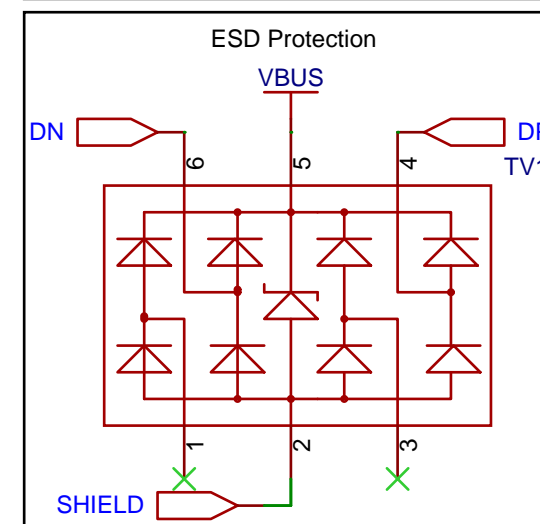
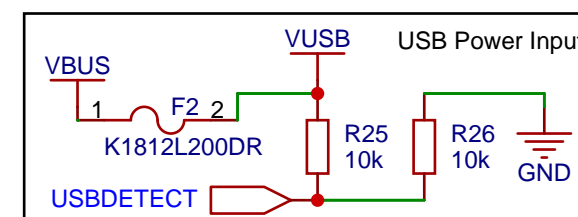
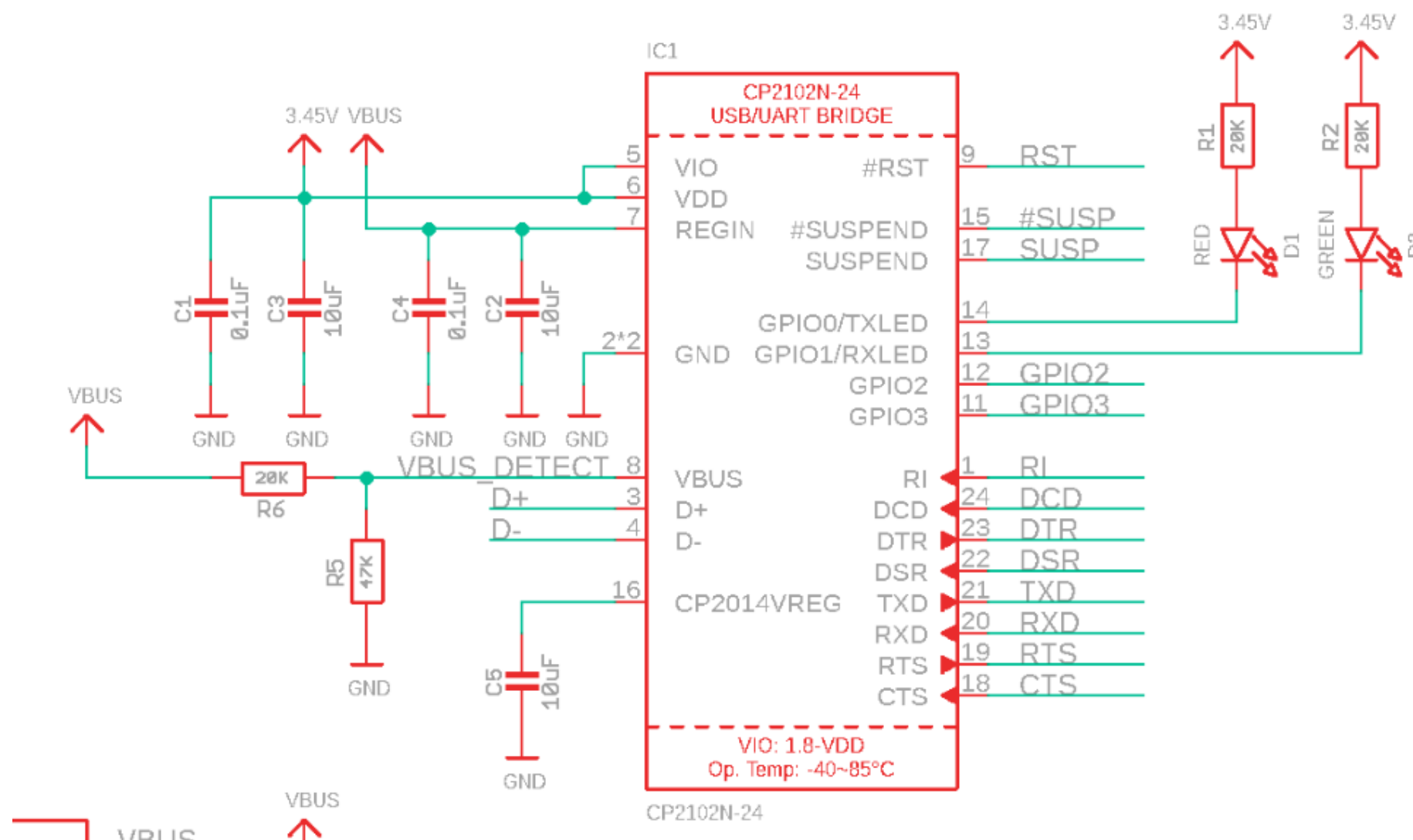
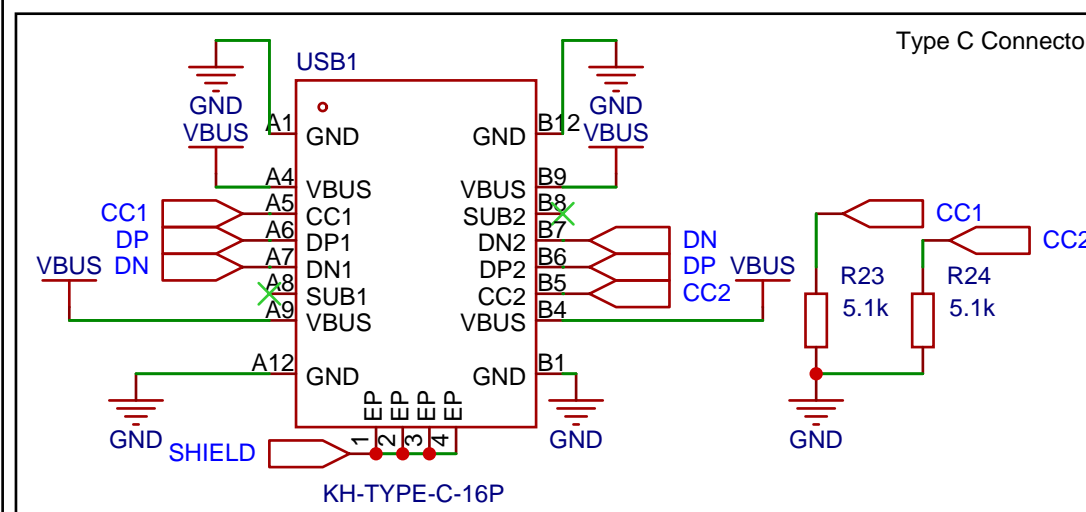
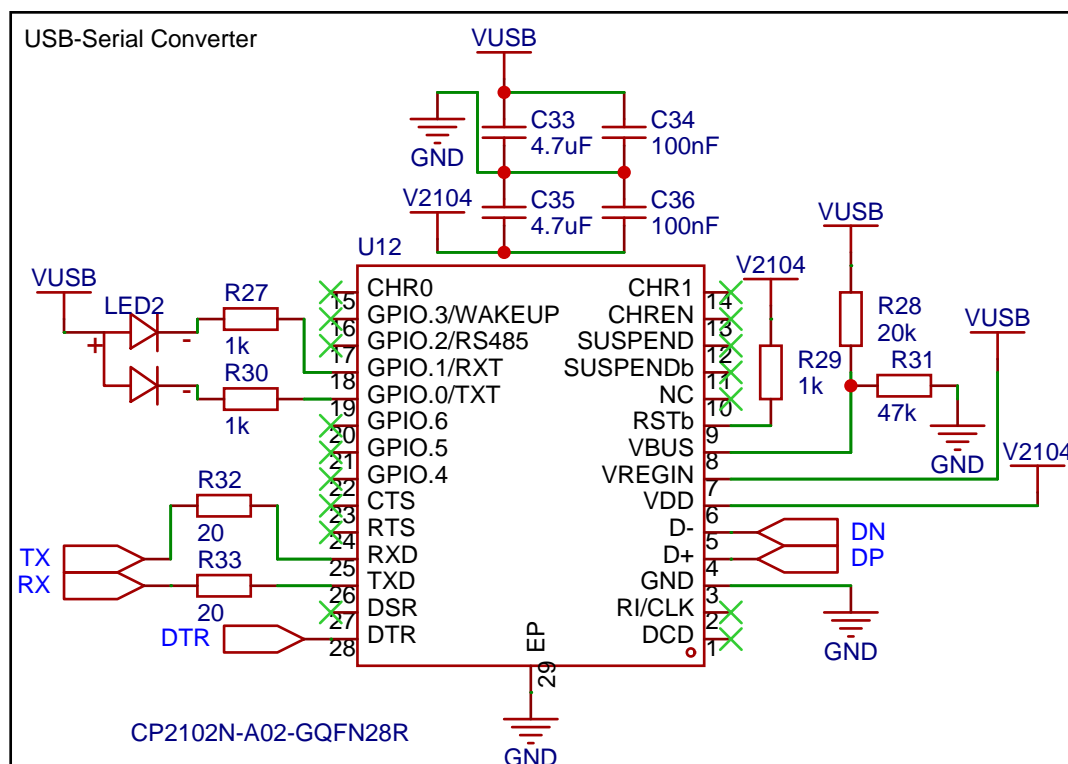
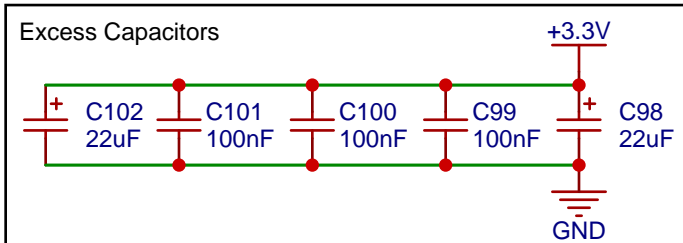
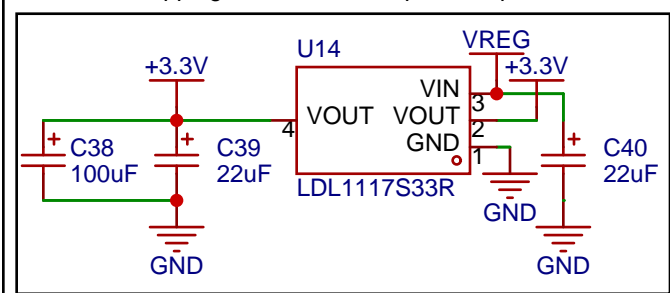


