

ECE 320 - Homework #6

Boolean Logic, DTL, TTL, Mosfets

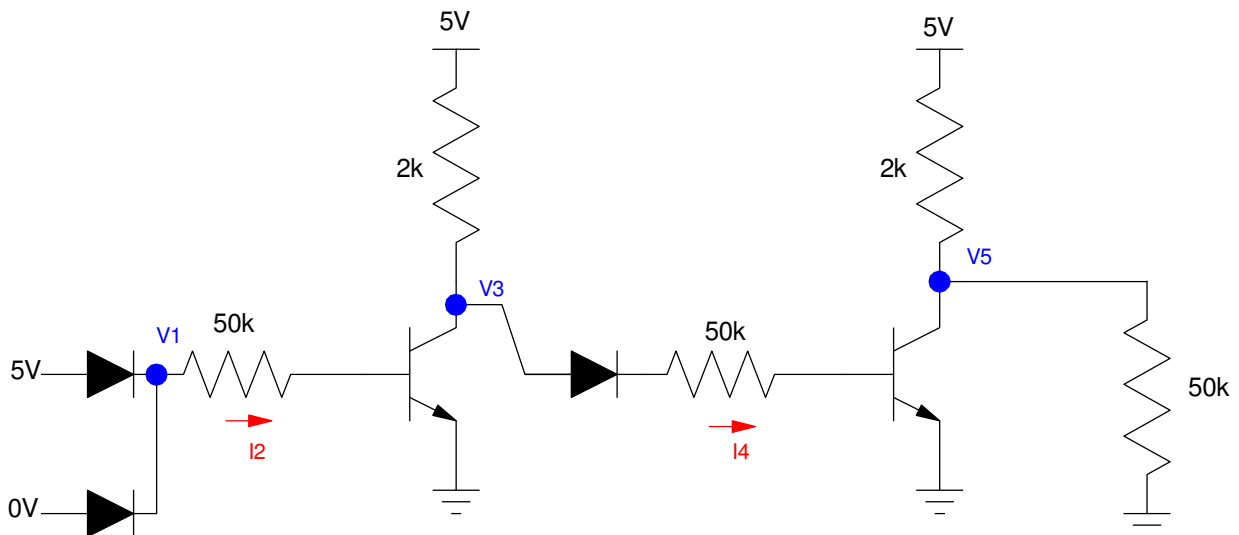
Boolean Logic

- 1) Design a circuit to implement Y using NAND gates
- 2) Design a circuit to implement Y using NOR gates

Y(A,B,C,D)		CD			
		00	01	11	10
AB	00	1	0	1	x
	01	1	0	0	1
	11	1	1	1	0
	10	x	1	x	0

