Power

File: Power.kicad_sch

Microcontroller

File: Microcontroller.kicad_sch

USB

File: USB.kicad_sch

microSD

File: microSD.kicad_sch

Sensors

File: Sensors.kicad_sch

Miscellaneous

File: Miscellaneous.kicad_sch

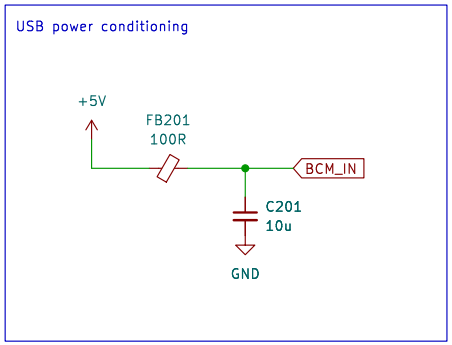
John Antolik

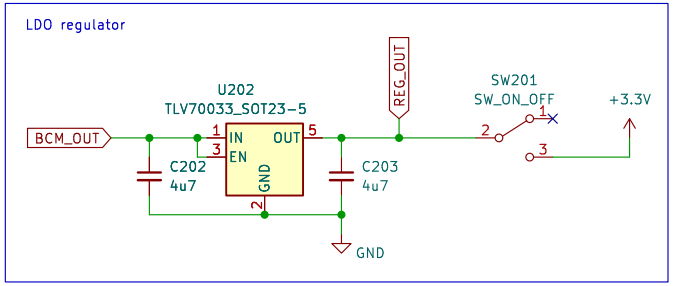
Sheet: /

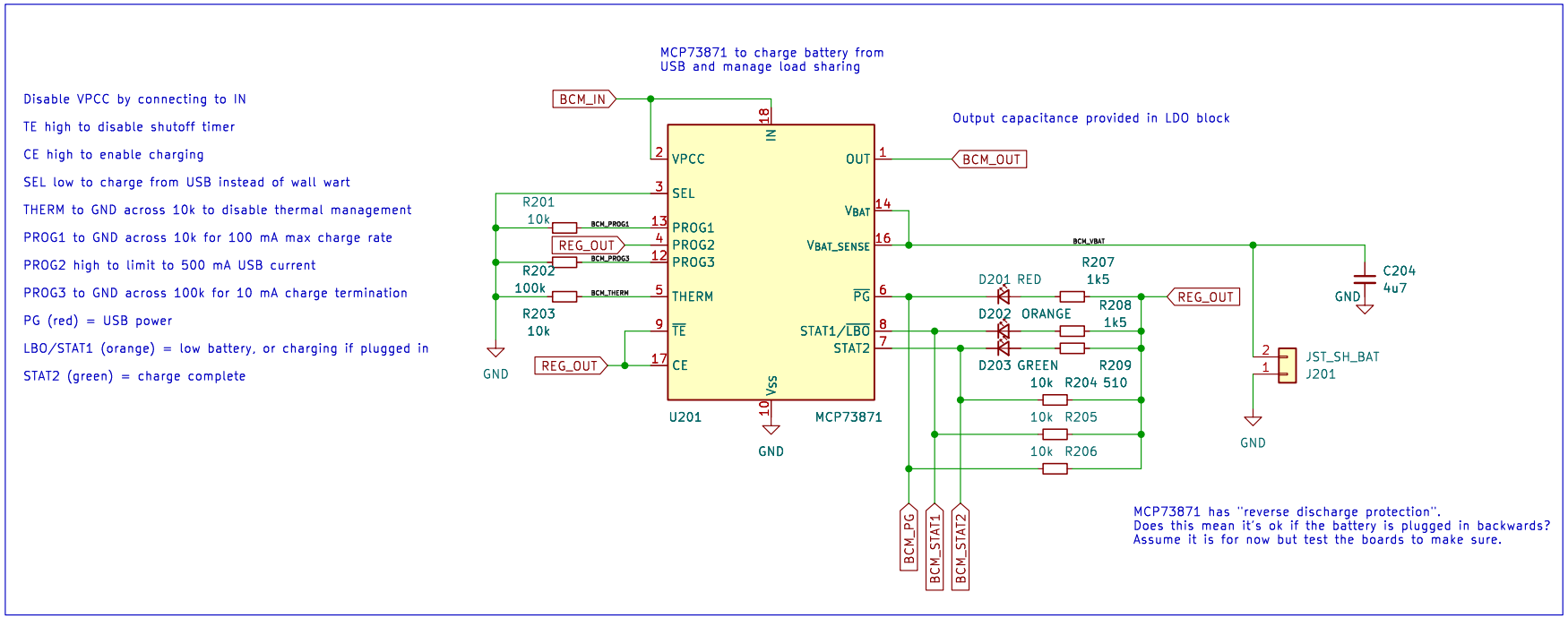
File: IMpack.kicad_sch

Title: IMpack

Size: A	Date: 2023-12-14	**Rev: 1.0**
KiCad E.D.A. 8.0.4		Id: 1/7







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+3.3V

One 100n decoupling cap per VDD pin, close to pin

C301 10u C302 100n C304 100n C306 100n C307 100n C308 100n

10u bulk decoupling, close to microcontroller

GND

Extra filtering for analog supply

+3.3V L301 39n +3.3VA

C309 1u C310 10n

GND

Leave in run mode and program with SWD.
Solder jumper option to set boot mode

JP301 BOOT0

BOOT0 1 2 +3.3V Boot mode

R303 10k

GND Run mode

External crystal oscillator (refer to AN2867 by ST)

HSE_IN HSE_OUT

Y301 16MHz

R304 47 Resistor prevents overdriving crystal (noise)

