To Rocket CAN bus

PWR_FLAG

+12V

J2
Conn_02x06
Harwin connector

1
2
3
4
5

GND

Power Supplies & Regulators

5V_SWITCHED

12V_PWR_DIS
AUX_PWR_EN
AUX_CURR_SENSE

File: grandpapa_Power.kicad_sch

Output Connectors
Minisensor is a Harwin connector, all others are dupont

1
2
3   Logger Board
CANH_PAYLOAD   4   J5
CANL_PAYLOAD   5   Conn_01x06_Female
6

GND

Minisensor Board
J4

HARWIN CONN

1
2
3
CANL_PAYLOAD   4
CANH_PAYLOAD   5

GND

1
2   GPS Board
3   J3
CANH_PAYLOAD   4
CANL_PAYLOAD   5   Conn_01x06_Female
6

GND

MCU and CAN Controllers

CANL_ROCKET
CANH_ROCKET

12V_PWR_DIS
AUX_PWR_EN
AUX_CURR_SENSE

CANL_PAYLOAD   CANL_PAYLOAD
CANH_PAYLOAD   CANH_PAYLOAD

VBATT_CURR_SENSE
VBATT_VOLT_SENSE

File: grandpapa_MCU.kicad_sch

Battery Charging

VBATT_CURR_SENSE
VBATT_VOLT_SENSE

File: grandpapa_Charge.kicad_sch

Mounting Holes

H1   H4
MountingHole_Pad   MountingHole_Pad

H2   H5
MountingHole_Pad   MountingHole_Pad

H3   H6
MountingHole_Pad   MountingHole_Pad

H7   H8
MountingHole_Pad   MountingHole_Pad

GND

GND pins for testing
J11
Conn_01x04_Male

1
2
3
4

PWR_FLAG

GND

GND

Sheet: /
File: GrandPapa_Board.kicad_sch

Title: Grandpapa Board

Size: A4   Date: Rev: 0
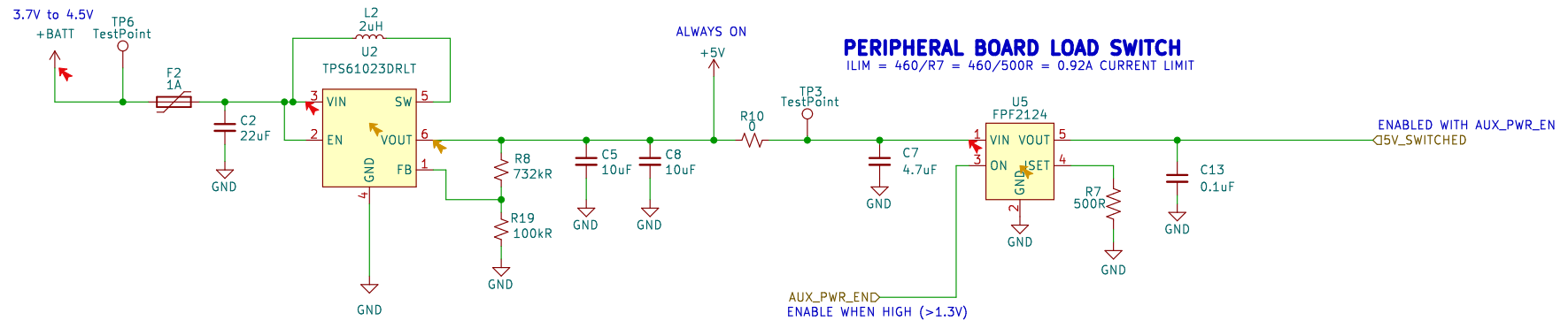KiCad E.D.A. kicad (6.0.5)   Id: 1/4

