

EET-210L Lab #2 Introduction to Digital Logic Gates

Digital is a word that means discrete. In this course, digital signals will take on only two values. This binary nature allows logic to be performed electronically. In this lab we will be concerned with TTL (transistor-transistor logic) logic gates. In TTL implementation, a signal between 0 and 0.8 volts is termed 'false' and a signal between 2.4 and 5 volts is termed 'true'. This allows one to design circuitry to implement the desired logical function.

The following terms are used interchangeably when describing a digital signal.

True=One=High, For TTL > 2.4V

False=Zero=Low, For TTL < 0.8V

In this lab, you will experimentally verify the Truth Table for the AND gate, OR gate, NOT gate, NAND gate, NOR gate, XOR gate and find the Truth Table for the given combinations of logic gates. You should be able to show the logic representation, algebraic expression and truth table for each circuit constructed in this lab exercise. A sheet showing the pinouts for each chip is posted in the lab and is posted on the Forums with the pdf of this lab.

Wiring Guidelines:

- Connect a wire from the plus five volts to the bus with a red line and a wire from ground to the bus with a blue line. This will now allow you to have a more organized proto board.
- When placing your chips have them lay over the large gap in the middle of the proto board.
- Make sure to connect the Vcc pin to +5 volts and the ground pin to ground for every chip!
- Color code your wiring as much of your circuit as possible this will help in debugging the circuit.

As you work through these various exercises you will be asked to construct some basic logic circuits using 7400 series (TTL) logic chips. For each circuit that you construct, you should include a schematic diagram showing all pin numbers and a completed truth table. It's common practice to suppress the power connections on logic schematic diagrams as it is assumed that all chips will be connected to a proper power and ground supply.

When you are done, make sure you put all of your equipment and parts away. Components must be placed back in the proper drawers. Remove all components from the PAD234 Analog/Digital Trainer and put them away. **DO NOT PUT THE TRAINERS AWAY WITH ANY COMPONENTS MOUNTED ON THEM. DO NOT PUT SPARE WIRES IN THE TRAINERS.** Make sure your work area is cleaner than when you arrived.

When you have completed all parts of this experiment, have your instructor initial this sheet and post your progress on the cset.stcc.edu/forums Forums under EET-210 Lab Week #3.

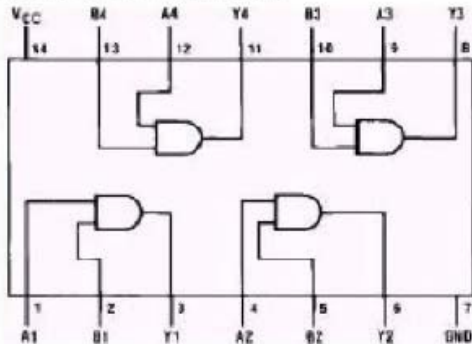
Instructor initial: _____

Date: _____

Part I

The connection diagram (with logic representation shown), the algebraic expression and the Truth Table for the 7408 AND gate are given next.

Connection Diagram



Function Table

$Y = AB$

Inputs		Output
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

H = HIGH Logic Level
L = LOW Logic Level

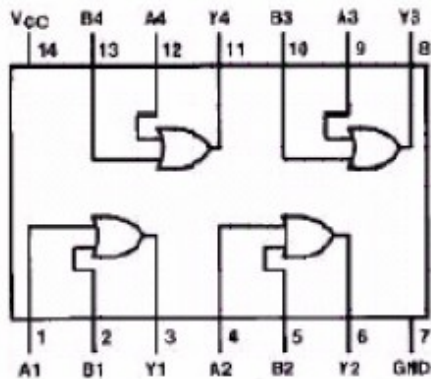
Experiment 1: Verify that each AND Gate (all four) is working properly by determining its truth table by connecting the inputs to two switches and the output to an LED. Do this for each of the 4 AND gates on the 7408 chip.

