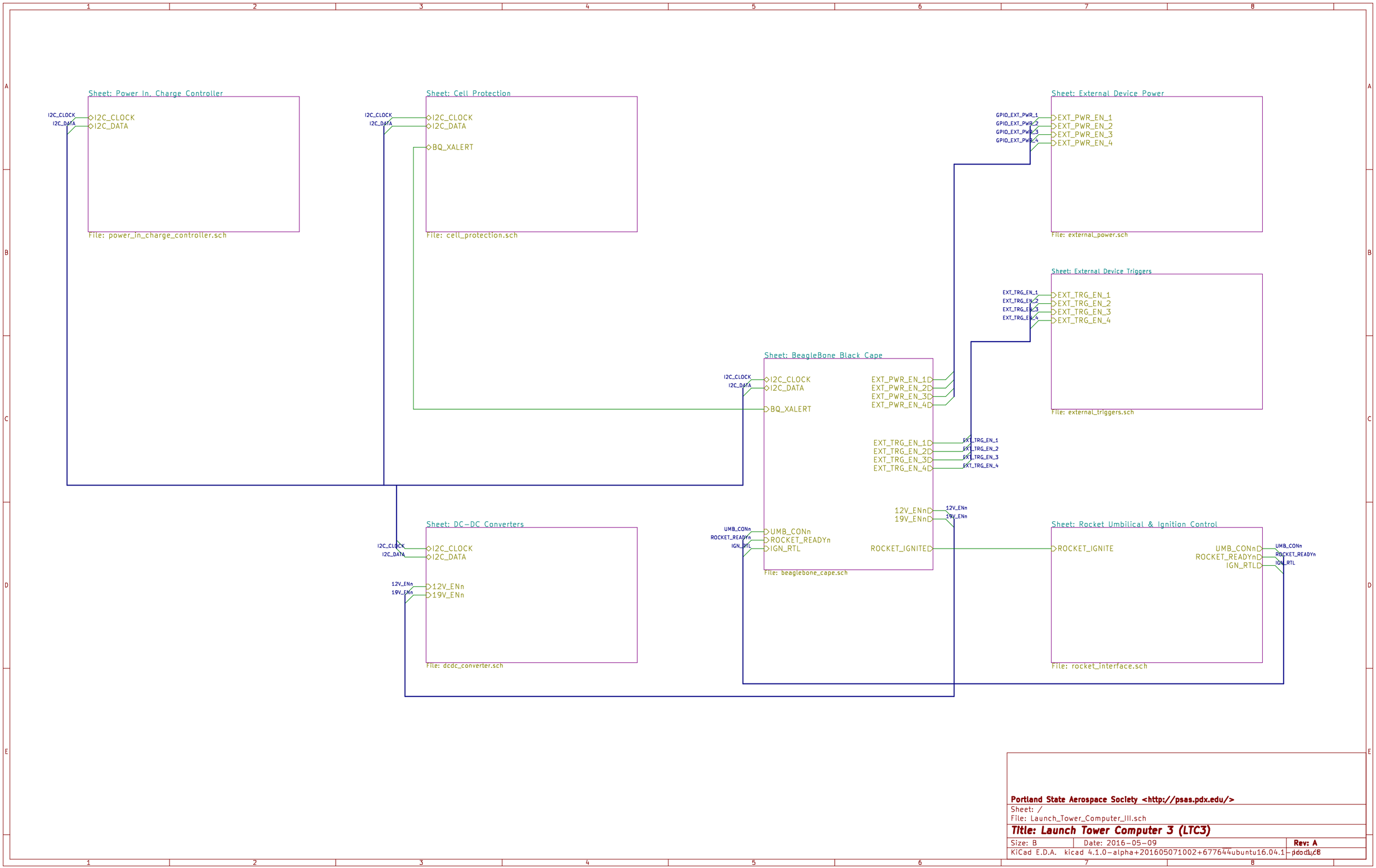

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Sheet: /
File: Launch_Tower_Computer_III.sch

Title: Launch Tower Computer 3 (LTC3)

Size: B	Date: 2016-05-09	**Rev: A**
KiCad E.D.A. kicad 4.1.0-alpha+201605071002+677644ubuntu16.04.1-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)

