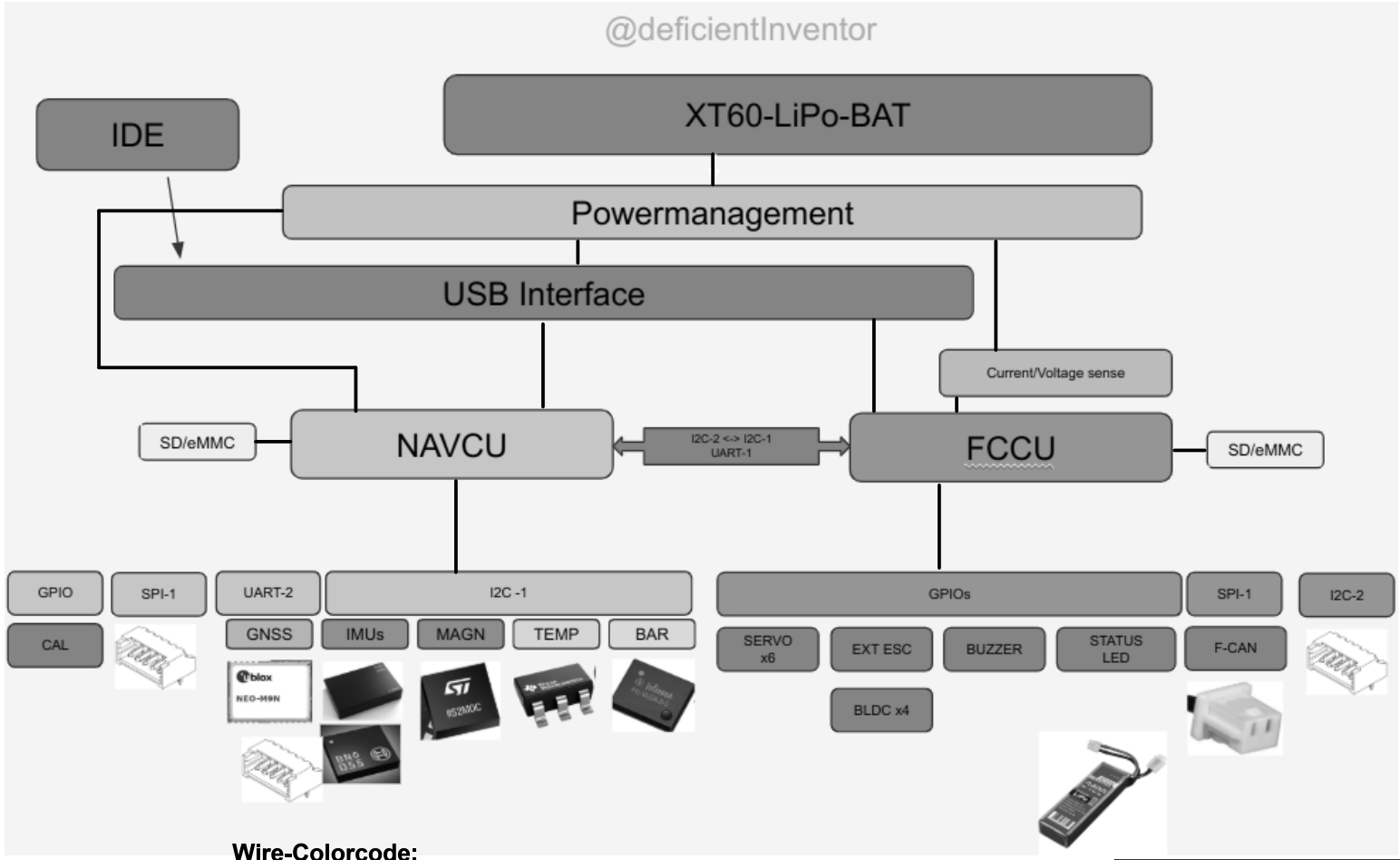


BATT_PWR_MANAGEMENT

FCCU_USB_INTERFACE

NAVCU_USB_INTERFACE

FCCU

NAVCU

FCCU_PHERIPHERALS

NAVIGATION_PHERIPHERALS

Wire-Colorcode:

POWER

Type	Color	Width
VBAT	———	2.5mm
+5V	———	0.5-2.5mm
+3V3	———	0.5mm
REG_FB	———	0.35mm
GND	———	0.5mm

SIGNAL

Type	Color	Impedance	Width
UART	———	50Ω	0.327mm
I2C	———	50Ω	0.327mm
SIgnal	———	50Ω	0.327mm
USB	———	90Ω	0.35mm
SPI	———	50Ω	0.327mm
RF	———	50Ω	0.37mm

Comments:

deficientInventor

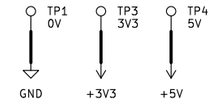
Sheet: /
File: feza_fcu_pcb.kicad_sch

Title: FEZA FLIGHT COMPUTER

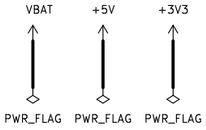
Size: A4	Date: 2024-11-18	**Rev: 1.1**
KiCad E.D.A. 8.0.7		Id: 1/8