USB-Serial Converter

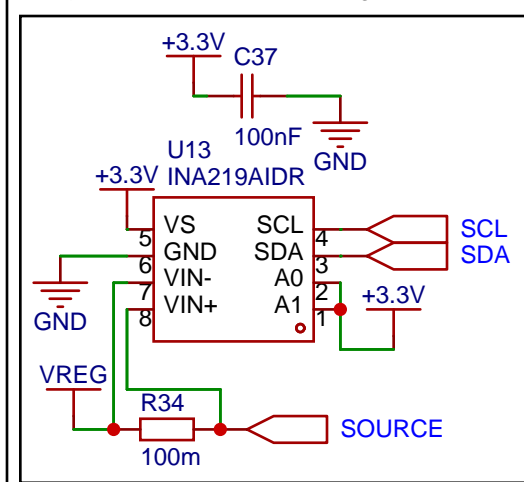


System for Controlling and Recording Airbrake Performance (SCRAP)
Schematic Page 2/10: USB Connection
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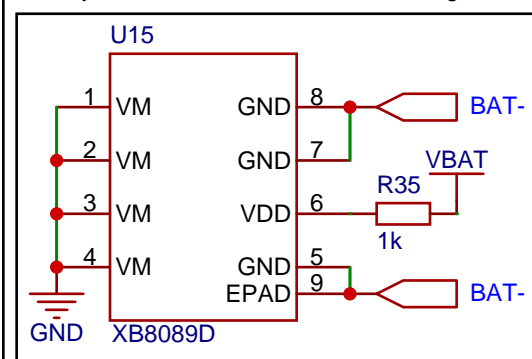
3.3v Regulator
 3.3v regulator has nomial dropout of 350mV at 1.2A
 Regulator internally current limits to 1.2A Max
 Consider swapping to MLCC where possible per datasheet



Source Power Monitor
 INA219 used for all power monitoring
 100mR shunt pre-calibrated by manufacturer
 Shunt allows up to 1.5A continuous at power dissipation. Derated to 1A for high ambient temps



Battery Protection IC Removes ground connection to battery in overvoltage, undervoltage, short-circuit, overcurrent, overtemp, undertemp, etc.