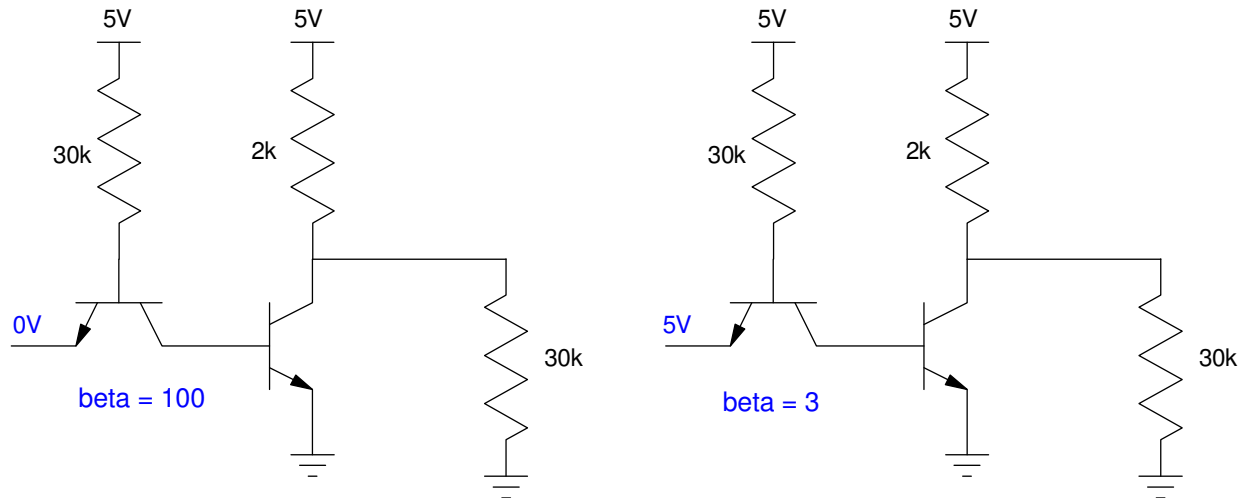
DTL Logic

- 3) Determine the voltages and currents for the following DTL OR gate. Assume 3904 NPN transistors
- 4) Simulate this circuit in CircuitLab to verify your answers



TTL Logic

- 5) Determine the voltages for the following TTL inverter. Assume 3904 transistors.
- 6) Simulate these circuits in CircuitLab to verify your answers



Problem 5-6

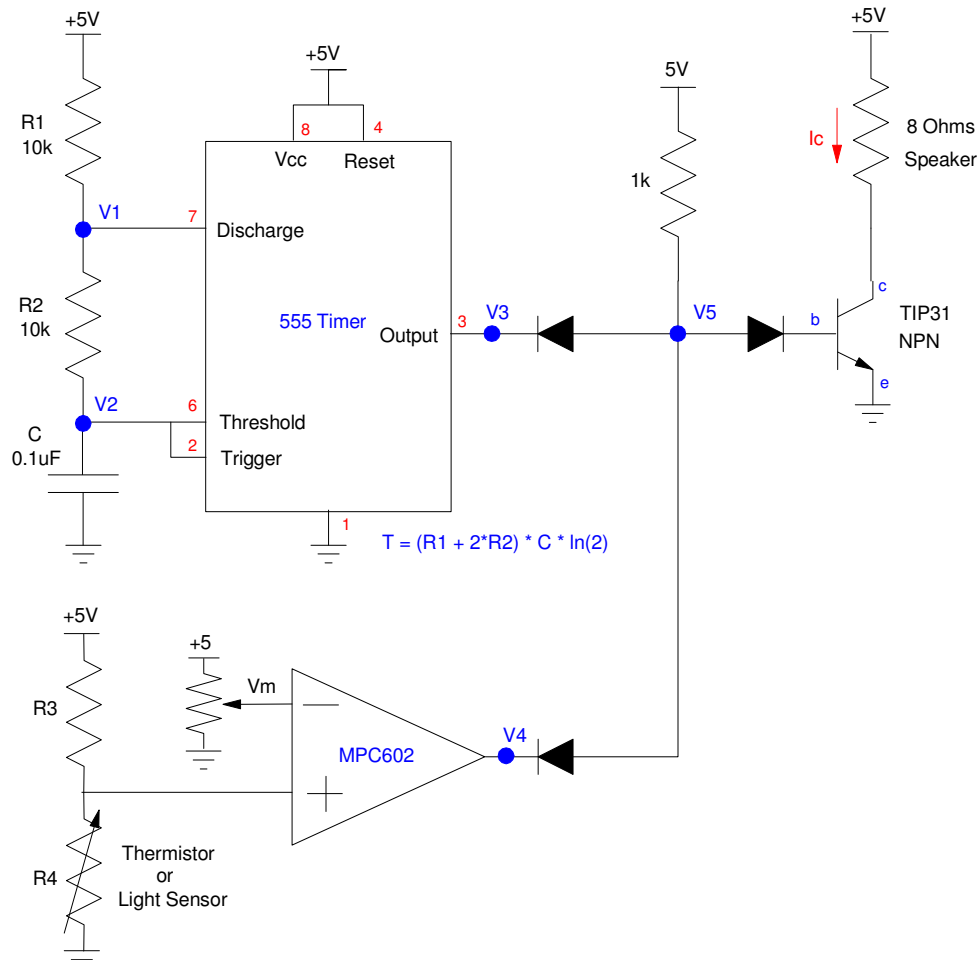
Light/Temperature Alarm using DTL Logic

The circuit below uses a DTL NOR gate to drive the speaker when

- The 555 timer outputs 5V, and
- The comparator outputs 5V,.