C311 12p C313 12p

GND

C_load = 2 * (C_load,crystal − C_stray)
= 2 * (12 pf − ~6 pf)

Microcontroller design based on: https://github.com/pms67/STM32F4-Reference-PCB
and: https://github.com/pms67/BluePhil

+3.3V +3.3VA

U301

SWD_NRST NRST 7
BOOT0 BOOT0 60
HSE_IN PH0 5
HSE_OUT PH1 6
SD_SDIO_CMD PD2 54

VBAT 1
VDD 19
VDD 32
VDD 48
VDD 64
VDD 13
VDDA 13

PA0 14 ADXL37x_INT2
PA1 15 ADXL37x_NSS
PA2 16
PA3 17 IIS3DWB_INT2
PA4 20 SPI1_NSS
PA5 21 SPI1_SCLK
PA6 22 SPI1_MISO
PA7 23 SPI1_MOSI
PA8 41
PA9 42 LED_STATUS
PA10 43 SD_CARD_DETECT
PA11 44 USB_D−
PA12 45 USB_D+
PA13 46 SWD_SWDIO
PA14 49 SWD_SWCLK
PA15 50

PC0 8
PC1 9
PC2 10 SPI2_MISO
PC3 11 SPI2_MOSI
PC4 24 ADXL37x_INT1
PC5 25 LSM6DSx_INT2
PC6 37
PC7 38
PC8 39 SD_SDIO_D0
PC9 40 SD_SDIO_D1
PC10 51 SD_SDIO_D2
PC11 52 SD_SDIO_D3
PC12 53 SD_SDIO_CLK
PC13 2
PC14 3
PC15 4

PB0 26
PB1 27
PB2 28
PB3 55 SWD_SWO
PB4 56 BUTTON
PB5 57 BCM_STAT1
PB6 58 BCM_STAT2
PB7 59 BCM_PG
PB8 61
PB9 62
PB10 29 I2C2_SCL
PB11 30 I2C2_SDA
PB12 33 LSM6DSx_INT1
PB13 34 SPI2_SCLK
PB14 35 IIS3DWB_NSS
PB15 36 IIS3DWB_INT1

