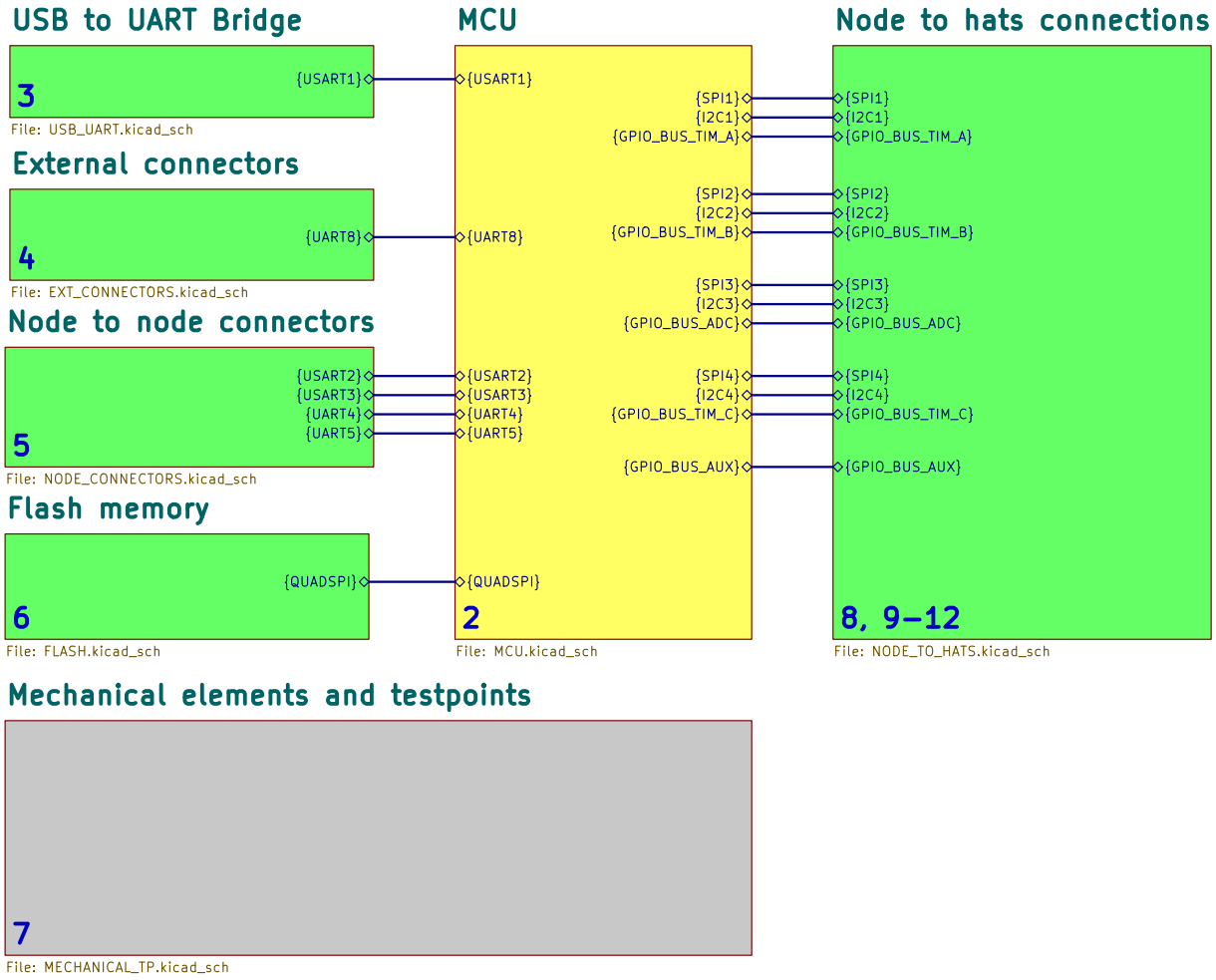
Orion PCB node overview



Author: Vincent Nguyen

EPFL Xplore

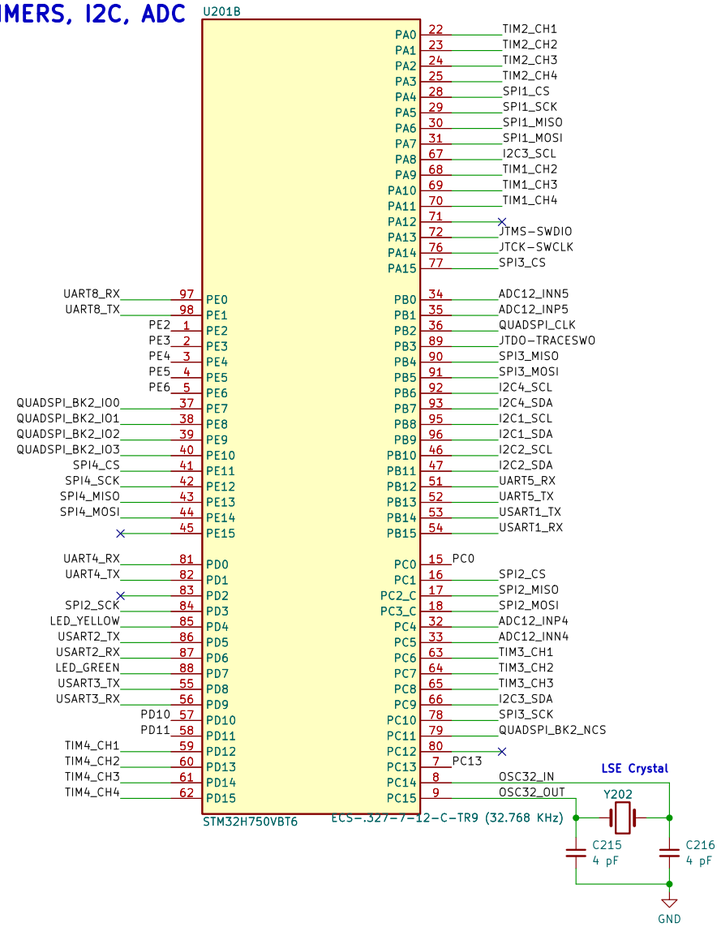
Sheet: /
File: orion_pcb.kicad_sch

Title: Orion PCB Node Overview

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 1/12

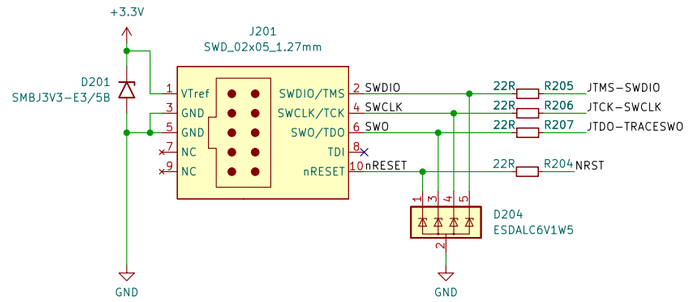
MCU (STM32H750VBT6)

GPIO, UART, SPI, TIMERS, I2C, ADC



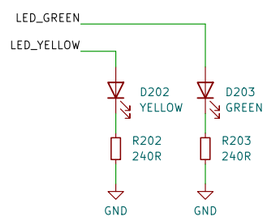
AN2867, p.12
Cs = 5 pF
CL = 7 pF
CL1 = CL2 = 2*(CL-CS) = 4 pF

Debug



See AN5612, 3.6.1

