# PCB #1

### Sensors
File: sensors.kicad_sch

### Connectors
File: io-1.kicad_sch

### User Interface
File: ui.kicad_sch

# PCB #2

### IO
File: io.kicad_sch

### Power
File: power.kicad_sch

### ESP-32
File: esp.kicad_sch

### ZED-F9P
File: zed.kicad_sch

# PCB #3

### PCB-3
File: PCB-3.kicad_sch

## Overview



- WiFi and Bluetooth Antenna Connector
- GNSS Antenna Connector
- OLED 1.5"
- microSD Card Reader
- PCB #1
- PCB #2
- PCB #3
- USB Type-C Connector (Data and Power)
- Battery (LiPo 1S 1Ah)

PCB #1

## LEDs

**Battery LEDs**

C4
+Vin
U19
VDD
GND
LED_PWM/VIN
+3.3V
R? 1MΩ
EN-LED
R? 1MΩ
R? 2MΩ
GND
Q?B BSD235C
Q?A BSD235C
+Vin
LED-PWM_+Vin
R? 2.2kΩ
R? 2.2kΩ
D? Red
D? Yellow
PGOOD
CHG
Power Good
Charge

**ESP / System LEDs**

+3.3V
Replaced w/ AOSN21319 due to availability.
EN-LED
Q? PJC7407_R1
LED-PWM_+3.3V
R? 2.2kΩ
D? Pink
GND
System Power
U? 150060RV75240
KR AR KG AG
R? 2.2kΩ  R? 2.2kΩ
LED-1-RED  LED-1-GRN
LED-1
U? 150060RV75240
KR AR KG AG
R? 2.2kΩ  R? 2.2kΩ
LED-2-RED  LED-2-GRN
LED-2

**GNSS Status LEDs**

D? Blue
D? Green
D? Iceblue
R? 2.2kΩ  R? 2.2kΩ  R? 2.2kΩ
GNSS-RTK-LED  GNSS-Fence-LED  GNSS-PPS-LED
RTK  Geofence  PPS

## 12V Step Up (for OLED)

L? 10µH LPS4018-103MRB
+3.3V
U? TLV61046ADB
VI  SW
EN  VOUT
GND  FB
+12V
50mA
C? 47µF
C? 10µF
R? 1MΩ
R? 71.5kΩ
C? 10µF
GND
Capacitors:
10µF: GRJ155R60J106ME11D

## Nav Switch

+3.3V
R? 4.7kΩ  R? 47kΩ  NAV-C-BUF  C? 1µF
R? 4.7kΩ  R? 47kΩ  NAV-SW-BUF  C? 1µF
R? 4.7kΩ  R? 47kΩ  NAV-A-BUF  C? 1µF
R? 4.7kΩ  R? 47kΩ  NAV-B-BUF  C? 1µF
R? 4.7kΩ  R? 47kΩ  NAV-D-BUF  C? 1µF

D? 5.5V
D? 5.5V
D? 5.5V
GND

U? NavigationSwitch_JS1400
A  B
COM
C  D
SHELL  SH
GND

D? 5.5V  D? 5.5V
GND  GND

C? 100nF  +3.3V
GND
U? 74AHCV17A
NAV-C-BUF  1A  VCC  1Y  NAV-C
NAV-D-BUF  2A       2Y  NAV-D
NAV-B-BUF  3A       3Y  NAV-B
NAV-A-BUF  4A       4Y  NAV-A
NAV-SW-BUF 5A       5Y  NAV-B
           6A  GND  6Y  NAV-SW
GND

Hardware debouncing with Schmitt-Trigger because ESP's interrupts are cursed.

https://github.com/espressif/arduino-esp32/issues/4172

Diodes: ST ESDA7P120-1U1M

## 1.5'' OLED Screen

U? OLED-1.5-SSD1327
SPI4  I2C
VSPI_CLK  D0  SCLK  SCL  VCC
VSPI_MOSI D1  SDIN  SDA
          D2  NC    SDA
          D3  0  0
          D4  0  0
          D5  0  0
          D6  0  0
          D7  0  0
+3.3V
R? 10kΩ
OLED_CS   CS
OLED_RESET RES
OLED_DC   D/C
          R/W
          E/RD
BS1  0  1
BS2  0  0
R? 910kΩ
Iref
GPIO
VCI
VDO
VCOMH
VSS