Experiment 2: Connect the output from the first AND gate into the input of a second AND gate and connect the other input of this gate to a third switch. Draw the schematic diagram for this circuit showing all pin numbers. (The output of this second gate should be the ANDing of the three switches. That is, you just made a 3 input AND gate.) Construct and complete the Truth Table and the logic expression for this circuit. Demonstrate this to your instructor. Describe and explain what you have built in this experiment.

Part II

The connection diagram (with logic representation shown), the algebraic expression and the Truth Table for the 7432 OR gate are given next.

Connection Diagram



Function Table

$$Y = A + B$$

Inputs		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	H

H = HIGH Logic Level
L = LOW Logic Level

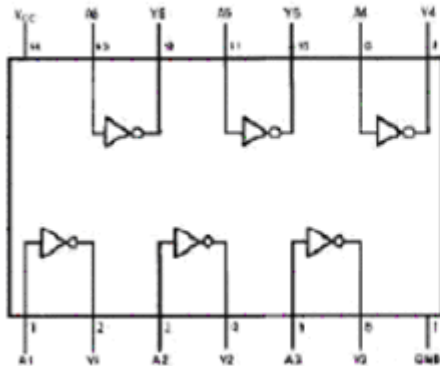
Experiment 1: Verify that each OR gate (all four) is working properly by determining its truth table by connecting the inputs to two switches and the output to a LED.

Experiment 2: Connect the output from the first OR gate into the input of a second OR gate and connect the other input of this second gate to a third switch. Draw the schematic diagram for this circuit showing all pin numbers. Construct and complete the Truth Table and the logic expression for each circuit. Demonstrate this to your instructor. Describe and explain what you have built in this experiment.

Part III

The connection diagram (with logic representation shown), the algebraic expression and the Truth Table for the 7404 NOT gate are given next.

Connection Diagram



Function Table

$$Y = \overline{A}$$

Input	Output
A	Y
L	H
H	L

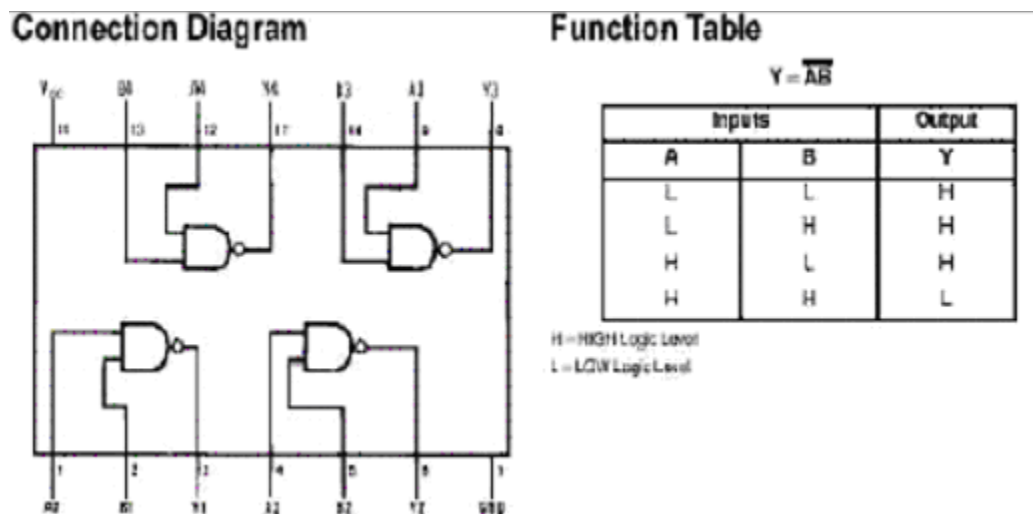
H = HIGH Logic Level
L = LOW Logic Level

Experiment 1: Verify that each NOT gate (all six) is working properly by determining its truth table by connecting a switch to the input and the output to a LED.

Experiment 2: Connect the output from the first NOT gate into the input of a second NOT gate. Draw the schematic diagram for this circuit showing all pin numbers. Construct and complete the Truth Table and the logic expression for each circuit. Demonstrate this to your instructor. Describe and explain what you have built in this experiment.

