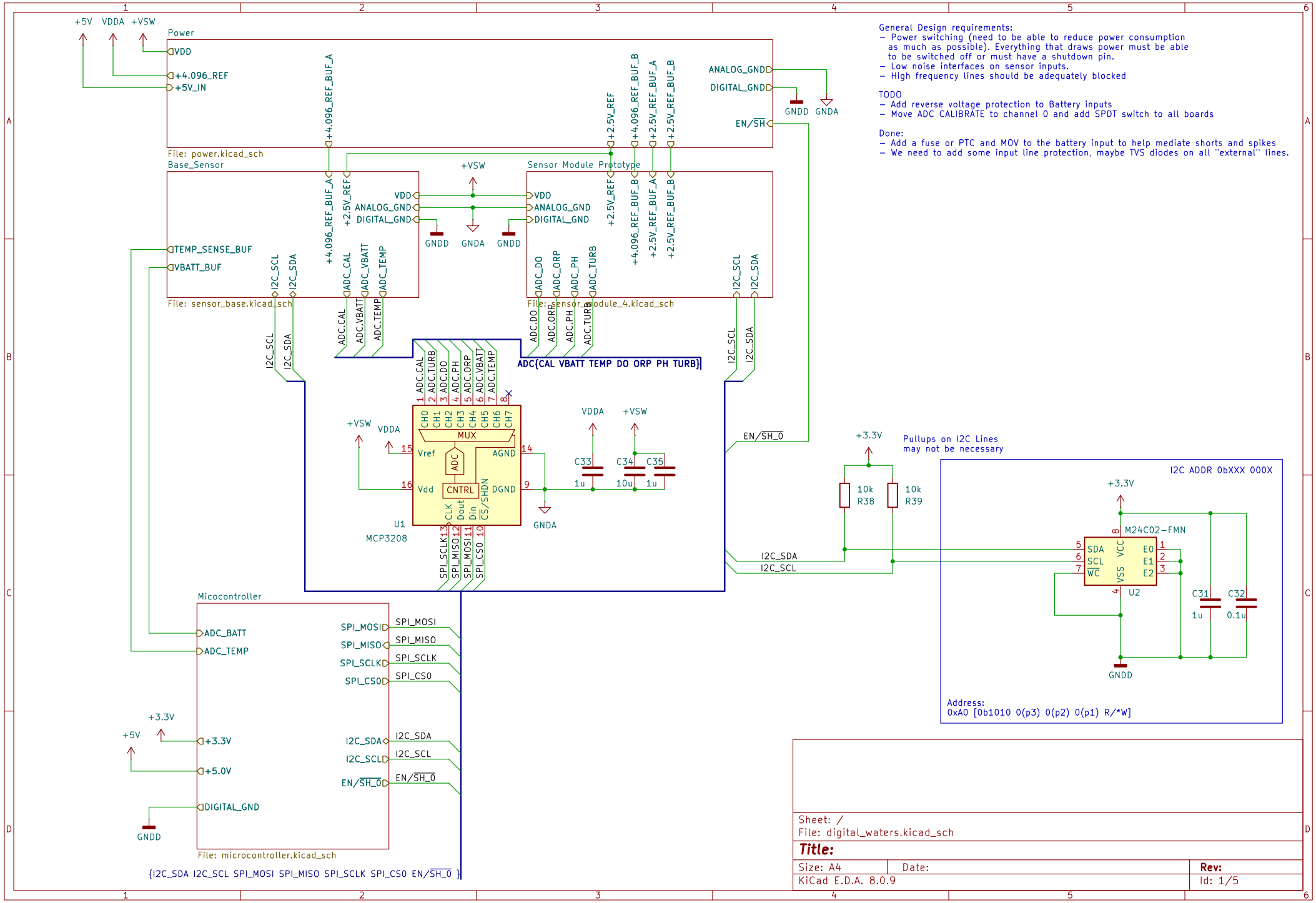
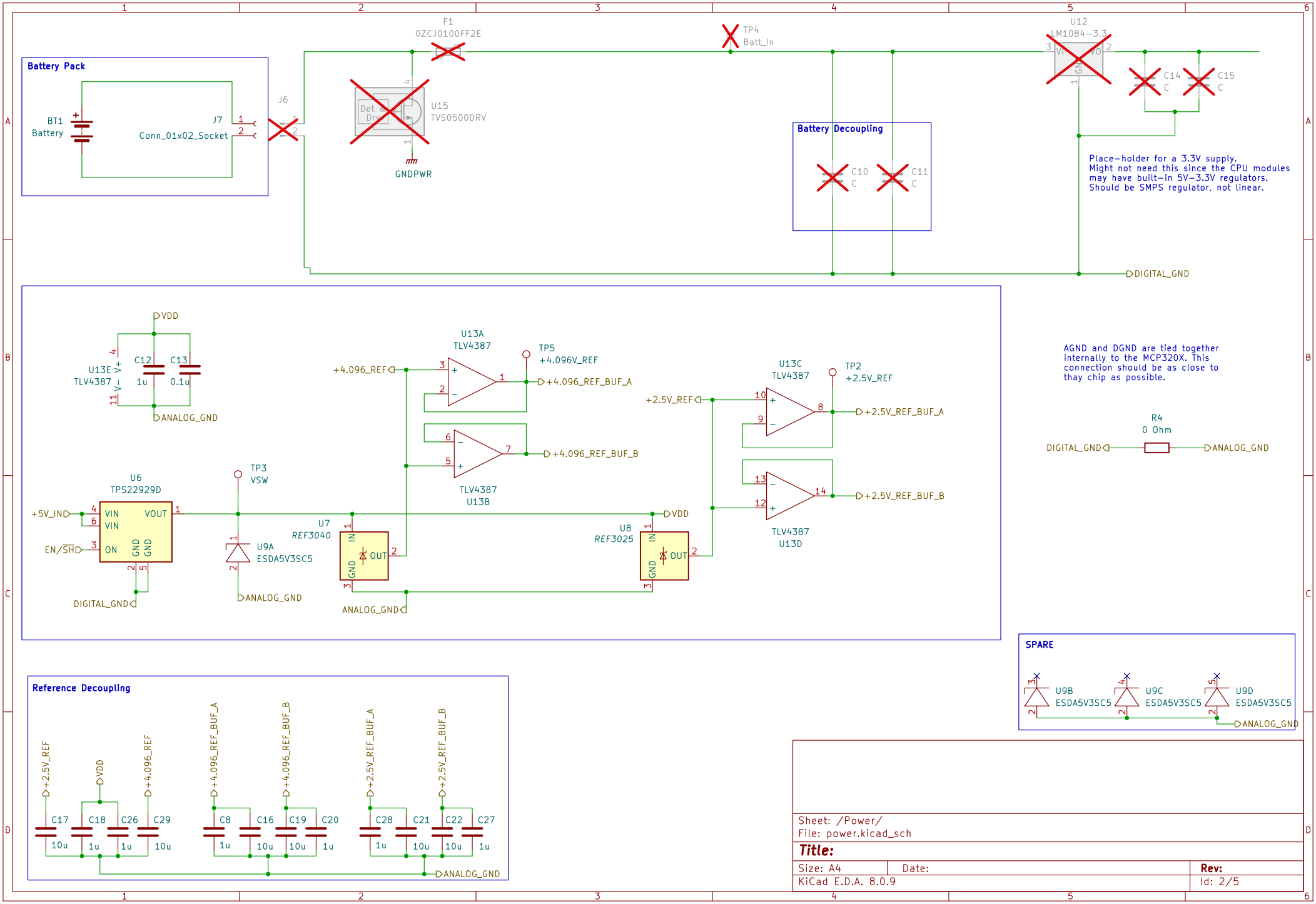