4.5V BUCK REGULATOR

IMAX = 1.5A
C6 should be an aluminum capacitor
C12 should be a tantallum capacitor
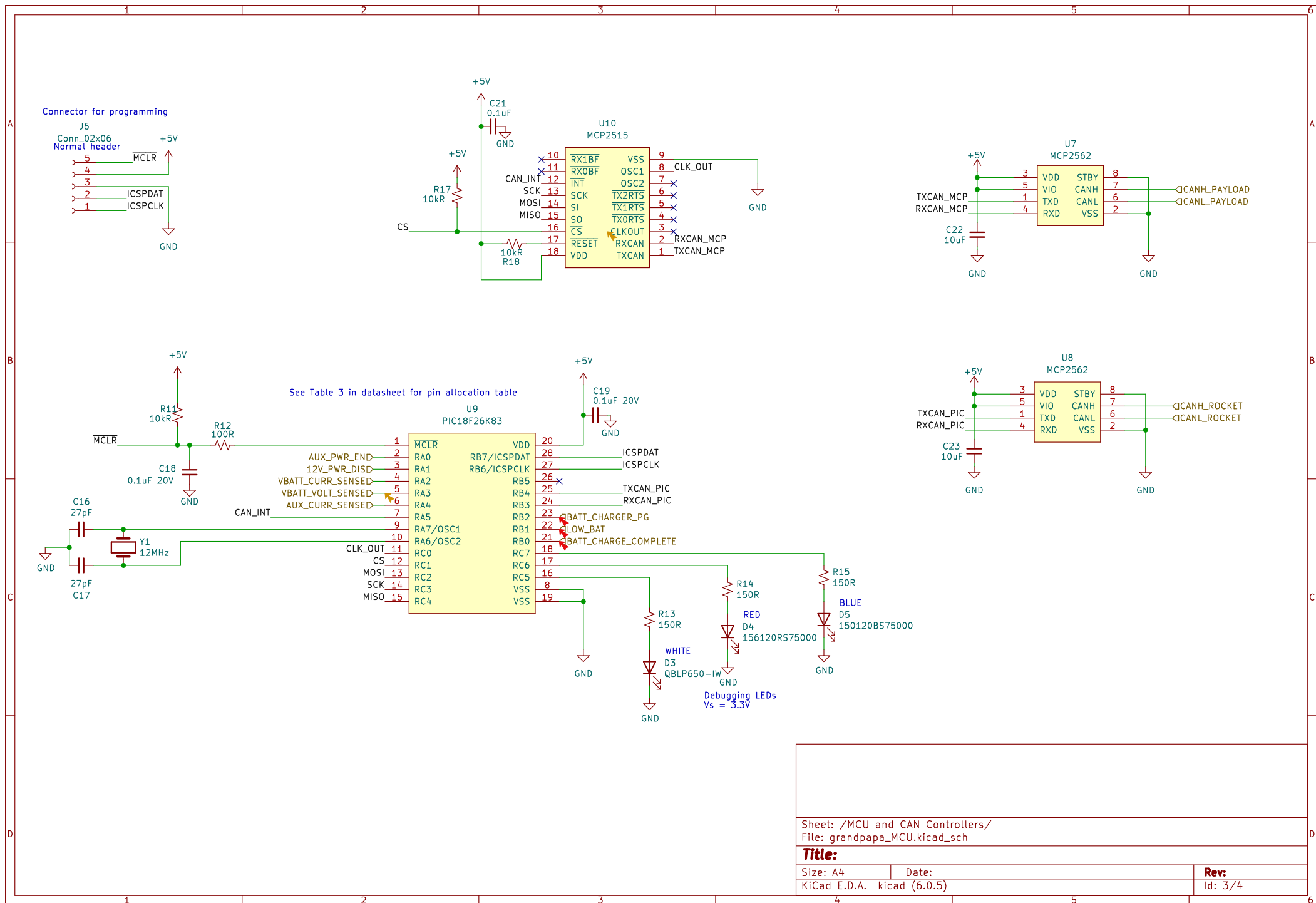L chosen to be 30uH as per datasheet recs for operation < 1A nominally

+12V

F1 2A

R1 20mR

R9 0

TP4 TestPoint

+5V

C14 0.1uF

GND

U6 INA180
- IVS 5
- IN- 4
- IN+ 3
- GND 2
- VO 1 → AUX_CURR_SENSE
- 100V/V

GND

VBATT_CURR_SENSE = Iout*R3*100V/V = (5V−0.02V) max = 4.98V max
I_max_sense = (4.98V)/(20mR*100V/V) = 2.49A

R16 20k
R25 10kR

GND

12V_PWR_DIS
DISABLE WHEN < 0.4V

C1 30uF

GND

U1 LT1576IS8−5#TRPBF
- VIN 2
- BOOST 3
- SHDN/SYNC 8
- GND 4
- VC 6
- VSW 1
- BIAS 5
- FB/SENSE 7

C3 100pF

GND

D2 1N914

C4 0.33uF

L1 30uH

+4.5V

R3 13.7kR

D1 1N5818

R2 4.99kR

C6 100uF

5V BOOST REGULATOR

IMAX = 1A
See doc for inductor calculations:
https://docs.google.com/spreadsheets/d/1l7EJS5MbtJSlwyG−RCYFS4woB5pbUpGjtHOA2−_d_7I/edit?usp=sharing