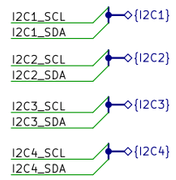
Status LEDs (user-controlled)



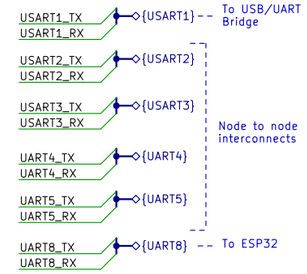
We aim for ~30% rel. lum.
If = 5 mA
Vf = 2.1 V
R = (3.3 V - 2.1 V)/(5 mA) = 240 Ohm

Buses

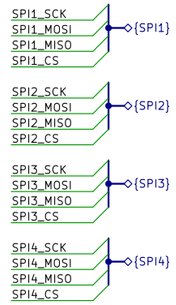
I2C



UART

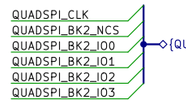


SPI

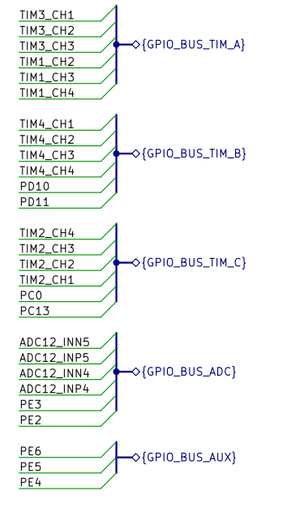


We only use one slave select pin per SPI bus. This means we are limited to one slave per SPI (unless a GPIO is reconfigured) which is enough.

