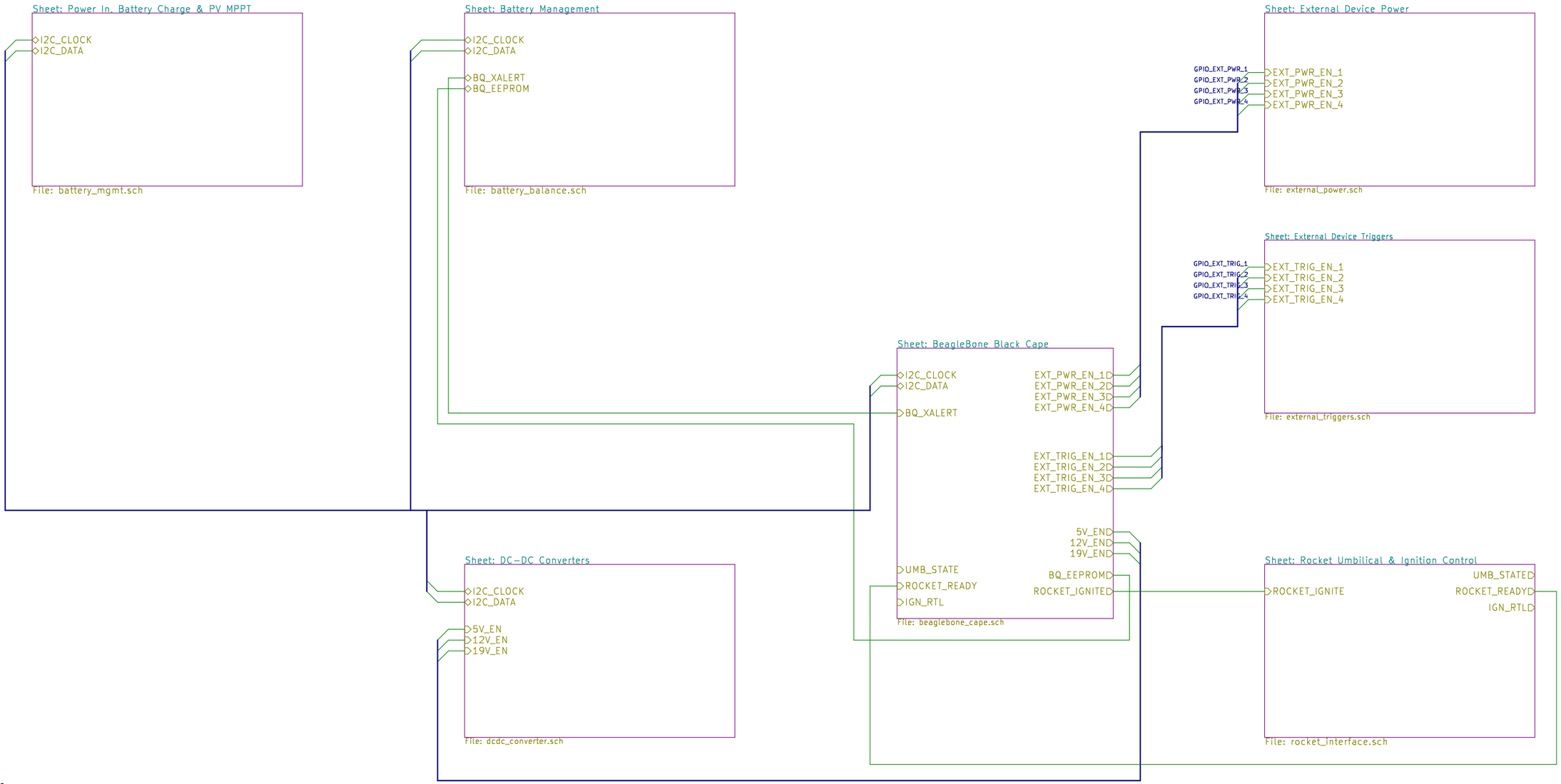


TODO:

- Finish wiring up sub-sheets.
  - Bus entries need labels on both sides!
- Create style legend.
- Consistent style:
  - No "embedded" multipliers in R vals.
- Add test points where appropriate.
  - Esp. around SMD packages, parts w/ no exposed leads, etc.
  - through-hole 2x1 pin header (1 to signal, other to gnd)

