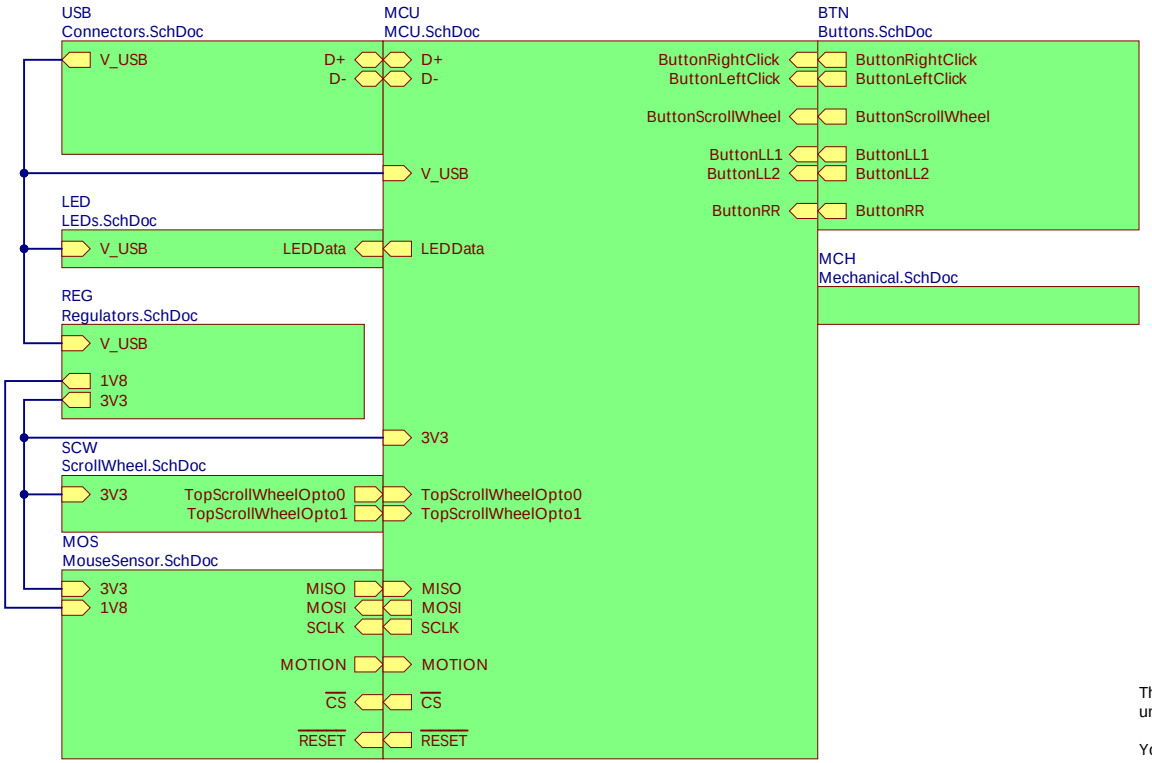

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Source location:
https://github.com/ploopyco/trackball-mini

As per CERN-OHL-S v2 section 4, should You produce hardware based on this source, You must where practicable maintain the Source Location visible on the external case of the products you make using this source.

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Title:	Thumb.SchDoc
PCB:	Thumb.PrjPCB
Version:	R1.001
Date:	8/25/2021
Time:	2:42:30 PM
Sheet	1 of 9

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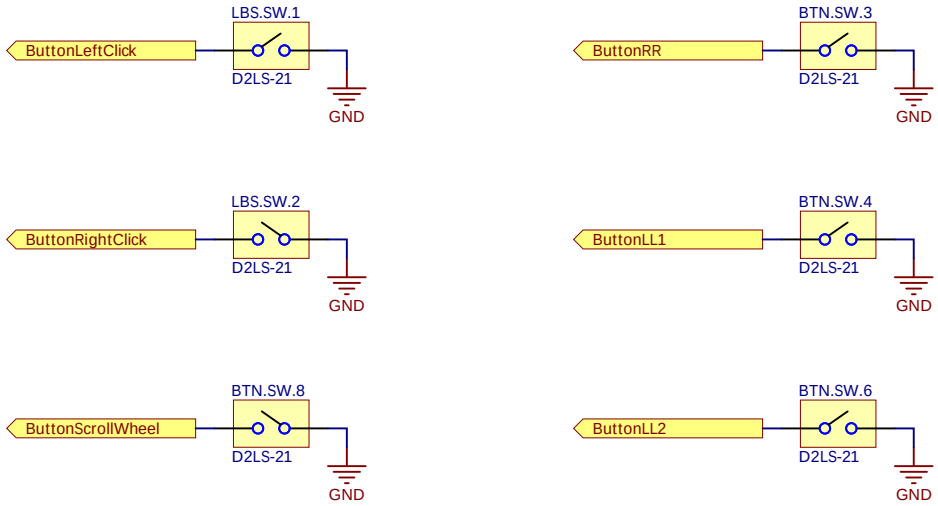
These switches can be found under the various buttons on the mouse.

