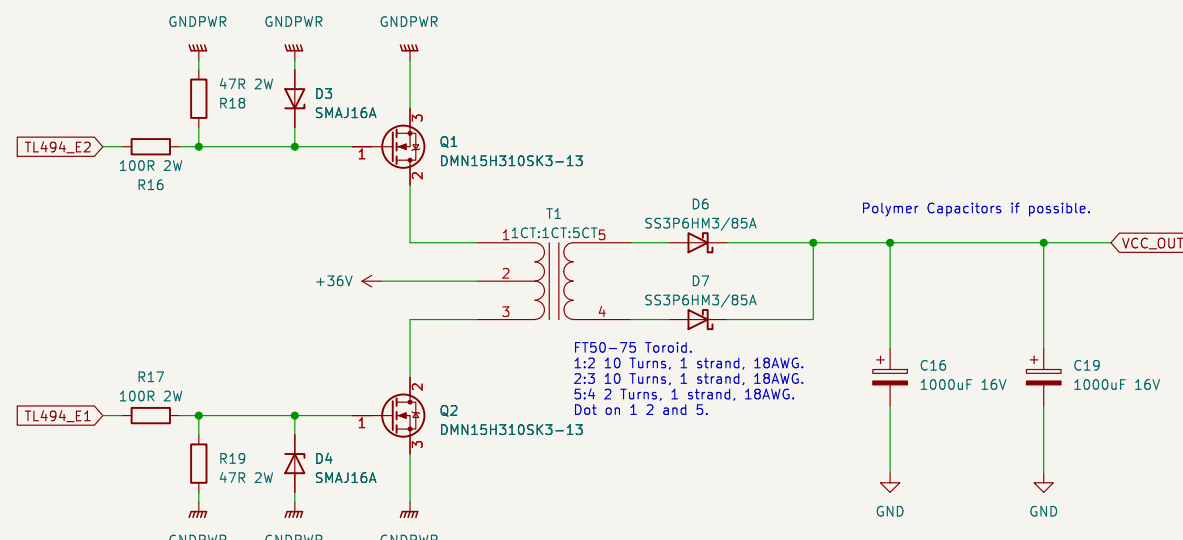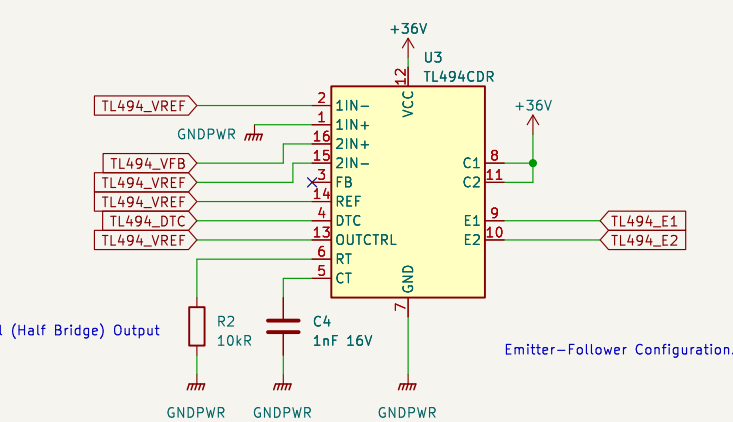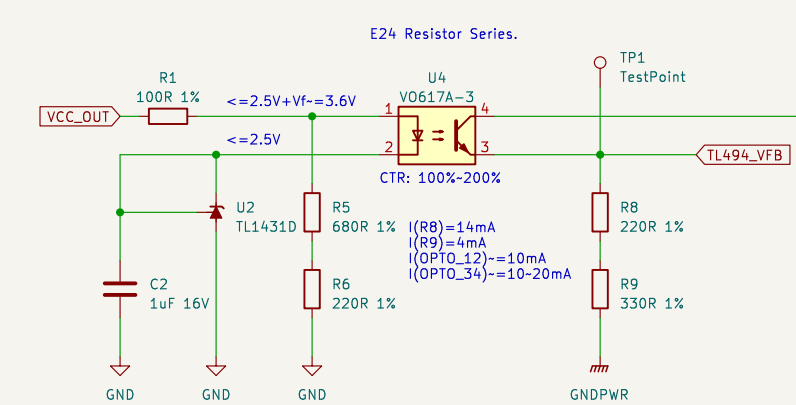# Isolated Push Pull DC/DC Converter
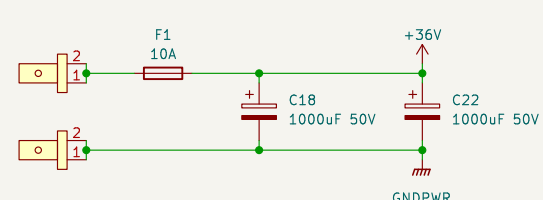
TL494 is an OG chip, can be replaced with new ICs like SG3525, etc.
However TL494 is still the most widely used DC/DC chip even today.
Because it is cheap and reliable.