Portland State Aerospace Society <http://psas.pdx.edu/>		
Sheet: / File: Launch_Tower_Computer_III.sch		
Title: Launch Tower Computer 3 (LTC3)		
Size: B	Date: 2016-04-23	**Rev: A**
KiCad E.D.A. kicad 0.201604212032+670644ubuntu16.04.1-product		Id: 1/8

PV_IN:
Open Circuit = 17 V
Short Circuit = 2.4 A

Supply Detection (p.15, p.34)

Input Current Sense (p. 20)

Output Current Sense (p. 20)

Input Feedback (p.14)

Shutdown (p. 27)

Battery Charge Controller
w/ MPPT

LT8490

U204

Output Feedback (p. 17)

Temp Sense (p. 21)

Feedback Resistor Disconnect

Voltage, Current, & Temp Sense

I2C addr 0x98

TODO: label pull-up resistors as no-place?

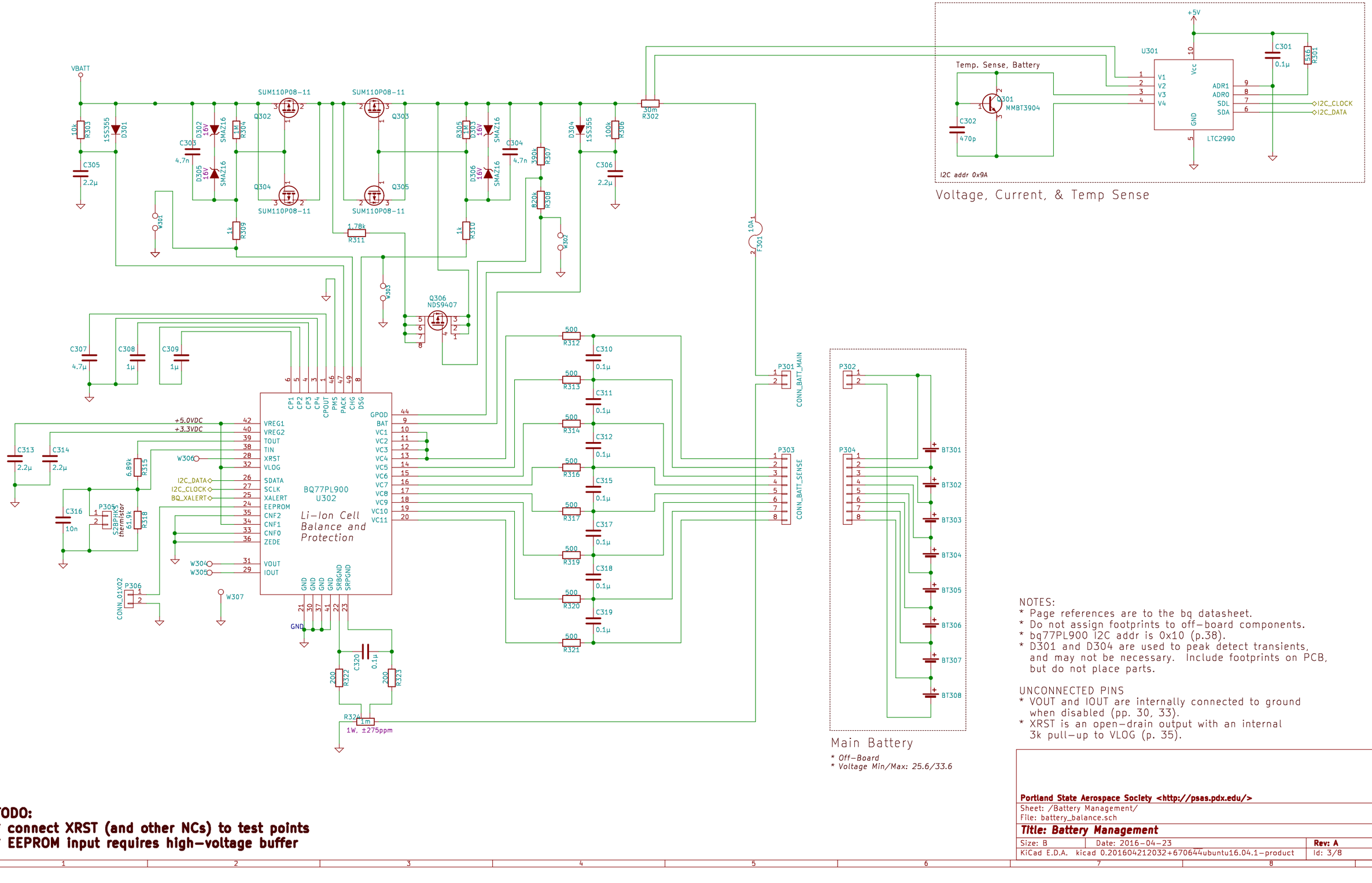
CHARGING PARAMETERS:
Stage 2 Voltage: 33.6 V
Maximum Charging Current: 10 A?
Maximum Trickle Current: 1 A
Switching Frequency: 202 kHz

