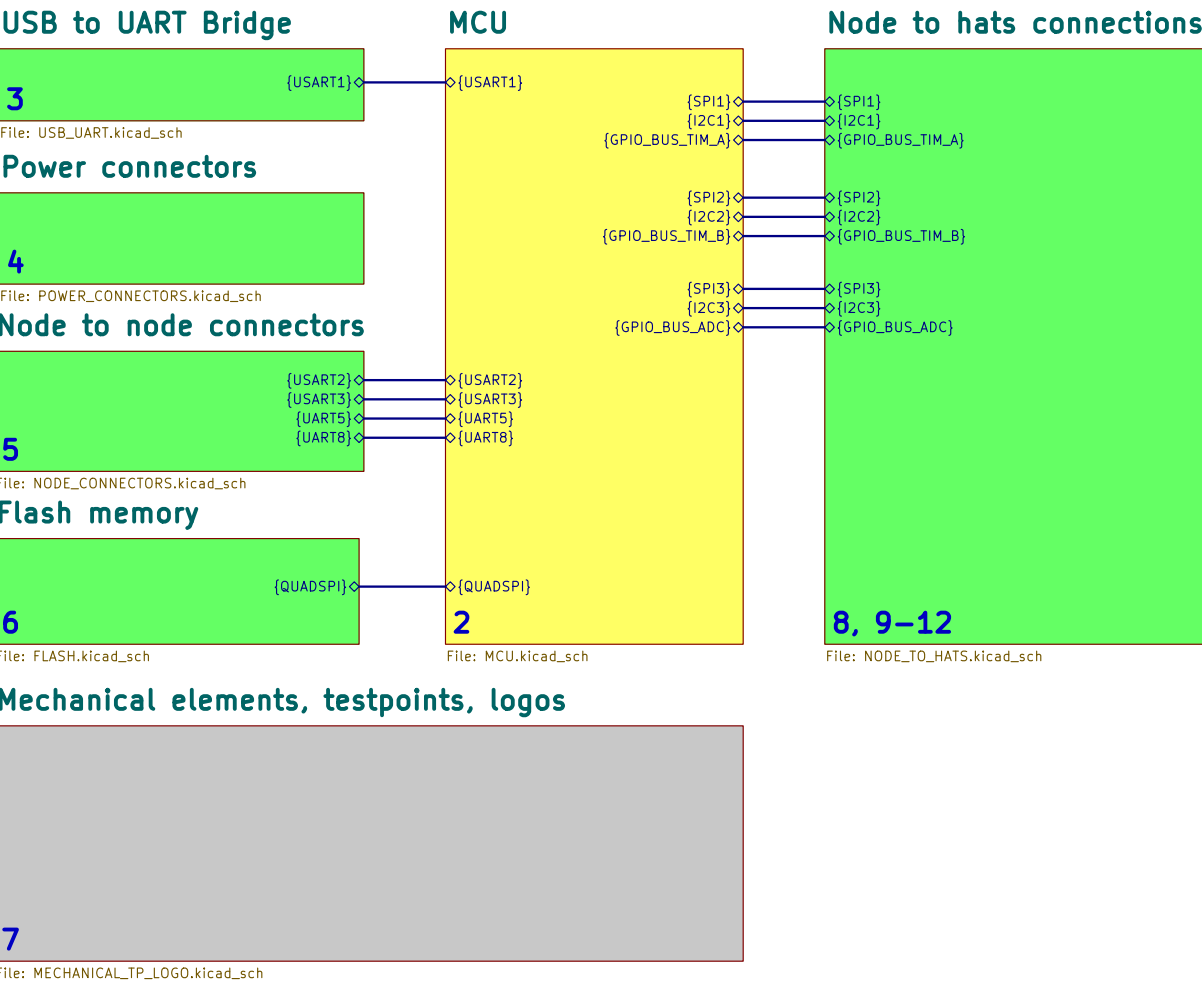


Orion PCB node overview



Author: Vincent Nguyen

EPFL Xplore

Sheet: /
File: orion_pcb.kicad_sch

Title: Orion PCB Node Overview

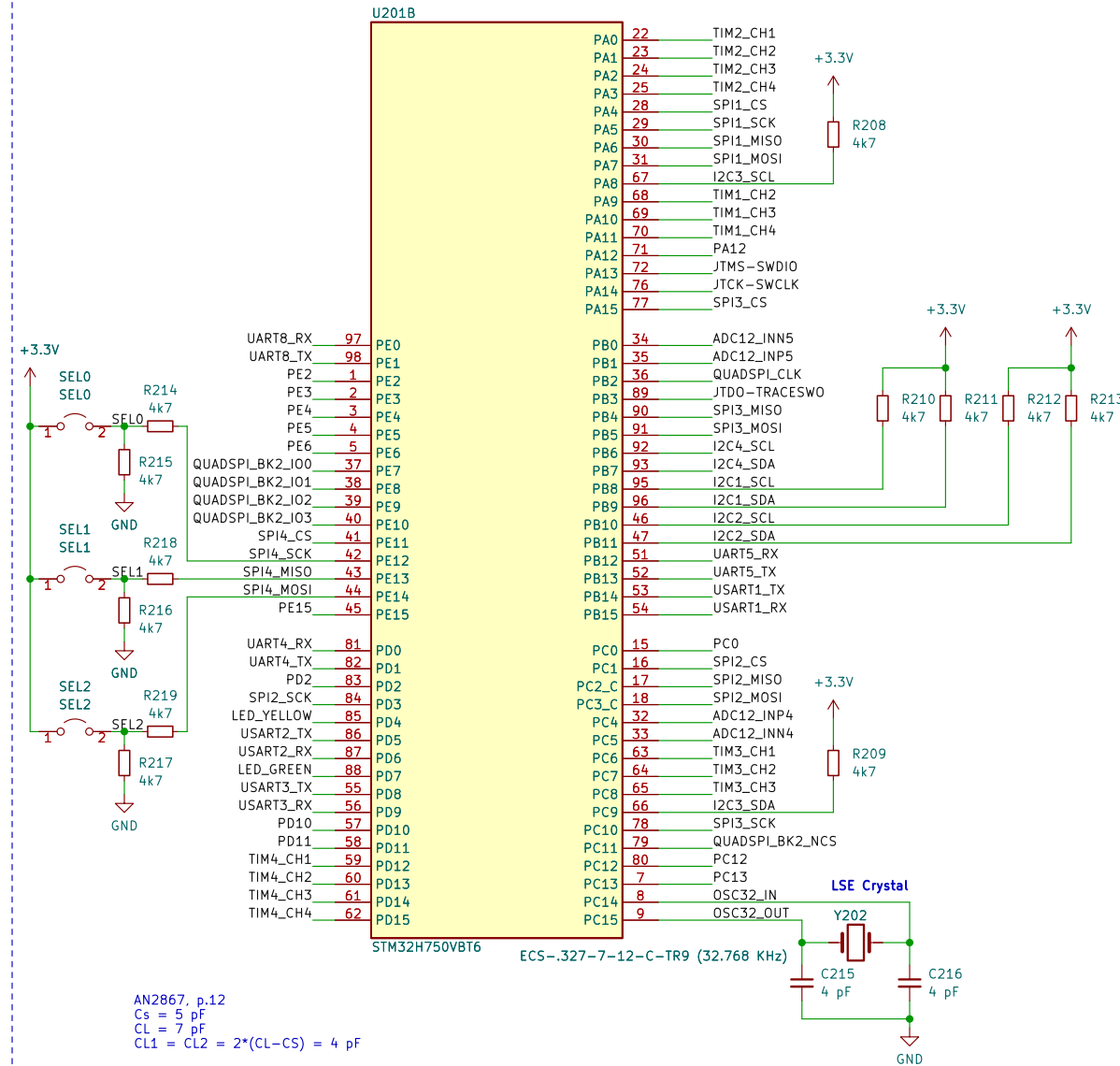
Size: A4
KiCad E.D.A. kicad (6.0.7)

Date:

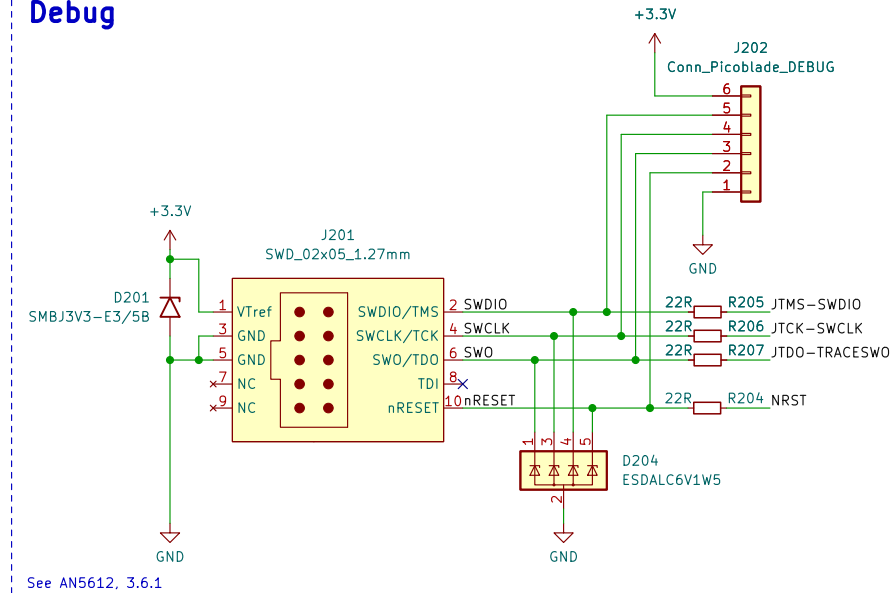
Rev:
Id: 1/11

MCU (STM32H750VBT6)

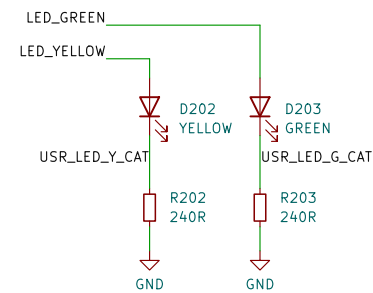
GPIO, UART, SPI, TIMERS, I2C, ADC



Debug



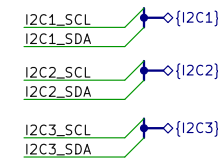
Status LEDs (user-controlled)



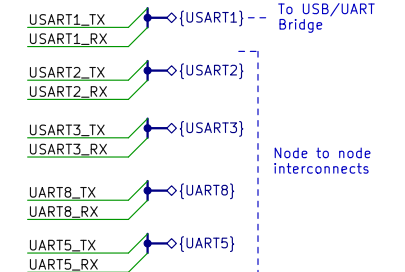
We aim for ~30% rel. lum.
If = 5 mA
Vf = 2.1 V
R = (3.3 V - 2.1 V)/(5 mA) = 240 Ohm