U3 TL494CDR

Push-Pull (Half Bridge) Output

Emitter-Follower Configuration.

Polymer Capacitors if possible.

FT50-75 Toroid.
1/2 10 Turns, 1 strand, 18AWG.
2/3 10 Turns, 1 strand, 18AWG.
5/4 2 Turns, 1 strand, 18AWG.
Dot on 1 2 and 5.

Q1 DMN15H310SK3-13
Q2 DMN15H310SK3-13

Because of leakage inductance, VDS should be at least 3x~4x +36V.

Soft start ~1ms

E24 Resistor Series.

CTR: 100%-200%

10mA is the ideal working current for photocoupler primary side.
Check CTR curve on the datasheet for more info.

Adjustable Resistor Pair.
Tune resistance values until VFB = 5V when VCC_OUT is 5.1V-5.5V.
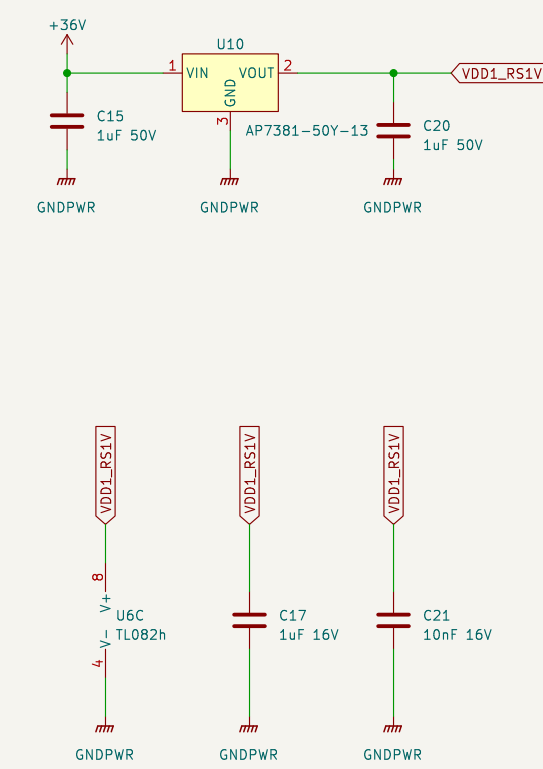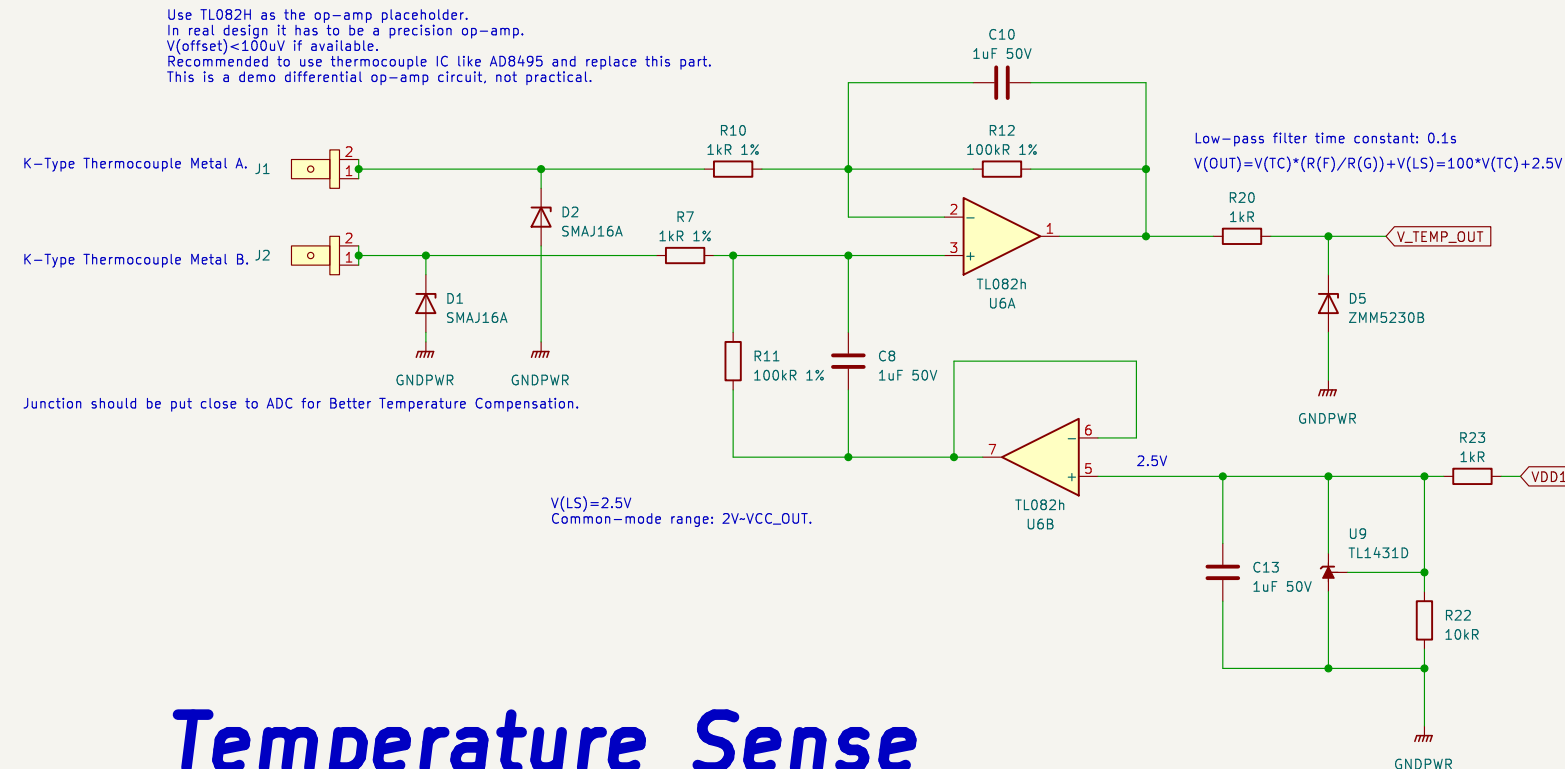Small-signal analysis TBD in LTSpice.