1% Resistors
75V Capacitors

Place close to VIN.

Portland State Aerospace Society <http://psas.pdx.edu/>	
Sheet: /Power In, Battery Charge & PV MPPT/	
File: battery_mgmt.sch	
Title: Power In, Battery Charge, & PV MPPT	
Size: B	Date: 2016-04-23
KiCad E.D.A. kicad 0.201604212032+670644ubuntu16.04.1-product	Id: 2/8

Rev: A



NOTES:
* Page references are to the bq datasheet.
* Do not assign footprints to off-board components.
* bq77PL900 I2C addr is 0x10 (p.38).
* D301 and D304 are used to peak detect transients, and may not be necessary. Include footprints on PCB, but do not place parts.

UNCONNECTED PINS
* VOUT and IOUT are internally connected to ground when disabled (pp. 30, 33).
* XRST is an open-drain output with an internal 3k pull-up to VLOG (p. 35).

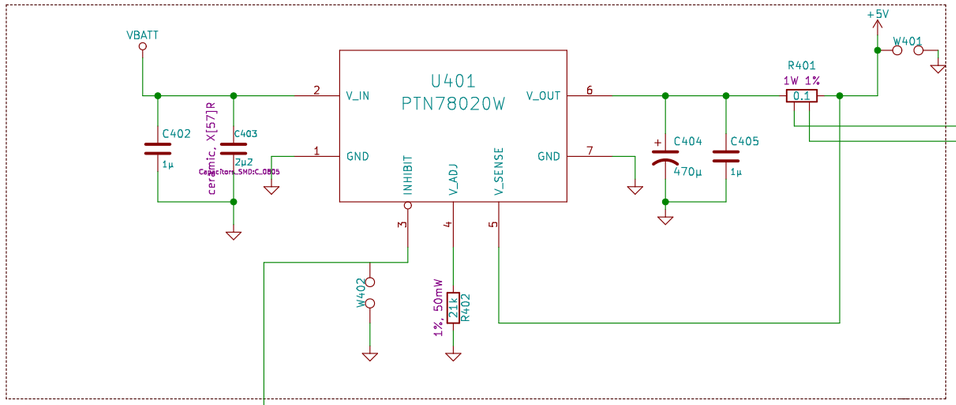
TODO:
*** connect XRST (and other NCs) to test points**
*** EEPROM input requires high-voltage buffer**

Portland State Aerospace Society <http://psas.pdx.edu/>

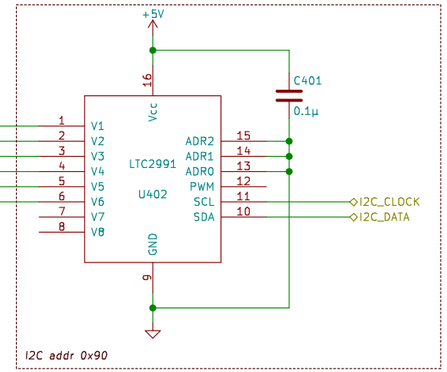
Sheet: /Battery Management/
File: battery_balance.sch

Title: Battery Management

Size: B	Date: 2016-04-23	**Rev: A**
KiCad E.D.A.	kicad 0.201604212032+670644ubuntu16.04.1-product	Id: 3/8

