

# 6 Digit Nixie Clock "64Bit" - Driver Board

A

64Bit comes from the fact that this clock is driven with shift registers. Between the 6 nixie digits, and indicators, 64 bits are sent from the microcontroller to the shift registers to create the display output

This is an STM32F446 based project.

The clock time keeping is handled via a Real Time Clock (RTC) communicated with via I2C. The STM32 also has an on-board RTC that can be utilized. Both RTCs have a battery backup via a replaceable 2032 coin cell.

The interface with the clock is via a rotory encoder with a push button. Interfacing with remote capacitive buttons is possible via connectors on the bottom of the Driver Board.

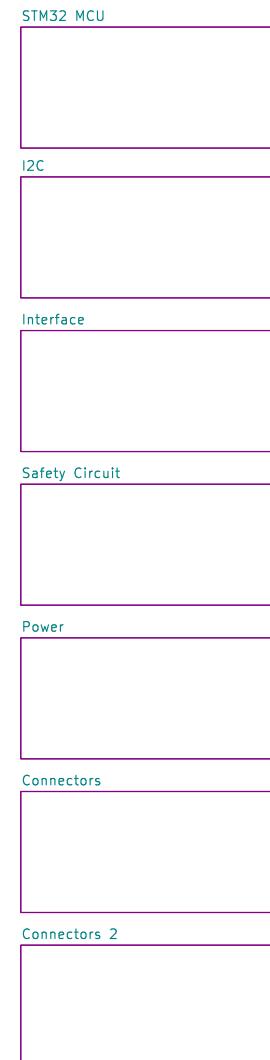
There is a full-color LCD display using driving chip ST7789V2. Communication occurs via SPI.

This clock was designed with safety in mind. There is a dedicated safety circuit that cuts the input and output connections of the high voltage power supply via relays. There are connectors for interfacing external spring pin connections to the cover of the clock, ensuring the high voltage power supply is not on while the lid is off. The safety circuit features dual channels and feedback to the microcontroller. With the spring pin feature, it will provide isolation from the high voltage, even in an event where the microcontroller experiences an error.

The power design of the clock relies on simple components. There are two inputs available to power the clock. A USB-C port and a 12V barrel jack. A boost converter utilizing XL6009 converts (boost) the incoming voltage to 12VDC. Then an LDO creates 5V then another LDO, in series, creates 3.3V. The high voltage power supply typically is set to output 170VDC to 180VDC. It is supplied by a power supply module that sources 12V power.

This driver board interfaces with the display board PCB via right angle board-to-board connectors. Mounted to the back of the display board is an LED board to provide RGB backlighting to each IN-12 Nixie Tubes.

The circuit boards will be mounted to a 3D printed base via brass standoffs. Overtop of the PCBs will be a glass top. The glass top will have sections where copper tape is applied. Spring pins contact the copper tape to pass connections for the safety circuit.



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Sheet: /  
File: 64 Bit – Main Board.kicad\_sch