Battery Charge Controller
w/ MPPT

LT8490

U204

Input Feedback (p.14)

Shutdown (p. 27)

Output Feedback (p. 17)

Temp Sense (p. 21)

Voltage, Current, & Temp Sense

I2C addr 0x98

Feedback Resistor Disconnect

TODO: select FET part

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

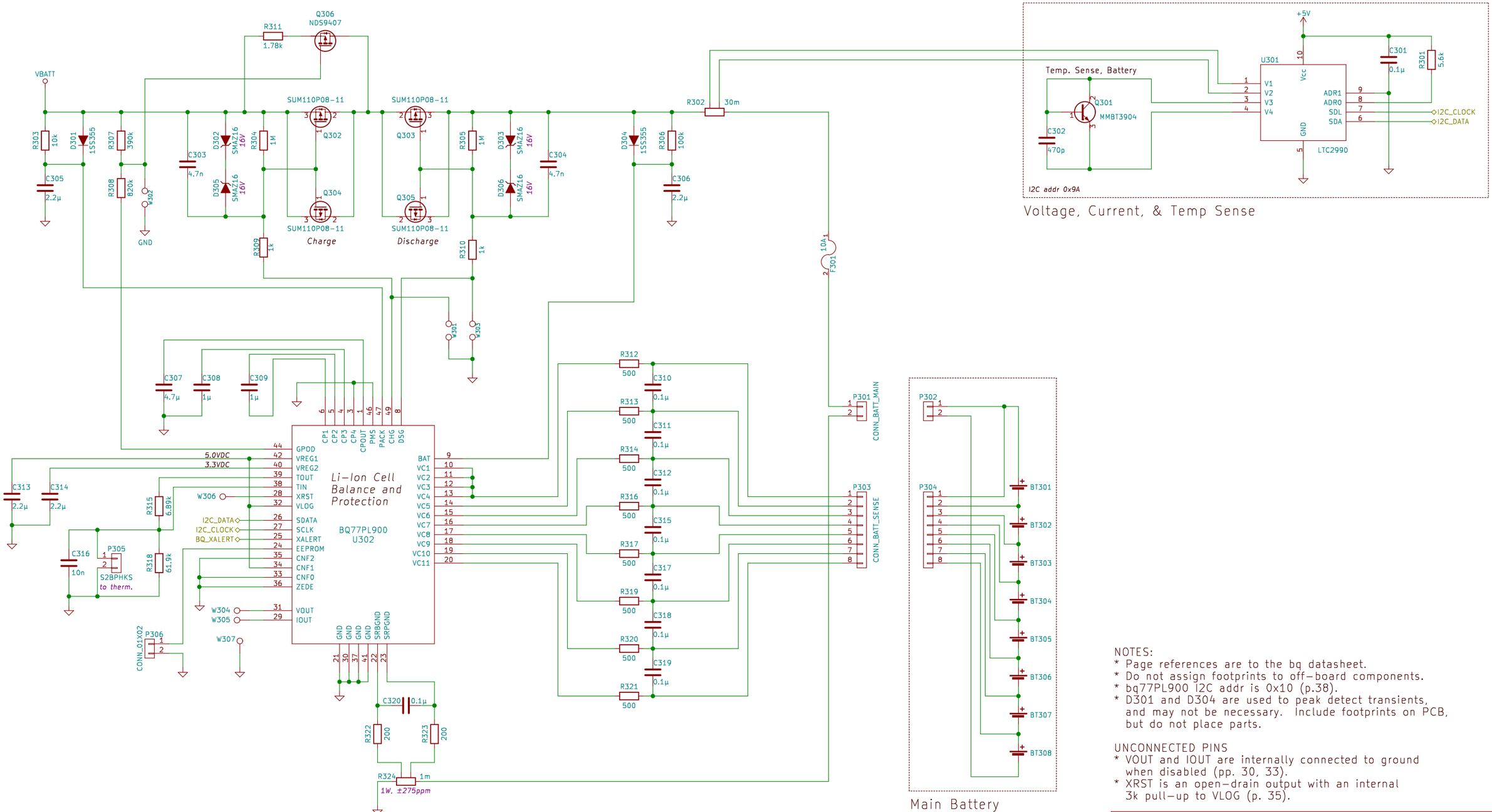
CHARGING PARAMETERS:
Stage 2 Voltage: 33.6 V
Maximum Charging Current: 10 A?
Maximum Trickle Current: 1 A
Switching Frequency: 202 kHz