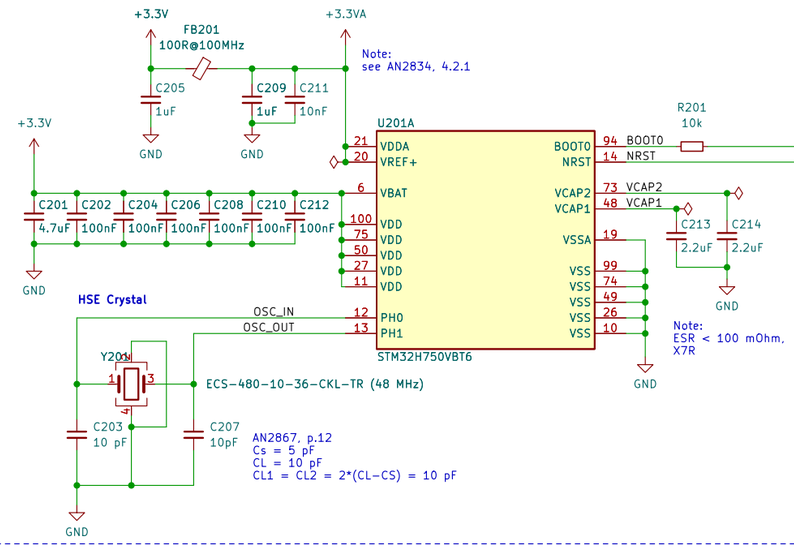
QUADSPI



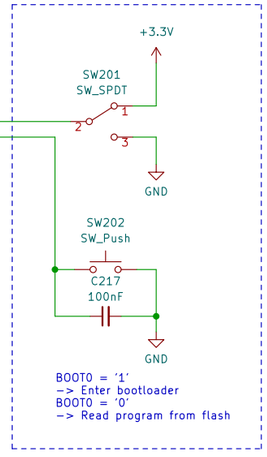
GPIO



Power inputs, reset, boot



Reset and boot



Maybe consider a single push reset/boot circuit

Author: Vincent Nguyen

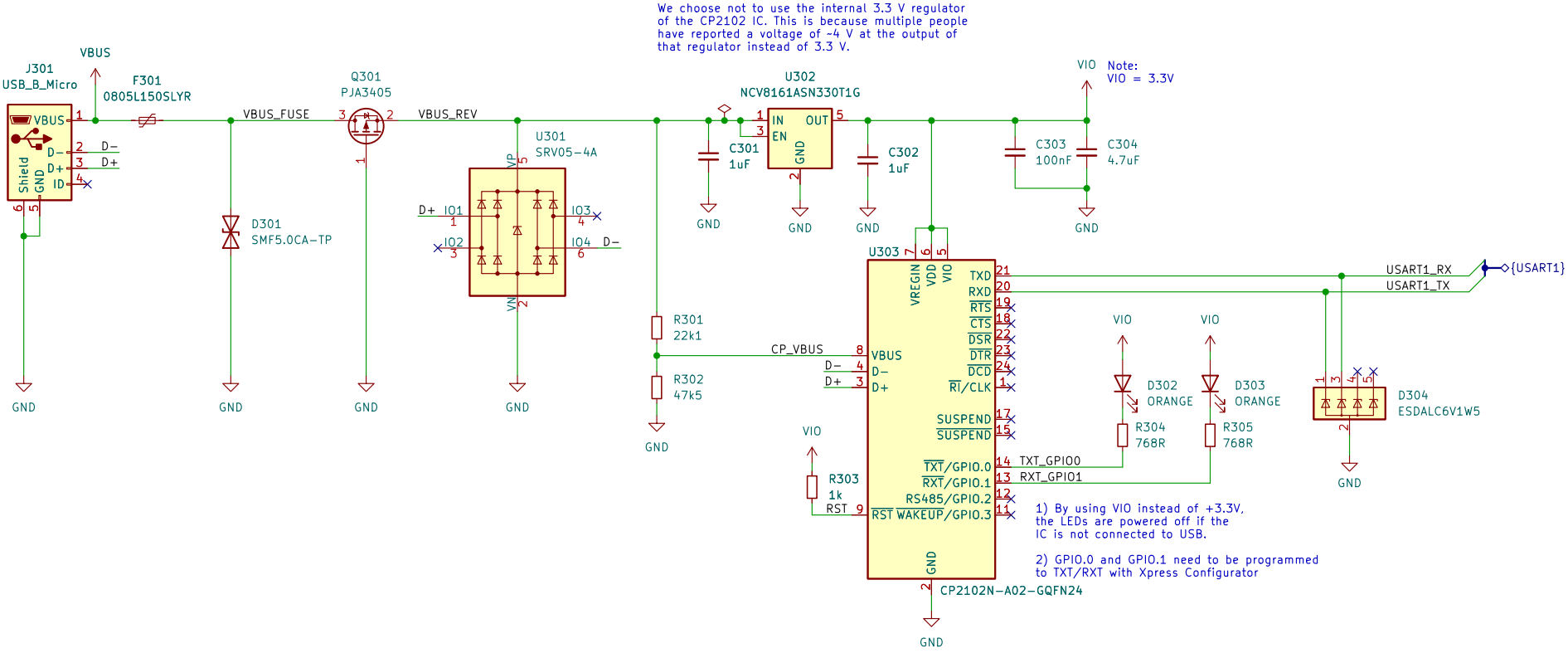
EPFL Xplore

Sheet: /MCU/
File: MCU.kicad_sch

Title: MCU

Size: A3	Date:	Rev:
KiCad E.D.A. kicad (6.0.7)		Id: 2/12

USB to UART bridge



Author: Vincent Nguyen

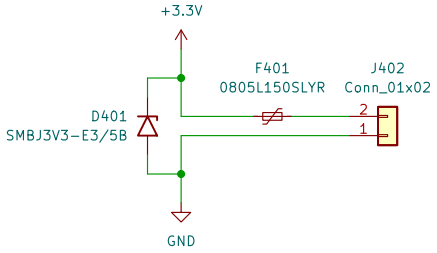
EPFL Xplore

Sheet: /USB to UART Bridge/
File: USB_UART.kicad_sch

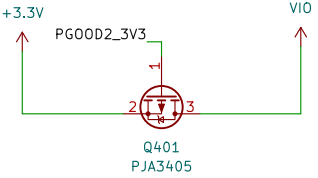
Title: USB to UART Bridge

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 3/12

Raw power input



Power path



Diode forward voltage VDS = 1.2 V (VSD = −1.2 V)

