

**Bootstrap Capacitor**  
source: <https://www.onsemi.com/pub/Collateral/AN-6076.pdf>  
 $\Delta V_{boot} = V_{dd} - V_f - V_{gmin}$   
 $\Delta V_{boot} = 17V - (0.220.45V) - 10V = 6.556.78V$   
(10V for min  $R_{ds(on)}$ )  
(CUS08F30,H3F for schottky diode)

$Q_{total} = Q_{gate} + (I_{lkg} + I_{lkc} + I_{qbs} + I_{lkd}) \cdot t_{ON} + Q_{ls}$   
 $Q_{total} = (22nC \cdot 2) + (100nA + (\text{neglected for ceramic cap}) + 150uA + 50uA + 50uA) \cdot 25us + 3nC (\text{assumption})$   
 $Q_{total} = 53.2525nC$

$C_{boot} = 53.2525nC / (6.556.78V) = 7.8548.130nF$

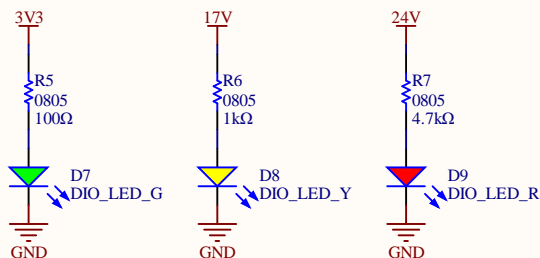
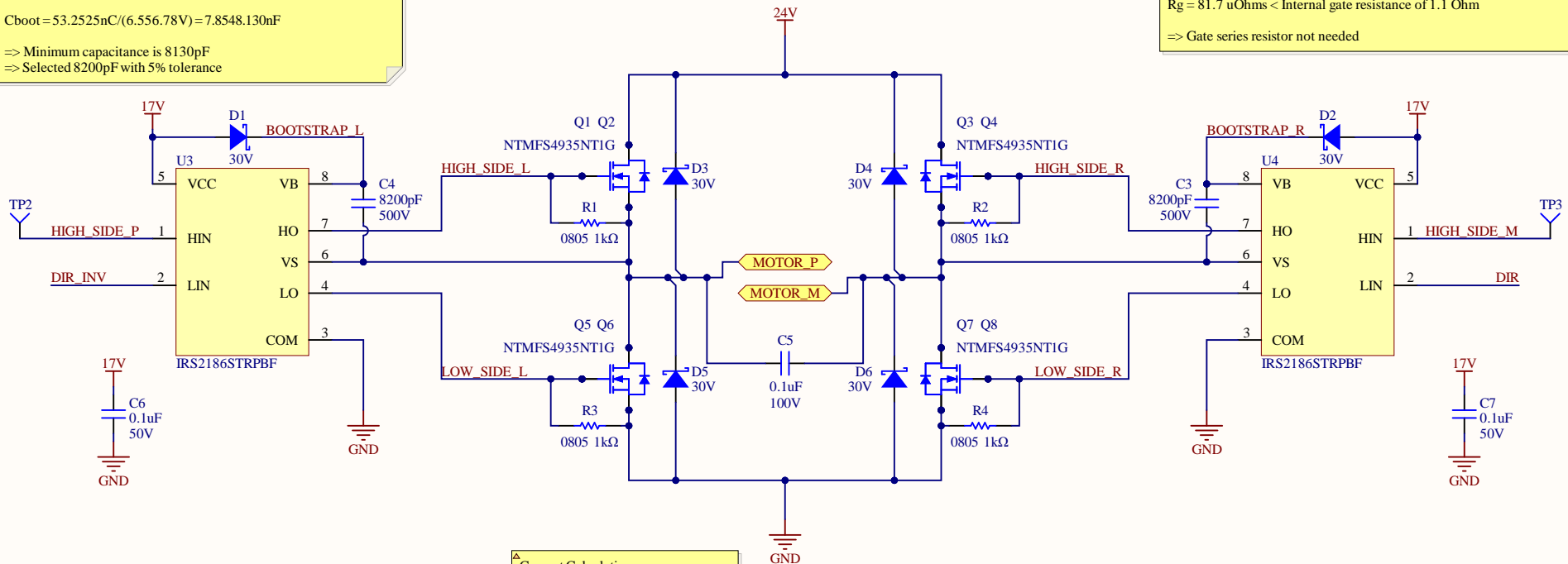
=> Minimum capacitance is 8130pF  
=> Selected 8200pF with 5% tolerance

