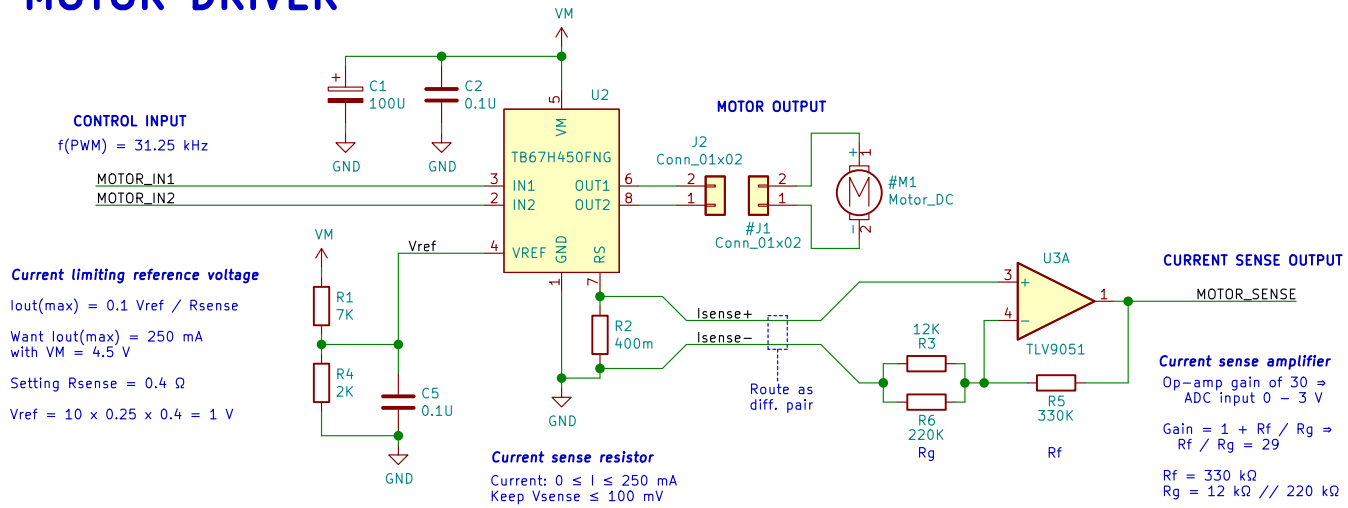
MOTOR DRIVER



CONTROL INPUT

f(PWM) = 31.25 kHz

Current limiting reference voltage

Iout(max) = 0.1 Vref / Rsense

Want Iout(max) = 250 mA
with VM = 4.5 V

Setting Rsense = 0.4 Ω

Vref = 10 x 0.25 x 0.4 = 1 V

Current sense resistor

Current: 0 ≤ I ≤ 250 mA
Keep Vsense ≤ 100 mV

Rsense = 0.4 Ω ⇒ 0 ≤ Vsense ≤ 0.1 V

(Pmax = 25 mW)

Current sense amplifier

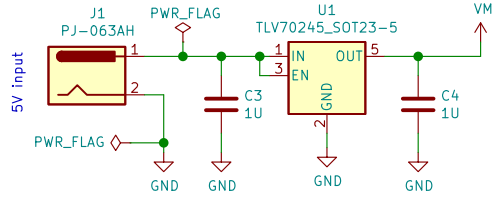
Op-amp gain of 30 ⇒
ADC input 0 – 3 V

Gain = 1 + Rf / Rg ⇒
Rf / Rg = 29

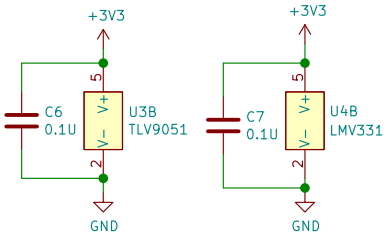
Rf = 330 kΩ
Rg = 12 kΩ // 220 kΩ

POWER

MOTOR POWER INPUT (5V to 4.5 V)



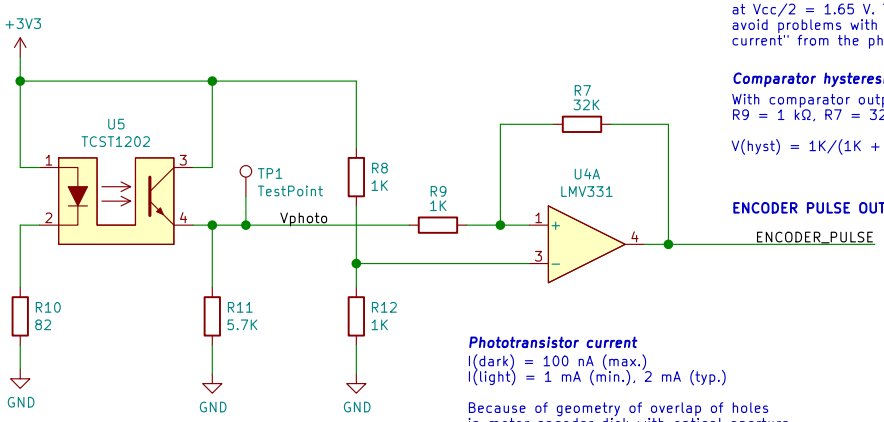
3.3 V POWER FROM NUCLEO BOARD



Motor coil
current sense
opamp

Motor encoder
comparator

MOTOR ENCODER



Comparator threshold

R8 and R12 set the comparator threshold at Vcc/2 = 1.65 V. This is large enough to avoid problems with ambient light "dark current" from the phototransistor.

Comparator hysteresis

With comparator outputs 0 and 3.3 V,
R9 = 1 kΩ, R7 = 32 kΩ gives

V(hyst) = 1K/(1K + 32K) * (3.3 – 0) = 0.1 V

ENCODER PULSE OUTPUT

Infra-red LED

Vf = 1.25 V (typ.), 1.6 V (max.)
If = 20 mA (nominal from datasheet plots)

R10 = 82Ω ⇒ If = 25 mA (typ.), 21 mA (min.)

Phototransistor current

I(dark) = 100 nA (max.)
I(light) = 1 mA (min.), 2 mA (typ.)

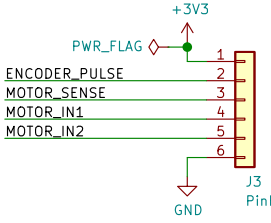
Because of geometry of overlap of holes in motor encoder disk with optical aperture, we'll get 0.5 mA (min.), 1 mA (typ.)

Phototransistor current conversion

To get Vphoto high enough for I(light) = 0.5 mA, put R11 = 5.7 kΩ (gives Vphoto = 2.85 V)

(If I(light) is much larger, the phototransistor goes into saturation.)

NUCLEO CONNECTIONS



NUCLEO PIN		
+3V3		CN8 7
DIGITAL INPUT (PG3)		CN8 16
ANALOG INPUT (PA3, ADC123_IN3)		CN9 1
DIGITAL OUTPUT (PD14, TIM4_CH3)		CN7 16
DIGITAL OUTPUT (PD15, TIM4_CH4)		CN7 18
GND		CN8 11

Motor driver and encoder prototype board
Part of the Mini-Mapper project
Designed for AISLER 2-Layer Service

Sheet: /
File: motor-board.sch

Title:

Size: A4	Date:	**Rev: 1**
KiCad E.D.A. kicad 5.1.6		Id: 1/1