University of Engineering and Technology Peshawar

Digital Logic Design (DLD)

LAB # 01

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Submitted by: **FAWAD ALI**

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Class Section: **C**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: ______________

Submitted to:

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DEPARTMENT OF COMPUTER SYSTEMS ENGINEERING

Digital Logic Gates

Objectives:

- To know about the logic gates.
- To know about the logical operation, logical symbol of the gates.
- Verify the truth table of logic gates when they use power supply.
- Haw to use the ics of the logic gates.

Equipment:

Dc power supply

Digital Multimter

Components:

Ics of the all gates

Breadboard

Wires

Theory:

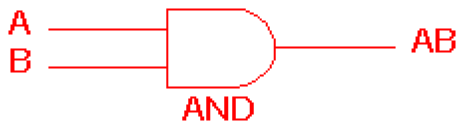
Introduction:

Digital circuits makeup the cornerstone of modern computational hardware. By representing binary digits (i.e. {0,1}) with voltage levels, digital circuits are able to process binary numbers electronically. Logic gates are the fundamental components within digital circuits so understanding their behavior is important. Therefore, the purpose of this experiment is to introduce you to gate behavior and logic interpretation as well as the basics of circuit wiring and troubleshooting. To do so, we will explore the function of several of the basic logic gates discussed.

Logic Gates:

Logic gates are the basic building blocks of any digital system. It is an electronic circuit having one or more than one input and only one output. The relationship between the input and the output is based on a certain logic. Based on this, logic gates are named as AND gate, OR gate, NOT gate etc.

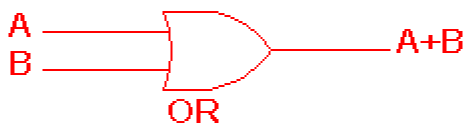
AND gate:



2 Input AND gate		
A	B	A.B
0	0	0
0	1	0
1	0	0
1	1	1

The AND gate is an electronic circuit that gives a high output (1) only if all its inputs are high. A dot (.) is used to show the AND operation i.e. A.B. Bear in mind that this dot is sometimes omitted i.e. AB

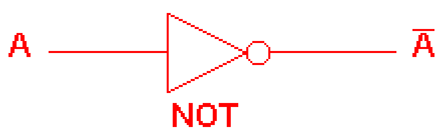
OR gate:



2 Input OR gate		
A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

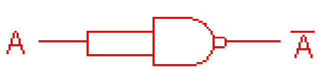
The OR gate is an electronic circuit that gives a high output (1) if one or more of its inputs are high. A plus (+) is used to show the OR operation.

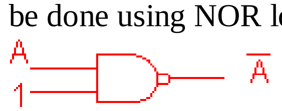
NOT gate:



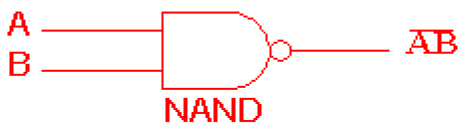
NOT gate	
A	$\overline{A}$
0	1
1	0

The NOT gate is an electronic circuit that produces an inverted version of the input at its output. It is also known as an inverter. If the input variable is A, the inverted output is known as NOT A. This is also shown as A', or A with a bar over the top, as shown at the outputs. The diagrams below show two ways that the NAND logic gate can be configured to produce a NOT gate. It can also be done using NOR logic gates in the same way.





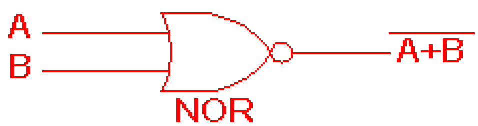
NAND gate:



2 Input NAND gate		
A	B	$\overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

This is a NOT-AND gate which is equal to an AND gate followed by a NOT gate. The outputs of all NAND gates are high if any of the inputs are low. The symbol is an AND gate with a small circle on the output. The small circle represents inversion.

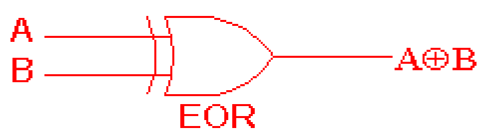
NOR gate



2 Input NOR gate		
A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

This is a NOT-OR gate which is equal to an OR gate followed by a NOT gate. The outputs of all NOR gates are low if any of the inputs are high. The symbol is an OR gate with a small circle on the output. The small circle represents inversion.

