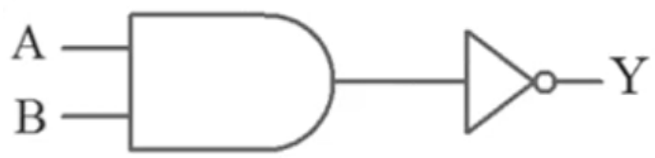
دانشگاه آزاد اسلامی واحد تهران جنوب

آزمایشگاه مدار های منطقی ومعماری کامپیوتر

مدرس: اسماعیل صادقی

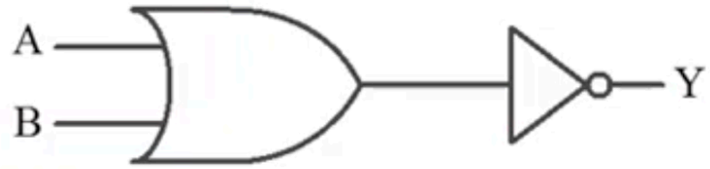
Integrated circuit (Hhybrid)

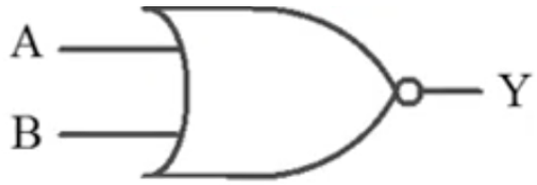
NAND



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

NOR

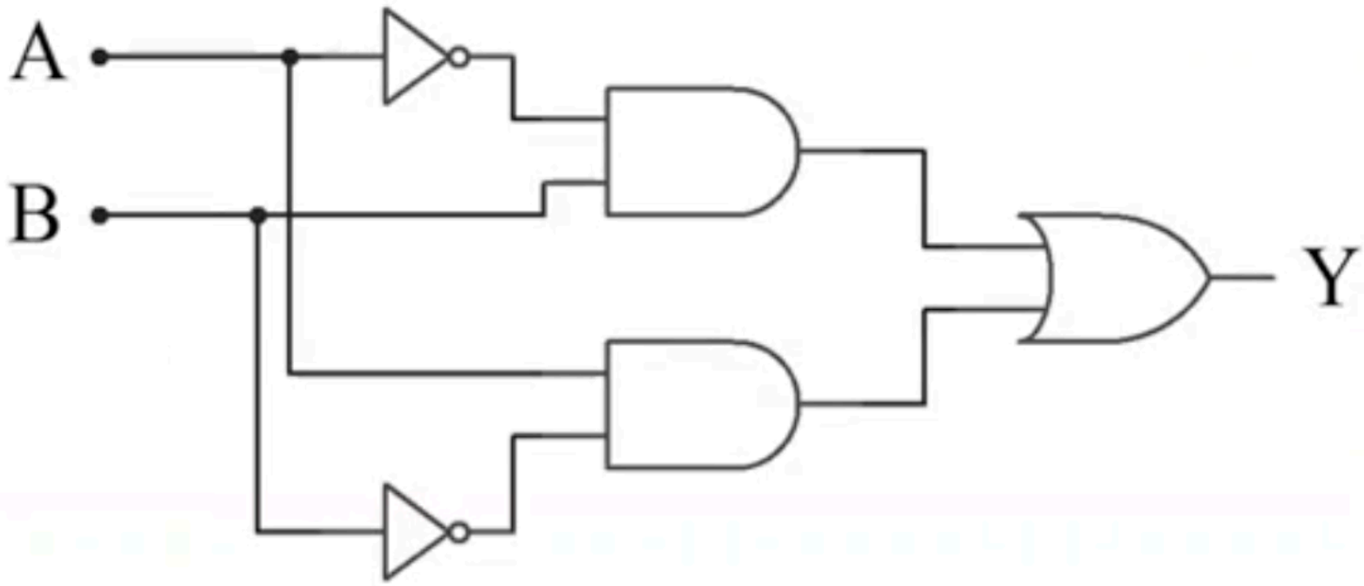


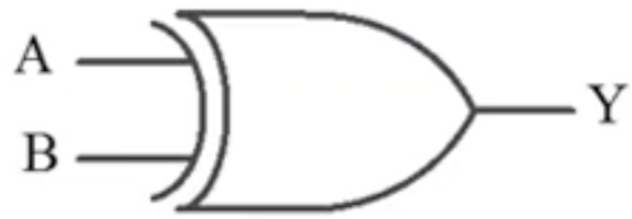


A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Integrated circuit (Hhybrid)

