

## HDD Clock V4.0

This is the schematic for the Driver board of my HDD Persistence of Vision Clock V4.0 V3.0 never got completely finished. I have decided to approach power in a different way so I've moved the project to V4.0.

If a \* is placed next to a line it indicates it is new to V4.0

Main improvements and included features of this driver board:

1. \*Powered fully from 12V DC Jack
  - \*-features a buck converter design capable of 2.4A @ 5V
  - \*-3.3V LDO capable of 500mA
2. APA102-2020 LEDs instead of WS2812B LEDs (V3.0 had this idea too, but was never finished)
  - The new LEDs are capable of 25x data speed.
  - the 2020 package takes up 60% less area allowing many more to be placed in the same space.
  - \*-Lessons learned from V3.0 is these are a bit tricky to assemble. Take great care when installing these LEDs. Very prone to shorts.
3. Integrated I2C PCB Temperature sensors.
  - Driver Board PCB temp
  - Ambient air temperature
  - LED Board temp (connections for this off-board temp sensor)
4. Upgraded light mask and persistence of vision method.
  - This version uses several holes in the spinning light mask rather than 1 large slit. precise tracking of the holes and lighting of specific LEDs should allow for 'pixels' to be drawn around the spinning platter rather than just being able to draw a line from the center. (Turns out this is not new like I thought it was. The spinning light mask that I described is what's known as a Nipkow Disk. I'm planning to use the Nipkow method multiplied several times to complete a full circle effectively combining multiple small displays into one large circular one.)
5. Potentiometer was replaced with an encoder.
  - It wasn't always clear to every user that there was an end to the travel of the potentiometer on V1 and V2. An encoder will remove this problem.
6. Right angle buttons replace the old buttons. Buttons reduced from 4 to 3.
  - Finding the old buttons was often difficult. Spacing the buttons out further and making them more visible should help this problem.
7. Wires have been removed from the assembly.
  - Connections between this driver board and the LED board are made with SMT spring-loaded PCB pins on the driver board and matching pin target pad on the LED board.

STM32F411 + Level shifting

I2C Devices

Power

Interface

LED Board and Motor Connections

Mounting Holes

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Sheet: /

File: Driver Board\_HDDCLKV4.0.kicad\_sch

**Title: Cover Page**

Size: A4

Date: 2022-07-03

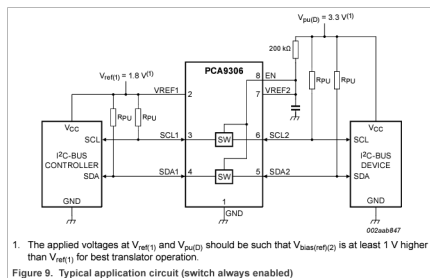
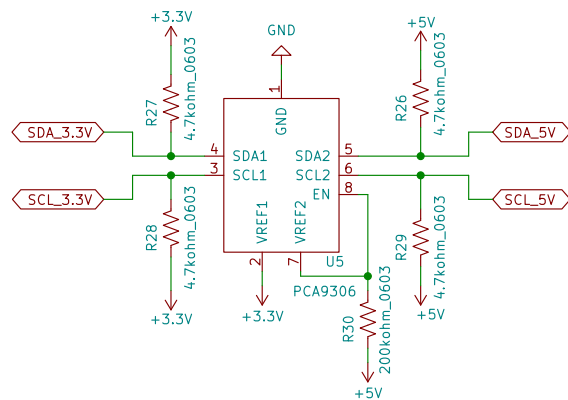
**Rev: 4.0**

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Id: 1/12



## I2C Level Shifter



5V I2C Devices

3V3 I2C Devices

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Sheet: /I2C Devices/  
File: I2C Devices.kicad\_sch

