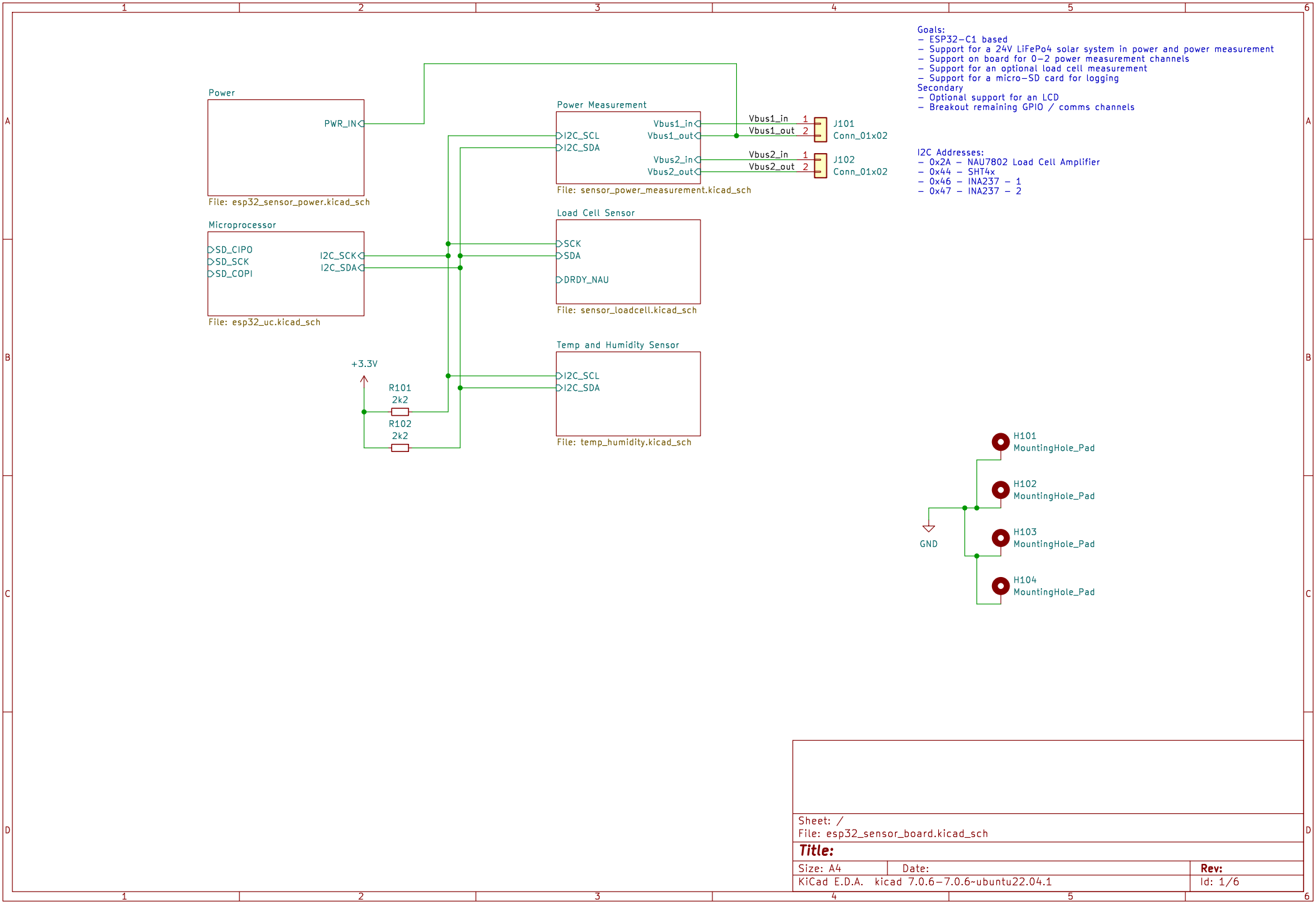
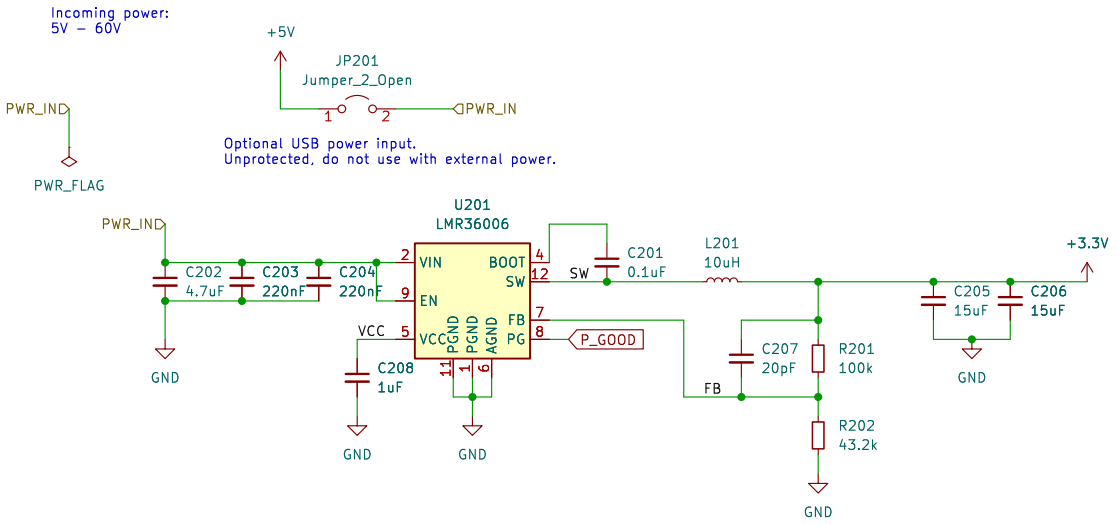
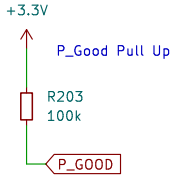