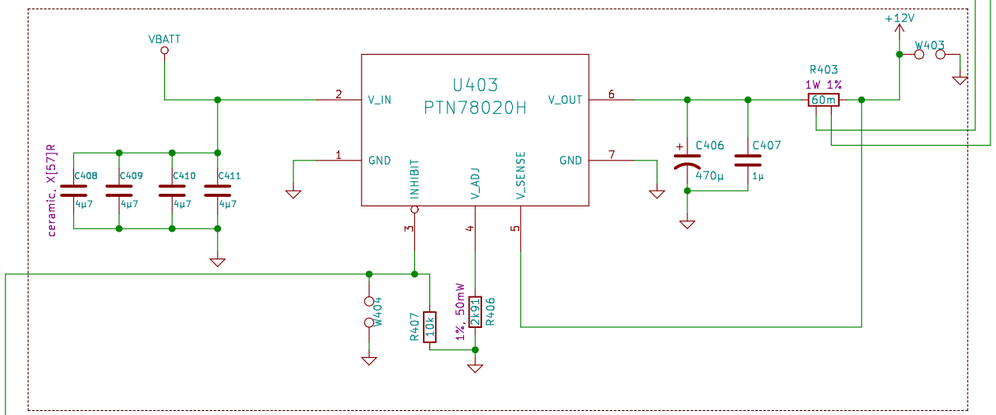


+5V DC Rail



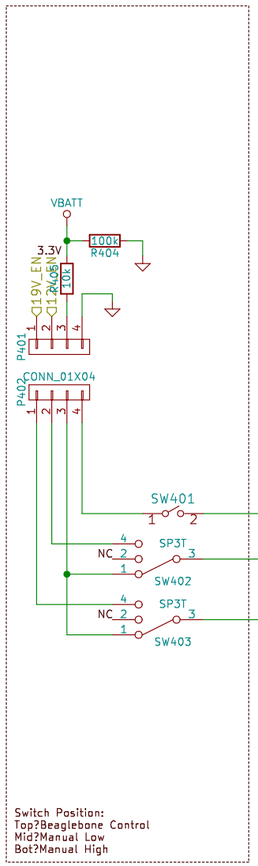
Voltage, Current, & Temp Sense

Current Sense Resistors
full-scale voltage = 0.300 V
R_sense_max = 0.300/Imax
1 A = 300mΩ
3 A = 100mΩ
5 A = 60mΩ
10 A = 30mΩ



+12V DC Rail

+19V DC Rail



Inhibit Control

NB:
1. V_sense should connect as close as possible to the largest load on the given power rail.
2. Place Rset resistors as close to package pins as possible.
3. Ceramic (Cin) capacitors should be located within 0.5 in of the input pins.
4. We may need heat sinks on the converters. The datasheet indicates a range of 2W to 5W of power dissipation given our specs.
5. Pay attention to the datasheet's recommendations regarding capacitor selection.

