching

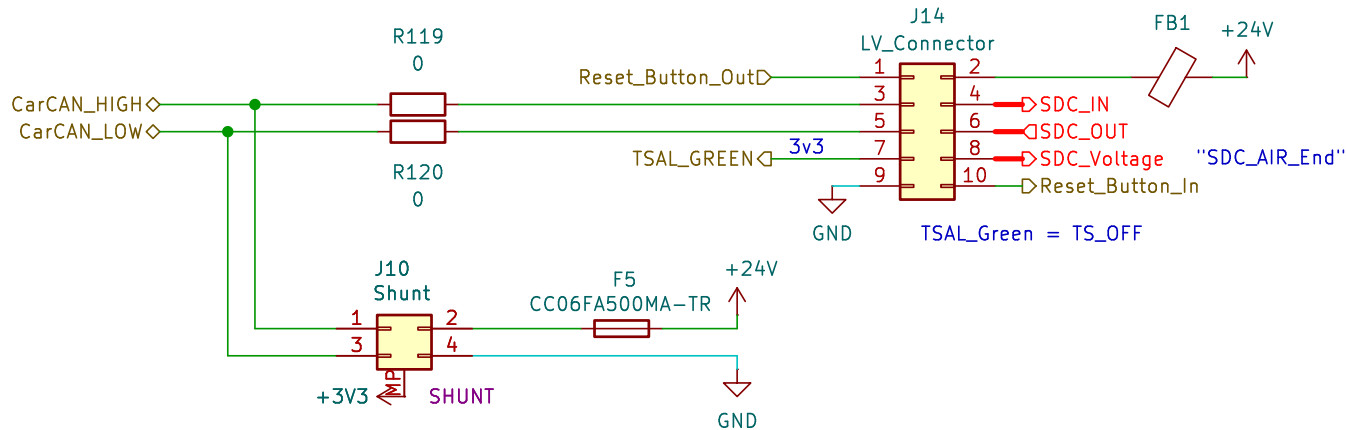
- The AMS\_OK signal is pulled low until the following conditions are met:
  - The AMS Master communicates with all six AMS Slaves, each providing valid voltage and temperature measurements.
  - The AMS Master communicates with the shunt sensor (IVT-S-300-U3-I-CAN2-12/24)

# 2 SCS signal implementation



Both signals are transmitted every 50 ms over the CAN bus. If the Dashboard does not receive a CAN message from the AMS Master within 150 ms, it will trigger a fault condition. In response to this fault, the following LEDs will be activated: the **AMS Error** LED will be turned on, the **IMD Error** LED will be turned on, and the **TS Off** LED will remain off.



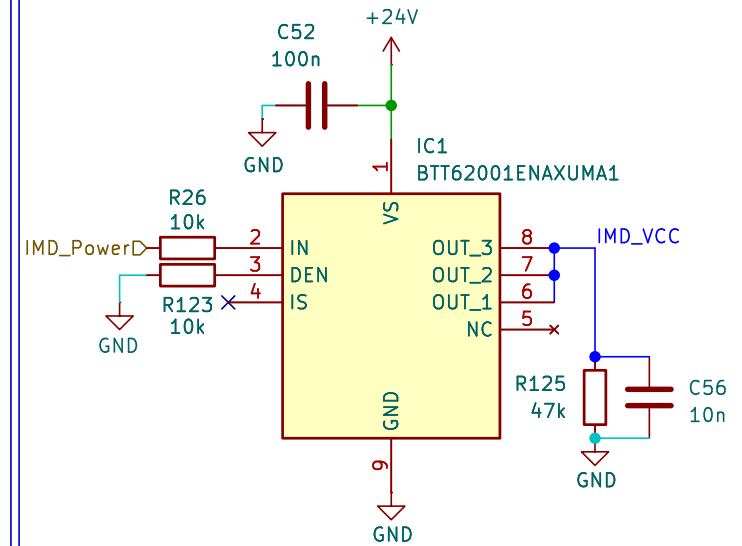


SHUNT:  
IVT-S-300-U3-I-CAN1-12/24  
max. 80mA

Datasheet  
<https://www.isabellenhuettenusa.com/wp-content/uploads/2022/07/Datasheet-IVT-S-V1.03.pdf>

## Main Connector

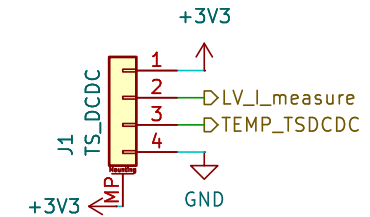
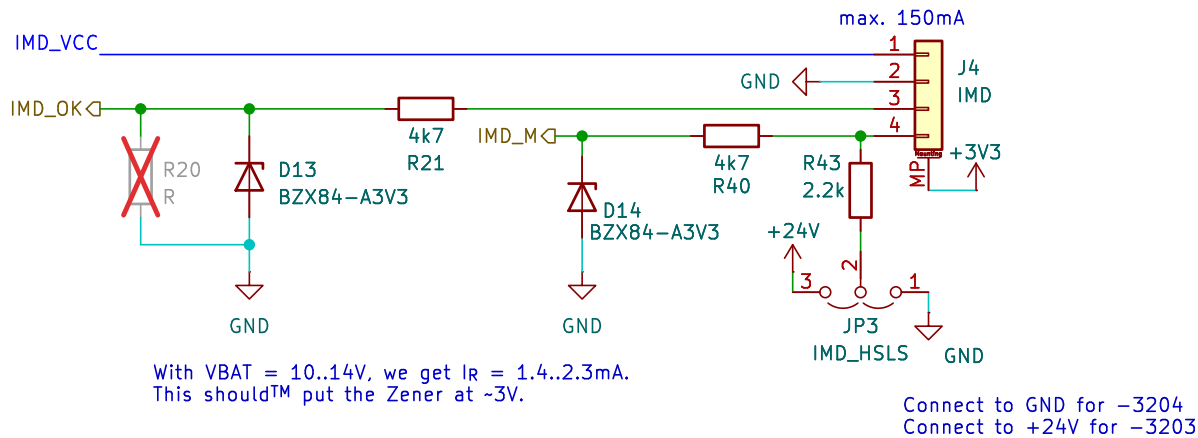
## IMD Supply



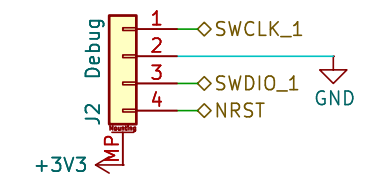
## IMD Connector

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)



