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

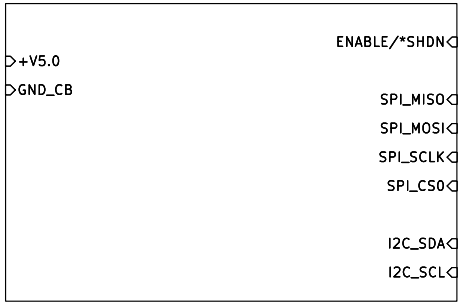
Power

File: power.kicad_sch

Micocontroller

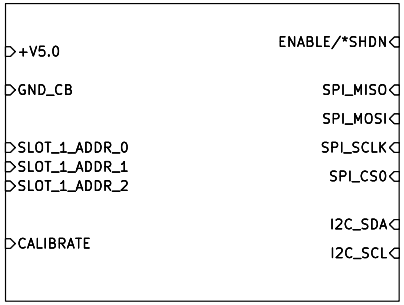
File: microcontroller.kicad_sch

Base_Sensor



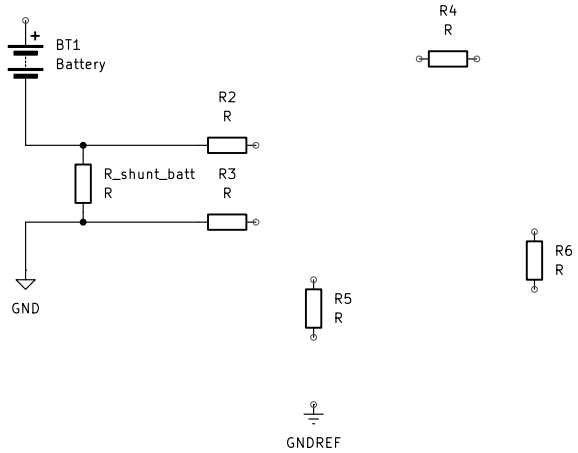
File: sensor_base.kicad_sch

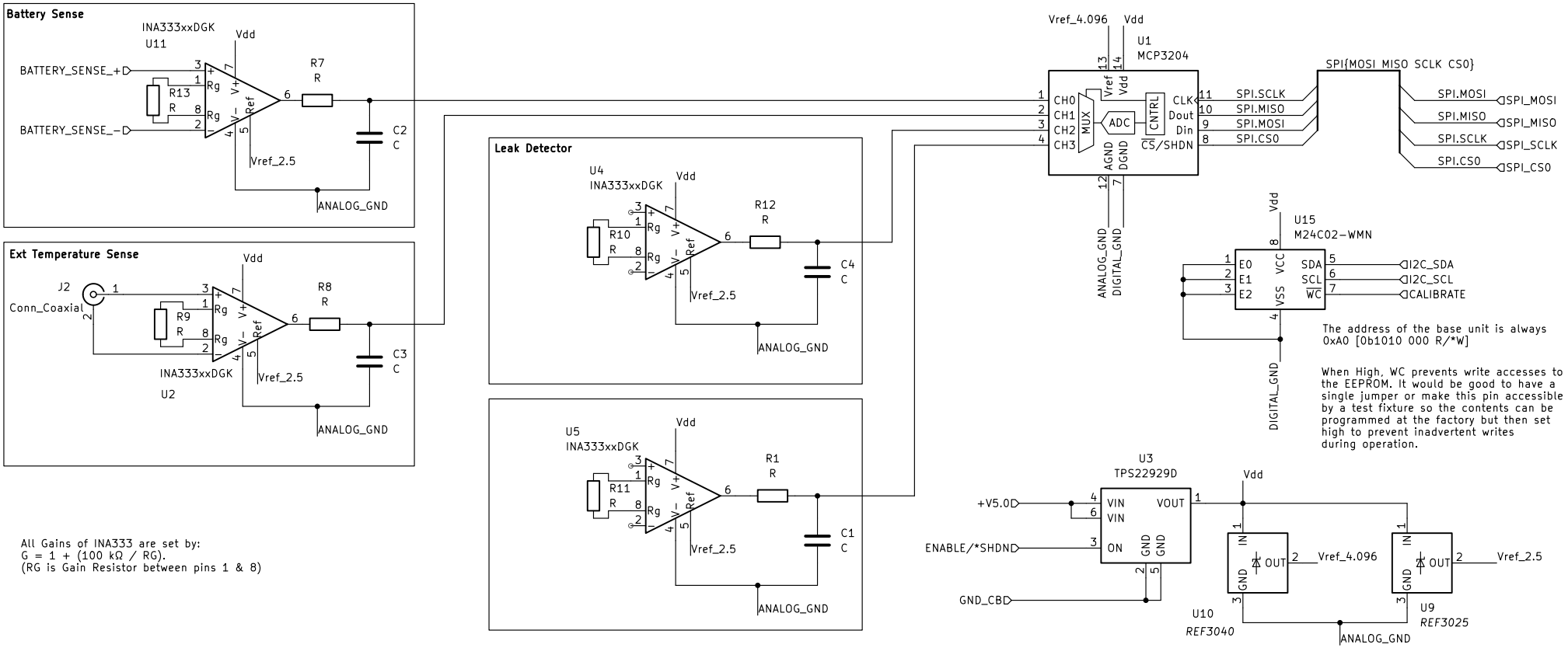
Sensor Module

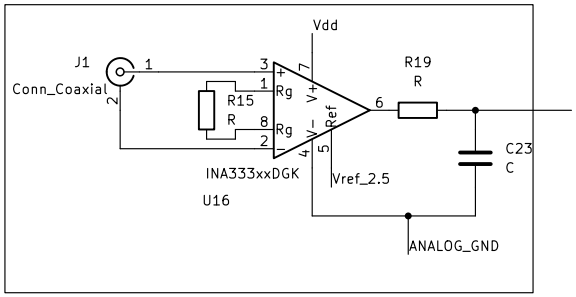


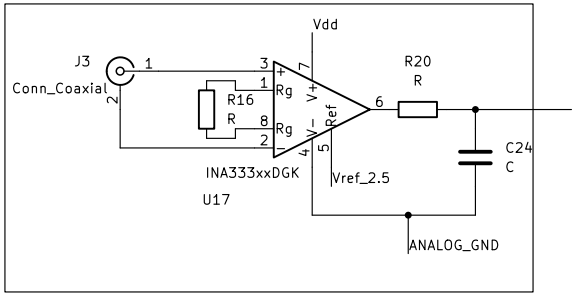
File: sensor_module.kicad_sch

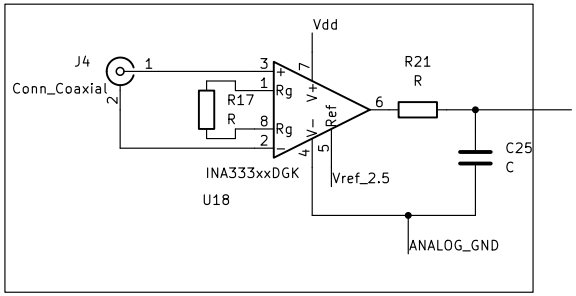
The 5V power rail is supplied by a battery bank. We need to have some more power conditioning in order to make sure that we aren't coupling too much noise into the ADC circuits. To this end, we may want to use an LDO to provide a lower voltage rail to the OP-amp circuits, or use a higher voltage battery and use the LDO to provide a "clean" 5.0V rail.

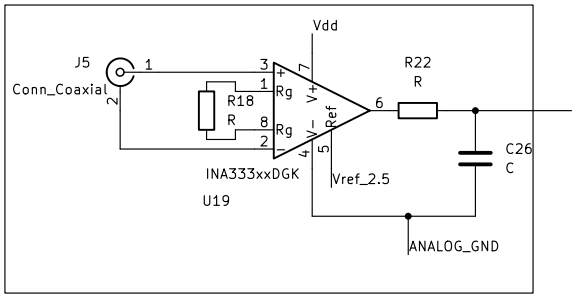



Battery Sense
INA333xxDGK
U11
Vdd
BATTERY_SENSE_+
BATTERY_SENSE_−
R13
R
R7
R
C2
C
Vref_2.5
ANALOG_GND
Ext Temperature Sense
J2
Conn_Coaxial
R9
R
R8
R
C3
C
INA333xxDGK
U2
Vref_2.5
ANALOG_GND
Leak Detector
U4
INA333xxDGK
Vdd
R10
R
R12
R
C4
C
Vref_2.5
ANALOG_GND
U5
INA333xxDGK
Vdd
R11
R
R1
R
C1
C
Vref_2.5
ANALOG_GND
Vref_4.096
Vdd
U1
MCP3204
CH0