LittleFuse Low Profile MINI® Fuses Rated 58V.
Color Code: Red 10A.

F1 10A

Temperature Sense

Use TL082H as the op-amp placeholder.
In real design it has to be a precision op-amp.
V(offset)<100uV if avilable.
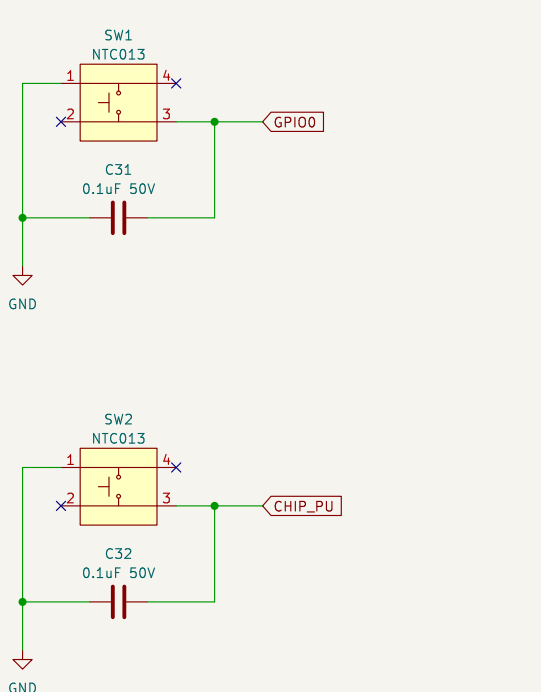