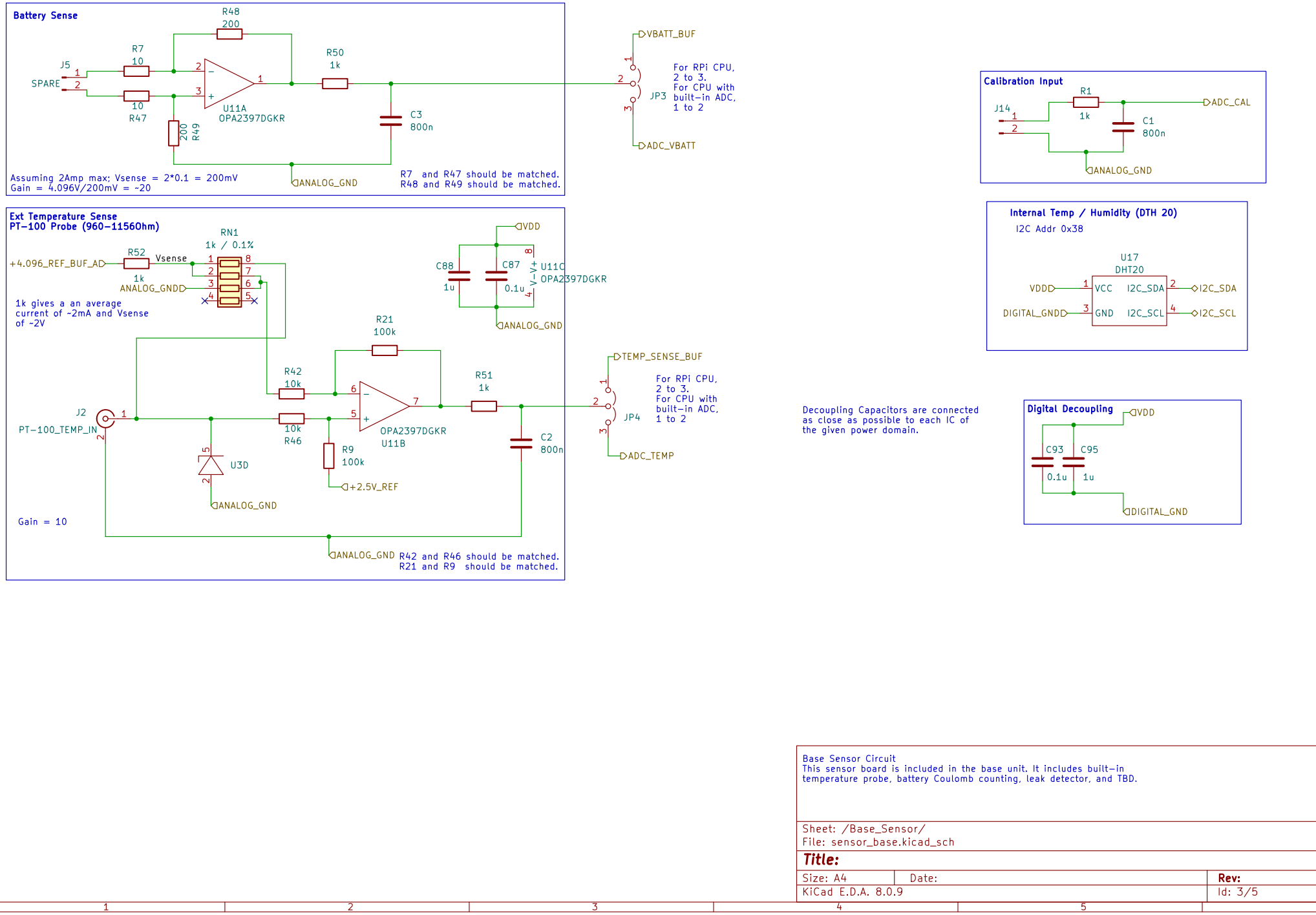