+12V
C? 4.7µF  C? 4.7µF  C? 100nF  C? 100nF  C? 47pF  C? 47pF
GND

+3.3V
C? 1µF  C? 1µF
GND

C? 4.7µF
GND

GND  GND

GND

Sheet: /User Interface/
File: ui.kicad_sch
**Title: GNSS**
Size: A3    Date:
KiCad E.D.A. eeschema (6.0.4-0)
Rev: B
Id: 2/9

# ISM330 IMU (6 DoF)

i²c: 0x6A

C? 100nF  
C? 100nF  
GND  +3.3V  GND

SCL-2  SCL  
SDA-2  SDA  
VDD  VDDIO  
INT1  ISM-INT1  
INT2  ISM-INT2  
SCx  
SDx  GND  
GND  SDO/SA0  SDO_Aux  
+3.3V  CS  OCS_Aux  
GND  
U?  
ISM330DHCXTR

# BMM150 Magnetometer (3 DoF)

i²c: 0x10

C? 100nF  
C? 100nF  
GND  +3.3V  GND

SDA-2  SDI  VDDIO  VDD  DRDY  BMM-DRDY  
SDO  INT  BMM-INT  
SCL-2  SCK  
CSB  PS  +3.3V  
GND  GND  
U?  
BMM150

# DPS310 Pressure Sensor (1 DoF)

i²c: 0x77

+3.3V  
DPS?  
DPS310  
C? 100nF  
C? 100nF  
VDD  SDO  DPS-INT  
VDDIO  SDI  SDA-2  
SCK  SCL-2  
GND  CSB  
GND  

bosch?

# I2C Pullups

+3.3V  +3.3V  
R? 4.7kΩ (DNP)  
R? 4.7kΩ (DNP)  
SDA-2  
SCL-2

# i²c Port Expander

i²c: 0x22

C? 100nF  +3.3V  
GND  
U?  
MCP23017_ML

SDA-2  SDA  VDD  GPB0  LED-1-GRN  
SCL-2  SCK  GPB1  Spare TP?  
GPB2  
GPB3  Spare TP?  
+3.3V  GPB4  
GPB5  Spare TP?  
GPB6  
R? 10kΩ  R? 10kΩ  R? 10kΩ  GPB7  SD-SW  Spare TP?  
MCP-INT2  
INTB  GPA0  ISM-INT2  Spare TP?  
MCP-INT  INTA  GPA1  ISM-INT1  
MCP-RESET  GPA2  BMM-DRDY  Spare TP?  
RESET  GPA3  BMM-INT  
GPA4  DPS-INT  
A2  GPA5  LED-2-RED  
A1  GPA6  LED-2-GRN  
A0  EP  VSS  GPA7  LED-1-RED  
GND

# Wheel Tick / Direction Input

J?  
JST SH 2  
R? 3.3kΩ  R? 470Ω  
C? 1nF  D? BZX84 5.6V  
U? 141352145000  
DIR-A  
DIR-K  
+3.3V  +3.3V  
R? 910Ω  
C? 100nF  GND  
C? 22nF  GND  GND  
WT-IN  
U?  
SN74AUP1G17DBVR  
GND

J?  
JST SH 2  
R? 3.3kΩ  R? 470Ω  
C? 1nF  D? BZX84 5.6V  
U? 141352145000  
WT-A  
WT-K  
+3.3V  +3.3V  
R? 910Ω  
C? 100nF  GND  
C? 22nF  GND  GND  
DIR-IN  
U?  
SN74AUP1G17DBVR  
GND

Sheet: /Sensors/  
File: sensors.kicad_sch  
Title: GNSS  
Size: A3  Date:  Rev: B  
KiCad E.D.A. eeschema (6.0.4-0)  Id: 3/9

# ZED-UART2-Breakout

+3.3V

JP?
Jumper_2_Open

U?
MAX22246CAWA+

C? 100nF
GND

C? 100nF
GND2

VCCA | VCCB
OUT1 | IN1
IN2 | OUT2
GNDA | GNDB

ZED-RX-2
ZED-TX-2

GND

GND2

GND2

ZED UART 2
J?

