USB

File: usb.kicad_sch

Battery

File: battery.kicad_sch

Power

File: power.kicad_sch

MCU

File: mcu.kicad_sch

Peripherals

File: peripherals.kicad_sch

Switches

File: switches.kicad_sch

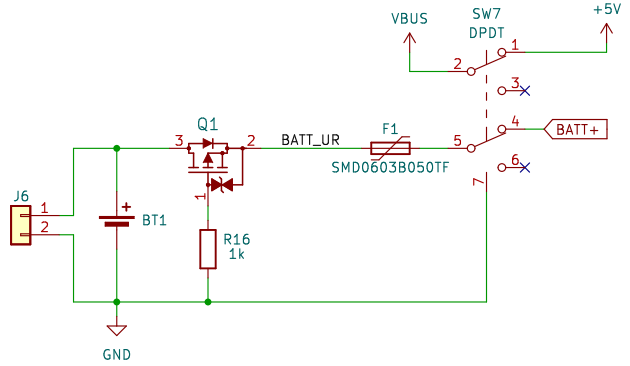
**Stefano Nicolis**

Sheet: /
File: optical_mouse.kicad_sch

***Title: optical_mouse***

| Size: A4 | Date: | **Rev: 0** |
|---|---|---|
| KiCad E.D.A. kicad 7.0.11 | | Id: 1/7 |

## Battery

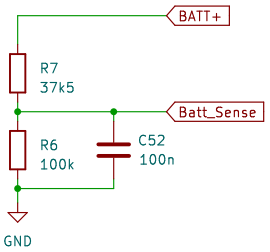



Battery is a 16340 single cell.
Chemistry is Lithium Manganese Nickel (LiNiMnCoO2).
Also known as INR or NMC.

---

SW5 is a safety switch, when OFF battery can't charge and MCU has no power. SW5 should always stay ON.
Q1 is for reverse polarity protection, has low Rds_on.
J6 is an extra battery attach point, if battery format will be changed.

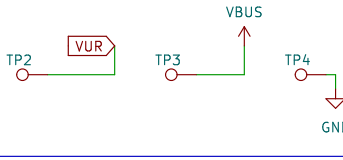
## Battery Level Monitor



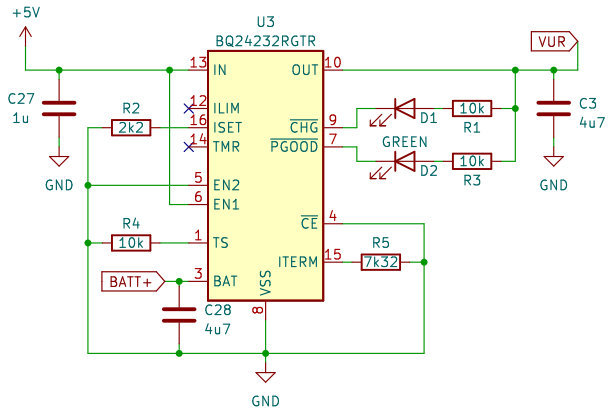

C52 lower sampling time and allows to use higher total resistance in divider.

See: https://devzone.nordicsemi.com/nordic/nordic-blog/b/blog/posts/measuring-lithium-battery-voltage-with-nrf52

## Test Points




## Charger & Power Manager




See Section 8.4.1 for charging profile overview (graph + description)
See Section 8.3.3.2 for short circuit management
VBAT(REG) = 4.2V, final battery voltage
ICHG = ~400mA, charging current in cc mode, see Section 9.2.1.2.1.1
RISET = KISET/ICHG = 870 / 0.4 = 2175 Ohm
ITERM = KITERM*(RITERM/RISET) = 0.03 * 7k32 /2k2 = 100mA, see Section 8.4.1.4
TMR disconnected sets safety timers to internal defaults.