+5V VDDA +VSW
Power
VDD
+4.096_REF
+5V_IN
+4.096_REF_BUF_A
+2.5V_REF
+4.096_REF_BUF_B
+2.5V_REF_BUF_A
+2.5V_REF_BUF_B
ANALOG_GND
DIGITAL_GND
EN/SH
GNDD GNDA
File: power.kicad_sch
Base_Sensor
Sensor Module Prototype
+VSW
VDD
ANALOG_GND
DIGITAL_GND
GNDD GNDA GNDD
TEMP_SENSE_BUF
VBATT_BUF
I2C_SCL
I2C_SDA
ADC_CAL
ADC_VBATT
ADC_TEMP
ADC_DO
ADC_ORP
ADC_PH
ADC_TURB
File: sensor_base.kicad_sch
File: sensor_module_4.kicad_sch
ADC{CAL VBATT TEMP DO ORP PH TURB}
1 ADC_CAL
2 ADC_TURB
3 ADC_DO
4 ADC_PH
5 ADC_ORP
6 ADC_VBATT
7 ADC_TEMP
8
CH0 CH1 CH2 CH3 CH4 CH5 CH6 CH7
MUX
Vref
ADC
AGND
Vdd
CNTRL
DGND
CLK Dout Din CS/SHDN
15 14 16 9 13 12 11 10
U1
MCP3208
SPI_SCLK SPI_MISO SPI_MOSI SPI_CS0
VDDA +VSW
C33 C34 C35
1u 10u 1u
GNDA
EN/SH_0
+3.3V
10k R38
10k R39
Pullups on I2C Lines
may not be necessary
I2C ADDR 0bXXX 000X
M24C02-FMN
SDA SCL WC
VCC VSS
E0 E1 E2
U2
C31 C32
1u 0.1u
GNDD
Address:
0xA0 [0b1010 0(p3) 0(p2) 0(p1) R/*W]
Micocontroller
ADC_BATT
ADC_TEMP
SPI_MOSI
SPI_MISO
SPI_SCLK
SPI_CS0
+3.3V
+5V
+5.0V
DIGITAL_GND
I2C_SDA
I2C_SCL
EN/SH_0
GNDD
File: microcontroller.kicad_sch
{I2C_SDA I2C_SCL SPI_MOSI SPI_MISO SPI_SCLK SPI_CS0 EN/SH_0 }
General Design requirements:
– Power switching (need to be able to reduce power consumption as much as possible). Everything that draws power must be able to be switched off or must have a shutdown pin.
– Low noise interfaces on sensor inputs.
– High frequency lines should be adequately blocked
TODO
– Add reverse voltage protection to Battery inputs
– Move ADC CALIBRATE to channel 0 and add SPDT switch to all boards
Done:
– Add a fuse or PTC and MOV to the battery input to help mediate shorts and spikes
– We need to add some input line protection, maybe TVS diodes on all "external" lines.
Sheet: /
File: digital_waters.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 8.0.9
Id: 1/5