3.7V to 4.5V
+BATT

TP6 TestPoint

F2 1A

C2 22uF

GND

L2 2uH

U2 TPS61023DRLT
- VIN 3
- EN 2
- GND 4
- SW 5
- VOUT 6
- FB 1

GND

R8 732kR

R19 100kR

GND

GND

C5 10uF

GND

C8 10uF

GND

ALWAYS ON
+5V

R10 0

TP3 TestPoint

C7 4.7uF

GND

PERIPHERAL BOARD LOAD SWITCH

ILIM = 460/R7 = 460/500R = 0.92A CURRENT LIMIT

U5 FPF2124
- VIN 1
- ON 3
- GND 2
- VOUT 5
- ISET 4

GND

R7 500R

GND

C13 0.1uF

GND

ENABLED WITH AUX_PWR_EN
5V_SWITCHED

AUX_PWR_EN
ENABLE WHEN HIGH (>1.3V)

Convoluted Payload Power Path 101

1. 12V supply power is provided from the rocket (only while on the pad prior to flight)
2. U1 regulates the 12V supply down to 4.5V, which is what our battery charger IC can take
3. Our battery charger takes 4.5V in and charges the battery, as well as passing
the 4.5V supply onward to supply power to everything else. When it loses that external source,
it switches its output to drain battery power instead —
that's why +BATT varies between 3.7V (battery voltage) and 4.5V (charger pass−through)
4. +BATT supplies U2, which boosts the voltage up to a smooth 5V
5. 5V is always supplied to the MCU and CAN hardware
6. U5 controls the flow of power into the other boards hooked up to GrandPapa,
to stop them from turning on and drawing power when we don't need them to

Connector for programming

J6
Conn_02x06
Normal header

5 $\overline{MCLR}$
4 +5V
3
2 ICSPDAT
1 ICSPCLK

GND

+5V

C21
0.1uF

GND

+5V

R17
10kR

CS

10kR
R18

U10
MCP2515

10 $\overline{RX1BF}$
11 $\overline{RX0BF}$ VSS 9
CAN_INT 12 $\overline{INT}$ OSC1 8 CLK_OUT
SCK 13 SCK   OSC2 7
MOSI 14 SI $\overline{TX2RTS}$ 6
MISO 15 SO $\overline{TX1RTS}$ 5
16 $\overline{CS}$ $\overline{TX0RTS}$ 4
17 $\overline{RESET}$ CLKOUT 3
18 VDD   RXCAN 2 RXCAN_MCP
TXCAN 1 TXCAN_MCP

GND

+5V

U7
MCP2562

3 VDD   STBY 8
TXCAN_MCP   5 VIO   CANH 7 CANH_PAYLOAD
RXCAN_MCP   1 TXD   CANL 6 CANL_PAYLOAD
4 RXD   VSS 2

C22
10uF

GND   GND

+5V

R11
10kR

R12
100R

$\overline{MCLR}$

C18
0.1uF 20V

GND

See Table 3 in datasheet for pin allocation table

+5V

C19
0.1uF 20V

GND

U9
PIC18F26K83

1 $\overline{MCLR}$ VDD 20
AUX_PWR_END 2 RA0   RB7/ICSPDAT 28 ICSPDAT
12V_PWR_DISD 3 RA1   RB6/ICSPCLK 27 ICSPCLK
VBATT_CURR_SENSED 4 RA2   RB5 26
VBATT_VOLT_SENSED 5 RA3   RB4 25 TXCAN_PIC
AUX_CURR_SENSED 6 RA4   RB3 24 RXCAN_PIC
CAN_INT 7 RA5   RB2 23 BATT_CHARGER_PG
9 RA7/OSC1   RB1 22 LOW_BAT
10 RA6/OSC2   RB0 21 BATT_CHARGE_COMPLETE
CLK_OUT 11 RC0   RC7 18
CS 12 RC1   RC6 17
MOSI 13 RC2   RC5 16
SCK 14 RC3   VSS 8
MISO 15 RC4   VSS 19

