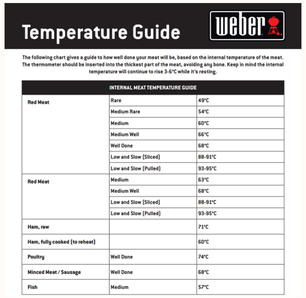
Power Management
02_Power.SchDoc
+3V6
Temperature Sensor Interface
03_Temp_Sensor.SchDoc
Microcontroller
06_MCU.SchDoc
SCL
SDA
HMI
05_Human_Interaction.SchDoc
SCL
SDA
Gyroscope Interface
04_Gyro.SchDoc



Temperature Guide

weber

The following chart gives a guide to how well done your meat will be, based on the internal temperature of the meat. The thermometer should be inserted into the thickest part of the meat, avoiding any bone. Keep in mind the internal temperature will continue to rise 3-6°C while it's resting.

INTERNAL MEAT TEMPERATURE GUIDE		
Red Meat	Rare	49°C
	Medium Rare	54°C
	Medium	60°C
	Medium Well	66°C
	Well Done	68°C
	Low and Slow (Sliced)	88-91°C
	Low and Slow (Pulled)	93-95°C
Red Meat	Medium	63°C
	Medium Well	68°C
	Low and Slow (Sliced)	88-91°C
	Low and Slow (Pulled)	93-95°C
Ham, raw		71°C
Ham, fully cooked (to reheat)		60°C
Poultry	Well Done	74°C
Minced Meat / Sausage	Well Done	68°C
Fish	Medium	57°C

Product Specifications:
Battery Life: 2 hours

Temperature sensing range (max): 400°C (or roughly 350°C)

Module operating temperature range: roughly 60°C ambient on outside of module. With heat insulation in place, hopefully reduce ambient temperature to a max of 40°C (possibly lower)

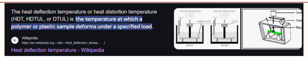
Sensing accuracy (max): ±2°C (since meat has a 5°C range between doneness levels)

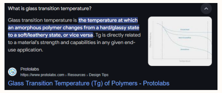
Interaction: rocker power switch, LEDs to indicate when grill needs to be turned, connect to mobile through WiFi and display GUI, run HTML web app with arelevant information and selection of presets

Gyro: to sense when the grid has been flipped

Info Regarding 3D printed housing

Temperature reading at the handle of the grid measured to be ±55°C, so the 3D printed housing should have a HDT (Heat Deflection Temperature) comfortably above that to ensure housing does not deform during use of product.
Also have to check the Glass Transition Temperature of the polymer.





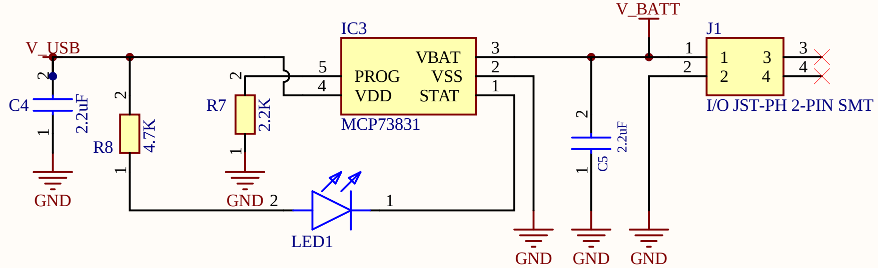
https://omni3d.com/blog/filament-temperature-resistance-in-fdm-fff-3d-printing/

Title			
Size A4	Number		Revision
Date:	2/19/2025	Sheet of	
File:	D:_Studies\..\01_Top.SchDoc	Drawn By:	