1) External power is not connected (PGOOD2 = 0 V)

1a) USB is connected (VIO = 3.3 V)
Initially:
VS = VIO − VDS = 3.3 V − 1.2 V = 2.1 V
VGS = VG − VS = 0 V − 2.1 V = −2.1 V <= VGS(th) -> CLOSED
Then:
CLOSED -> VS = VD = VIO = 3.3 V
VGS = VG − VS = 0 V − 3.3 V < VGS(th) -> stays CLOSED

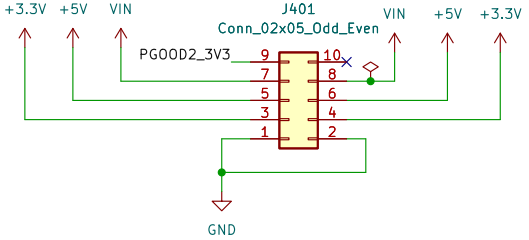
1b) USB is disconnected (VIO = 0 V)
No voltages, everything is at 0 V

2) External power is connected (PGOOD2 = 5 V, VS = 3.3 V)

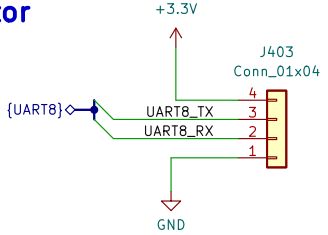
2a) USB is connected (VIO = 3.3 V)
VGS = VG − VS = 5 V − 3.3 V = 1.7 V > VGS(th) -> OPEN

2b) USB is disconnected (VIO = 0 V)
VGS = VG − VS = 5 V − 3.3 V = 1.7 V > VGS(th) -> OPEN

Voltage regulator connector



ESP32 Connector



Author: Vincent Nguyen

EPFL Xplore

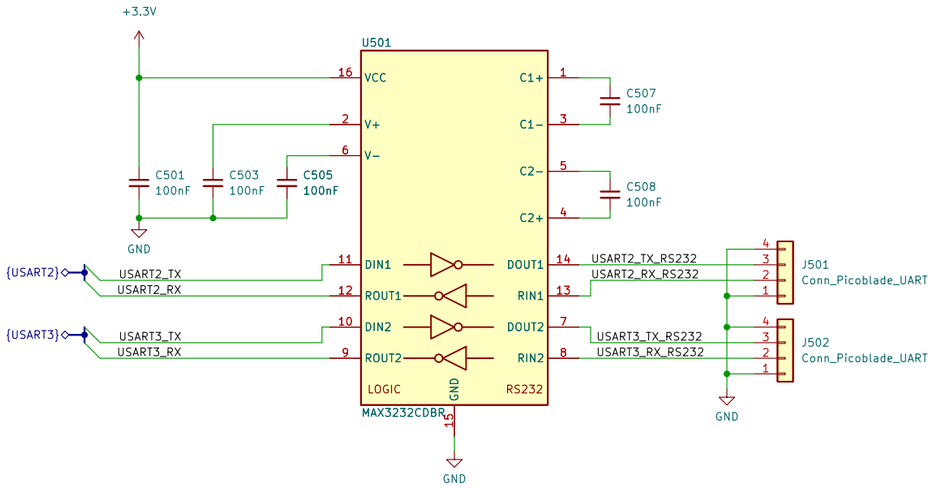
Sheet: /External connectors/
File: EXT_CONNECTORS.kicad_sch

Title: External Connectors and Power Path

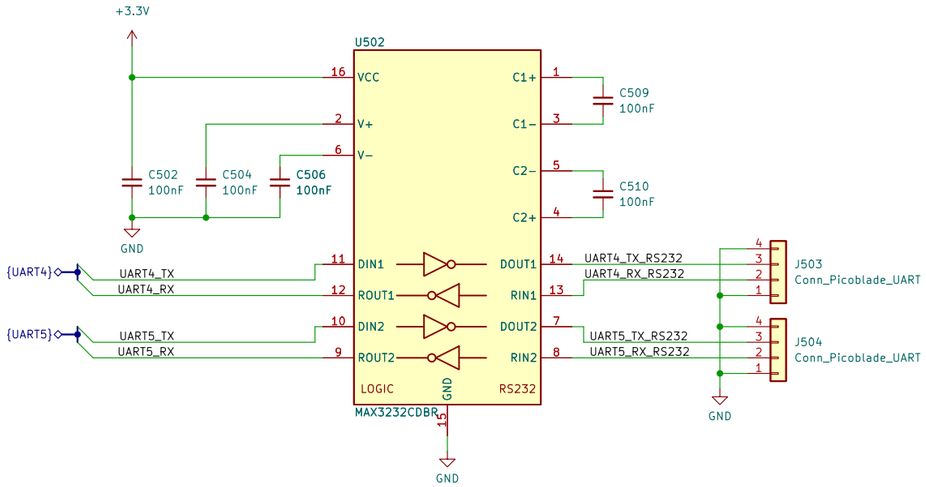
Size: A5	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 4/12