Goals:
– ESP32-C1 based
– Support for a 24V LiFePo4 solar system in power and power measurement
– Support on board for 0-2 power measurement channels
– Support for an optional load cell measurement
– Support for a micro-SD card for logging
Secondary
– Optional support for an LCD
– Breakout remaining GPIO / comms channels
I2C Addresses:
– 0x2A – NAU7802 Load Cell Amplifier
– 0x44 – SHT4x
– 0x46 – INA237 – 1
– 0x47 – INA237 – 2
Power
PWR_IN
File: esp32_sensor_power.kicad_sch
Power Measurement
Vbus1_in
Vbus1_out
I2C_SCL
I2C_SDA
Vbus2_in
Vbus2_out
File: sensor_power_measurement.kicad_sch
Vbus1_in 1
Vbus1_out 2
J101
Conn_01x02
Vbus2_in 1
Vbus2_out 2
J102
Conn_01x02
Microprocessor
SD_CIPO
SD_SCK
SD_COPI
I2C_SCK
I2C_SDA
File: esp32_uc.kicad_sch
Load Cell Sensor
SCK
SDA
DRDY_NAU
File: sensor_loadcell.kicad_sch
+3.3V
R101
2k2
R102
2k2
Temp and Humidity Sensor
I2C_SCL
I2C_SDA
File: temp_humidity.kicad_sch
H101
MountingHole_Pad
H102
MountingHole_Pad
H103
MountingHole_Pad
H104
MountingHole_Pad
GND
Sheet: /
File: esp32_sensor_board.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 7.0.6-7.0.6~ubuntu22.04.1
Id: 1/6



Supply Rails:
+3.3V

LMR36006-Q1
– 4.2V – 60V input
– Integrated FET
– 3.3V, 5V fixed or Adjustable output
– Power Good signal
– $2.71 in single quantities
LMR36006CRNXT – Adjustable, 2.1 MHz switching frequency



Discarded options

MAX17501
– 4.5 – 60V Input
– Adjustable, 3.3V (MAX17501A) or 5V (MAX17501B) outputs
– 500mA
– $4.56ea

IFX80471SKV
– 5V – 60V
– Output adjustable from 1.25 – 15V
  – Integrated reset only at 7V+