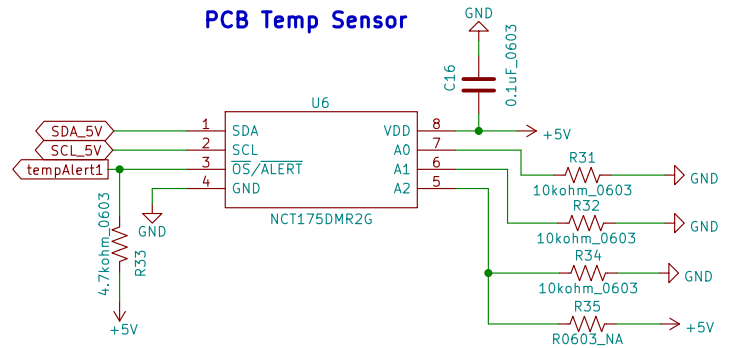
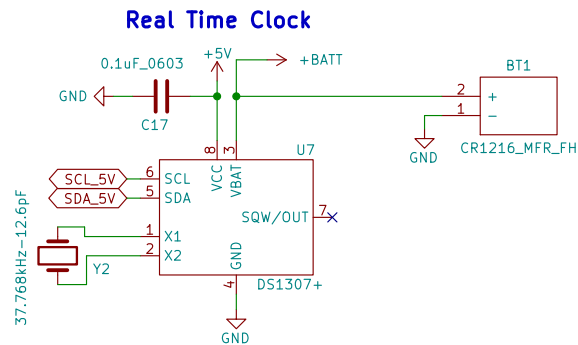
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Size: A4 Date: 2022-07-03

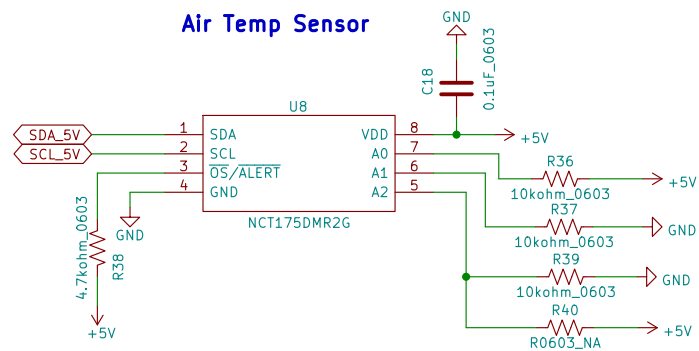
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address setting resistors



address setting resistors

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Sheet: /I2C Devices/5V I2C Devices/  
File: 5V I2C Devices.kicad\_sch

**Title: +5V I2C Devices**

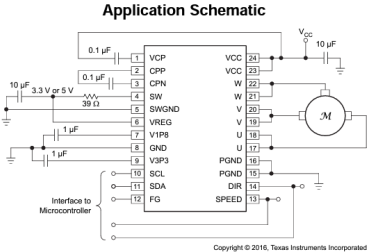
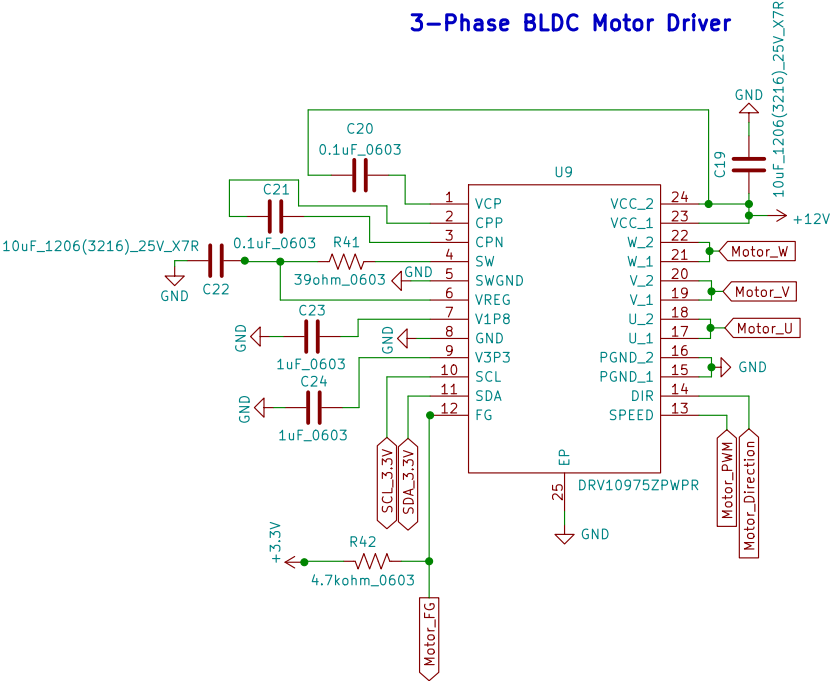
Size: A4 Date: 2022-07-03

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3-Phase BLDC Motor Driver



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Sheet: /I2C Devices/3V3 I2C Devices/  
File: 3V3 I2C Devices.kicad\_sch