## TSDCDC Connector



## Debug Connector

# FASTTUBE

**Title: Input/Output**

**Project: Master\_FT25**

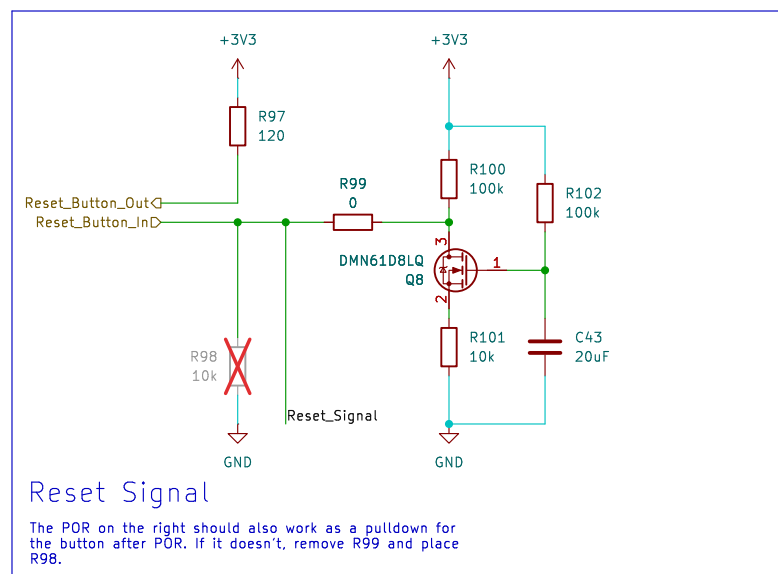
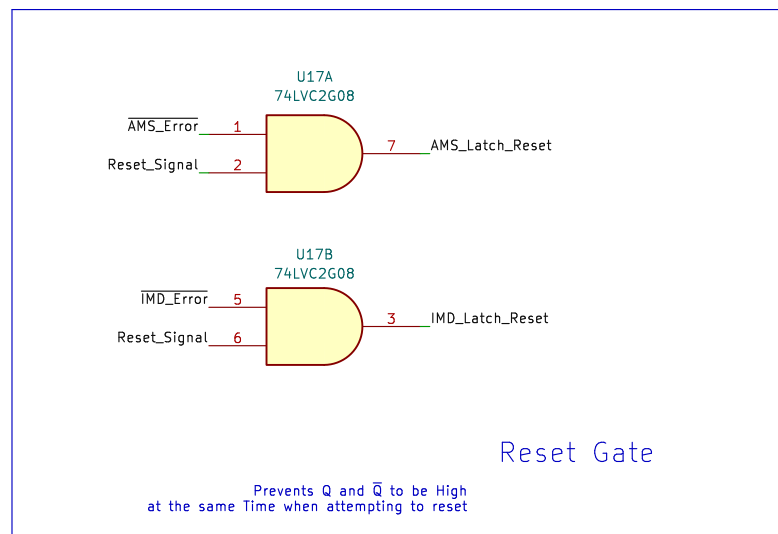
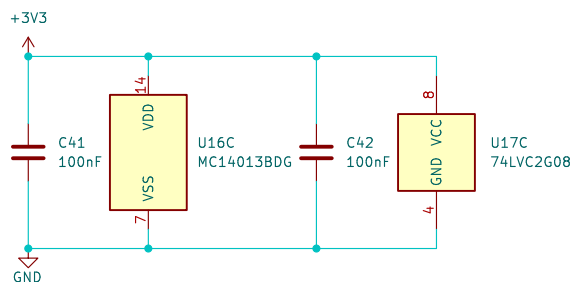
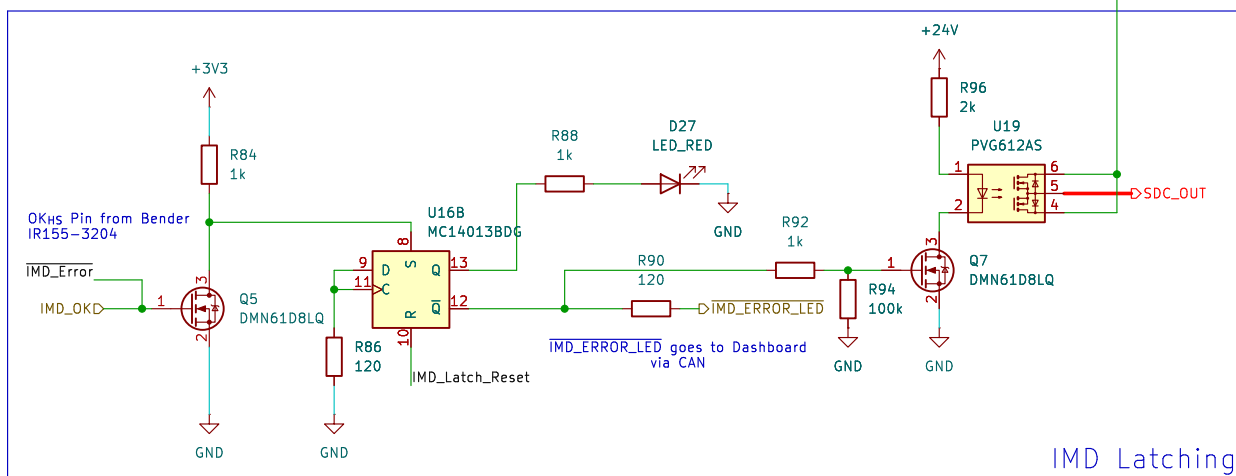
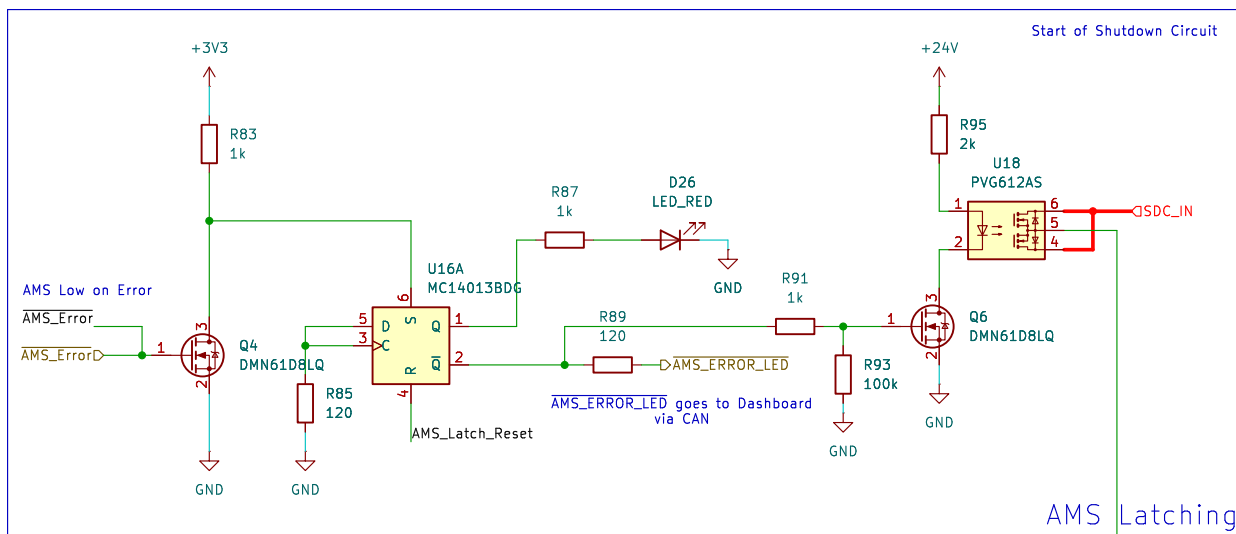
**Author: Lene Marquardt**