Sheet: /Power/ File: esp32_sensor_power.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
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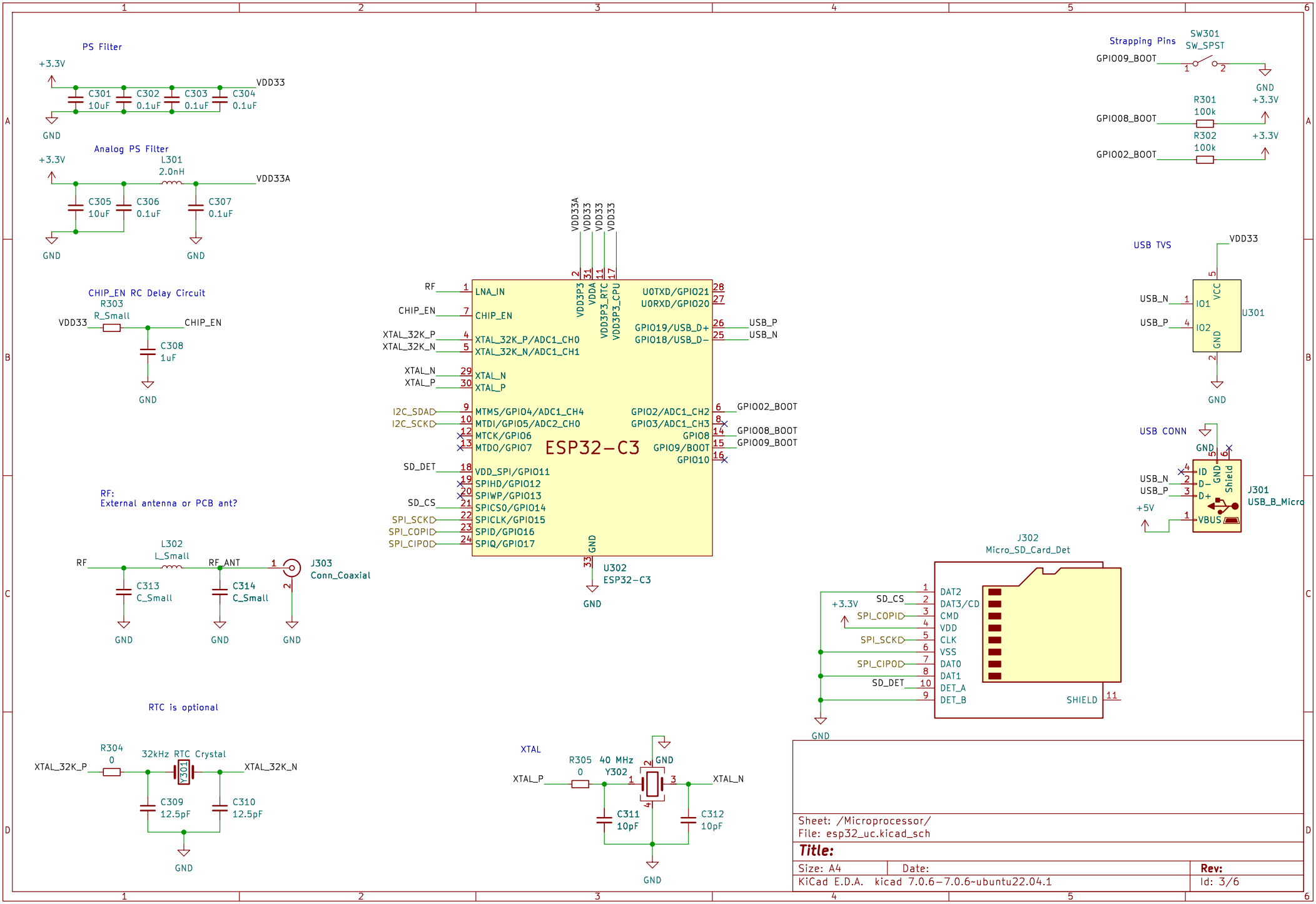