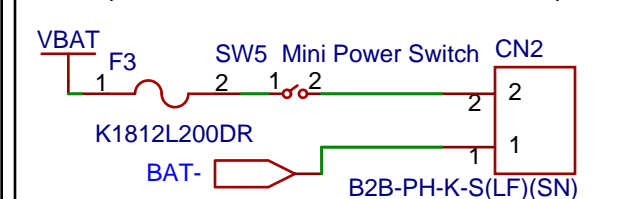


Acts in both charging and discharging protection.
 20mR RSDon

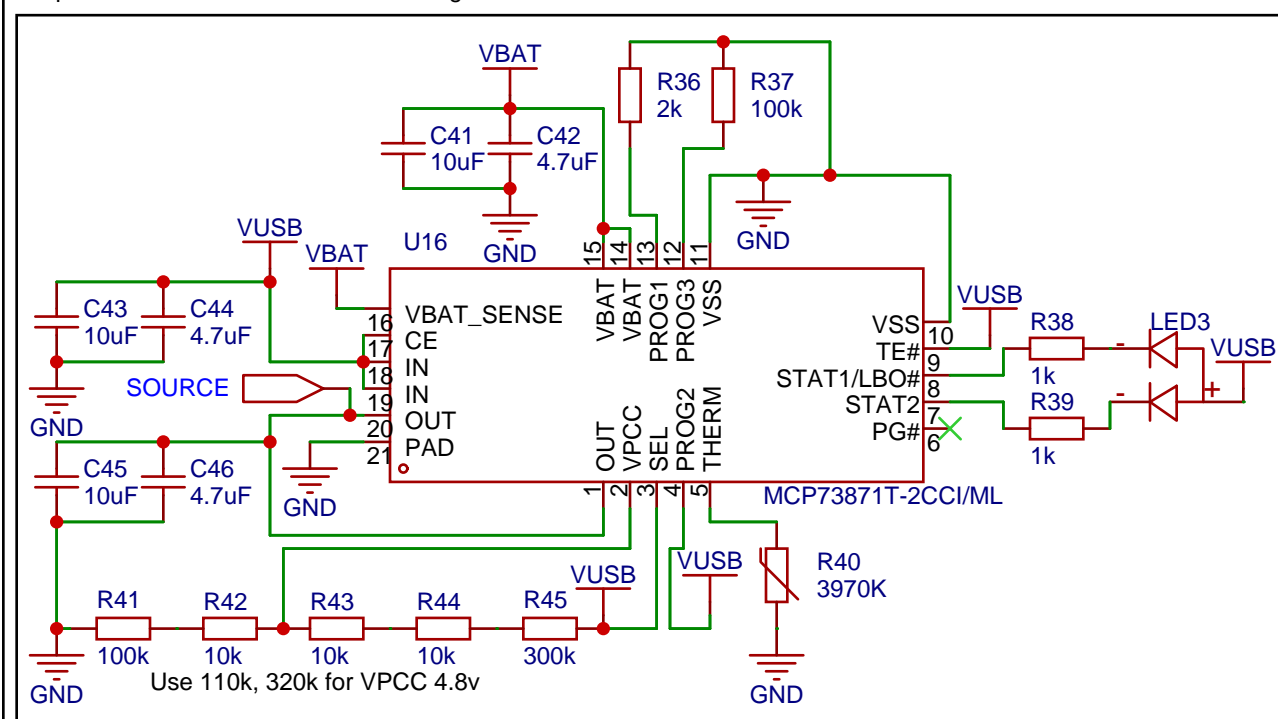
PART NUMBER	Package	Overcharge Detection Voltage [Vcu] (V)	Overcharge Release Voltage [Vcl] (V)	Overdischarge Detection Voltage [Vdl] (V)	Overdischarge Release Voltage [Vdr] (V)	Overcurrent Detection Current [Iov1] (A)	Top Mark
XB8089D	SOP8 -PP	4.250	4.10	2.50	3.0	10.0	XB8089DYW ^(note)

Note: "YW" is manufacture date code, "Y" means the year, "W" means the week

Main Battery Connector (Check polarity!)
 Battery has fuse, switch
 Switch oriented with hot contact in, reducing shock risk
 Fuse trips at 4A, holds at 2A, Rmax 0.08, 3sec trip time