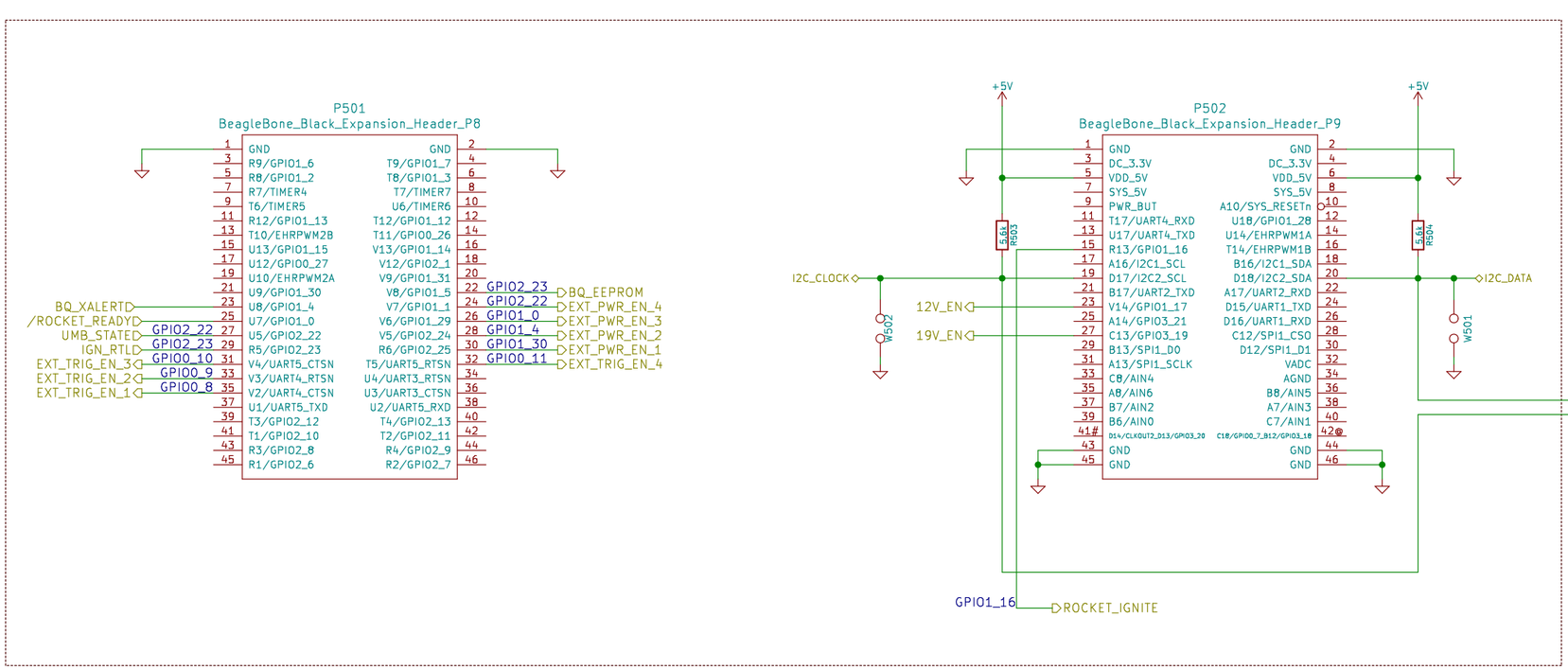
TODO:
* ~~jumpers on all INHIBIT pins~~
* ~~Values for converter enable pull-down resistors. Don't exceed the BB's low source max.!~~
* ~~Capacitor values are minimums. Consider increasing these. Consult datasheet for more info.~~

Portland State Aerospace Society <http://psas.pdx.edu/>

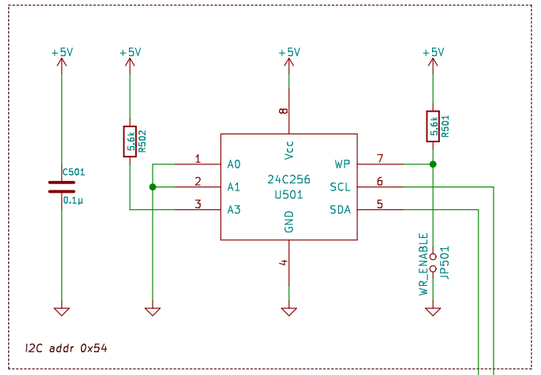
Sheet: /DC-DC Converters/
File: dcdc_converter.sch

Title: LTC3 DC-DC Converters

Size: B	Date: 2016-04-23	**Rev: A**
KiCad E.D.A. kicad 0.201604212032+6706~~4~~4ubuntu16.04.1-product		Id: 4/8



BeagleBone Expansion Headers



Cape EEPROM

I2C Devices

ADDR	Part	Type	Location
0x10	U203	BQ77PL900	B/PM
0x54	U501	EEPROM	BBB
0x90	U402	LTC2991	DC-DC
0x98	U203	LTC2990	Power In
0x9A	U301	LTC2990	B/PM

NOTES:
* Do NOT change ROCKET_IGNITE, pin default reset state is High-Z w/ pulldown resistor. Other pins can be configured in EEPROM at boot time.
* All I2C devices on LTC3 are slaves. The BBB is the only master so the LTC will not need arbitration.

Portland State Aerospace Society <http://psas.pdx.edu/>

Sheet: /BeagleBone Black Cape/
File: beaglebone_cape.sch

Title: LTC3 BeagleBone Black Cape Interface

Size: B	Date: 2016-04-23	**Rev: A**
KiCad E.D.A. kicad 0.201604212032+670644ubuntu16.04.1-product		Id: 5/8

Ignition battery pack disconnected until
flight computer has asserted ROCKET_READY
and 19 VDC rail (shore power) has been shut off.

