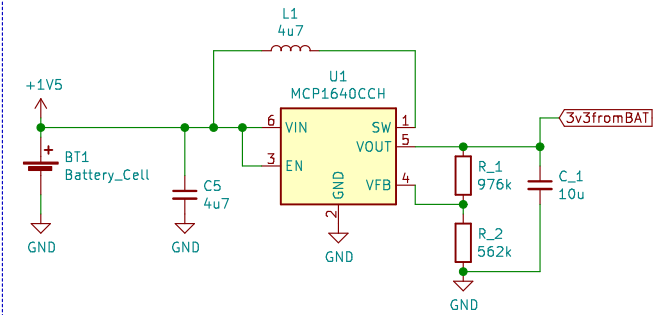# Power section
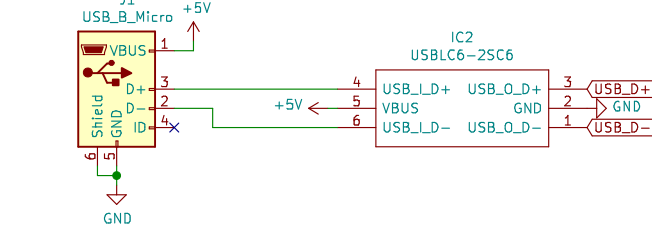
Reference design from datasheet for MCP1640 step-up from 1.5V battery to 3.3V
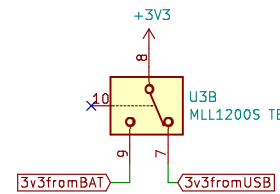
L1 4u7
U1 MCP1640CCH
+1V5
BT1 Battery_Cell
C5 4u7
R_1 976k
R_2 562k
C_1 10u
3v3fromBAT
VIN SW VOUT VFB EN GND
GND

USB connector

J1 USB_B_Micro
+5V
VBUS D+ D- ID GND Shield
IC2 USBLC6-2SC6
USB_I_D+ USB_O_D+
VBUS GND
USB_I_D- USB_O_D-
USB_D+ GND USB_D-
+5V
GND

USB power regulator 5V to 3.3V

IC1 LD3985M33R
+5V
C11 1u
C12 100n
VIN GND INHIBIT VOUT BYPASS
C14 10n C15 100n C16 1u
3v3fromUSB
GND

Power selector switch

+3V3
U3B MLL1200S TE
3v3fromBAT 3v3fromUSB

BNO055 9DOF senzor I2C and 32.768 kHz OSC

+3V3 +3V3
U4 BNO055_my
R6 10K
C24 22p
C25 22p
RESET VDD XOUT32
BNO055_INT INT VDDIO XIN32
BOOT_LOAD_PIN
BL_IND
I2C_SDA COM0-SDA PS0
I2C_SCL COM1-SCL PS1
COM2 CAP
ADDR GNDIO
Y3 NX2012SA-32768BK
R10 10K R11 10K
C23 1u
C20 100n
GND +3V3 GND
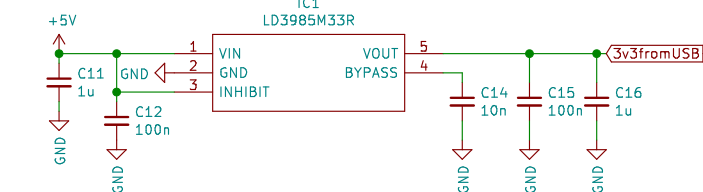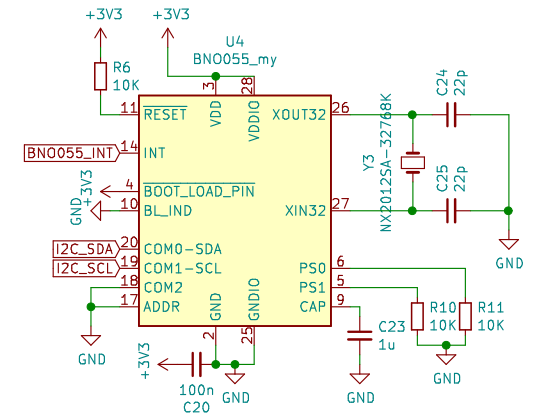
STM32WB microcontroller section