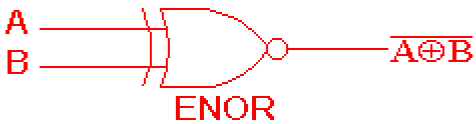
XOR gate:



2 Input EXOR gate		
A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

The 'Exclusive-OR' gate is a circuit which will give a high output if either, but not both, of its two inputs are high. An encircled plus sign ($\oplus$) is used to show the EOR operation.

XNOR gate:



2 Input EXNOR gate		
A	B	$\overline{A\oplus B}$
0	0	1
0	1	0
1	0	0
1	1	1

The 'Exclusive-NOR' gate circuit does the opposite to the EOR gate. It will give a low output if either, but not both, of its two inputs are high. The symbol is an EXOR gate with a small circle on the output. The small circle represents inversion.

Ics 7400 series of logic Gates:

Logic gates are constructed from transistors, which are analog switches. These transistors can be forced to operate in two modes, namely ”ON” or ”OFF.” In doing so, we can abstractly think of electronic signals within a digital circuit as being either HIGH or LOW (i.e. ’1’ or ’0’). A digital gate takes as input one or more digital signals and outputs a digital signal as a result of a boolean operation. Figure 1 depicts the standard logic gate symbols and their associated boolean operation.

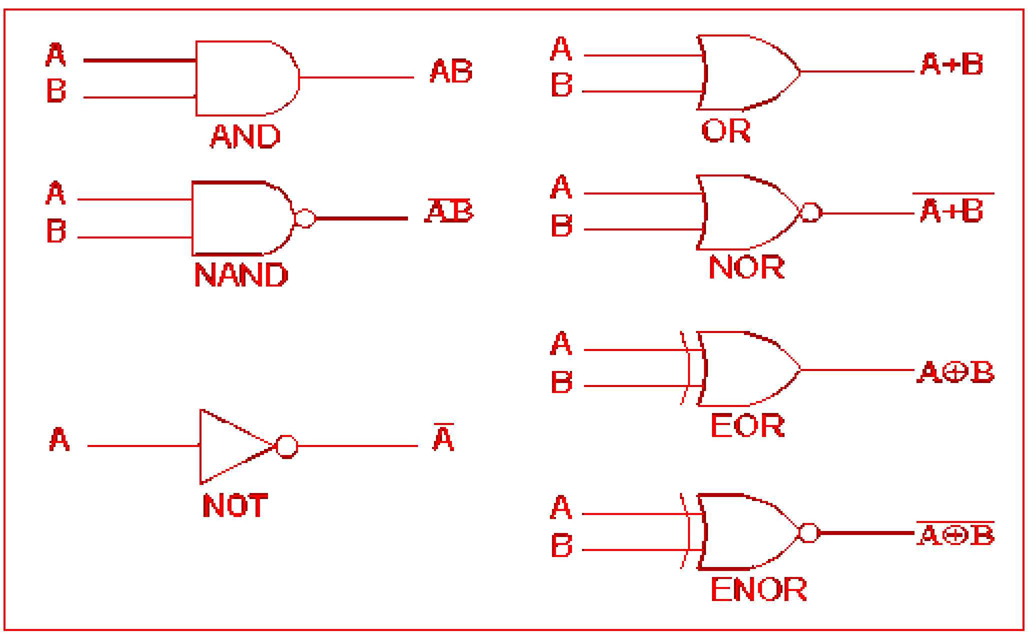


Figure 1: Logic Gates

The basic gates you will study in lecture are available in a series of Integrated Circuits (ICs) commonly referred to as the “7400” series. Within this series, there are various IC package types available; however, for bread-boarding digital circuits in the laboratory, we will use the Dual-Inline Package (DIP) type as shown

