

Simone Tollardo

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File: LAITS-HW.kicad_sch

Title: LAITS (Light Analysis lot porTable Spectrometer)

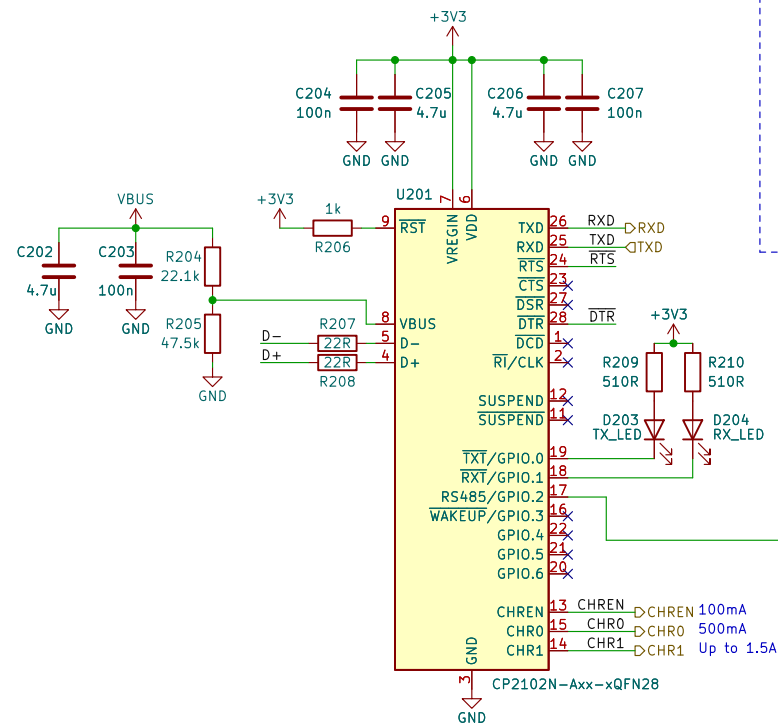
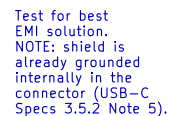
Size: A4 Date: 2022-08-11

KiCad E.D.A. kicad 6.0.7-1.fc36

Rev: 1.0.2

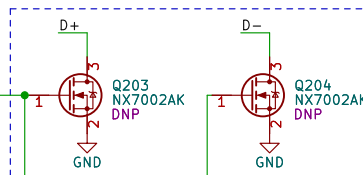
Id: 1/6

J201
USB_C_Receptacle_USB2.0



CP2102N GPIO must be configured for Battery Charging using Xpress Configurator (see Datasheet).

The diagram shows two PTC114Y modules, Q201 and Q202, connected to a 100V power source. The modules are controlled by RTS and DTR signals. The output of Q201 is connected to 100V, and the output of Q202 is connected to EN.



Workaround for known silicon issue (CP2102N_E110), GPIO2 need to be set with Xpress Configurator, see Errata.