VCAP_1 31
VCAP_2 47

Low ESR C303 2u2 C305 2u2

GND GND

VSS 18
VSSA 12

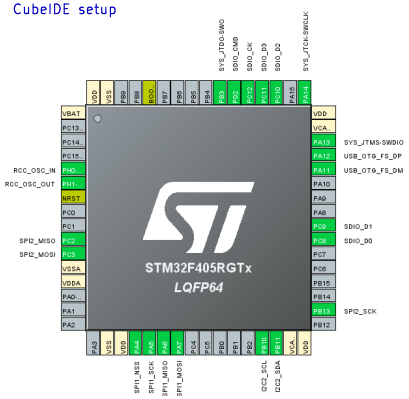
STM32F405RGT6

GND

Picked microcontroller from STM32F4 "foundation" line.
This has higher stock on JLCPCB than F446 and the F407 is not available in 10 mm package.

Can move LED_STATUS, BUTTON, SD_CARD_DETECT and the accelerometer INT and NSS signals to facilitate layout (all just GPIO), also BCM_PG, BCM_STAT1, BCM_STAT2

CubeIDE setup



Button to trigger the accelerometer reading

SW301 BUTTON

BUTTON +3.3V

R302 10k

GND

LED_STATUS

D301 BLUE

R301 1k5 For instance, blinking when armed, on when recording

GND

Debug header

+3.3V

TagConnect_TC2030-NL

Series resistors reduce ringing in high speed lines, place at driving end

D302

VCC 1
RESET 3
SWCLK 4
SWDIO 2
SWO 6
GND 5

SWD_NRST
SWD_SWCLK_PRT R305 22 SWD_SWCLK
SWD_SWDIO_PRT R306 22 SWD_SWDIO
SWD_SWO_PRT R307 22 SWD_SWO

C312 100n

D303 D304 D305 D306 RCLAMP0521P-N

GND GND GND GND GND GND

Capacitor to prevent spurious resets

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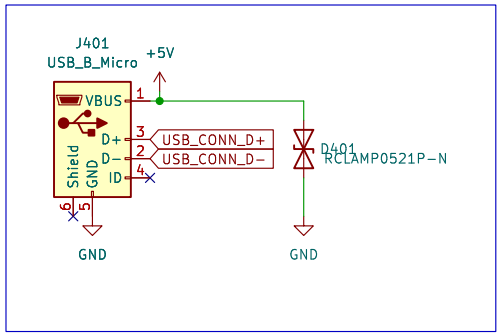