## Title: Project Overview

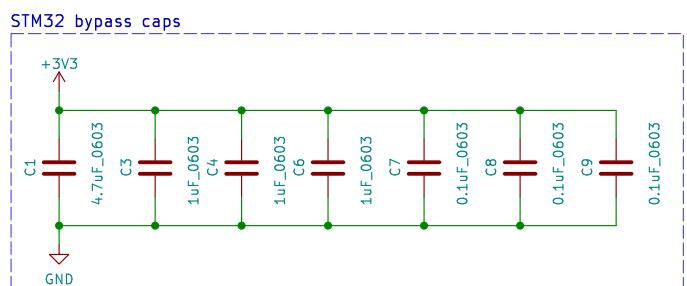
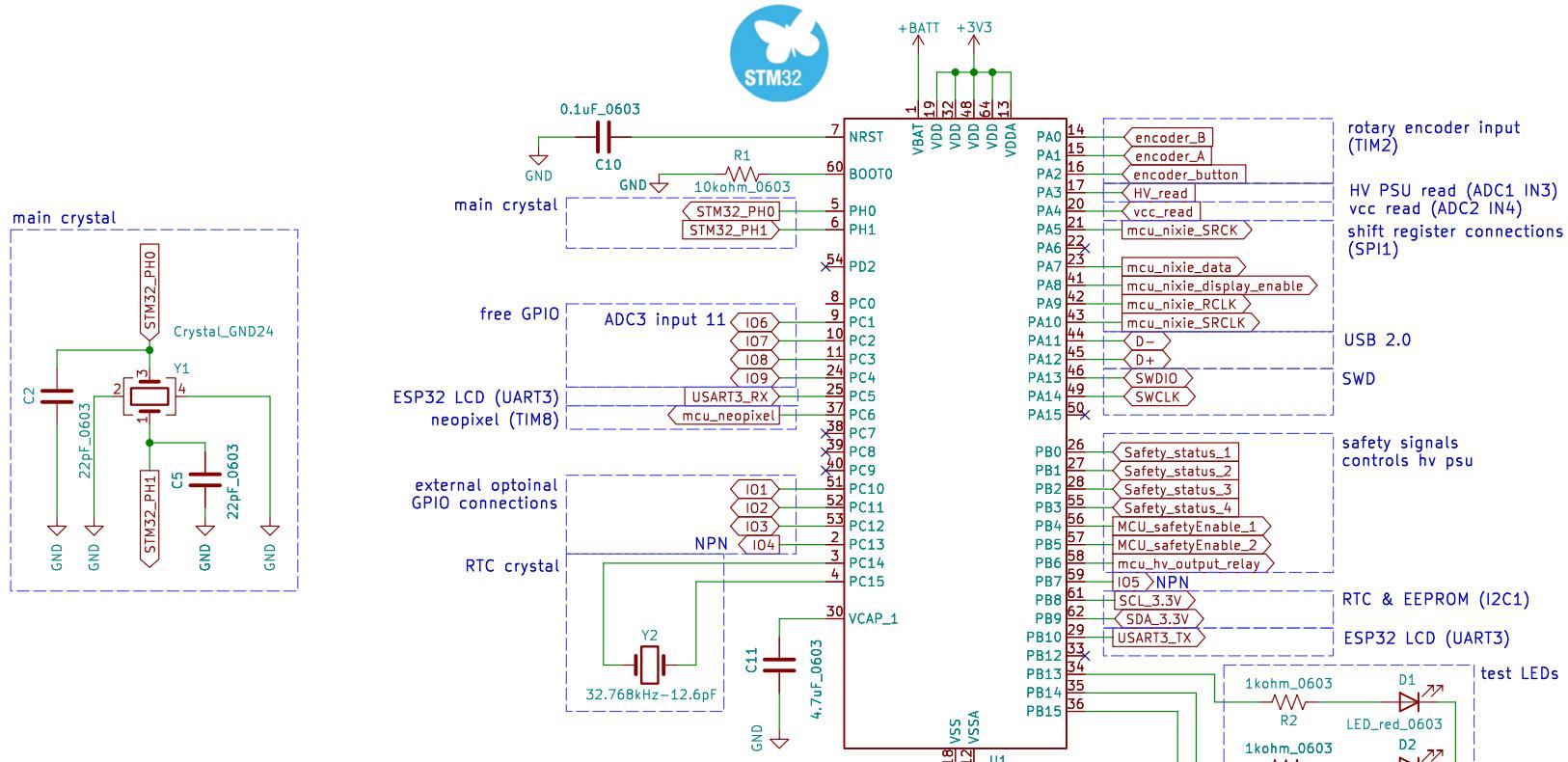
Size: A4	Date: 2025-OCT-04
KiCad E.D.A. 9.0.4	