1 2 3 4

A

Battery Charger



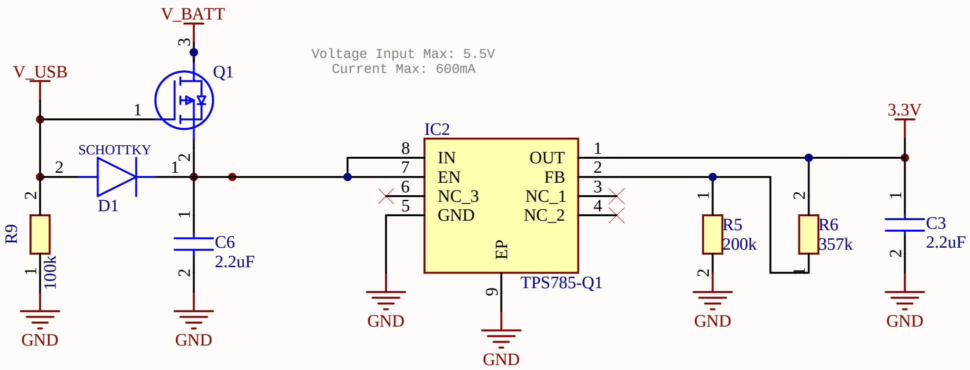
I_CHG = 1000 / R_PROG

I_CHG = 400mA
R_prog = 1000/400mA
= 2.5kΩ
≈ 2.2kΩ (454.54mA)

For 1200mAh battery the max charge time will be ±2h30m.

3V3 Regulator

Voltage Input Max: 5.5V
Current Max: 600mA



B

8.1.3 Adjustable Device Feedback Resistors

The device requires external feedback divider resistors to set the output voltage. Figure 8-1 shows how the output voltage of an adjustable device can be configured from 1.2 V to 5.5 V by using a resistor divider network.

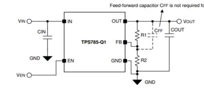


Figure 8-1. Adjustable Operation

C

$$V_{OUT} = V_{FB} \times (1 + R_1 / R_2) + I_{FB} \times R_1 \quad (2)$$

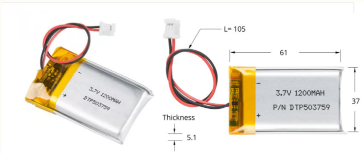
V_{FB}	Feedback voltage	Adjustable output only	1.182	1.2	1.218	V
I_{FB}	Feedback pin current	Adjustable output only	–0.05	0.01	0.05	μA

To disregard the effect of the FB pin current error term in Equation 2 and to achieve best accuracy, choose R_2 to be equal to or smaller than 550 kΩ so that the current flowing through R_1 and R_2 is at least 100 times larger than the I_{FB} current listed in the *Electrical Characteristics* table. Lowering the value of R_2 increases the immunity against noise injection. Increasing the value of R_2 reduces the quiescent current for achieving higher efficiency at low load currents. Equation 3 calculates the setting that provides the maximum feedback divider series resistance.

$$(R_1 + R_2) \le V_{OUT} / (I_{FB} \times 100) \quad (3)$$

Vout = 3.3V
R2 = 200k
R1 = 350k → R1 = 357k
Vout_new = 3.342V

D



Battery LiPo 1200mAh 3.7V

Brand: Generic
Product Code: 503759
Weight: 0.026kg
Product Status : Active

Stock

Warehouse	Stock Status	Location
Centurion	In Stock	BAT-F
Stellenbosch	In Stock	D6007

We ship free of charge between branches to complete your order.

R68.00 (Inc Tax: R78.20)

Qty
1
Add to Cart

Battery has about 300 cycles. Include easy replacable battery slot in final design for if customers battery dies then it can be replaced.
Aim to have max power consumption of entire system to be 500mA so that product can last 2 hours of use.

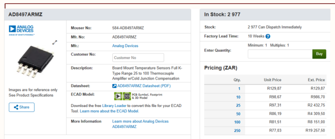
Title		
Size: A4	Number	Revision
Date: 2/19/2025		Sheet of
File: D:_Studies\..\02_Power.SchDoc		Drawn By:

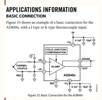
1 2 3 4

1 2 3 4

A

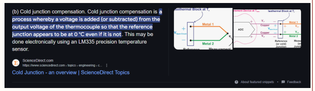
Option 1

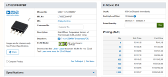




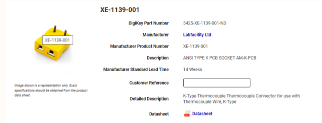
Cold junction compensation

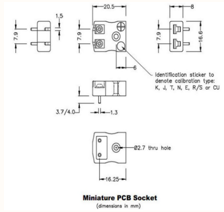
Cold junction compensation is necessary to get accurate readings from thermocouples.