Sheet: /USB/
File: USB.kicad_sch

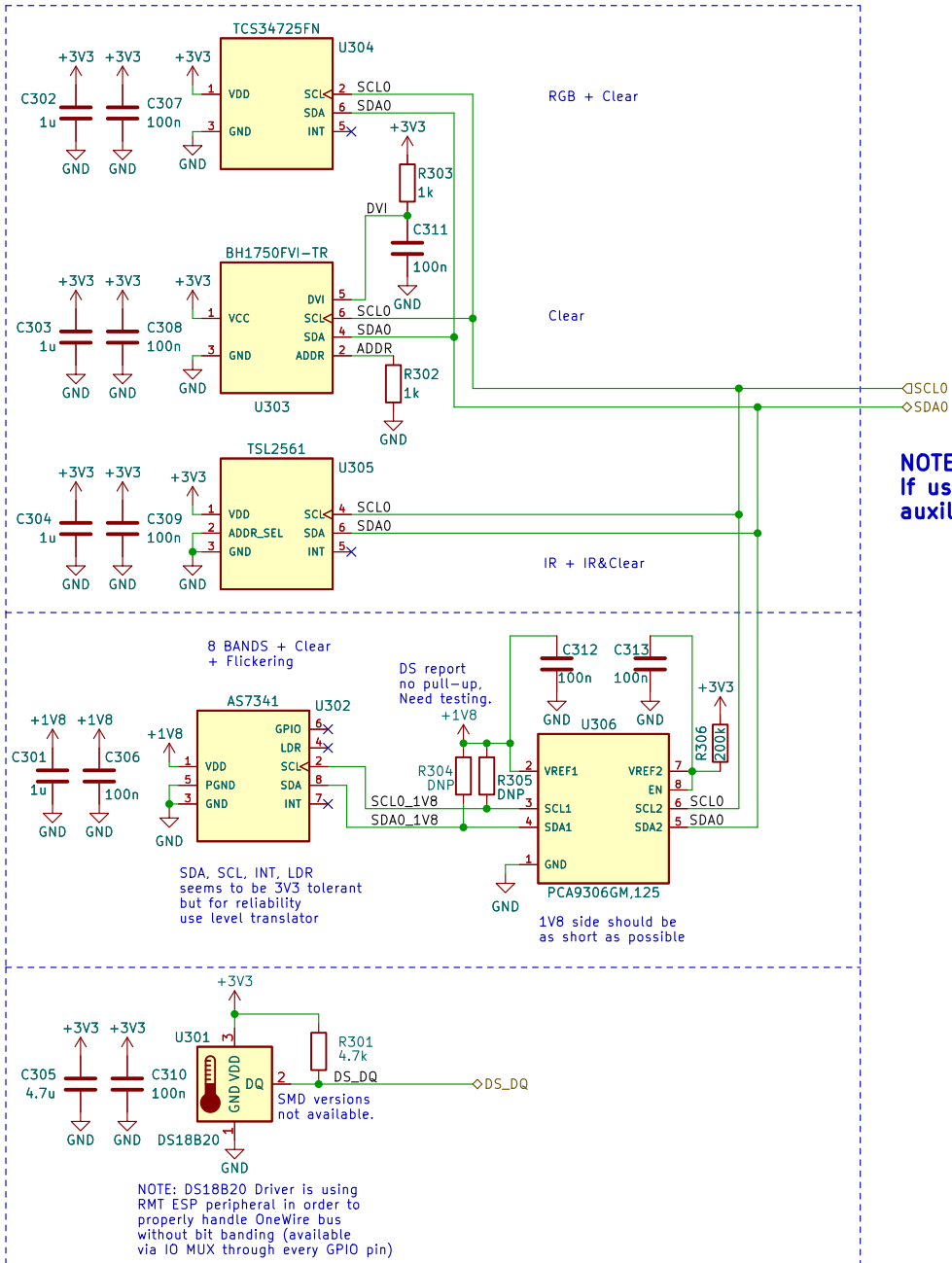
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SENSORS



NOTE: AS7341 can replace TCS, BH and TSL.
 If used do not place TCS, BH, TSL and their
 auxiliary components.



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Sheet: /Sensors/

File: Sensors.kicad_sch

Title: Sensors

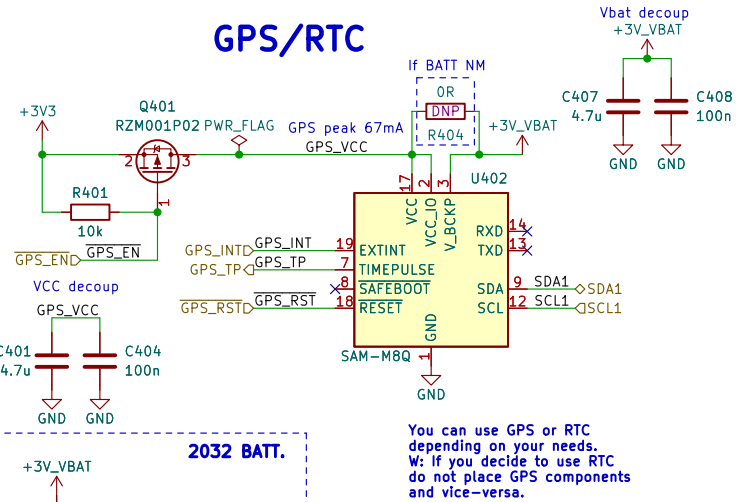
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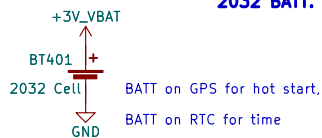
Rev: 1.0.2