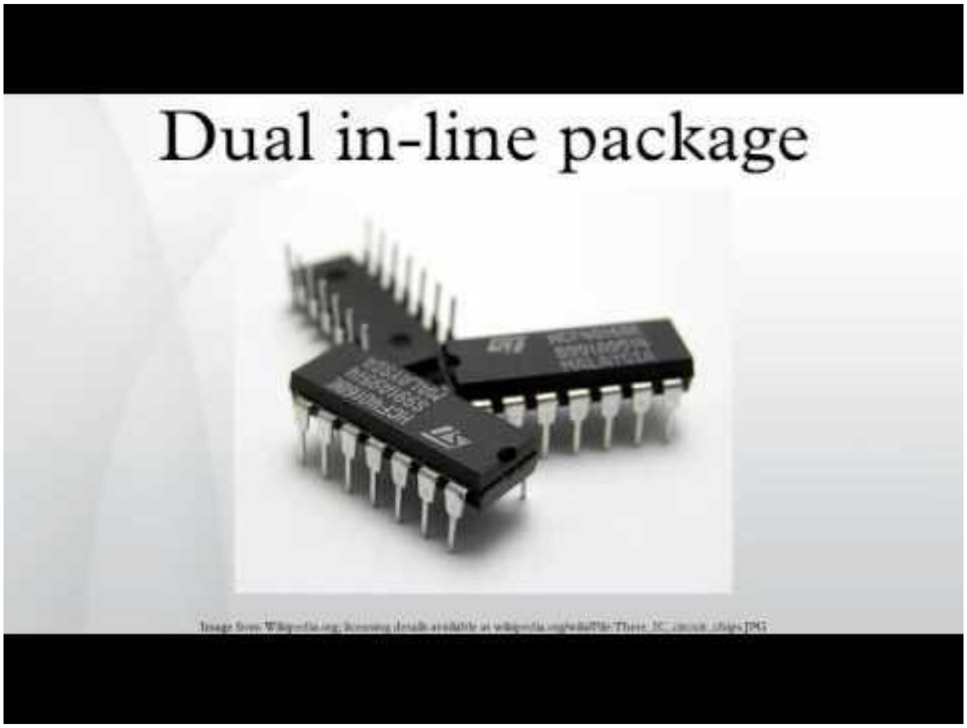


Figure 2: Dual-Inline Package

in Figure 2. As shown, the DIP features a black plastic package with pins on both sides, slightly resembling a flat caterpillar. Figure 3 shows the DIP pinout diagrams for the all gates.