Rev: 1
Id: 1/9

1 2 3 4 5 6

Level Shifting

### STM32F446 Processor ARM M4 168MHz



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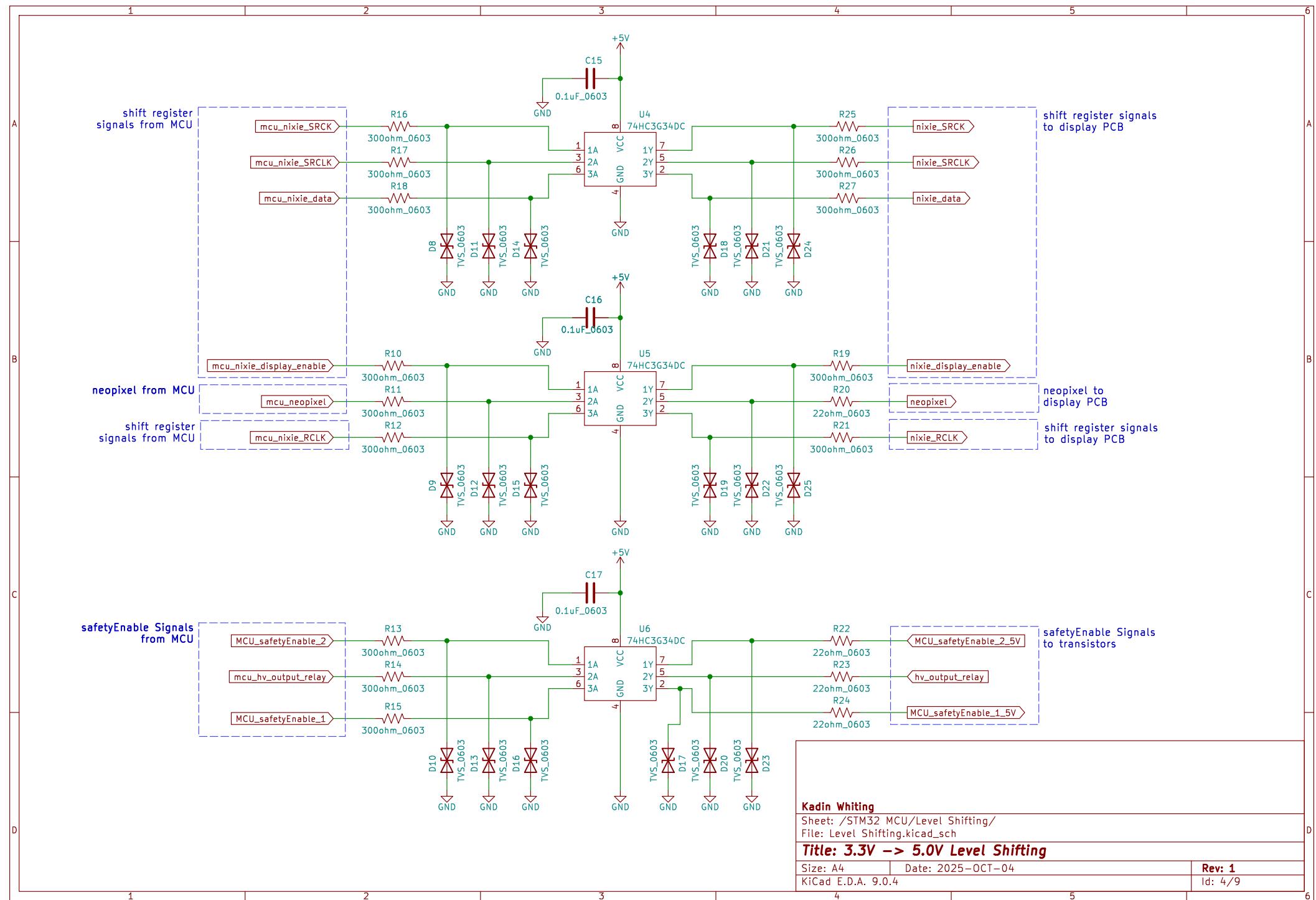
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File: STM32 MCU.kicad\_sch