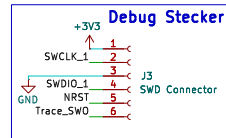
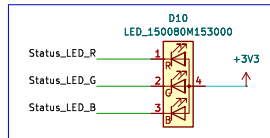
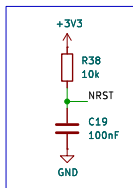
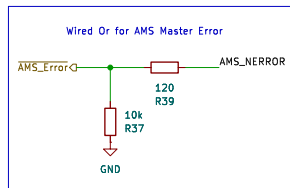
**Rev: V1**

**Date: 2025-03-09**

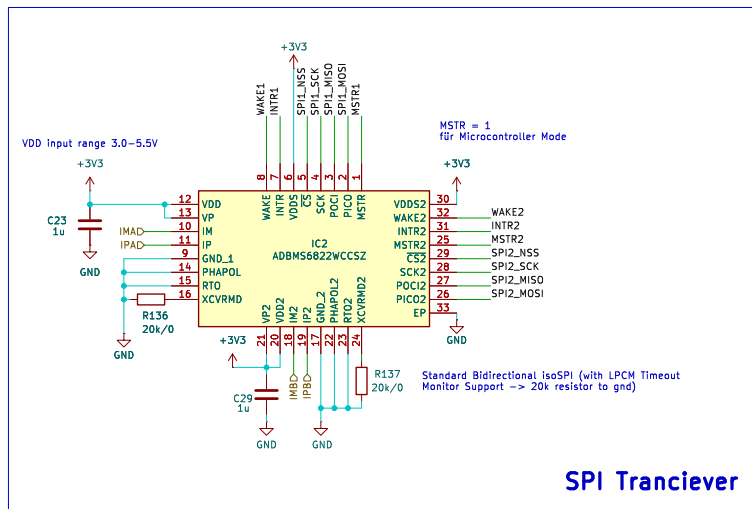
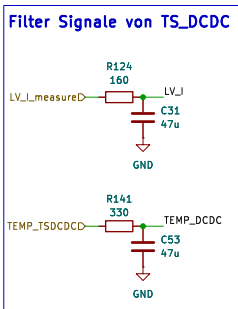
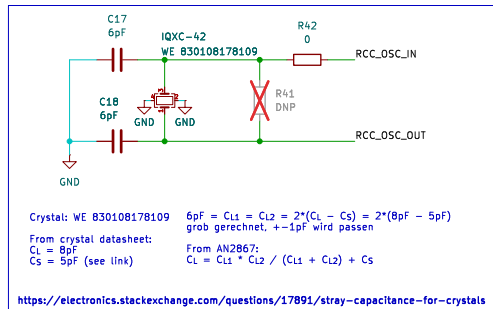
**Exp. Date: 2025-04-27**