ZED-RX-2-ISO
ZED-TX-2-ISO

JP?
Jumper_2_Open

GND | GND2

U?
SR05.TCT

GND2

FTDI-compatible UART I/O.
Voltage has to be provided by the
secondary device (1.71 V - 5.5 V).

The pinout is flipped because the
header is mounted upside down.

# I²C-Breakout

+3.3V

JP?
Jumper_2_Open

C? 1µF

U?
ISO1541

C? 100nF
GND

C? 100nF

VCC1 | VCC2
SDA1 | SDA2
SCL1 | SCL2
GND1 | GND2

SDA-2
SCL-2

GND

GND3

GND3

VDD-ISO

SCL-2-ISO
SDA-2-ISO
VCC-I2C-ISO

R? 1.5kΩ | R? 1.5kΩ

GND

J?
JST SH 4P.

GND3

VCC* ≤ 2.5 V
=> Lockout mode:
I/O in Hi-Z.

JP?
Jumper_2_Open

GND | GND3

U?
SR05.TCT

GND3

qwiic- and STEMMA-QT-compatible.
However, the secondary device has
to provide power (3 V ... 5.5 V)
unless jumpers are populated.

# microSD Card Slot

C? 1µF
+3.3V

GND

J?
microSD-Card-CTF-11081-P

VDD
DAT2/RSV
DAT3/CS
CMD/DI
CLK
DAT0/DO
DAT1/RSV
Card_Det
VSS
SHIELD

SD_CS
VSPI_MOSI
VSPI_CLK
VSPI_MISO

+3.3V

R? 4.7kΩ

SD-SW

GND

GND

SH

GND

+3.3V

U?
SRV05-4

IO1 | IO3
IO2 | IO4

VIN

GND

# Flat Flex Connector

Used for connection between boards #1 and #2

+3.3V    +3.3V

J?
FFC

GND
GNSS-Fence-LED
GNSS-PPS-LED
GNSS-RTK-LED
ZED-TX-2
GND

ZED-RX-2

GND

TP?
Spare

CHG
PGOOD

For BQ25075's LEDs. +Vin

GND

SDA-2
LED_PWM/VIN
NAV-B
NAV-SW
NAV-A
NAV-D
VSPI_MOSI
SD_CS
OLED_CS
VSPI_CLK
MCP-INT
WT-IN
DIR-IN
OLED_DC
OLED_RESET
VSPI_MISO
SCL-2
NAV-C

GND

Sheet: /Connectors/
File: io-1.kicad_sch

Title: GNSS

Size: A3 | Date:
KiCad E.D.A.  eeschema (6.0.4-0)

Rev: B
Id: 4/9

H? M2
H? M2
H? M2
H? M2

H? M3
H? M3
H? M3
H? M3

GND

PCB #2

## USB-C Connector
### 5V 0.5A legacy mode

J2
USB_C_Receptacle_USB2.0_C393939

VBUS
R20  5.1kΩ
R21  5.1kΩ
GND
U1
SR05.TCT
USB-IN-DN
USB-IN-DP
GND

## FTDI for ESP32

+3.3V
C40 100nF
C42 4.7µF
GND  GND
U20
FT231XQ
3V30UT
VCC
VCCIO
TXD
RXD
RTS
CTS
DTR
DSR
DCD
RI
USBDM
USBDP
RESET
CBUS0
CBUS1
CBUS2
CBUS3
GND GND GND
R22 27Ω
R23 27Ω
FTDI-ESP_USB-DN
FTDI-ESP_USB-DP
TP14 ESP-RX
TP15 ESP-TX
ESP-RX
ESP-TX
FTDI-ESP-RXLED
FTDI-ESP-TXLED
VBUS
R57 4.7k (DNP)
FT-VBUSSENS
R58 10kΩ (DNP)
GND
PRGM
TP2
GPIO0
Q1A
UMH4NFHATN
Q1B
UMH4NFHATN
ESP-EN
RESET
TP1

The VBUS-sense option is not really needed with the used hub.