7) Determine the voltages when

- $V_3 = V_4 = 0V$
- $V_3 = V_4 = 5V$



MOSFET

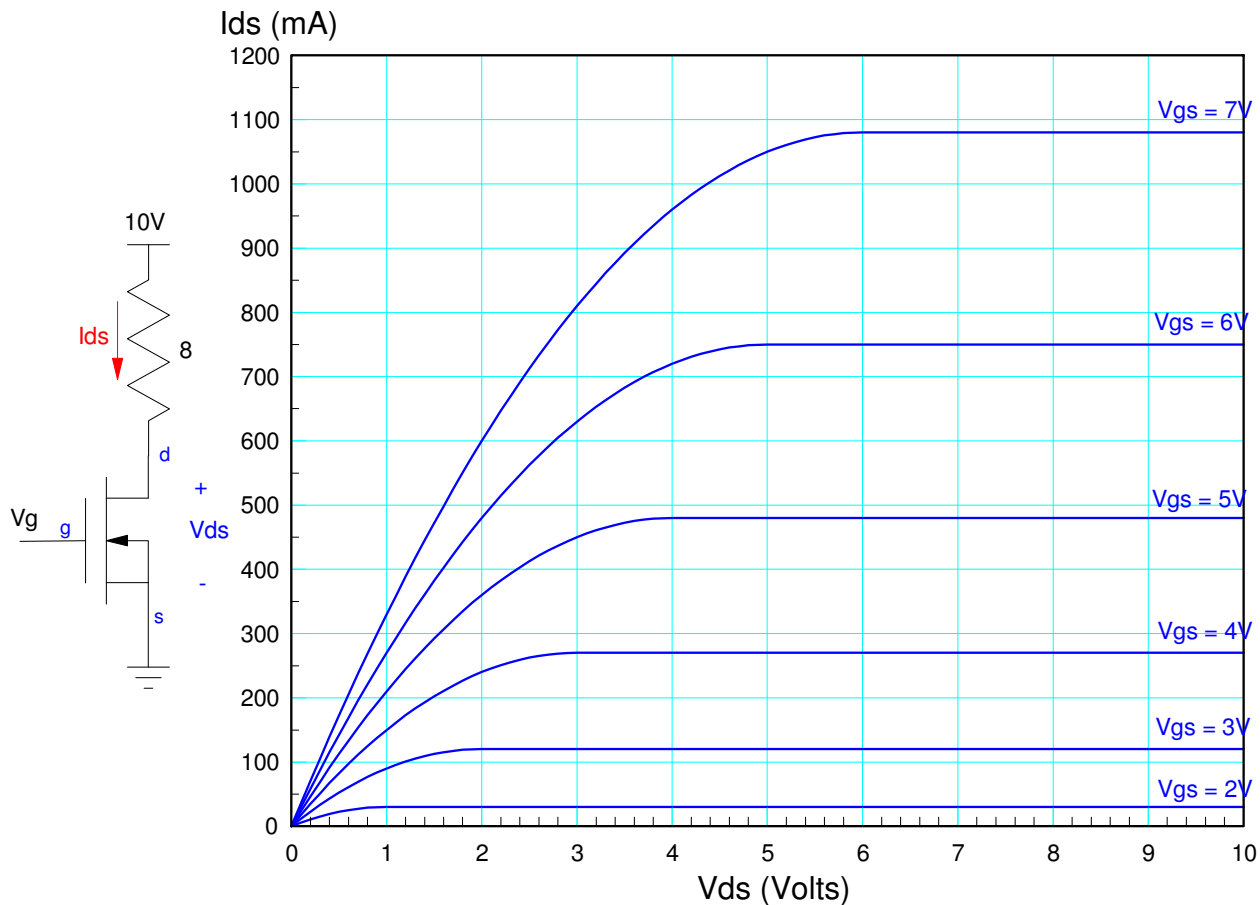
8) Label the operating regions on the graph below (off, ohmic, saturated) and determine the transconductance gain, k_n . Assume the turn-on voltage is $V_t = 1.00\text{V}$