1% Resistors
75V Capacitors

Portland State Aerospace Society <http://psas.pdx.edu/>
Sheet: /Power In, Charge Controller/
File: power_in_charge_controller.sch

Title: Power In, Battery Charge, & PV MPPT

Size: B | Date: 2016-05-09 | Rev: A
KiCad E.D.A. kicad 4.1.0-alpha+201605071002+677644ubuntu16.04.1 | Id: 2/8



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).

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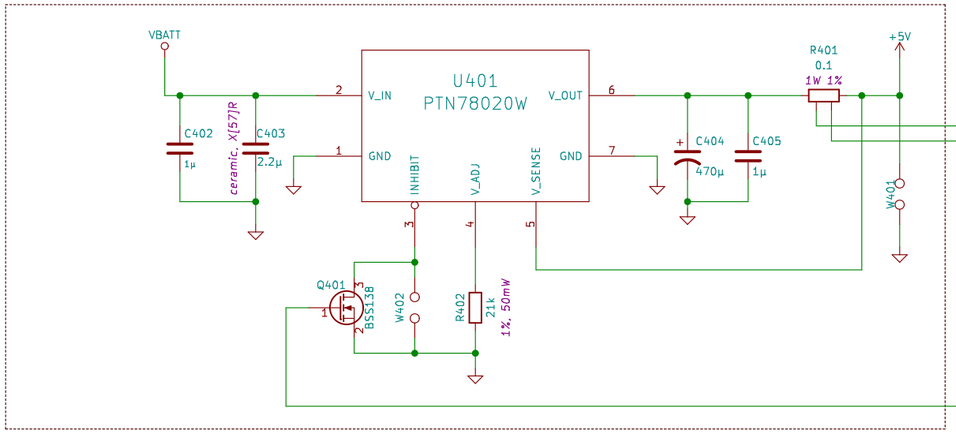
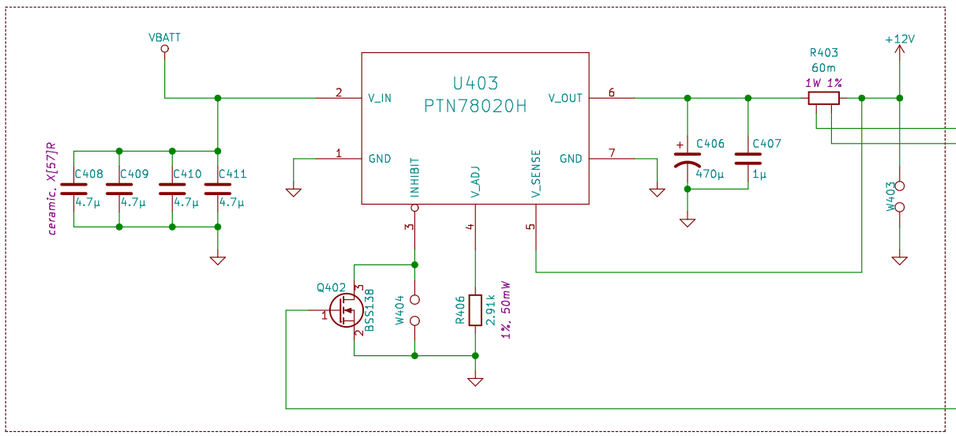
Sheet: /Cell Protection/
File: cell_protection.sch

