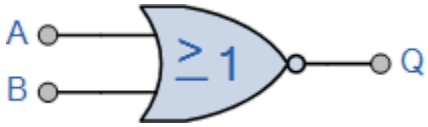
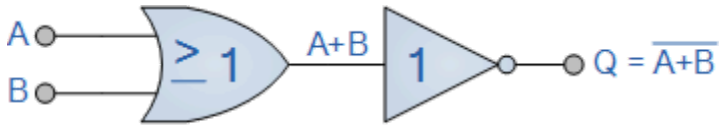


Logic NOR Gate Tutorial

The Logic NOR Gate gate is a combination of the digital logic OR gate and an inverter or NOT gate connected together in series

The inclusive NOR (Not-OR) gate has an output that is normally at logic level "1" and only goes "LOW" to logic level "0" when **ANY** of its inputs are at logic level "1". The **Logic NOR Gate** is the reverse or "*Complementary*" form of the inclusive OR gate we have seen previously.

Logic NOR Gate Equivalent



2-input "OR" gate plus a "NOT" gate

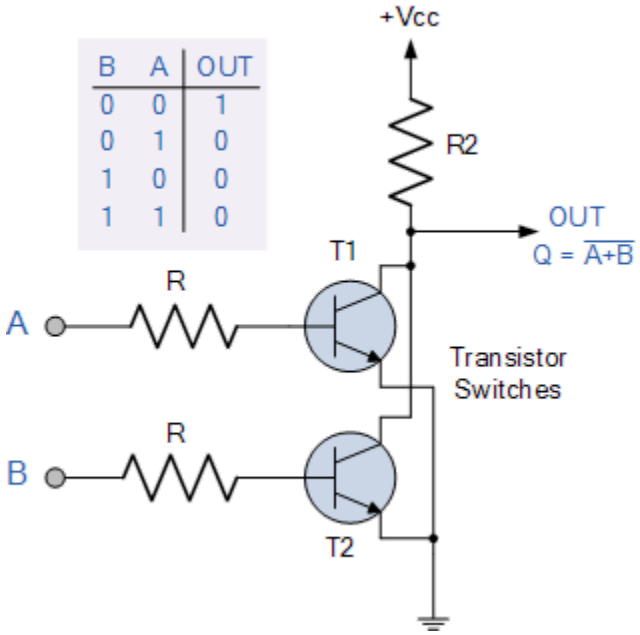
The logic or Boolean expression given for a logic NOR gate is that for *Logical Multiplication* which it performs on the *complements* of the inputs. The Boolean expression for a logic NOR gate is denoted by a plus sign, (+) with a line or *Overline*, (¯) over the expression to signify the NOT or logical negation of the NOR gate giving us the Boolean expression of: $\overline{A+B} = Q$.

Then we can define the operation of a 2-input digital logic NOR gate as being:

"If both A and B are NOT true, then Q is true"

Transistor NOR Gate

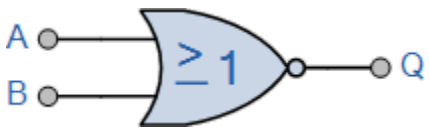
A simple 2-input logic NOR gate can be constructed using RTL Resistor-transistor switches connected together as shown below with the inputs connected directly to the transistor bases. Both transistors must be cut-off "OFF" for an output at Q.



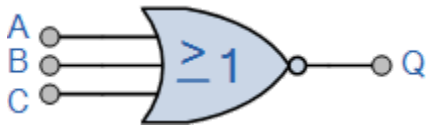
Logic NOR Gates are available using digital circuits to produce the desired logical function and is given a symbol whose shape is that of a standard OR gate with a circle, sometimes called an "inversion bubble" at its output to represent the NOT gate symbol with the logical operation of the NOR gate given as.

The Digital Logic "NOR" Gate

2-input NOR Gate

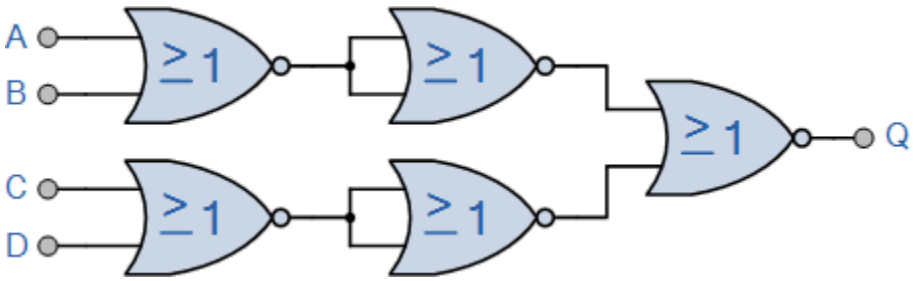
<table>
<tr><th colspan="2">Symbol</th><th colspan="3">Truth Table</th></tr>
<tr><td colspan="2" rowspan="5"> 
2-input NOR Gate</td><td>B</td><td>A</td><td>Q</td></tr>
<tr><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
<tr><td colspan="2">Boolean Expression Q = $\overline{A+B}$</td><td colspan="3">Read as A OR B gives NOT Q</td></tr>
</table>

3-input NOR Gate

Symbol	Truth Table			
 3-input NOR Gate	C	B	A	Q
	0	0	0	1
	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	0
Boolean Expression **Q** = $\overline{\mathbf{A+B+C}}$	Read as A **OR** B **OR** C gives **NOT** Q			

As with the OR function, the NOR function can also have any number of individual inputs and commercial available NOR Gate IC's are available in standard 2, 3, or 4 input types. If additional inputs are required, then the standard NOR gates can be cascaded together to provide more inputs for example.