XOR

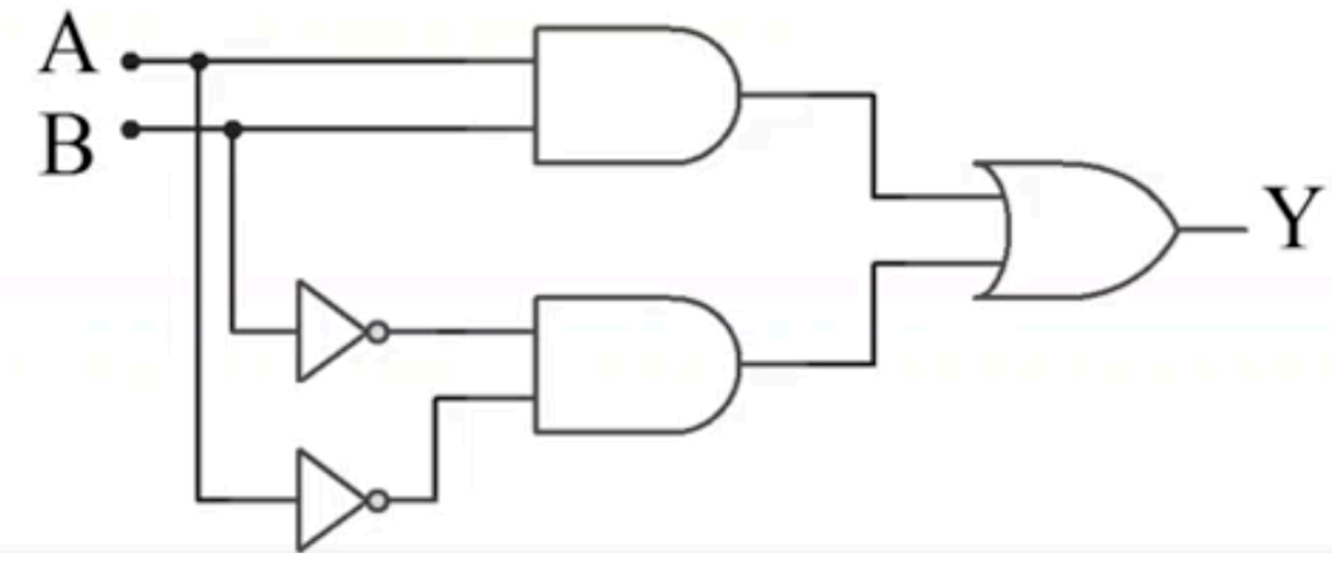




A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Integrated circuit (Hhybrid)

XNOR

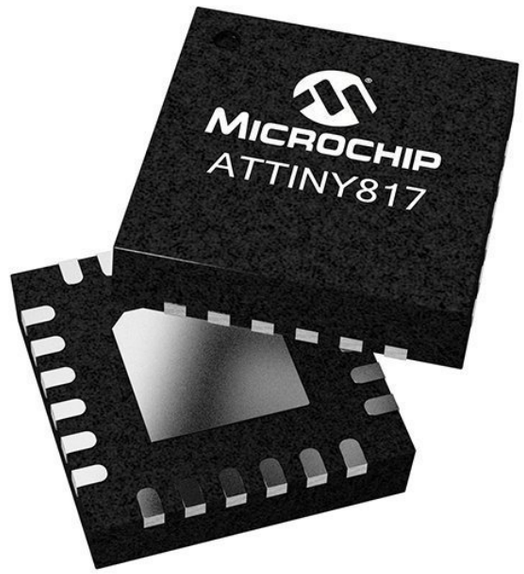


A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1

integrated circuit (IC)

What are integrated circuits?

An integrated circuit (IC), sometimes called a chip, microchip or microelectronic circuit, is a semiconductor
wafer on which thousands or millions of tiny resistors, capacitors, diodes and transistors are fabricated. An IC can function as an amplifier, oscillator, timer, counter, logic gate, computer memory, microcontroller or microprocessor.