**Size: A5 Page: 13/15**

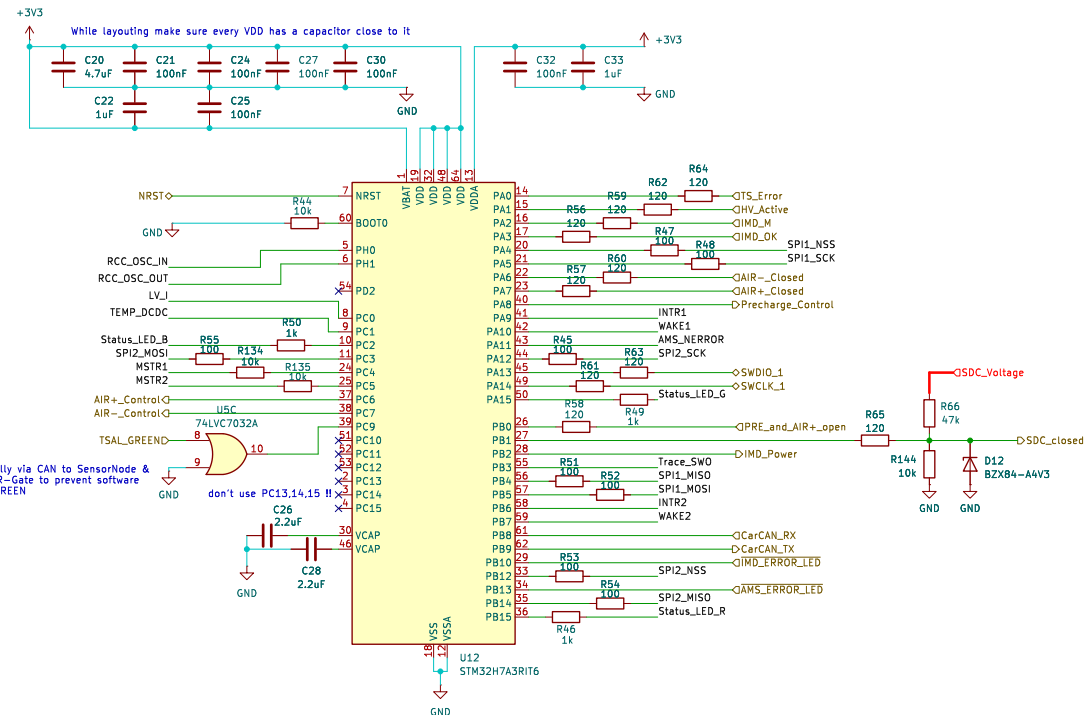


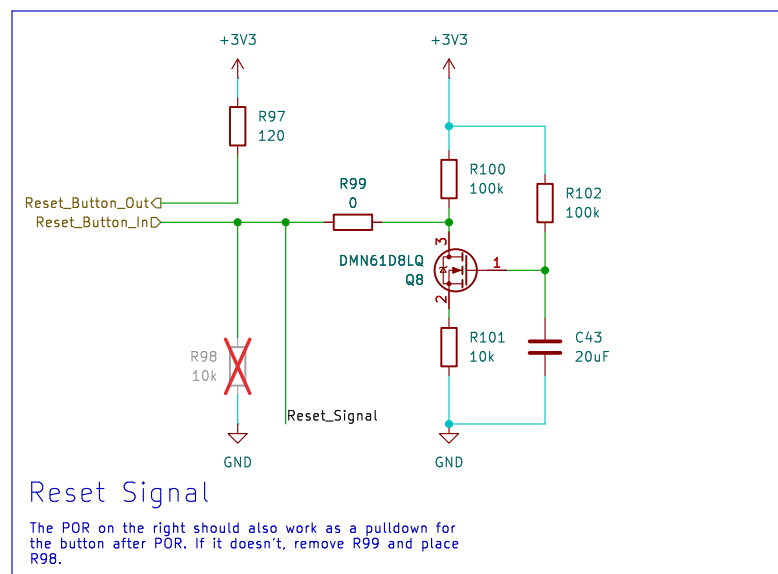
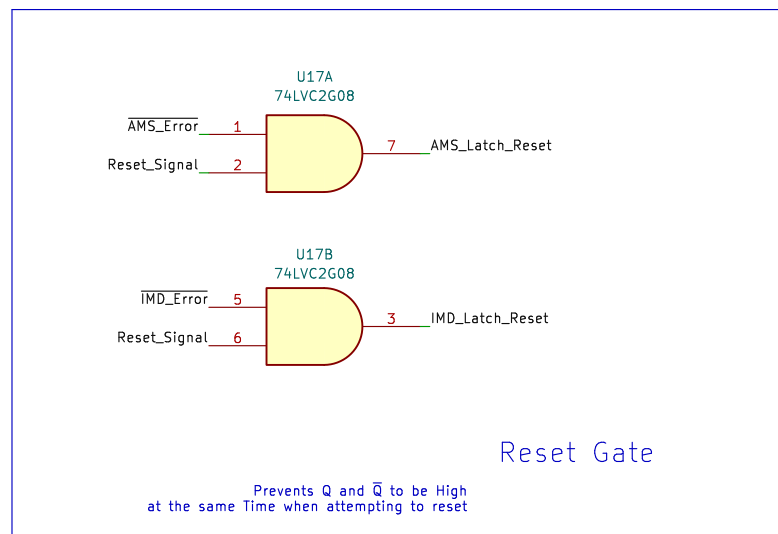
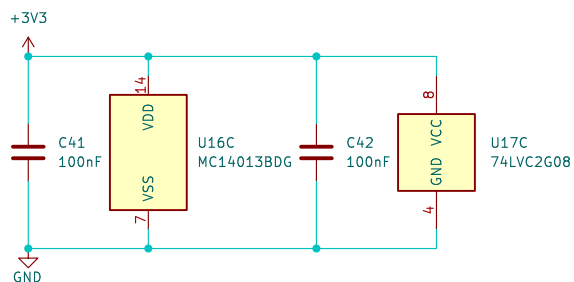
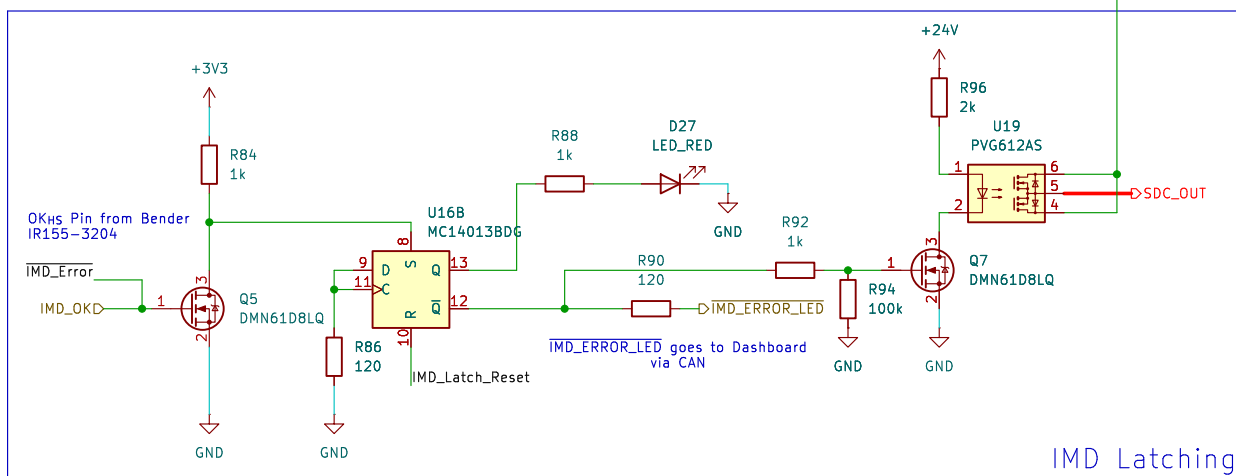
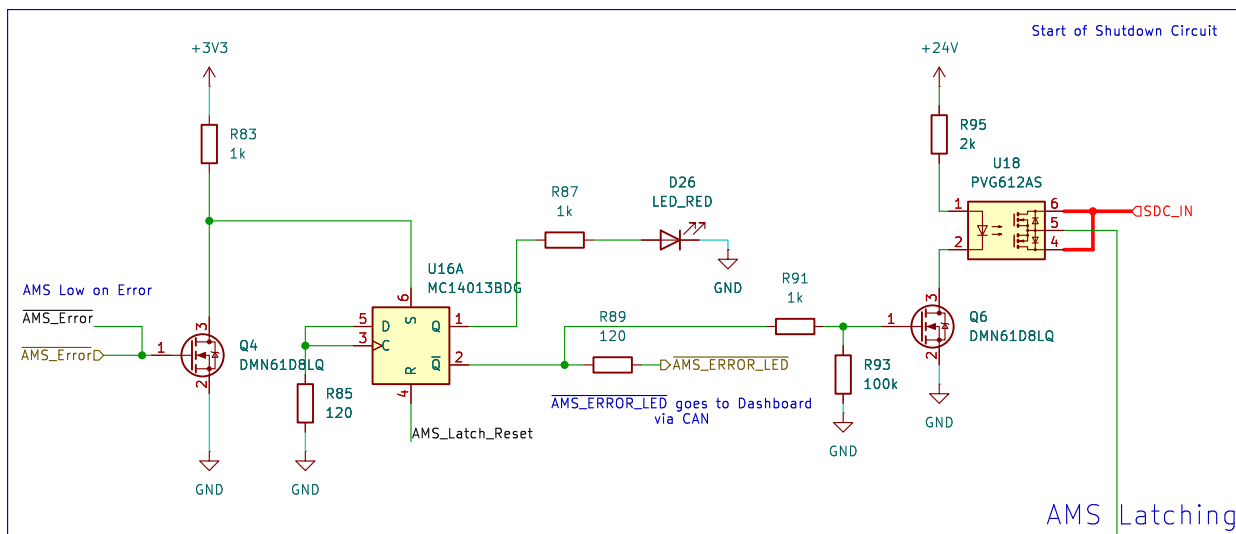