PS Filter
+3.3V
C301 10uF
C302 0.1uF
C303 0.1uF
C304 0.1uF
VDD33
GND
Analog PS Filter
+3.3V
L301 2.0nH
VDD33A
C305 10uF
C306 0.1uF
C307 0.1uF
GND
CHIP_EN RC Delay Circuit
R303 R_Small
VDD33
CHIP_EN
C308 1uF
GND
RF:
External antenna or PCB ant?
L302 L_Small
RF
RF_ANT
C313 C_Small
C314 C_Small
J303 Conn_Coaxial
RTC is optional
R304 0
32kHz RTC Crystal
Y301
XTAL_32K_P
XTAL_32K_N
C309 12.5pF
C310 12.5pF
ESP32-C3
LNA_IN
CHIP_EN
XTAL_32K_P/ADC1_CH0
XTAL_32K_N/ADC1_CH1
XTAL_N
XTAL_P
MTMS/GPIO4/ADC1_CH4
MTDI/GPIO5/ADC2_CH0
MTCK/GPIO6
MTDO/GPIO7
VDD_SPI/GPIO11
SPIHD/GPIO12
SPIWP/GPIO13
SPICS0/GPIO14
SPICLK/GPIO15
SPID/GPIO16
SPIQ/GPIO17
U0TXD/GPIO21
U0RXD/GPIO20
GPIO19/USB_D+
GPIO18/USB_D-
GPIO2/ADC1_CH2
GPIO3/ADC1_CH3
GPIO8
GPIO9/BOOT
GPIO10
VDD3P3
VDDA
VDD3P3_RTC
VDD3P3_CPU
VDD33A
VDD33
I2C_SDA
I2C_SCK
SD_DET
SD_CS
SPI_SCK
SPI_COPI
SPI_CIPO
USB_P
USB_N
GPIO002_BOOT
GPIO008_BOOT
GPIO009_BOOT
U302 ESP32-C3
XTAL
R305 0
40 MHz Y302
XTAL_P
XTAL_N
C311 10pF
C312 10pF
Strapping Pins
SW301 SW_SPST
GPIO009_BOOT
R301 100k
R302 100k
GPIO008_BOOT
GPIO002_BOOT
USB TVS
U301
USB_N
USB_P
USB CONN
J301 USB_B_Micro
+5V
J302 Micro_SD_Card_Det
DAT2
DAT3/CD
CMD
VDD
CLK
VSS
DAT0
DAT1
DET_A
DET_B
SHIELD
Sheet: /Microprocessor/
File: esp32_uc.kicad_sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 7.0.6-7.0.6~ubuntu22.04.1
Id: 3/6

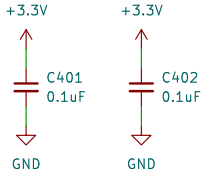
Shunt Resistor:
ADC ranges: +−40.96mV (ADC Range 1) or +−163.84mV (ADC Range 0)
Using +−40 to choose low power loss over accuracy.

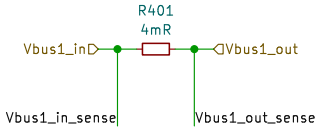
Full scale: 10A
R = 0.004 ohms

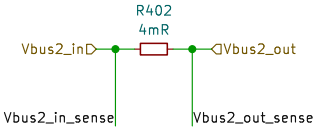
Power disappation at 60V, 10A:
40mV * 10A = 0.4W

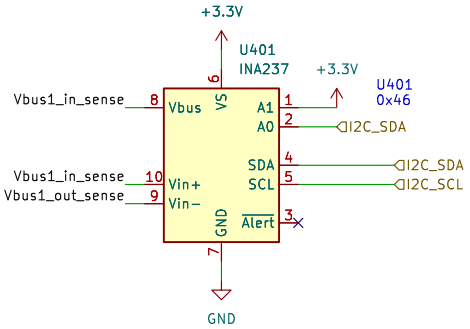
Current_LSB = 305.176mA
SHUNT_CAL = 4000 (ADC Range 1 requires multiplying by 4)

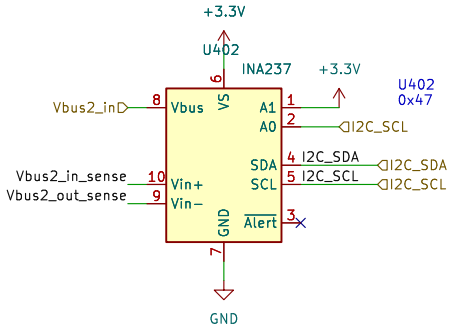
INA237-Q1
- 0-85V
- I2C with 16 addresses
- 2.7 to 5.5V supply
- $3.27 ea











