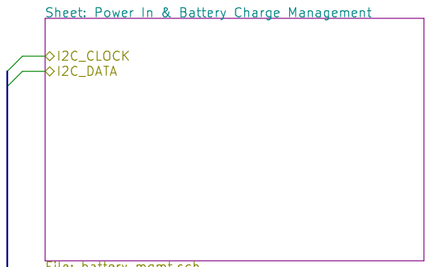

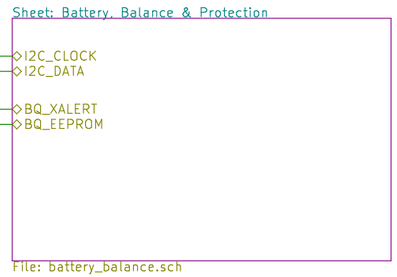

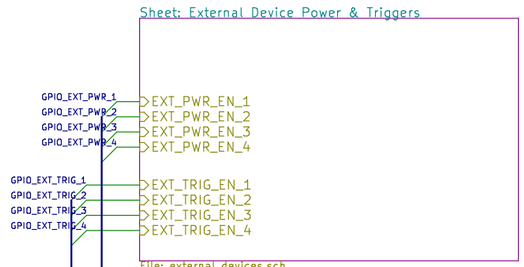

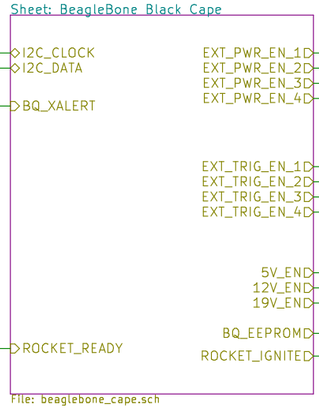

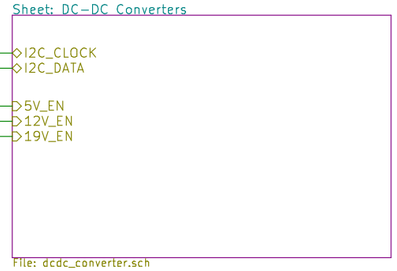

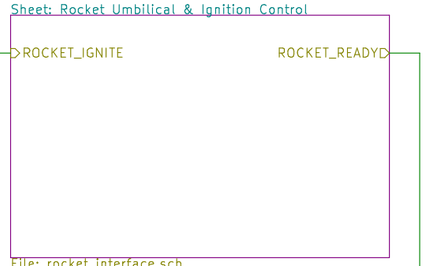

TODO:
* Finish wiring up sub-sheets.
  * Bus entries need labels on both sides!

Notes:
 * LTC3 is a single board represented on multiple sheets.

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Sheet: /
File: Launch_Tower_Computer_III.sch

Title: Launch Tower Computer 3 (LTC3)

Size: B	Date: 2016-01-16	**Rev: A**
KiCad E.D.A. kicad 4.0.0rc1a-stable		Id: 1/7

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

Supply Detection (p.15, p.34)

Current Sense (p. 20)

Current Sense (p. 20)

Battery Charge Controller
w/ MPPT

LT8490

U202

Output Feedback (p. 17)

Temp Sense (p. 21)

Shutdown (p. 27)

Input Feedback (p.14)