Battery Pack
BT1
Battery
J7
Conn_01x02_Socket
J6
F1
0ZCJ0100FF2E
U15
TVS0500DRV
GNDPWR
TP4
Batt_In
Battery Decoupling
C10
C
C11
C
U12
LM1084-3.3
VI
VO
GND
C14
C
C15
C
Place-holder for a 3.3V supply.
Might not need this since the CPU modules
may have built-in 5V-3.3V regulators.
Should be SMPS regulator, not linear.
DIGITAL_GND
VDD
U13E
TLV4387
C12
1u
C13
0.1u
ANALOG_GND
U13A
TLV4387
TP5
+4.096V_REF
+4.096_REF
+4.096_REF_BUF_A
+4.096_REF_BUF_B
TLV4387
U13B
U13C
TLV4387
TP2
+2.5V_REF
+2.5V_REF
+2.5V_REF_BUF_A
+2.5V_REF_BUF_B
TLV4387
U13D
U6
TPS22929D
+5V_IND
EN/SHD
VIN
VOUT
ON
GND
TP3
VSW
U9A
ESDA5V3SC5
U7
REF3040
U8
REF3025
IN
OUT
GND
AGND and DGND are tied together
internally to the MCP320X. This
connection should be as close to
thay chip as possible.
R4
0 Ohm
SPARE
U9B
ESDA5V3SC5
U9C
ESDA5V3SC5
U9D
ESDA5V3SC5
Reference Decoupling
+2.5V_REF
VDD
+4.096_REF
+4.096_REF_BUF_A
+4.096_REF_BUF_B
+2.5V_REF_BUF_A
+2.5V_REF_BUF_B
C17
10u
C18
1u
C26
1u
C29
10u
C8
1u
C16
10u
C19
10u
C20
1u
C28
1u
C21
10u
C22
10u
C27
1u
Sheet: /Power/
File: power.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. 8.0.9
Id: 2/5