GND

## USB2514B HUB
### Could be replaced with USB2513

+3.3V
C5 100nF
C17 100nF
C24 100nF
C26 100nF
GND
C23 100nF
C25 100nF
C27 4,7µF
GND
U2
USB2514B_Bi
VBUS
TP3 VBUS_Det
+VUSB_Det
R6 100kΩ
R7 100kΩ
C45 100nF
+3.3V
TP9 Reset-Hub
R39 100kΩ
C4 100nF
GND  GND
R1 12.0kΩ
Y1 24MHz
C1 18pF
C2 18pF
C19 100nF
C21 100nF
GND GND GND GND
+3.3V  +3.3V
R5 100kΩ
R8 100kΩ
GND  GND
R40 100kΩ
R41 100kΩ
GND GND

VDDA33 VDDA33 VDDA33 VDDA33 VDD33 VDD33
VBUS_DET
USBDM_UP
USBDP_UP
RESET_N
TEST
RBIAS
XTALIN/CLKIN
XTALOUT
PLLFILT
CRFILT
SCL/SMBCLK/CFG_SEL0
SDA/SMBDATA/NON_REM1
SUSP_IND/LOCAL_PWR/NON_REM0
HS_IND/CFG_SEL1
VSS

USBDM_DN1/PRT_DIS_M1
USBDP_DN1/PRT_DIS_P1
PRTPWR1/BC_EN1
OCS_N1
USBDM_DN2/PRT_DIS_M2
USBDP_DN2/PRT_DIS_P2
PRTPWR2/BC_EN2
OCS_N2
USBDM_DN3/PRT_DIS_M3
USBDP_DN3/PRT_DIS_P3
PRTPWR3/BC_EN3
OCS_N3
USBDM_DN4/PRT_DIS_M4
USBDP_DN4/PRT_DIS_P4
PRTPWR4/BC_EN4
OCS_N4

ZED-USB-DN
ZED-USB-DP
FTDI-ZED_USB-DN
FTDI-ZED_USB-DP
FTDI-ESP_USB-DN
FTDI-ESP_USB-DP
R42 10kΩ  +3.3V
R37 10kΩ
USB-IN-DN
USB-IN-DP
GND

Quite some massive caps for the tiny crystal. But works.

The hub is configured as self-powered, however current is drawn from the bus. This might violate the USB standard but should work.
CFG_SEL[1:0] = 00: Strap options enabled, self-powered
CFG_SEL[1:0] = 10: Strap options enabled, bus-powered

NON_REM[1:0] = 00: All ports are removable.
NON_REM[1:0] = 11: (when available) ports 1, 2, and 3 are non-removable

Low-Side-Resistors: 100kΩ; High-Side-Resistors: 10kΩ

## FTDI for ZED-F9P

+3.3V
C41 100nF
C43 4.7µF
GND  GND
U9
FT231XQ
3V30UT
VCC
VCCIO
TXD
RXD
RTS
CTS
DTR
DSR
DCD
RI
USBDM
USBDP
RESET
CBUS0
CBUS1
CBUS2
CBUS3
GND GND GND
R49 27Ω
R50 27Ω
FTDI-ZED_USB-DN
FTDI-ZED_USB-DP
TP11 ZED-RX
TP12 ZED-TX
ZED-RX-1
ZED-TX-1
R55 0Ω (DNP)
R56 0Ω (DNP)
ZED-RESET
ZED-SAFEBOOT
FTDI-ZED-RXLED
FTDI-ZED-TXLED
R59 0Ω (DNP)
FT-VBUSSENS
GND

## TX/RX-LEDs for FTDIs

R51 4.7kΩ
R52 4.7kΩ
U3
150060RV75240
R53 4.7kΩ
R54 4.7kΩ
U19
150060RV75240
+3.3V
FTDI-ESP-RXLED
FTDI-ESP-TXLED
FTDI-ZED-RXLED
FTDI-ZED-TXLED

SMT-Spacers for stackup
J?  SMT Threaded Spacer
J?  SMT Threaded Spacer
J?  SMT Threaded Spacer
GND
H? M3
H? M3
H? M3
H? M3

# Schematic: GNSS Power

## 3.3V Discharge Protection and Battery Disconnect circuit

VBAT

If battery's UVLO does indeed kick in (which it should not), the pullup voltage could also be sourced from USB.