**Title: Microcontroller**

Size: A4 Date: 2025-OCT-04  
KiCad E.D.A. 9.0.4

Rev: 1  
Id: 2/9

1 2 3 4 5 6



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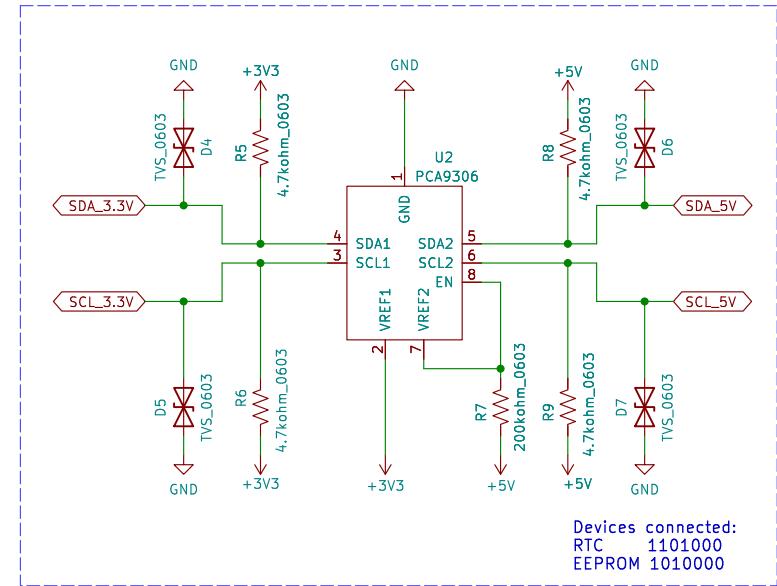
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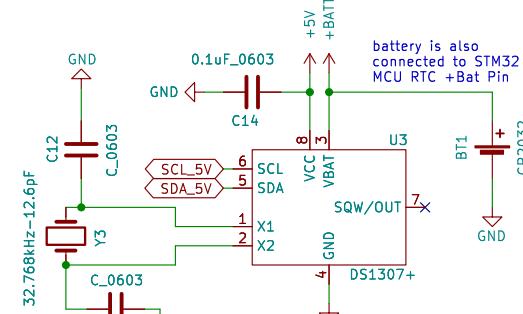
D

D

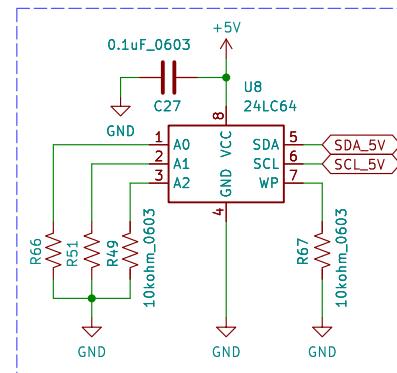
## 3.3V to 5V I2C level shifter



## Real Time Clock



## EEPROM



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Sheet: /I2C/  
File: I2C.kicad\_sch**Title: RTC & RTC Level Shifting**Size: A4 Date: 2025-OCT-04  
KiCad E.D.A. 9.0.4Rev: 1  
Id: 3/9