POWERMANAGEMENT

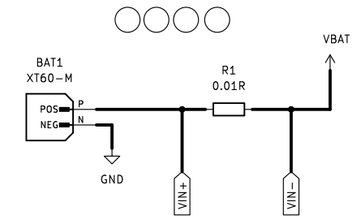
TESTPOINTS



POWERFLAGS



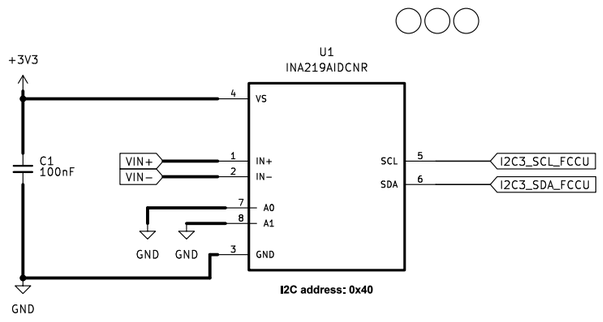
BATTERY INPUT & CURRENT SENSE RESISTOR



Maximum Input voltage: 26V

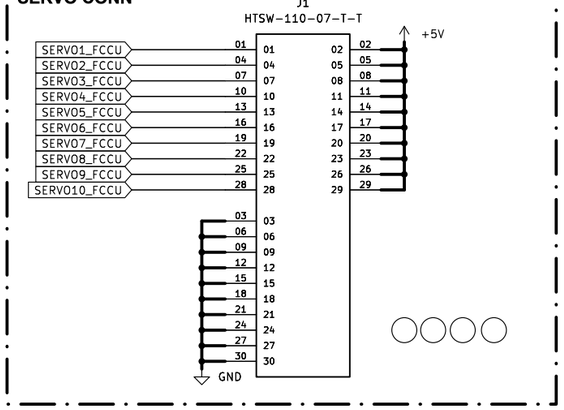
R1 10mOhm 1W 2512

VOLTAGE/CURRENT/POWERSENSE IC

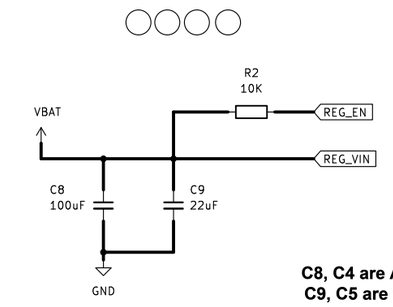


I2C address: 0x40

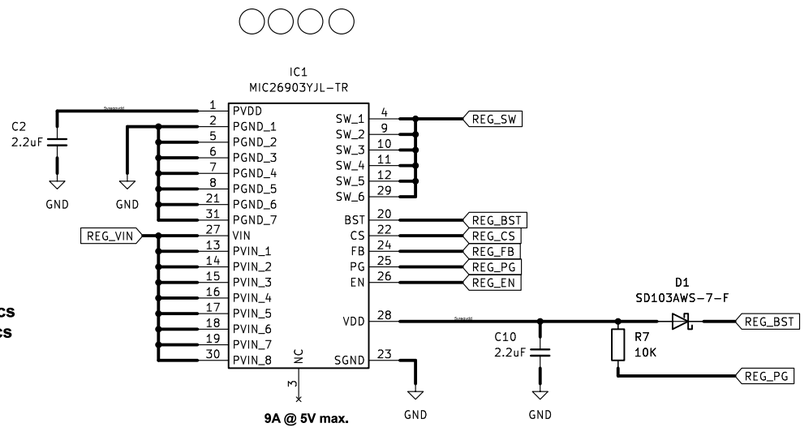
SERVO CONN



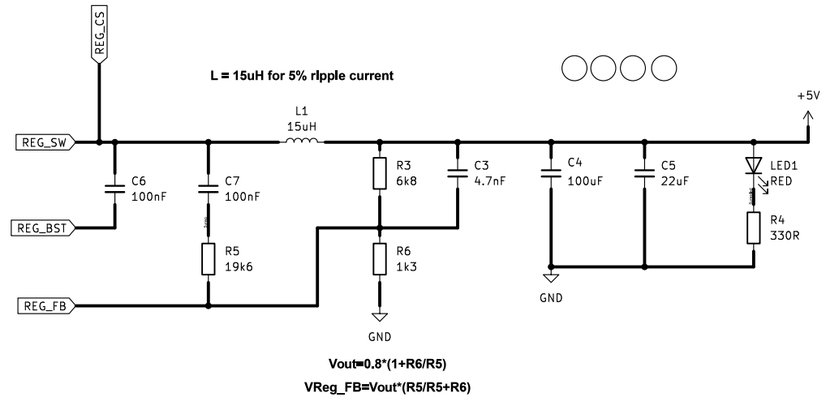
SWITCHING REGULATOR



C8, C4 are Al Electrolytics
C9, C5 are 1210 ceramics
C8, C9 ratet at >= 35V



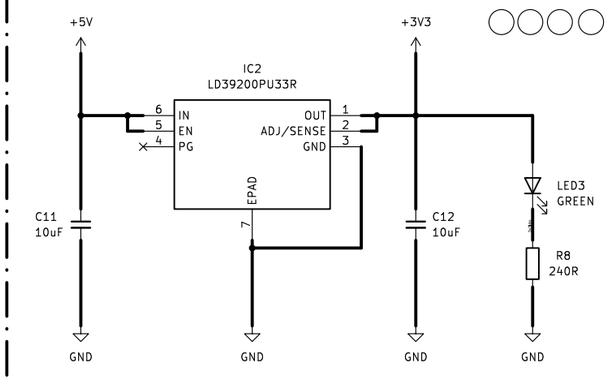
9A @ 5V max.

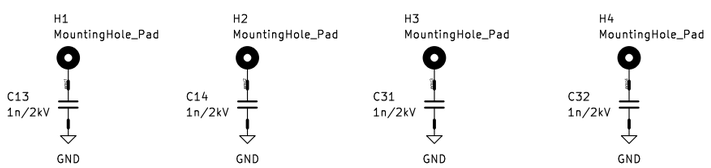


Vout=0.8*(1+R6/R5)

VReg_FB=Vout*(R5/R5+R6)

LDO/PWRLED3v3 (MCUs and Sensors)





SANITY-CHECK LEGEND:

- Associations
- ESD
- Schottky
- Testpoints
- Functional
- Nets

References: 1:1 PHILS LAB HADES

Comment:

I understand everything, except the switching regulator.
The Datasheet was highly complicated for me to understand
It is saying that i should keep SGND and PGND seperate.
Rick Hartley says, that splitting grounds creates more problems than it solves. The Datasheet says if VIN of the REG is >5.5V PVDD should be connected to VIN, but Phil did connected It to GND.
- Is the Schottky Diode on the REG placed correctly?

deficientInventor

Feza

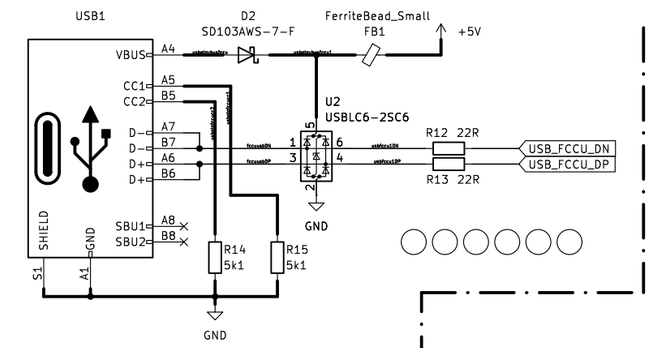
Sheet: /BATT_PWR_MANAGEMENT/
File: BATT_PWR_MANAGEMENT.kicad_sch