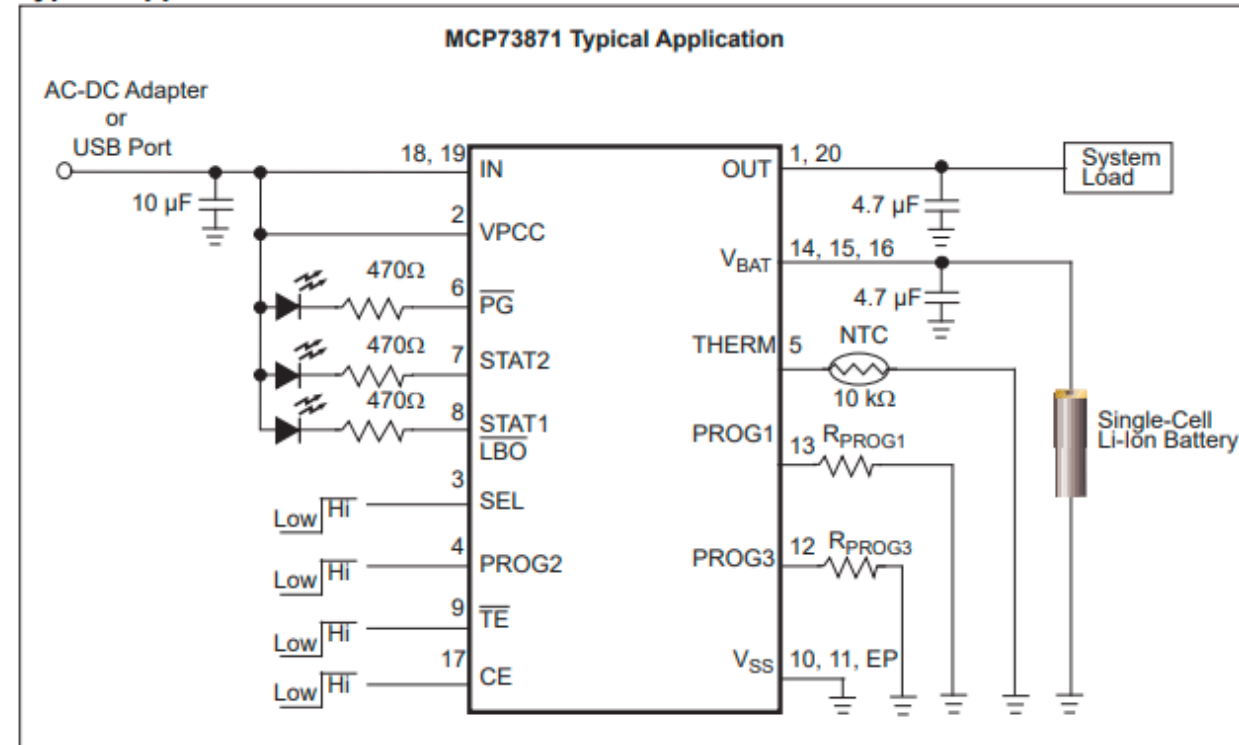


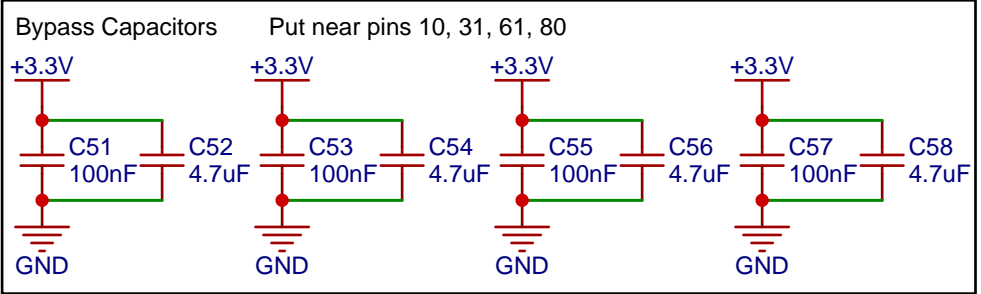
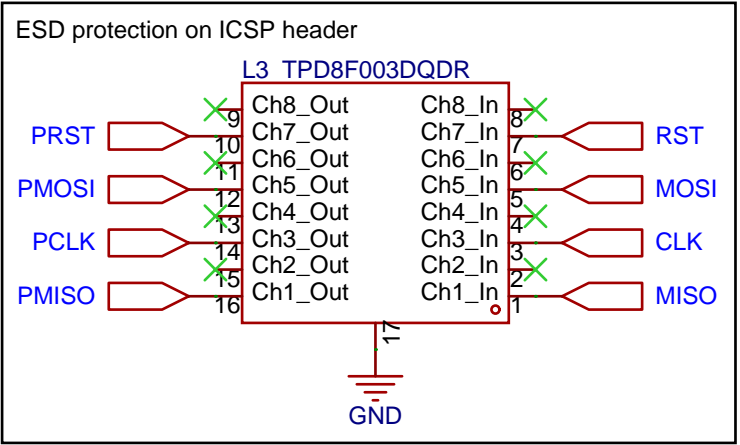
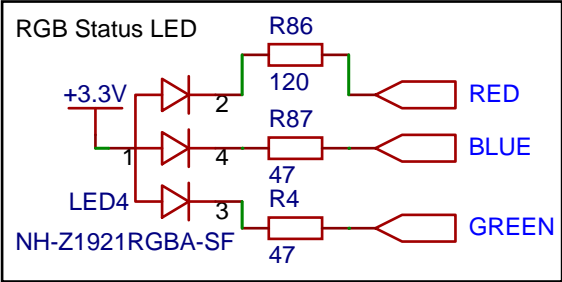
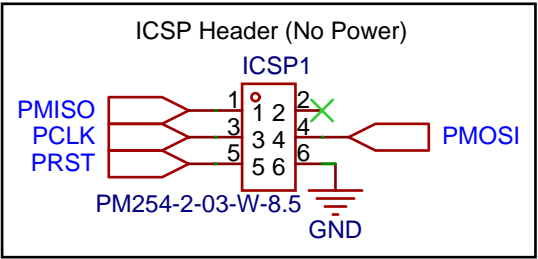
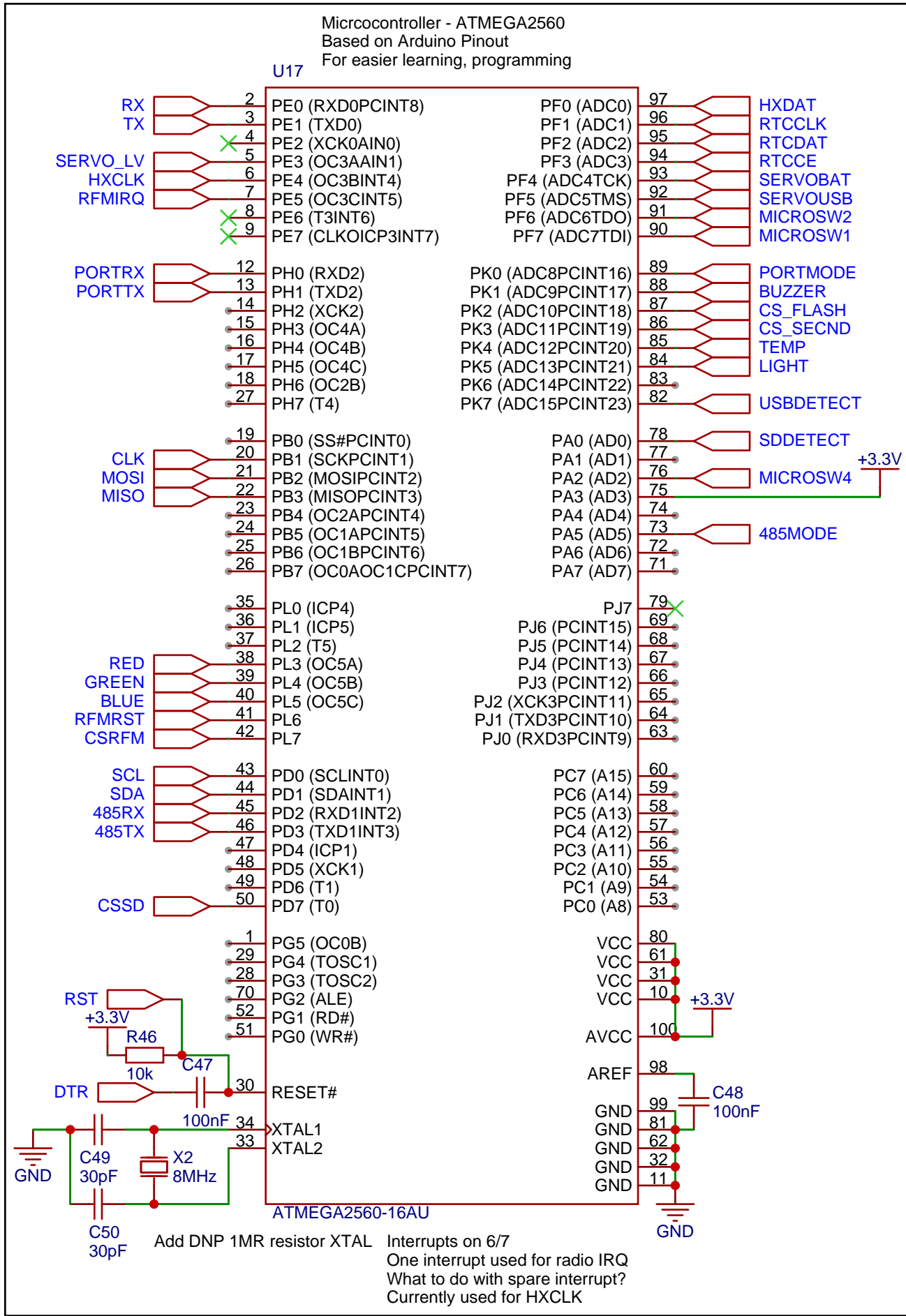
Battery Charger and PowerPath
 Battery charger, manager, and powerpath IC
 Automatic load share allows SCRAP to run off USB-C while charging
 Charge current reduced in overtemp, undertemp, overload detected
 Output has thermal shutdown and limiting safeties



2k Rprog1 = 500mA max charge 100k Prog3 = 1mA charge termination
 Charge termination at 40 Deg C, 5 Deg C, scales charging current as each extreme approached