## Battery Protector

A dedicated battery protector is not included because:
- battery overvoltage during charge is prevented by the end-of-charge current threashold (ITERM)
- battery undervoltage during usage is prevented by the MCU monitoring the voltage and going to sleep and ultimately by a voltage monitor IC
- battery short is prevented by a fuse and internally by the charger

**Stefano Nicolis**

Sheet: /Battery/
File: battery.kicad_sch

***Title: optical_mouse***

| Size: A4 | Date: | **Rev:** |
|---|---|---|
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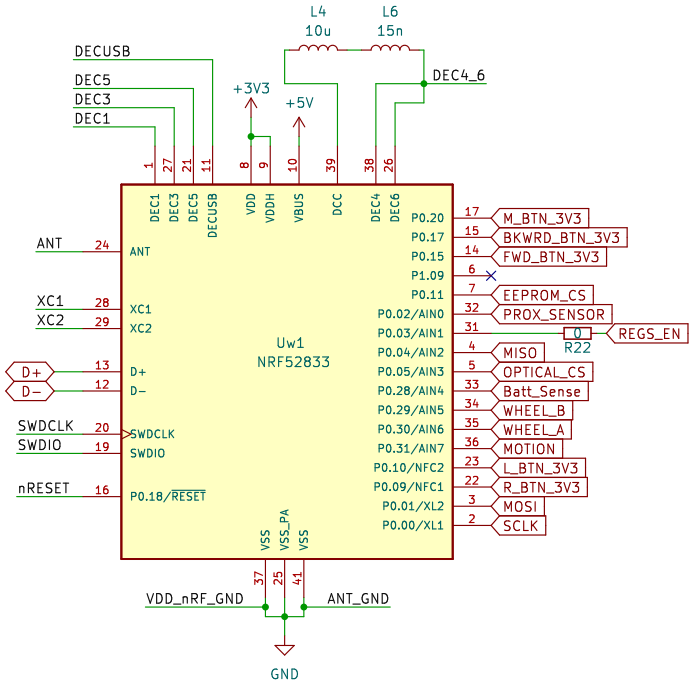
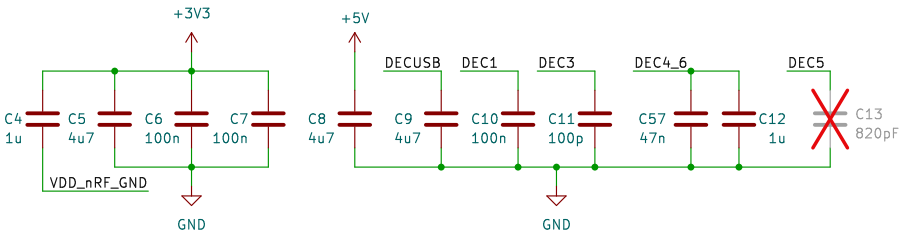
## MCU



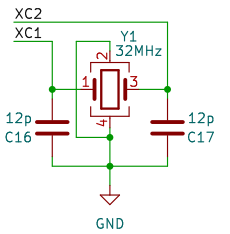

Schematic taken from Section 7.3.10 in datasheet V1.5

## Decoupling



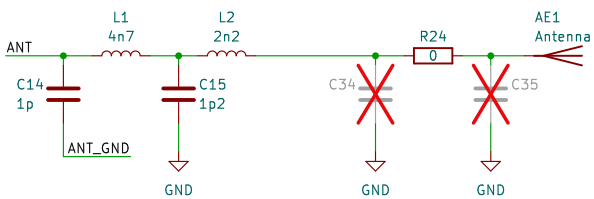

DEC5 is for retro-compatibility

## Crystal



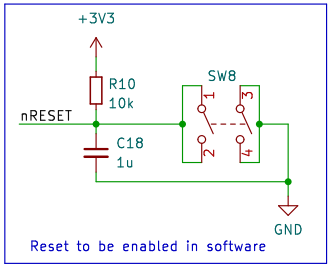

Cl = 8pF

## Antenna



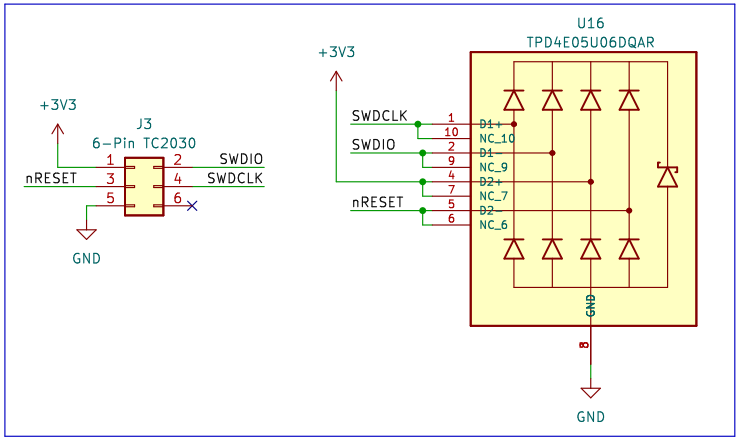

C14-L1-C15-L2 is the 50-Ohm matching network for the radio pin
C34-R24-C35 is used to tune the antenna without changing its geometry