RS232 Transceivers

USART2, USART3



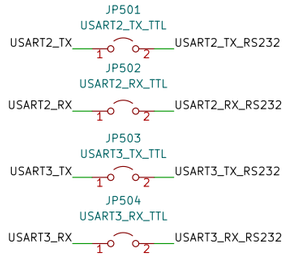
UART4, UART5



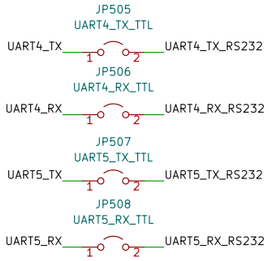
Maximum speed is 250 kb/s if using RS232 transceiver

Jumpers

USART2, USART3



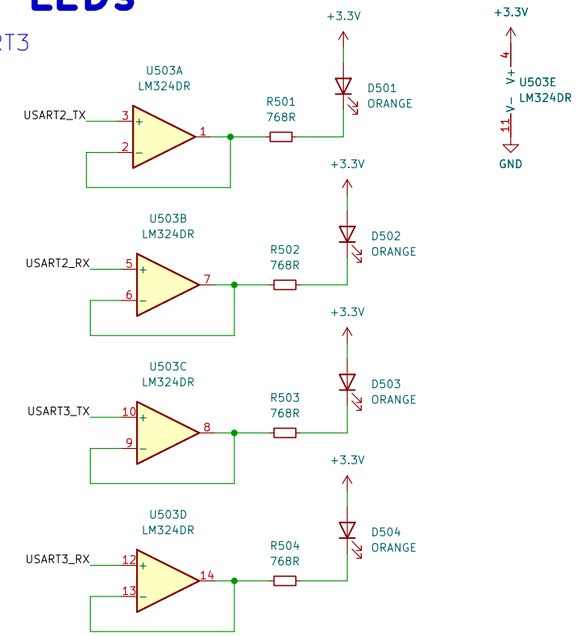
UART4, UART5



To use TTL voltage levels, short ALL of the jumpers
for both nodes, for the corresponding UART buses.

Activity LEDs

USART2, USART3



UART4, UART5

Activity LEDs don't need to be very bright.
We choose If = 1.7 mA
R = (3.3 V − 2 V)/(2 mA) = 765 Ohm
Closest standard resistor −> 768 Ohm

Author: Vincent Nguyen

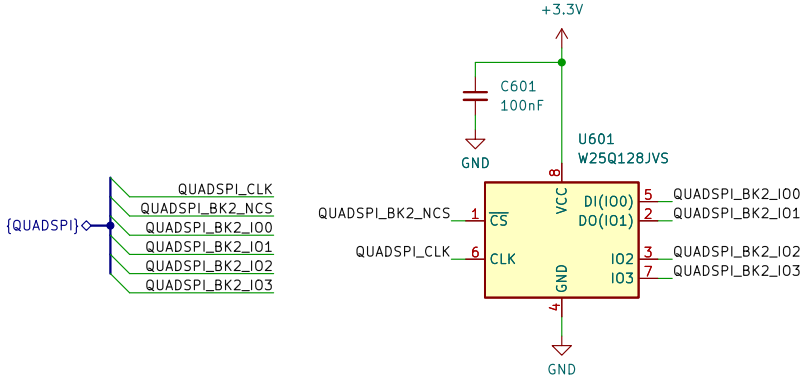
EPFL Xplore

Sheet: /Node to node connectors/
File: NODE_CONNECTORS.kicad_sch

Title: RS232 UART Node to Node Connectors

Size: A3	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 5/12

Quad-SPI external flash memory



Author: Vincent Nguyen

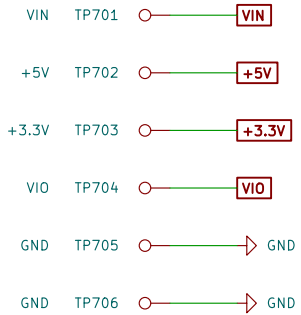
EPFL Xplore

Sheet: /Flash memory/
File: FLASH.kicad_sch

Title: External Flash Memory

Size: A5	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 6/12

Test points



Mounting holes

H701
MountingHole

H702
MountingHole

H703
MountingHole

H704
MountingHole

Author: Vincent Nguyen

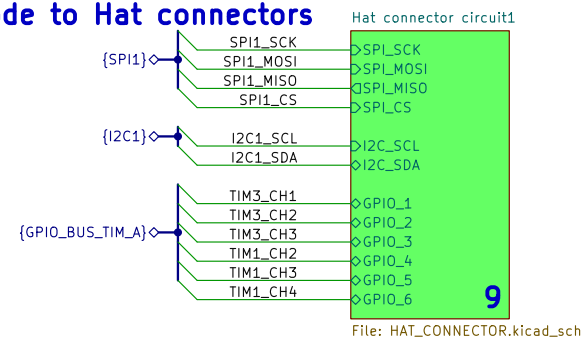
EPFL Xplore

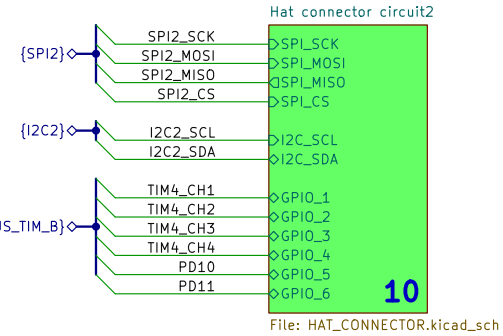
Sheet: /Mechanical elements and testpoints/
File: MECHANICAL_TP.kicad_sch