Feedback Resistor Disconnect

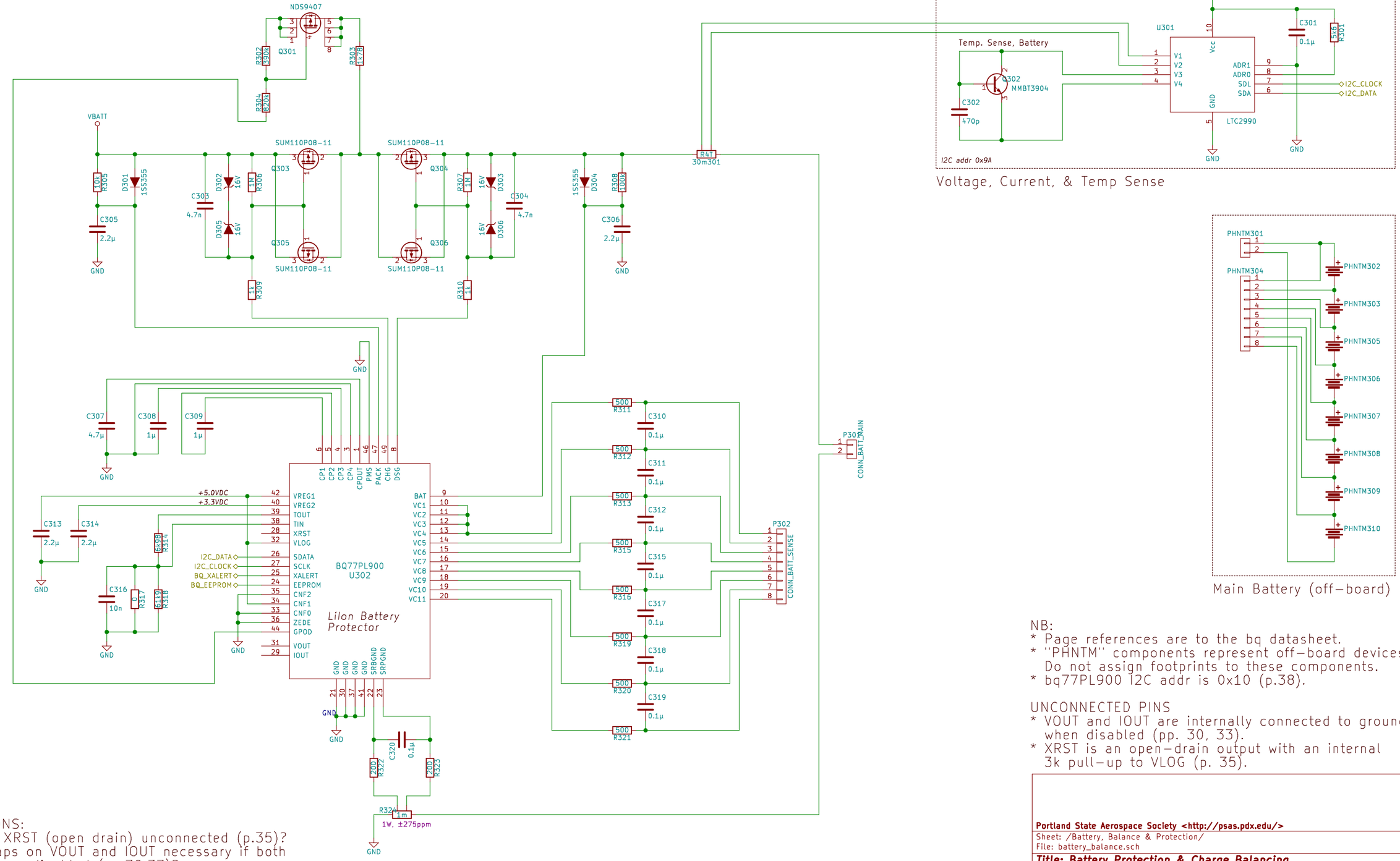
Voltage, Current, & Temp Sense

I2C addr 0x98

CHARGING PARAMETERS:
Stage 2 Voltage: 33.6 V
Maximum Charging Current: 11.4 A
Maximum Trickle Current: 3 A
Switching Frequency: 202 kHz

QUESTIONS:
* Safe to use one current-sense resistor for both the LT8490 and the LTC2991?
  * Maybe. Check datasheets for input impedances. Add zero-ohm resistor btw. 2991 and shunt.
* What happens w/out a battery connected?

Portland State Aerospace Society <http://psas.pdx.edu/>
Sheet: /Power In & Battery Charge Management/
File: battery_mgmt.sch
Title: Power In, Battery Management
Size: B | Date: 2016-01-16 | Rev: A
KiCad E.D.A. kicad 4.0.0rc1a-stable | Id: 2/7



NB:
* Page references are to the bq datasheet.
* "PHNTM" components represent off-board devices. Do not assign footprints to these components.
* bq77PL900 I2C addr is 0x10 (p.38).

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).

QUESTIONS:
* Leave XRST (open drain) unconnected (p.35)?
* Are caps on VOUT and IOUT necessary if both outputs are disabled (pp.30,33)?