add esd siehe slave 24



## SPI Tranciever

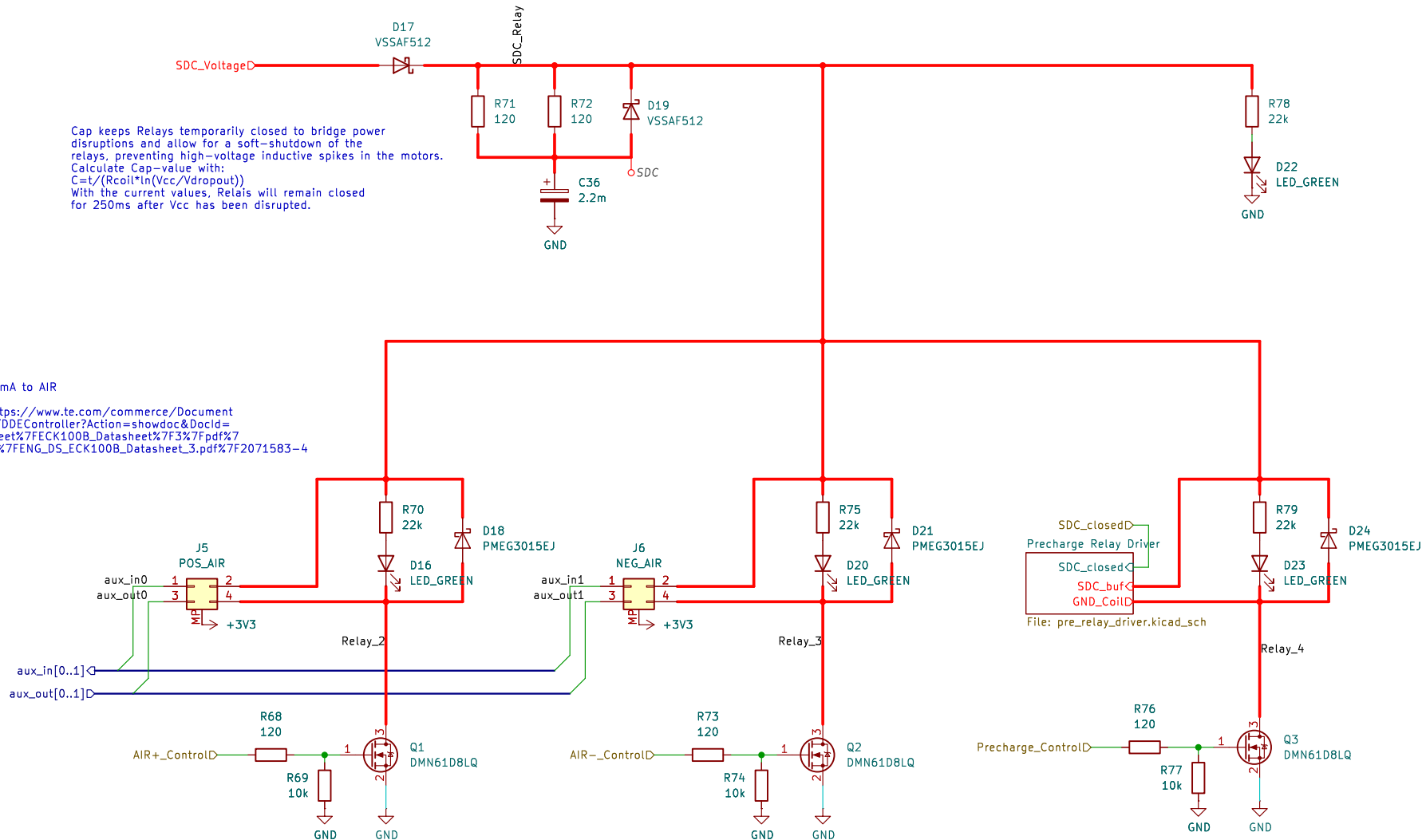




Cap keeps Relays temporarily closed to bridge power disruptions and allow for a soft-shutdown of the relays, preventing high-voltage inductive spikes in the motors.  
 Calculate Cap-value with:  
 $C = t / (R_{coil} * \ln(V_{cc} / V_{dropout}))$   
 With the current values, Relais will remain closed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



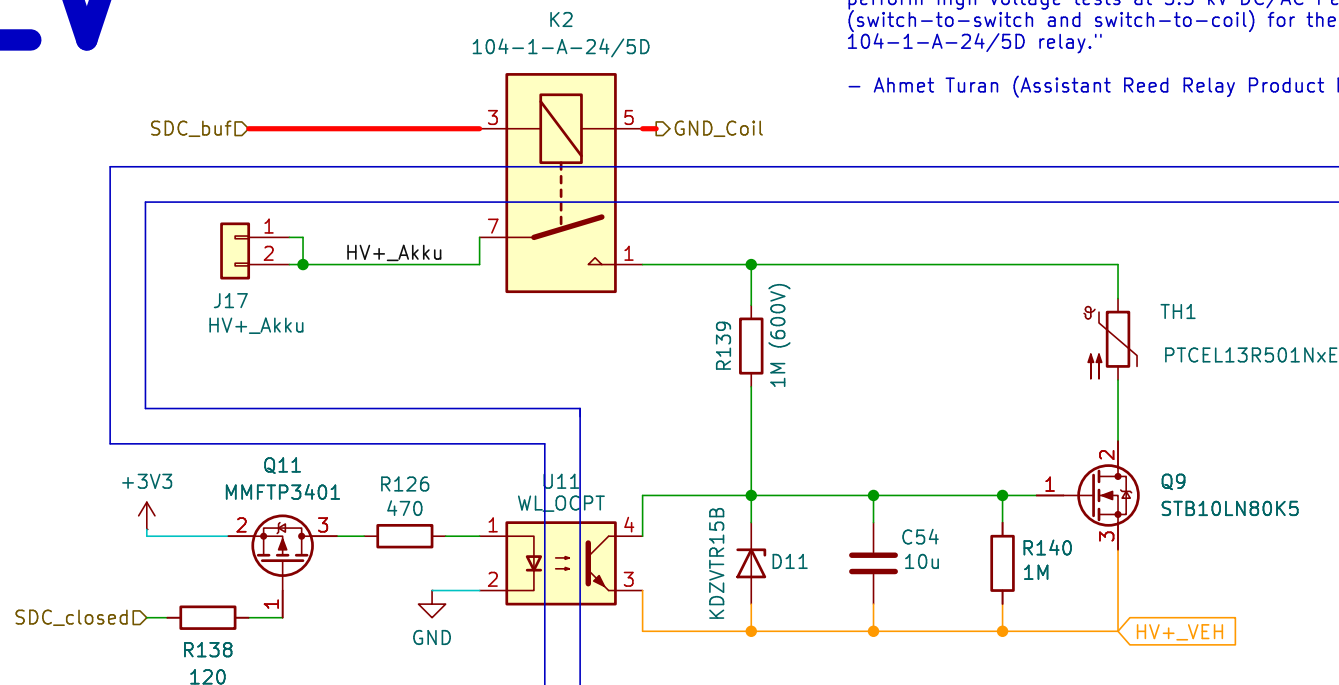
The MOSFETs act as a low-side switch for the Power-relais used. The diodes protect the MOSFETs from inductive voltage spikes caused by the Relais-coils when powered off.

# LV

TS-LV isolation via relay pn distance (10.16mm)

"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)