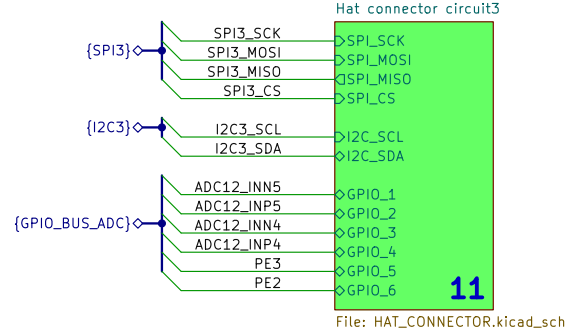
Title: Mechanical Elements and Test Points

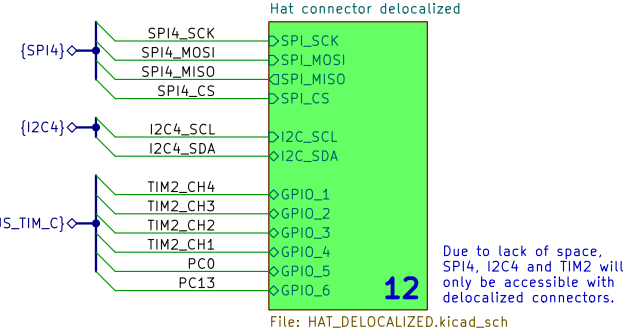
Size: A5	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 7/12

Node to Hat connectors

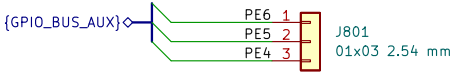








Due to lack of space, SPI4, I2C4 and TIM2 will only be accessible with delocalized connectors.