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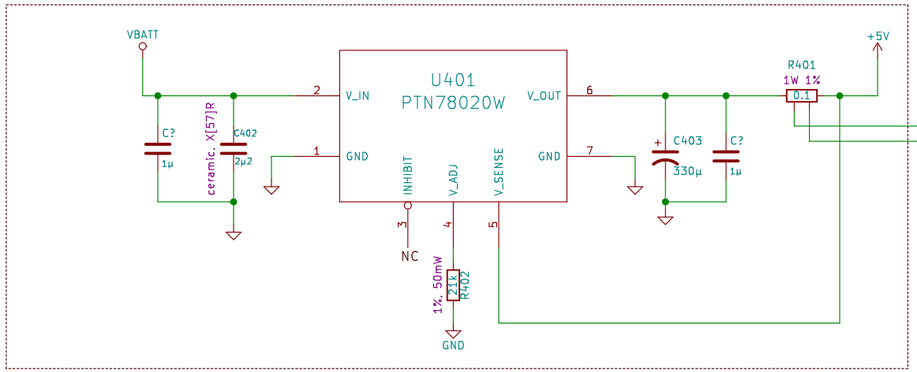
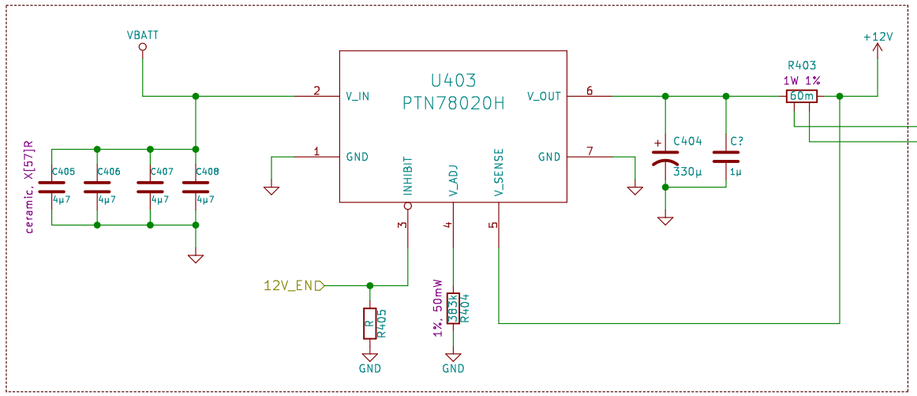
Sheet: /Battery, Balance & Protection/
File: battery_balance.sch

Title: Battery Protection & Charge Balancing

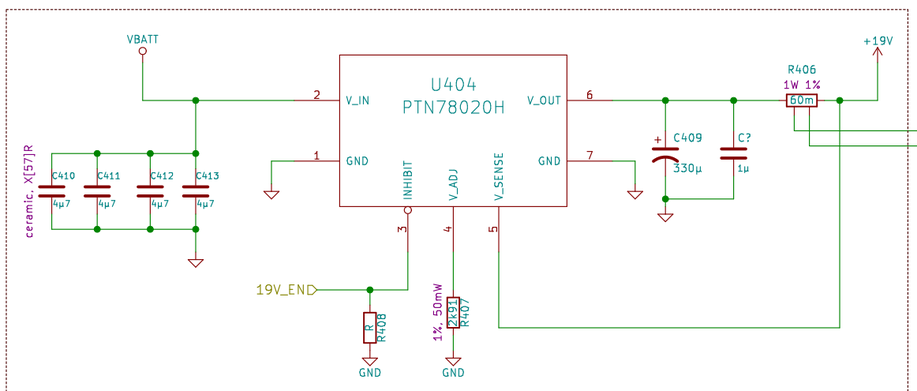
Size: B	Date: 2016-01-16	**Rev: A**
KiCad E.D.A. kicad 4.0.0rc1a-stable		Id: 3/7



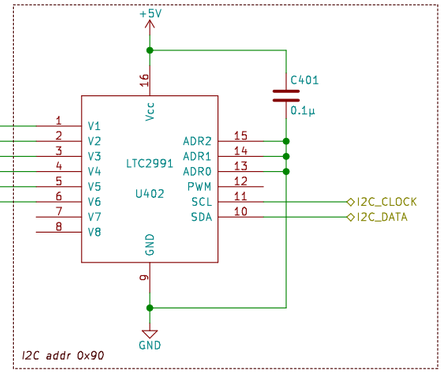
+5V DC Rail



+12V DC Rail



+19V 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

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:
* 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: 2016-01-16	**Rev: A**
KiCad E.D.A. kicad 4.0.0rc1a-stable		Id: 4/7

TODO: connect these labels
to BBB GPIO pins.