# TS

## FASTTUBE

**Title: Precharge Relay Driver**

**Rev: V1**

**Date: 2025-03-09**

**Project: Master\_FT25**

**Exp. Date: 2025-04-27**

**Author: Lene Marquardt**

**Size: A5 | Page: 10/15**

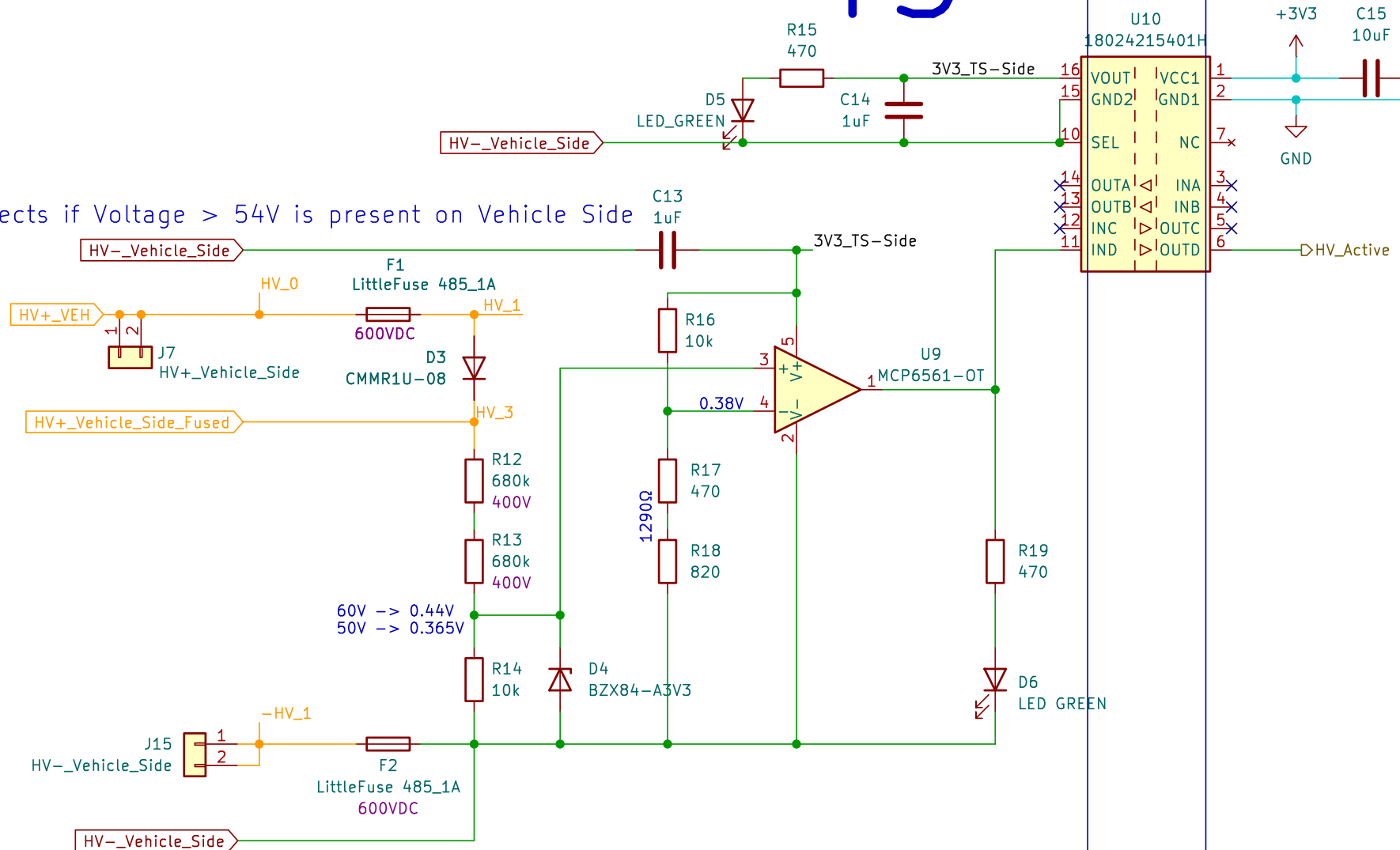




# TS

# LV

Detects if Voltage > 54V is present on Vehicle Side



## FASTTUBE

**Title: TSAL HV Detection**

**Rev: V1**

**Date: 2025-03-09**

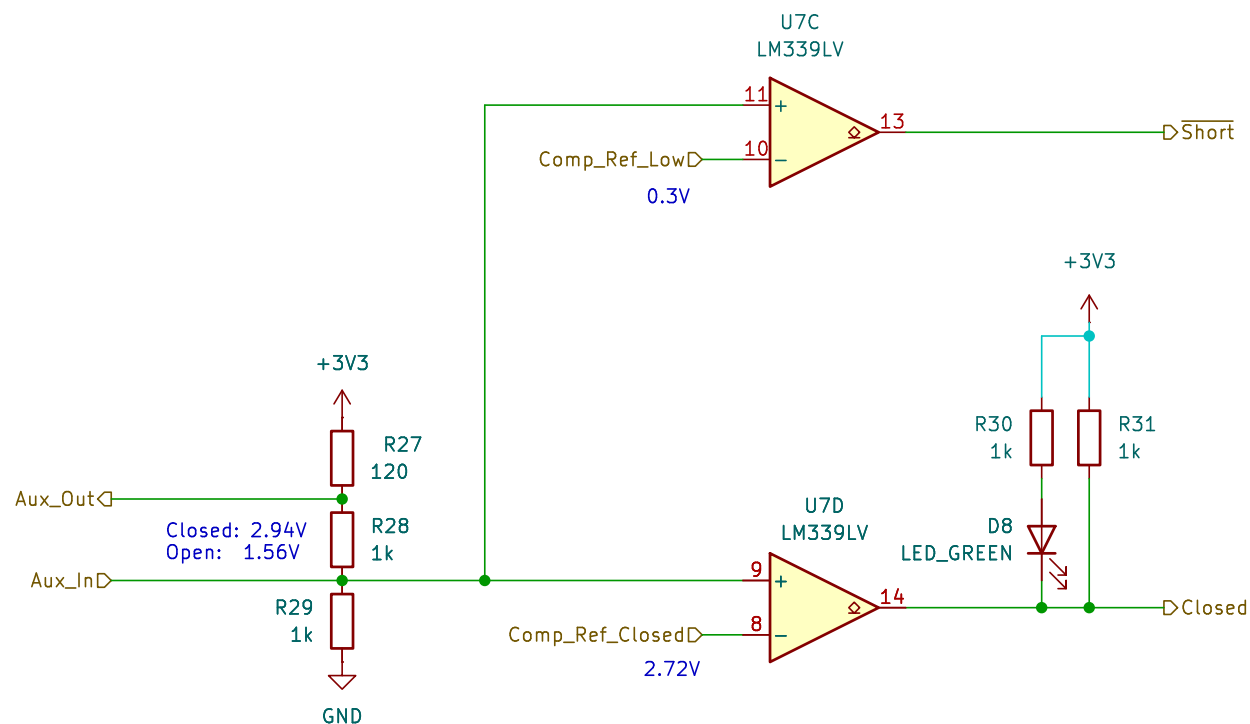
**Project: Master\_FT25**

**Exp. Date: 2025-04-27**

**Author: Lene Marquardt**

**Size: A5 | Page: 3/15**

# Accumulator TSAL – Relay state detection



# FASTTUBE

**Title: AIR Relay State Detection**

**Rev: V1**

**Date: 2025-03-09**

**Project: Master\_FT25**

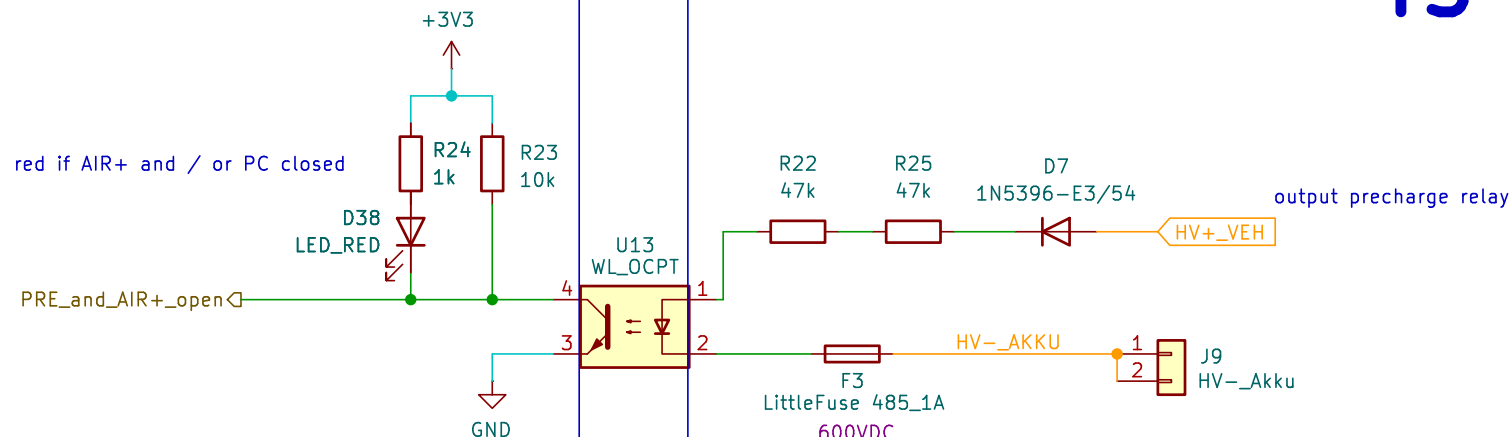
**Exp. Date: 2025-04-27**

**Author: Lene Marquardt**

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

