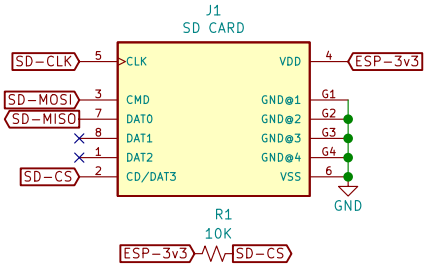
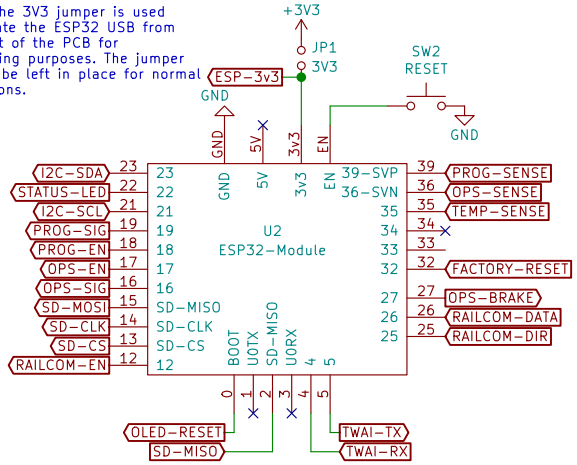
MicroSD Storage

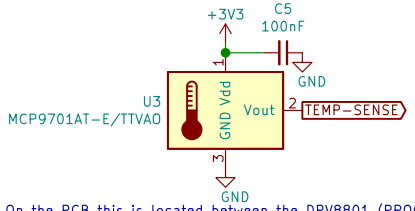


It is highly recommended to use a MicroSD card instead of the built-in flash for persistent configuration data as this will reduce the wear on the flash. The TTGO-T1 board has a built-in MicroSD slot that is wired in parallel to this one.

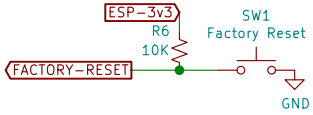
Note: The 3V3 jumper is used to isolate the ESP32 USB from the rest of the PCB for debugging purposes. The jumper should be left in place for normal operations.



Ambient temperature sensor

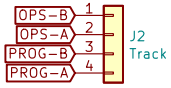


On the PCB this is located between the DRV8801 (PROG) and the DRV8873 (OPS). The goal being to alert the user(s) when the PCB temperature is exceeding safe thresholds that are configured by the user.

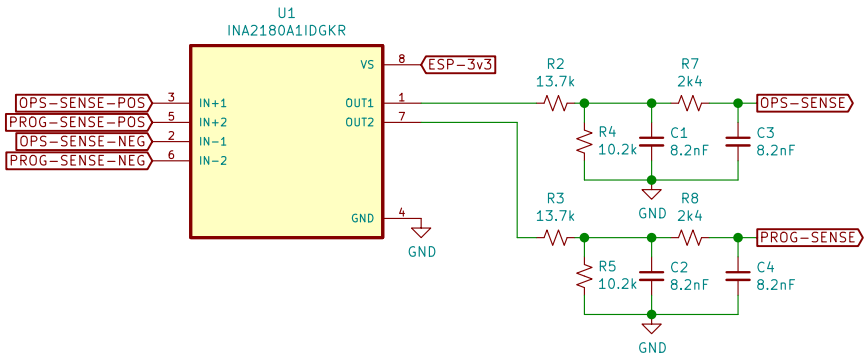


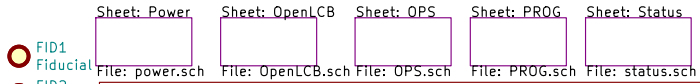
The Factory Reset jumper can be put in place during startup to force clear all persistent configuration data.