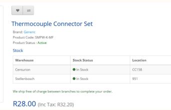




Thermocouple probe connector

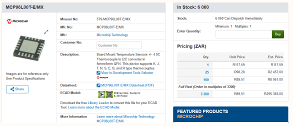






B

Option 2

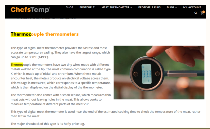


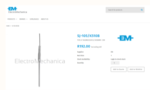
C

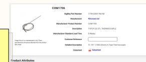
Option 3

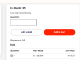
Another option is to get an analog amplifier with a separate ADC module (as ESP32 module ADC usually isn't as accurate).
The setback regarding this option is the cumulative cost of getting both an analog thermocouple amplifier and an ADC is more expensive than getting a standalone thermocouple amplifier with built in ADC with I2C

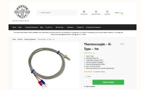
Thermocouple probe





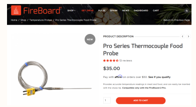






Need two probes (left and right) to measure temperature over the coals to tell when temperature is correct to start braaing, and whether the heat is evenly distributed. Thermocouples to measure coals temperature doesn't need to have a penetrative tip (sharp tip) since it won't have to be inserted into anything.

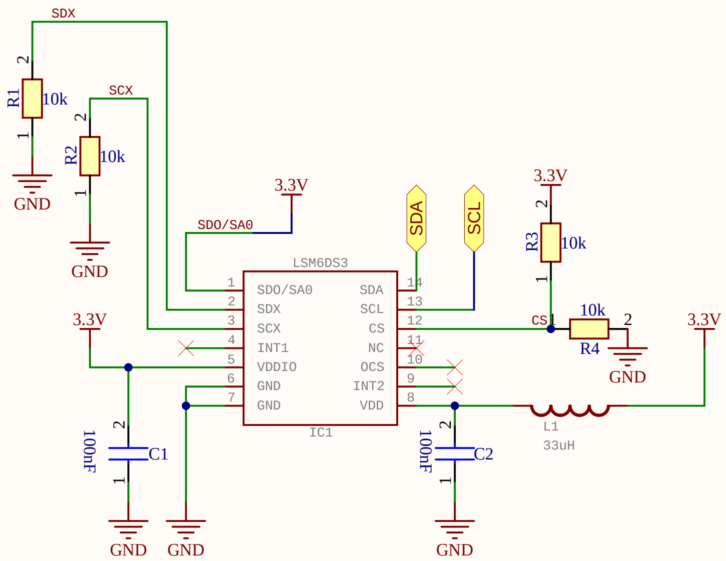
Need one (minimum) probe to measure temperature in the meat. The probe will have to have a penetrative tip so as to not damage the meat upon inserting into the meat.