# LV

# TS



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

## FASTTUBE

**Title: Precharge State Detection**

**Rev: V1**

**Date: 2025-03-09**

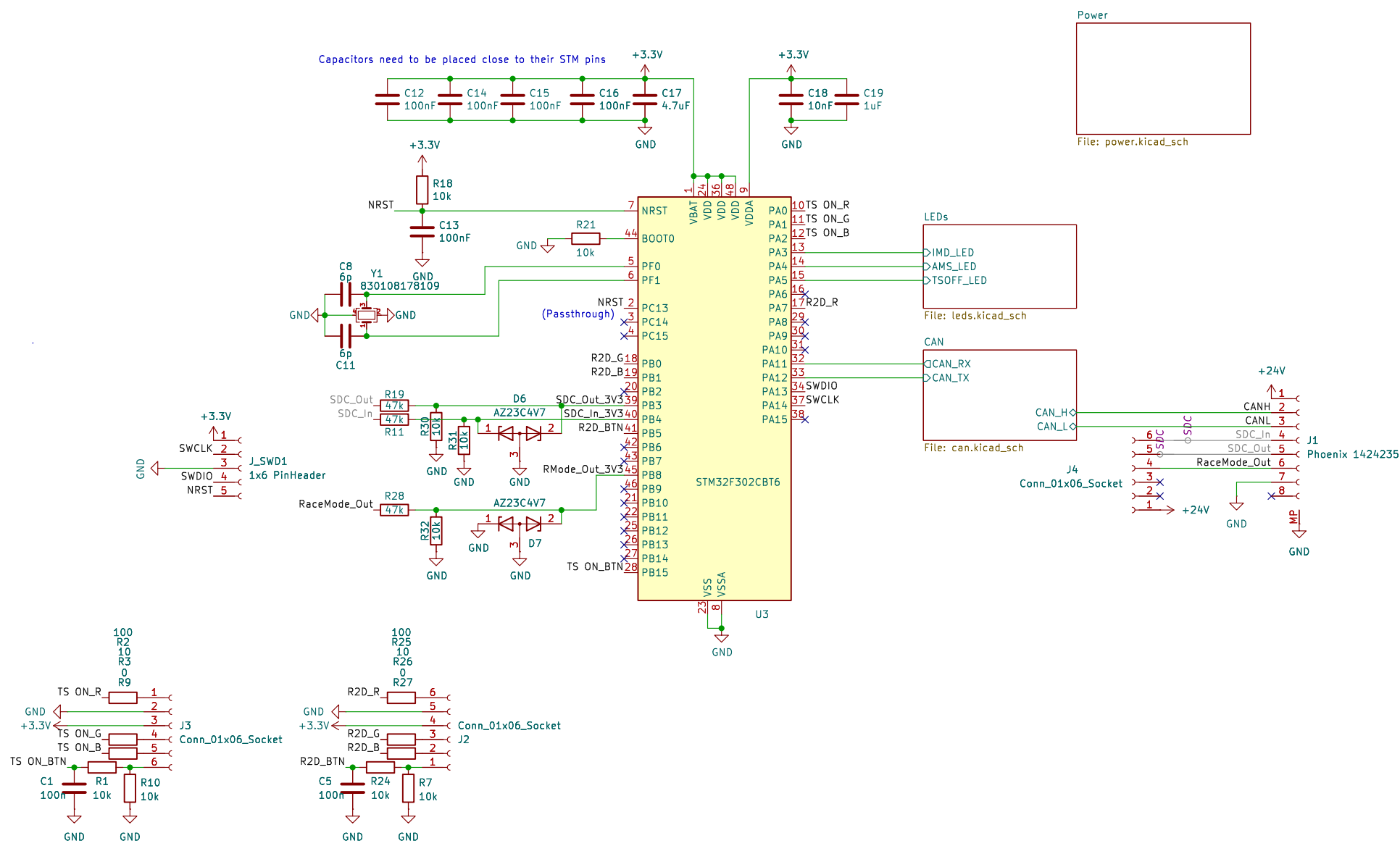
**Project: Master\_FT25**

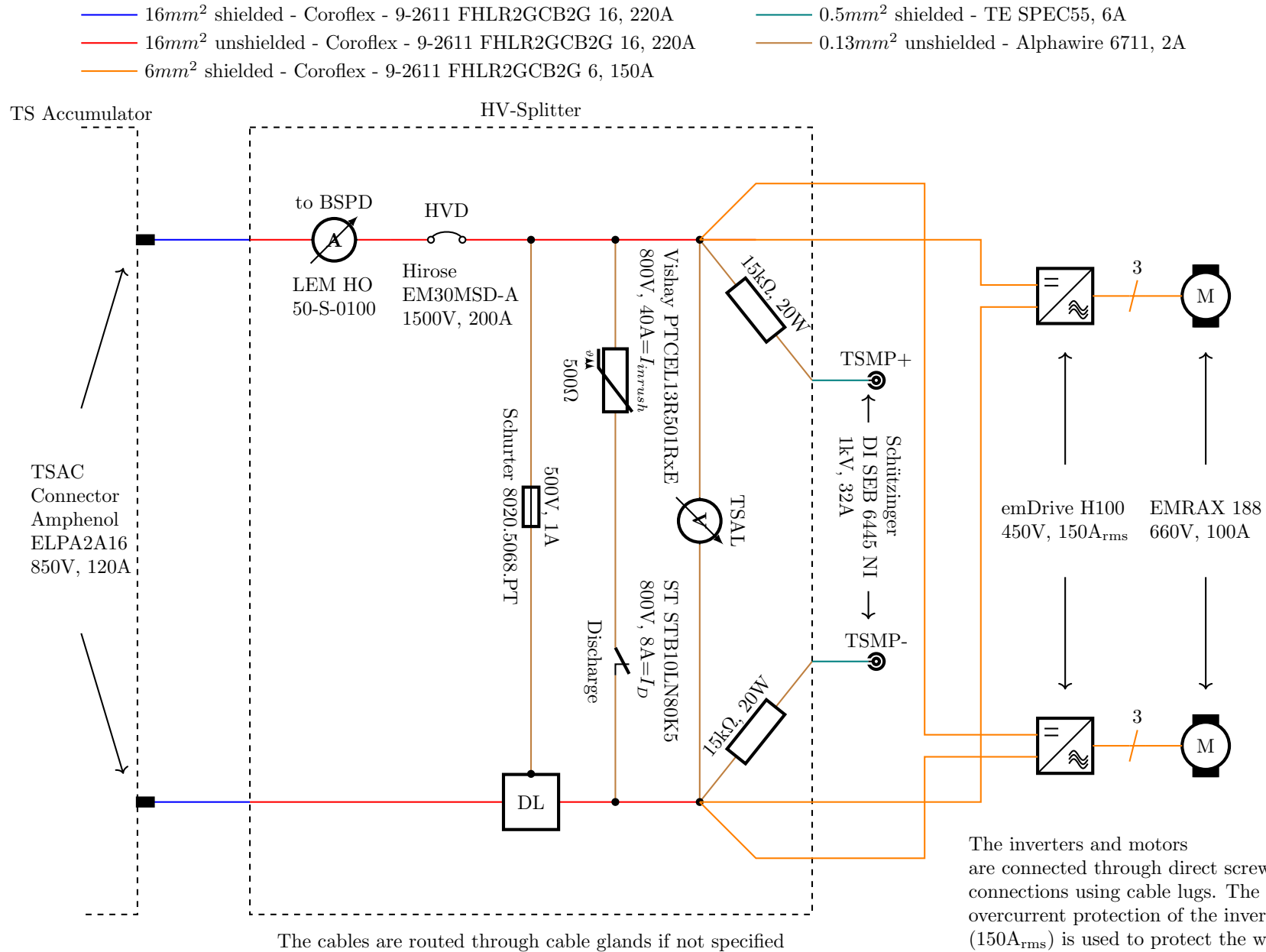
**Exp. Date: 2025-04-27**

**Author: Lene Marquardt**

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

# Dashboard



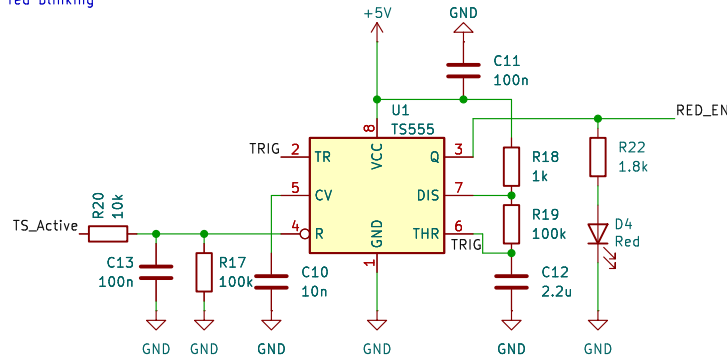


The inverters and motors are connected through direct screwed connections using cable lugs. The built-in overcurrent protection of the inverters (150A<sub>rms</sub>) is used to protect the wires, which can handle a continuous current of 170A

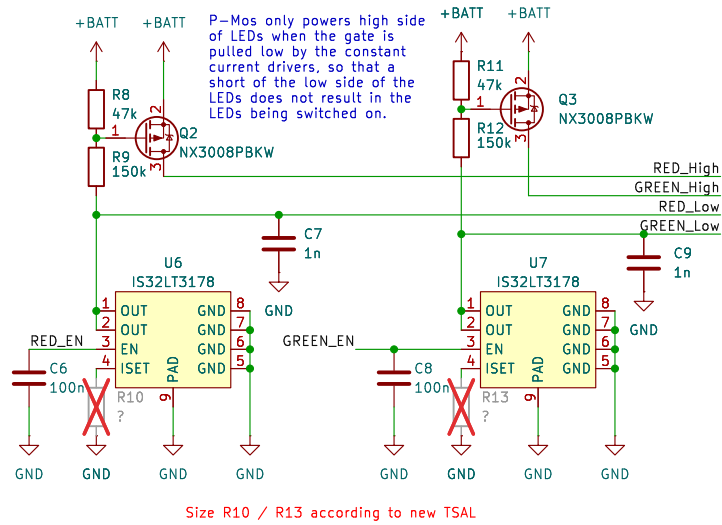
# TSAL driver board and DC-link voltage detection

LV TS

