ECE 320 - Homework #8

TTL Logic - MOSFETs Due Monday, March 23rd

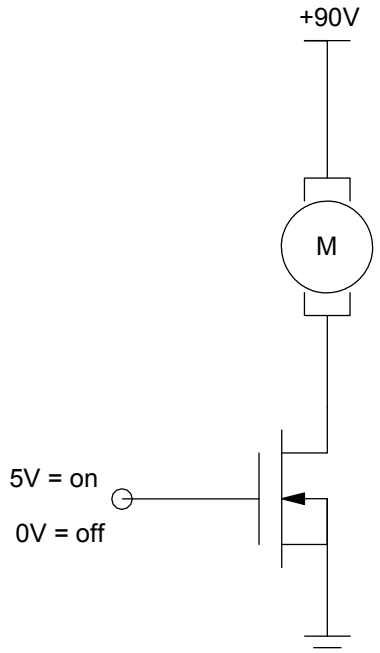
MOSFET Switch:

1) Design a circuit usint a MOSFET to turn on and off an 90V DC servo motor:
   - MotionTek SM341100 (http://www.motiontek.ca/dcservomotor.html)
   - 90V DC, 40A
   - 0.408 Ohm resistance

If you ignore the 40A max current, you need a circuit which can turn on and off 0.408 Ohms at 90V (220A)

Select an Infineon Technologies IPT004N03LATMA1

- Vth = 2.2V
- Rds = 0.0004 Ohms @ 120A @ Vgs = 4.5V
- Ic max = 300A



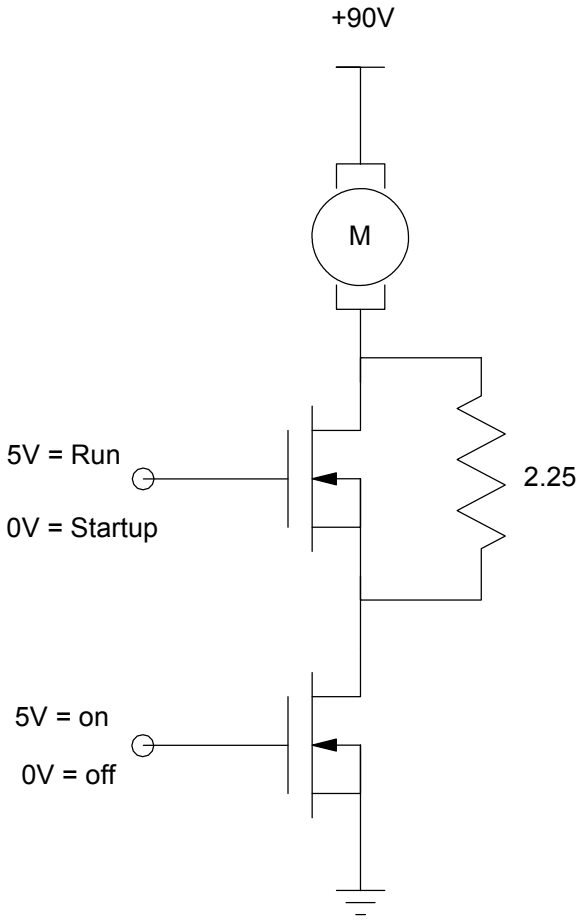
Note: If you did this, you would burn out the motor. The start-up current is 220A.

2) For problem 1, note that 90V @ 0.408 Ohms is more than the rated current. This causes problems at start-up. Design a circuit using MOSFETs which allows you to add or remove a 3 Ohm resistor in series with the motor.

- On start-up, you add in this resistor
- Once up to speed, you remove it.

Add in a 2.25 Ohm resisto so that the start-up current is 40A.

Use a second MOSFET to short out this resistor with 0.0004 Ohms when the motor gets up to speed



3 - 4) Assume a thermistor with the following temperature - resistance relationship

$$R \approx 1000 \cdot e^{-0.04(T-25)}\Omega$$

where T is the temperature in degrees C.

