Supporting Information

Open Source Photoreactor

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Contents

1 Introduction

2 Electronics

2.1 Analog

Analog Control LED Driver
0.3R = max current of 333 mA

+12V

GND

+12V

RV1
100KOhm
2
3

CTRL   VIN   5

R1   0.3R

SET   4

U1
AL8805W5-7
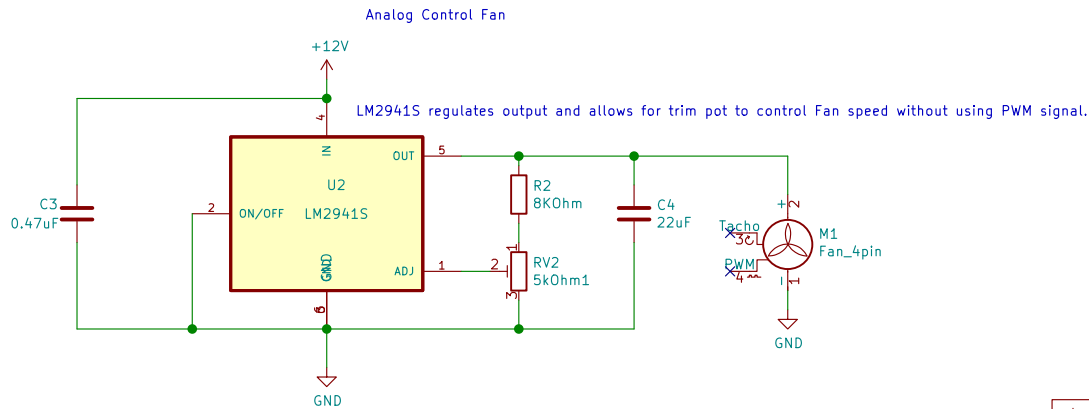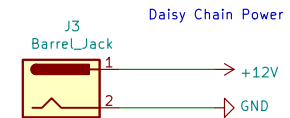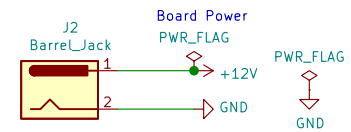
C1
1uF

LED +
1
2
J1
Conn_01x02
LED -

D1
MBRA140

C2
2.2uF

GND

2   GND   SW   1

L1
33uH
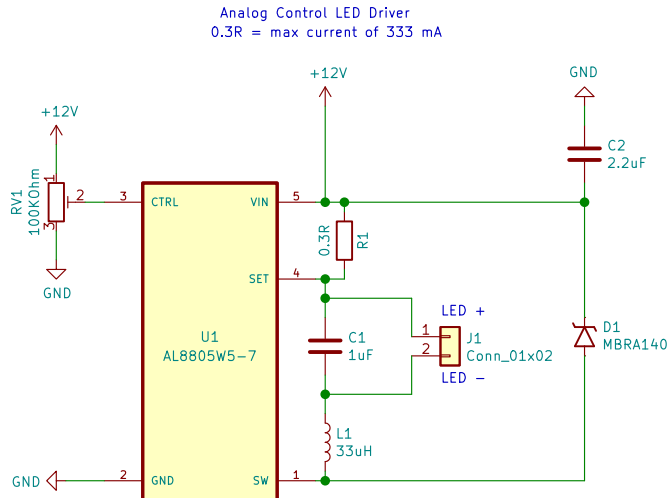
This LED driver is adapted from SparkFun femtobuck design.
I've added a trim pot to control the driver. It should output constant 330 mA to LEDs.

J2
Barrel_Jack

Board Power
PWR_FLAG

1   +12V

2   GND

PWR_FLAG

GND

J3
Barrel_Jack

Daisy Chain Power

1   +12V

2   GND

Analog Control Fan

+12V

4

IN   OUT   5

U2
LM2941S

ON/OFF

GND

ADJ   1

C3
0.47uF
2

R2
8KOhm

2   RV2
5kOhm1
3

C4
22uF

Tacho
3
PWM
4

+   2
M1
Fan_4pin
-    1

GND

6

GND

LM2941S regulates output and allows for trim pot to control Fan speed without using PWM signal.