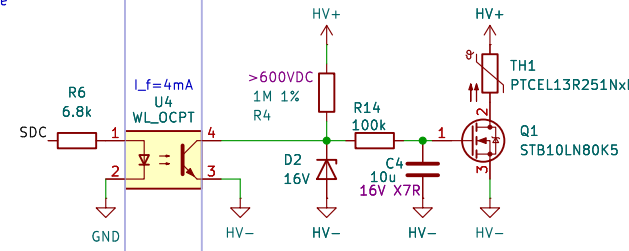
Timer for red blinking



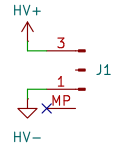
LED Drivers



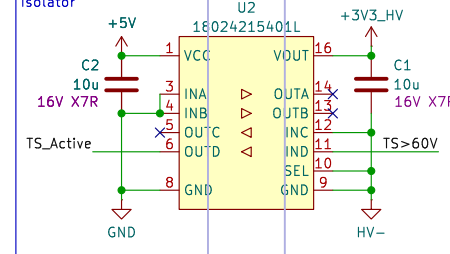
Discharge Circuit



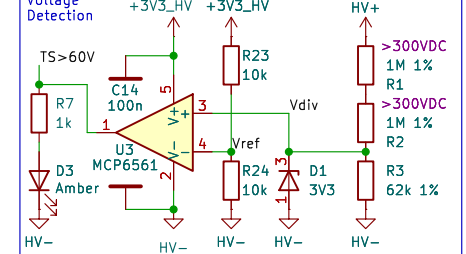
HV Connector



Isolator



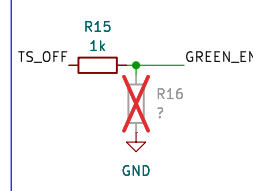
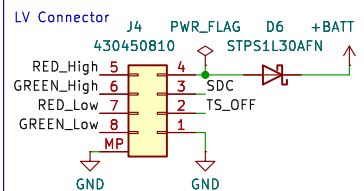
Voltage Detection



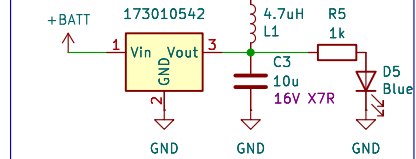
$$V_{ref\_max} = 3.47V \cdot 10.1k\Omega / (10.1k\Omega + 9.9k\Omega) = 1.76V$$

$$V_{div@60V\_min} = 60V \cdot 61.38\Omega / (2 \cdot 990k\Omega + 61.38k\Omega) = 1.8V$$

$$V_{hyst\_max@75deg} = 6mV < 40mV (1.80V - 1.76V)$$



Isolator Supply & Filter



**FASTTUBE**

Title: Discharge Circuit

Project: DC

Author: Karlsson Winkels

Rev: V1

Date: 2024-11-10

Exp. Date: 2025-04-27

Size: A4 Page: 1/1