OPS and PROG track connection



OPS and PROG current sense monitoring



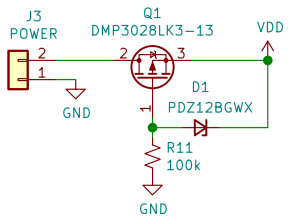


Sheet: /
File: esp32cspcb.sch

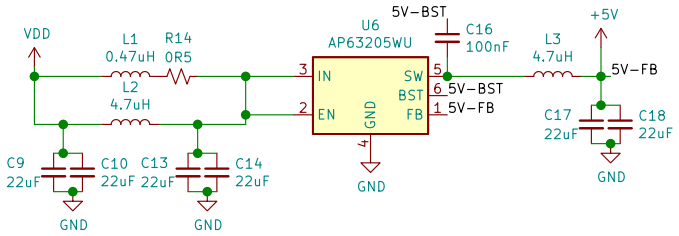
Title: ESP32 Command Station

Size: A4	Date: 2021-02-12	**Rev: v1.5.1**
KiCad E.D.A. kicad 5.1.8		Id: 1/6

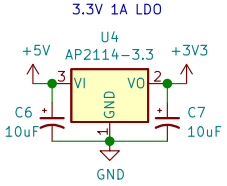
Incoming power with
Reverse Current protection



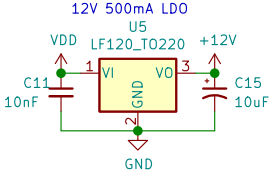
5V 2A buck converter



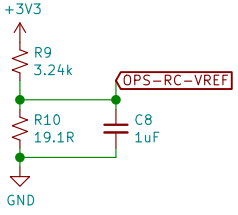
3.3V 1A LDO



12V 500mA LDO

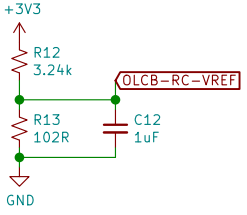


OPS track RailCom
reference voltage



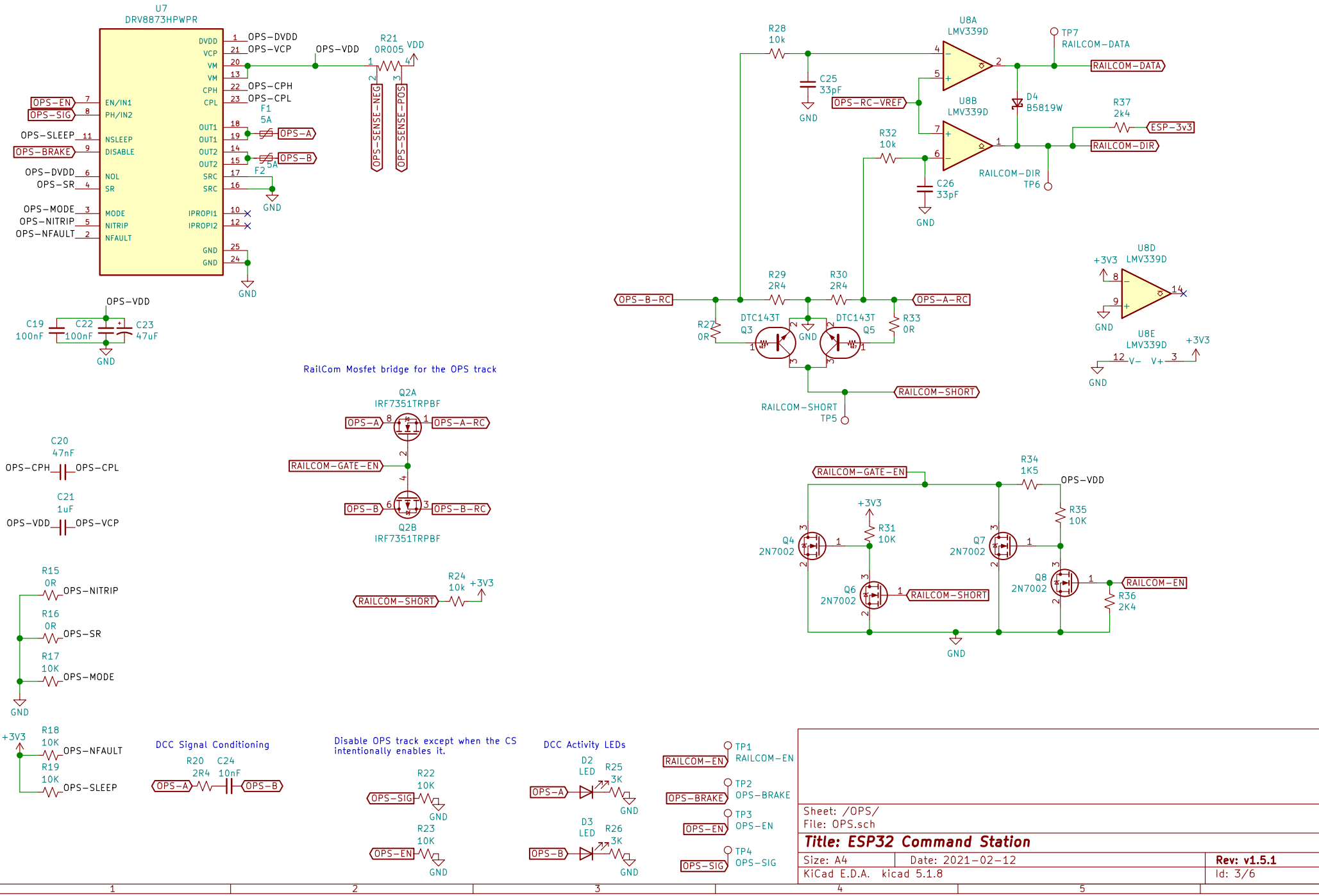
OPS-RC-VREF = (3.3v x R) / (R + R)
OPS-RC-VREF = (3.3 x 19.1) / (3240 + 19.1)
OPS-RC-VREF = 19mV