Title: FEZA FLIGHT COMPUTER

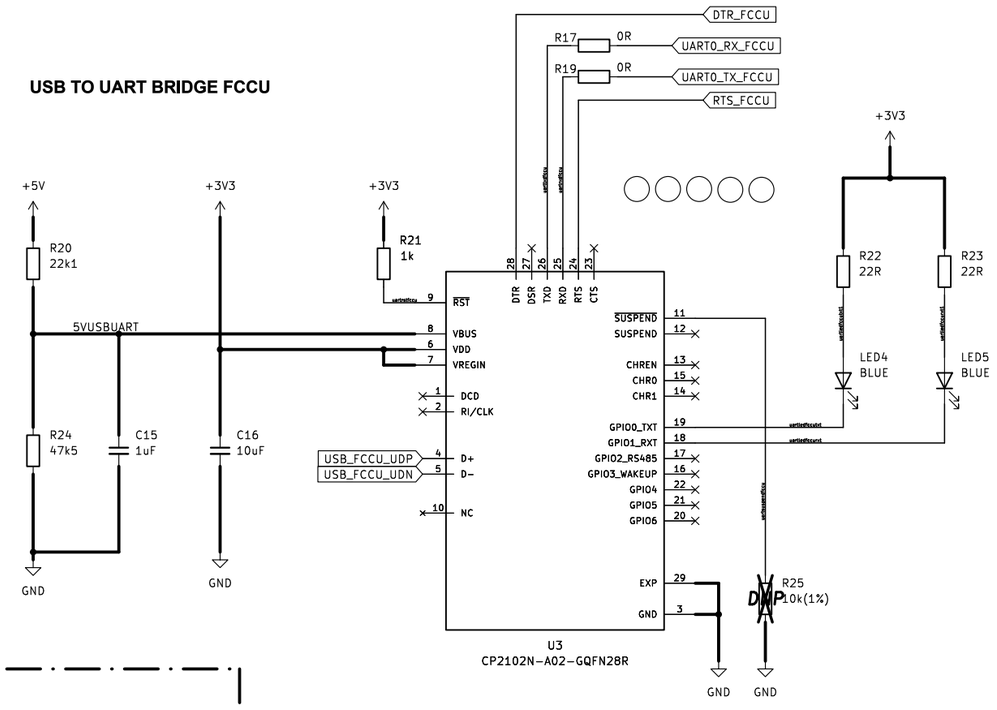
Size: A3	Date: 2024-11-18	**Rev: 1.1**
KiCad E.D.A. 8.0.7		Id: 3/8

FCCU-USB-INTERFACE

USB-OTG-FCCU

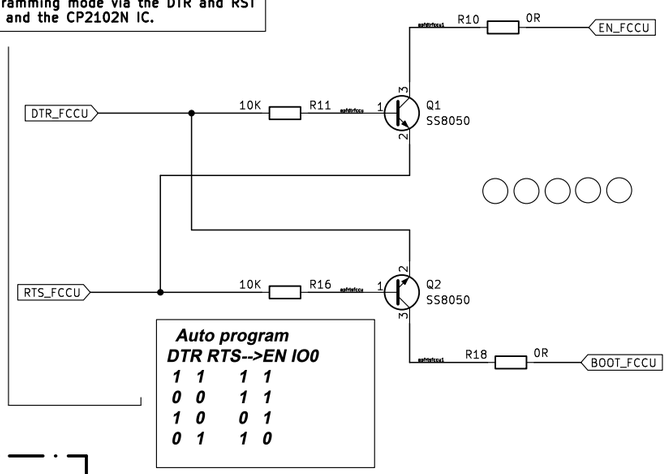


USB TO UART BRIDGE FCCU



AUTO PROGRAMMER FCCU

With the logic shown below, the software-IDEs PIO, Arduino, or ESP-IDF can automatically put the board into programming mode via the DTR and RST pins and the the CP2102N IC.

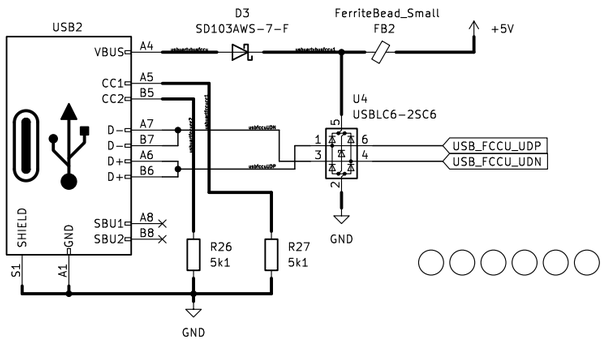


GPIO_TXT and GPIO_RXT are LED status indicators for data transmission. They are connected according to the technical documentation of the CP2102N-A2-xxx28R. See page 23 of the technical documentation.

LED resistors were chosen based on reference values to produce a dimmed light.

Click here to access the documentation.

USB-UART-FCCU



SANITY-CHECK LEGEND:

- Associations
- ESD
- Schottky
- Testpoints
- Functional
- Nets

Comments:

This Page is almost a exact copy of the Dev Board except
-the additional LEDS for the TXT and RXT for UART
-USB-C instead of uUSB

References:

https://www.silabs.com/documents/public/data-sheets/cp2102n-datasheet.pdf
https://dl.espressif.com/dl/schematics/SCH_ESP32-S3-DevKitC-1_V1.1_20221130.pdf

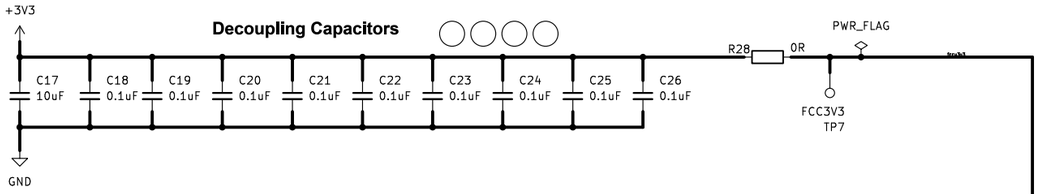
Sheet: /FCCU_USB_INTERFACE/
File: FCCU_USB_INTERFACE.kicad_sch

Title: FEZA FLIGHT COMPUTER

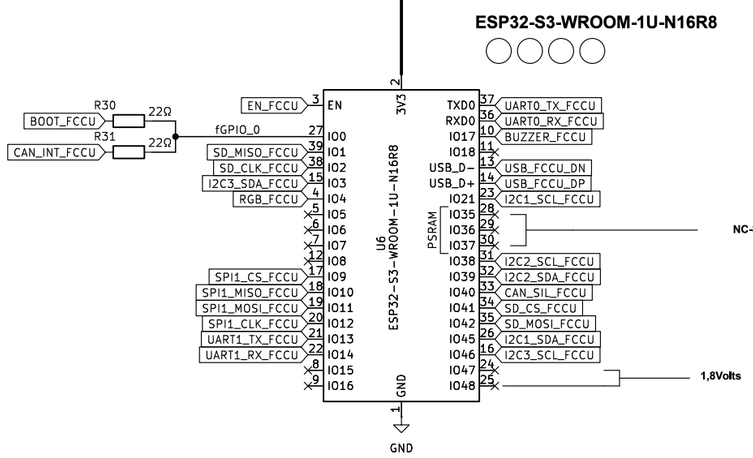
Size: A3	Date: 2024-11-18	**Rev: 1.1**
KiCad E.D.A. 8.0.7		Id: 4/8