Title: Battery Management

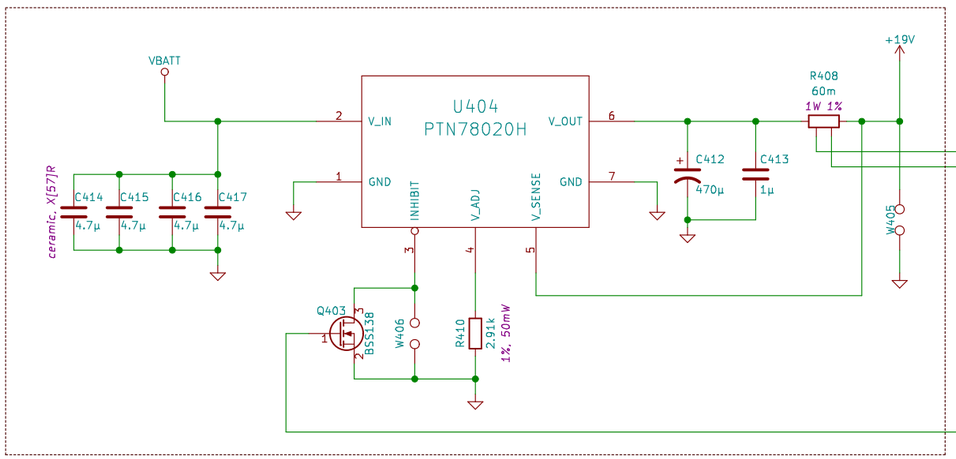
Size: B	Date: 2016-05-09	**Rev: A**
KiCad E.D.A. kicad 4.1.0-alpha+201605071002+677644ubuntu16.04.1-product		Id: 1/8



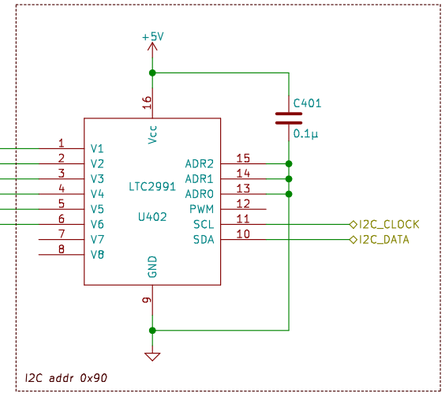
+5V DC Supply



+12V DC Supply

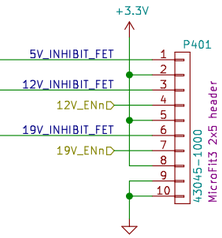


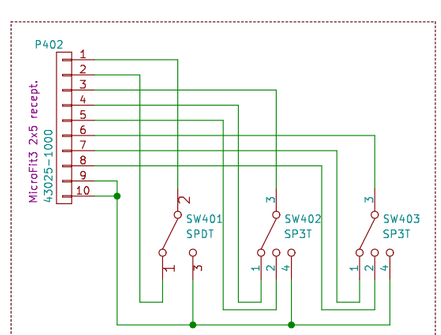
+19V DC Supply



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





Manual Override Switches, Front Panel

Toggle 5V converter's INHIBIT FET between +3.3V and ground. Toggle 12V and 19V converters' INHIBIT FET between the BeagleBone, +3.3V, or ground.

NB: The 5V converter supplies the BeagleBone. We don't want the BB to be able to commit suicide, thus it does not get a connection to the 5V converter's INHIBIT FET.

NOTES
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.