A0, A1 can each be GND, SCL, SDA or VS
Base Address: 0x40
Max Address: 0x4F
A0
GND − 0x0
VS − 0x1
SDA − 0x2
SCL − 0x3
A1
GND − 0x0
VS − 0x4
SDA − 0x8
SCL − 0xC

Sheet: /Power Measurement/		
File: sensor_power_measurement.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
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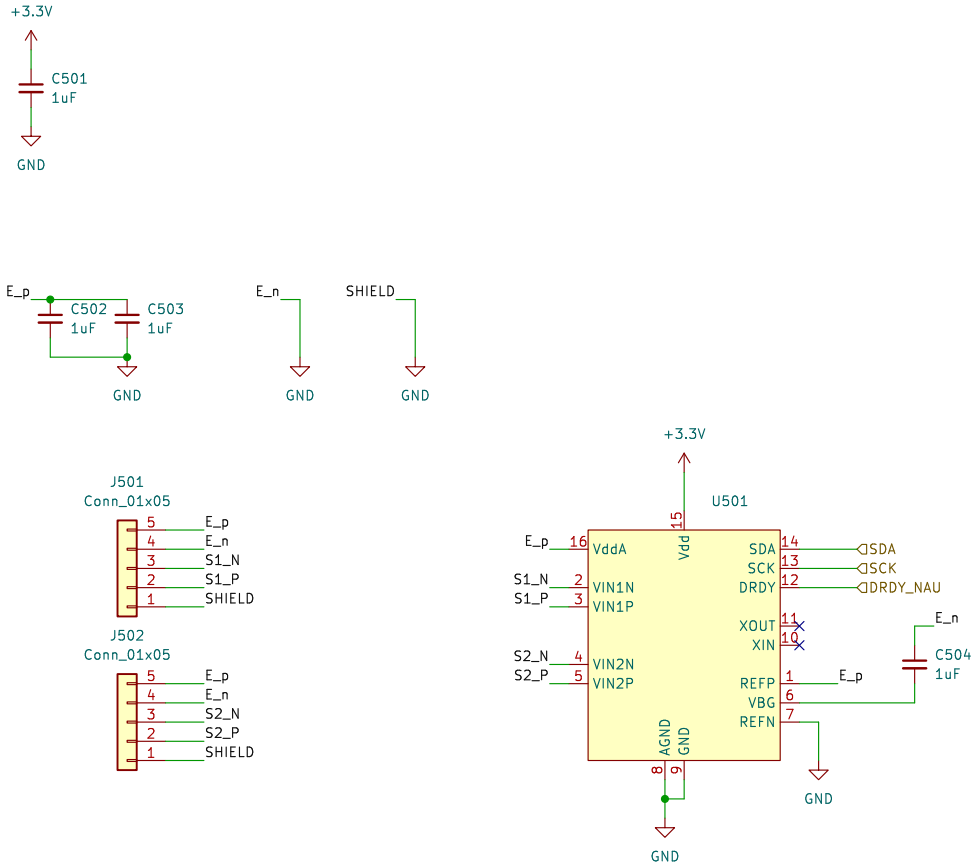
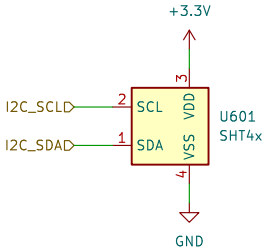


NAU7802
- 2 inputs
- Direct support for scales
- Up to 80 Hz
- 24-bit
- PGA: 1-128
- < $2 in low quantities
- No cut tape (?)

https://www.nuvoton.com/export/resource-files/NAU7802%20Data%20Sheet%20V1.7.pdf

Populate filter caps for unused channels
330pF for 3.3V
680pF for 5V

Sheet: /Load Cell Sensor/		
File: sensor_loadcell.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 7.0.6-7.0.6~ubuntu22.04.1		Id: 5/6



Sheet: /Temp and Humidity Sensor/ File: temp_humidity.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 7.0.6-7.0.6~ubuntu22.04.1		Id: 6/6