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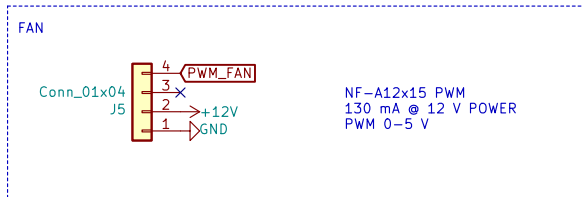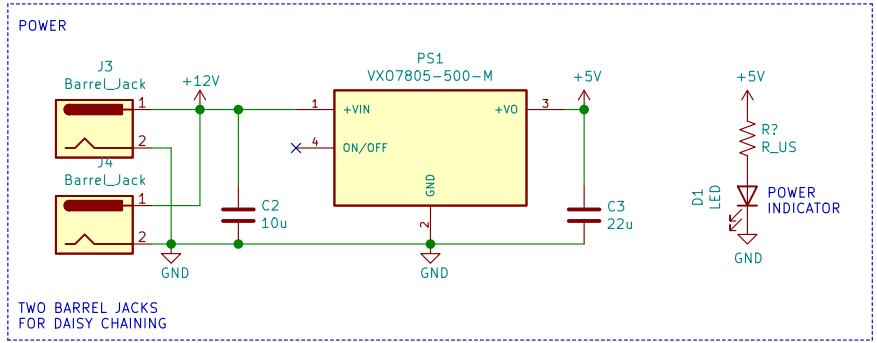University of Wisconsin-Madison

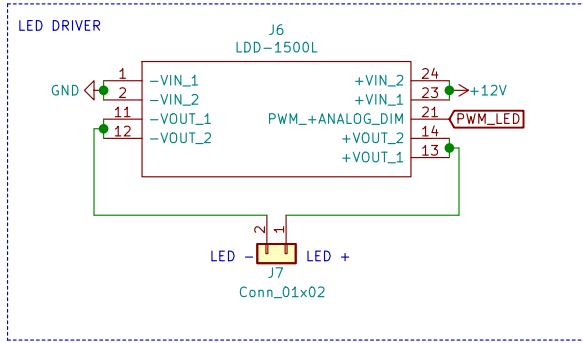Sheet: /
File: driver.sch

Title: Analog Photoreactor Driver

Size: USLetter   Date: 2021-01-19   Rev: 1.0.0
KiCad E.D.A. kicad 5.1.8+dfsg1-1+b1   Id: 1/1

2.2 Digital

TODO: document I2C connection choice. Consistent with Adafruit, Sparkfun, Seeed...

2.2.1 Driver

MICROCONTROLLER

ATtiny85 HAS INTERNAL PULLUPS

C1 0.1uF
+5V
GND
VCC 8

U1
ATtiny85-20PU

5 AREF/PB0 — SDA
6 PB1 — PWM_FAN
7 PB2 — SCL
2 XTAL1/PB3 — INDICATOR
3 XTAL2/PB4 — PWM_LED
1 RESET/PB5 — +5V

R? 10k

4 GND
GND

I2C

Conn_01x04
J1
4 — GND
3
2
1

Conn_01x04
J2
4 — GND
3
2
1

I2C ASSIGNMENTS
1 – SCL
2 – SDA
3 – VCC
4 – GND

+5V
R4 R_US
R5 R_US
Q1 2N7000
SDA

+5V
R6 R_US
R7 R_US
Q2 2N7000
SCL

INDICATOR
R? R_US
LED D2
GND

TRANSISTORS SHIFT 3.3 OR 5
TO 5 V INTERNALLY

INDICATOR LIGHTS UPON
I2C COMMUNICATION

LED DRIVER

J6
LDD-1500L

1 -VIN_1
2 -VIN_2   +VIN_2 24
11 -VOUT_1   +VIN_1 23 — +12V
12 -VOUT_2   PWM_+ANALOG_DIM 21 — PWM_LED
              +VOUT_2 14
              +VOUT_1 13