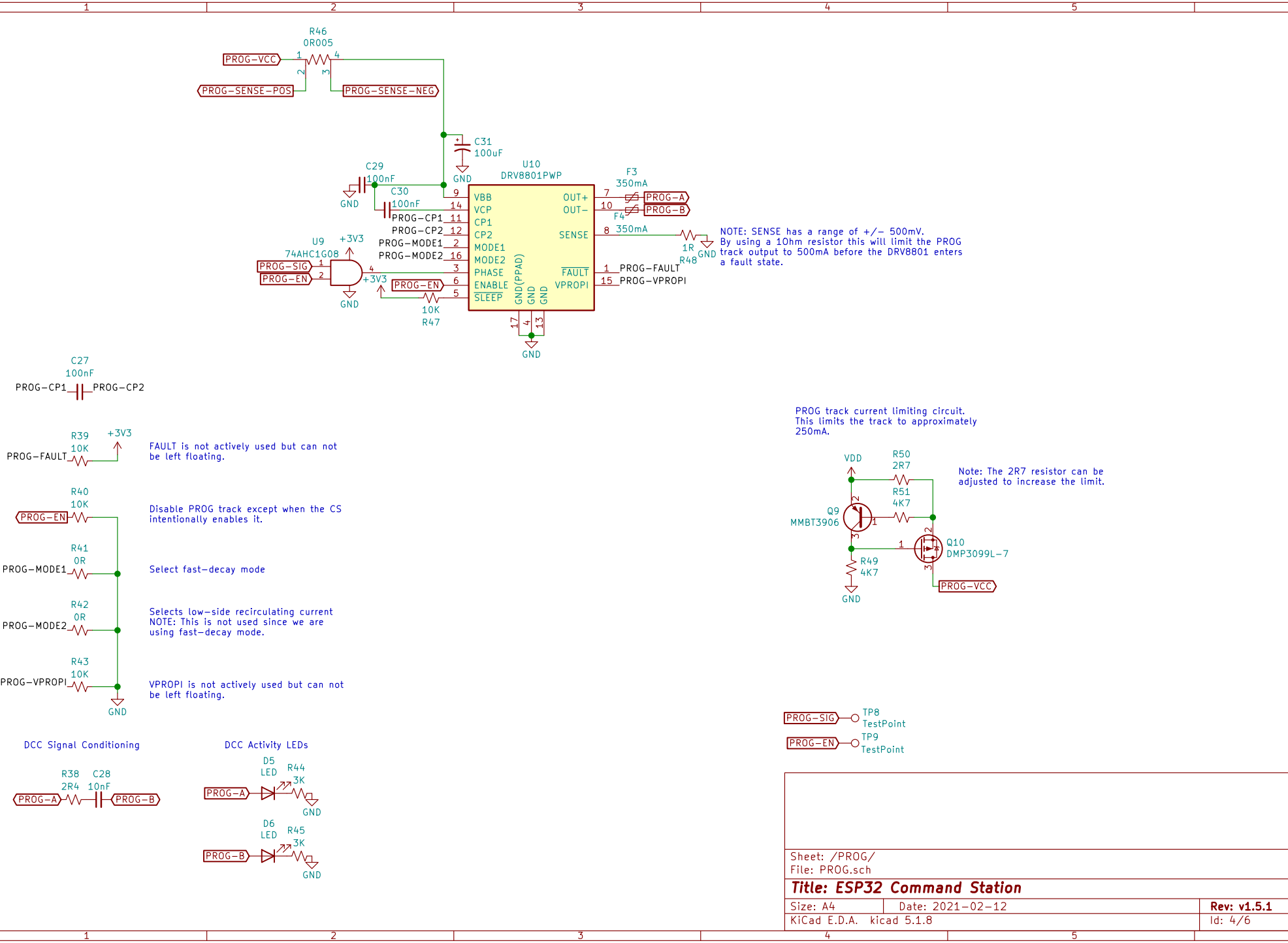
OpenLCB connection RailCom
reference voltage