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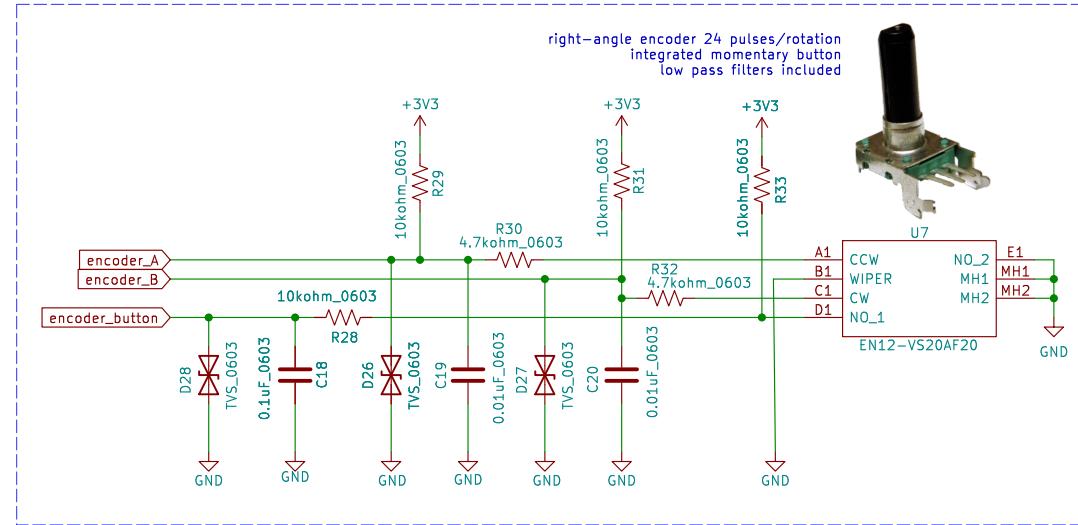
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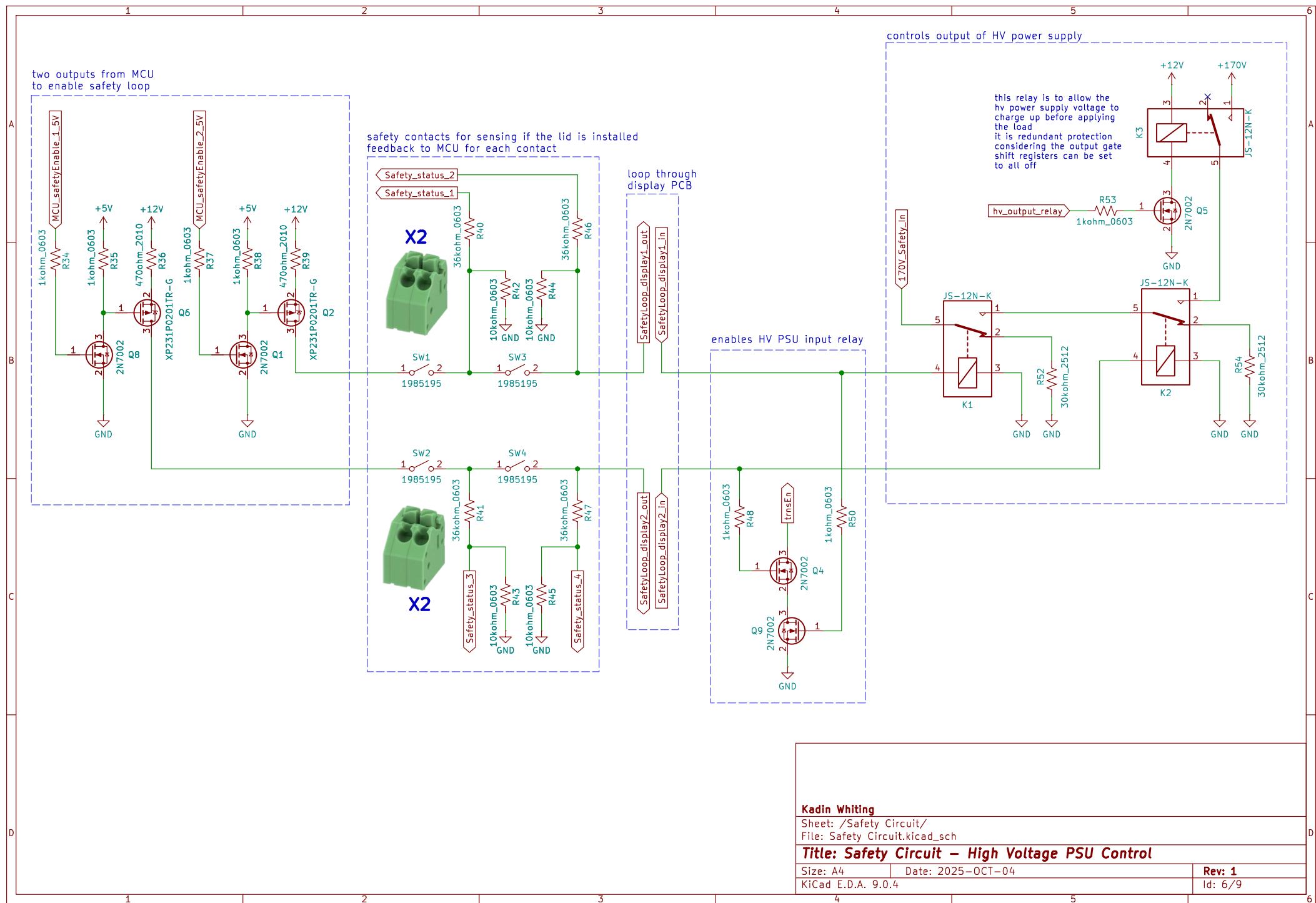
**rotary encoder with push button****Kadin Whiting**