9) Draw the load line for the circuit below. From the load line, determine the operating point (V_{ds} , I_{ds}) when

- $V_g = 2\text{V}$
- $V_g = 7\text{V}$

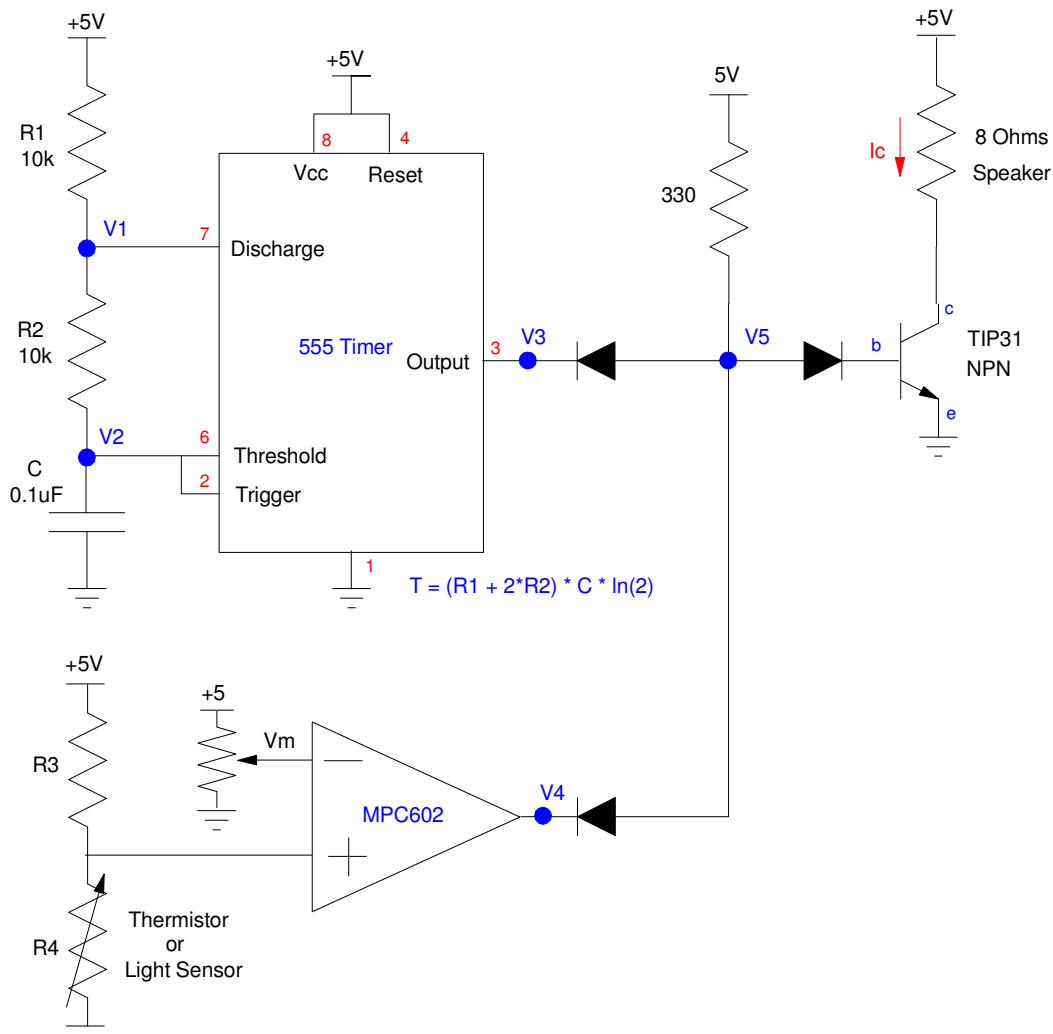
10) Calculate the operating point (V_{ds} , I_{ds}) when