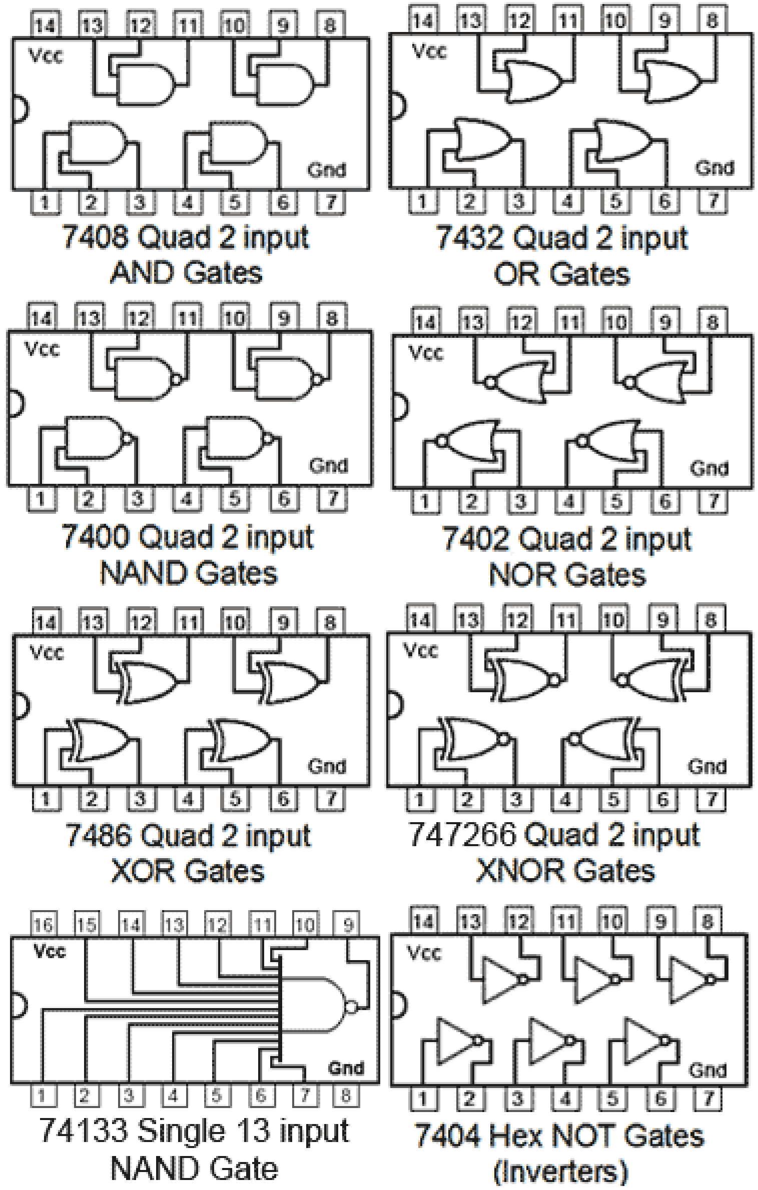


Figure 3: All gates Pinout Diagrams

Procedure:

We will start by setting up the DC power supply and multi-meter for our use. Be sure both are turned off. Then check to see that the multi-meter is set to measure DC, and be sure the red lead is connected to the red multi-meter input that is marked for voltage. Finally, set the scale to the range you need to measure (usually between 0V to 5V for digital circuits). Now, set the DC power supply voltage output to zero (turn the 9 coarse adjustment counterclockwise until it stops). Connect the red lead of the power supply to the red lead of the multi-meter. Likewise, connect the black lead of the power supply to the black lead of the multi-meter.

Note: Do not connect Power (RED) and Ground (Black) together. This will cause a short.

1. We set the power supply and the digital multimeter.
2. Put the ics in breadboard which we know that the ics have 14 pins the 7th pin is connect to the ground or 0v and the 14th pins is Vcc connect to the 5v.
3. We show the figure 3 the input in output of the all ics pinout diagram.
4. We can verify the above truth table so 0 is low voltage apply 0v in the 1 is high voltage apply 5 volt.
5. Check the output which high or low in the multimeter.
6. These procedure follow the every logic gates ics in verify the truth table.

Note: First fill in the second column of the table using the readings from the multimeter. Then determine the answers to the last column based upon these readings. If the output is high (H), the multimeter will read approximately 3.9V - 4.2V; when it is low (L), the multimeter will read about 91.9 mV.

Observation and Calculation:

We can put the L=low and the H=high the low voltage is zero in the high voltage is 5.21.

Table 1: Truth Table for AND Gate (7408)

Input		Output value	Output
x	y	z=x.y	z=x.y
L	L	0.02	L
L	H	0.02	L
H	L	0.02	L
H	H	4.43	H

Table 2: Truth Table for OR Gate (7432)

Input		Output value	Output
x	y	z=x+y	z=x+y
L	L	0.00	L
L	H	5.21	H
H	L	5.21	H
H	H	5.21	H

Table 3: Truth Table for XOR Gate (7486)

Input		Output value	Output
x	y	z= x $\oplus$ y	z= x $\oplus$ y
L	L	0.00	L
L	H	5.21	H
H	L	5.21	H
H	H	0.00	L

Table 4: Truth Table for NAND Gate (7400)

Input		Output value	Output
x	y	z	z
L	L	5.21	H
L	H	5.21	H
H	L	5.21	H
H	H	0.00	L

Table 5: Truth Table for NOR Gate (7402)

Input		Output value	Output
x	y	z	z
L	L	5.10	H
L	H	0.01	L
H	L	0.01	L
H	H	0.01	L

Table 6: Truth Table for XNOR (747266)

Input		Output value	Output
x	y	z	z
L	L	5.21	H
L	H	0.01	L
H	L	0.01	L
H	H	5.21	H

Table 7: Truth Table for NOT Gate (7404)

Input	Output value	Output
x	y	y
L	5.21	H
H	0.00	L