Typical Application Circuit



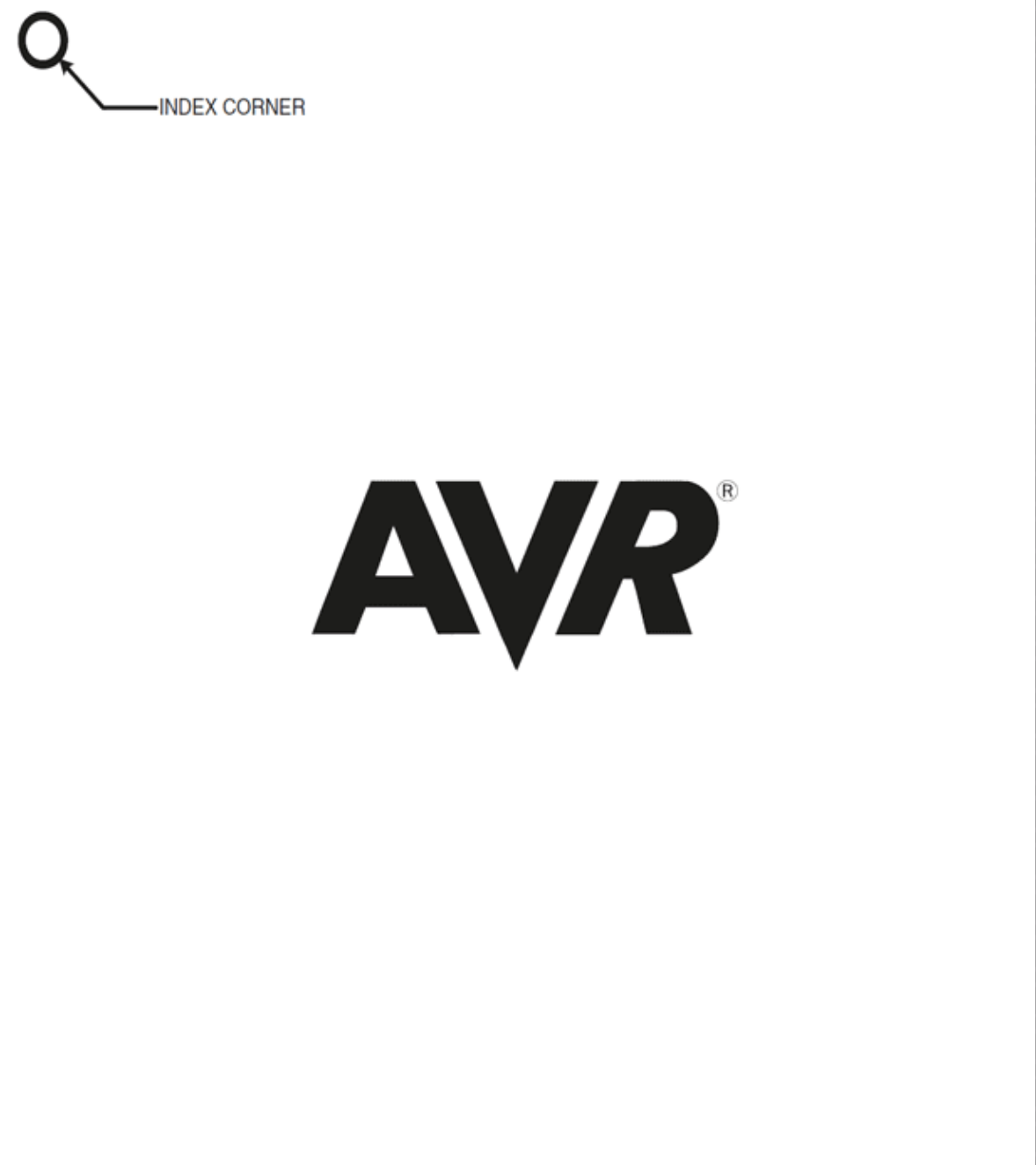


Digital pin 4 (PWM)
Digital pin 0 (RX0)
Digital pin 1 (TX0)
Digital pin 5 (PWM)
Digital pin 2 (PWM)
Digital pin 3 (PWM)

VCC
GND
Digital pin 17 (RX2)
Digital pin 16 (TX2)

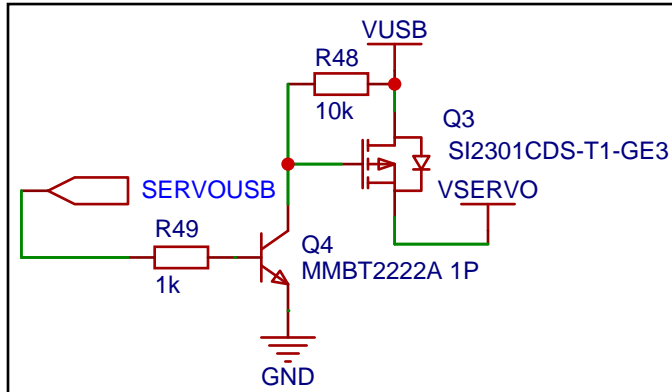
Digital pin 6 (PWM)
Digital pin 7 (PWM)
Digital pin 8 (PWM)
Digital pin 9 (PWM)
Digital pin 53 (SS)
Digital pin 52 (SCK)
Digital pin 51 (MOSI)
Digital pin 50 (MISO)
Digital pin 10 (PWM)
Digital pin 11 (PWM)
Digital pin 12 (PWM)

(OC0B) PG5
(RXD0/PCINT8) PE0
(TXD0) PE1
(XCK0/AIN0) PE2
(OC3A/AIN1) PE3
(OC3B/INT4) PE4
(OC3C/INT5) PE5
(T3/INT6) PE6
(CLKO/ICP3/INT7) PE7
VCC
GND
(RXD2) PH0
(TXD2) PH1
(XCK2) PH2
(OC4A) PH3
(OC4B) PH4
(OC4C) PH5
(OC2B) PH6
(SS/PCINT0) PB0
(SCK/PCINT1) PB1
(MOSI/PCINT2) PB2
(MISO/PCINT3) PB3
(OC2A/PCINT4) PB4
(OC1A/PCINT5) PB5
(OC1B/PCINT6) PB6

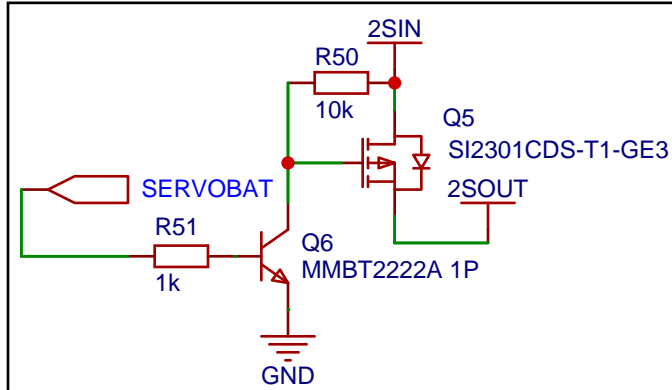


Digital pin 13 (PWI)
RESET
VCC
GND
XTAL2
XTAL1
Digital pin 49
Digital pin 48
Digital pin 47
Digital pin 46 (PWM)
Digital pin 45 (PWM)
Digital pin 44 (PWM)
Digital pin 43
Digital pin 42
Digital pin 21 (SCL)
Digital pin 20 (SDA)
Digital pin 19 (RX1)
Digital pin 18 (TX1)
Digital pin 38

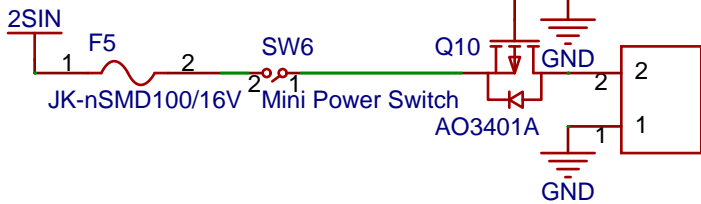
Servo USB Toggle
Toggle power from USB port to run servo



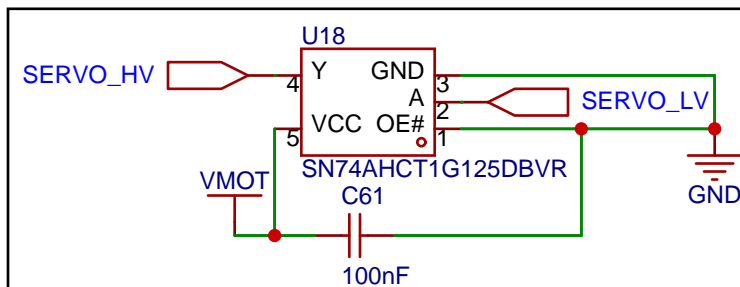
Servo Battery Toggle
Toggle power from battery to run servo