ROCKET_READY
BQ_XALERT

EXT_PWR_EN_1
EXT_PWR_EN_2
EXT_PWR_EN_3
EXT_PWR_EN_4

12V_EN
19V_EN
BQ_EEPROM
ROCKET_IGNITE

P8 C501A

1	GND	GND	2
3	R9/GPIO1_6	T9/GPIO1_7	4
5	R8/GPIO1_2	T8/GPIO1_3	6
7	R7/TIMER4	T7/TIMER7	8
9	T6/TIMER5	U6/TIMER6	10
11	R12/GPIO1_13	T12/GPIO1_12	12
13	T10/EHRPWM2B	T11/GPIO0_26	14
15	U13/GPIO1_15	V13/GPIO1_14	16
17	U12/GPIO0_27	V12/GPIO2_1	18
19	U10/EHRPWM2A	V9/GPIO1_31	20
21	U9/GPIO1_30	V8/GPIO1_5	22
23	U8/GPIO1_4	V7/GPIO1_1	24
25	U7/GPIO1_0	V6/GPIO1_29	26
27	U5/GPIO2_22	V5/GPIO2_24	28
29	R5/GPIO2_23	R6/GPIO2_25	30
31	V4/UART5_CTSN	T5/UART5_RTSN	32
33	V3/UART4_RTSN	U4/UART3_RTSN	34
35	V2/UART4_CTSN	U3/UART3_CTSN	36
37	U1/UART5_TXD	U2/UART5_RXD	38
39	T3/GPIO2_12	T4/GPIO2_13	40
41	T1/GPIO2_10	T2/GPIO2_11	42
43	R3/GPIO2_8	R4/GPIO2_9	44
45	R1/GPIO2_6	R2/GPIO2_7	46

GND
GND
GPIO_10
GPIO_9
GPIO_8
GPIO_11
EXT_TRIG_EN_3
EXT_TRIG_EN_2
EXT_TRIG_EN_1
EXT_TRIG_EN_4
BeagleBone_Black_Expansion_Header

P9 C501B

1	GND	GND	2
3	DC_3.3V	DC_3.3V	4
5	VDD_5V	VDD_5V	6
7	SYS_5V	SYS_5V	8
9	PWR_BUT	A10/SYS_RESETn	10
11	T17/UART4_RXD	U18/GPIO1_28	12
13	U17/UART4_TXD	U14/EHRPWM1A	14
15	R13/GPIO1_16	T14/EHRPWM1B	16
17	A16/I2C1_SCL	B16/I2C1_SDA	18
19	D17/I2C2_SCL	D18/I2C2_SDA	20
21	B17/UART2_TXD	A17/UART2_RXD	22
23	V14/GPIO1_17	D15/UART1_TXD	24
25	A14/GPIO3_21	D16/UART1_RXD	26
27	C13/GPIO3_19	C12/SPI1_CS0	28
29	B13/SPI1_D0	D12/SPI1_D1	30
31	A13/SPI1_SCLK	VADC	32
33	C8/AIN4	AGND	34
35	A8/AIN6	B8/AIN5	36
37	B7/AIN2	A7/AIN3	38
39	B6/AIN0	C7/AIN1	40
41#	D14/CLKOUT2_D13/GPIO3_20	C18/GPIO0_7_B12/GPIO3_18	42@
43	GND	GND	44
45	GND	GND	46

+5V
+5V
5.6k R501
5.6k R502
I2C_CLOCK
I2C_DATA
GND
GND
GND
GND
BeagleBone_Black_Expansion_Header

+5V
+5V
+5V
+5V
5.6k R504
5.6k R503
C502
0.1µ
8
Vcc
24C256
U501
A0
A1
A3
GND
4
WP
SCL
SDA
7
6
5
WR_ENABLE
JP501
GND
GND
GND
GND
I2C addr 0x54
Cape EEPROM

BeagleBone Expansion Headers

TODO:
* Pick GPIO for rocket-ready signal.
* Buffer btw rocket-ready signal and BB, ign. board, etc?
* Umbilical connection state
* Ignition fuse state