Buses

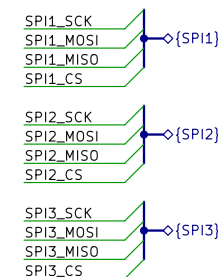
I2C



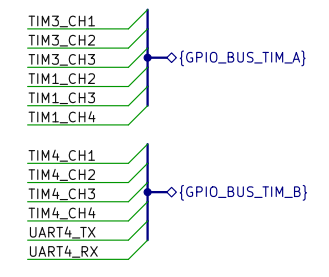
UART



SPI

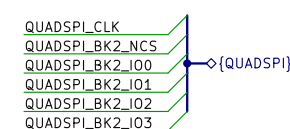


GPIO

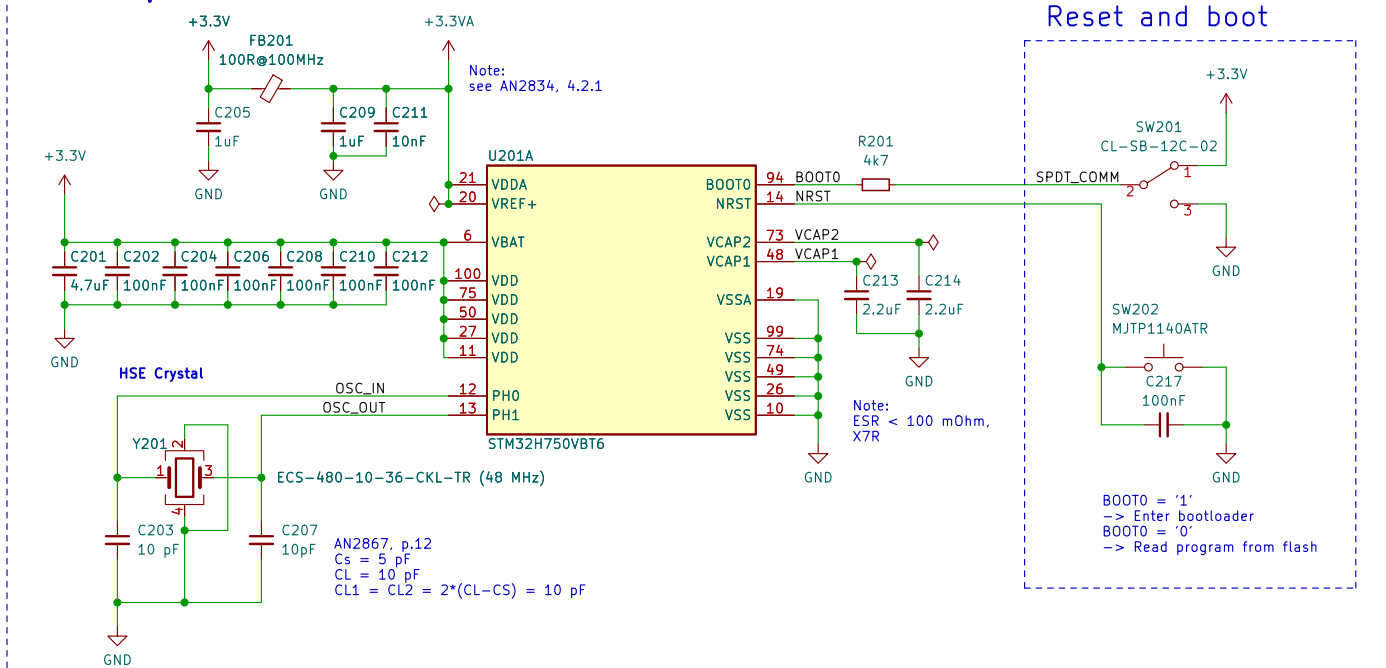


We only use one slave select pin per SPI bus. This means we are limited to one slave per SPI (unless a GPIO is reconfigured) which is enough.