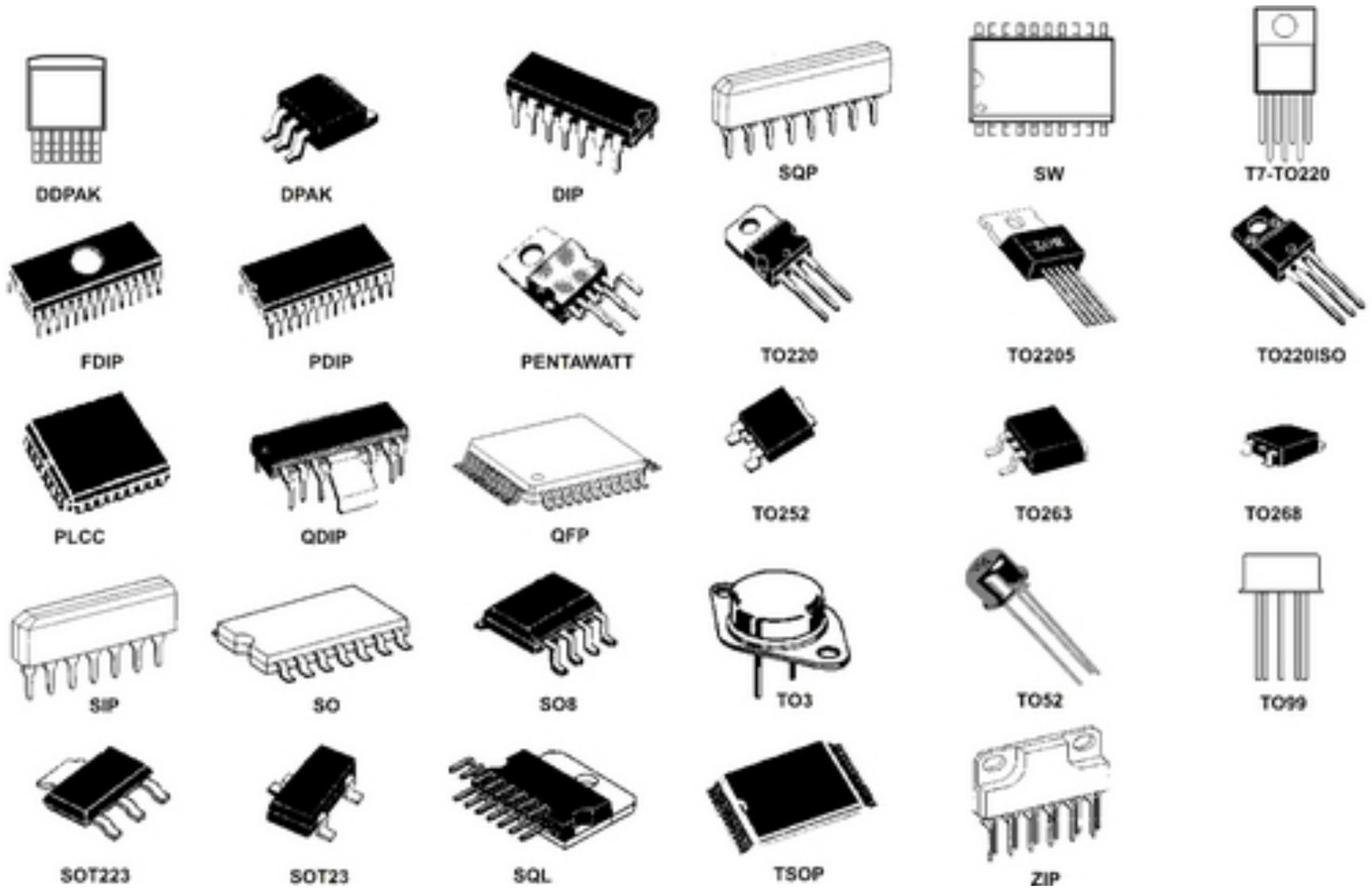
integrated circuit logic gates

Types of logic family:

* Saturated Bipolar Logic Families are:

1. **Diode logic (DL)**
2. **Resistor Transistor Logic (RTL)**
3. **Diode Transistor Logic (DTL)**
4. **Integrated Injection Logic (IIL or I2L)**
5. **Transistor Transistor Logic (TTL)**

IC package

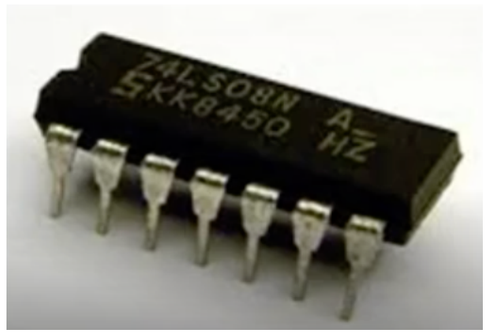

DDPAK
DPAK
DIP
SQP
SW
T7-TO220
FDIP
PDIP
PENTAWATT
TO220
TO220S
TO220ISO
PLCC
QDIP
QFP
TO252
TO263
TO268
SIP
SO
SO8
TO3
TO52
TO99
SOT223
SOT23
SQL
TSOP
ZIP

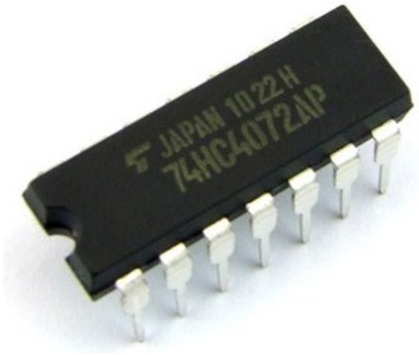
integrated circuit logic gates

Types of logic family:

* Non-saturated Bipolar Logic Families are:

1. **TTL (Transistor–transistor logic)**
2. **CMOS (Complementary metal–oxide–semiconductor)**





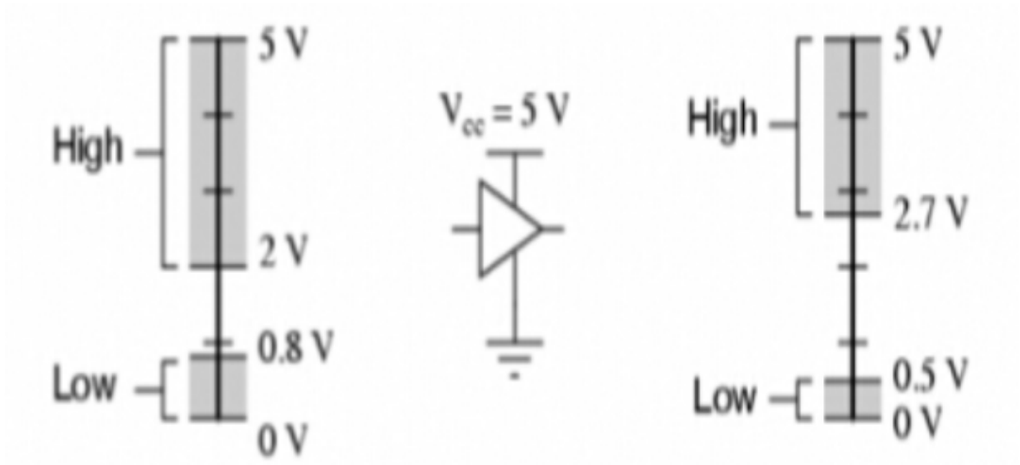
CMOS

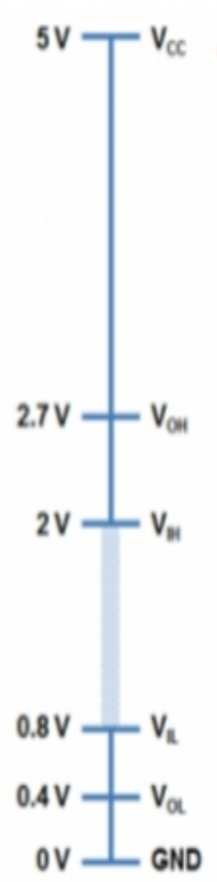
Unipolar logic family:

* Unipolar logic family consists of **Metal Oxide Semiconductor (MOS) logic families**. They are

1. **P-type MOS (PMOS) Logic**
2. **N-type MOS (NMOS) logic**
3. **Complementary MOS (CMOS) logic**
4. **Bipolar MOS (BiMOS) logic**
5. **Bipolar CMOS (BiCMOS) logic**
6. **CMOS (Complementary metal–oxide–semiconductor)**

TTL


5 V
High
2 V
0.8 V
Low
0 V
$V_{cc} = 5$ V
5 V
High
2.7 V
0.5 V
Low
0 V


5 V
V_{CC}
2.7 V
V_{OH}
2 V
V_{IH}
0.8 V
V_{IL}
0.4 V
V_{OL}
0 V
GND

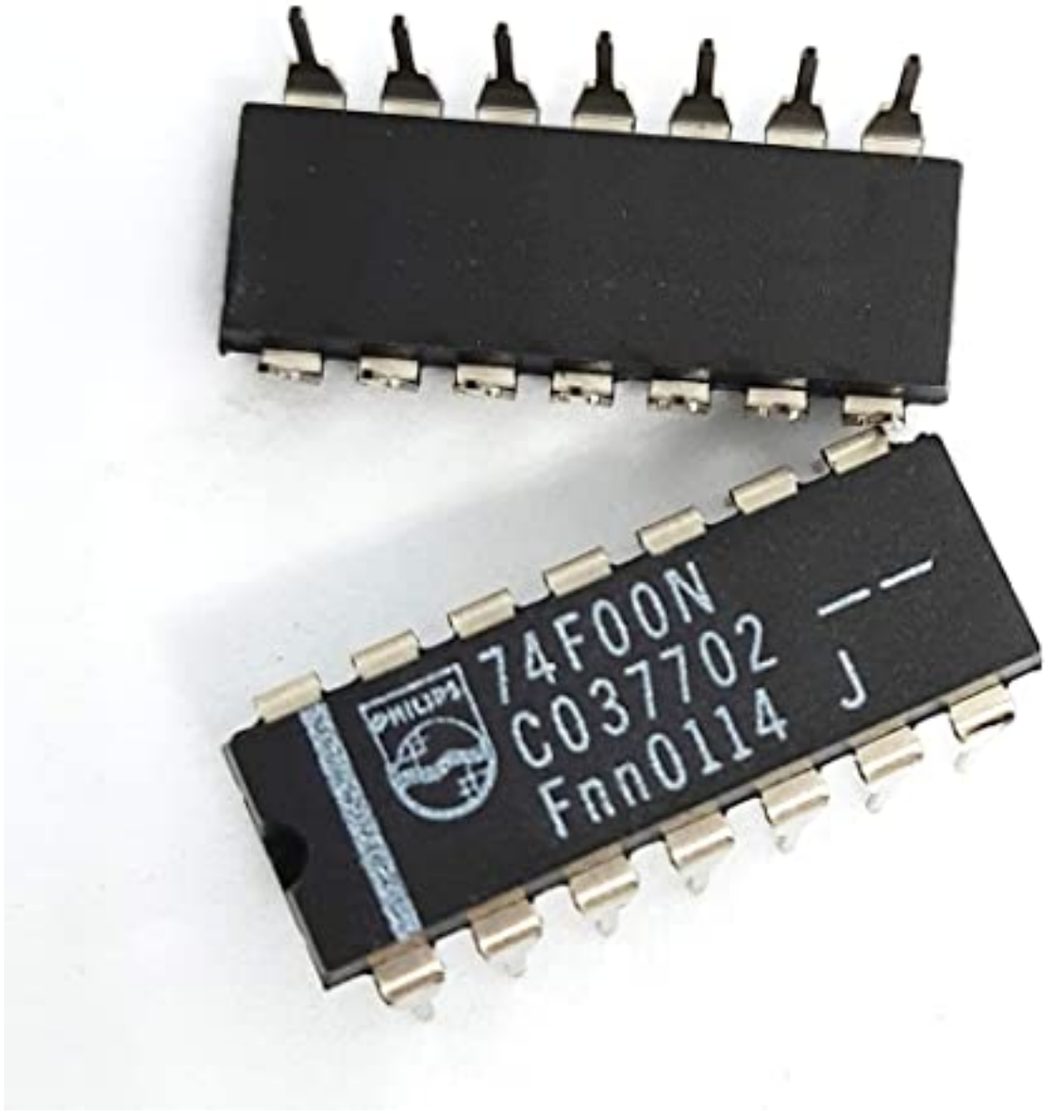
Comparison between TTL and CMOS technology