Battery Sense
R48
200
R7
10
J5
SPARE
10
R47
200
R49
U11A
OPA2397DGKR
R50
1k
C3
800n
VBATT_BUF
For RPi CPU,
2 to 3.
For CPU with
built-in ADC,
1 to 2
JP3
ADC_VBATT
ANALOG_GND
Assuming 2Amp max; Vsense = 2*0.1 = 200mV
Gain = 4.096V/200mV = ~20
R7 and R47 should be matched.
R48 and R49 should be matched.
Calibration Input
J14
R1
1k
C1
800n
ADC_CAL
ANALOG_GND
Ext Temperature Sense
PT-100 Probe (960-11560hm)
RN1
1k / 0.1%
R52
1k
+4.096_REF_BUF_AD
Vsense
ANALOG_GND
1k gives a an average
current of ~2mA and Vsense
of ~2V
C88
1u
C87
0.1u
VDD
U11C
OPA2397DGKR
ANALOG_GND
R21
100k
R42
10k
R51
1k
J2
PT-100_TEMP_IN
10k
R46
R9
100k
U3D
OPA2397DGKR
U11B
C2
800n
+2.5V_REF
ANALOG_GND
TEMP_SENSE_BUF
For RPi CPU,
2 to 3.
For CPU with
built-in ADC,
1 to 2
JP4
ADC_TEMP
Gain = 10
ANALOG_GND
R42 and R46 should be matched.
R21 and R9 should be matched.
Internal Temp / Humidity (DTH 20)
I2C Addr 0x38
U17
DHT20
VDD
DIGITAL_GND
VCC
GND
I2C_SDA
I2C_SCL
I2C_SDA
I2C_SCL
Decoupling Capacitors are connected
as close as possible to each IC of
the given power domain.
Digital Decoupling
VDD
C93
0.1u
C95
1u
DIGITAL_GND
Base Sensor Circuit
This sensor board is included in the base unit. It includes built-in
temperature probe, battery Coulomb counting, leak detector, and TBD.
Sheet: /Base_Sensor/
File: sensor_base.kicad_sch
Title:
Size: A4
Date:
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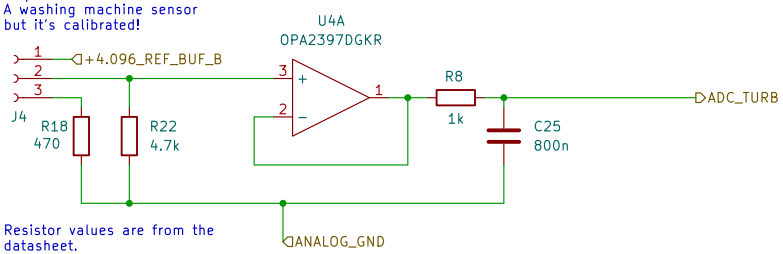
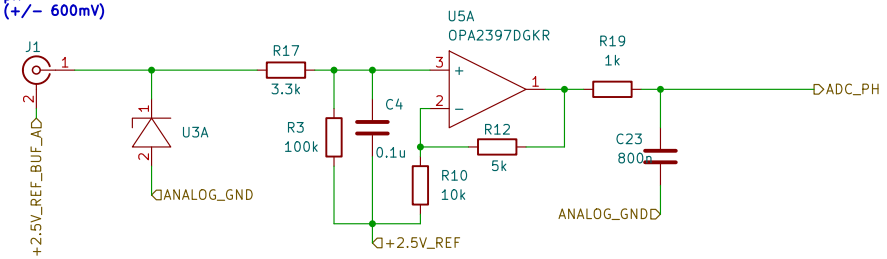
Id: 3/5

