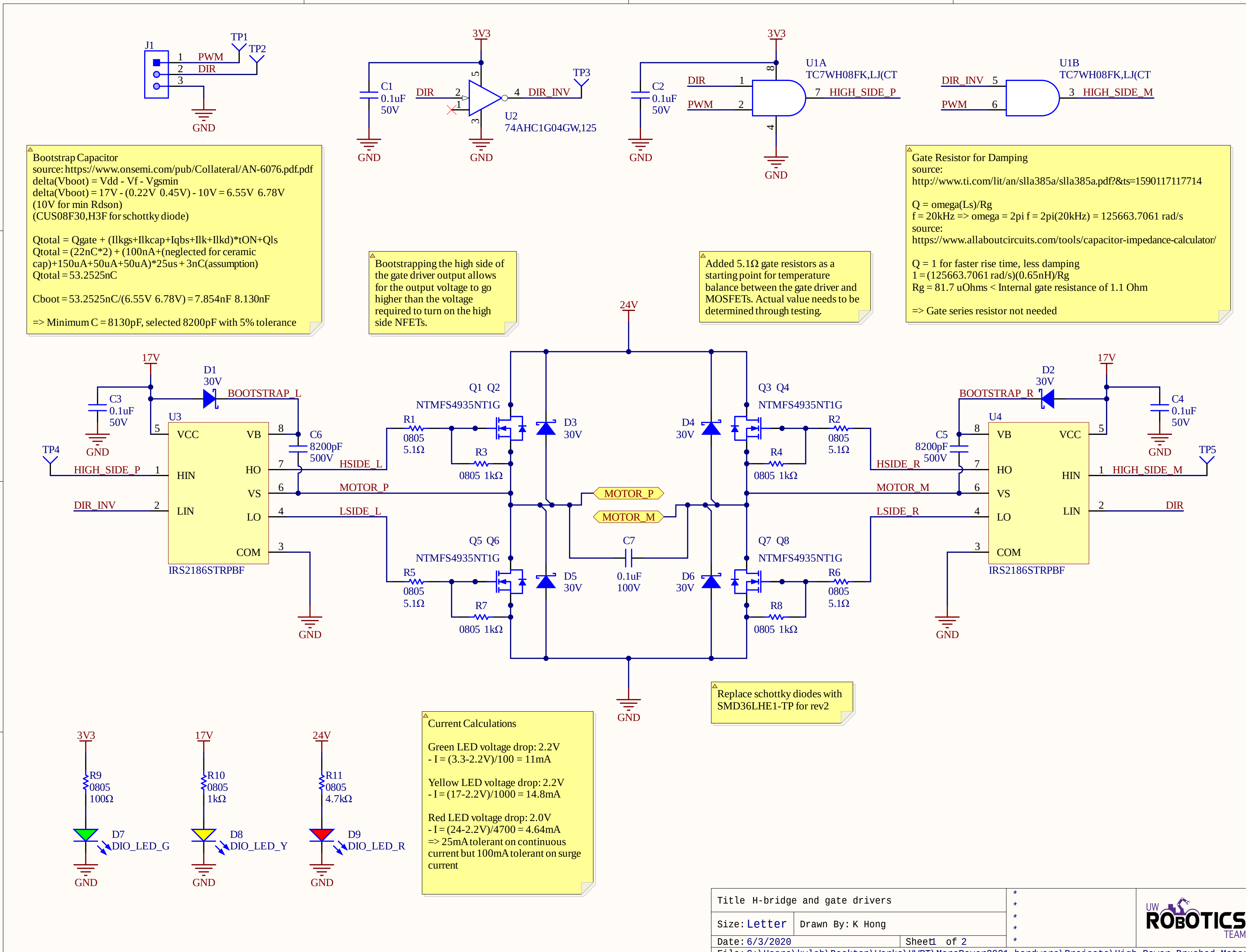

Bootstrap Capacitor
source: https://www.onsemi.com/pub/Collateral/AN-6076.pdf.pdf
delta(Vboot) = Vdd - Vf - Vgsmin
delta(Vboot) = 17V - (0.22V 0.45V) - 10V = 6.55V 6.78V
(10V for min Rdson)
(CUS08F30,H3F for schottky diode)

Qtotal = Qgate + (Ilkgs+Ilkcap+Iqbs+Ilk+Ilkd)*tON+Qls
Qtotal = (22nC*2) + (100nA+(neglected for ceramic cap)+150uA+50uA+50uA)*25us + 3nC(assumption)
Qtotal = 53.2525nC

Cboot = 53.2525nC/(6.55V 6.78V) = 7.854nF 8.130nF

=> Minimum C = 8130pF, selected 8200pF with 5% tolerance

Bootstrapping the high side of the gate driver output allows for the output voltage to go higher than the voltage required to turn on the high side NFETs.