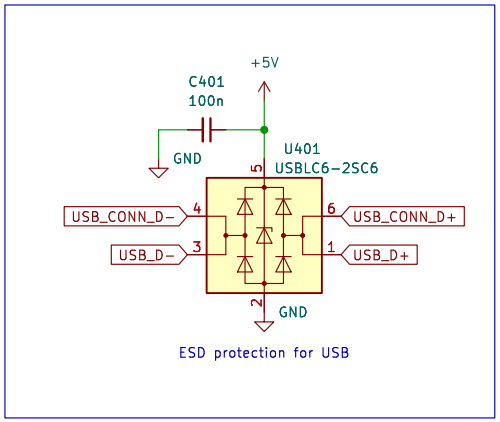

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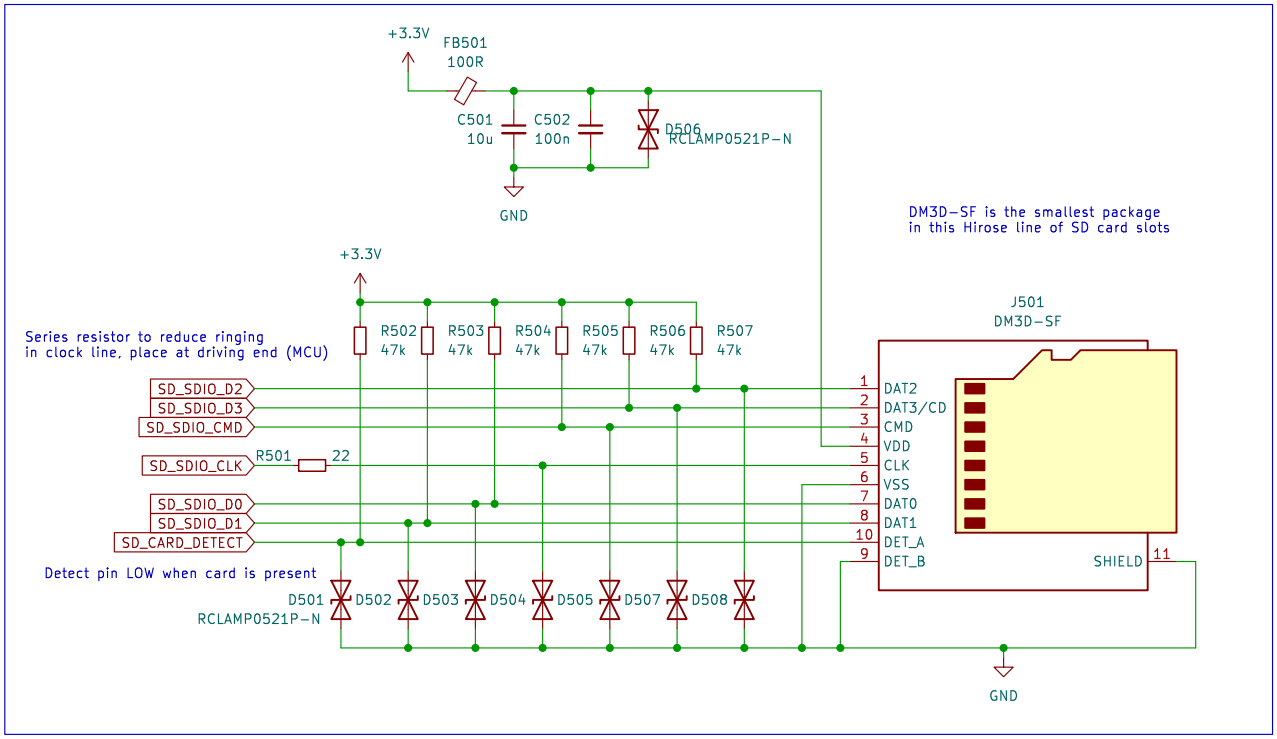

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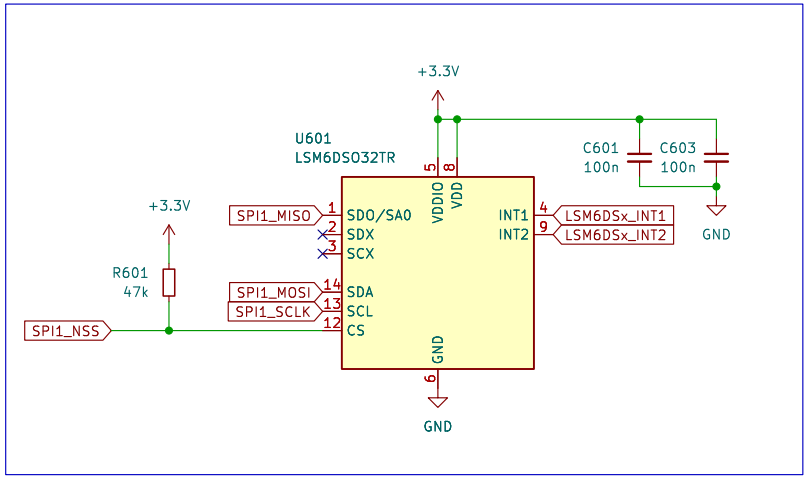