A 4-input NOR Function



The Boolean Expression for this 4-input NOR gate will therefore be: $\mathbf{Q = \overline{A+B+C+D}}$

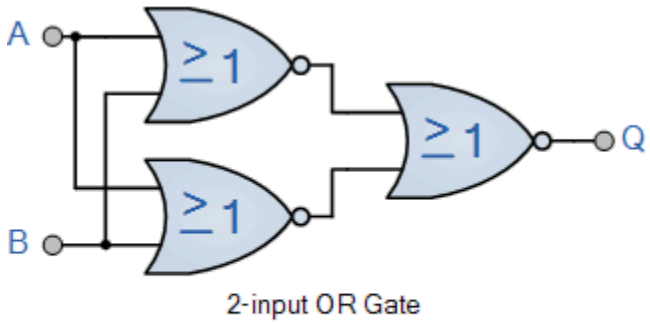
If the number of inputs required is an odd number of inputs any "unused" inputs can be held LOW by connecting them directly to ground using suitable "Pull-down" resistors.

The **Logic NOR Gate** function is sometimes known as the **Pierce Function** and is denoted by a downwards arrow operator as shown, $A \downarrow B$.

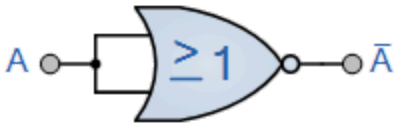
The “Universal” NOR Gate

Like the NAND gate seen in the last section, the NOR gate can also be classed as a “Universal” type gate. NOR gates can be used to produce any other type of logic gate function just like the NAND gate and by connecting them together in various combinations the three basic gate types of AND, OR and NOT function can be formed using only NOR gates, for example.

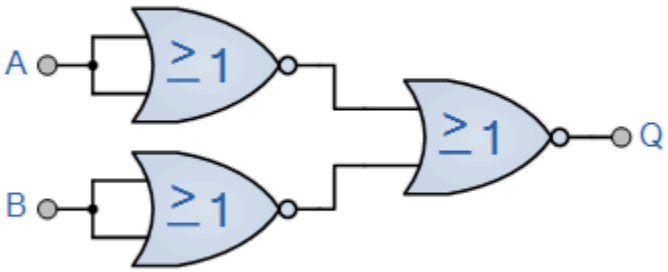
Various Logic Gates using only NOR Gates



2-input OR Gate



NOT Gate



2-input AND Gate

As well as the three common types above, Exclusive-OR, Exclusive-NOR and standard NOR gates can also be formed using just individual NOR gates.

Commonly available digital logic NOR gate IC’s include:

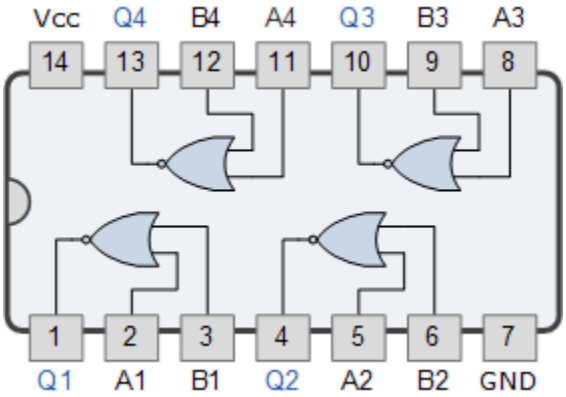
TTL Logic NOR Gates

74LS02 Quad 2-input
74LS27 Triple 3-input
74LS260 Dual 4-input

CMOS Logic NOR Gates

CD4001 Quad 2-input
CD4025 Triple 3-input
CD4002 Dual 4-input

7402 Quad 2-input NOR Gate



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

32 Comments

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Email Address

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SUBMIT

R Raghulvenkateswaran

Please explain the A, B, C bar values from all gates

Posted on October 19th 2018 | 3:06 am

Reply

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m monu kumar

nice

Posted on October 18th 2018 | 7:19 am

Reply

Y Yogeshwari

Can you give in TTL by using 3parts with help of functional operation

Posted on September 18th 2018 | 2:46 pm

Reply

K Keerthi

(AB'+D')E+C(A'+B'D)…Implement the function with only two input nor gates..may i please have the answer for it..tried of trying it..tq

Posted on August 12th 2018 | 10:42 am

Reply

Shikha Singh

S

Is RTL NAND gate & RTL NOR gate are two different circuits ???

Posted on April 27th 2018 | 3:03 pm

Reply

W Wayne Storr

The NAND gate and the NOR gate as their name suggests, are two different circuits.

Posted on April 27th 2018 | 4:25 pm

Reply

L Lathiya harsh

Send exclusieve news

Posted on April 03rd 2018 | 3:41 pm

Reply

O Orapeleng

hey, what's the difference between an NAND Gate and a Negative NOR Gate ?

Posted on March 01st 2018 | 6:25 am

Reply

W Wayne Storr

In negative logic, a NOR gate works like a NAND gate. That is, a two-input NOR gate output is false if both of its inputs are true as a low voltage as TRUE and a high voltage as FALSE.

Posted on March 01st 2018 | 8:17 am

Reply

D Daniel Tabala

Hi. I just need your help in gates circuit and it compliments.Can you construct a circuit with only nor gates there for this A'BC+AB'C+ABC'+ABC?

Posted on February 28th 2018 | 8:29 am

Reply

A Abhishek Kb

Show how you will obtain an AND gate using only NOR gates. Draw the truth table for this arrangement of gates

Posted on February 19th 2018 | 8:40 am

Reply

S Sumanth

How can we construct xor gate using nand gate only?

Posted on January 06th 2018 | 5:41 am

Reply

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