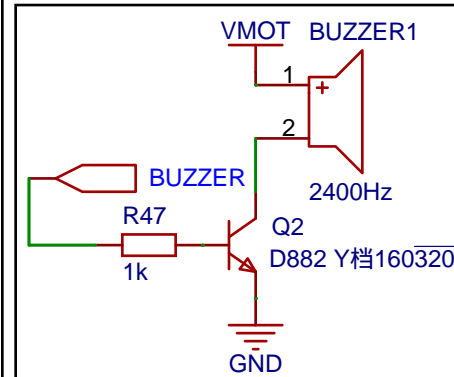
2S LiPo - Check Polarity!
2S Input for LiPo has E-fuse, RPP, switch
fuse holds at 1A, trips at 2A



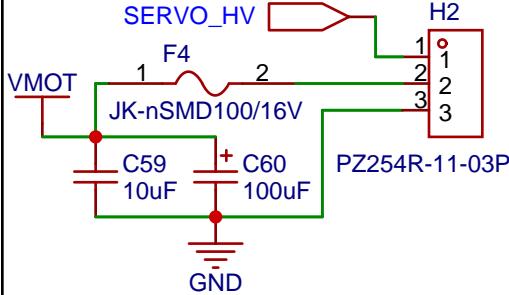
Servo PWM Logic Shifting
No good documentation on logic level of servo signals
Shifting to 5V to be safe



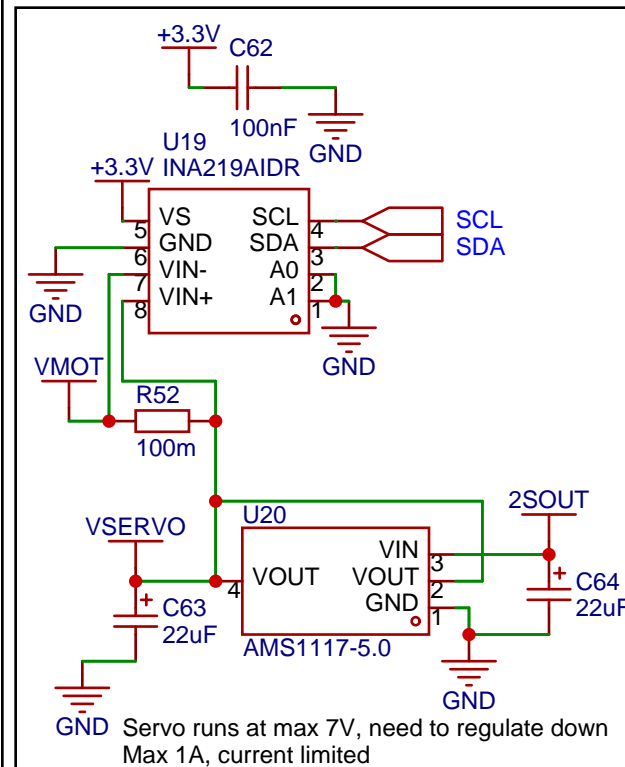
Buzzer
Runs off servo batt after landing
Min 88dB (10cm) at 2400Hz



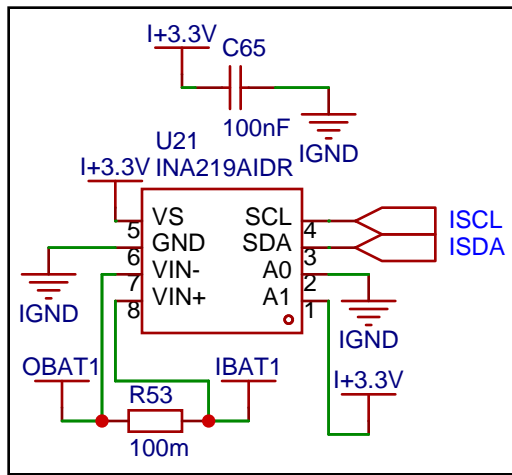
Servo Connector - Check Wiring
Polyfuse holds at 1A, trips at 2A



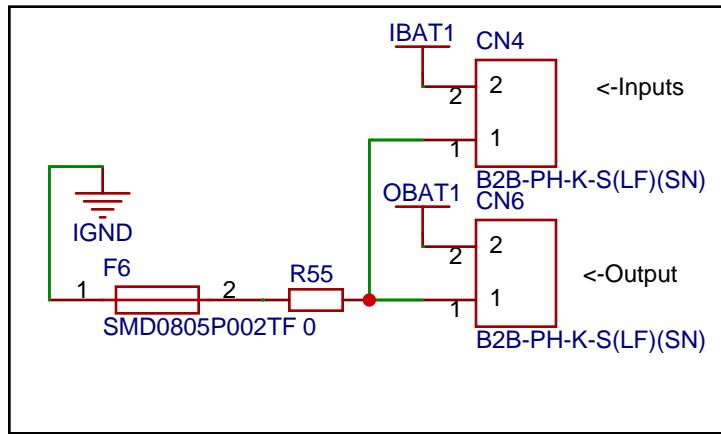
Servo Power Regulation + Logging
See page 3 for details on power monitoring
Used as safety against movement while bound/constrained
Suggestion: Move INA219 to before AMS1117
Currently voltage just tells us out of AMS1117, not battery



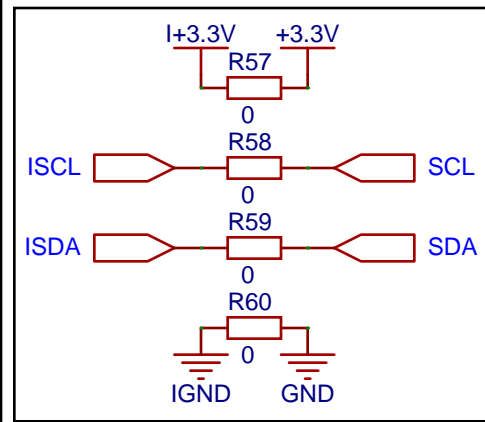
Power Monitoring
See page 3 for more informatin



Battery Passthrough - Check Polarity!
Ground reference through a low-current fuse, should be 0 current

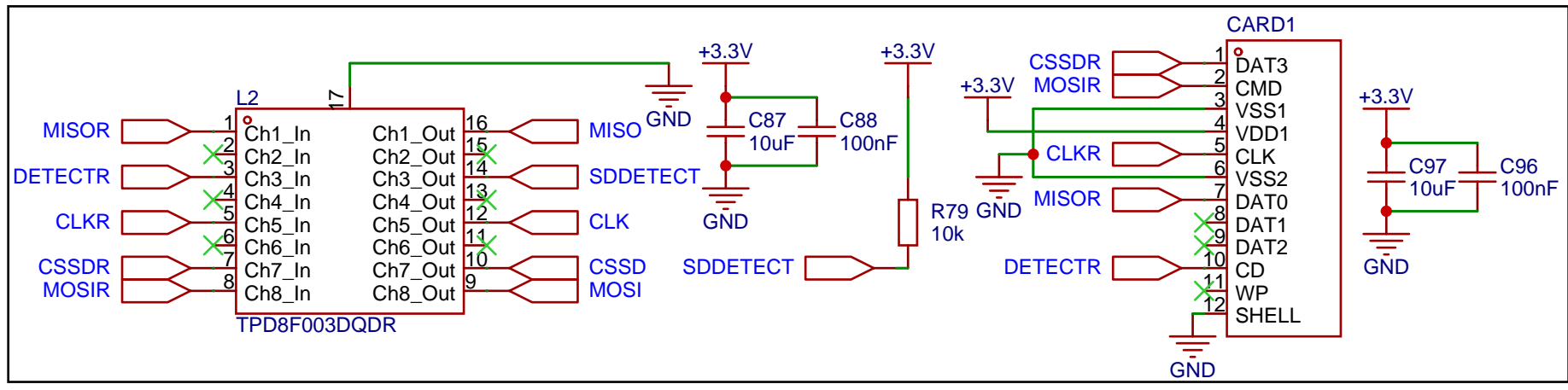


Jumpers
All connections to passthrough can be severed
by removing 0R resistors



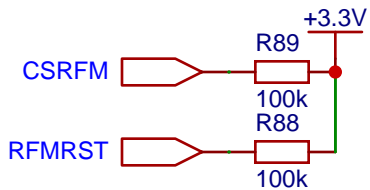
System for Controlling and Recording Airbrake Performance (SCRAP)
Schematic Page 6/10: COTS Power Passthrough
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SD Card with ESD protection
SD Card socket connected via SPI