GND

LED –   LED +
J7
Conn_01x02

POWER

J3
Barrel_Jack
1
2

J4
Barrel_Jack
1
2

+12V

C2 10u
GND

PS1
VXO7805-500-M
1 +VIN   +VO 3 — +5V
4 ON/OFF
GND 2

GND

C3 22u

+5V
R? R_US
D1 LED
POWER INDICATOR
GND

TWO BARREL JACKS
FOR DAISY CHAINING

FAN

Conn_01x04
J5
4 — PWM_FAN
3
2 — +12V
1 — GND

NF-A12x15 PWM
130 mA @ 12 V POWER
PWM 0-5 V

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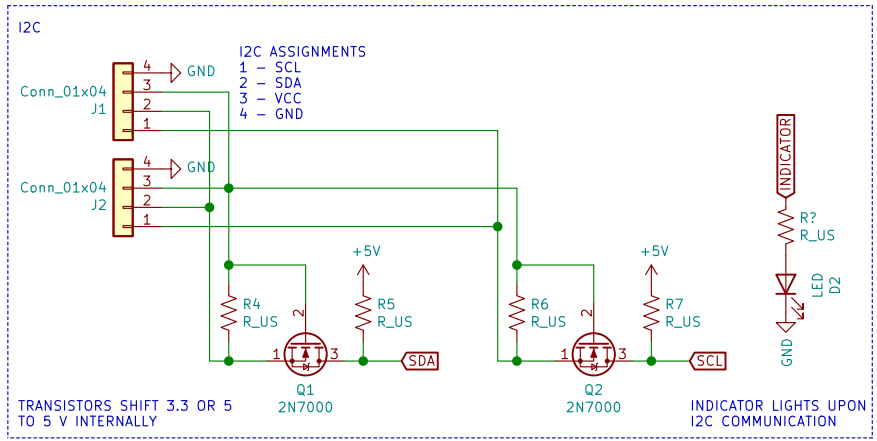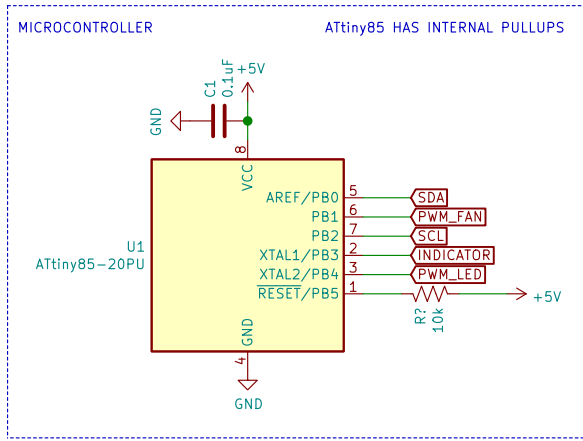
Sheet: /
File: driver.sch
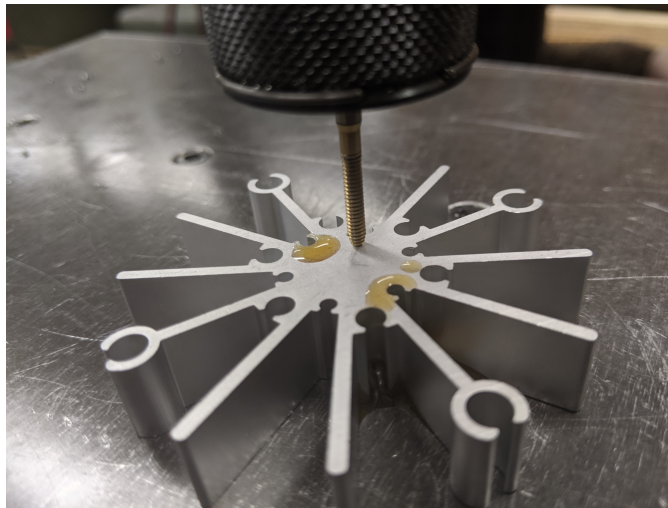Title: Digital Photoreactor Driver

2.2.2 Controller

Figure S1: Two of the innermost holes on the extruded heatsink must be 4-40 tapped.

3 Mechanical Construction

3.1 Base

3.1.1 LED and Heatsink

TODO: LED PCB part number

TODO: heatsink part number

Tap the heatsink. We used thread-forming tap: OSG 1400105300.

TODO: heatsink compoud

Install with wires facing towards printed hole

Use 4-40 1/4".

3.1.2 Fan

TODO: fan part number

Noctua NF-A12x15 PWM

pins: blue: PWM (5 V) yellow: +12 V black: ground

Use 4-40 3/4" into captured nuts

4   Efficacy