Activate the pull-up resistors on the GPIO pins attached to these switches to make them work.



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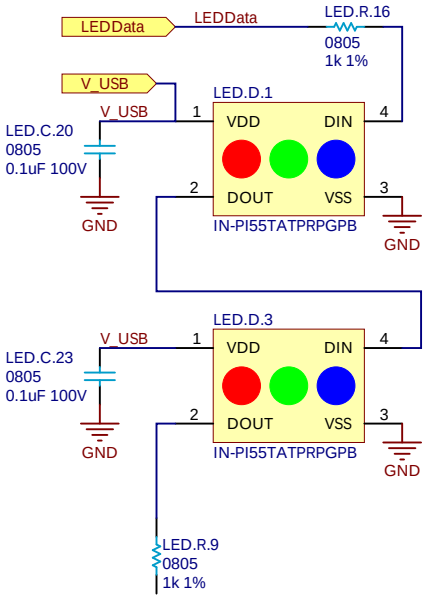

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Pick and Place Fiducials

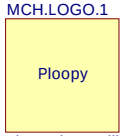
MCH.FID.1

IPC-7351 Fiducial 1mm

MCH.FID.2

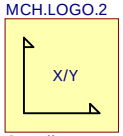
IPC-7351 Fiducial 1mm

MCH.LOGO.1



Ploopy logo, silkscreen

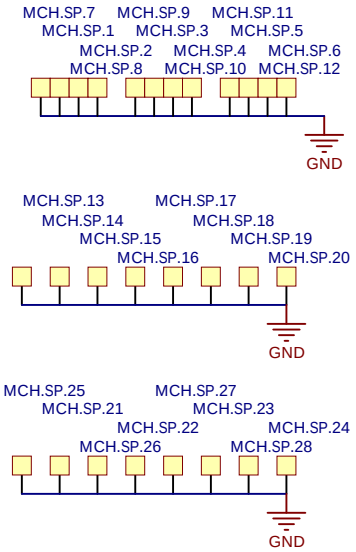
MCH.LOGO.2



Coordinate system marker for assembly

Spark Gaps -- Case

Since the case has gaps in it, we expect ESD to worm its way in via creepage and perhaps other ways. To protect the board from this eventuality, we place spark gaps along the edges.