## Reset button




Reset to be enabled in software

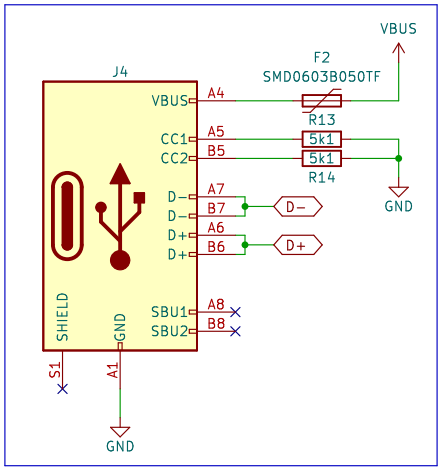
## SWD + ESD



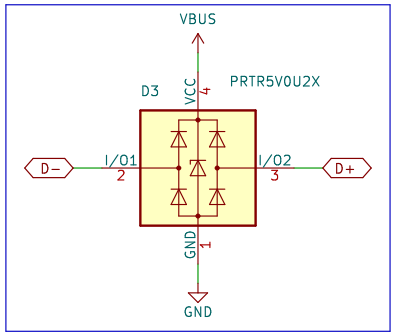

| | |
|---|---|
| **Stefano Nicolis** | |
| Sheet: /MCU/ | |
| File: mcu.kicad_sch | |
| ***Title: optical_mouse*** | |
| Size: A4 | Date: |
| KiCad E.D.A. kicad 7.0.11 | Id: 3/7 |

**Rev:**

## USB-C



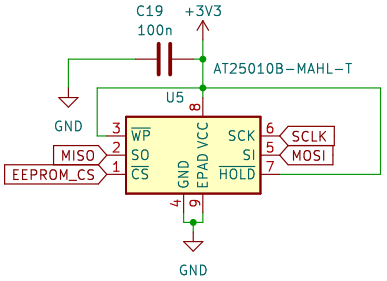

## ESD




| | |
|---|---|
| **Stefano Nicolis** | |
| Sheet: /USB/ | |
| File: usb.kicad_sch | |
| ***Title: optical_mouse*** | |
| Size: A4 | Date: |
| KiCad E.D.A. kicad 7.0.11 | **Rev:** Id: 4/7 |

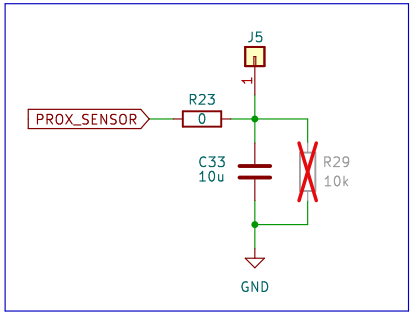
## Optical Sensor

## EEPROM



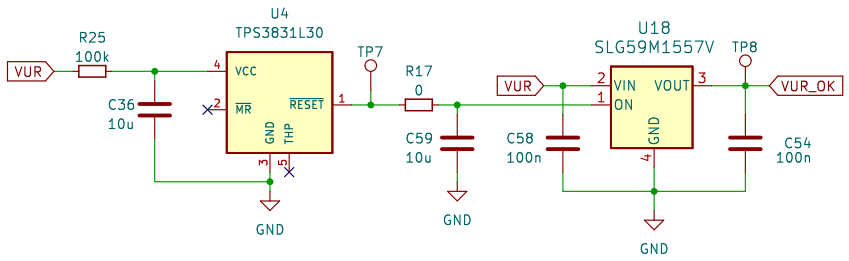

1Kbit eeprom, 10MHz@3.3V

## Proximity sensor




| | | |
|---|---|---|
| **Stefano Nicolis** | | |
| Sheet: /Peripherals/<br>File: peripherals.kicad_sch | | |
| ***Title: optical_mouse*** | | |
| Size: A4 | Date: | **Rev:** |
| KiCad E.D.A. kicad 7.0.11 | | Id: 6/7 |