QUADSPI



Power inputs, reset, boot



Maybe consider a single push reset/boot circuit

Author: Vincent Nguyen

EPFL Xplore

Sheet: /MCU/
File: MCU.kicad_sch

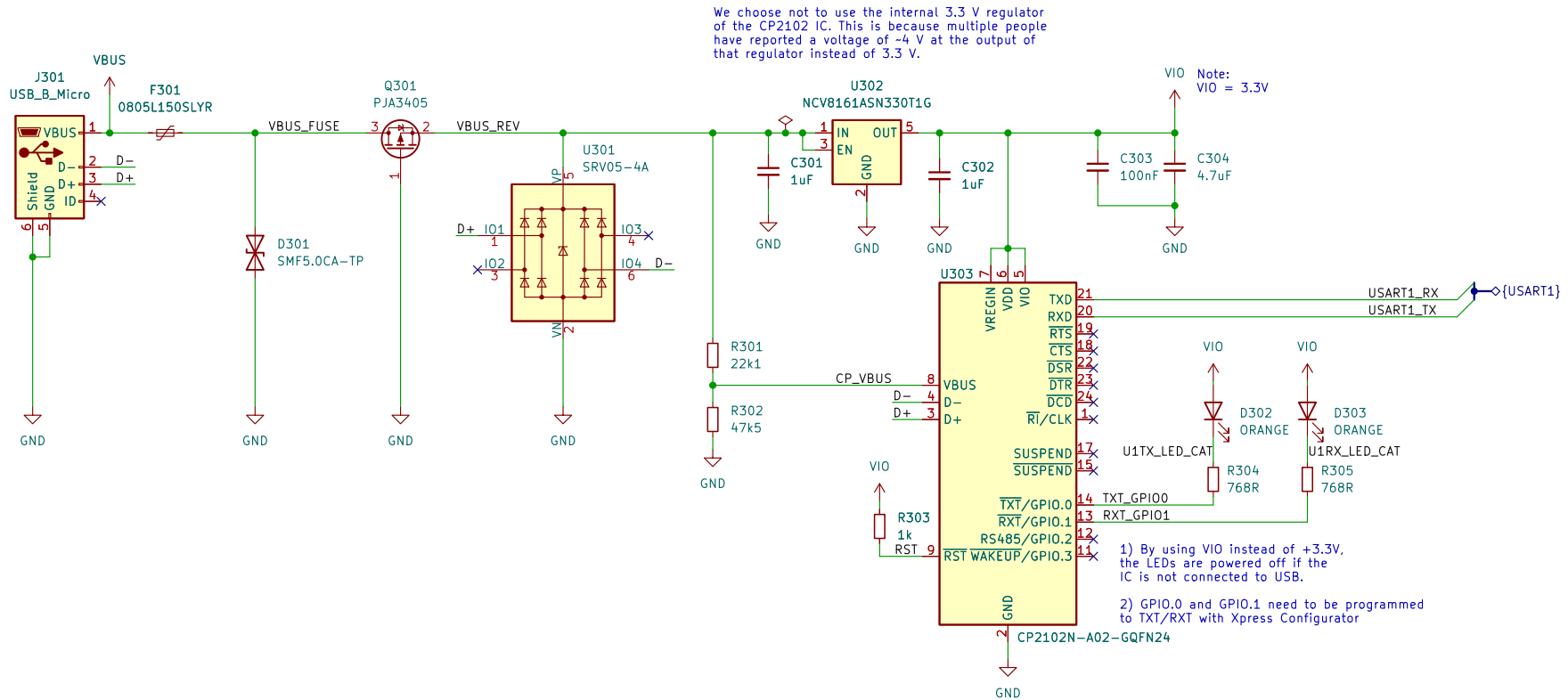
Title: MCU

Size: A3
KiCad E.D.A. kicad (6.0.7)

Date:
Id: 2/11

Rev:

USB to UART bridge



EPFL Xplore

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

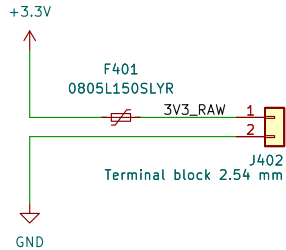
Title: USB to UART Bridge

Date:

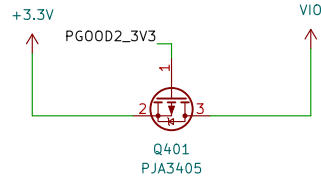
Rev:

Id: 3/11

Raw power input



Power path



Diode forward voltage $V_{DS} = 1.2 \text{ V}$ ($V_{SD} = -1.2 \text{ V}$)

1) External power is not connected ($PG00D2 = 0 \text{ V}$)

1a) USB is connected ($V_{IO} = 3.3 \text{ V}$)

Initially:

$$V_S = V_{IO} - V_{DS} = 3.3 \text{ V} - 1.2 \text{ V} = 2.1 \text{ V}$$

$$V_{GS} = V_G - V_S = 0 \text{ V} - 2.1 \text{ V} = -2.1 \text{ V} \leq V_{GS(th)} \rightarrow \text{CLOSED}$$

Then:

$$\text{CLOSED} \rightarrow V_S = V_D = V_{IO} = 3.3 \text{ V}$$

$$V_{GS} = V_G - V_S = 0 \text{ V} - 3.3 \text{ V} < V_{GS(th)} \rightarrow \text{stays CLOSED}$$

1b) USB is disconnected ($V_{IO} = 0 \text{ V}$)

No voltages, everything is at 0 V

2) External power is connected ($PG00D2 = 5 \text{ V}$, $V_S = 3.3 \text{ V}$)

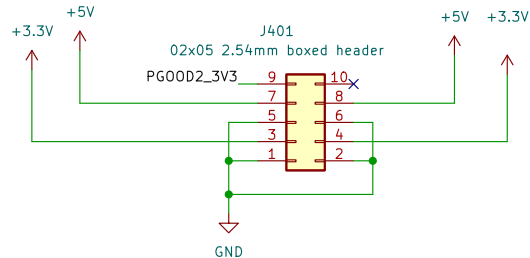
2a) USB is connected ($V_{IO} = 3.3 \text{ V}$)

$$V_{GS} = V_G - V_S = 5 \text{ V} - 3.3 \text{ V} = 1.7 \text{ V} > V_{GS(th)} \rightarrow \text{OPEN}$$

2b) USB is disconnected ($V_{IO} = 0 \text{ V}$)

$$V_{GS} = V_G - V_S = 5 \text{ V} - 3.3 \text{ V} = 1.7 \text{ V} > V_{GS(th)} \rightarrow \text{OPEN}$$

Voltage regulator connector



Author: Vincent Nguyen

EPFL Xplore

Sheet: /Power connectors/

File: POWER_CONNECTORS.kicad_sch

Title: External Connectors and Power Path

Size: A5

Date:

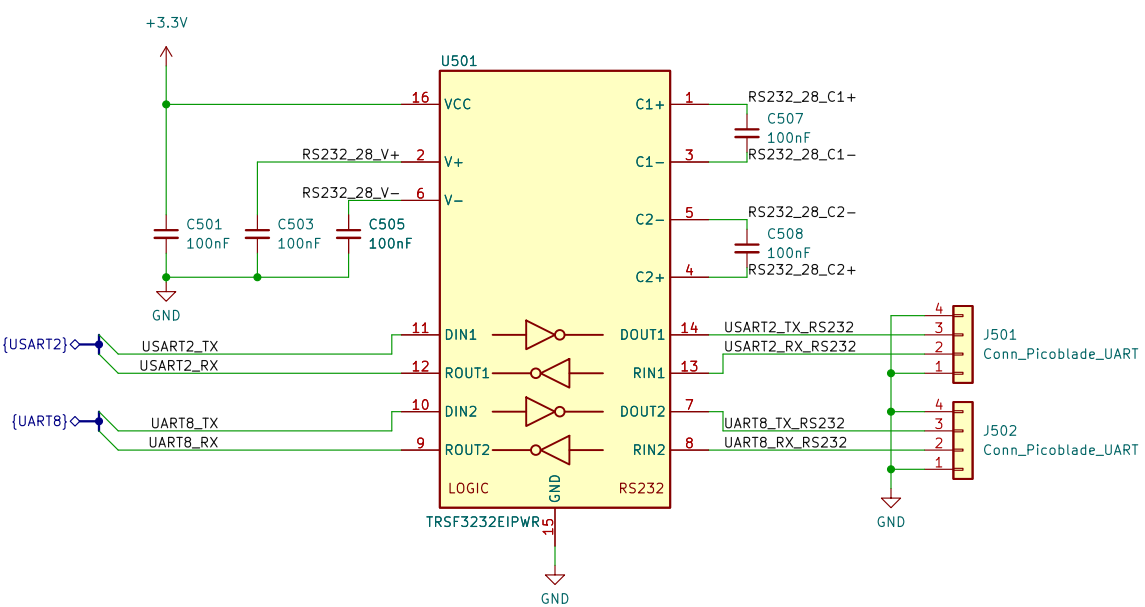
KiCad E.D.A. kicad (6.0.7)

Rev:

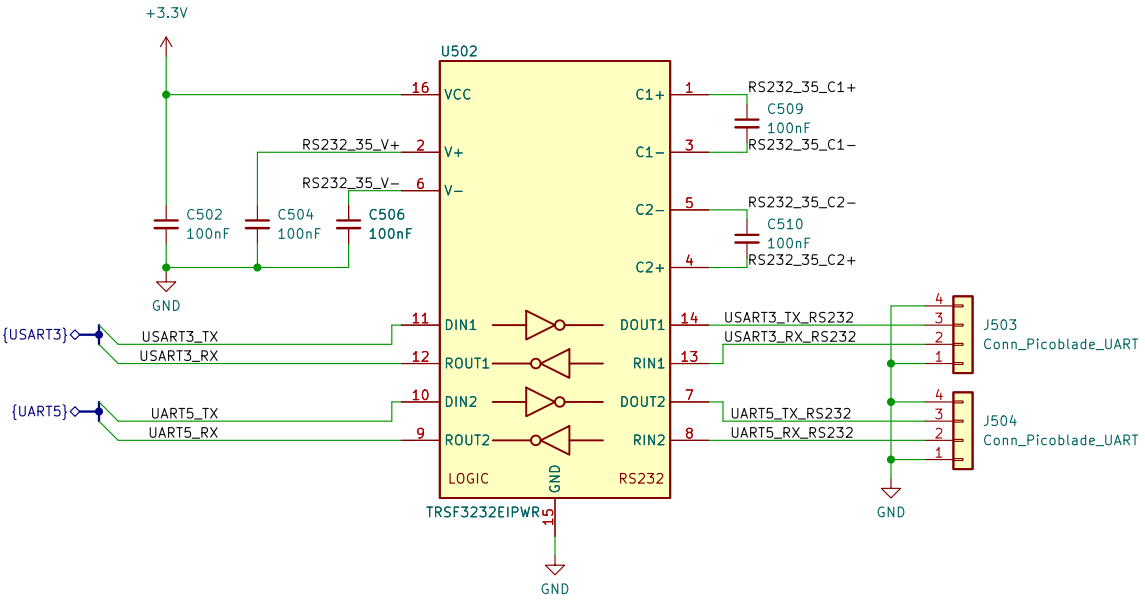
Id: 4/11

RS232 Transceivers

USART2, USART8



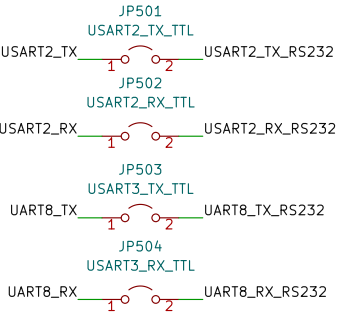
UART3, UART5



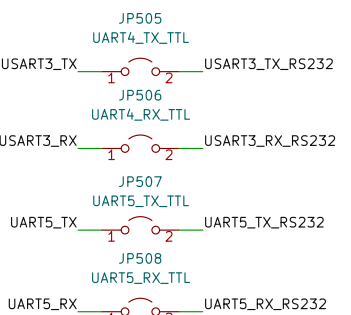
Maximum speed is 250 kb/s if using RS232 transceiver

