

Basic Logic Gates

Logic gates are an important concept if you are studying electronics. These are important digital devices that are mainly based on the Boolean function. Logic gates are used to carry out logical operations on single or multiple binary inputs and give one binary output. In simple terms, logic gates are the electronic circuits in a digital system.

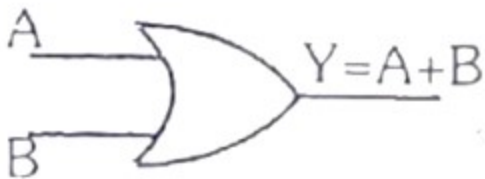
Types of Basic Logic Gates

There are several basic logic gates used in performing operations in digital systems. The common ones are;

- OR Gate
- AND Gate
- NOT Gate
- XOR Gate
- NOR Gate
- XNOR Gate
- NAND Gate

OR Gate

In OR gate the output of an OR gate attains the state 1 if one or more inputs attain the state 1.



The Boolean expression of OR gate is $Y = A + B$, read as Y equals A 'OR' B.

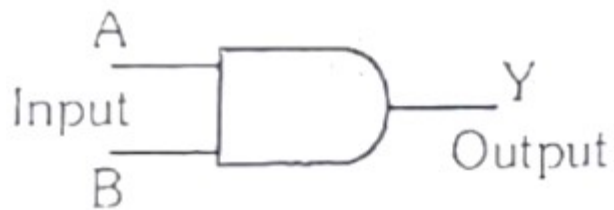
The truth table of a two-input OR basic gate is given as;

A	B	Y
0	0	0
0	1	1
1	0	1

1	1	1
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AND Gate

In AND gate the output of an AND gate attains the state 1 if and only if all the inputs are in state 1.



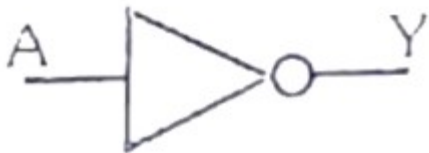
The Boolean expression of AND gate is $Y = A.B$

The truth table of a two-input AND basic gate is given as;

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

NOT Gate

In NOT gate the output of a NOT gate attains the state 1 if and only if the input does not attain the state 1.



The Boolean expression is $Y = \bar{A}$, read as Y equals NOT A.

The truth table of NOT gate is as follows;

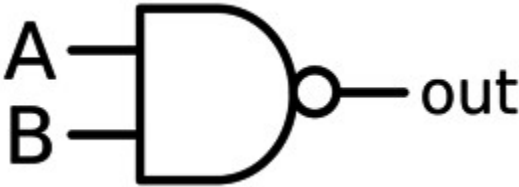
A	Y
0	1

1	0
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The three gates (OR, AND and NOT), when connected in various combinations, give us basic logic gates such as NAND, NOR gates, which are the universal building blocks of digital circuits.

NAND Gate

This basic logic gate is the combination of AND and NOT gate.



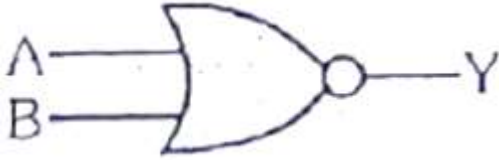
The Boolean expression of NAND gate is $Y = \bar{A.B}$

The truth table of a NAND gate is given as;

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

NOR Gate

This gate is the combination of OR and NOT gate.



The Boolean expression of NOR gate is $Y = \bar{A+B}$

The truth table of a NOR gate is as follows;

A	B	Y

0	0	1
0	1	0
1	0	0
1	1	0

Exclusive-OR gate (XOR Gate)

In XOR gate the output of a two-input XOR gate attains the state 1 if one and only one input attains the state 1.



The Boolean expression of the XOR gate is $\bar{A}B + A\bar{B}$, or, $Y = A \oplus B$ or $Y = A \oplus B$

The truth table of an XOR gate is;

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Exclusive-NOR Gate (XNOR Gate)

In XNOR gate the output is in state 1 when its both inputs are the same that is, both 0 or both 1.



The Boolean expression of XNOR gate $Y = A.B + \bar{A}\bar{B} + \bar{A}B + A\bar{B}$, or, $Y = A \oplus B$
 $Y = A.B + AB + \bar{A}\bar{B} + \bar{A}B$ or $Y = A \oplus B$

The truth table of an XNOR gate is given below;

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1