TTL	CMOS
TTL stands for Transistor-Transistor Logic. The name is derived from the use of two Bipolar Junction Transistors or BJTs in the design of each logic gate.	CMOS stands for Complementary Metal Oxide Semiconductor.
TTL is a classification of integrated circuits.	CMOS is another classification of ICs that uses field effect transistors in the design.
The density of logic gates is less in TTL as compared to CMOS.	The primary advantage of CMOS chips to TTL chips is in the greater density of logic gates within the same material.
A single gate on a TTL chip can consume around 10mW of power.	An equivalent single gate in a CMOS chip can consume around 10nW.
TTL chips are lesser delicate and is not very suseptible to electrostatic discharge.	CMOS chips are a bit more delicate compared to TTL chips when it comes to handling as it is quite susceptible to electrostatic discharge.
TTL chips do not have CMOS logic.	There are CMOS chips that have TTL logic and are meant as replacements for TTL chips.
A logic gate in a TTL chip can consist of a substantial number of parts as extra components like resistors are needed.	A single logic gate in a CMOS chip can consist of as little as two Field Effect Transistors.
TTL circuits consumes more power compared to CMOS circuits at rest.	CMOS circuits comsumes less power at rest.

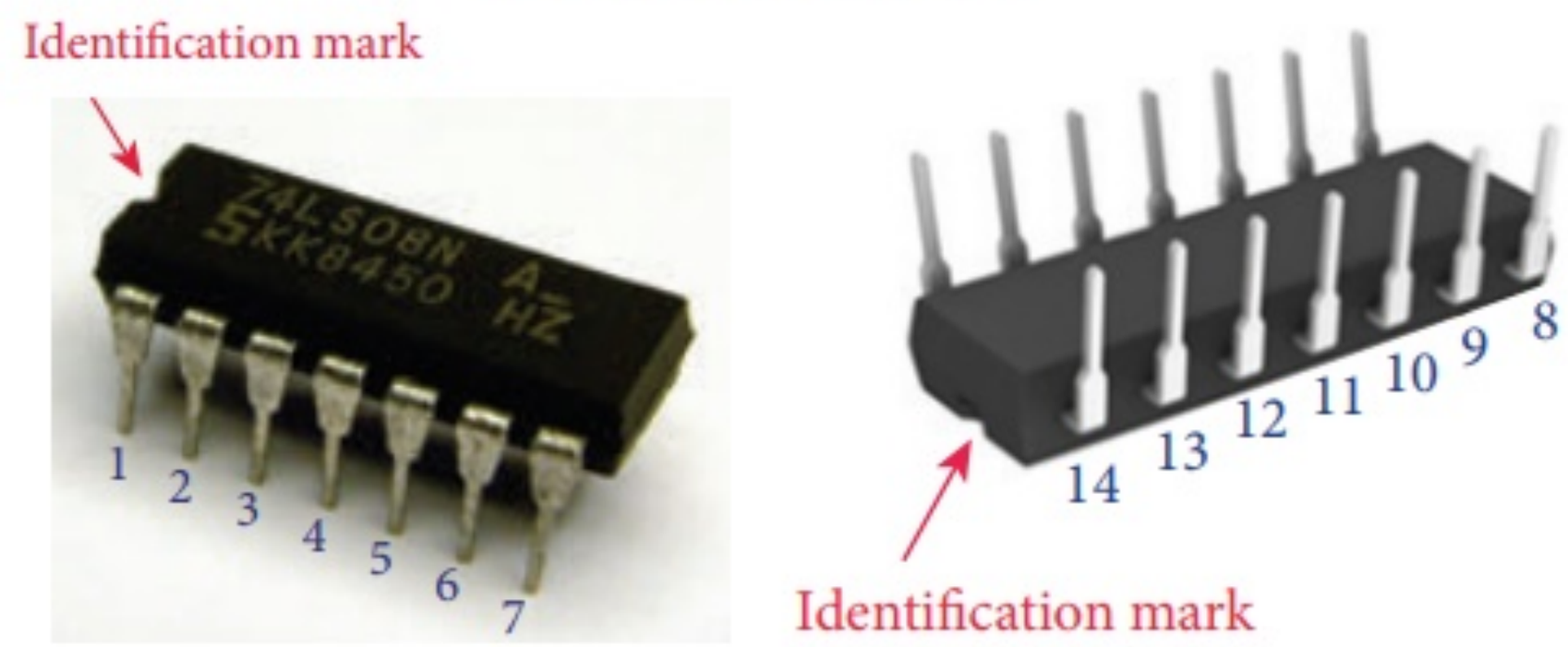
IC

SN 74 ××× +++ *

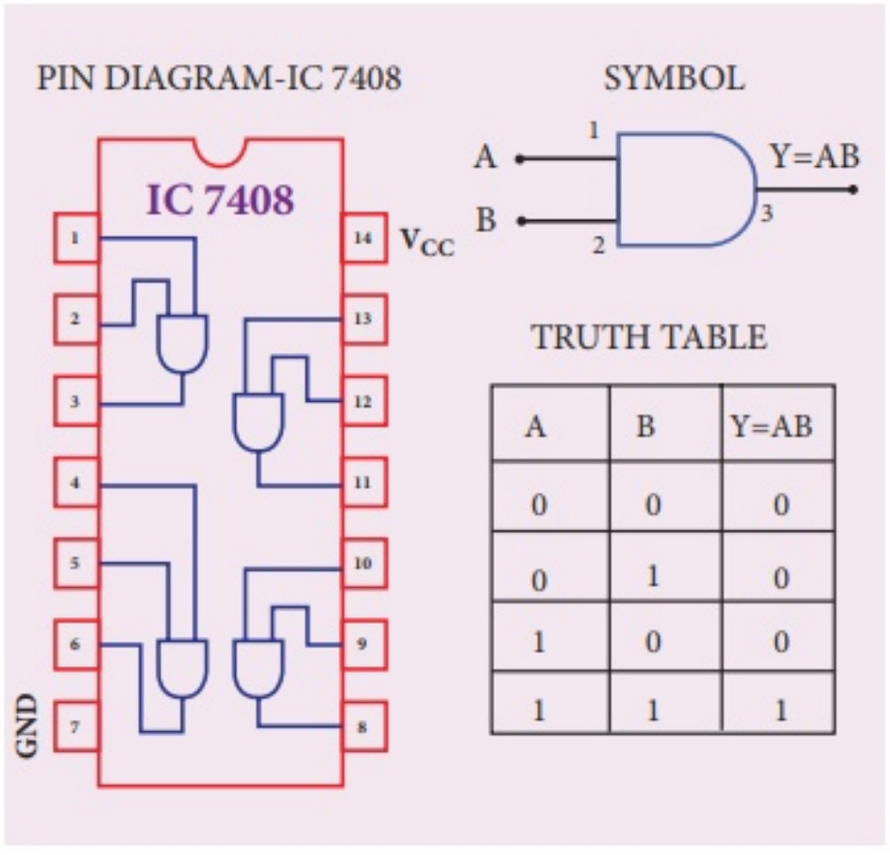
Digital Electronics: Integrated Circuit Logic Gates



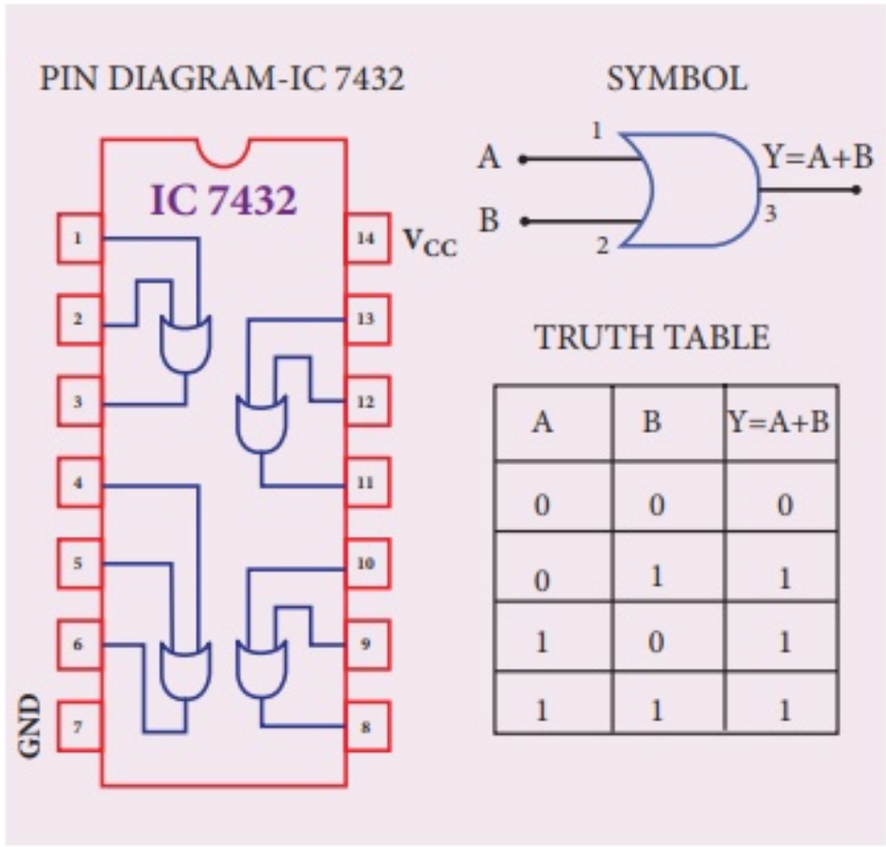
Digital Electronics: Integrated Circuit Logic Gates



AND Gate

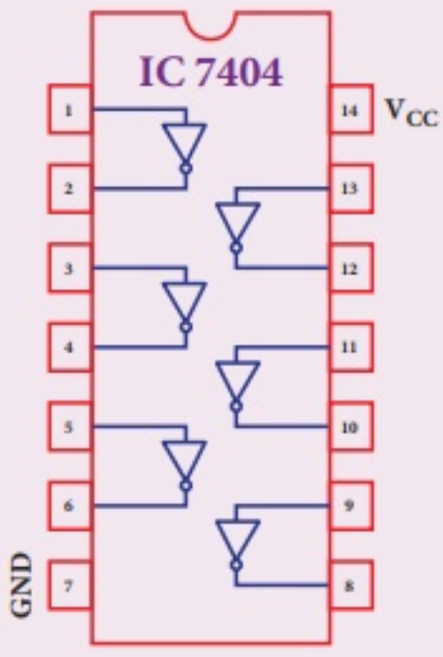

PIN DIAGRAM-IC 7408
IC 7408
V_{CC}
GND
1
2
3
4
5
6
7
8
9
10
11
12
13
14
SYMBOL
A
B
Y=AB
1
2
3
TRUTH TABLE
A
B
Y=AB
0
0
0
0
1
0
1
0
0
1
1
1