Author: Vincent Nguyen

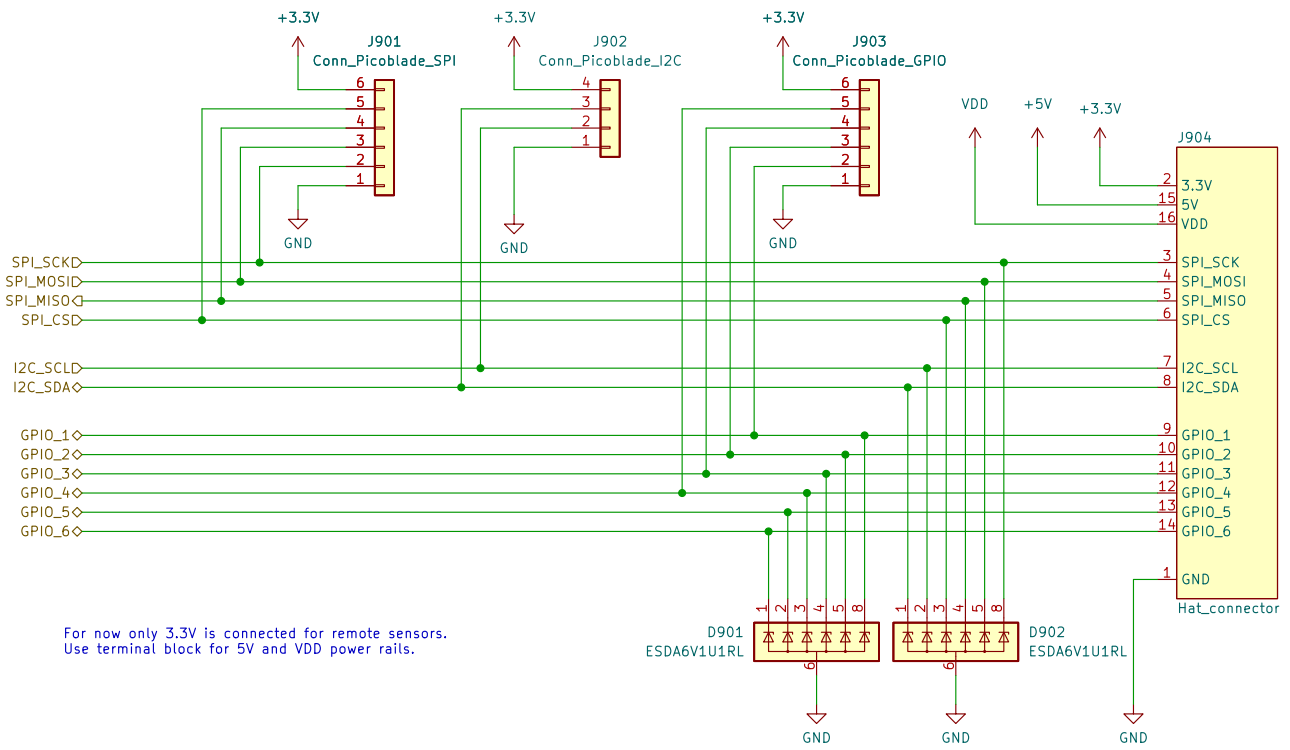
EPFL Xplore

Sheet: /Node to hats connections/
File: NODE_TO_HATS.kicad_sch

Title: Hat Connectors and Delocalized Connectors

Size: A5	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 8/12

Hat connector



Author: Vincent Nguyen

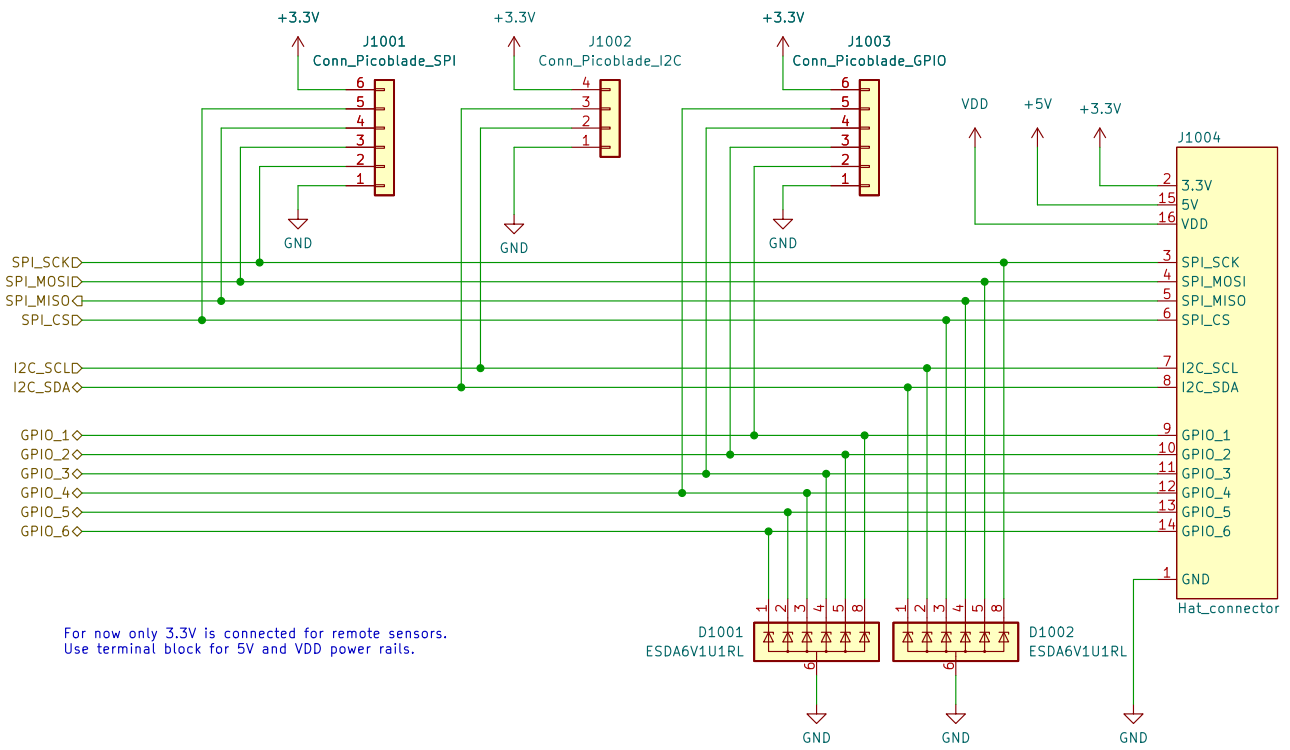
EPFL Xplore

Sheet: /Node to hats connections/Hat connector circuit1/
File: HAT_CONNECTOR.kicad_sch