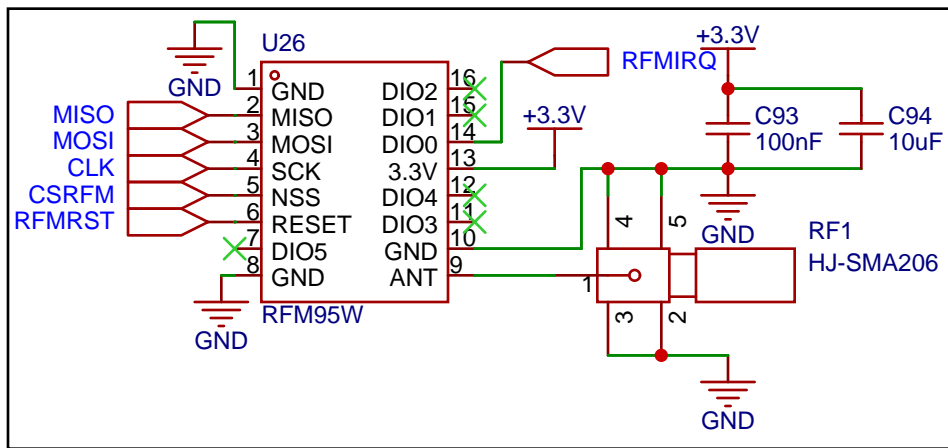
System for Controlling and Recording Airbrake Performance (SCRAP)
Schematic Page 7/10: SD Card
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Weak pullup on reset and CS