C16
27pF

Y1
12MHz

GND

27pF
C17

U8
MCP2562

3 VDD   STBY 8
TXCAN_PIC   5 VIO   CANH 7 CANH_ROCKET
RXCAN_PIC   1 TXD   CANL 6 CANL_ROCKET
4 RXD   VSS 2

+5V

C23
10uF

GND   GND

R13
150R

WHITE
D3
QBLP650-IW

GND

GND

R14
150R

RED
D4
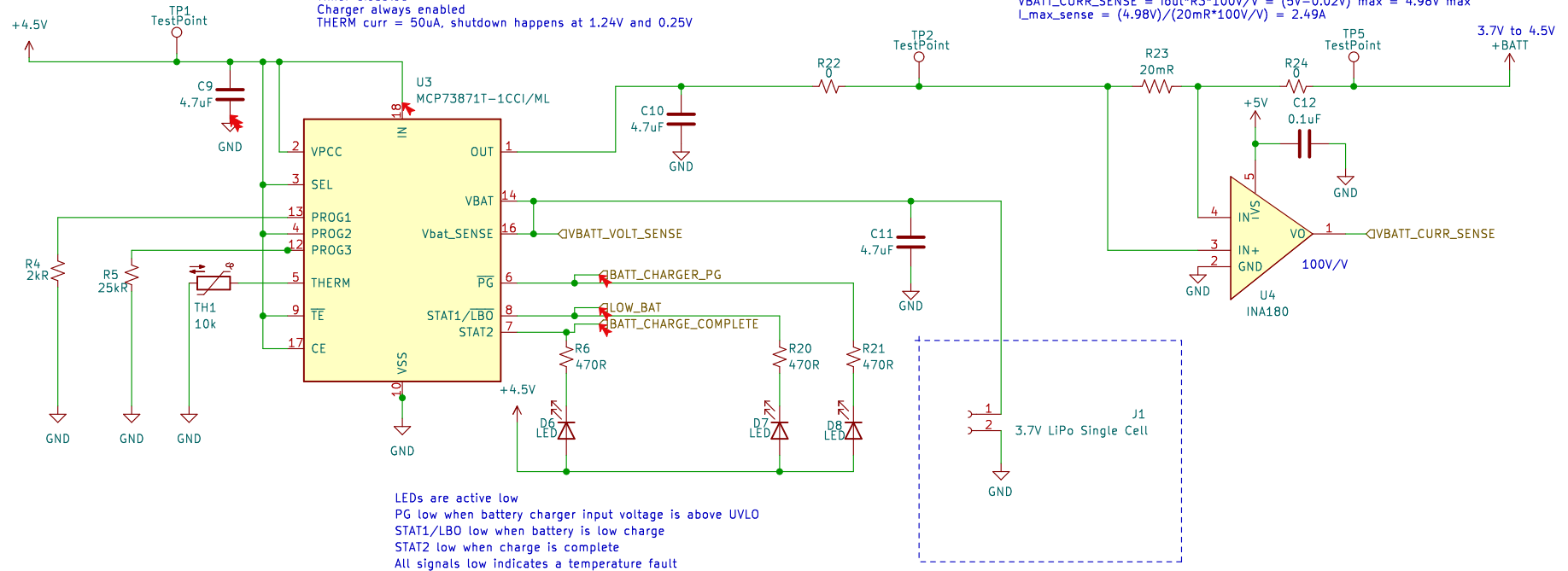156120RS75000

GND

Debugging LEDs
Vs = 3.3V

R15
150R

BLUE
D5
150120BS75000

GND

BATTERY CHARGE IC

LIPO charge voltage = 4.1V, 4.121V MAX
Fast charge current = 1000V/Rprog1 = 1000/2kOhm = 500mA
Timer disabled
Charger always enabled
THERM curr = 50uA, shutdown happens at 1.24V and 0.25V

VBATT_CURR_SENSE = Iout*R3*100V/V = (5V−0.02V) max = 4.98V max
I_max_sense = (4.98V)/(20mR*100V/V) = 2.49A

+4.5V

TP1
TestPoint

C9
4.7uF

GND

TP2
TestPoint

R22
0

C10
4.7uF

GND

R23
20mR

R24
0

TP5
TestPoint

3.7V to 4.5V
+BATT

+5V

C12
0.1uF

GND

U3
MCP73871T-1CCI/ML

18
IN

2 VPCC

3 SEL

13 PROG1
4 PROG2
12 PROG3

5 THERM

9 TE

17 CE

OUT 1

VBAT 14

Vbat_SENSE 16

PG 6

STAT1/LBO 8
STAT2 7

VSS
10

GND

VBATT_VOLT_SENSE

BATT_CHARGER_PG

LOW_BAT
BATT_CHARGE_COMPLETE

C11
4.7uF

GND

5
IVS

4 IN

3 IN+

2 GND

VO 1

VBATT_CURR_SENSE

100V/V

U4
INA180

GND

R4
2kR

R5
25kR

TH1
10k

GND   GND   GND

R6
470R

R20
470R

R21
470R

+4.5V

D6
LED

D7
LED

D8
LED

J1
3.7V LiPo Single Cell

1

2

GND

LEDs are active low
PG low when battery charger input voltage is above UVLO
STAT1/LBO low when battery is low charge
STAT2 low when charge is complete
All signals low indicates a temperature fault

Sheet: /Battery Charging/
File: grandpapa_Charge.kicad_sch

Title:

Size: A4   Date: Rev:

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