OLCB-RC-VREF = (3.3v x R) / (R + R)
OLCB-RC-VREF = (3.3v x 102) / (3240 + 102)
OLCB-RC-VREF = 101mV

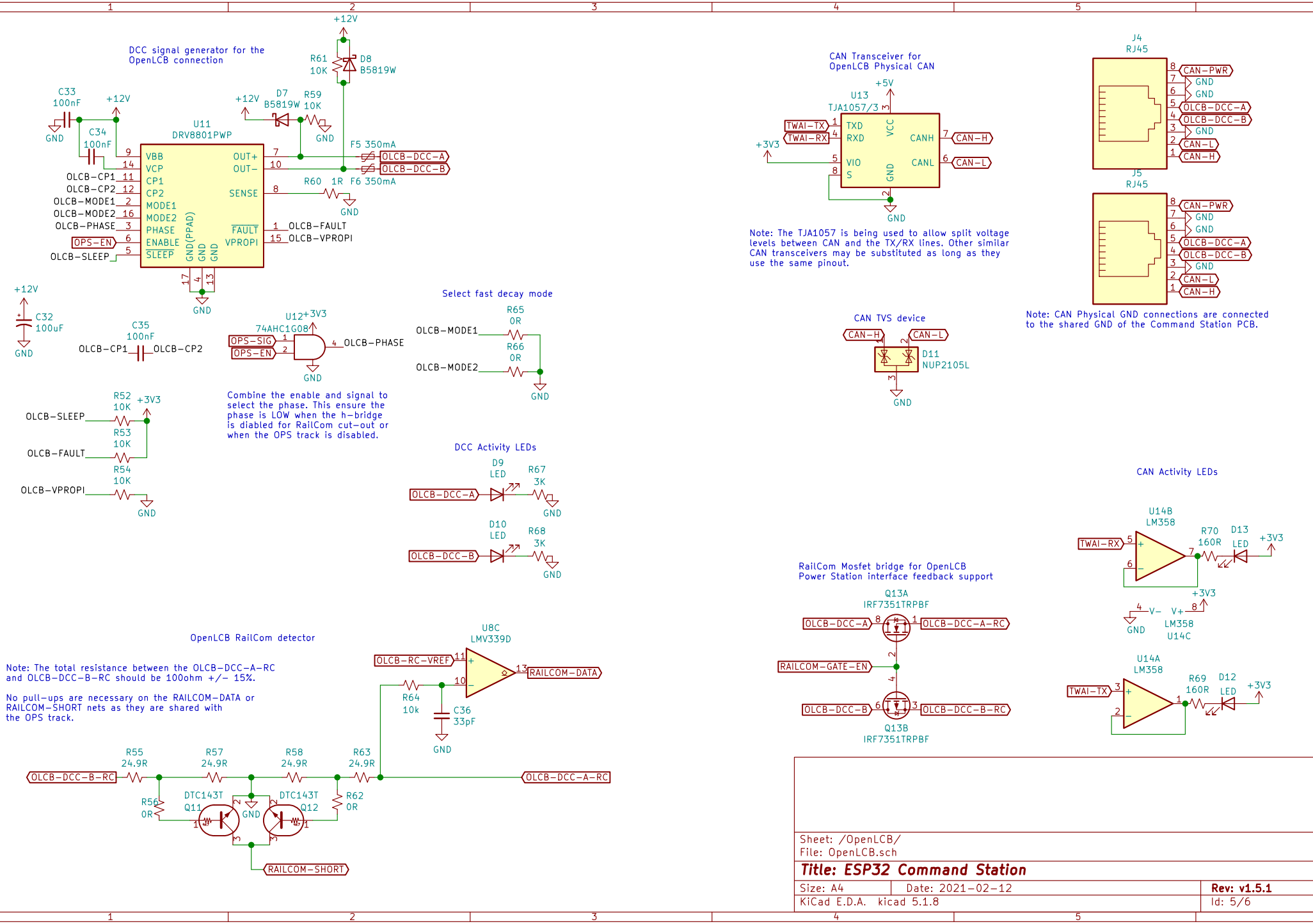
Sheet: /Power/		
File: power.sch		
Title: ESP32 Command Station		
Size: A4	Date: 2021-02-12	**Rev: v1.5.1**
KiCad E.D.A. kicad 5.1.8		Id: 2/6