Id: 3/6

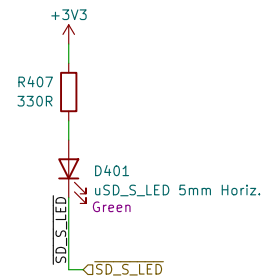
GPS/RTC



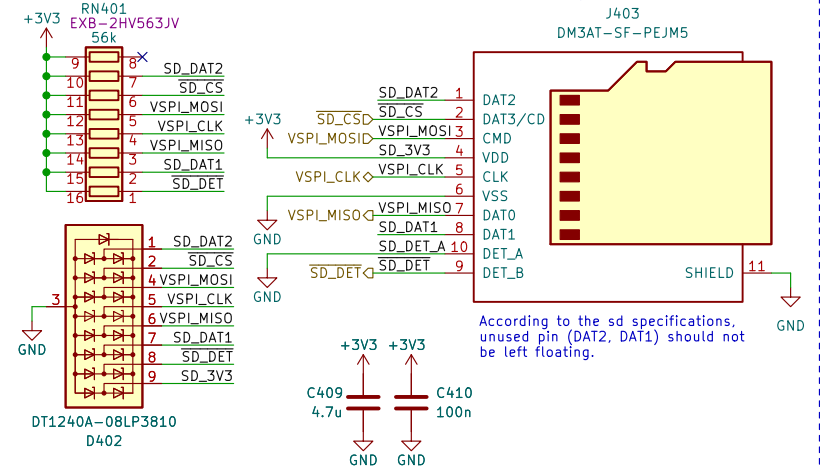
2032 BATT.



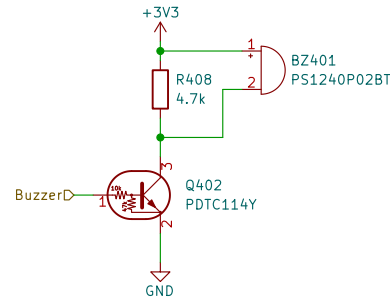
μSD STATUS



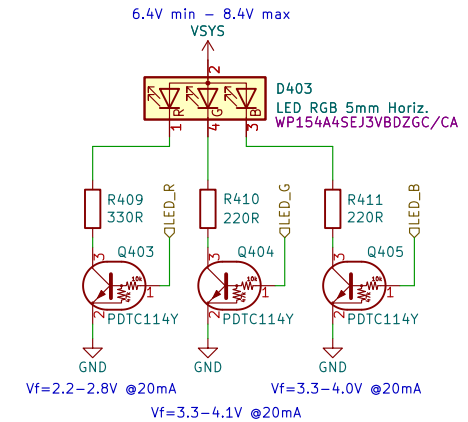
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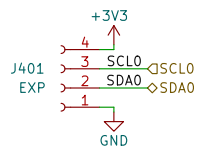
BUZZER



WIFI/CHARGING STATUS



I2C Expansion



LA TS

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Sheet: /AUX + Peripherals/
File: Aux_peripherals.kicad_sch

Title: AUX + Peripherals

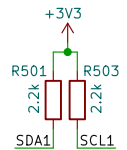
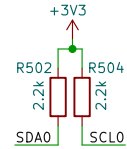
Size: A4 Date: 2022-08-11