R38 0Ω
V_PULLUP

D4 BAT54CW.115

R19 1MΩ

R11 1MΩ

PGOOD

Q2B BSD235C

R32 10kΩ

C10 1µF
GND

U7 NCP302LSN33T1G
Input  Reset/out
GND  CD

R12 1MΩ

R18 1MΩ (DNP)

Q2A BSD235C

GND

TP6

$V_{Det-}$: 3.3 V
$V_{Hys}$: 0.165 V
Active Low

GND

3.3V cutoff should effectively remove only very little of the battery's capacity. However a 3.2V Supervisor could be a better choice considering the relatively linear discharge curve in the voltage range.

## LiIon Chager & Powerpath Manager

VBUS

C44 1µF
GND

Capacitors:
10µF: Murata GRM188R61E106MA73D
22µF: Murata GRM188R61A226ME15D

+Vin

SYSOFF

U10 BQ24075RGT
SYSOFF  IN
OUT
CE  CE
TMR  TMR  BAT
EN1  EN1
EN2  EN2  TS
ILIM  ILIM
ISET  VSS  PGOOD  CHG

VBAT

C46 22µF
GND

C47 10µF
GND

TS-PowerManager

PGOOD
CHG

GND

TP6 I$_{CH}$

+Vin R24 0Ω EN1
GND
R25 0Ω EN2
GND

I$_{in,max}$=500mA

R26 0Ω
CE

R33 DNP
TMR

R34 1.7kΩ
ILIM

R45 1.2kΩ
ISET

GND

Safety timer
$R_{TMR}$ = $t_{MAXCHG}$ / (480 s/kΩ)
Left open for 30' precharge and 5h charge time.
Timer is reset by toggling $\overline{CE}$.

Input Current Limit
$R_{ILIM}$ = 1550 AΩ/I$_{I,MAX}$
Set to 912 mA (- USB 3.0)

Charge Current Limit
$R_{ISET}$ = 890 AΩ/I$_{CHG}$
Set to -742 mA

The input current setting determined by ENx overwrites the selection of ILIM and ISET.

## LiIon Fuel Gauge

D2 ESDA7P120-1U1M

J6 JST PH S2B
BAT

POLARITY IS NOT CONSISTENT AMONG THOSE LIPOS!

GND GND

R44 10mΩ

U12 BQ27441-G1
BAT  VDD
SRP  GPOUT
SRN  BIN
PAD  SCL
VSS  SDA

C29 1µF
GND

C30 0.47µF
GND

+3.3V  +3.3V  +3.3V

R46 5.1kΩ  R47 5.1kΩ  R48 5.1kΩ

TS-FuelGauge

BQ-GPOUT
SCL-2
SDA-2

R35 1MΩ  R36 1MΩ
GND  GND

i2c: 0x55

TH2 10kΩ
TS-FuelGauge

TH1 10kΩ
TS-PowerManager

GND

The BIN function seems to be completely unnecessary as the BQ27441 is not being powered when there's no battery attached. Thus, the pin is just always being pulled low. If the BI-feature is needed, it can be added in Software.

TDK NTCG103JF103FT1
R = 10k Ω B = 3435 K
should allow for 0-50°C

## 3.3V Buck Converter

+Vin

U4 TLV62568DDBV
VIN  SW
EN  FB

L2 2.2µH

+3.3V

TP17 3.3V

C6 4.7µF
GND

C51 100nF

R13 453kΩ

C7 6.8pF

C8 22µF
GND

C9 10µF
GND

R29 100kΩ
GND

TP16 TLV EN

+Vin

SW1 PWR SW

R10 10kΩ

U21 SN74LVC1G17DBVRG4

C3 1µF
GND

GND

Capacitors:
10µF: Murata GRM188R61E106MA73D
22µF: Murata GRM188R61A226ME15D

## ZED LDO Converter

+Vin  +3.3V

U15 NCV8705ML33TCG
IN  OUT
EN  GND

+3.3V_ZED

C34 22µF
GND

C35 22µF
GND

Capacitors:
22µF: Murata GRM188R61A226ME15D

## RTC LDO Converter

R30 100kΩ (DNP)