Title: +3.3V I2C Devices

Size: A4 Date: 2022-07-03

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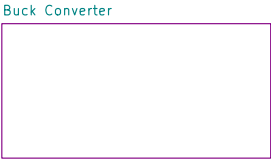
POWER:

12V -> 5V -> 3.3V

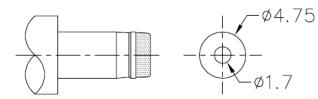
12V DC Jack -> 5V Buck Converter -> 3.3V LDO

5V USB -> 3.3V LDO (no motor power)

This version of the HDD Persistence of vision clock takes 12V in from a DC jack. The motor driver uses the 12V to drive the motor. The 12V is fed into a buck converter circuit. This circuit is capable of 2.5A @ 5V. 5V powers the RTC, temp sensors and LEDs. 5V is fed into a 3.3V regulator capable of 500mA. 3.3V powers the stm32 ARM processor and motor chip and communication.

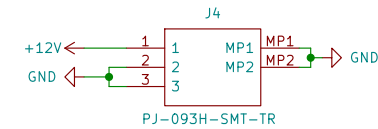


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Sheet: /Power/		
File: Power.kicad_sch		
Title: Power Overview		
Size: A4	Date: 2022-07-03	Rev: 4.0
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MATING PLUG  
Jack Insertion Depth: 8 mm

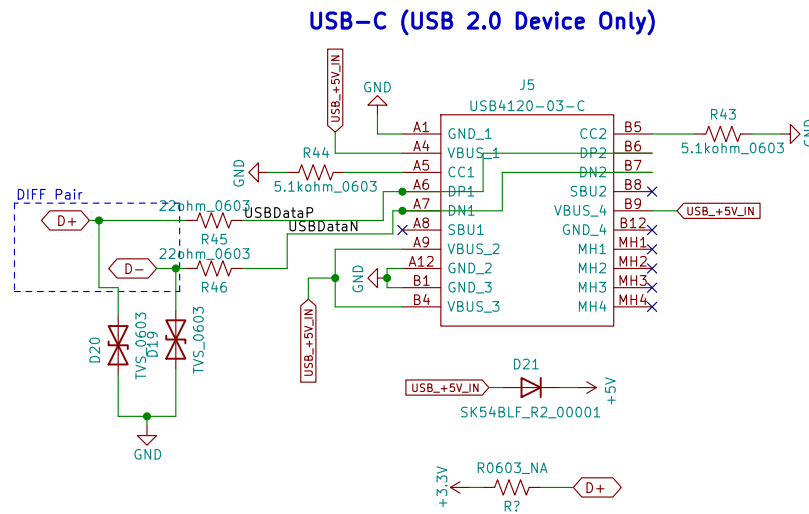
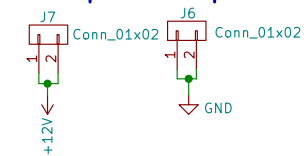
SCHEMATIC	
Model	PJ-093H-SMT-TR
Center Pin	Ø1.65 mm