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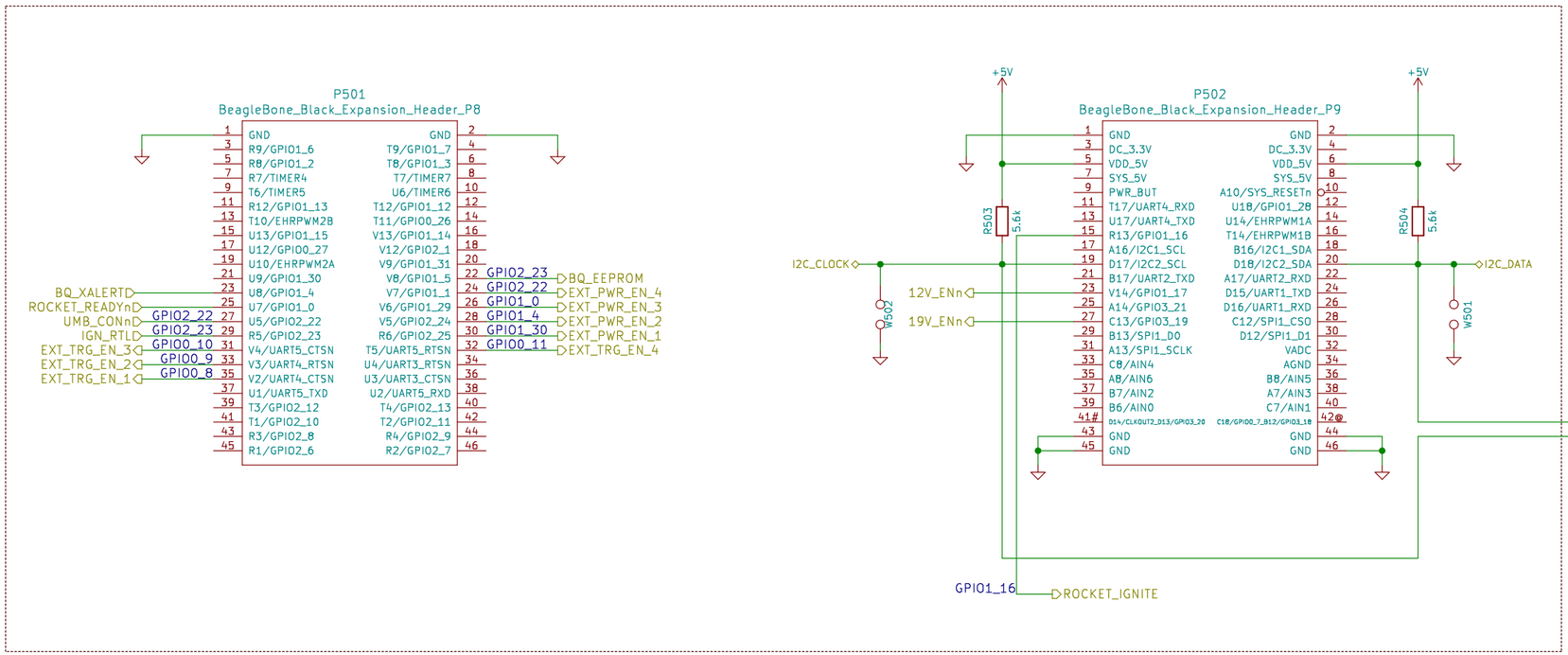
Sheet: /DC-DC Converters/
File: dcdc_converter.sch

Title: LTC3 DC-DC Converters

Size: B	Date: 2016-05-09	**Rev: A**
KiCad E.D.A. kicad 4.1.0-alpha+201605071002+6776~4ubuntu16.04.1		Id: 4/8



BeagleBone Expansion Headers

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.

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

Title: LTC3 BeagleBone Black Cape Interface

Size: B	Date: 2016-05-09	**Rev: A**
KiCad E.D.A. kicad 4.1.0-alpha+201605071002+6776~44ubuntu16.04.1-product		Sheet 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

R602 120

IC601 TLP3542

+5V

R601 10k

U601A CD74HC14

R605 10k

U601B CD74HC14

R603 62k

ROCKET_READYn

+3.1V

R604 100k

U603 741G08

U602 SN65220DBV SOT-23

TODO: "SOT-23"?

Shore Power Check

+19V

R612 5.6k

R613 1.5k

C603 0.1µ

W603 0/5V

U601F CD74HC14

R615 10k

W604 0/5V

W605 0/5V

Input Logic

D602 CDSU4148

R606 100

R607 500k

R609 NP

C601 10µ

C602 NP

W606 0/5V

Delay (5s)

+5V

K601 RELAY_1C

CDSU4148 D601

IGN_BATT_P

W601 14.8–16.8V

GND_IGN

P601 BATT-IN

U601D CD74HC14

U601C CD74HC14

U601E CD74HC14

Q601 PMV45EN

R608 10k

R611 62k

R610 250

IGN_RTL

+3.1V

R614 100k

D603 LED Ready-To-Launch

Ignition Battery Relay

RJ45 J601

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

R621 5.1k

R616 5.1k

UMB_CONn

D609 3.3V

C604 1µ

TODO: conn. to umbilical conn. on front panel

Rocket Umbilical

Rocket–to–BeagleBone Ethernet

Q603 ZVN4525E6

Q604 ZVN4525E6

Q605 ZVN4525E6

R617 30k

R618 30k

R619 30k

S4B–PH–K P606

+5V

K602 RELAY_1C

D604 CDSU4148

ROCKET_IGNITED

Q602 PMV45EN

R620 250

Rocket_Ignite

D605

W607 0/3.3V

R622 10k

P605 43045–0200 MicroFit3 1x2 header

P607 43045–0200 MicroFit3 1x2 header

GND_IGN

Rocket Ignition Relay

P604 43025–0200 MicroFit3 1x2 recept.