KiCad E.D.A. kicad 6.0.7-1.fc36

Rev: 1.0.2

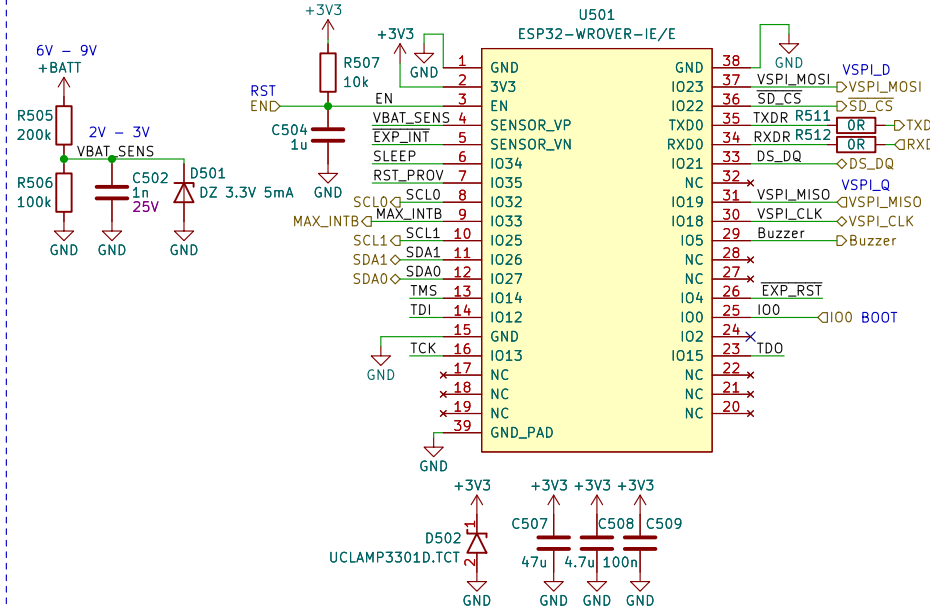
Id: 4/6

I2C Pull-up



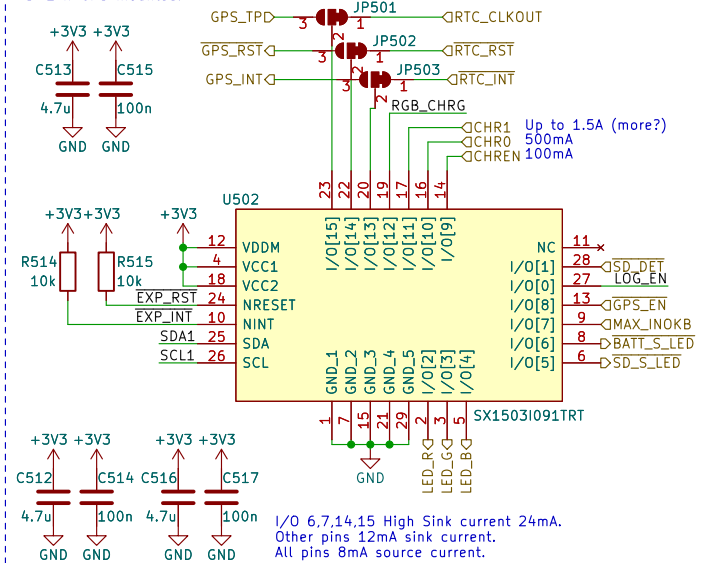
Depending on the I2C bus speed, these values may be adjusted.
100KHz=4.7K
400KHz=2.2K
In every case this need some testing.

ESP

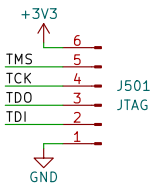


GPIO Expander

Solder Jumpers Pos.
1-2 if RTC mounted,
3-2 if GPS mounted.

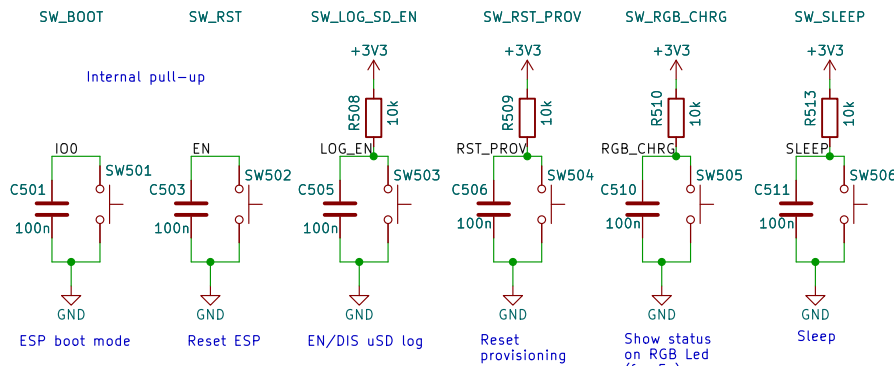


JTAG



Since MTDI and MTDO are bootstrapping pins, wait for reset before using JTAG interface.