W602 0/5V

120 R602

IC601 TLP3542

+5V

10k R601

U601A CD74HC14

/ROCKET_READY_3V3

+3.1V

U601B CD74HC14

62k R603

100k R604

10k R605

U602 SN65220DBV SOT-23

Shore Power Check +19V

5.6k R612

4.5k R613

C603 0.1µ

W603 0/5V

U601F CD74HC14

10k R615

W604 0/5V

W605 0/5V

U603 741G08

D602 CDSU4148

100 R606

500k R607

NP R609

C601 10µ

C602 NP

W606 0/5V

Input Logic

Delay (5s)

+5V

CDSU4148 D601

K601 RELAY_1C

30 86 85 87a 87

IGN_BATT_P

P601 BATT-IN

W601 14.8–16.8V

GND_IGN

U601C CD74HC14

U601D CD74HC14

U601E CD74HC14

Q601 PMV45EN

560 R610

10k R608

62k R611

D603 LED

READY_TO_LAUNCH +3.1V

100k R614

LED: ROCKET_READY relay active

Ignition Battery Switch

Rocket–to–BeagleBone Ethernet

RJ45 J601

SHIELD

ROCKET_READY_5V

+19V

P603

UMBILICAL

ROCKET_ETH_1
ROCKET_ETH_2
ROCKET_ETH_3
ROCKET_ETH_4
UMB_CONN_FROM_RKT
UMB_CONN_TO_LTC

+5V

R616 5.1k

5.1k R621

UMB_DISCONN

C604 1µ

D609 3.3V

Rocket Umbilical

TODO: confirm R vals

R617 10k
R618 10k
R619 10k
R620 10k

D605 LED
D606 LED
D607 LED
D608 LED

BAKERCON Indicator

1: Ignition battery present
2: RR asserted; power to ign relay
3: Ign relay closed; power to arm switch
4: Arm sw closed; power to shorting bar

+5V

CDSU4148 D604

K602 RELAY_1C

30 86 85 87a 87

TODO: replace fuse w/ breaker?

F601 FUSE

SW601 Ign. Arm

P602 CONN_01x02 To Away Box

GND_IGN

ROCKET_IGNITED

Q602 PMV45EN

W607 0/3.3V

10k R622

JP601

P604 CONN_01x02

Shorting Bar
(off board)