Added 5.1Ω gate resistors as a starting point for temperature balance between the gate driver and MOSFETs. Actual value needs to be determined through testing.

Gate Resistor for Damping
source:
http://www.ti.com/lit/an/slla385a/slla385a.pdf?&ts=1590117117714

Q = omega(Ls)/Rg
f = 20kHz => omega = 2pi f = 2pi(20kHz) = 125663.7061 rad/s
source:
https://www.allaboutcircuits.com/tools/capacitor-impedance-calculator/

Q = 1 for faster rise time, less damping
1 = (125663.7061 rad/s)(0.65nH)/Rg
Rg = 81.7 uOhms < Internal gate resistance of 1.1 Ohm

=> Gate series resistor not needed

Replace schottky diodes with SMD36LHE1-TP for rev2

Current Calculations

Green LED voltage drop: 2.2V
- I = (3.3-2.2V)/100 = 11mA

Yellow LED voltage drop: 2.2V
- I = (17-2.2V)/1000 = 14.8mA

Red LED voltage drop: 2.0V
- I = (24-2.2V)/4700 = 4.64mA
=> 25mA tolerant on continuous current but 100mA tolerant on surge current

Title H-bridge and gate drivers
Size: Letter Drawn By: K Hong
Date: 6/3/2020 Sheet 1 of 2
File: C:\Users\kyleh\Desktop\Works\UWRT\MarsRover2021-hardware\Projects\High Power Brushed Motor Contro

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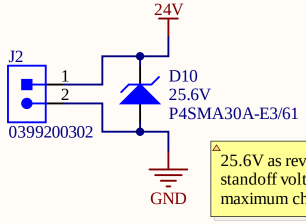
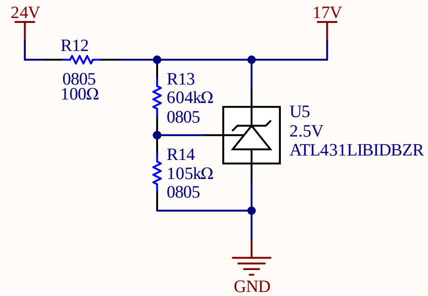


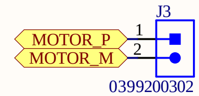
25.6V as reverse standoff voltage with maximum charged

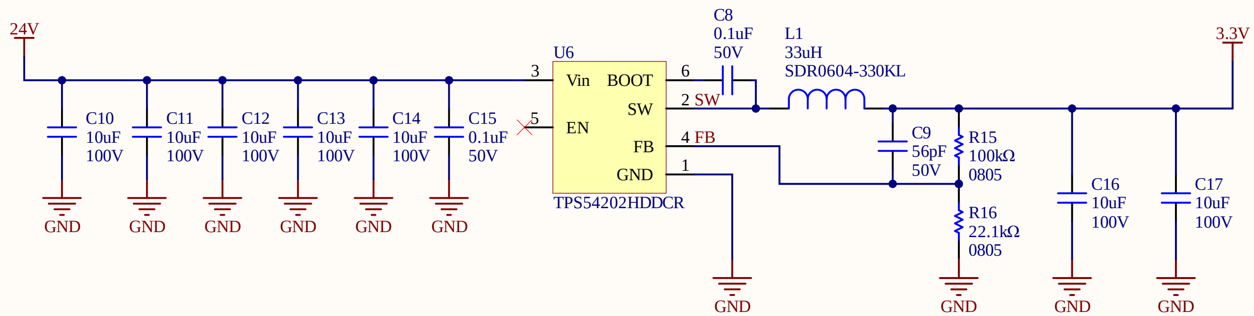


Shunt Regulator Reference Voltage
Source:
www.ti.com/lit/ds/symlink/atl431.pdf?ts=1590628044417

Vo = (1+R1/R2) Vref
17V = (1+R1/R2)2.5V
R1/R2 = 5.8

604k/105k = 5.75 (from WEBENCH)
Real Vo = 16.88V





Buck Converter Reference Voltage
Source:
http://www.ti.com/lit/ds/symlink/tps54202h.pdf?HQS=TI-null-null-digikeymode-df-pf-null-wwe&ts=1590631773108

Vout = Vref(R2/R3 + 1)
3.3V = 0.6V(R2/R3 +1)
R2/R3 = 4.5

100k/22.1k = 4.525
Real Vout = 3.315V

Title Connectors and PDB		*
Size: Letter	Drawn By: Kyle Hong	*
Date: 6/3/2020	Sheet 2 of 2	*
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