D

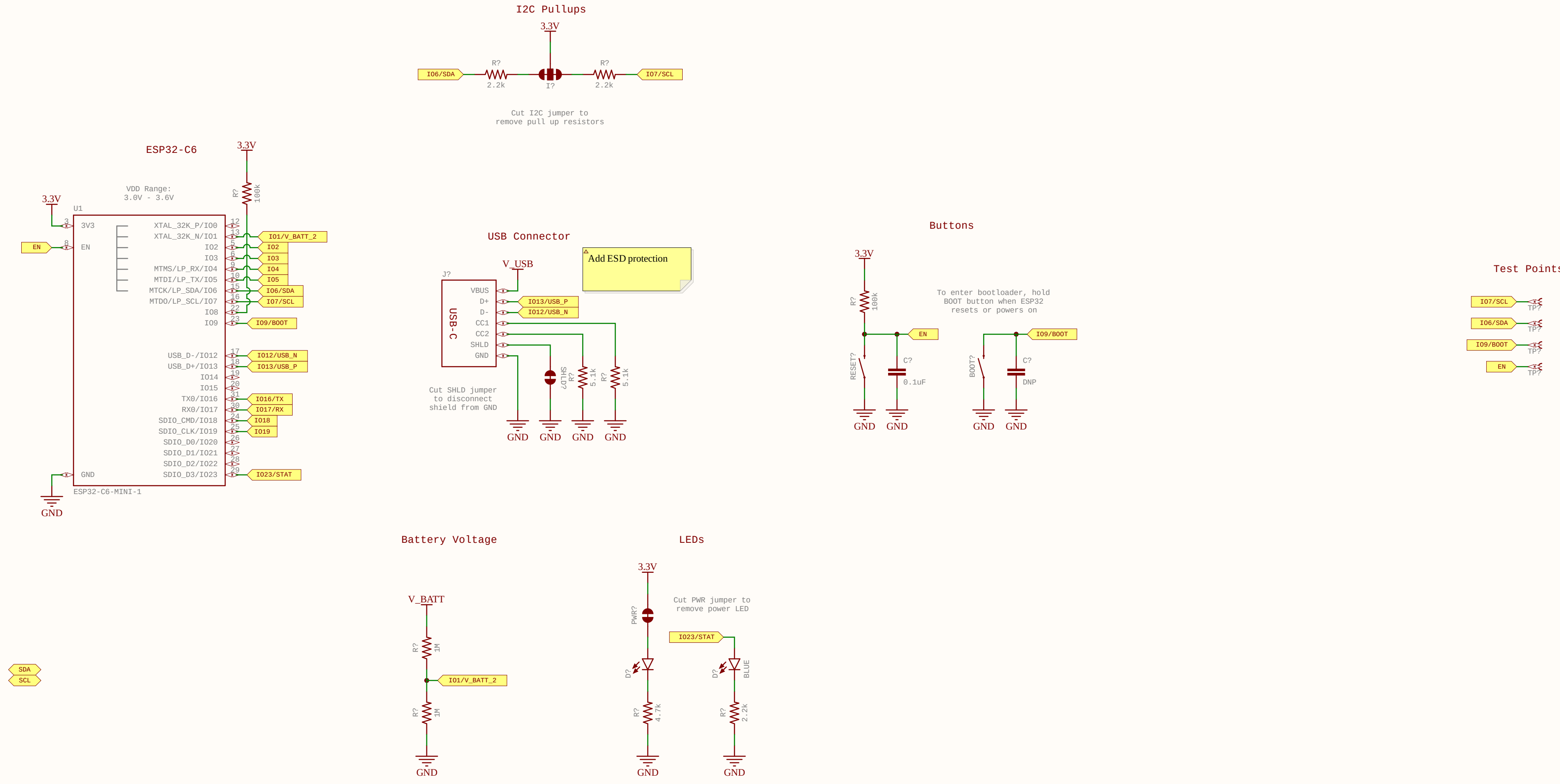
Title		
Size A4	Number	Revision
Date: 2/19/2025		Sheet of
File: D:_Studies\..\03_Temp_Sensor.SchDoc		Drawn By:

1 2 3 4



Title		
Size A4	Number	Revision
Date: 2/19/2025		Sheet of
File: D:_Studies\..\04_Gyro.SchDoc		Drawn By:

REVISION	DESCRIPTION	DATE	APPROVED



APPROVALS	DATE
ENG: *	--/--/--
DSN: *	--/--/--
CHK: *	--/--/--

REFERENCE DOCUMENTS
BOM:
ASSY DWG:
FAB DWG:
PCB DWG:

PROJECT *
Altium
PROJECT REVISION: 31959d58403a2d3b31b0a6c7745e79454497
DOCUMENT REVISION:
DESIGN ITEM:
TITLE *

SIZE B | CAGE CODE | DWG NO. | REV
SCALE: | FILE NAME 06_MCU.SchDoc | SHEET 6 OF 6