**Gate Resistor**  
source: <http://www.ti.com/lit/an/slla385a/slla385a.pdf?ts=1590117117714>

$Q = \omega(L_s)/R_g$   
 $f = 20kHz \Rightarrow \omega = 2\pi f = 2\pi(20kHz) = 125663.7061 \text{ rad/s}$   
source: <https://www.allaboutcircuits.com/tools/capacitor-impedance-calculator/>

$Q = 1$  for faster rise time, less damping  
 $1 = (125663.7061 \text{ rad/s})(0.65nH)/R_g$   
 $R_g = 81.7 \text{ uOhms} < \text{Internal gate resistance of } 1.1 \text{ Ohm}$

=> Gate series resistor not needed

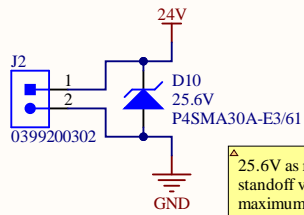


**Current Calculations**

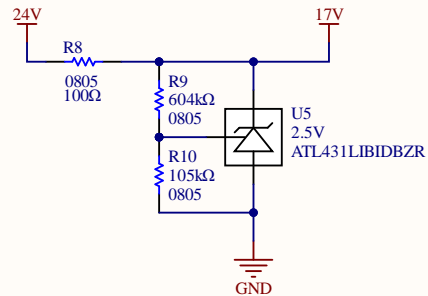
Green LED voltage drop: 2.2V  
 $I = (3.3 - 2.2V) / 100 = 11mA$

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



25.6V as reverse  
standoff voltage with  
maximum charged



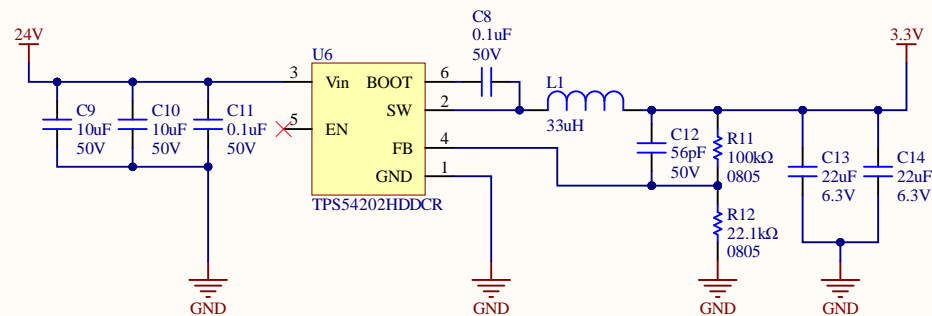
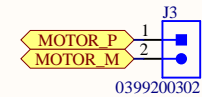
Shunt Regulator Reference Voltage  
Source:  
[www.ti.com/lit/ds/symlink/atl431.pdf?ts=1590628044417](http://www.ti.com/lit/ds/symlink/atl431.pdf?ts=1590628044417)

$$V_o = (1 + R_1/R_2) V_{ref}$$

$$17V = (1 + R_1/R_2) 2.5V$$

$$R_1/R_2 = 5.8$$

$$604k/105k = 5.75 \text{ (from WEBENCH)}$$

$$\text{Real } V_o = 16.88V$$


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

$$V_{out} = V_{ref}(R_2/R_3 + 1)$$

$$3.3V = 0.6V(R_2/R_3 + 1)$$

$$R_2/R_3 = 4.5$$

$$100k/22.1k = 4.525$$

$$\text{Real } V_{out} = 3.315V$$