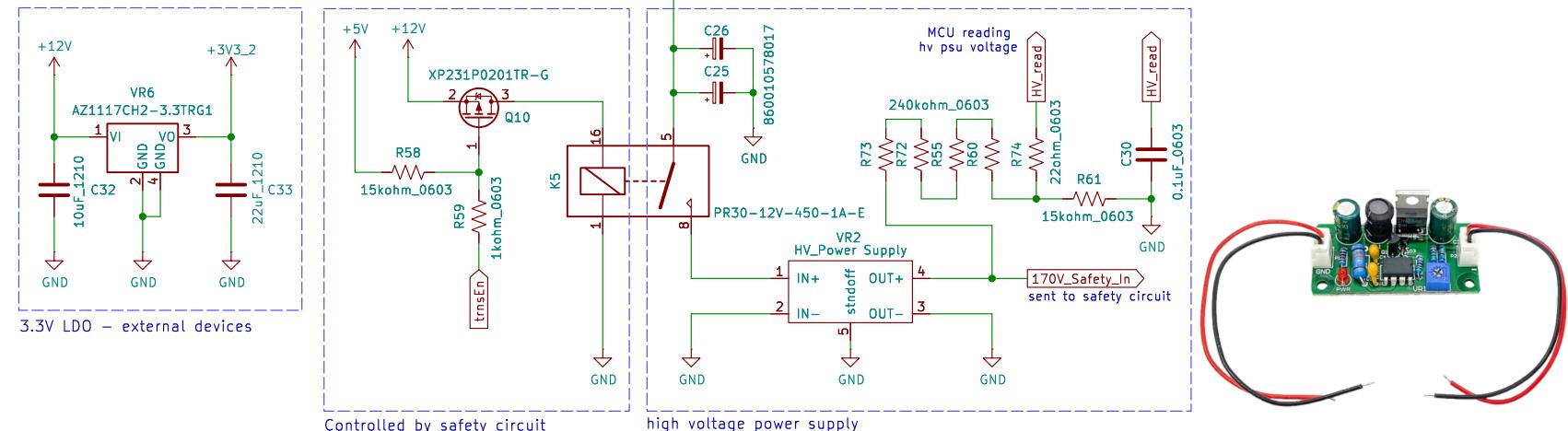
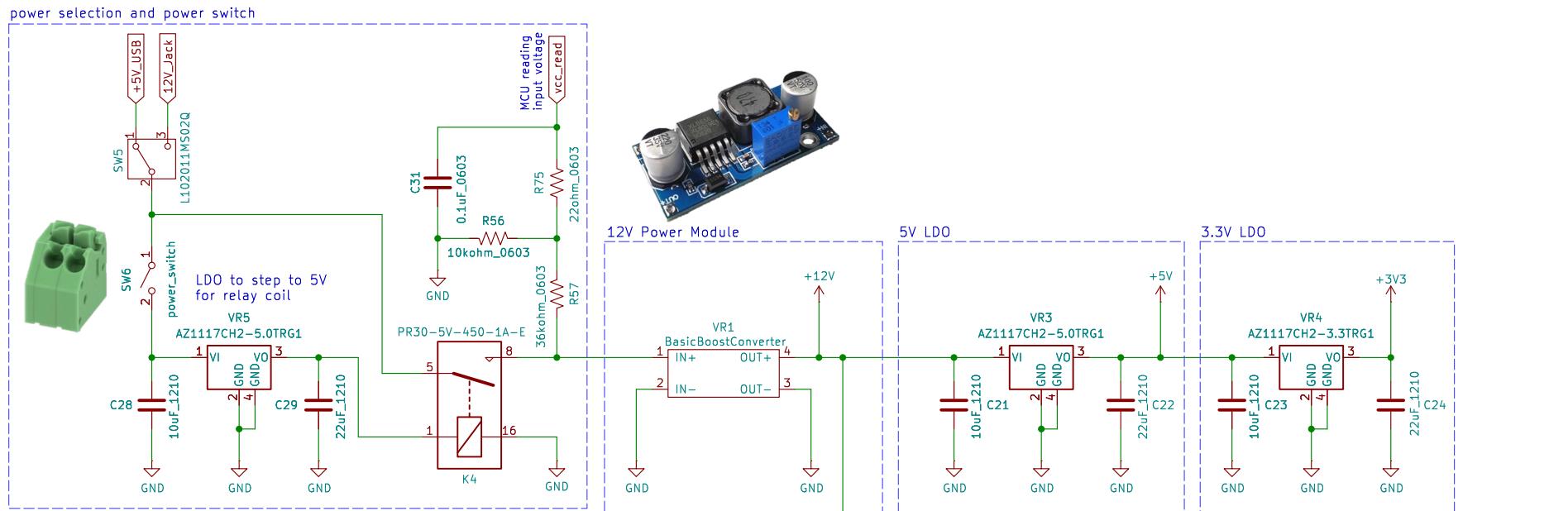
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**Title: Interface – Rotary Encoder**