Turbidity
Amphenol TSW-10
A washing machine sensor
but it's calibrated!



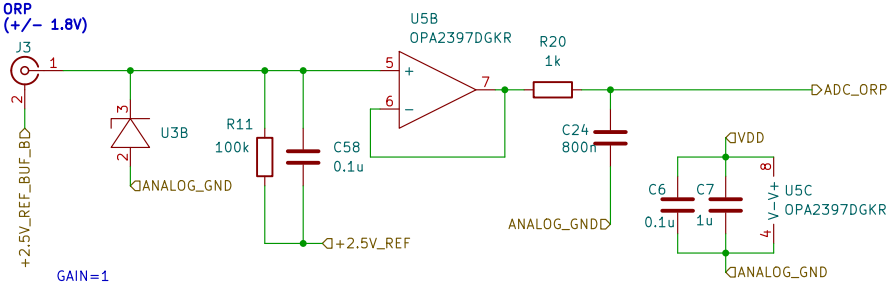
Resistor values are from the datasheet.

pH
(+/- 600mV)



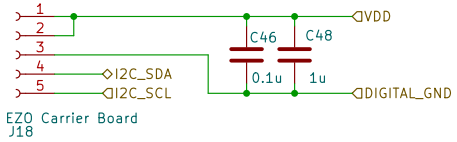
GAIN=1.5

ORP
(+/- 1.8V)



GAIN=1

Atlas Scientific
Isolated Carrier Board

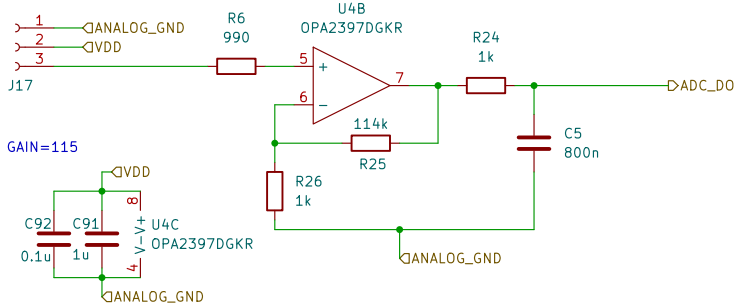


NOTE!!! The header socket is flipped for mounting the carrier board upsidedown.

This is initially for the Atlas Scientific Conductivity board.
It is required to initialize the EC_EZO module to I2C comms.
See the EZO-EC datasheet for more information.

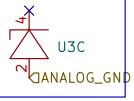
DO (Analog)
Atlas Scientific Surveyor
42mV=100% saturation

NOTE!!! The header socket is flipped for mounting the carrier board upsidedown.