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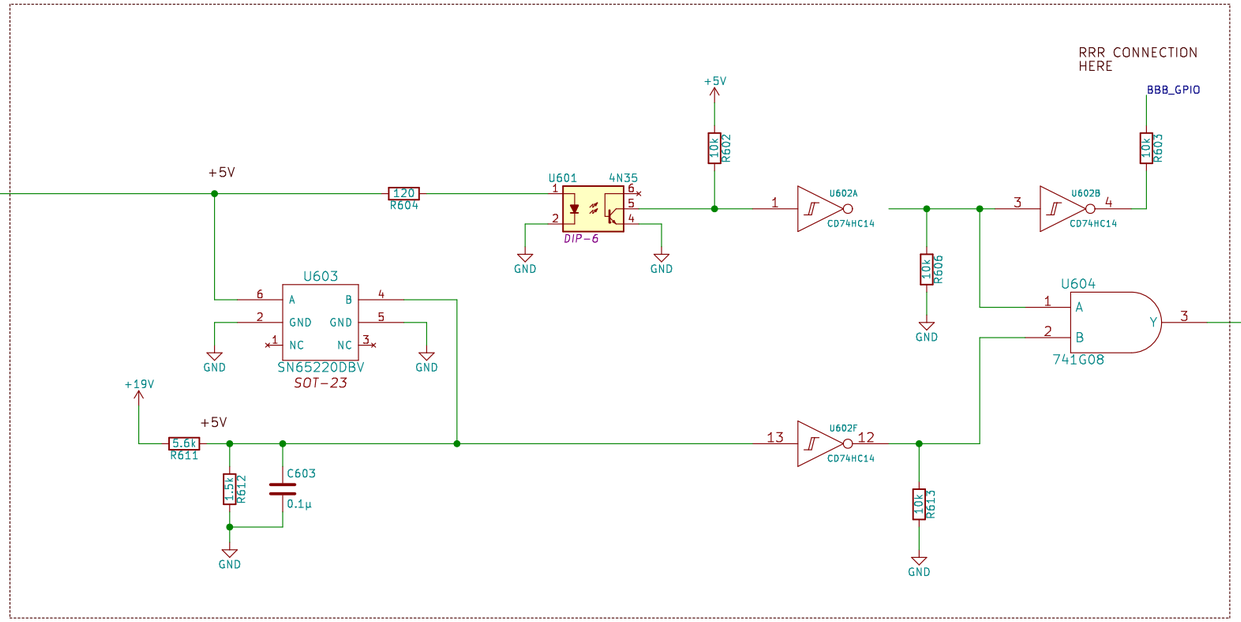
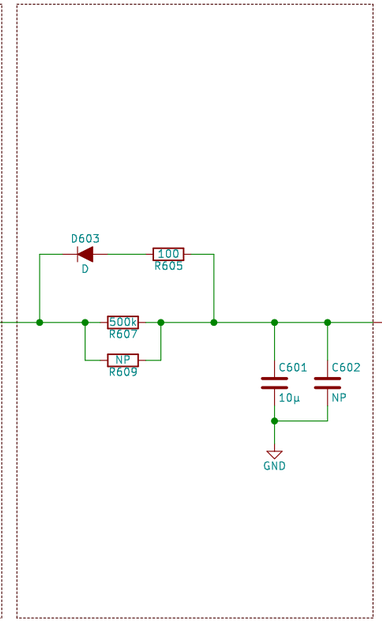
Sheet: /BeagleBone Black Cape/
File: beaglebone_cape.sch

