Observation of the Behavior of a NAND Logic Gate

Jairo Portillo

PHY 338K Electronic Techniques
Department of Physics
The University of Texas at Austin
Austin, TX 78712, USA

April 21, 2016

Abstract

In this lab, we will explore the behavior of a Logic Gates. We will confirm the expected truth table of the NAND Logic Gate and determine the truth table for a three input NAND. We will also observe and confirm the behavior of a contact bounce eliminator NAND.

1 Preperation

In order to prepare for this lab, we must go over the Boolean functionality of the logic gates specifically a NAND gate. For logic gates, 1 is TRUE and 0 is FALSE. 1 indicates there is an input voltage and 0 indicates there is no voltage.

A	B	F
0	0	0
0	1	0
1	0	0
1	1	1

Table 1: AND Gate Behavior

An AND Gate follows the the A and B Boolean function. As seen in Table 1, TRUE and TRUE gives TRUE while TRUE and FALSE returns FALSE.

A	B	F
0	0	1
0	1	1
1	0	1
1	1	0

Table 2: NAND Gate Behavior

On the other hand a NAND Gate follows the Boolean function

Not(A and B)

As seen in Table 2, NOT(TRUE and TRUE) gives FALSE while NOT(TRUE and FALSE) returns TRUE.

1.1 Data Collection

2 Lab work

2.1 Apparatus

This lab will use a DC power supply, a two NAND logic gate chip, two low resistors of the same resistance in our case 2.2 kΩ, and led to confirm output.

2.2 Data Collection

For the first portion of the lab we simply confirmed the truth table of a singe NAND gate which we were able to.

A	B	F
0	0	1
0	1	1
1	0	1
1	1	0

Table 3: NAND Gate Results

For the second portion, we found the truth table of a three input nand gate. This can bee seen in Figure 1 below, the output of one NAND gate goes into one of the inputs of another NAND gate.

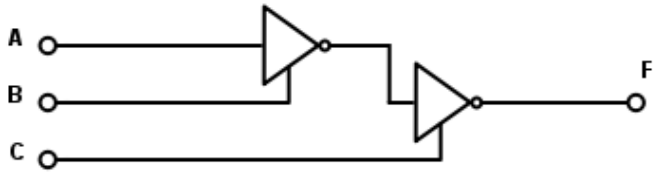

Figure 1: Our common emitter amplifier circuit. With node as the AC input and a DC voltage input

A three input NAND gate yields a Boolean function of

NOT(NOT(A and B) and C)

A	B	C	F
0	0	0	1
1	0	0	1
1	1	1	1
0	1	1	1
0	0	1	1
0	1	0	1
1	0	1	0

Table 4: Three input NAND Gate Results

Finally we tested the contact bounce eliminator switch and how the output will only change once when the switch is contacted multiple times.

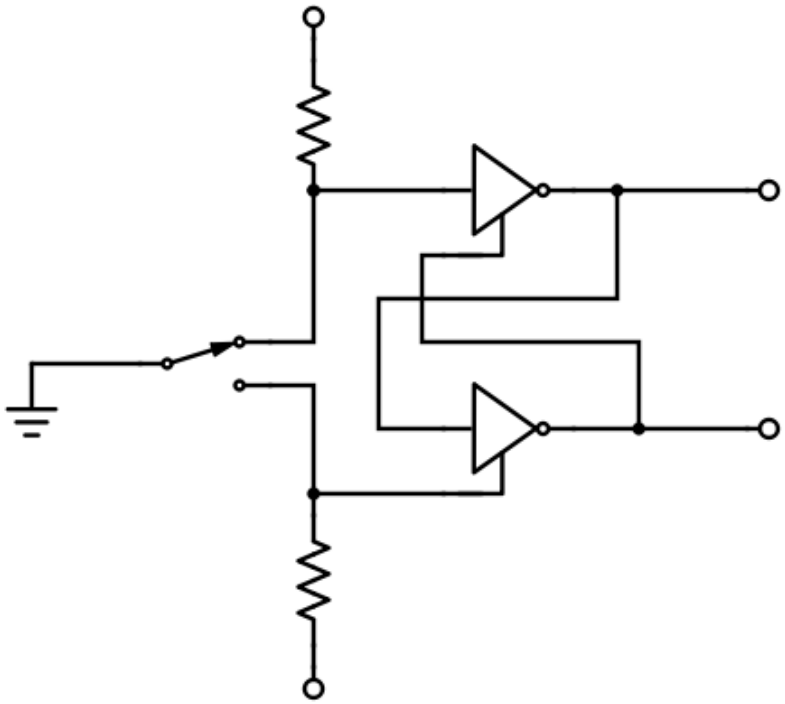

Figure 2: A Contact Bounce Eliminator NAND with 2.2 kΩ resistors.

For our actual circuit there was no switch but simply moving where the ground connected to in place of the switch. We were able to confirm that the output only changes once when the respective terminal is contacted with ground.

3 Summary and conclusions

In this lab we observed how NAND logic gate follows the behavior of the Boolean function

Not(A and B)

and the three input NAND follows the

NOT(NOT(A and B) and C)

Boolean function. We were able record these behavior and confirm the switch behavior of the contact bounce eliminator.