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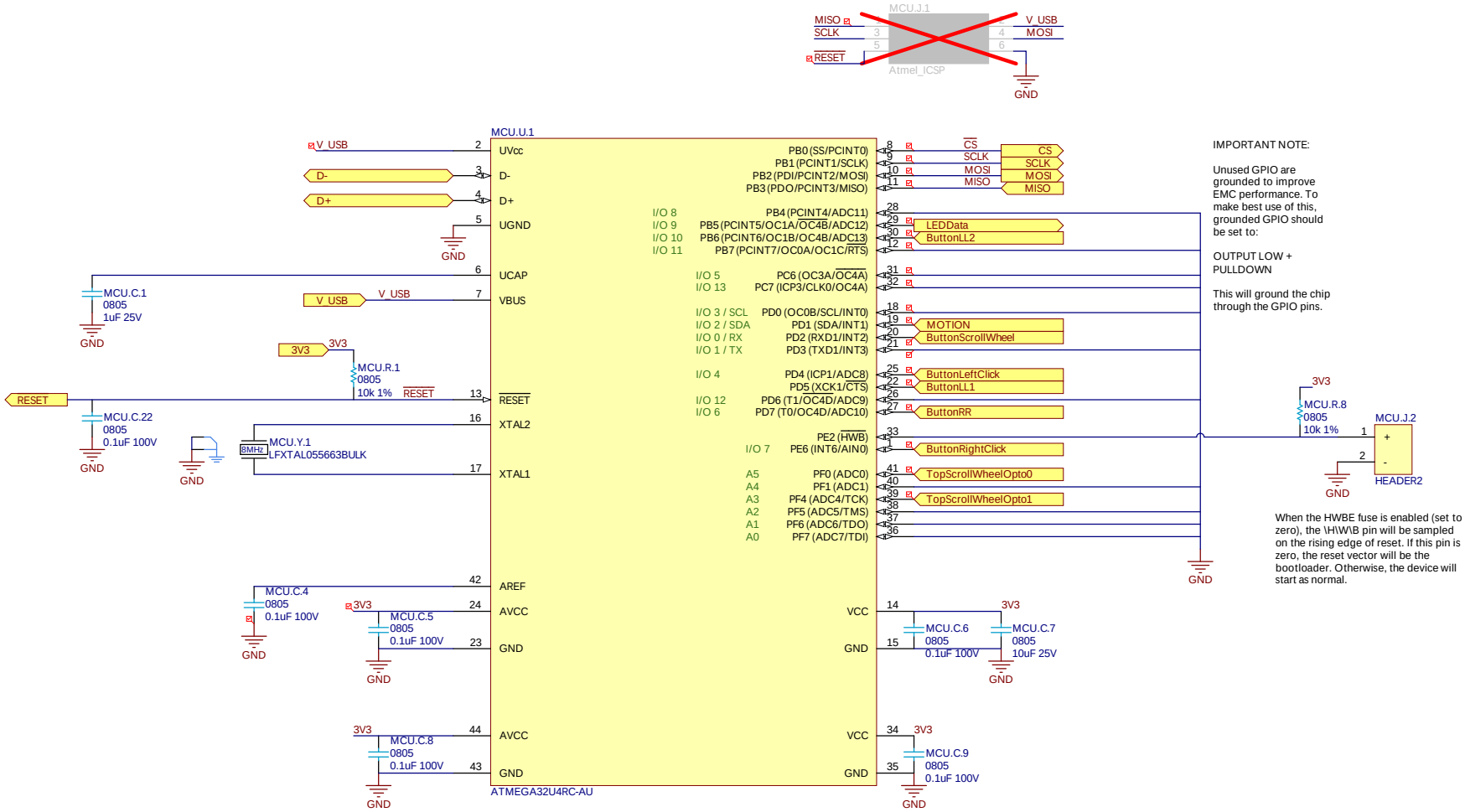

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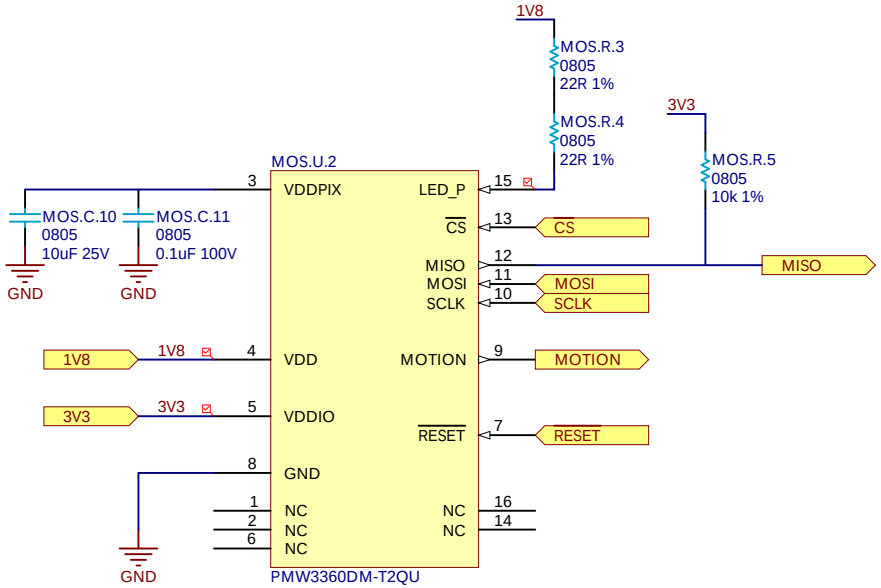