CONN_01x02 P605

GND

W608 0/14.8–16.8V

Ignition Switch

+5V VCC

VCC for CD74HC14

C605 0.1µ
C606 0.1µ

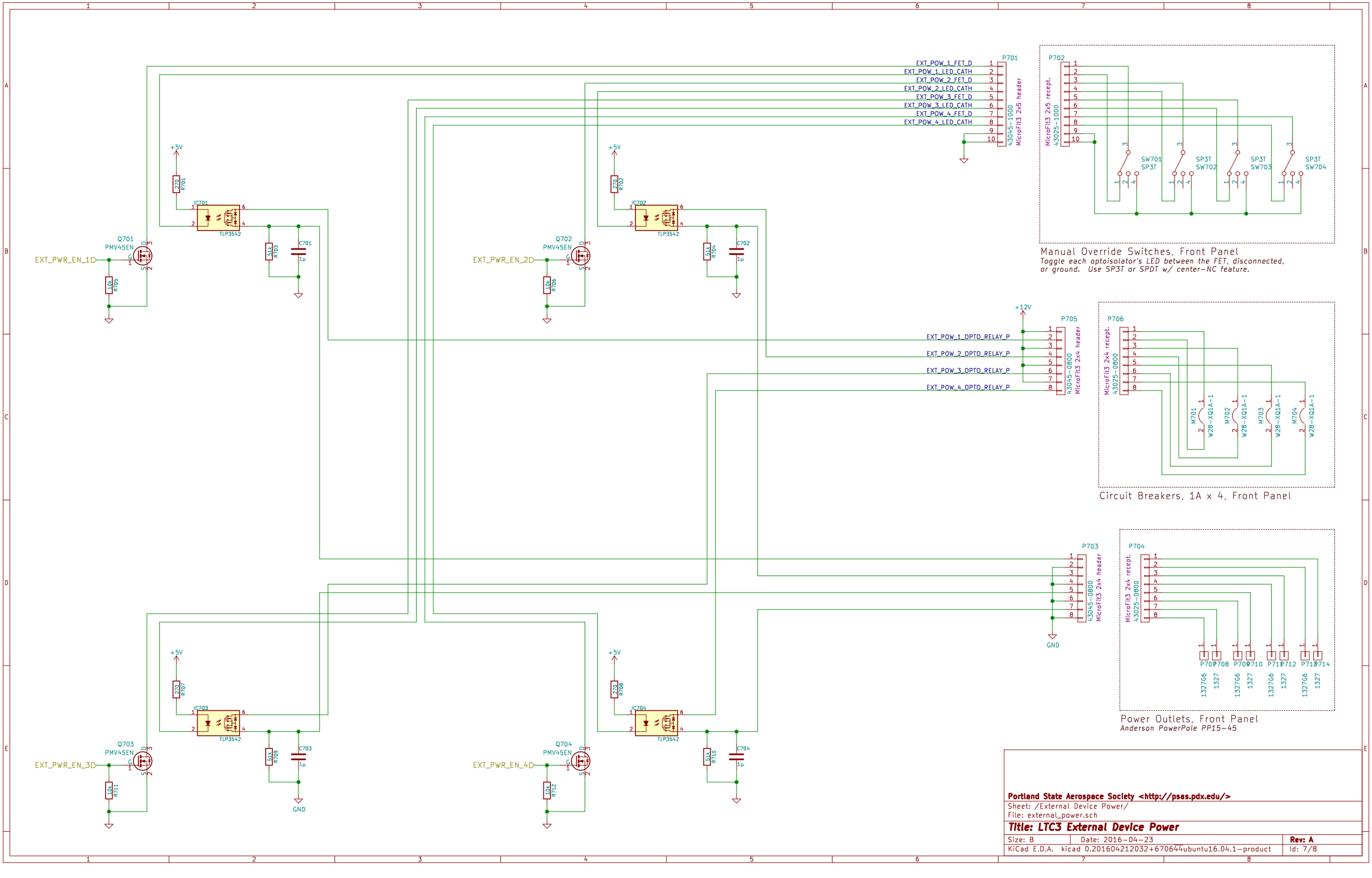
Bypass Capacitors
(one per IC VCC)

Portland State Aerospace Society <http://psas.pdx.edu/>

Sheet: /Rocket Umbilical & Ignition Control/
File: rocket_interface.sch

Title: LTC3 Rocket Umbilical & Ignition Control

Size: B	Date: 2016–04–23	Rev: A
KiCad E.D.A. kicad 0.201604212032+670644ubuntu16.04.1–product		Id: 6/8