Title: Hat Connector

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 9/12

Hat connector



Author: Vincent Nguyen

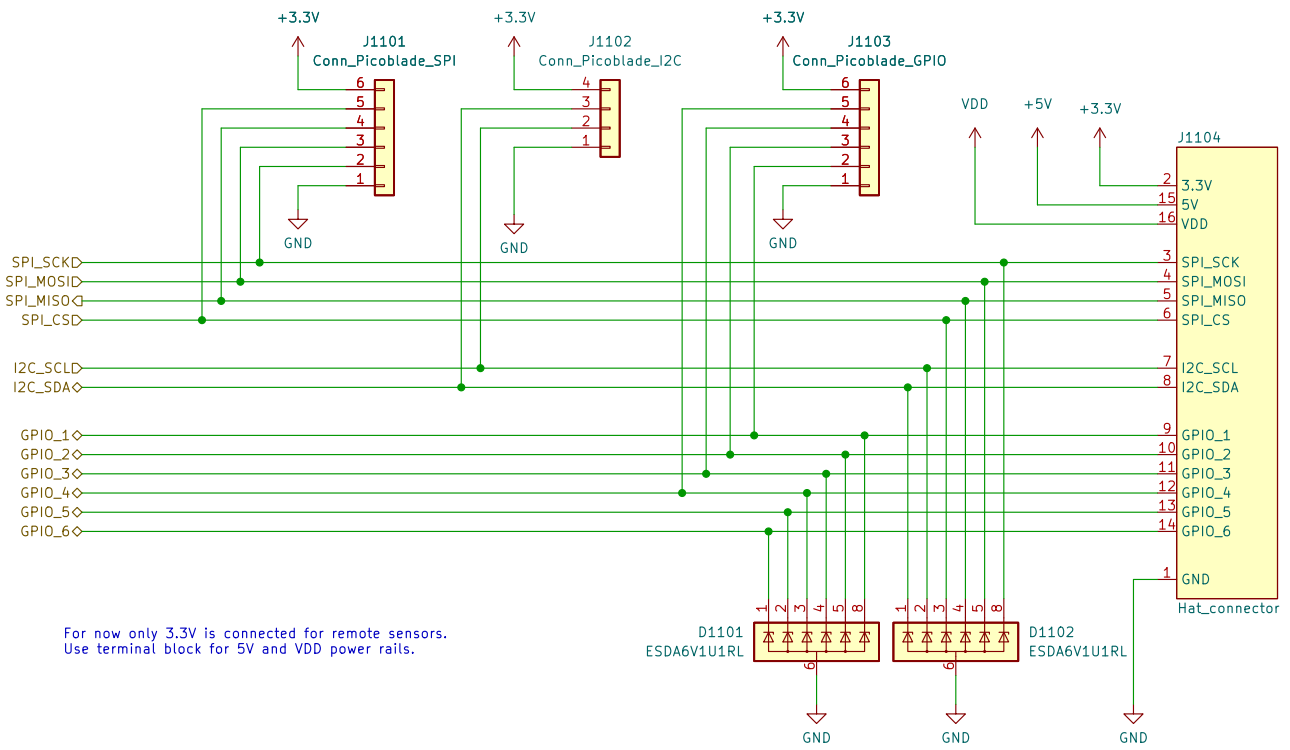
EPFL Xplore

Sheet: /Node to hats connections/Hat connector circuit2/
File: HAT_CONNECTOR.kicad_sch

Title: Hat Connector

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 10/12

Hat connector



Author: Vincent Nguyen

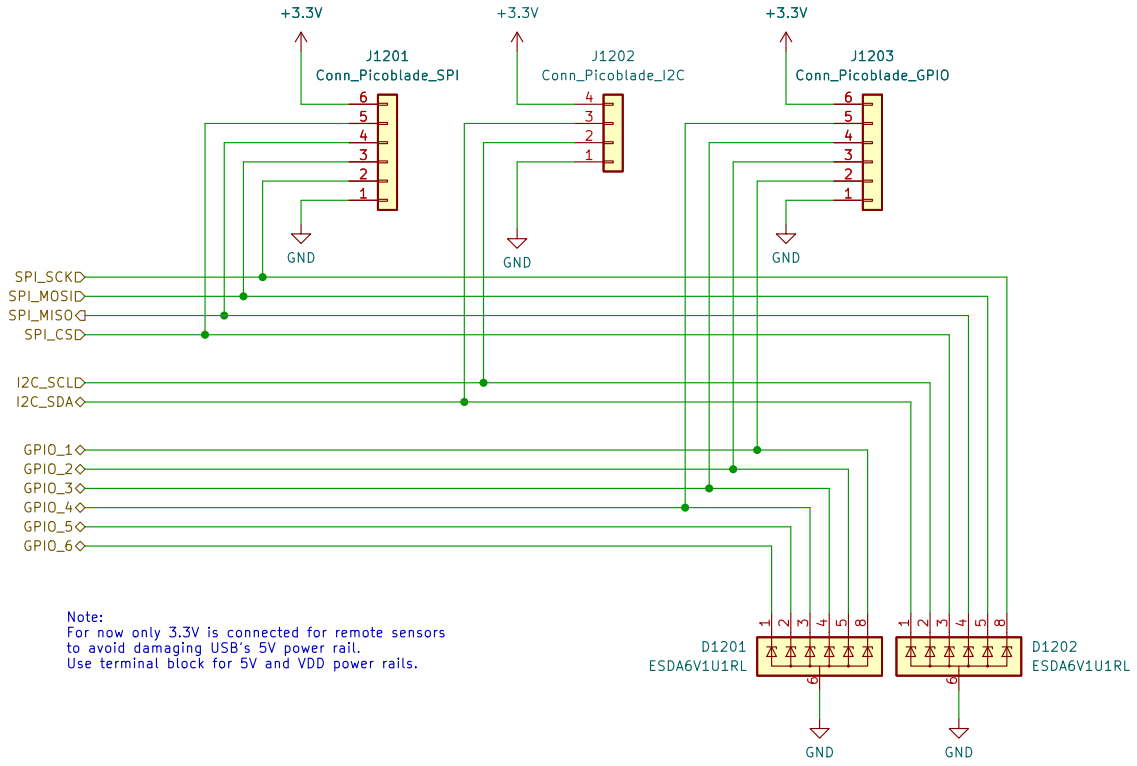
EPFL Xplore

Sheet: /Node to hats connections/Hat connector circuit3/
File: HAT_CONNECTOR.kicad_sch

Title: Hat Connector

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 11/12

Delocalized hat connector



Author: Vincent Nguyen

EPFL Xplore

Sheet: /Node to hats connections/Hat connector delocalized/
File: HAT_DELOCALIZED.kicad_sch

Title: Delocalized Connector

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad (6.0.7)		Id: 12/12