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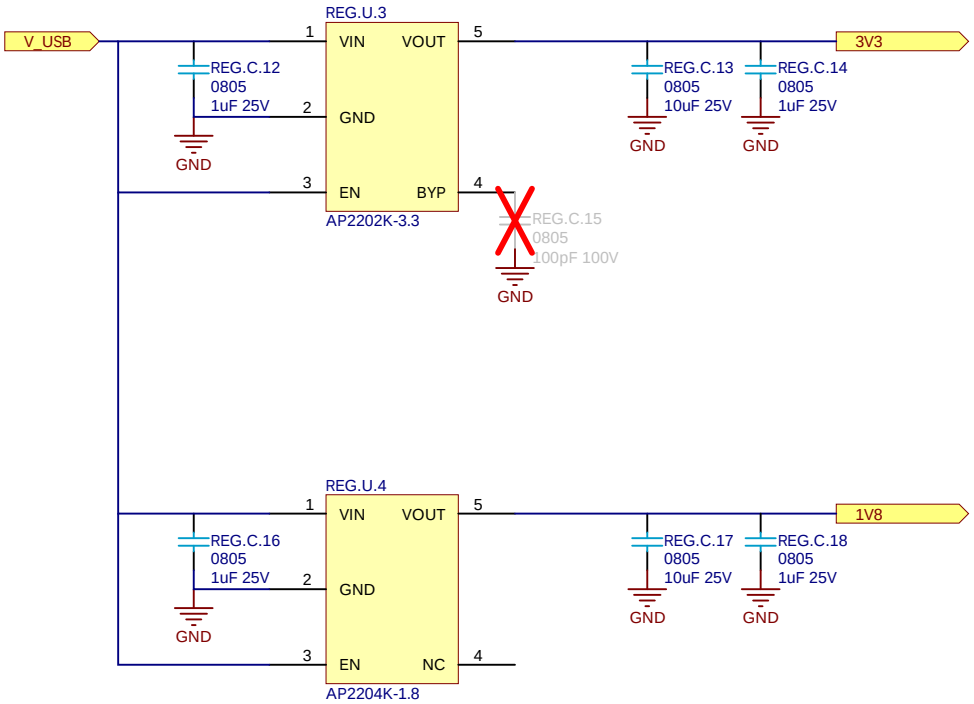

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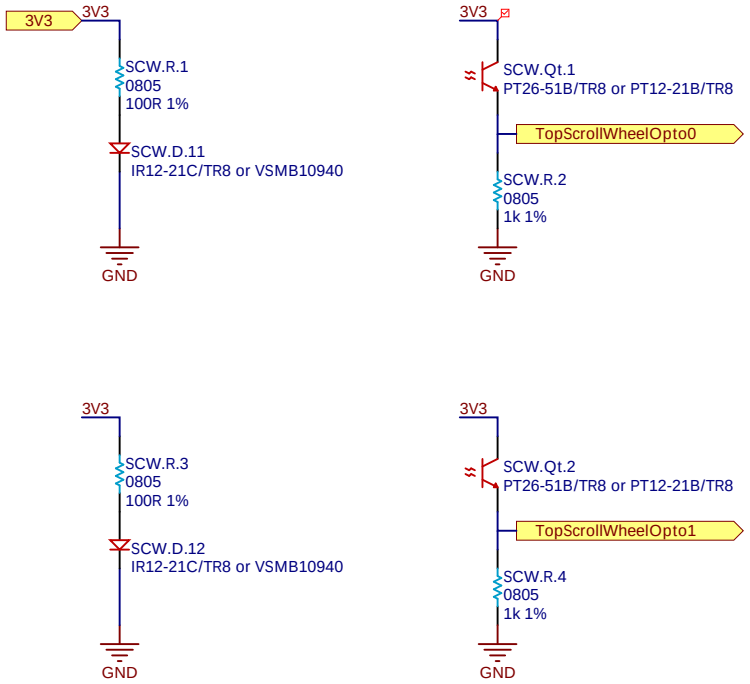

The scroll wheel mechanism is a 2-bit optical encoder. The light paths are spaced 1.5 periods over the encoder wheel holes, which should allow for the detection of the rotation direction as well as the rotation itself.

Two IR LEDs are used as light sources; the light from these is obstructed by the encoder wheel built into the scroll wheel mechanism. Two phototransistors are used to detect when the light is blocked/not blocked by the wheel.