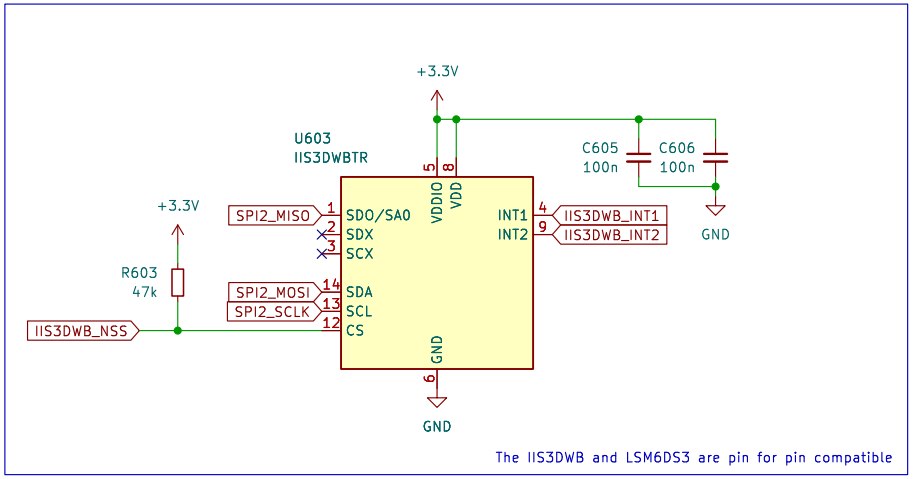

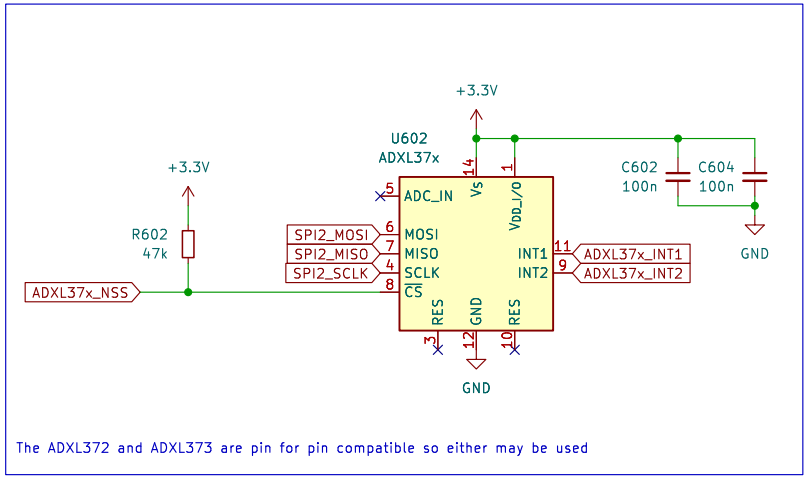

Sensor array:
IIS3DWBTR: >20 kHz sample rate, +/- 16 g range, 14-LGA
ADXL372: +/- 200 g range, 16-LGA
(or ADXL373: +/- 400 g range, 2.5 kHz bandwidth)
LSM6DSx: low cost, 6 kHz sample rate accel. and gyro., 14-LGA

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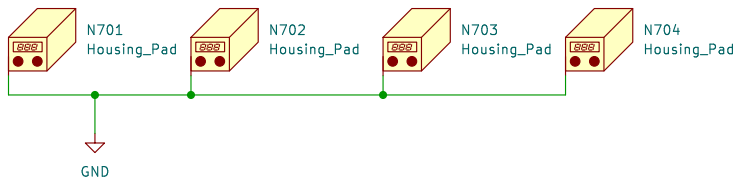
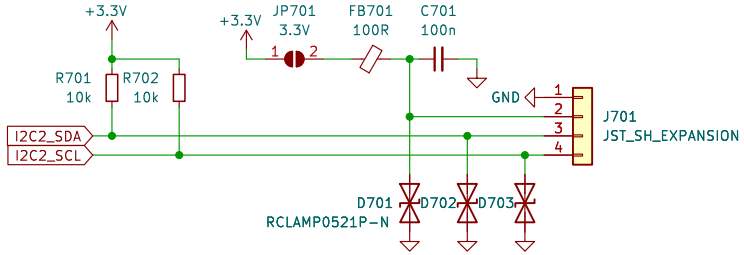
Board outline

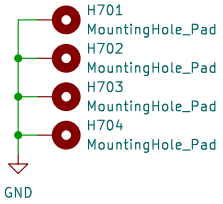


Expansion connector



Using the QWIIC/STEMMA QT JST-SH connector and pinout.
Could also be used as simple GPIO triggers (but no ADC available on these pins)

Mounting holes



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