M601 W28–XQ1A–0.25

SW601 SPST

JP601 Banana Jack, 1x2

P608 43025–0200 MicroFit3 1x2 recept.

P602 CONN_01X02 To Away Box

Breaker, Arm Switch,
Shorting Bar, &
Ignition Connector
(front panel)

VCC

VCC for
CD74HC14

C605 0.1µ

C606 0.1µ

Bypass Capacitors
(one per IC VCC)

P609 PHR–4

Batt. Relay Closed D606 557–1702–203F

Ign. Relay Closed D608 557–1702–203F

Ignition HOT D610 557–1502–203F

BAKERCON Hazard Gauge

(super–bright LEDs, exterior panel)

TODO: find out if Dialight 557
LED indicators require current–
limiting resistor

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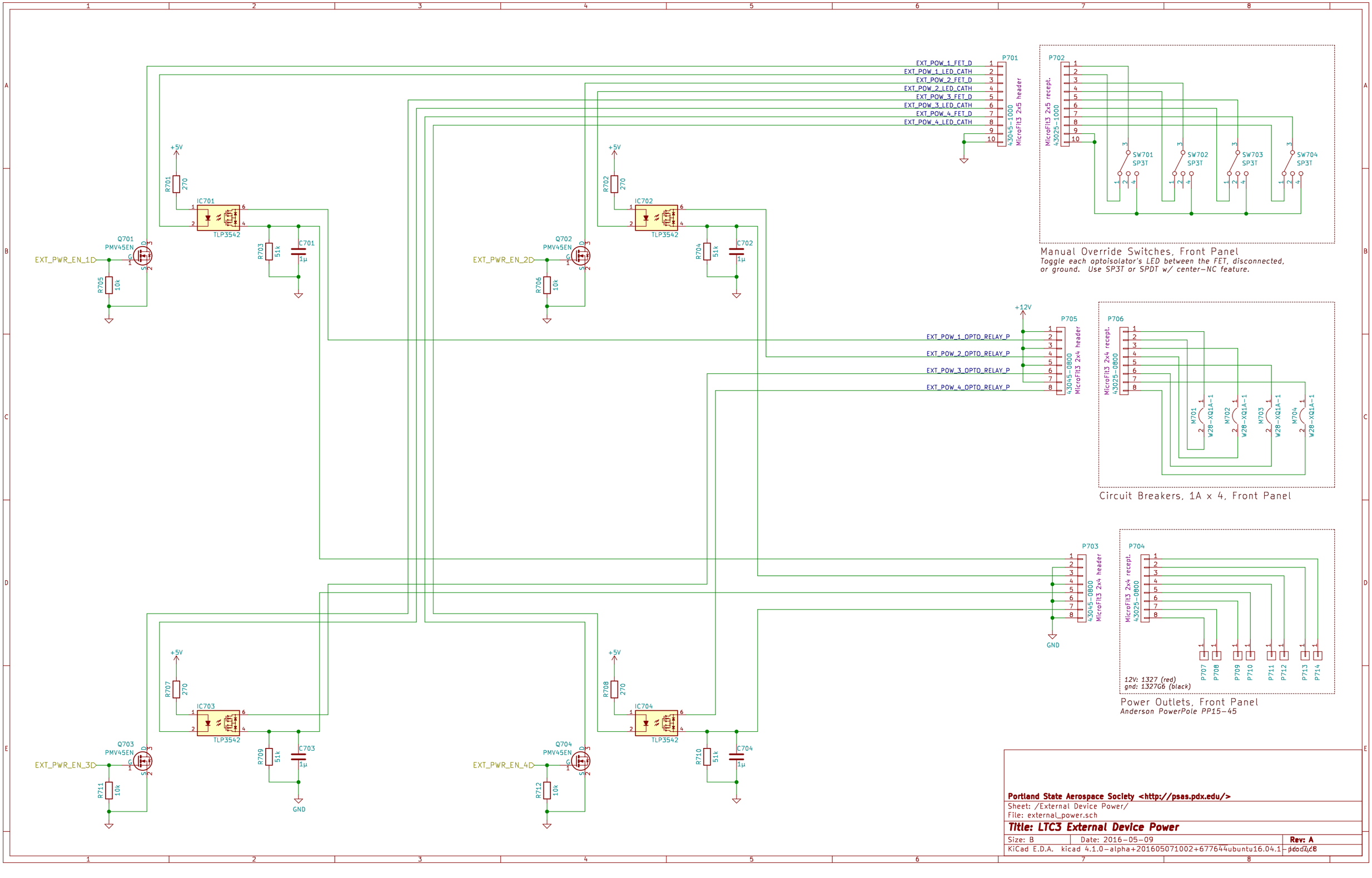
Sheet: /Rocket Umbilical & Ignition Control/

