

Simple Digital Electronics

Integrated Circuits (I.C.'s)

Integrated circuits or micro chips, like the transistor and the diode, are semi conductors. They are a method of mass producing complicated electronic circuits containing thousands of transistors, diodes, resistors, capacitors and interconnecting wires in a very tiny form.

Logic Gates

AND Gate - Integrated circuits contain 'logic gates' which allow digital circuits to make decisions.

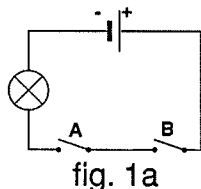


fig. 1a

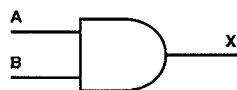


fig. 1b

A	B	X
1	0	0
0	1	0
1	1	1
0	0	0

fig. 1c

Fig. 1a shows a simple electronic circuit. If both switch A AND switch B are operated then the lamp will light. This is how the 'AND' logic gate works and the symbol for a two input AND gate is shown in fig. 1b. The number of inputs can vary from two upwards. Digital circuits normally use power supplies of 5 Volts. If 5V is connected to inputs A and B, then 5V would be present at output X. Fig. 1c is a truth table showing the output at X for each possible input at A and B. 5V is represented by a 1, and 0V by a 0.

OR Gate - In fig. 2a the lamp will light when switch A OR B is operated. Similarly, in Fig. 2b, if inputs A or B are 5V then the output X is 5V.

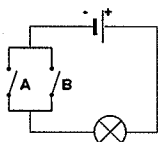


fig. 2a

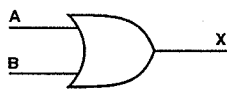


fig. 2b

A	B	X
1	0	1
0	1	1
1	1	1
0	0	0

fig. 2c

NAND & NOR Gate - Fig. 3 shows the circuit symbol for an inverter or 'NOT' gate. If we connect this onto an AND gate as in fig. 4a then any output at x will be Inverted. i.e. if a and b are 5V, x would be 5V but the output at y would be 0V. This is a NOT AND or NAND gate and the symbol for this is shown in fig. 4b. Fig. 4c shows the truth table as in previous examples.

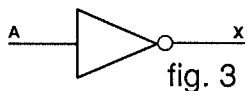


fig. 3

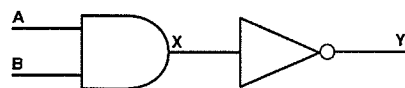


fig. 4a

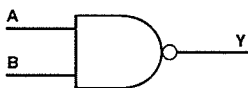


fig. 4b

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

fig. 4c

Fig. 5a shows the NOT Gate performing the same operation with an OR Gate, which results in the NOT OR or NOR Gate (Fig. 5b). Fig. 5c is the truth table for the NOR Gate.

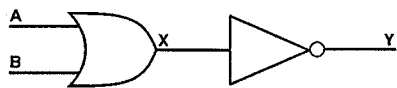


fig. 5a

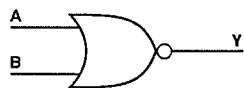


fig. 5b

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

fig. 5c

EXCLUSIVE OR GATE - Finally, let us consider Fig. 6a. Here, four contacts are used, two on switch A and two on switch B. If A is operated, the lamp lights via A1 and B2. If B is operated, the lamp lights via B1 and A2. If both A and B are operated, then nothing happens, as both circuits are disconnected. This represents an EXCLUSIVE OR GATE.

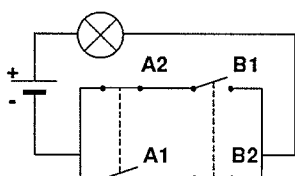


fig. 6a



fig. 6b

A	B	X
1	0	1
0	1	1
1	1	0
0	0	0

fig. 6c