BUTTONS



ESP Bootstrapping pins:
MTDI (GPIO12) -> need to be kept low at startup: 0=LDO 3V3, 1=LDO 1V8

MTDO (GPIO15) -> 1=U0TXD Active 0=U0TXD Silent

BOOT (GPIO0) -> 1=SPI, 0=Bootloader

GPIO2 -> 0 for Bootloader mode

GPIO5 (Pull-up at startup) SDIO timing
Since we are not using SDIO interface we can freely use GPIO5.

GPIO34-35-36-37-38-39 Input only

RTC PINS can receive interrupt and wake up ESP from deep-sleep.

NINT, RGB, CHRG, RST PROV, MAX_INTB.

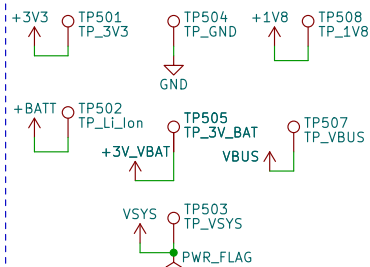
SPI and UART direct I/O via I/O MUX while I2C and other low speed stuff can be mapped anywhere through GPIO Matrix.

SPI, GPIO16, GPIO17 used by internal FLASH and PSRAM. HSPi mapped on same pins of JTAG VSPI is free.

SPIID=MOSI
SPIQ=MISO
SPICLK=SPICLK
SPIHD=Hold
SPIWP=Write Protect

WP & HD pin not used in SPI 1 bit mode

Testpoints



LA TS

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Sheet: /ESP/
File: ESP.kicad_sch

Title: ESP

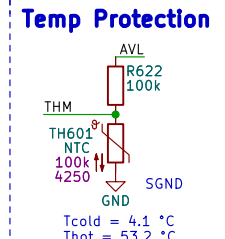
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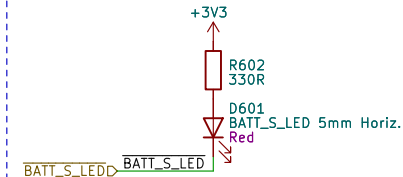
Id: 5/6

- With a valid external power source at CHGIN:
 - The external power source is the primary source of energy.
 - The battery is the secondary source of energy.
 - Energy delivery to SYS has the highest priority.
 - Any remaining energy from the power source that is not required by the system is available to the battery charger.
- With no valid external power source at CHGIN:
 - The battery is the primary source of energy.
 - When OTG mode is enabled, energy delivery to SYS has the highest priority.
 - Any remaining energy from the battery that is not required by the system is available to power the CHGIN.

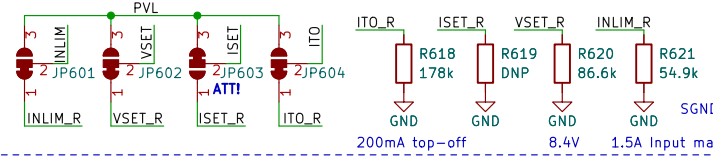


According to the DS of CP2102N, implementing USB BC 1.2, 1.5A is the TOTAL MAX CURRENT drawn from USB 5V rail.

There are also some proprietary protocols (e.g. Apple, Samsung and Blackberry chargers) that allows to draw more than 1.5A without USB C PD, but they are not implemented on CP2102N.



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So, if available input power is 0.5A and system is using 1A, if battery are charged they will deliver the remaining 0.5A, otherwise the DCDC will detect a failure.
For this reason the ESP32 has as input CHREN, CHRO and CHR1 and it should go to power save mode (disable wifi and other peripherals) if power is not enough.

Needed only if AS7341 used.

$$\begin{aligned} PD_{max} &= (T_{jmax} - T_a) / R_{\theta JA} = \\ &= (125 - 20) / 158 = 0.66 \text{ W} \\ PD &= V_{in}(I_{gnd}(I_{out})) + I_{out}(V_{in} - V_{out}) = \\ &= 3.3(0) + 300m(3.3 - 1.8) = 0.45 \text{ W} \end{aligned}$$

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LA💡TS