Supply domain

+3V3
C7 100n C8 100n C9 100n C10 100n
FB1 Z0805C601BSMST
C3 100n
+3V3
C1 100n C2 100p
C4 4u7 C6 100n
U2G STM32WB55CG
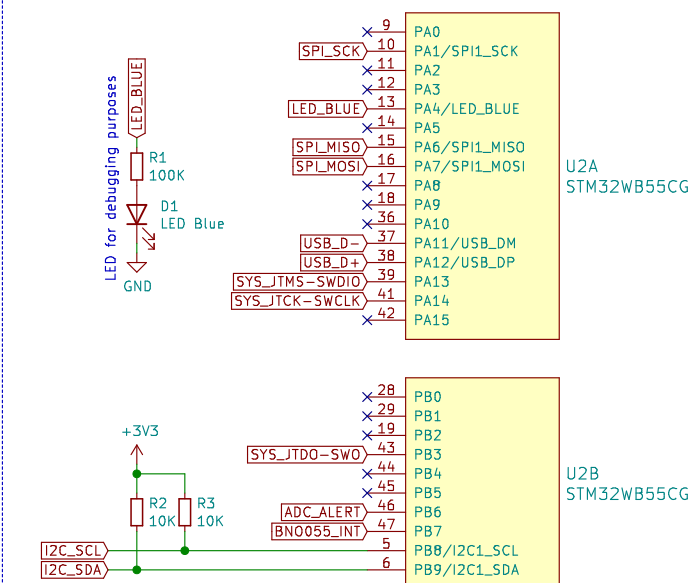VBAT VDD VDD VDD VDDA VDDRF VDDSMPS VDDUSB VSSRF VSSSMPS
GND
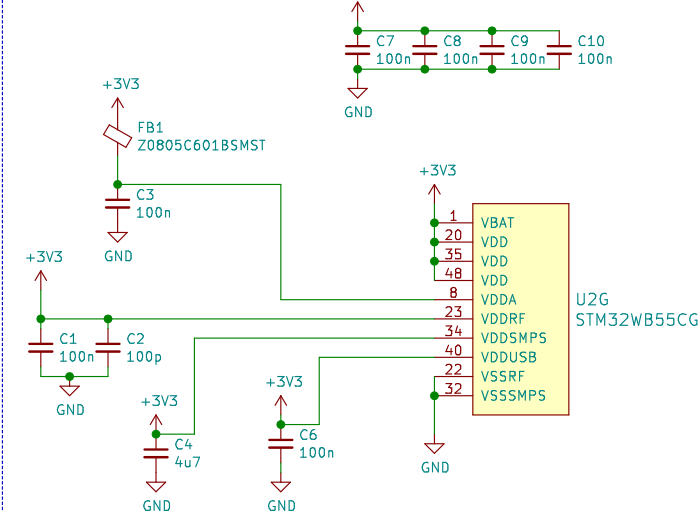
SpyPen
This pen uses ST32WB55 wireless Bluetooth LE microcontroller.
Powered by a 1.5 AAAA or AAA battery thanks to MCP1640 stepup to 3.3V
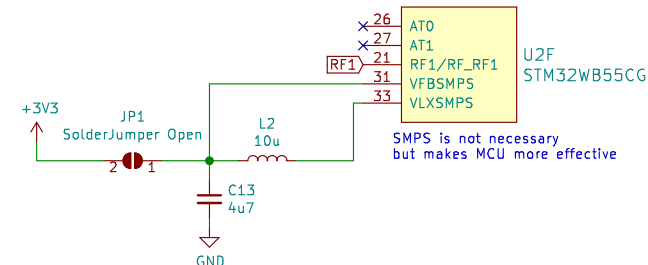I2C connections to peripherals:
1. TI ADS1115 for converting analog FSR04 force input to digital
2. Bosch BNO055 for 9-way motion detection - Accelerometer, Gyroscope, Magnetometer

This is a prototype. It has few unnecessary parts
(ST-Link, SMPS, switch),
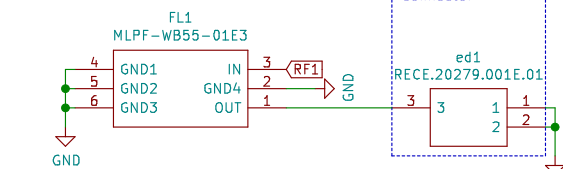although these parts make debugging easier.
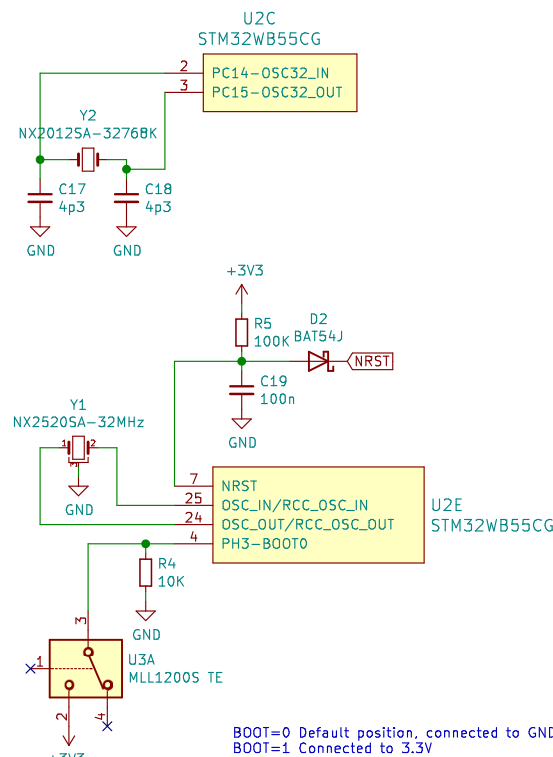
Pin setup for USB and peripherals