FLIGHT CONTROLLER UNIT

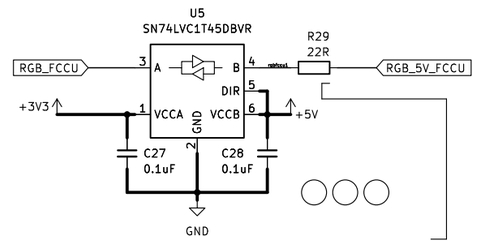
Decoupling Capacitors



ESP32-S3-WROOM-1U-N16R8

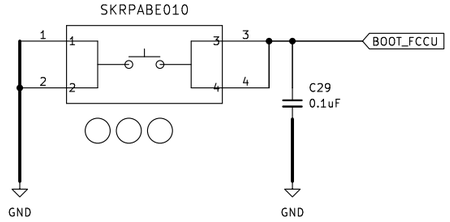


3V3-5V LEVEL SHIFTER (LED)



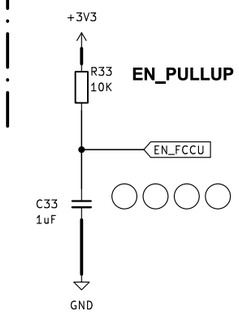
Series resistor recommendation of neopixels best practices says 300-500ohm series resistor (I guess for longer data lines) since this is a PCB design I decided to use 22ohm series resistor.
https://learn.adafruit.com/adafruit-neopixel-uberguide/best-practices

BOOT_BTN

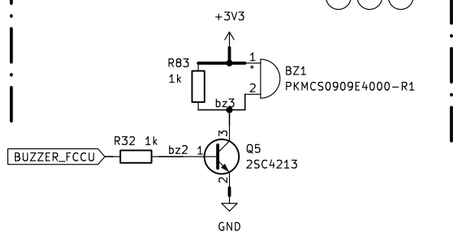


RST_BTN

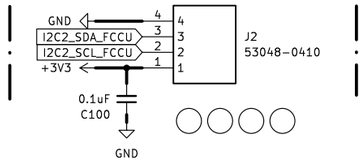
EN_PULLUP



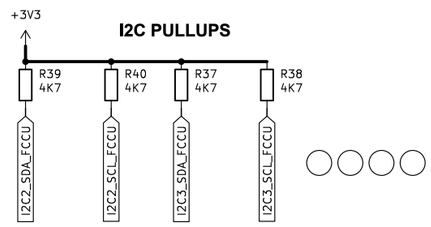
BUZZER



I2C2 FCCU CONN

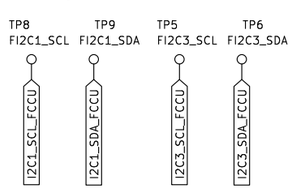


I2C PULLUPS

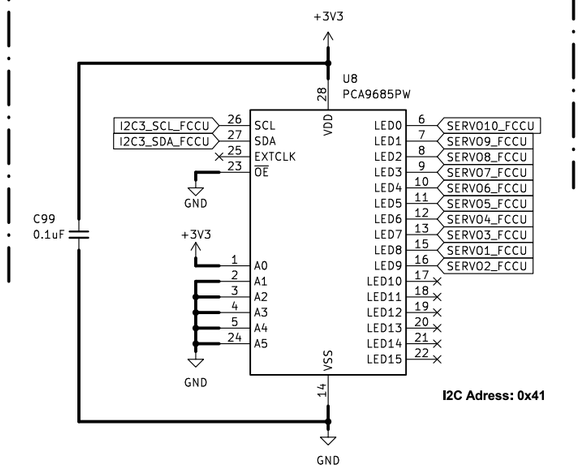


I2C2 PWRSENSE & EXT-CONN
I2C1 FCCU <--> NAVCU (NAVCU SCHEMATIC)

I2C Testpoints

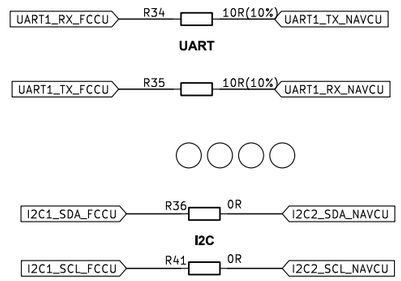


I2C2 CAN BE TESTED WITH EXT CONN



I2C Adress: 0x41

FCCU <--> NAVCU



SANITY-CHECK LEGEND:

- Associations
- ESD
- Schottky
- Testpoints
- Functional
- Nets

Comments:

I understand everything on this page, however,
I have difficulties choosing the right value for series resistors.
I choose the values based on reference
from Philslab and Robert Feranec.

-The array of decoupling capacitors maybe is overkill,
i choosed it based on Hades from Philslab.
-CAN can be tested via the external conn.
-I2C2 also can be tested via ext. conn

deficientInventor

Feza

Sheet: /FCCU/
File: FCCU.kicad_sch

Title: FEZA FLIGHT COMPUTER

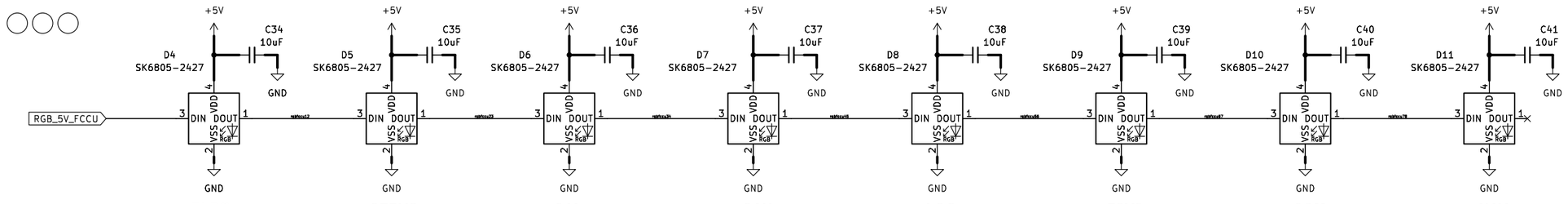
Size: A3	Date: 2024-11-18	Rev: 1.1
KiCad E.D.A. 8.0.7		Id: 5/8

References:

https://www.espressif.com/sites/default/files/documentation/esp32-s3-wroom-1_wroom-1u_datasheet_en.pdf
https://docs.espressif.com/projects/esp-hardware-design-guidelines/en/latest/esp32/esp-hardware-design-guidelines-en-master-esp32.pdf
https://dl.espressif.com/dl/schematics/SCH_ESP32-S3-DevKitC-1_V1.1_20221130.pdf
https://learn.adafruit.com/16-channel-pwm-servo-driver?view=all