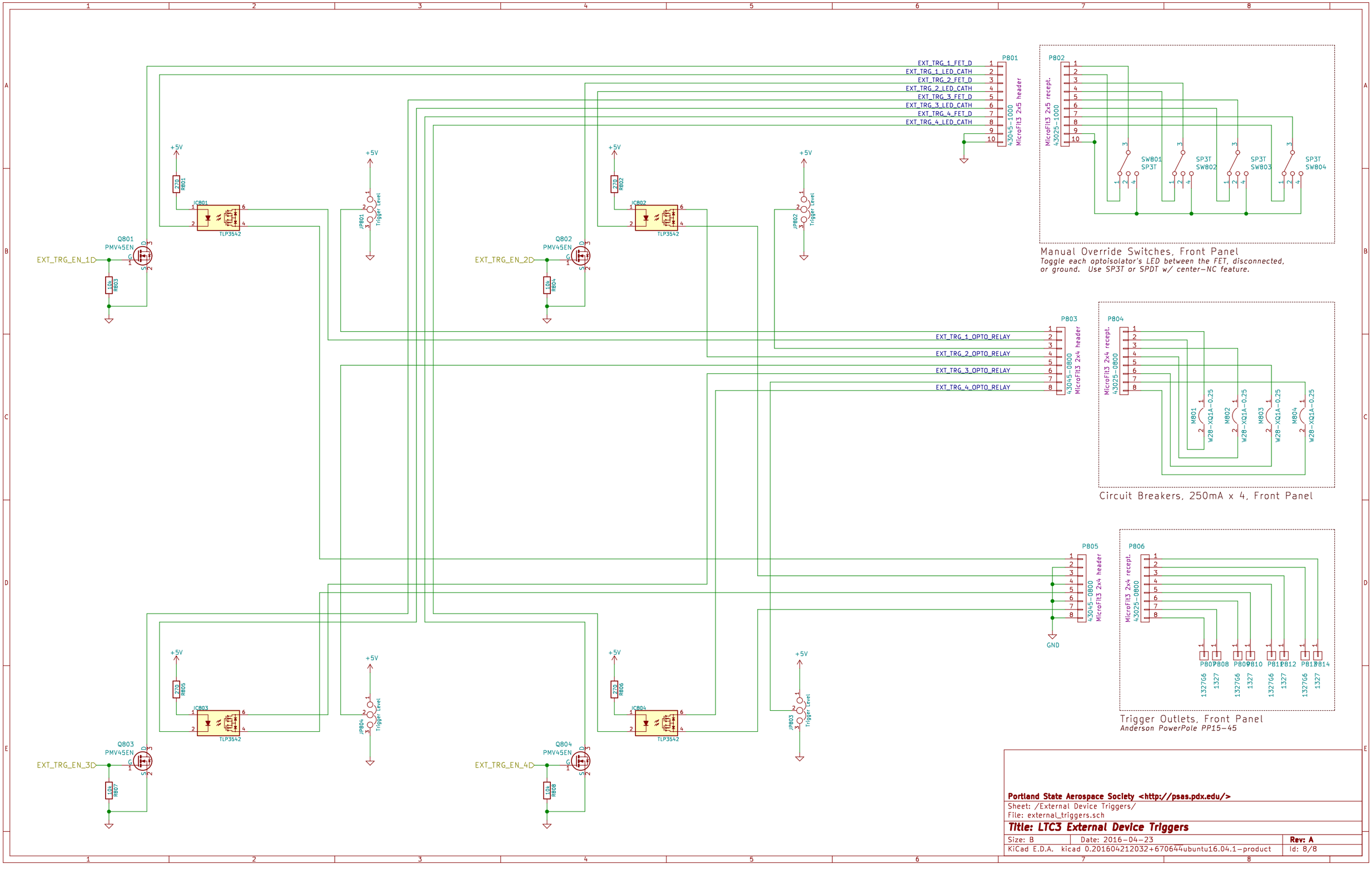


Portland State Aerospace Society <http://psas.pdx.edu/>

Sheet: /External Device Power/
File: external_power.sch

Title: LTC3 External Device Power

Size: B	Date: 2016-04-23	**Rev: A**
KiCad E.D.A. kicad 0.201604212032+6706~44ubuntu16.04.1-product		Id: 7/8


P801
EXT_TRG_1_FET_D
EXT_TRG_1_LED_CATH
EXT_TRG_2_FET_D
EXT_TRG_2_LED_CATH
EXT_TRG_3_FET_D
EXT_TRG_3_LED_CATH
EXT_TRG_4_FET_D
EXT_TRG_4_LED_CATH
43045-1000
MicroFit3 2x5 header
P802
MicroFit3 2x5 recept.
43025-1000
SW801
SP3T
SW802
SW803
SW804
Manual Override Switches, Front Panel
Toggle each aptoisolator's LED between the FET, disconnected, or ground. Use SP3T or SPDT w/ center-NC feature.
+5V
270
R801
IC801
TLP3542
JP801
Trigger Level
Q801
PMV45EN
EXT_TRG_EN_1
10k
R803
R802
IC802
JP802
Q802
EXT_TRG_EN_2
R804
P803
EXT_TRG_1_OPTO_RELAY
EXT_TRG_2_OPTO_RELAY
EXT_TRG_3_OPTO_RELAY
EXT_TRG_4_OPTO_RELAY
P804
M801
M802
M803
M804
W28-XQ1A-0.25
Circuit Breakers, 250mA x 4, Front Panel
P805
GND
P806
P807
P808
P809
P810
P811
P812
P813
P814
1327G6
1327
R805
IC803
JP804
Q803
EXT_TRG_EN_3
R807
R806
IC804
JP803
Q804
EXT_TRG_EN_4
R808
Trigger Outlets, Front Panel
Anderson PowerPole PP15-45
Portland State Aerospace Society <http://psas.pdx.edu/>
Sheet: /External Device Triggers/
File: external_triggers.sch
Title: LTC3 External Device Triggers
Size: B
Date: 2016-04-23
Rev: A
KiCad E.D.A. kicad 0.201604212032+6706~44ubuntu16.04.1-product
Id: 8/8