### Ordered Cable Polarity



### Backup Power Input



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

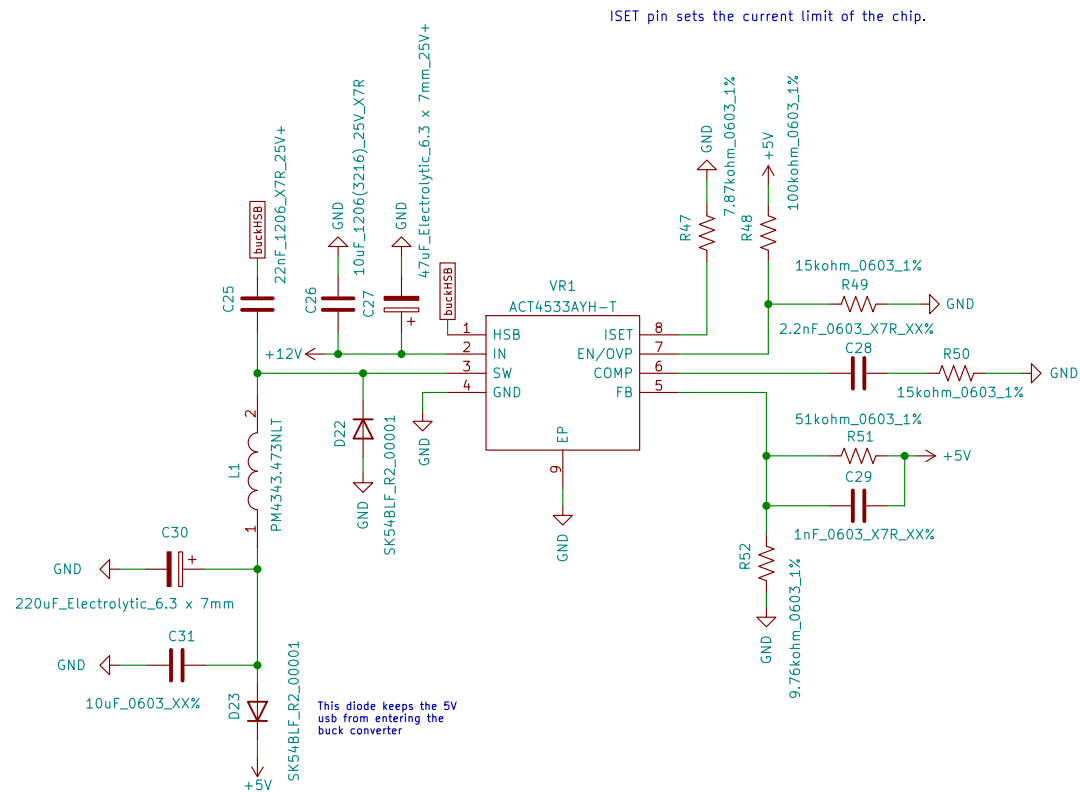
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Size: A4 Date: 2022-07-03

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**Rev: 4.0**

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Sheet: /Power/Buck Converter/  
File: Buck Converter.kicad\_sch

**Title: Buck Converter (5V@2.4A)**

Size: A4 Date: 2022-07-03

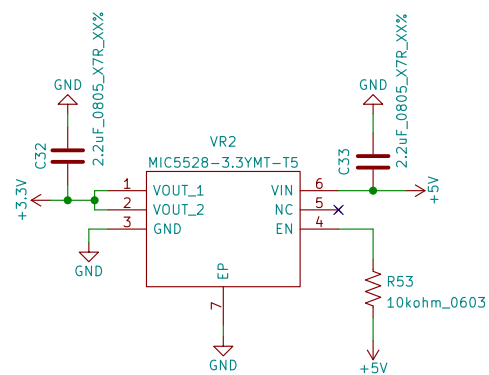
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Rev: 4.0

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# 3.3V LDO



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Sheet: /Power/LDO/

File: LDO.kicad\_sch

**Title: +3.3V LDO (500mA)**

Size: A4

Date: 2022-07-03

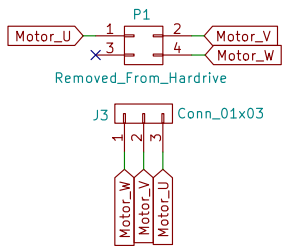
Rev: 4.0

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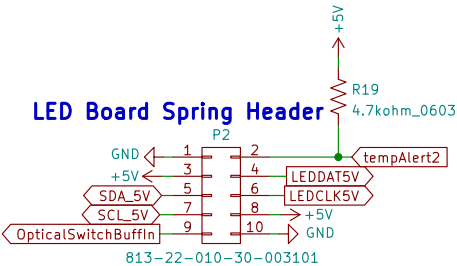
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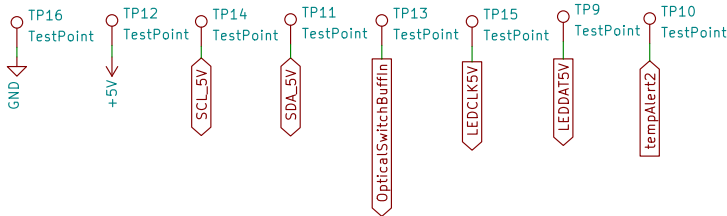
Motor Connections



LED Board Spring Header



Test points for LED Board alignment verification



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Sheet: /LED Board and Motor Connections/		
File: LED Board and Motor Connections.kicad_sch		
Title: LED Board and Motor Connections		
Size: A4	Date: 2022-07-03	Rev: 4.0
KiCad E.D.A. kicad (6.0.1)		Id: 11/12