OR Gate

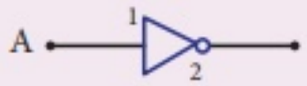

PIN DIAGRAM-IC 7432
IC 7432
V_{CC}
GND
1
2
3
4
5
6
7
14
13
12
11
10
9
8
SYMBOL
A
B
Y=A+B
1
2
3
TRUTH TABLE
A B Y=A+B
0 0 0
0 1 1
1 0 1
1 1 1

NOT Gate

PIN DIAGRAM-IC 7404



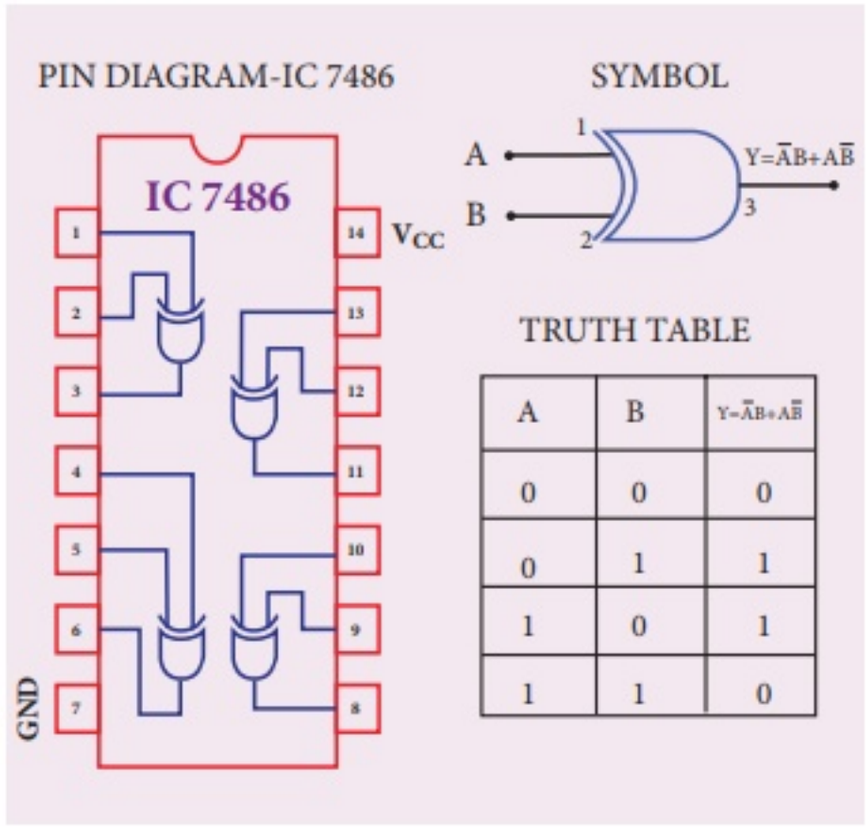
SYMBOL



TRUTH TABLE

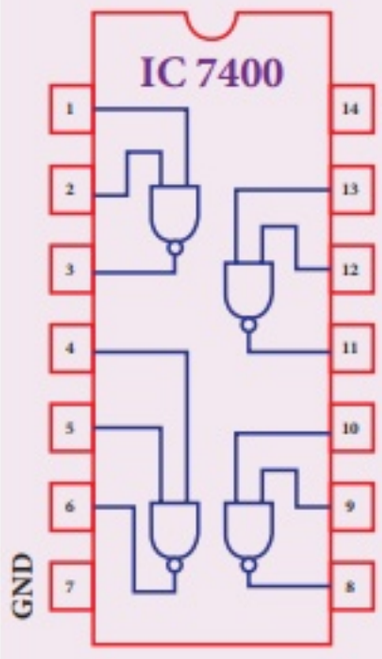
A	$Y=\bar{A}$
0	1
1	0

XOR Gate


PIN DIAGRAM-IC 7486
IC 7486
1
2
3
4
5
6
7
14
13
12
11
10
9
8
VCC
GND
SYMBOL
A
B
1
2
3
Y=ĀB+AB̄
TRUTH TABLE
A
B
Y=ĀB+AB̄
0
0
0
0
1
1
1
0
1
1
1
0