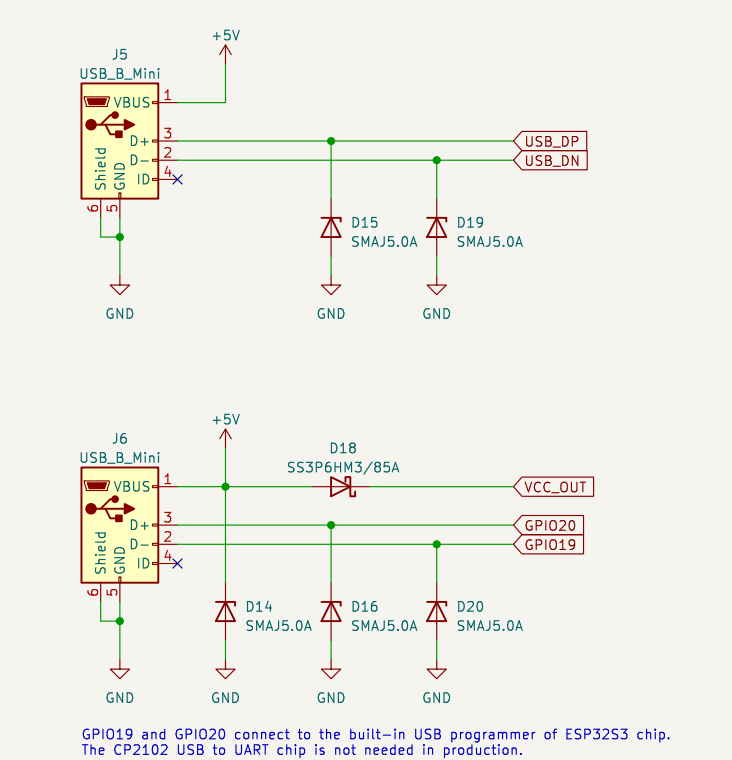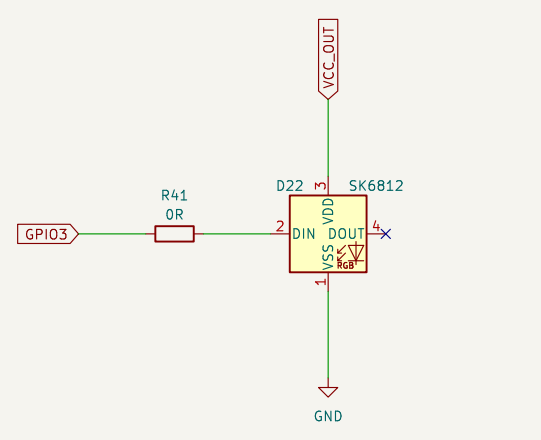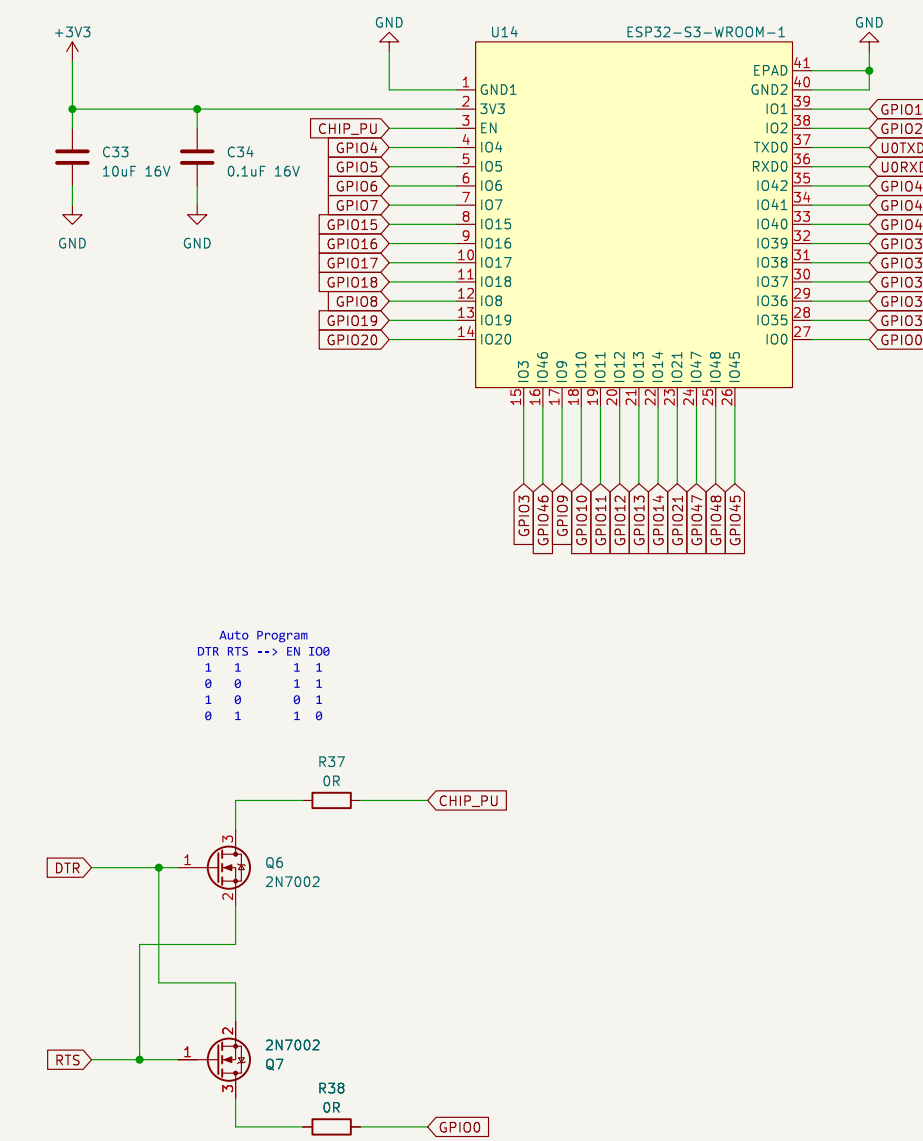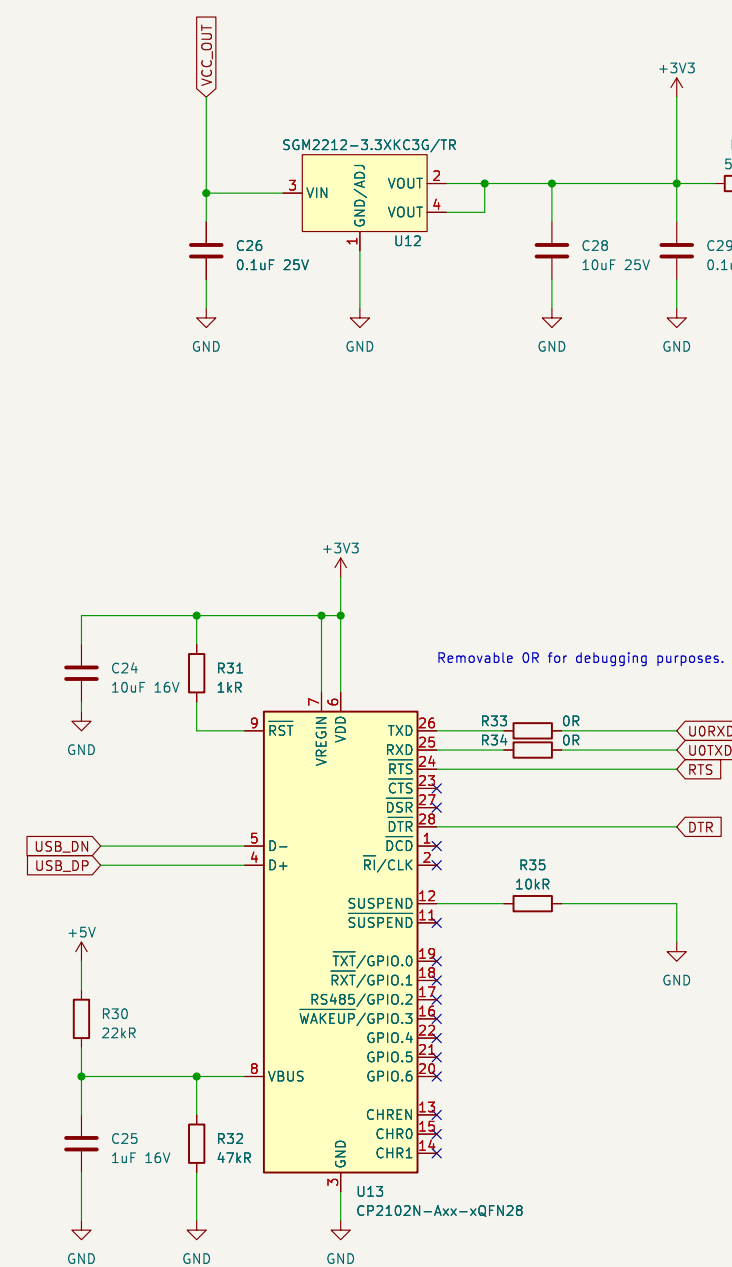Recommend to use thermocouple IC like AD8495 and replace this part.
This is a demo differential op-amp circuit, not practical.