+Vin

U16 MIC5206-3.3YM5-TR
VIN  OUT
EN  GND  FLAG

V_RTC

C36 1µF
GND

C37 330nF
GND

## ZED USB Power Switch

+VUSB_Det
+3.3V_ZED

U14 TCK111G
VIN  VOUT
VIN  VOUT
CTRL  GND

+V_USB

C32 1µF
GND

C12 1µF
GND

Sheet: /Power/
File: power.kicad_sch

**Title: GNSS**

Size: A3   Date:
KiCad E.D.A.  eeschema (6.0.4-0)

Rev: B
Id: 6/9

# ESP32 MCU

C22
4.7µF
+3.3V
GND

U8
NINA-W101

J11
SMA (WiFi)
Normal Non-RP-SMA Connector
('Standard' for WiFi would be RP).

D1
WE femtoF

GND

| Function | ESP-IO | | | |
|---|---|---|---|---|
| | 23 | VSPI_MOSI | 1 | GPIO_1/SPI_V_MOSI |
| Input only. | 34 | NAV-D | 2 | GPI_2/ADC_2 |
| Input only. | 39 | NAV-A | 3 | GPI_3/ADC_3 |
| Input only. | 36 | NAV-SW | 4 | GPI_4/ADC_4 |
| | 32 | NAV-B | 5 | GPIO_5 |
| | 33 | LEDs-PWM | 7 | LP0_IN |
| | 21 | SDA-2 | 8 | GPIO_8/RMII_TXEN/SPI_V_HD |
| | 25 | NAV-C | 16 | GPIO_16/RMII_RXD0/DAC_16 |
| | 26 | SDA-1 | 17 | GPIO_17/RMII_RXD1/DAC_17 |
| | 27 | SCL-1 | 18 | GPIO_18/RMII_CRSDV |
| | 22 | SCL-2 | 20 | GPIO_20/UART_RTS/RMII_TXD1/SPI_V_WP |
| | 19 | VSPI_MISO | 21 | GPIO_21/UART_CTS/RMII_TXD0/SPI_V_MISO |
| | 1 | ESP-TX | 22 | GPIO_22/UART_TXD |
| | 3 | ESP-RX | 23 | GPIO_23/UART_RXD |
| | 4 | OLED_RESET | 24 | GPIO_24/RMII_MDIO |
| Booting Mode: Low / Floating. | 2 | OLED_DC | 25 | RMII_MDCLK |
| Low during startup for firmware download. | 0 | GPIO0 | 27 | RMII_CLK/SYS_BOOT |

The input voltage can be measured through the voltage level network of the LED mosfets. However, the voltage divider is too high of a value to deliver a stable signal without a cap.

C18
22nF (DNP)
LEDs-PWM
GND

| | | | |
|---|---|---|---|
| ANT | 13 | | |
| GPIO_28/SPI_V_CS | 28 | MCP-INT | |
| GPIO_29/SPI_V_CLK | 29 | VSPI_CLK | |
| GPIO_31/JTAG_TMS | 31 | SD_CS | |
| LOG_BOOT/JTAG_TDO | 32 | OLED_CS | |
| | 33 | RSVD33 | |
| GPI_34/ADC_34 | 34 | WT-IN | |
| GPI_35/JTAG_CLK | 35 | BQ-GPOUT | |
| GPIO_36/JTAG_TDI | 36 | DIR-IN | |
| RESET_N | 19 | ESP-EN | |
| RSVD11 | 11 | | |
| RSVD15 | 15 | | |

| ESP-IO | Function |
|---|---|
| 5 | Debug Printouts: High / Floating. |
| 18 | |
| 14 | |
| 15 | Debug Printouts: High / Floating. |
| 35 | Input only. |
| 13 | |
| 12 | Internal flash voltage: High / Floating (this module: 1.8V). |

GND

Strapping Pins: https://docs.espressif.com/projects/esptool/en/latest/esp32/advanced-topics/boot-mode-selection.html
Integration Manual: https://www.u-blox.com/sites/default/files/NINA-W1_SIM_UBX-17005730.pdf