GAIN = TBD

SPARE



Sheet: /Sensor Module Prototype/		
File: sensor_module_4.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
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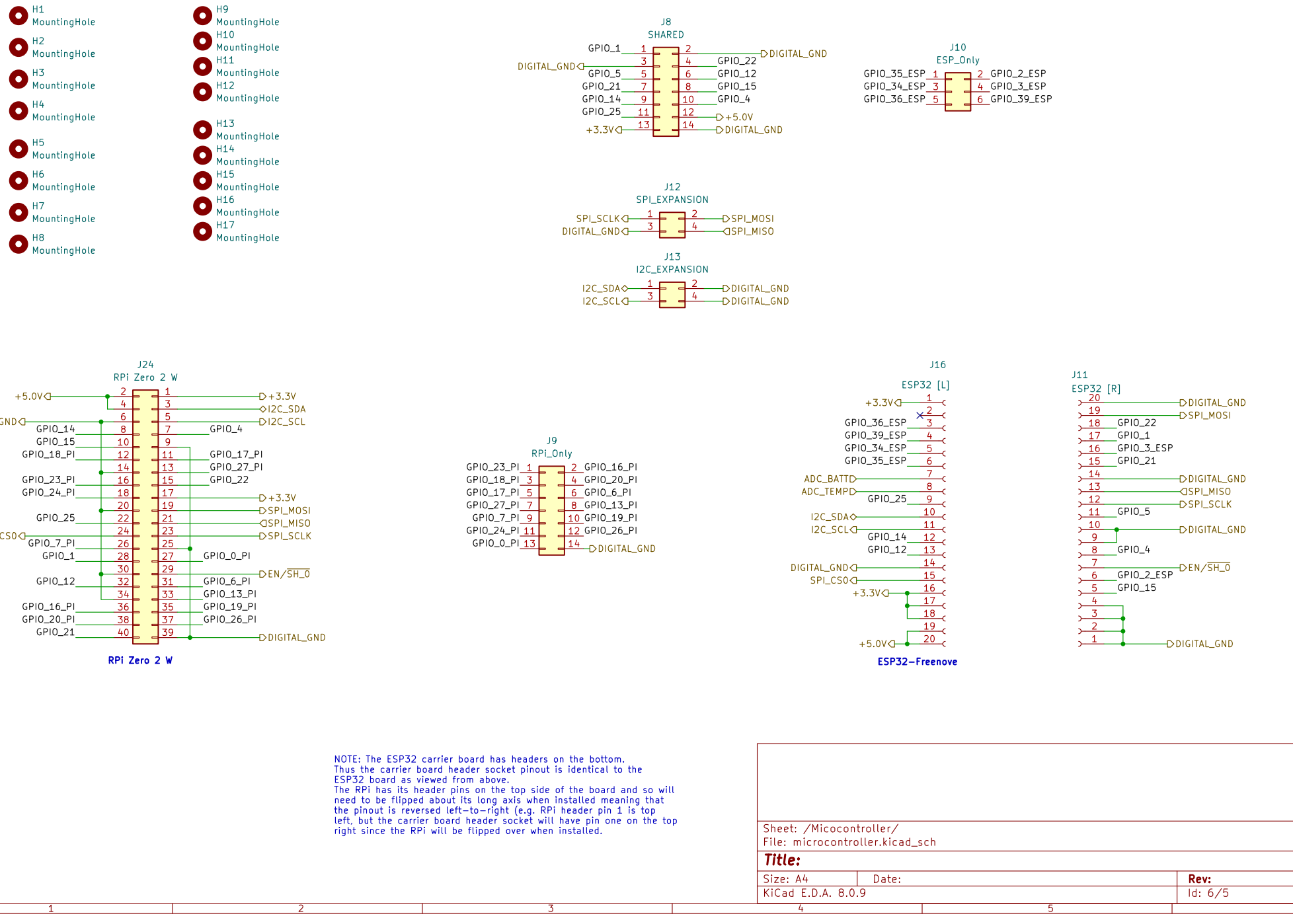

NOTE: The ESP32 carrier board has headers on the bottom.
Thus the carrier board header socket pinout is identical to the ESP32 board as viewed from above.
The RPi has its header pins on the top side of the board and so will need to be flipped about its long axis when installed meaning that the pinout is reversed left-to-right (e.g. RPi header pin 1 is top left, but the carrier board header socket will have pin one on the top right since the RPi will be flipped over when installed.

Sheet: /Micocontroller/		
File: microcontroller.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. 8.0.9		Id: 6/5