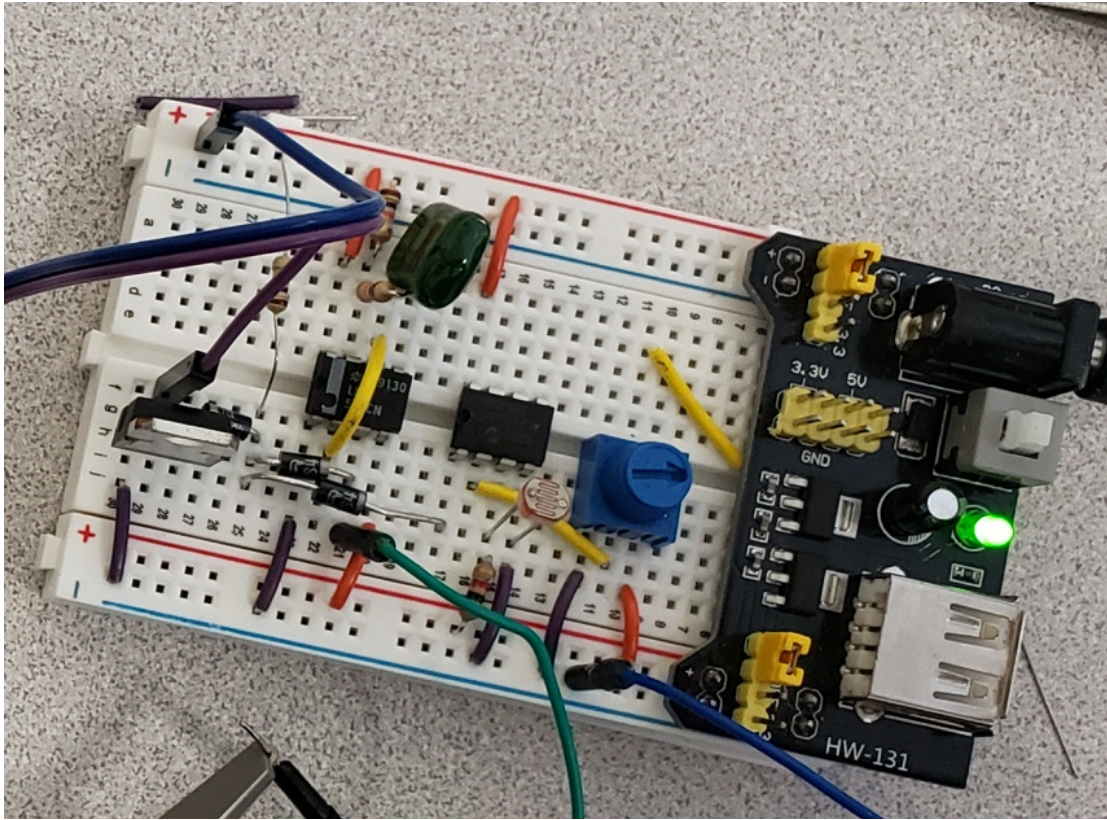
- $V_g = 2\text{V}$
- $V_g = 7\text{V}$.



Lab: DTL Temperature Alarm

- 11) Build the following the following circuit with your lab kit
 - Include a photo for full credit
- 12) Verify your design in hardware (build and test the circuit with your lab kit).
 - Alarm is off when it's hot ($R_4 = 100\ \Omega$)
 - Alarm is on when it's cold ($R_4 = 10\text{k}\ \Omega$)
 - You can also adjust V_m to turn on and off the alarm
- 13) Demonstrate your temperature alarm
 - Adjust V_m so that the on/off temperature is close to room temperature
 - The alarm should turn off when you blow hot air on the thermistor
 - The alarm should go back on when the thermistor cools off





Sample of what your breadboard circuit might look like

Notes:

- Use a powered breadboard
 - Red rail = +5V
 - Blue rail = 0V
- Color code your wires
 - Red = +5V
 - Black = ground
- Keep your circuit neat
 - Saves a lot of time debugging
- Include a photo of your circuit with your solutions