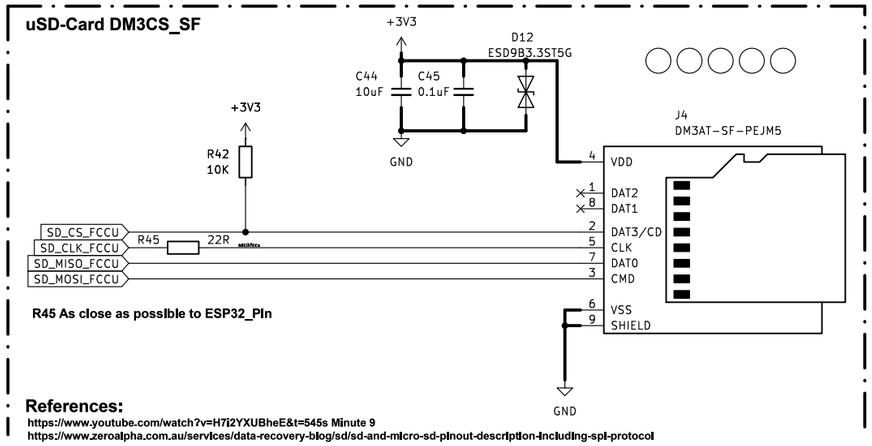
FLIGHT CONTROLLER UNIT PHERIPHERALS

STATUS LEDS



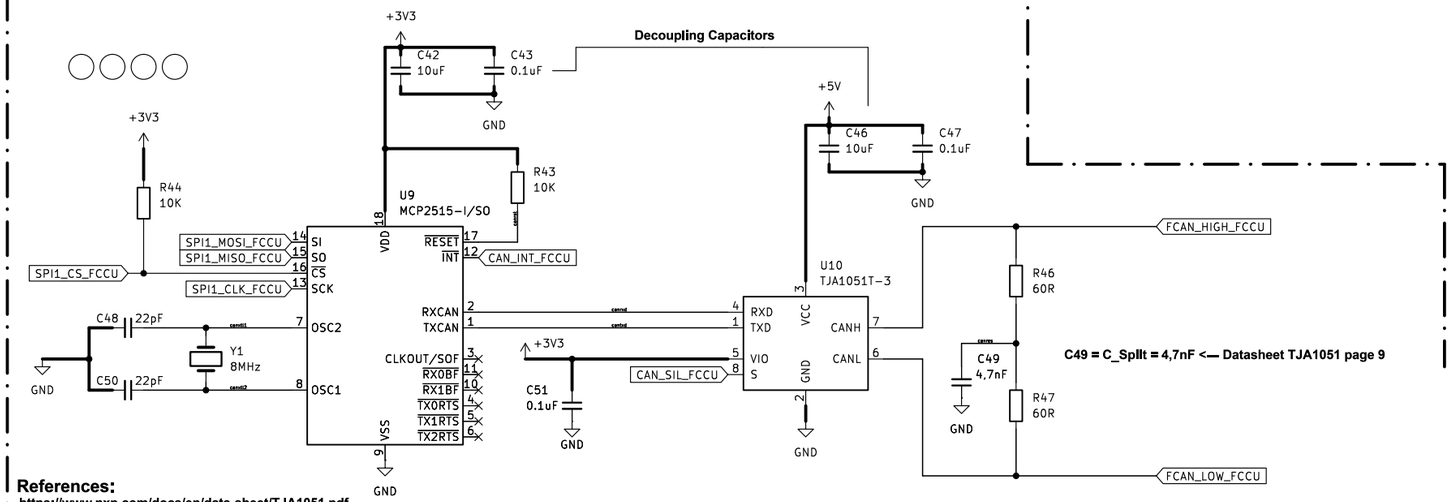
References:
https://cdn-shop.adafruit.com/product-files/3484/3484_Datasheet.pdf
https://dl.espressif.com/dl/schematics/SCH_ESP32-S3-DevKitC-1_V1.1_20221130.pdf

uSD-Card DM3CS_SF



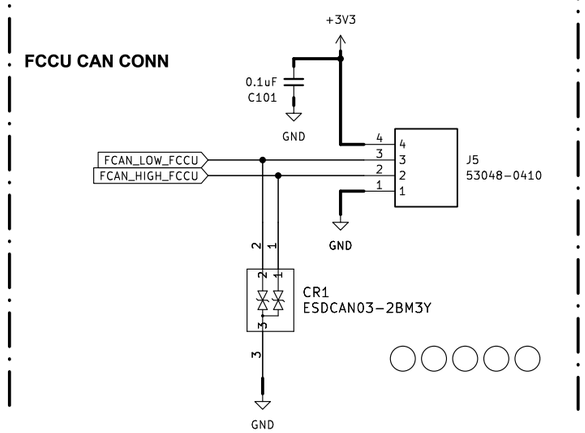
References:
https://www.youtube.com/watch?v=H7i2YXUBheE&t=545s Minute 9
https://www.zeroalpha.com.au/services/data-recovery-blog/sd/sd-and-micro-sd-pinout-description-including-spi-protocol

CAN BUS FCCU



References:
https://www.nxp.com/docs/en/data-sheet/TJA1051.pdf
https://e2e.ti.com/support/interface-group/interface/f/interface-forum/290299/iso1050-can-tx-rx-filter
https://how2electronics.com/interfacing-mcp2515-can-bus-module-with-arduino/

FCCU CAN CONN



CANBUS CAN BE TESTED WITH EXT CONN

SANITY-CHECK LEGEND:

- Associations
- ESD
- Schottky
- Testpoints
- Functional
- Nets

Comments:

deficientInventor

Feza

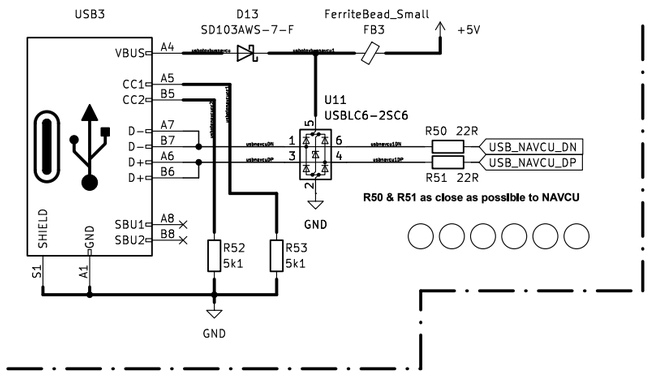
Sheet: /FCCU_PHERIPHERALS/
File: FCCU_PHERIPHERALS.kicad_sch