# Flat Flex Connector

J1
FFC
+3.3V          +3.3V

| | | | | |
|---|---|---|---|---|
| GND | 3 | | 1 2 | SDA-2 |
| | 5 | | 4 | LEDs-PWM |
| GNSS-Fence-LED | 7 | | 6 8 | NAV-B |
| GNSS-PPS-LED | 9 | | 10 | NAV-SW |
| GNSS-RTK-LED | 11 | | 12 | NAV-A |
| ZED-TX-2 | 13 | | 14 | NAV-D |
| GND | 15 | | 16 | VSPI_MOSI |
| | 17 | | 18 | SD_CS |
| ZED-RX-2 | 19 | | 20 | OLED_CS |
| GND | 21 23 | | 22 | VSPI_CLK |
| TP4 Spare | 25 | | 24 | MCP-INT |
| CHG | 27 | | 26 | WT-IN |
| PGOOD | 29 | | 28 | DIR-IN |
| For BQ25075's LEDs. +Vin | 31 | | 30 | OLED_DC |
| | 33 | | 32 | OLED_RESET |
| GND | 35 37 | | 34 | VSPI_MISO |
| | 39 | | 36 | SCL-2 |
| | | | 38 | NAV-C |

MP1
GND

# INPUT ISOLATION

## USB Isolator

C11 100nF
+3.3V

GND

U11 PI3USB4002AQ
- VDD 10
- 2 L0- C0- 7 ZED-USB-DN
- ZED-USB-BUF-DN
- ZED-USB-BUF-DP 1 L0+ C0+ 8 ZED-USB-DP
- 6 REF EN 9
- GND 5

TP8 EN-ZED-IO

R14 10kΩ

C28 1µF 25V
GND

GND

## I/O Isolator

C48 100nF +3.3V

GND

U17 74CBTLV3306GTX
- VCC 8
- 1OE 1
- GNSS-RTK-BUF 3 1B 1A 2 ZED-RTK
- 2OE 7
- ZED-GEOFENCE 6 2B 2A 5 GNSS-GEOFENCE-BUF
- GND 4

GND

C49 100nF +3.3V

GND

U18 74CBTLV3306GTX
- VCC 8
- 1OE 1
- ZED-TX-2-BUF 3 1B 1A 2 ZED-TX-2
- 2OE 7
- ZED-RX-2 6 2B 2A 5 ZED-RX-2-BUF
- GND 4

GND

C50 100nF +3.3V

GND

U5 74CBTLV3244BQ.115
- VCC 20
- ZED-TIMEPULSE 18 1B1 1A1 2 GNSS-TIMEPULSE-BUF
- ZED-SAFEBOOT 16 1B2 1A2 4 GNSS-SAFEBOOT-BUF
- SCL-1 14 1B3 1A3 6 SCL-1-BUF
- ZED-RX-1 12 1B4 1A4 8 ZED-RX-1-BUF
- 1OE 1
- ZED-TX-1-BUF 9 2B1 2A1 11 ZED-TX-1
- SDA-1-BUF 7 2B2 2A2 13 SDA-1
- GNSS-RESET-BUF 5 2B3 2A3 15 ZED-RESET
- GNSS-INT-BUF 3 2B4 2A4 17 ZED-INT
- 2OE 19 EN-ZED-IO
- GND 10

I/O

ZED

ZED

I/O

GND

+3.3V R3 100kΩ

C38 4.7µF (DNP)
C39 4.7µF
R60 1MΩ

Q4 AO3400A

GNDGND GND GND

~.5 sec of delay

## LED Driver

C31 +3.3V 100nF

GND

U13 SN74LVC3G07YZPR
- VCC A2
- ZED-TIMEPULSE A1 B2 GNSS-PPS-LED
- ZED-RTK C1 C2 GNSS-RTK-LED
- ZED-GEOFENCE C2 B1 GNSS-Fence-LED
- GND D1

GND

TP7 Safeboot
R16 22Ω
GNSS_Safeboot-TP ZED-SAFEBOOT

TP5 EXTINT
R43 22Ω
GNSS_EXTINT-TP ZED-INT

TP10 Reset-F9P
R31 22Ω
GNSS_Reset-TP ZED-RESET
RESET triggers cold start!