Size: A4 Date: 2025-OCT-04  
KiCad E.D.A. 9.0.4

Rev: 1  
Id: 5/9





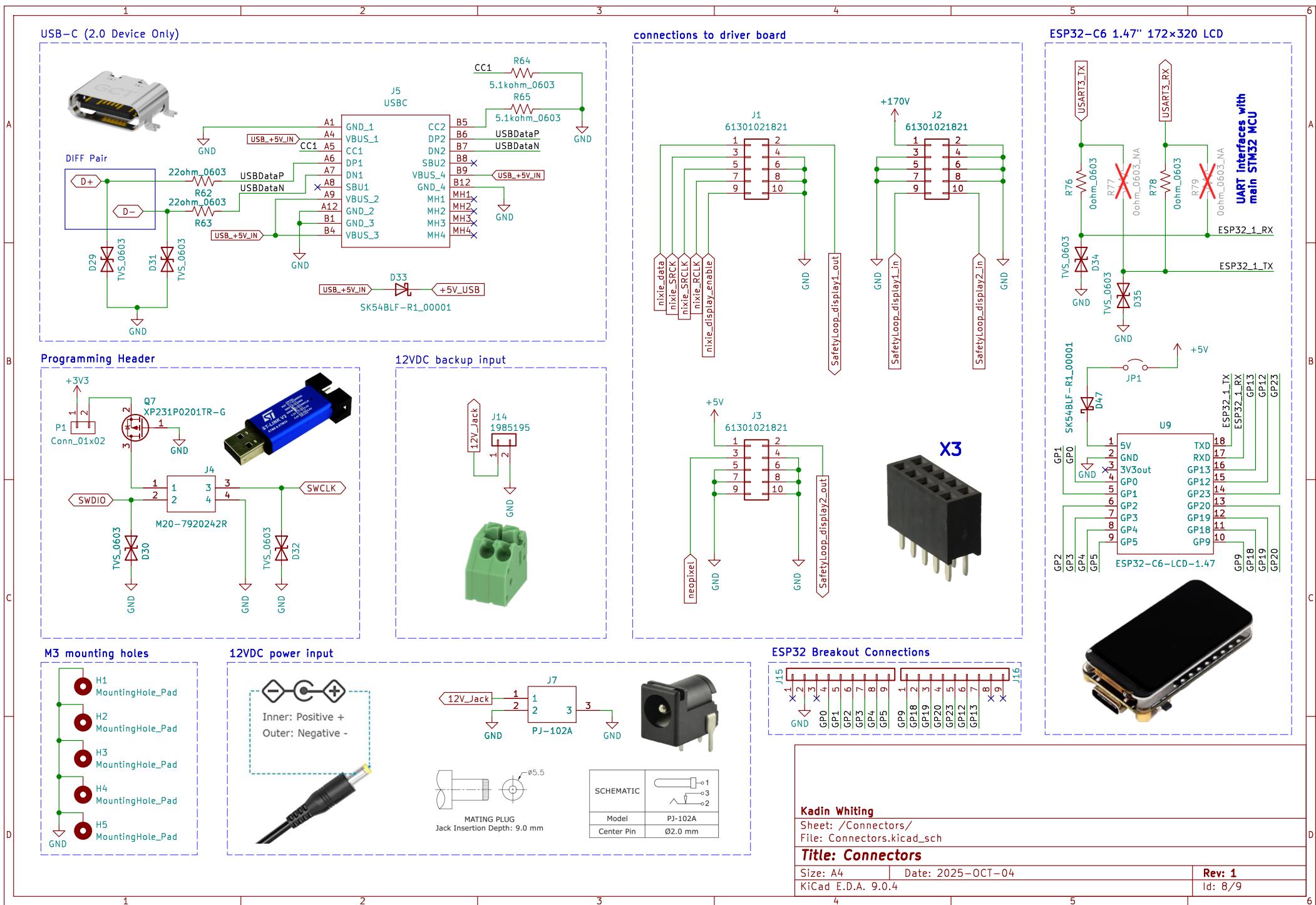
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Sheet: /Power/  
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**Title: Power**