LED_BLUE
R1 100K
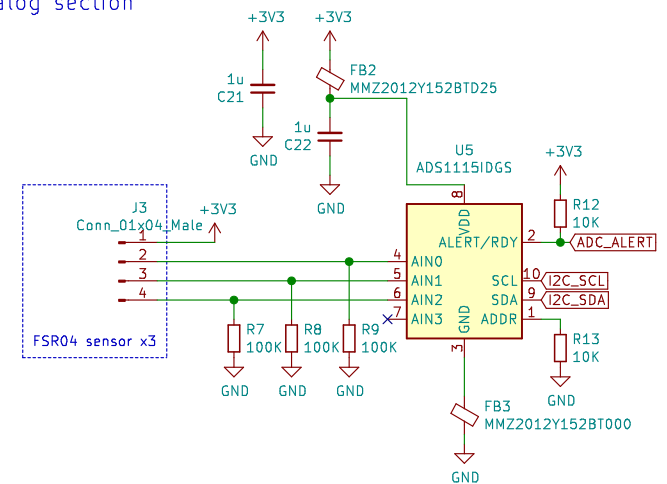D1 LED Blue
LED for debugging purposes
U2A STM32WB55CG
PA0 PA1/SPI1_SCK PA2 PA3 PA4/LED_BLUE PA5 PA6/SPI1_MISO PA7/SPI1_MOSI PA8 PA9 PA10 PA11/USB_DM PA12/USB_DP PA13 PA14 PA15
SPI_SCK LED_BLUE SPI_MISO SPI_MOSI USB_D- USB_D+ SYS_JTMS-SWDIO SYS_JTCK-SWCLK
GND

U2B STM32WB55CG
+3V3
R2 10K R3 10K
PB0 PB1 PB2 PB3 PB4 PB5 PB6 PB7 PB8/I2C1_SCL PB9/I2C1_SDA
SYS_JTDO-SWO ADC_ALERT BNO055_INT I2C_SCL I2C_SDA
GND

SMPS and RF section

U2F STM32WB55CG
+3V3
JP1 SolderJumper Open
L2 10u
C13 4u7
ATO AT1 RF1/RF_RF1 VFBSMPS VLXSMPS
RF1
SMPS is not necessary
but makes MCU more effective
GND

RF Bluetooth antenna

FL1 MLPF-WB55-01E3
GND1 GND2 GND3 IN GND4 OUT
RF1
GND

Coaxial antenna connector

ed1 RECE.20279.001E.01

Oscilator section 32MHz and 32768 kHz crystals
Boot pin for loading booloader and NReset pin

U2C STM32WB55CG
Y2 NX2012SA-3276BK
C17 4p3 C18 4p3
PC14-OSC32_IN PC15-OSC32_OUT
GND

+3V3
R5 100K
D2 BAT54J
C19 100n
NRST
Y1 NX2520SA-32MHz
U2E STM32WB55CG
NRST OSC_IN/RCC_OSC_IN OSC_OUT/RCC_OSC_OUT PH3-BOOT0
R4 10K
U3A MLL1200S TE
+3V3
BOOT=0 Default position, connected to GND
BOOT=1 Connected to 3.3V
GND

Analog section

+3V3 +3V3
C21 1u
FB2 MMZ2012Y152BTD25
C22 1u
U5 ADS1115IDGS
+3V3
R12 10K
ADC_ALERT
J3 Conn_01x04_Male
+3V3
FSR04 sensor x3
R7 100K R8 100K R9 100K
VDD ALERT/RDY AIN0 SCL AIN1 SDA AIN2 ADDR AIN3 GND
I2C_SCL I2C_SDA
R13 10K
FB3 MMZ2012Y152BT000
GND

Pinout section

J2 Conn_01x03_Male
SPI_MOSI SPI_MISO SPI_SCK

ST-Link

J4 Conn_01x05_Male
NRST SYS_JTMS-SWDIO SYS_JTCK-SWCLK SYS_JTDO-SWO
GND

For DEBUGGING ONLY
These pins are not necessary
just in case MCU comes without
DFU firmware (allows USB programming)
3.3V and GND are in Analog section