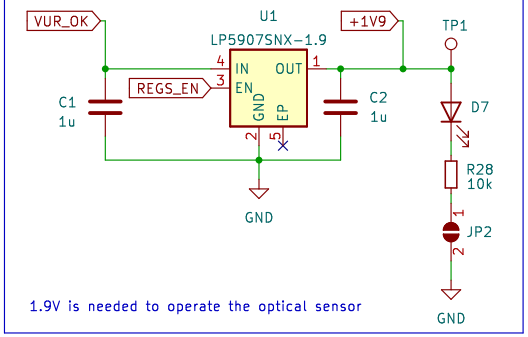
## VCC supervisor + load switch




U4 disables main power rail when battery reaches 2.63V.

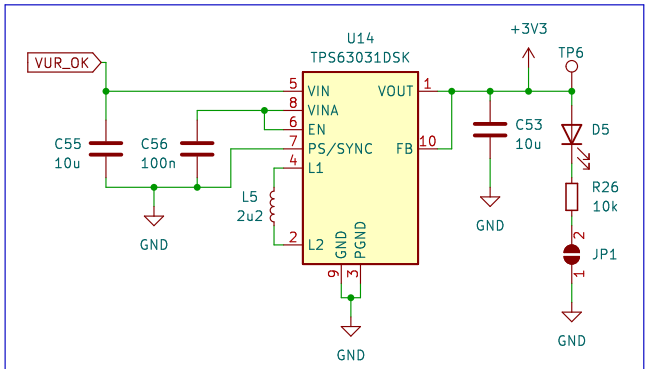
Low-pass filter on voltage supervisor input prevents fast glitches when the voltage threshold is passed.
Slow glitches are normal: when Vbatt is low power is cut, which makes Vbatt raises a bit, enabling power again etc.

## +1V9 LDO



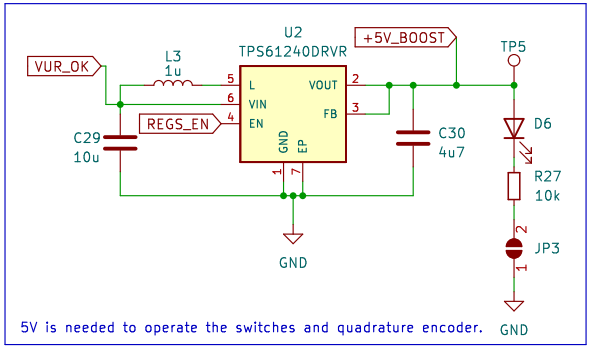

1.9V is needed to operate the optical sensor

## +3V3 Buck/Boost




PS/SYNC = 0 enables power save mode: higher efficency at low loads.
Expected load is 10mA max during normal operation and sub mA during sleep.

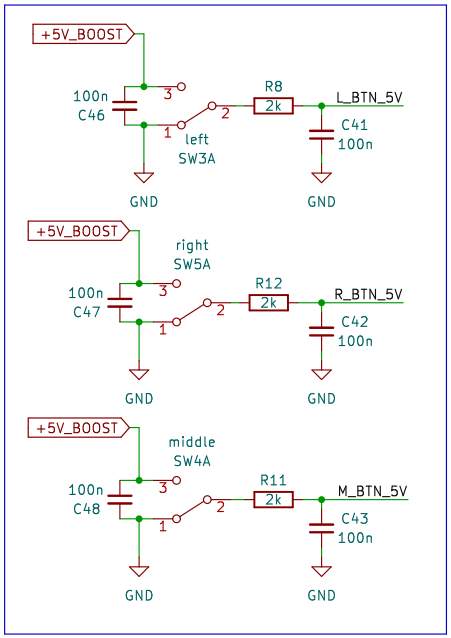
## +5V Boost Converter



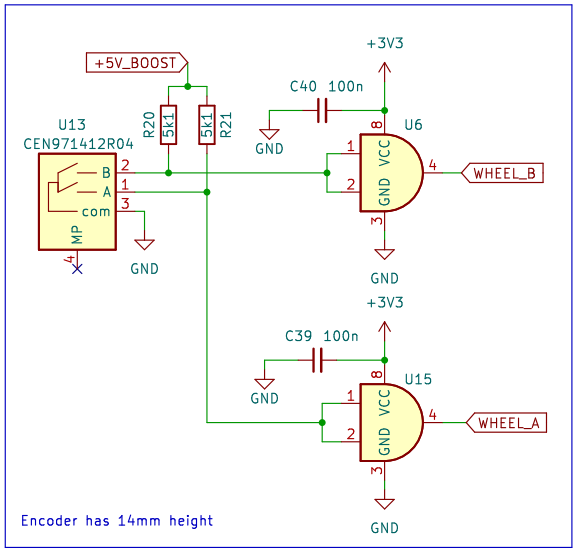

5V is needed to operate the switches and quadrature encoder.

