

# ECE 320 - Homework #8

Schmitt Triggers, Boolean Logic, DTL Logic. Due Monday, October 15th, 2018

## Comparitors and Schmitt Triggers

A temperature sensor has the following characteristics:

$$R = 1000 \cdot \exp\left(\frac{3905}{T} - \frac{3905}{298}\right) \Omega$$

where T is the temperture in degrees Kelvin.

1) Design a circuit which outputs

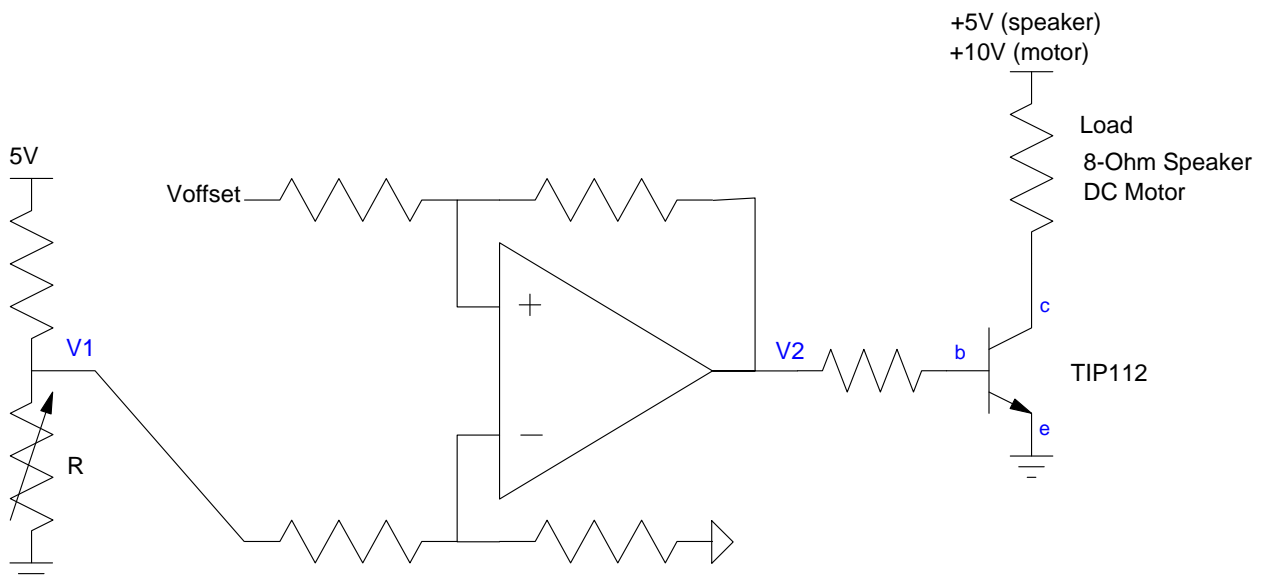
- $V_2 = 0V$  for  $T < 15C$
- $V_2 = 5V$  for  $T > 15C$

2) Design a circuit with hysteresis which outputs

- $V_2 = 0V$  for  $T < 15C$
- $V_2 = 5V$  for  $T > 20C$
- No change for  $15C < T < 20C$

3) Build these two circuits in lab connected to a TIP112 NPN transistor to turn on and off a DC motor or 8 Ohm speaker (your pick). Using a potentiometer instead of the thermistor, (easier to adjust), determine the following for the compaitor and Schmitt Trigger:

- What resistance (or voltage) does the output jump to +5V?
- What resistance (or voltage) does the output jump to -5V?



Problem 1-3: Turn on and off a speaker and/or DC motor using a comparator and Schmitt Trigger.

## Boolean Logic:

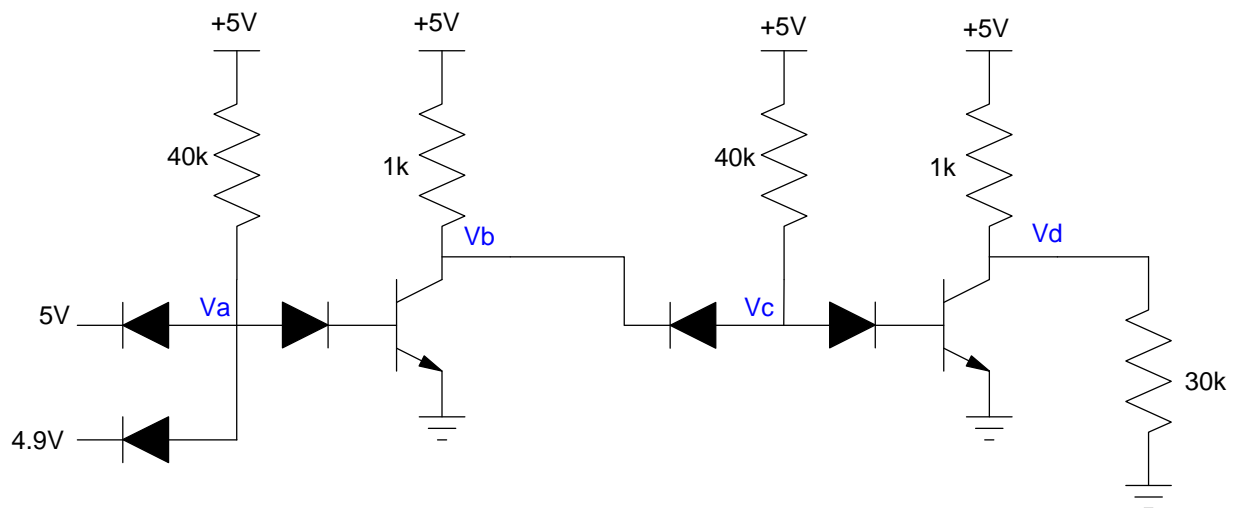
- 4) Determine a circuit using NAND gates to implement the following function (i.e. circle the ones)
- 5) Determine a circuit using NOR gates to implement the following function (i.e. circle the zeros)

$Y = f(A,B,C,D)$

		CD			
		00	01	11	10
AB	00	0	0	1	1
	01	1	1	0	1
	11	x	x	x	x
	10	1	1	x	x

## DTL Logic:

- 6) Determine the voltages and currents for the following DTL AND gate. Assume 3904 transistors
  - $\beta = 200$
  - $V_{ce(sat)} = 0.2V$
  - $V_{be} = 0.7V$
- 7) Determine the voltages and currents for the previous circuit when the input voltages (on the left) are 0.1V and 0.0V
- 8) Check your results for problem 6 and 7 using PartSim.



Problem 6-8: For problem #8, replace the 5V and 4.9V input voltages with 0.1V and 0.0V