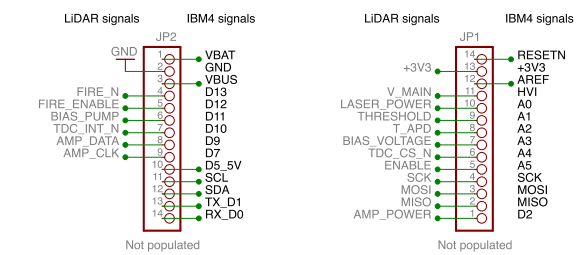
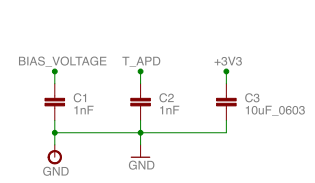


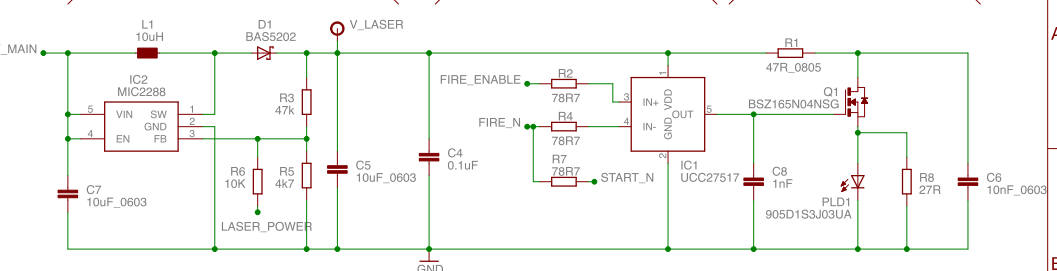
Headers.



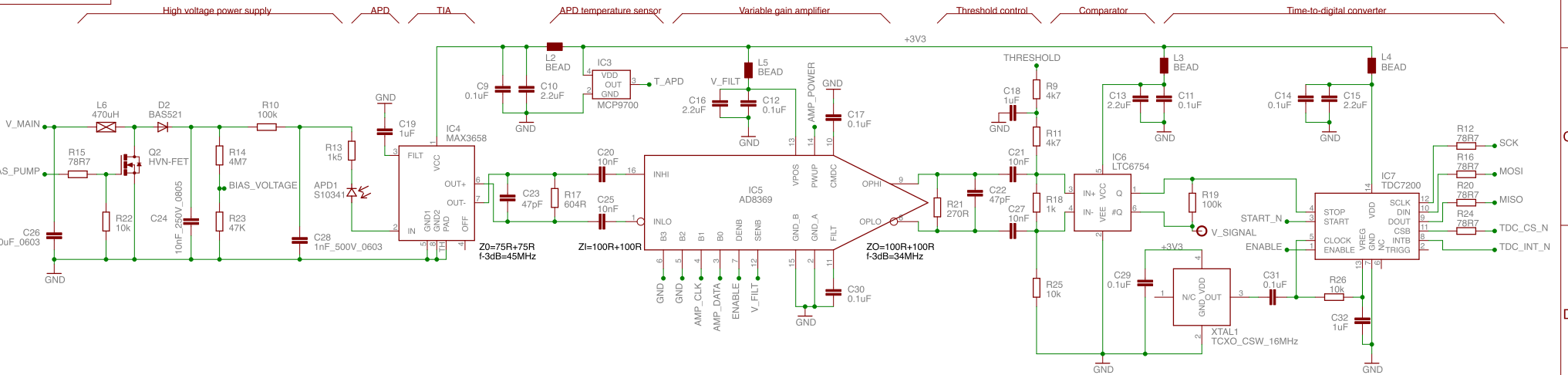
Additional decoupling.



Laser driver.



Signal chain and timer.



Revision history.

Rev1 14 Jan 2019:  
 Added impedance resistor to FIRE\_ENABLE line.  
 Added laser power control using A0.  
 Added laser pulse width control using FIRE\_ENABLE line.  
 Moved laser emission point by 0.25mm to suit laser body.  
 Changed laser SMPS inductor to 0805.  
 Combined ENABLE lines for TDC and AMP.  
 Made I2C pins available to user.  
 Increased mounting holes size and clearance.  
 Moved 5V power to HVI to allow for battery operation.  
 Added power controls to VGA on D2 PWM.  
 Tested servos on D4 and D5.  
 Added overdrive cap for MAX40658.  
 Total current consumption at 5V = 78mA incl ItsyBitsy.  
 TODO - Update eye safety limits for different laser power settings.

Rev0 21 Dec 2018:  
 Initial release.  
 Made pins compatible with ItsyBitsy M4 running MicroPython.  
 Made separation between laser and APD 13.7mm to suit optics.  
 Board detail - black solder mask, 5/5mil, 0.25mm holes, 0.6mm thick  
 Average V\_laser current @ 2048 shots per second = 2.5mA  
 Typical V\_APD current = 2.0mA  
 EMC emission and susceptibility testing done.  
 Eye safety testing done.

Laser voltage control:  
 V\_laser = 1.24 (1 + Rtop / Rbottom)  
 Open control = 13.64V  
 High control = 19.47V  
 Low control = 7.7V

Eye safety limits EN60825-1:2014:  
 Classification Class1M  
 Pave 0.5mW @ 905nm  
 Freq 2048 Hz  
 Pulse 15ns  
 Source Elliptical 12x6mm  
 MPE Ex 0.576  
 Class1 AEL Ex 1.00  
 AE @ 0.05m 0.576 x MPE  
 NOHD <10mm  
 Test distance 0.05m

Board stackup: 35um Cu on all layers, FR4, Er=4  
 L1-L2: 0.175mm  
 L2-L3: 0.17mm  
 L3-L4: 0.175mm  
 L1-L4: 0.60mm  
 Analog tracks ZO = 100R; H2 = 0.345mm, W = 5.5mil  
 Analog tracks ZO = 75R; H2 = 0.345mm, W = 12mil  
 Digital tracks ZO = 78R7; H1 = 0.175mm, W = 5mil

Product code: Unruly  
 Revision: Rev1  
 Drawn by: LD  
 Initial release: 14 Jan 2019

Passive component package size is Imperial 0402 unless otherwise specified.