

Logic AND Gate Tutorial

The Logic AND Gate is a type of digital logic circuit whose output goes HIGH to a logic level 1 only when all of its inputs are HIGH

The output state of a digital logic AND gate only returns “LOW” again when **ANY** of its inputs are at a logic level “0”. In other words for a logic AND gate, any LOW input will give a LOW output.

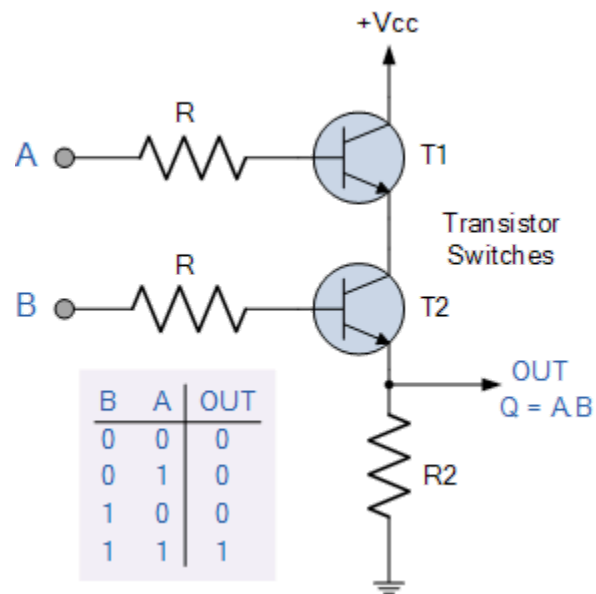
The logic or Boolean expression given for a digital logic AND gate is that for *Logical Multiplication* which is denoted by a single dot or full stop symbol, (.) giving us the Boolean expression of: $A.B = Q$.

Then we can define the operation of a digital 2-input logic AND gate as being:

“If both A and B are true, then Q is true”

2-input Transistor AND Gate

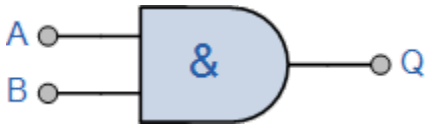
A simple 2-input logic AND gate can be constructed using RTL Resistor-transistor switches connected together as shown below with the inputs connected directly to the transistor bases. Both transistors must be saturated “ON” for an output at Q.



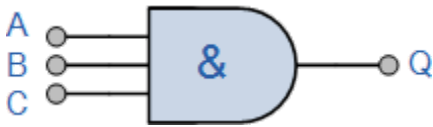
Logic AND Gates are available using digital circuits to produce the desired logical function and is given a symbol whose shape represents the logical operation of the AND gate.

Digital Logic “AND” Gate Types

The 2-input Logic AND Gate

Symbol	Truth Table		
 <p>2-input AND Gate</p>	B	A	Q
	0	0	0
	0	1	0
	1	0	0
	1	1	1
Boolean Expression $Q = A.B$	Read as A AND B gives Q		

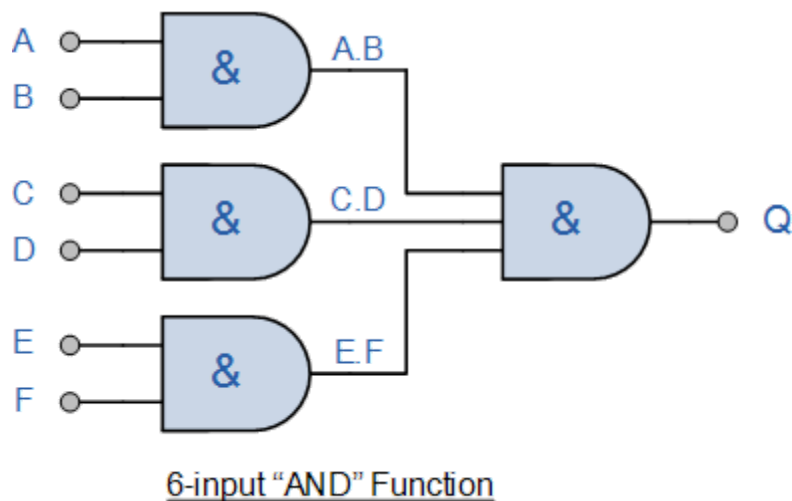
The 3-input Logic AND Gate

Symbol	Truth Table			
	C	B	A	Q
	0	0	0	0

3-input AND Gate	0	0	1	0
	0	1	0	0
	0	1	1	0
	1	0	0	0
	1	0	1	0
	1	1	0	0
	1	1	1	1
Boolean Expression $Q = A.B.C$				Read as A AND B AND C gives Q