TP13 GND
GND

GND

# FILTERING

FL1 NFL18ST207X1C3B
ZED-TX-1-BUF ZED-TX-1-RAW
GND

FL6 NFL18ST207X1C3B
ZED-RX-1-BUF ZED-RX-1-RAW
GND

FL2 NFL18ST207X1C3B
ZED-TX-2-BUF ZED-TX-2-RAW
GND

FL7 NFL18ST207X1C3B
ZED-RX-2-BUF ZED-RX-2-RAW
GND

FL3 NFL18ST207X1C3B
SDA-1-BUF SDA-1-RAW
GND

FL8 NFL18ST207X1C3B
SCL-1-BUF SCL-1-RAW
GND

FL4 NFL18ST207X1C3B
GNSS-INT-BUF GNSS-INT-RAW
GND

FL9 NFL18ST207X1C3B
GNSS-SAFEBOOT-BUF GNSS-SAFEBOOT-RAW
GND

FL5 NFL18ST207X1C3B
GNSS-RESET-BUF GNSS-RESET-RAW
GND

FL11 NFL18ST207X1C3B
GNSS-TIMEPULSE-BUF GNSS-TIMEPULSE-RAW
GND

FL10 NFL18ST207X1C3B
GNSS-RTK-BUF GNSS-RTK-RAW
GND

FL12 NFL18ST207X1C3B
GNSS-GEOFENCE-BUF GNSS-GEOFENCE-RAW
GND

# ZED-F9P GNSS Receiver

R15 100kΩ
+V_USB

C13 1µF

C16 2.2µF
V_RTC

C14 1µF
+3.3V_ZED

GND

U6 ZED-F9P
- 34 USB_DM VCC
- 36 V_BCKP
- 38 V_USB
- 35 VCC_RF
- 39 USB_DM
- 40 USB_DP
- 42 TXD/SPI_MISO ANT_OFF 4
- 43 RXD/SPI_MOSI ANT_DETECT 5
- ANT_SHORT 6
- 27 TXD2
- 26 RXD2 RF_IN 2
- 44 SDA/SPI_CS
- 45 SCL/SPI_CLK
- 51 EXTINT TIMEPULSE 3
- RTK_STAT 20
- 50 SAFEBOOT GEOFENCE_STAT 19
- 49 RESET TX_READY 46
- 47 D_SEL
- 48 GND

ZED-USB-BUF-DN R2 27Ω GNSS-USB_R-DN
ZED-USB-BUF-DP R4 27Ω GNSS-USB_R-DP
ZED-TX-1-RAW
ZED-RX-1-RAW
ZED-TX-2-RAW
ZED-RX-2-RAW
SDA-1-RAW
SCL-1-RAW
GNSS-INT-RAW
GNSS-SAFEBOOT-RAW
GNSS-RESET-RAW
GNSS_VRF_RAW
Timepulse

GND

Limit current to ~70mA

R27 10Ω
Q3B MBT3906DW1
C33 100nF
GND

C15 1µF
R17 220Ω
Q3A MBT3906DW1
R28 2.2kΩ
GNSS_VRF
L1 47nH LQG15HS47NJ02D

GNSS_RF
RF_IN

J3 SMA (GNSS)
D3 WE femtoF
GND GND

R9 0Ω
J5 U.FL
D7 WE femtoF
GND GND

GNSS-TIMEPULSE-RAW
GNSS-RTK-RAW
GNSS-GEOFENCE-RAW

Integration Manual: https://www.u-blox.com/sites/default/files/ZED-F9P_IntegrationManual_UBX-18010802.pdf
Datasheet: https://www.u-blox.com/sites/default/files/ZED-F9P-04B_DataSheet_UBX-21044850.pdf

Sheet: /ZED-F9P/
File: zed.kicad_sch

**Title: GNSS**

Size: A3 | Date: | Rev: B
KiCad E.D.A. eeschema (6.0.4-0) | Id: 8/9

PCB #3

H1
M3

H2
M3

H3
M3

H4
M3

1  J1
   SMT Threaded Spacer

1  J2
   SMT Threaded Spacer

1  J3
   SMT Threaded Spacer

GND