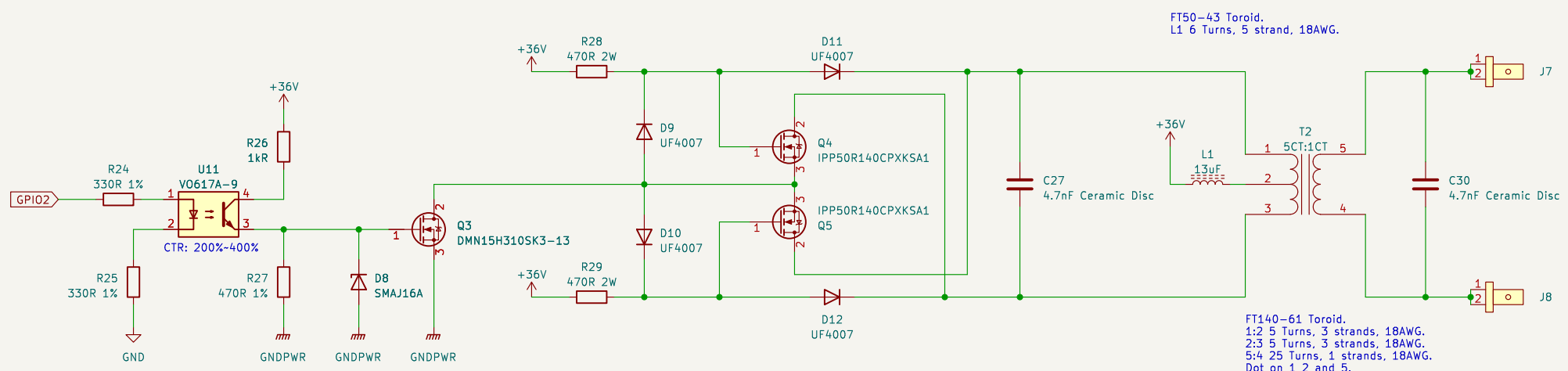K-Type Thermocouple Metal A. J1
K-Type Thermocouple Metal B. J2