Typical LED forward voltage is 1.3V @20mA. To achieve this current level with a 3.3V supply, we'll use a 100R resistor, which is very convenient.

At this power level, the output should be approx 2.3mW/sr.

Since the light path distance is about 12mm, that works out to about 2mW/cm^2, though the actual delivered power will be lower due to the vagaries of the obstructions in the mechanism.

With this amount of light (and accounting for the fact that we'll probably lose a lot of it along the way), we are expecting 1-3mA out of the phototransistor (see figure 6 of the datasheet), so we size the biasing resistor accordingly to produce a useful signal.

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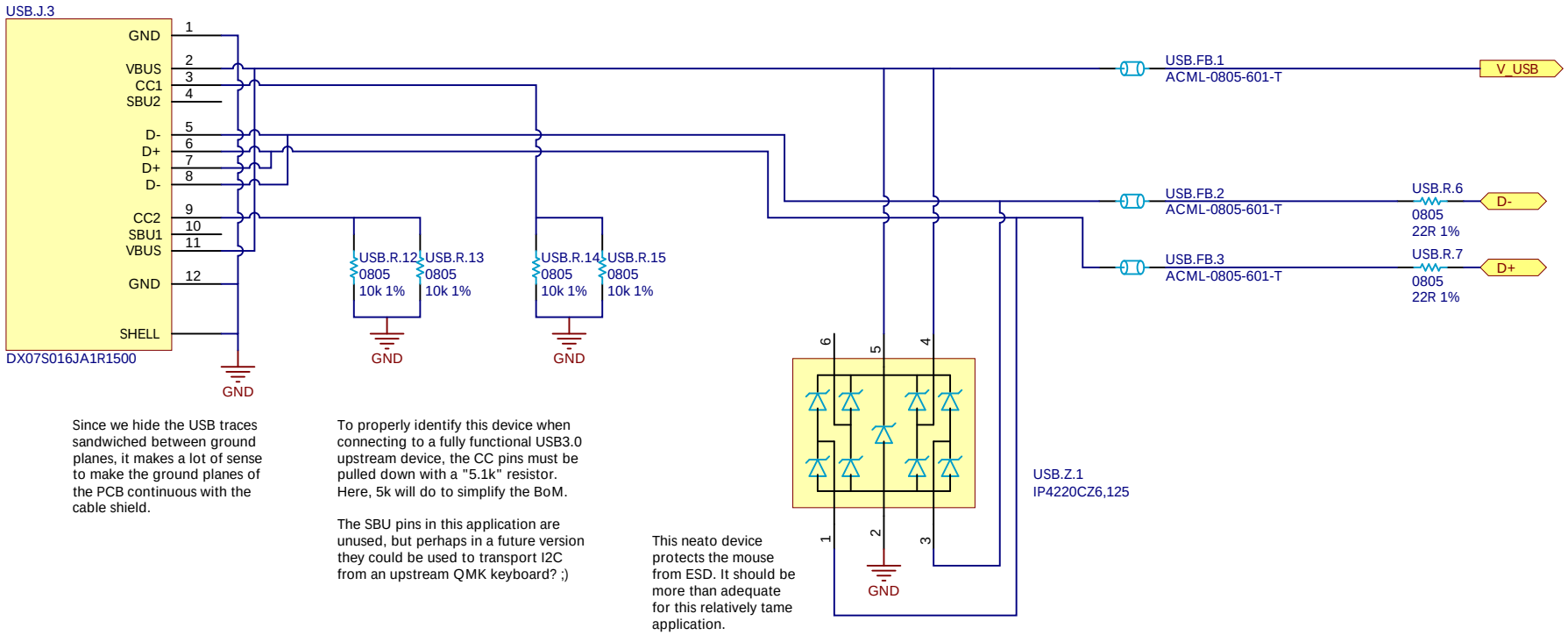

Since we hide the USB traces sandwiched between ground planes, it makes a lot of sense to make the ground planes of the PCB continuous with the cable shield.

To properly identify this device when connecting to a fully functional USB3.0 upstream device, the CC pins must be pulled down with a "5.1k" resistor. Here, 5k will do to simplify the BoM.

The SBU pins in this application are unused, but perhaps in a future version they could be used to transport I2C from an upstream QMK keyboard? ;)

This neato device protects the mouse from ESD. It should be more than adequate for this relatively tame application.