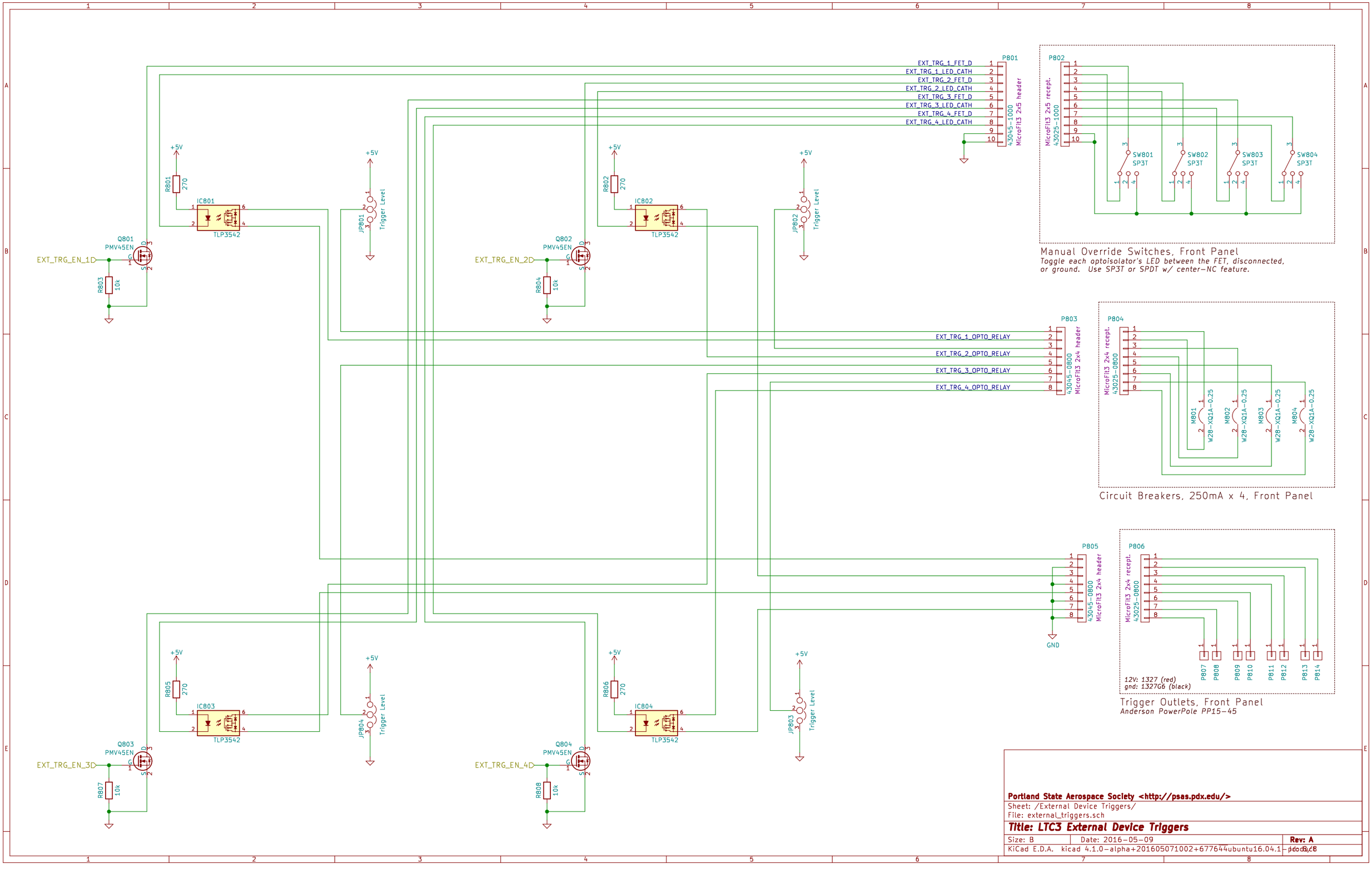
File: rocket_interface.sch

Title: LTC3 Rocket Umbilical & Ignition Control

Size: B | Date: 2016–05–09 | Rev: A

KiCad E.D.A. kicad 4.1.0–alpha+201605071002+677644ubuntu16.04.1–prod | Id: 6/8


P701
EXT_POW_1_FET_D
EXT_POW_1_LED_CATH
EXT_POW_2_FET_D
EXT_POW_2_LED_CATH
EXT_POW_3_FET_D
EXT_POW_3_LED_CATH
EXT_POW_4_FET_D
EXT_POW_4_LED_CATH
43045-1000
MicroFit3 2x5 header
P702
MicroFit3 2x5 recept.
43025-1000
SW701 SP3T
SW702 SP3T
SW703 SP3T
SW704 SP3T
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
R701 270
IC701
TLP3542
Q701
PMV45EN
EXT_PWR_EN_1
R705 10k
R703 51k
C701 1µ
R702 270
IC702
Q702
EXT_PWR_EN_2
R706 10k
R704 51k
C702 1µ
+12V
P705
EXT_POW_1_OPTO_RELAY_P
EXT_POW_2_OPTO_RELAY_P
EXT_POW_3_OPTO_RELAY_P
EXT_POW_4_OPTO_RELAY_P
43045-0800
MicroFit3 2x4 header
P706
MicroFit3 2x4 recept.
43025-0800
M701 W28-XQ1A-1
M702 W28-XQ1A-1
M703 W28-XQ1A-1
M704 W28-XQ1A-1
Circuit Breakers, 1A x 4, Front Panel
P703
GND
P704
P707 P708 P709 P710 P711 P712 P713 P714
12V: 1327 (red)
gnd: 1327G6 (black)
Power Outlets, Front Panel
Anderson PowerPole PP15-45