Low-pass filter time constant: 0.1s
V(OUT)=V(TC)*(R(F)/R(G))+V(LS)=100*V(TC)+2.5V

Junction should be put close to ADC for Better Temperature Compensation.

V(LS)=2.5V
Common-mode range: 2V~VCC_OUT.

Isolated ADC (Sigma-Delta ADC) and SPI Interface.

U1 RV1S9353A
U5 ACPL-0873
U8 TXS0108EPW

ESP32S3 USB/CAN/WiFi/BLE

U14 ESP32-S3-WROOM-1

SGM2212-3.3XKC3G/TR
U12

D21 PWR LED

Removable 0R for debugging purposes.

U13 CP2102N-Axx-xQFN28

Auto Program
DTR RTS --- EN IO0

GPIO19 and GPIO20 connect to the built-in USB programmer of ESP32S3 chip.
The CP2102 USB to UART chip is not needed in production.

Selectable 120R Terminal Resistor.

U15 TJA1445ATK

SW1 NTCD13
SW2 NTCD13

Q6 2N7002
Q7 2N7002

H1 MountingHole
H2 MountingHole
H3 MountingHole
H4 MountingHole

Baxandall Oscillator

FT50-43 Toroid.
L1 6 Turns, 5 strand, 18AWG.

U11 VO617A-9
CTR: 200%-400%

Q3 DMN15H310SK3-13
Q4 IPP50R140CPXKSA1
Q5 IPP50R140CPXKSA1

D9 UF4007
D10 UF4007
D11 UF4007
D12 UF4007

FT140-61 Toroid.
1/2 5 Turns, 3 strands, 18AWG.
2/3 5 Turns, 3 strands, 18AWG.
5/4 25 Turns, 1 strand, 18AWG.
Dot on 1 2 and 5.

Simulated in LTSpice.

Xiahua Liu

Sheet: /
File: biron.kicad.sch
Title: BIRON DEMO
Size: A1   Date: 2023-03-23   Rev: 0.1
KiCad E.D.A. kicad 7.0.1   Id: 1/1