NAND Gate

PIN DIAGRAM-IC 7400

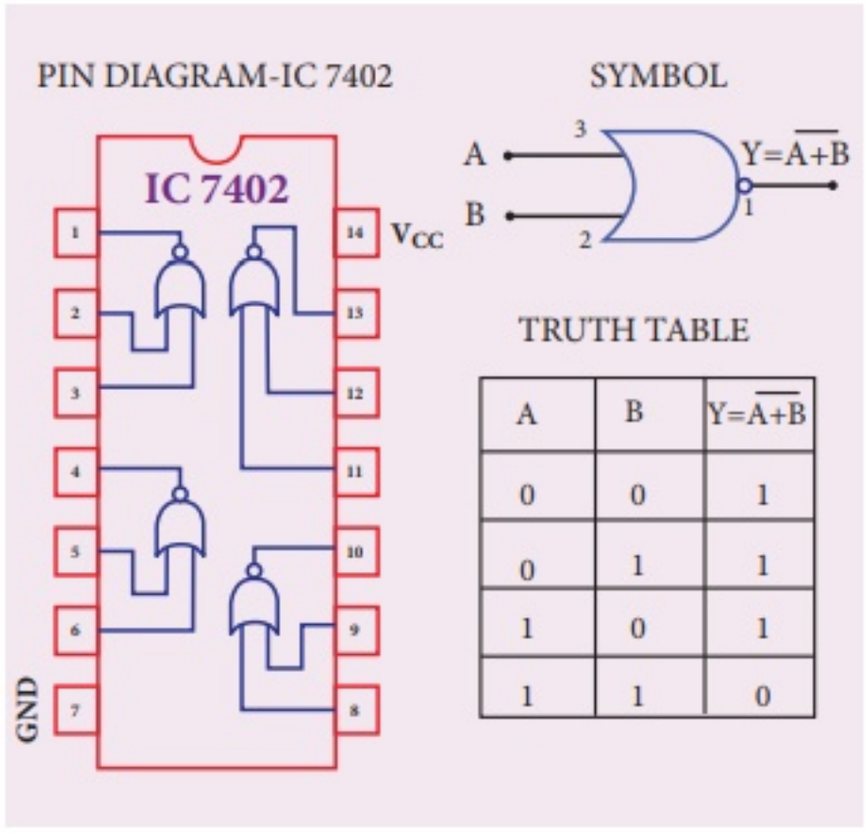


SYMBOL

TRUTH TABLE

A	B	Y=$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

NOR Gate


PIN DIAGRAM-IC 7402
IC 7402
VCC
GND
SYMBOL
A
B
Y=A+B
TRUTH TABLE
A | B | Y=A+B
0 | 0 | 1
0 | 1 | 1
1 | 0 | 1
1 | 1 | 0

Digital Electronics: Integrated Circuit Logic Gates

Number	Description
7400	Quad two-input NAND gate (four NAND gates)
7402	Quad two-input NOR gate (four NOR gates)
7404	Hex inverter (six NOT gates)
7408	Quad two-input AND gate (four AND gates)
7432	Quad two-input OR gate (four OR gates)
7486	Quad two-input XOR gate (four XOR gates)

Number	Description
4001	Quad two-input NOR gate (four NOR gates)
4009	Hex inverter (six NOT gates)
4011	Quad two-input NAND gate (four NAND gates)
4030	Quad two-input XOR gate (four XOR gates)
4071	Quad two-input OR gate (four OR gates)
4077	Quad two-input XNOR gate (four XNOR gates)
4081	Quad two-input AND gate (four AND gates)

Digital Electronics: Integrated Circuit Logic Gates

Number	Description
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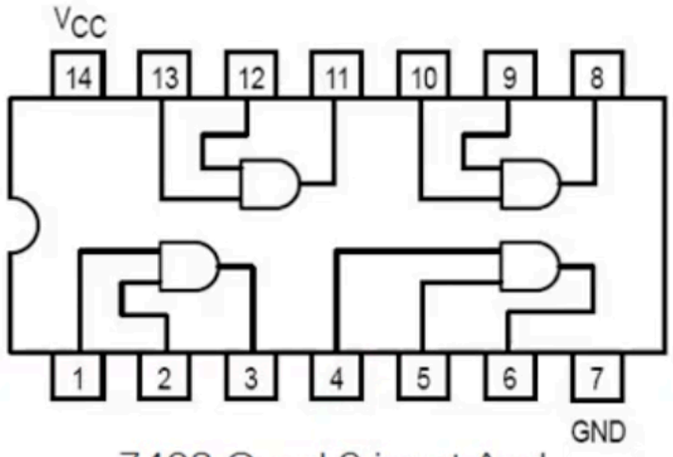
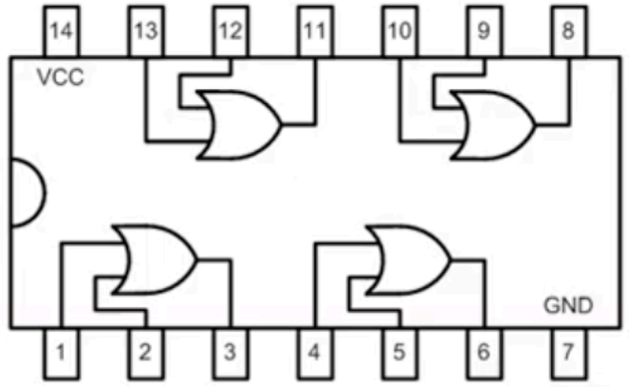
4081	Quad two-input AND gate (four AND gates)

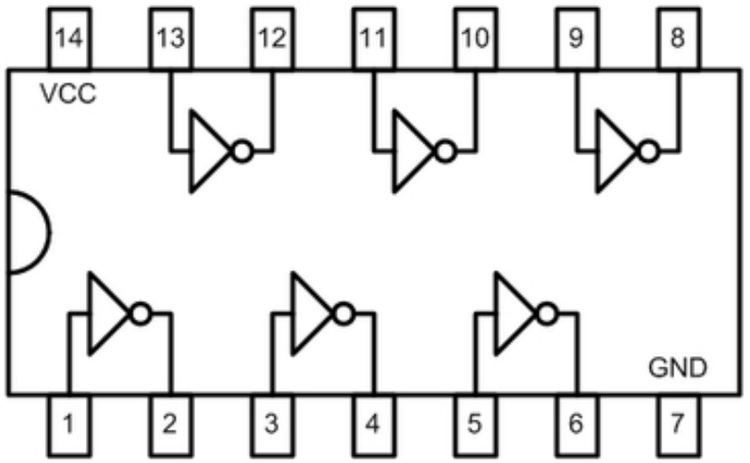
IC



7408 Quad 2 input And



7432 Quad 2 Input OR



7404 Hex Inverter