Part IV

The connection diagram (with logic representation shown), the algebraic expression and the Truth Table for the 7400 NAND gate are given next.



Experiment 1: Verify that each NAND gate (all four) is working properly by determining its truth table by connecting the inputs to two switches and the output to a LED.

Experiment 2: Connect both the inputs of the NAND gate together and apply one signal to them. Draw the schematic diagram for this circuit showing all pin numbers. Construct and complete the Truth Table and the logic expression for each circuit. Demonstrate this to your instructor.

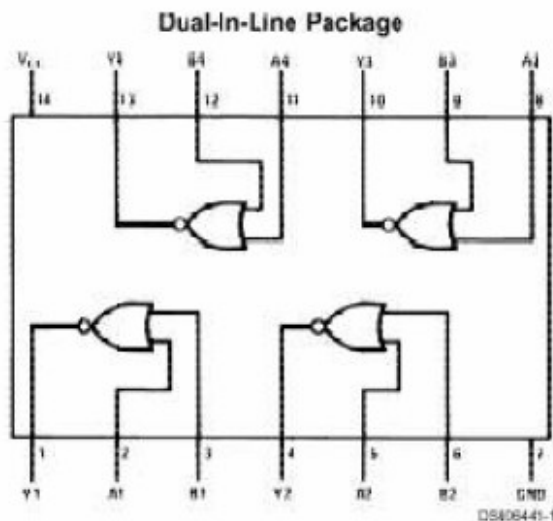
Experiment 3: Construct an AND gate using only NAND gates. Draw the schematic diagram for this circuit showing all pin numbers. Construct and complete the Truth Table and the logic expression for each circuit. Demonstrate this to your instructor.

Describe and explain what you have built in this experiment.

Part V

The connection diagram (with logic representation shown), the algebraic expression and the Truth Table for the 7402 NOR gate are given next.

Connection Diagram



Function Table

$$Y = \overline{A + B}$$

Inputs		Output
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L

H = High Logic Level
L = Low Logic Level

Experiment 1: Verify that each NOR gate (all four) is working properly by determining its truth table by connecting the inputs to two switches and the output to a LED.

Experiment 2: Connect both the inputs of the NOR gate together and apply one signal to them. Draw the schematic diagram for this circuit showing all pin numbers. Construct and complete the Truth Table and the logic expression for each circuit. Demonstrate this to your instructor.

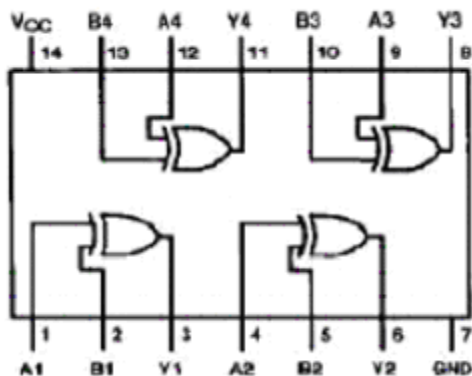
Experiment 3: Construct an OR gate using only NOR gates. Draw the schematic diagram for this circuit showing all pin numbers. Construct and complete the Truth Table and the logic expression for each circuit. Demonstrate this to your instructor.

Describe and explain what you have built in this experiment.

Part VI

The connection diagram (with logic representation shown), the algebraic expression and the Truth Table for the 7486 XOR gate are given next.

Connection Diagram



Function Table

$Y = A \oplus B$

Inputs		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

H = HIGH Logic Level
L = LOW Logic Level

Experiment 1: Verify that each XOR gate (all four) is working properly by determining its truth table by connecting the inputs to two switches and the output to a LED.

Experiment 2: Connect the output from the first XOR gate into the input of a second XOR gate and connect the other input of this second gate to a third switch. Draw the schematic diagram for this circuit showing all pin numbers. Construct and complete the Truth Table and the logic expression for each circuit. Demonstrate this to your instructor.

Describe and explain what you have built in this experiment.