R707 270
IC703
Q703
EXT_PWR_EN_3
R711 10k
R709 51k
C703 1µ
R708 270
IC704
Q704
EXT_PWR_EN_4
R712 10k
R710 51k
C704 1µ
Portland State Aerospace Society <http://psas.pdx.edu/>
Sheet: /External Device Power/
File: external_power.sch
Title: LTC3 External Device Power
Size: B
Date: 2016-05-09
Rev: A
KiCad E.D.A. kicad 4.1.0-alpha+201605071002+6776~44~ubuntu16.04.1-prod
Id: 1/1


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
SW802
SW803
SW804
SP3T
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
R801
270
IC801
TLP3542
JP801
Trigger Level
Q801
PMV45EN
EXT_TRG_EN_1
R803
10k
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
12V: 1327 (red)
gnd: 1327G6 (black)
Trigger Outlets, Front Panel
Anderson PowerPole PP15-45
R805
IC803
JP804
Q803
EXT_TRG_EN_3
R807
R806
IC804
JP803
Q804
EXT_TRG_EN_4
R808
Portland State Aerospace Society <http://psas.pdx.edu/>
Sheet: /External Device Triggers/
File: external_triggers.sch
Title: LTC3 External Device Triggers
Size: B
Date: 2016-05-09
Rev: A
KiCad E.D.A. kicad 4.1.0-alpha+201605071002+6776~44ubuntu16.04.1-prod
Id: 1/1