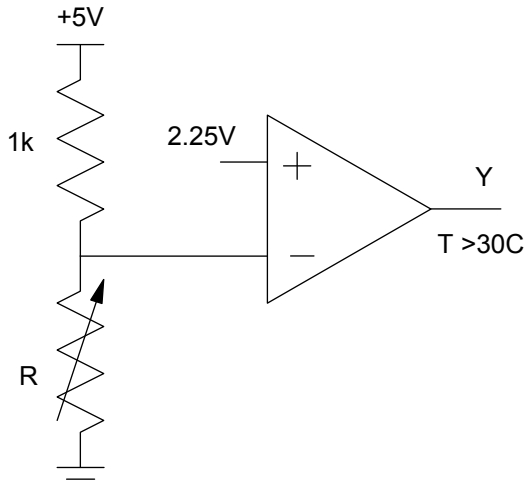
3) Comparitor: Design a circuit which outputs

- 0V for T < 30C
- 5V for T > 30C

At 30C, R = 818 Ohms

Using a voltage divicer with 5V and 1k, at 30C

Va = 2.25V



4) Schmitt Trigger: Design a circuit which outputs

- 0V when T < 25C
- 5V when T > 30C

Assuming the same 1k voltage divider

At 30C

R = 818 Ohms

Va = 2.25V

At 25C

R = 1000 Ohms

Va = 2.5V

Gain:

$$gain = \frac{5V-0V}{2.5V-2.25V} = 20$$

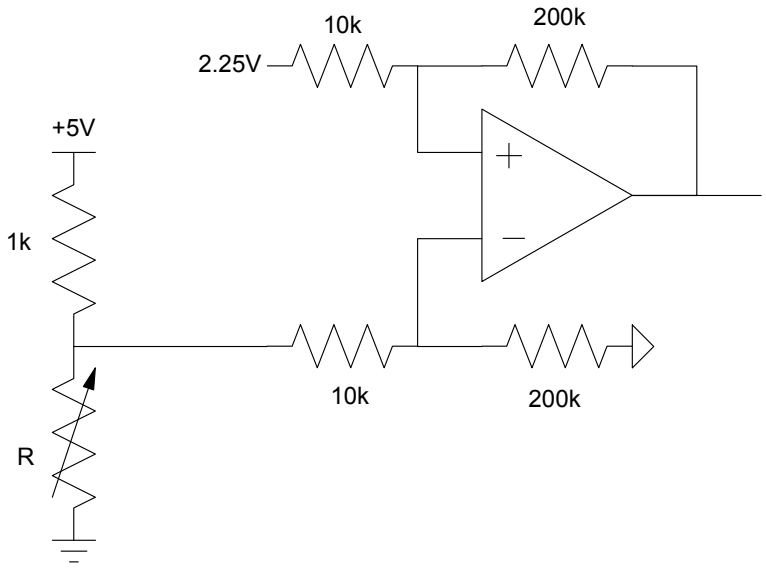
+ / - Input:

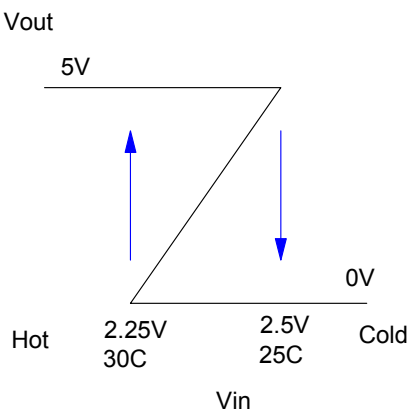
When the voltage becomes large (really cold), the output becomes small (0V). Connect to the - input.

Offset:

When the output is 0V (cold) and you're on the edge of switching, Vin = 2.25V.

Offset = 2.25V





Term Project

Take one section for your term project. For that section

5) Requirements: Specify the inputs / outputs / and how they relate
6) Analysis: Design a ciruit to meet these requirements. Include calculations for resistors and capacitors (if any).
7) Simulation: Check your analysis in simulation.
8) Testing: Build your circuit and collect data to check your analysis.