Because the Boolean expression for the logic AND function is defined as (\cdot), which is a binary operation, AND gates can be cascaded together to form any number of individual inputs. However, commercial available AND gate IC's are only available in standard 2, 3, or 4-input packages. If additional inputs are required, then standard AND gates will need to be cascaded together to obtain the required input value, for example.

Multi-input AND Gate



The Boolean Expression for this 6-input AND gate will therefore be:

$$Q = (A.B).(C.D).(E.F)$$

In other words:

A AND B AND C AND D AND E AND F gives Q

If the number of inputs required is an odd number of inputs any “unused” inputs can be held HIGH by connecting them directly to the power supply using suitable “Pull-up” resistors.

Commonly available digital logic AND gate IC’s include:

TTL Logic AND Gate

74LS08 Quad 2-input

74LS11 Triple 3-input

74LS21 Dual 4-input

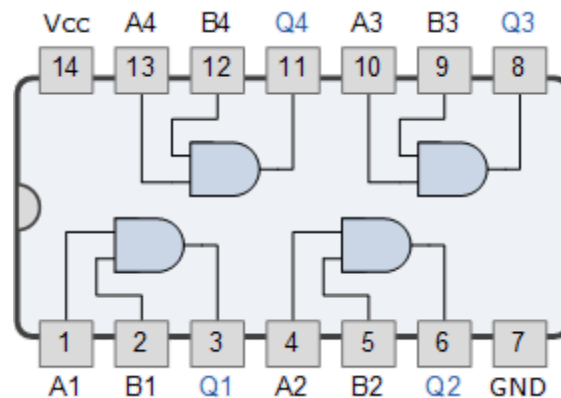
CMOS Logic AND Gate

CD4081 Quad 2-input

CD4073 Triple 3-input

CD4082 Dual 4-input

7408 Quad 2-input AND Gate



In the next tutorial about **Digital Logic Gates**, we will look at the digital logic OR Gate function as used in both TTL and CMOS logic circuits as well as its Boolean Algebra definition and truth tables.

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A Afzal

Very good

Posted on October 25th 2018 | 9:09 am

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F Faheem Khan

Deficit of detail.only transistors construction is depicted,and no other assemblage is available

Posted on October 24th 2018 | 11:52 am

← Reply

A Audry

It's really a great and useful piece of info. I am glad that you simply shared this helpful info with us. Please stay us informed like this.

Thanks for sharing.

portable computer (Adrianna)

Posted on October 23rd 2018 | 6:11 pm

← Reply

G Graves Sampson

Please can I get a full PDF file on logic gate with Circuit diagrams

Posted on October 23rd 2018 | 12:37 pm

← Reply



Ron

What is the importance of R2 connected below output point

Posted on September 21st 2018 | 4:54 am

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W Wayne Storr

It provides an $I^2 R$ output voltage

Posted on September 21st 2018 | 5:24 am

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E Eng.opano george

understandable thanks

Posted on September 20th 2018 | 5:58 am

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Sagar yaduwanshi

S I wish”you can help me reading a gates and other topics

Posted on August 28th 2018 | 2:41 pm

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S Susmita sunil dhake

Truth table for 18 in 4i/o

Posted on August 24th 2018 | 1:57 pm

← Reply

S Sanjay

Very easy

Posted on July 19th 2018 | 1:52 am

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s sadegh

what is the output when inputs are open? the output is Z or 0?

Posted on July 18th 2018 | 1:11 pm

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