Title: LTC3 BeagleBone Black Cape Interface

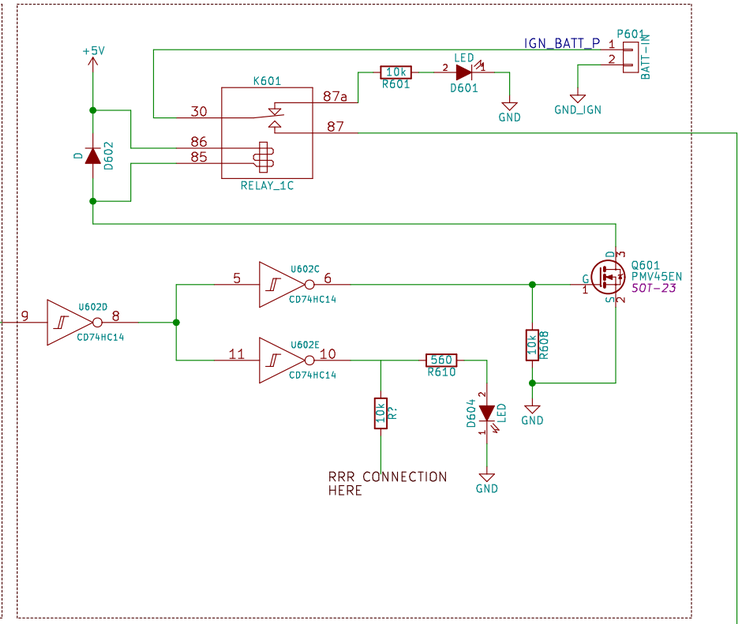
Size: B	Date: 2016-01-16	Rev: A
KiCad E.D.A. kicad 4.0.0rc1a-stable		Id: 5/7



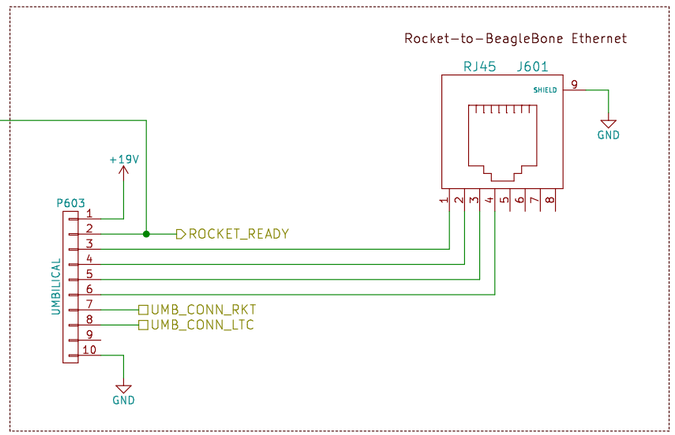
Input Logic



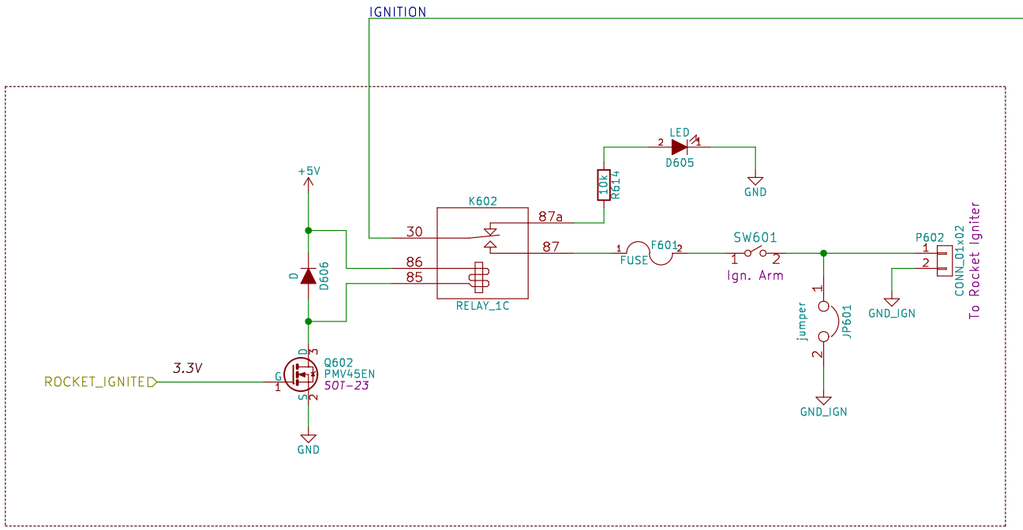
Delay (5s)



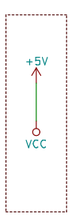
Ignition Battery Switch



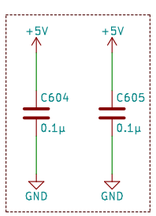
Rocket Umbilical



Ignition Switch



VCC for
CD74HC14



Bypass Capacitors
(one per IC VCC)

TODO:
* Select appropriate component values.
* Finish rocket umbilical connector.
  * Verify Enet jack "adapter" wiring.
  * Add umbilical connect sense lines circuitry.
* Label various LEDs.

QUESTIONS:
  *Will 5v from schmidt fry BBB GPIO?