Size: A4 Date: 2025-OCT-04  
KiCad E.D.A. 9.0.4

**Rev: 1**  
Id: 7/9



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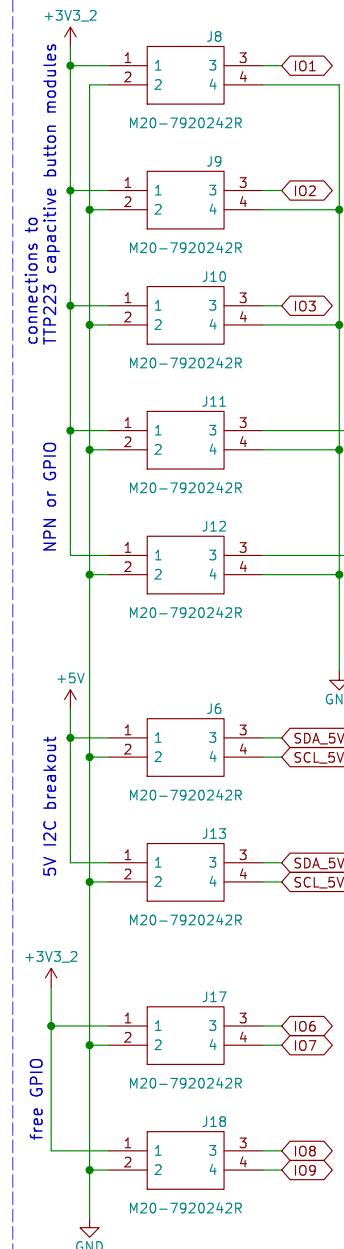
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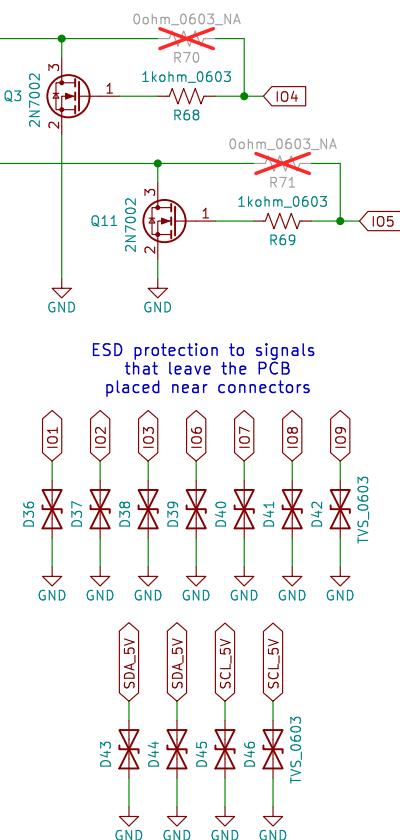
## external GPIO optional connections



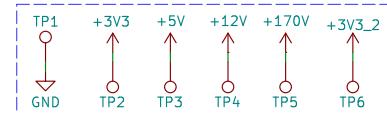
## X9 – Bottom side of PCB



Default x2 NPN outputs for LED filament strips  
Resistor configuration possible for GPIO



## power test points



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Sheet: /Connectors 2/  
File: Connectors 2.kicad\_sch

**Title: Connectors**

Size: A4 Date: 2025-OCT-04  
KiCad E.D.A. 9.0.4

**Rev: 1**  
Id: 9/9