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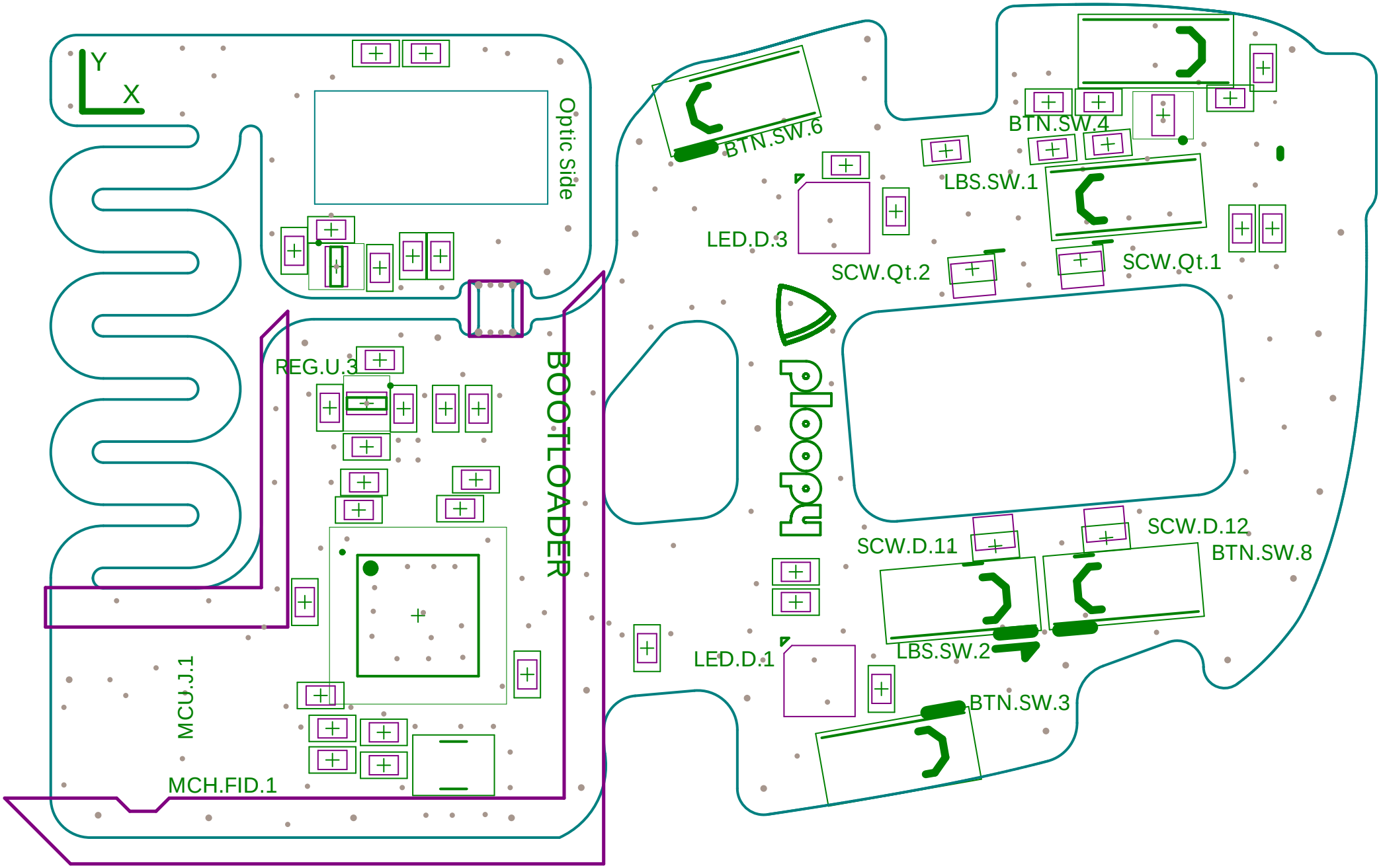
Y
X
Optic Side
BOOTLOADER
REG.U.3
MCU.J.1
MCH.FID.1
BTN.SW.6
BTN.SW.4
LBS.SW.1
LED.D.3
SCW.Qt.2
SCW.Qt.1
SCW.D.11
SCW.D.12
BTN.SW.8
LBS.SW.2
LED.D.1
BTN.SW.3