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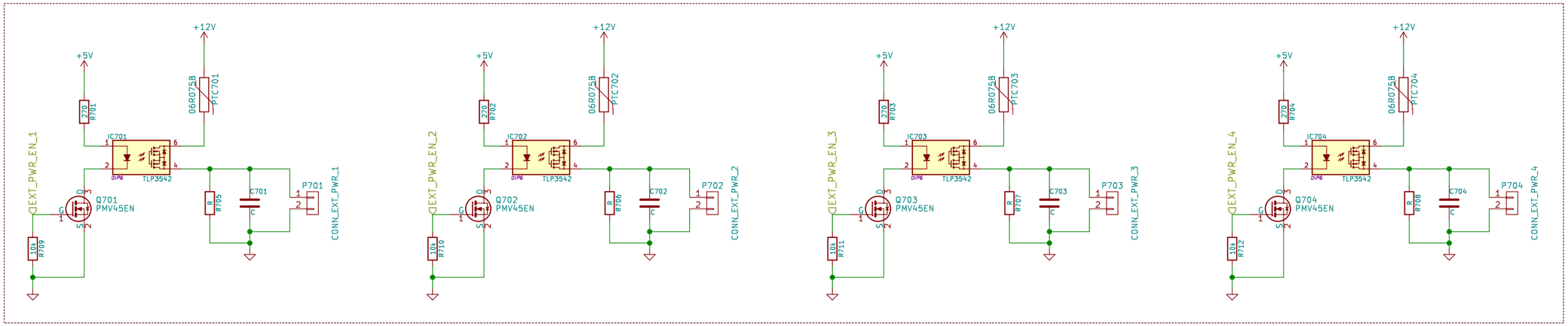
Sheet: /Rocket Umbilical & Ignition Control/
File: rocket_interface.sch

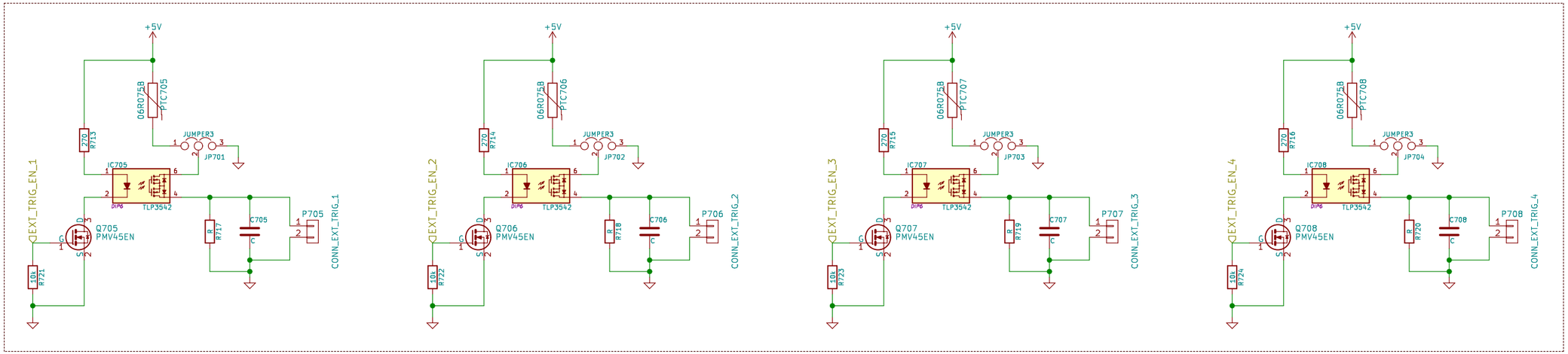
Title: LTC3 Rocket Umbilical & Ignition Control

Size: B	Date: 2016-01-16	**Rev: A**
KiCad E.D.A. kicad 4.0.0rc1a-stable		Id: 6/7

External Device Power



External Device Triggers



TODO:
* Determine values for bleeder resistor and filter capacitor on each output connector.
* Pick new PolyFuses, 0.5–1.0A max.

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

Sheet: /External Device Power & Triggers/
File: external_devices.sch

Title: LTC3 External Power & Triggers

Size: B	Date: 2016-01-16	**Rev: A**
KiCad E.D.A. kicad 4.0.0rc1a-stable		Id: 7/7