Jumpers

USART2, USART8



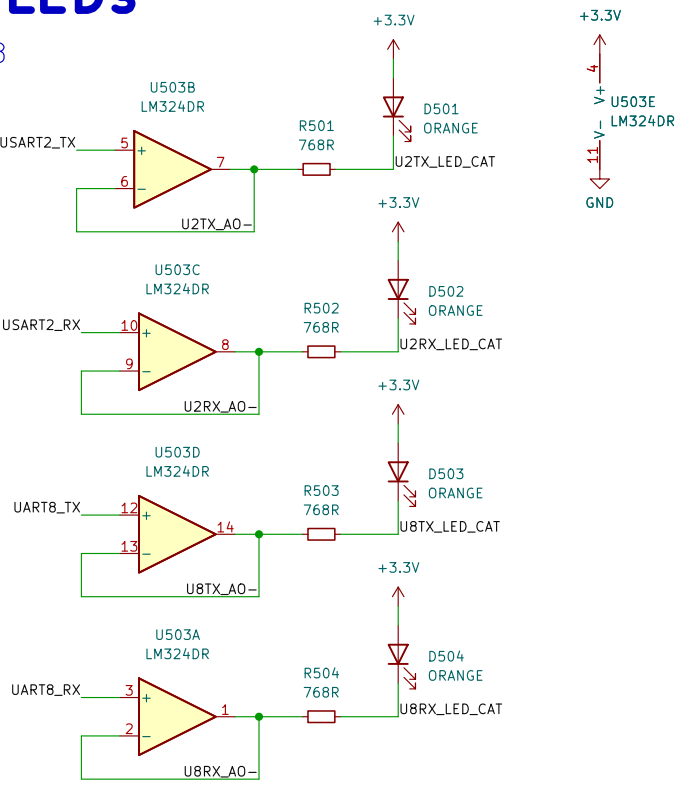
UART3, UART5



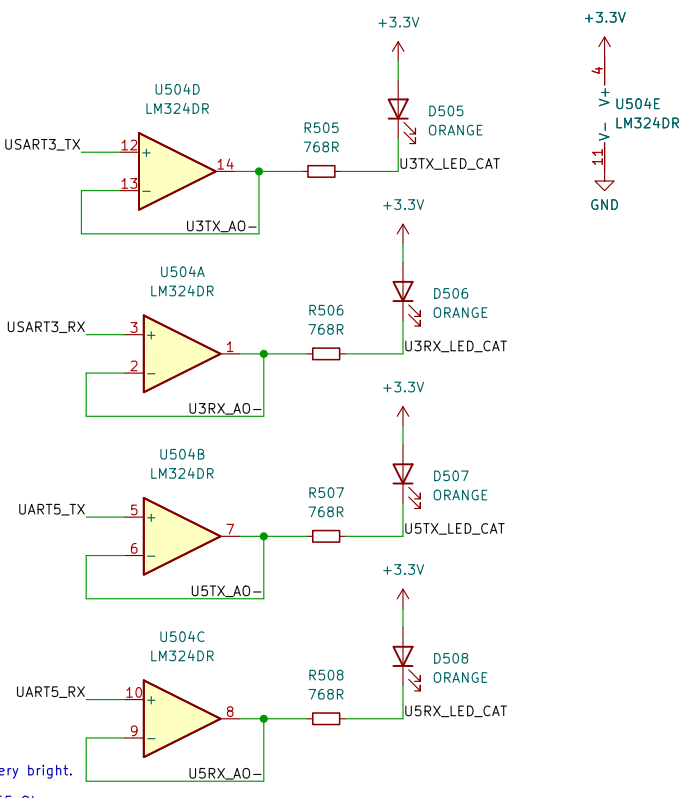
To use TTL voltage levels, short ALL of the jumpers for both nodes, for the corresponding UART buses.

Activity LEDs

USART2, USART8



UART3, UART5



Activity LEDs don't need to be very bright.
We choose $I_f = 1.7 \text{ mA}$
 $R = (3.3 \text{ V} - 2 \text{ V}) / (2 \text{ mA}) = 765 \text{ Ohm}$
Closest standard resistor $\rightarrow 768 \text{ Ohm}$

Author: Vincent Nguyen

EPFL Xplore

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

Title: RS232 UART Node to Node Connectors

Size: A3

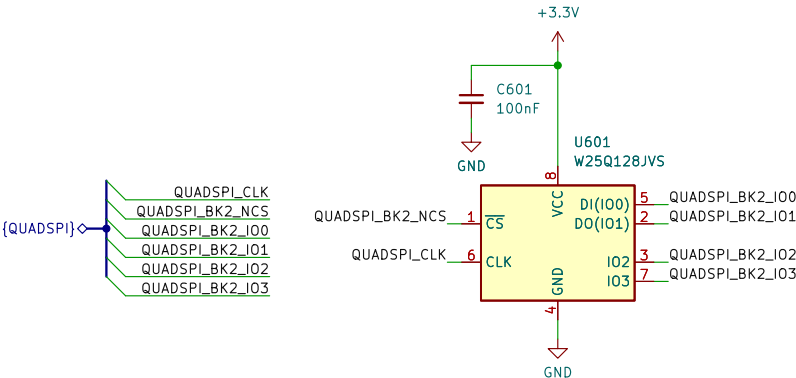
Date:

Rev:

KiCad E.D.A. kicad (6.0.7)

Id: 5/11

Quad-SPI external flash memory



Author: Vincent Nguyen

EPFL Xplore

Sheet: /Flash memory/
File: FLASH.kicad_sch

Title: External Flash Memory

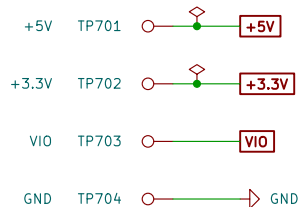
Size: A5
KiCad E.D.A. kicad (6.0.7)

Date:

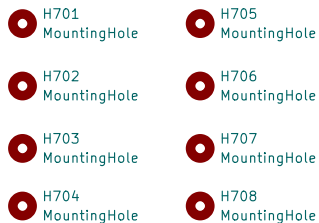
Rev:

Id: 6/11

Test points



Mounting holes



Logos



Author: Vincent Nguyen

EPFL Xplore

Sheet: /Mechanical elements, testpoints, logos/
File: MECHANICAL_TP_LOGO.kicad_sch

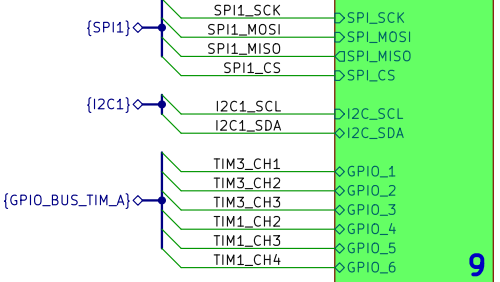
Title: Mechanical Elements and Test Points