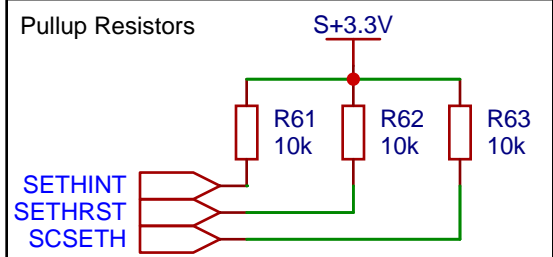
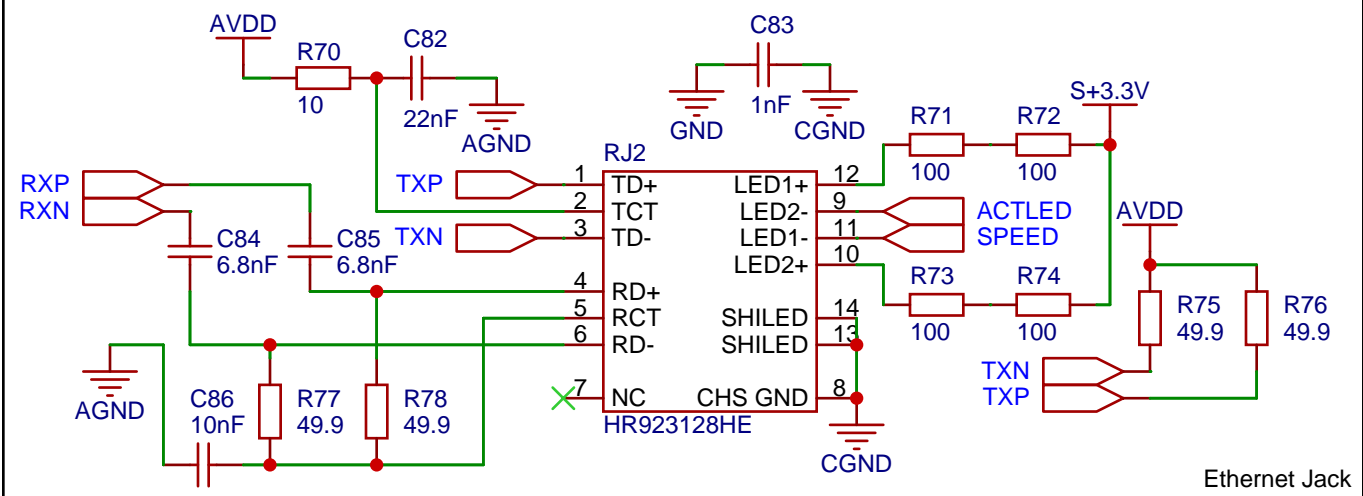
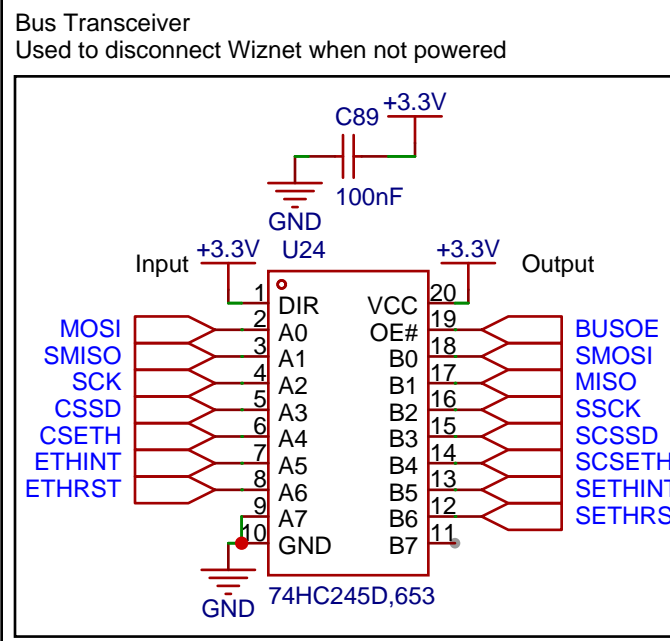
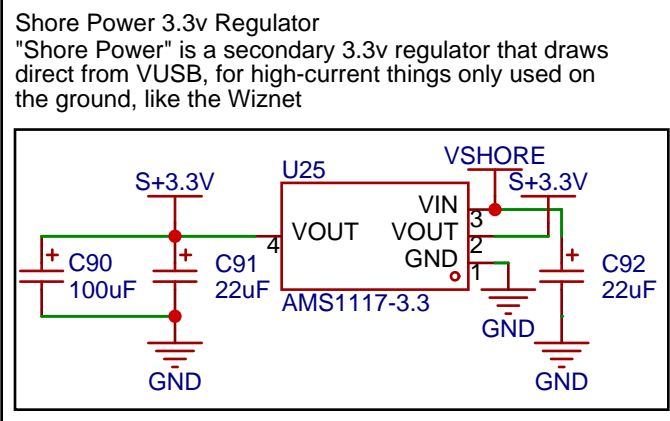
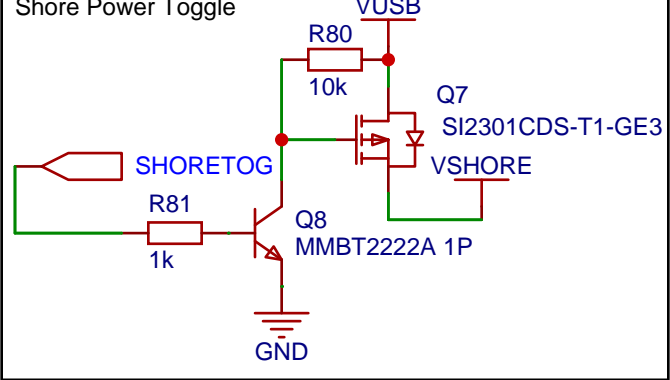
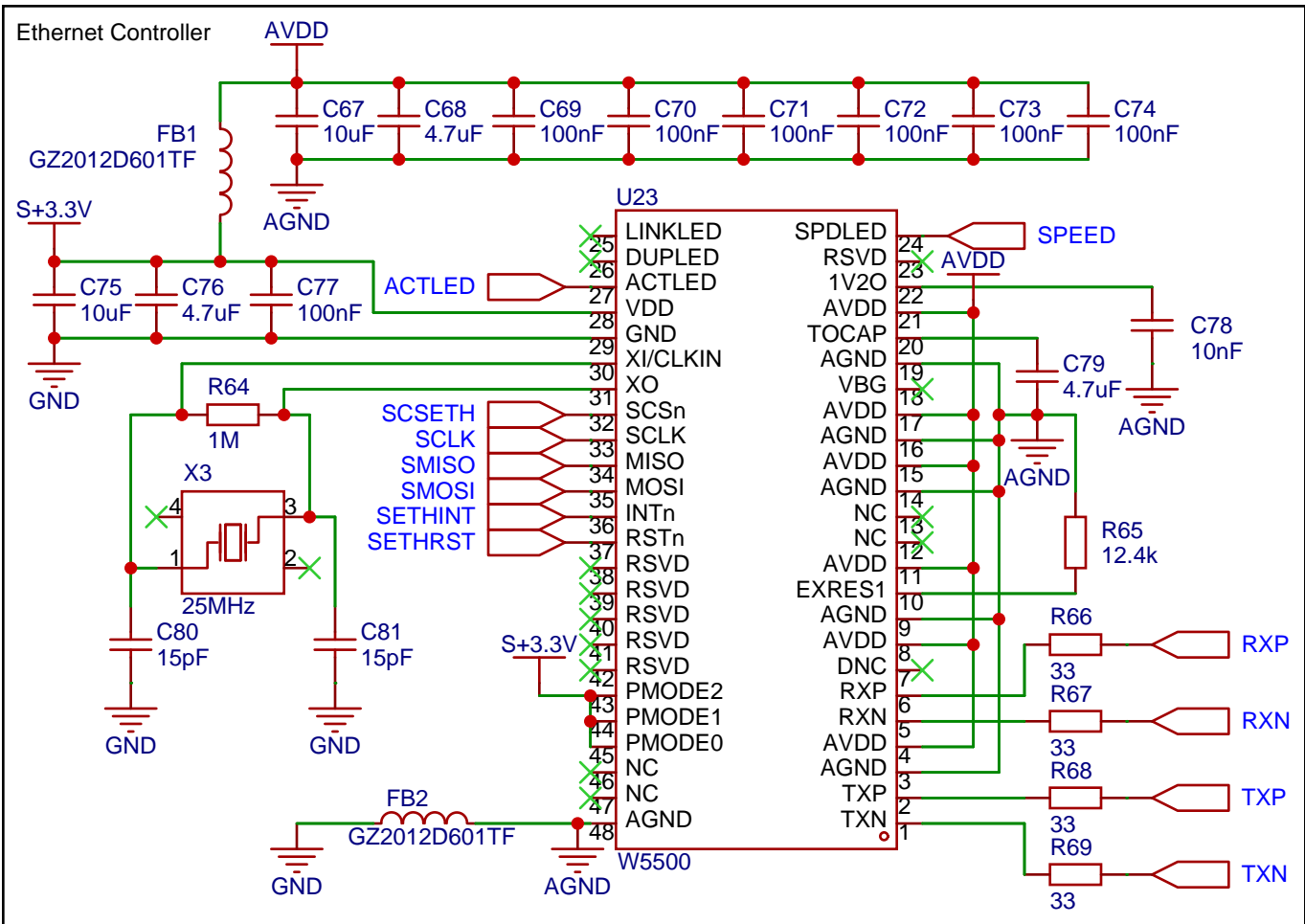
RFM95

Based on Adafruit implementation

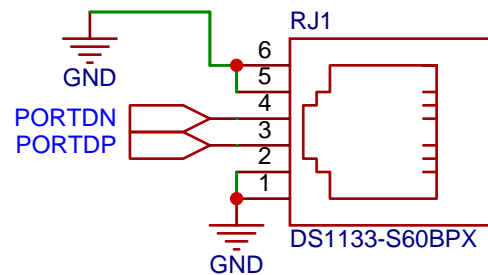
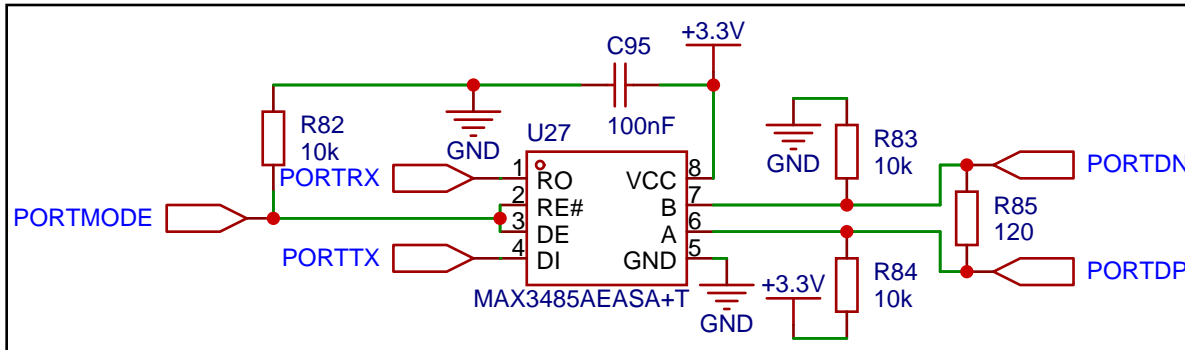


System for Controlling and Recording Airbrake Performance (SCRAP)
Schematic Page 8/10: 900MHz Radio
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Ethernet was the originally-planned way to allow long-range pad communications with SCRAP. Due to size and price constraints, it was deprecated in favor of an RS485 interface.



RS485 Transceiver
Connector for off-board long-range communications
Connection through pseudo-standard RJ11, RJ12 connector
Accompanying dongles have auto-crossover to allow for any style cable



System for Controlling and Recording Airbrake Performance (SCRAP)
Schematic Page 10/10: Pad RS485
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