Title: FEZA FLIGHT COMPUTER

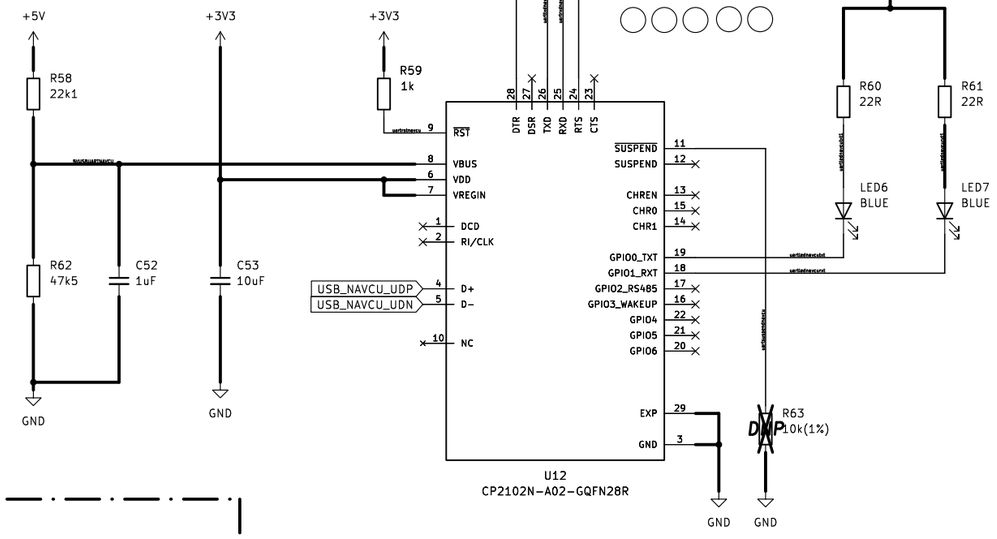
Size: A3	Date: 2024-11-18	**Rev: 1.1**
KiCad E.D.A. 8.0.7		Id: 6/8

NAVCU-USB-INTERFACE

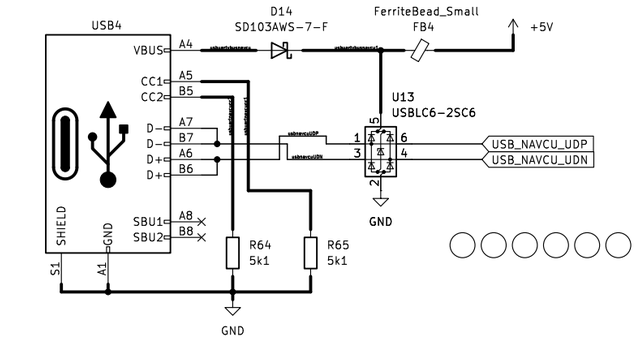
USB-OTG-NAVCU



USB TO UART BRIDGE NAVCU

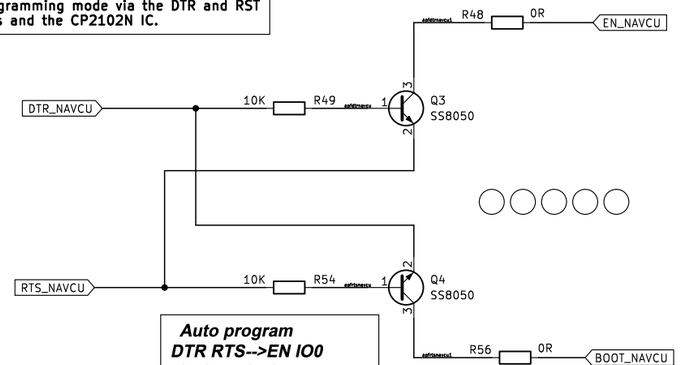


USB-UART-NAVCU



With the logic shown below, the software-IDEs PIO, Arduino, or ESP-IDF can automatically put the board into programming mode via the DTR and RST pins and the CP2102N IC.

AUTO PROGRAMMER NAVCU



Auto program
DTR RTS-->EN IO0

1	1	1	1
0	0	1	1
1	0	0	1
0	1	1	0

GPIO_TXT and GPIO_RXT are LED status indicators for data transmission. They are connected according to the technical documentation of the CP2102N-A2-xxx28R. See page 23 of the technical documentation.

LED resistors were chosen based on reference values to produce a dimmed light.

Click here to access the documentation.

SANITY-CHECK LEGEND:

- Associations ◯
- ESD ◯
- Schottky ◯
- Testpoints ◯
- Functional ◯
- Nets ◯

References:

https://www.silabs.com/documents/public/data-sheets/cp2102n-datasheet.pdf
https://dl.espressif.com/dl/schematics/SCH_ESP32-S3-DevKitC-1_V1.1_20221130.pdf

Comments:

This Page is almost a exact copy of the Dev Board except
-the additional LEDS for the TXT and RXT for UART
-USB-C instead of uUSB

deficientInventor

Feza

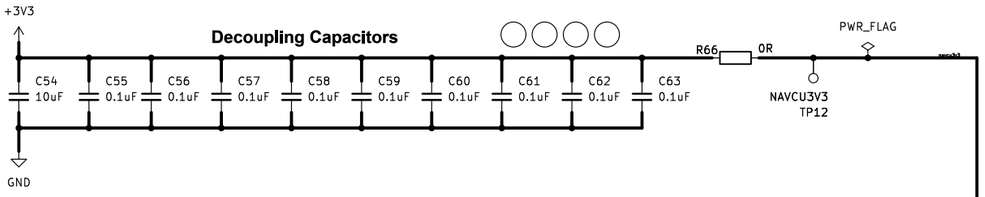
Sheet: /NAVCU_USB_INTERFACE/
File: NAVCU_USB_INTERFACE.kicad_sch

Title: FEZA FLIGHT COMPUTER

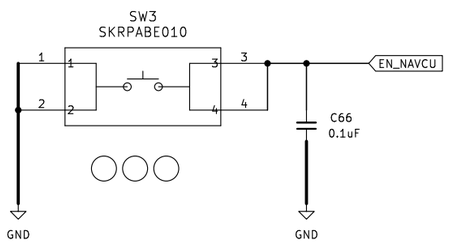
Size: A3	Date: 2024-11-18	**Rev: 1.1**
KiCad E.D.A. 8.0.7		Id: 7/8