CH1
CH2
CH3
MUX
ADC
CNTRL
CLK
Dout
Din
CS/SHDN
Vref
Vdd
AGND
DGND
SPI.SCLK
SPI.MISO
SPI.MOSI
SPI.CS0
SPI{MOSI MISO SCLK CS0}
SPI.MOSI
SPI.MISO
SPI.SCLK
SPI.CS0
ANALOG_GND
DIGITAL_GND
U15
M24C02−WMN
E0
E1
E2
VCC
VSS
SDA
SCL
WC
I2C_SDA
I2C_SCL
CALIBRATE
The address of the base unit is always 0xA0 [0b1010 000 R/*W]
When High, WC prevents write accesses to the EEPROM. It would be good to have a single jumper or make this pin accessible by a test fixture so the contents can be programmed at the factory but then set high to prevent inadvertent writes during operation.
DIGITAL_GND
U3
TPS22929D
+V5.0
ENABLE/*SHDN
GND_CBD
VIN
VOUT
ON
GND
Vdd
U10
REF3040
Vref_4.096
U9
REF3025
Vref_2.5
ANALOG_GND
All Gains of INA333 are set by:
G = 1 + (100 kΩ / RG).
(RG is Gain Resistor between pins 1 & 8)
Reference Decoupling
Vref_2.5
C21
C22
C6
C5
Analog Decoupling
Vdd
C9
C10
C11
C12
C13
C19
ANALOG_GND
TL431 might also be used for the 2.5V reference but buffered with an OPA333 or equivalent.
R14
0 Ohm
DIGITAL_GND
ANALOG_GND
Vref_4.096
C7
C8
Digital Decoupling
Vdd
C14
C15
C16
C17
C18
C20
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.









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G = 1 + (100 kΩ / RG).
(RG is Gain Resistor between pins 1 & 8)