| | | |
|---|---|---|
| **Stefano Nicolis** | | |
| Sheet: /Power/ | | |
| File: power.kicad_sch | | |
| ***Title: optical_mouse*** | | |
| Size: A4 | Date: | **Rev:** |
| KiCad E.D.A. kicad 7.0.11 | | Id: 7/7 |

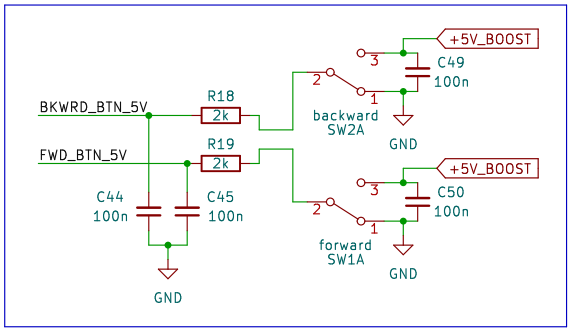
## Main switches



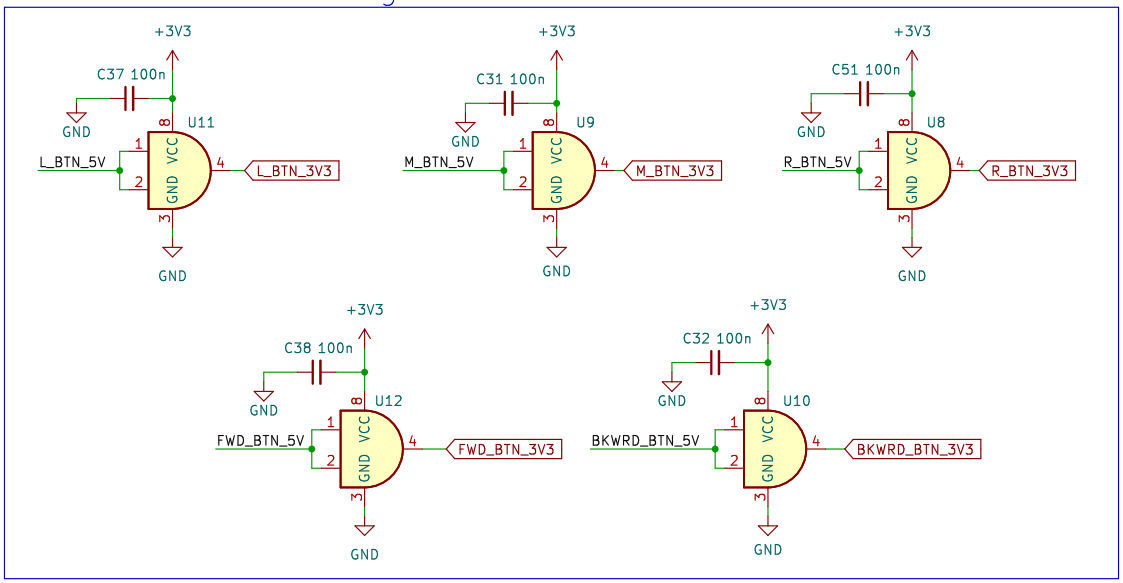

## Encoder + level shifting




## Side switches




## Switches level shifting




Switches and quadrature encoder have minimal rating of 5V@1mA.
Operating at 3V3 would result is short switch lifespan due to not enough Voltage/Current to provide a reliable electrical connection, see Wetting Current.
5V is needed to meet the spec and ensure long lifespan.

| | | |
|---|---|---|
| **Stefano Nicolis** | | |
| Sheet: /Switches/ | | |
| File: switches.kicad_sch | | |
| ***Title: optical_mouse*** | | |
| Size: A4 | Date: | **Rev:** |
| KiCad E.D.A. kicad 7.0.11 | | Id: 7/7 |