U7
DRV8873HPWPR
OPS-EN
OPS-SIG
OPS-SLEEP
OPS-BRAKE
OPS-DVDD
OPS-SR
OPS-MODE
OPS-NITRIP
OPS-NFAULT
OPS-DVDD
OPS-VCP
OPS-VDD
OPS-CPH
OPS-CPL
F1
5A
F2
5A
OPS-A
OPS-B
R21
0R005
VDD
OPS-SENSE-NEG
OPS-SENSE-POS
GND
C19
100nF
C22
100nF
C23
47uF
R28
10k
C25
33pF
U8A
LMV339D
TP7
RAILCOM-DATA
D4
B5819W
U8B
LMV339D
R37
2k4
ESP-3v3
R32
10k
C26
33pF
RAILCOM-DIR
TP6
U8D
LMV339D
U8E
LMV339D
+3V3
OPS-B-RC
OPS-A-RC
R29
2R4
R30
2R4
R27
0R
DTC143T
Q3
DTC143T
Q5
R33
0R
RAILCOM-SHORT
TP5
RailCom Mosfet bridge for the OPS track
Q2A
IRF7351TRPBF
Q2B
IRF7351TRPBF
RAILCOM-GATE-EN
C20
47nF
C21
1uF
R24
10k
R34
1K5
R35
10K
R31
10K
Q4
2N7002
Q7
2N7002
Q6
2N7002
Q8
2N7002
R36
2K4
RAILCOM-EN
R15
0R
R16
0R
R17
10K
R18
10K
R19
10K
DCC Signal Conditioning
R20
2R4
C24
10nF
Disable OPS track except when the CS intentionally enables it.
R22
10K
R23
10K
DCC Activity LEDs
D2
LED
R25
3K
D3
LED
R26
3K
TP1
RAILCOM-EN
TP2
OPS-BRAKE
TP3
OPS-EN
TP4
OPS-SIG
Sheet: /OPS/
File: OPS.sch
Title: ESP32 Command Station
Size: A4
Date: 2021-02-12
Rev: v1.5.1
KiCad E.D.A. kicad 5.1.8
Id: 3/6

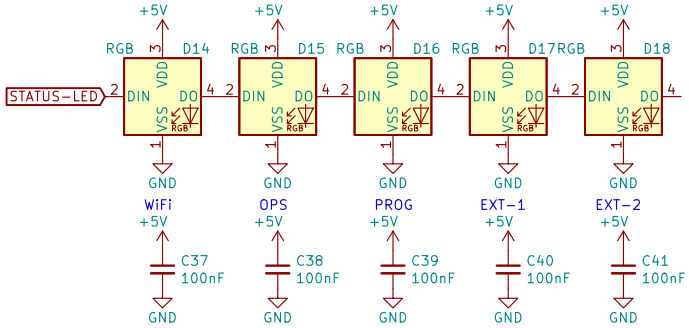


Sheet: /PROG/	
File: PROG.sch	
Title: ESP32 Command Station	
Size: A4	Date: 2021-02-12
KiCad E.D.A. kicad 5.1.8	Id: 4/6