NAVIGATION CONTROLLER UNIT

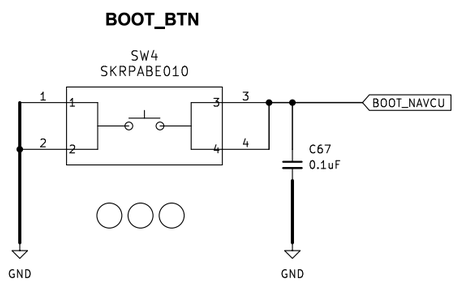
Decoupling Capacitors



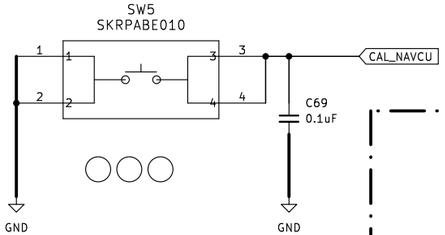
RST_BTN



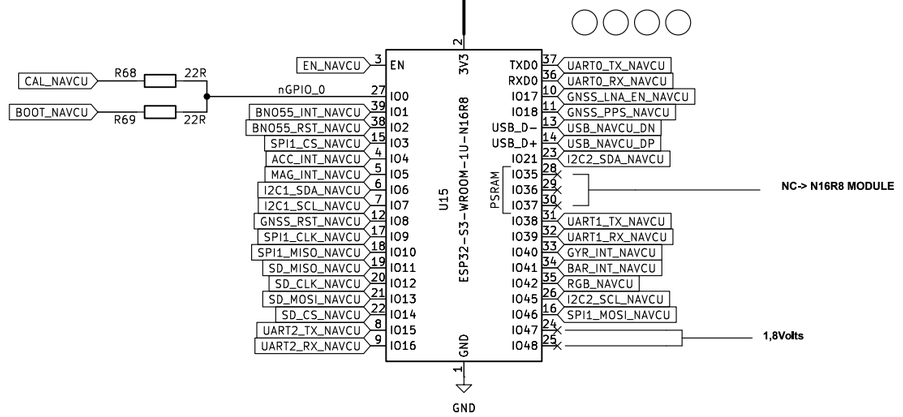
BOOT_BTN



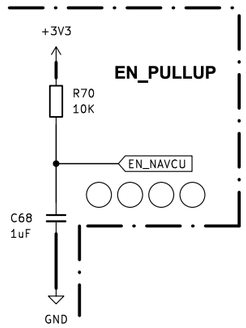
CAL_BTN



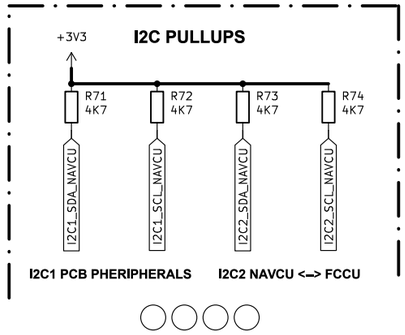
ESP32-S3-WROOM-1U-N16R8



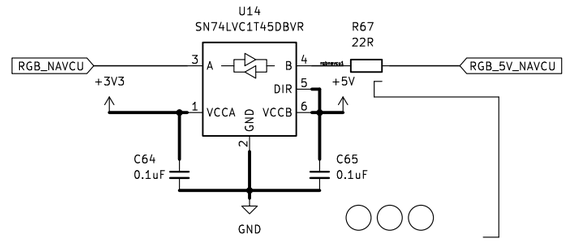
EN_PULLUP



I2C PULLUPS



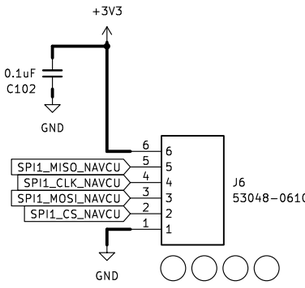
3V3-5V LEVEL SHIFTER (LED)



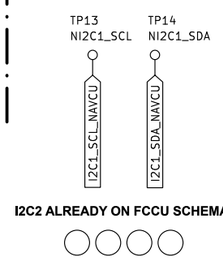
Series resistor recommendation of neopixels best practices says 300-500ohm series resistor (I guess for longer data lines) since this is a PCB design I decided to use 22ohm series resistor.

https://learn.adafruit.com/adafruit-neopixel-uberguide/best-practices

SPI/GPIO CONN



I2C Testpoints



I2C2 ALREADY ON FCCU SCHEMATIC

SANITY-CHECK LEGEND:

- Associations
- ESD
- Schottky
- Testpoints
- Functional
- Nets

Comments:

I understand everything on this page, however,
I have difficulties choosing the right value for series resistors.
I choose the values based on reference
from Phlslab and Robert Feranec.

-The array of decoupling capacitors maybe is overkill,
i choosed it based on Hades from Phlslab.
-I2C2 testpoints on FCCU Page

References:

https://www.espressif.com/sites/default/files/documentation/esp32-s3-wroom-1_wroom-1u_datasheet_en.pdf
https://docs.espressif.com/projects/esp-hardware-design-guidelines/en/latest/esp32/esp-hardware-design-guidelines-en-master-esp32.pdf
https://dlespressif.com/dl/schematics/SCH_ESP32-S3-DevKitC-1_V1.1_20221130.pdf

deficientInventor

Feza

Sheet: /NAVCU/
File: NAVCU.kicad_sch

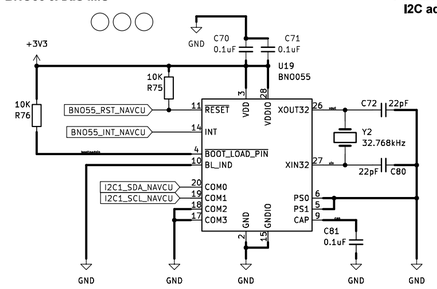
Title: FEZA FLIGHT COMPUTER

Size: A3	Date: 2024-11-18	**Rev: 1.1**
KiCad E.D.A. 8.0.7		Id: 8/8

NAVCU PHERIPHERALS

BNO55 9AXIS IMU

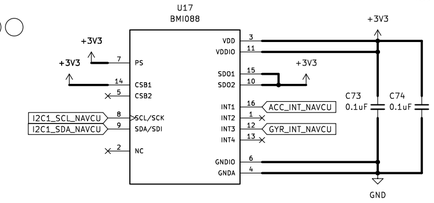
PS0 & PS1 GND = I2C
I2C address: 0x28



References:
https://www.bosch-sensortec.com/media/boschsensortec/downloads/application_notes_1/bst-bno055-an007.pdf
https://www.bosch-sensortec.com/media/boschsensortec/downloads/datasheets/bst-bno055-ds000.pdf

IMU BMI088 GYRO & ACC

I2C address: 0x19 (acc) 0x69 (gyr)

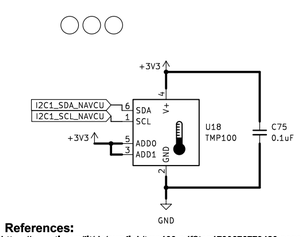


SDO1 & SDO2 HIGH FOR ADDR: 0x19 & 0x69
CSB 1 HIgh(acc) & PS HIgh(gyr) = I2C MODE

References:
https://www.bosch-sensortec.com/media/boschsensortec/downloads/datasheets/bst-bmi088-ds001.pdf PAGE48 & 13