Size: A5
KiCad E.D.A. kicad (6.0.7)

Date:

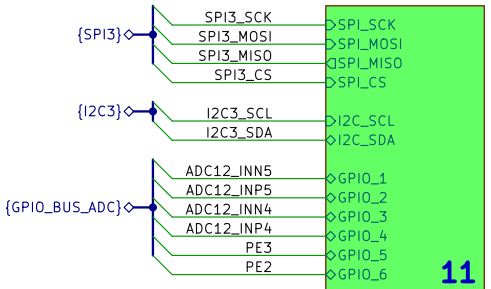
Rev:
Id: 7/11

Node to Hat connectors



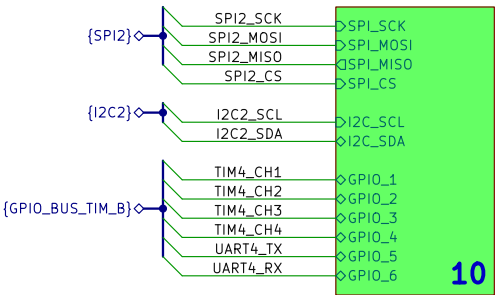
File: HAT_CONNECTOR.kicad_sch

Hat connector circuit3



File: HAT_CONNECTOR.kicad_sch

Hat connector circuit2



File: HAT_CONNECTOR.kicad_sch

Author: Vincent Nguyen

EPFL Xplore

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

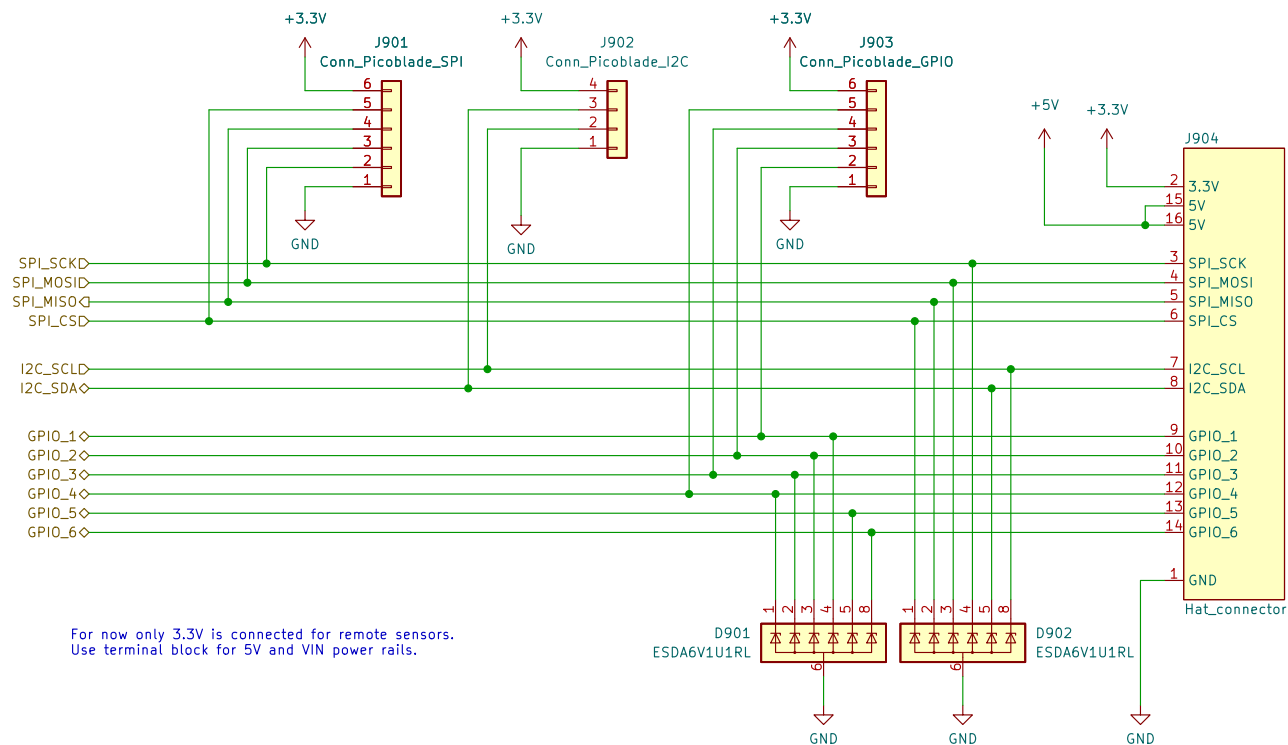
Title: Hat Connectors and Delocalized Connectors

Size: A5
KiCad E.D.A. kicad (6.0.7)

Date:

Rev:
Id: 8/11

Hat connector



Author: Vincent Nguyen

EPFL Xplore

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

Title: Hat Connector

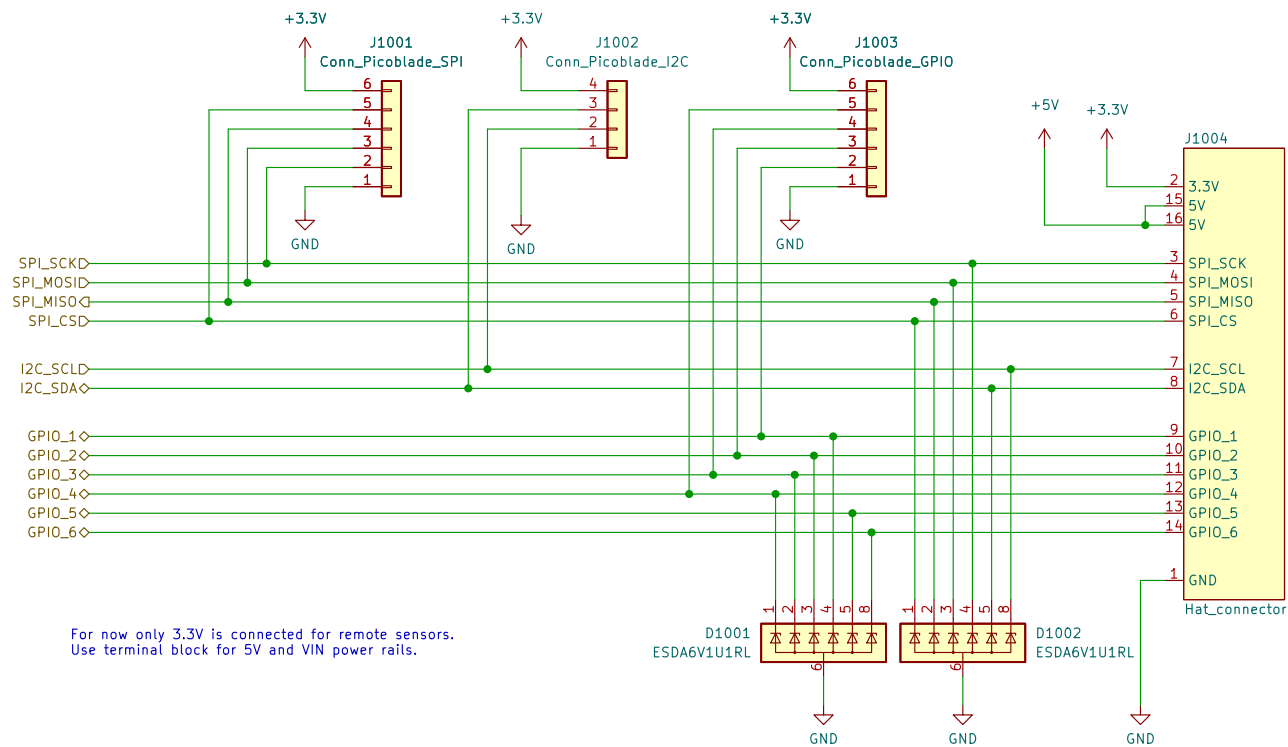
Size: A4
KiCad E.D.A. kicad (6.0.7)

Date:

Rev:

Id: 9/11

Hat connector



Author: Vincent Nguyen

EPFL Xplore

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

Title: Hat Connector

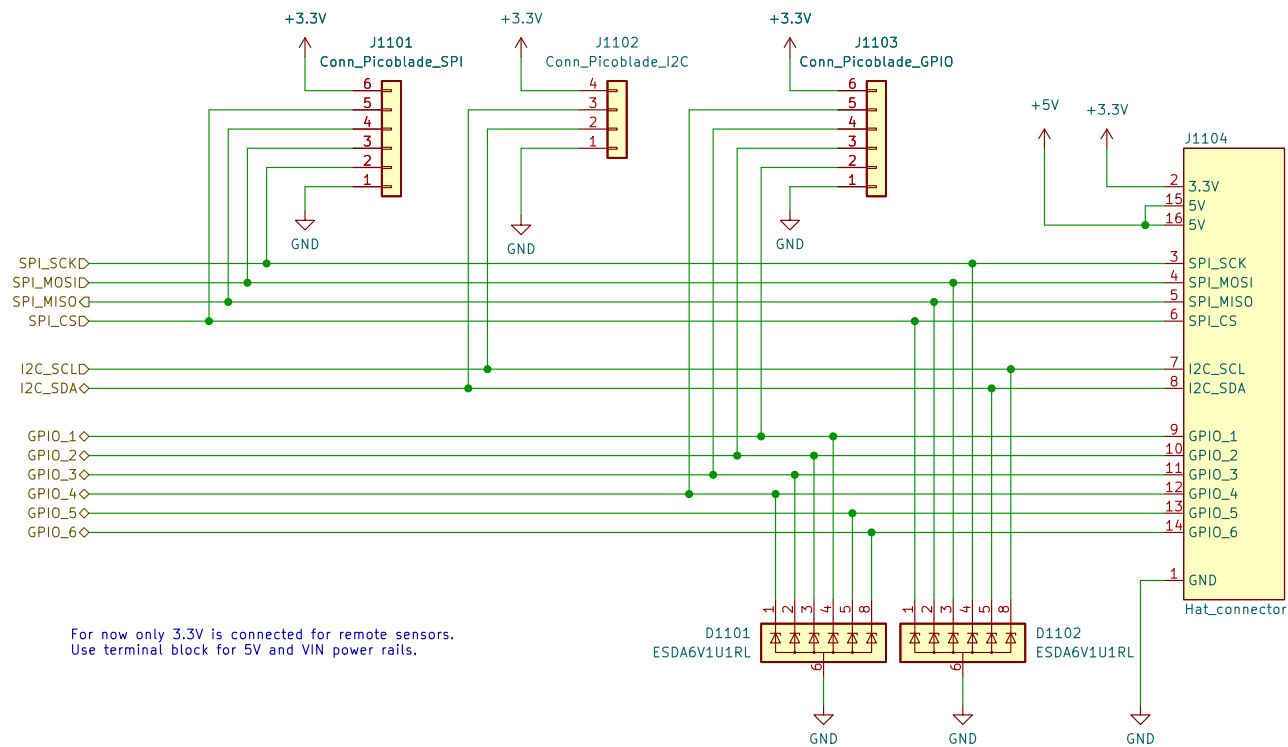
Size: A4
KiCad E.D.A. kicad (6.0.7)

Date:

Rev:

Id: 10/11

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
KiCad E.D.A. kicad (6.0.7)

Date:

Rev:

Id: 11/11