Rev: v1.5.1


DCC signal generator for the OpenLCB connection
U11
DRV8801PWP
VBB
VCP
CP1
CP2
MODE1
MODE2
PHASE
ENABLE
SLEEP
GND(PPAD)
OUT+
OUT−
SENSE
FAULT
VPROPI
OLCB-CP1
OLCB-CP2
OLCB-MODE1
OLCB-MODE2
OLCB-PHASE
OPS-EN
OLCB-SLEEP
OLCB-FAULT
OLCB-VPROPI
OLCB-DCC-A
OLCB-DCC-B
F5 350mA
F6 350mA
R60 1R
R61 10K
D8 B5819W
D7 B5819W
R59 10K
C33 100nF
C34 100nF
C32 100uF
C35 100nF
+12V
+3V3
GND
U12
74AHC1G08
OPS-SIG
Combine the enable and signal to select the phase. This ensure the phase is LOW when the h-bridge is diabled for RailCom cut-out or when the OPS track is disabled.
Select fast decay mode
R65 0R
R66 0R
R52 10K
R53 10K
R54 10K
DCC Activity LEDs
D9 LED
D10 LED
R67 3K
R68 3K
OpenLCB RailCom detector
U8C
LMV339D
OLCB-RC-VREF
RAILCOM-DATA
R64 10k
C36 33pF
R55 24.9R
R57 24.9R
R58 24.9R
R63 24.9R
R56 0R
R62 0R
DTC143T
Q11
Q12
OLCB-DCC-A-RC
OLCB-DCC-B-RC
RAILCOM-SHORT
Note: The total resistance between the OLCB-DCC-A-RC and OLCB-DCC-B-RC should be 100ohm +/- 15%.
No pull-ups are necessary on the RAILCOM-DATA or RAILCOM-SHORT nets as they are shared with the OPS track.
CAN Transceiver for OpenLCB Physical CAN
U13
TJA1057/3
TXD
RXD
VIO
S
VCC
GND
CANH
CANL
TWAI-TX
TWAI-RX
CAN-H
CAN-L
+5V
Note: The TJA1057 is being used to allow split voltage levels between CAN and the TX/RX lines. Other similar CAN transceivers may be substituted as long as they use the same pinout.
CAN TVS device
D11
NUP2105L
J4
RJ45
J5
RJ45
CAN-PWR
Note: CAN Physical GND connections are connected to the shared GND of the Command Station PCB.
RailCom Mosfet bridge for OpenLCB Power Station interface feedback support
Q13A
IRF7351TRPBF
Q13B
IRF7351TRPBF
RAILCOM-GATE-EN
CAN Activity LEDs
U14B
LM358
U14C
U14A
R70 160R
R69 160R
D13 LED
D12 LED
Sheet: /OpenLCB/
File: OpenLCB.sch
Title: ESP32 Command Station
Size: A4
Date: 2021-02-12
Rev: v1.5.1
KiCad E.D.A. kicad 5.1.8
Id: 5/6

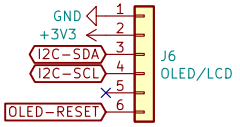
Status LEDs



WiFi:
Green [ON] – Connected
Green [Flashing] – Connecting
Blue – SoftAP Active
Red – Disconnected

OPS / PROG:
Green = On
Off/Black = Off
Yellow = Usage warning (75% of limit)
Red = Fault/Short

Status Display connection



The Status Display connection is for adding an OLED or LCD display to the Command Station. The display shows real-time statistics and status information about the Command Station.

Note: OLED-RESET will be pulsed LOW for approximately 50ms during startup to allow a connected OLED display to reset.

I2C pull-up resistors

Sheet: /Status/		
File: status.sch		
Title:		
Size: A4	Date: 2021-02-12	**Rev: v1.5.1**
KiCad E.D.A. kicad 5.1.8		Id: 6/6