PCB TEMP SENSE TMP100

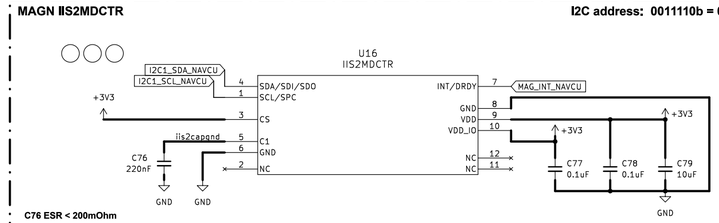
I2C address: 0x4E



References:
https://www.ti.com/lit/ds/symlink/tmp100.pdf?ts=1730676779420 page 10 & 21

MAGN IIS2MDCTR

I2C address: 0011110b = 0x1E



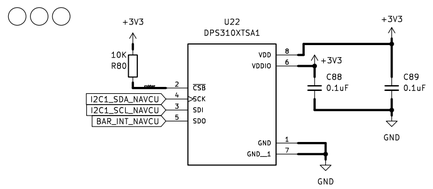
C76 ESR < 200mOhm

It must be connected as close as possible to pins 5 and 6 since very high current pulses flow from C1 to pin 5 and 6. This avoids problems caused by inductive effects due to the length of the copper strips.
-It is highly recommended to use low ESR (max 200 mOhm)

References:
https://www.st.com/resource/en/datasheet/iis2mdc.pdf
page 19 & 22 & 24

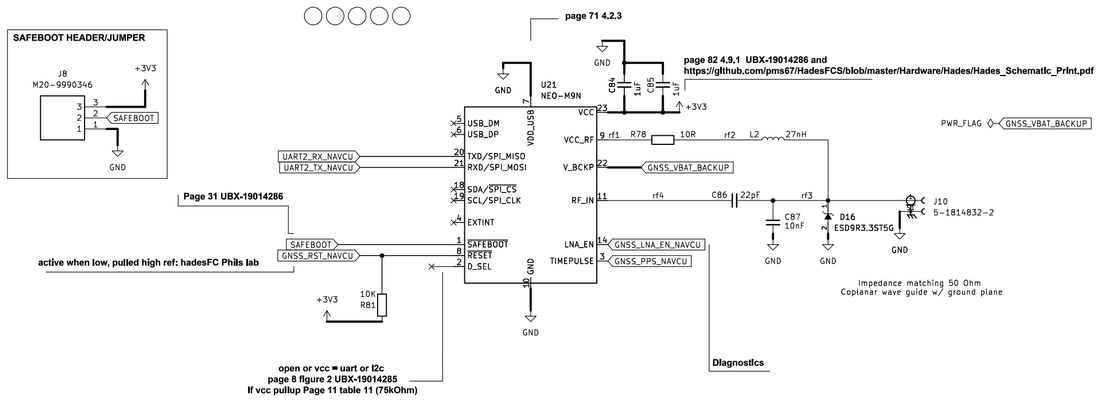
Pressure Sensor DSP310

I2C address: 0x76



References:
https://www.infineon.com/dgdl/Infineon-DPS310-DS-v01_00-EN.pdf?fileId=5546d462576f3475015750826c42242
page 18-19
https://learn.adafruit.com/assets/87733

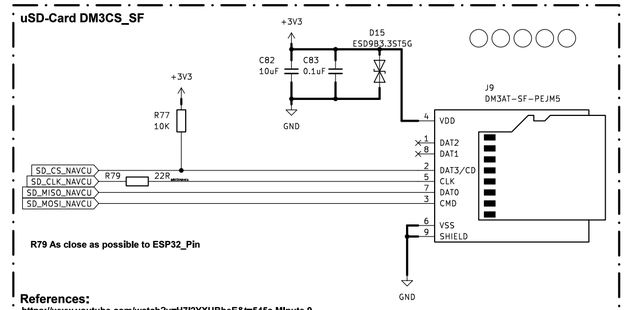
GNSS u Blox



References:
https://content.u-blox.com/sites/default/files/NEO-M9N_IntegrationManual_UBX-19014286.pdf
page 73 design, page 12 4.2.1

References:
https://content.u-blox.com/sites/default/files/NEO-M9N-00B_DataSheet_UBX-19014285.pdf
Page 8 FIgure 2

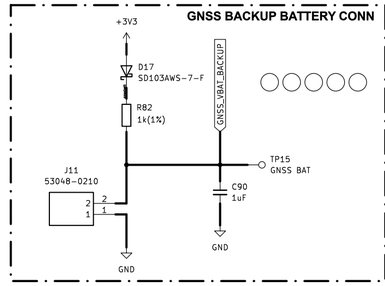
uSD-Card DM3CS_SF



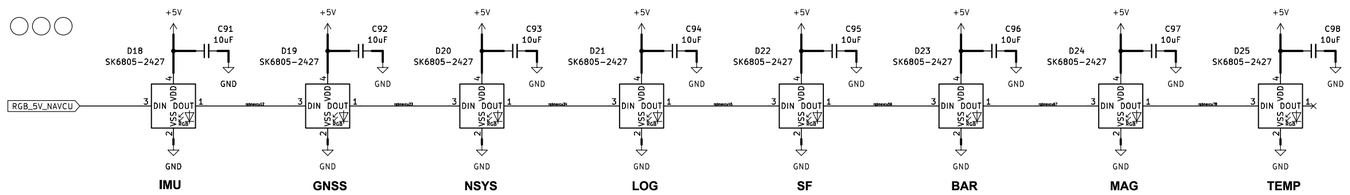
R79 As close as possible to ESP32_Pin

References:
https://www.youtube.com/watch?v=H7I2YXUBheE&t=545s Minute 9
https://www.zeroalpha.com.au/services/data-recovery-blog/sd/sd-and-micro-sd-pinout-description-including-spi-protocol

GNSS BACKUP BATTERY CONN

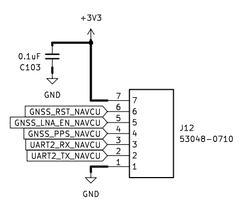


STATUS LEDS



References:
https://cdn-shop.adafruit.com/product-files/3484/3484_Datasheet.pdf
https://dl.espressif.com/dl/schematics/SCH_ESP32-S3-DevKitC-1_V1.1_20221130.pdf

uBLOX GNSS CONN



SANITY-CHECK LEGEND:

- Associations
- ESD
- Schottky
- Testpoints
- Functional
- Nets

Comments:
I understand everything on this page.

I choose 2 IMUs:
-BNO055 Main IMU 9 DoF.
-BMI088 Redundant IMU 6 DoF with IIS2MDCTR Magn

second SD-Card-Slot for Dataheavy Navigation Logging

I feel kinda unsure about the ESD on the external SMA-Antenna

deficientInventor

Feza

Sheet: /NAVIGATION_PHERIPHERALS/
File: NAVIGATION_PHERIPHERALS.kicad_sch

Title: FEZA FLIGHT COMPUTER

Size: A2	Date: 2024-11-18	**Rev: 1.1**
KiCad E.D.A. 8.0.7		Id: 9/8