



Gates

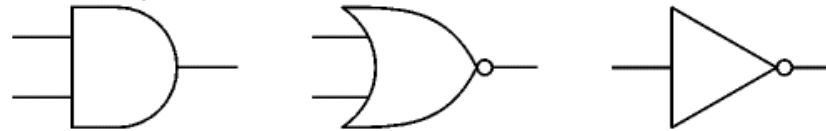


The 7400 chip, containing four NANDs. The two additional contacts supply power (+5 V) and connect the ground.

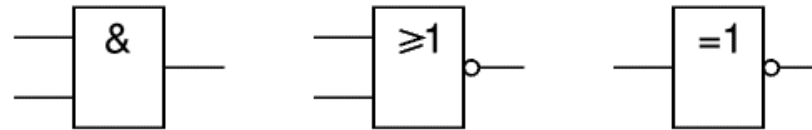
Logic Gates

There are two series of symbols for logic gates:

- The **traditional symbols** have distinctive shapes making them easy to recognise so they are widely used in industry and education.

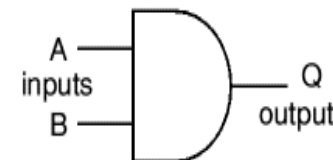


- The **IEC (International Electrotechnical Commission) symbols** are rectangles with a symbol inside to show the gate function. They are rarely used despite their official status, but you may need to know them for an examination.



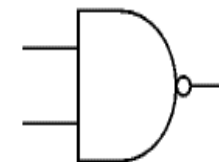
Inputs and outputs

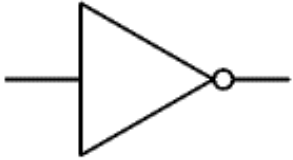
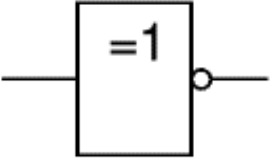
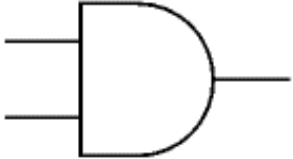
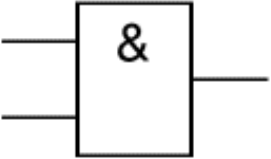
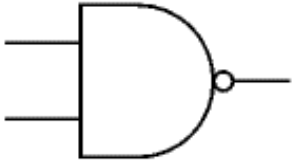
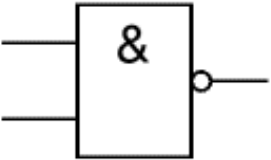
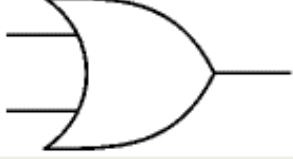
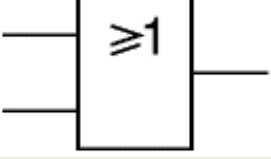
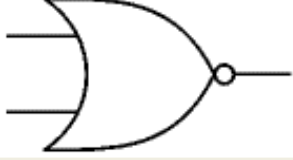
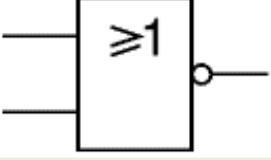

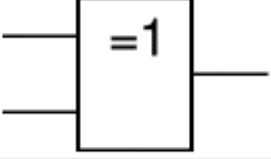
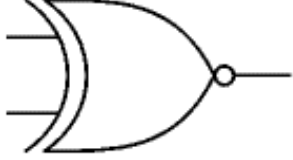
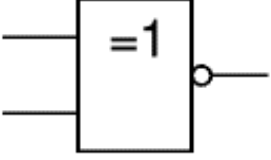
Gates have two or more inputs, except a NOT gate which has only one input. All gates have only one output. Usually the letters A, B, C and so on are used to label inputs, and Q is used to label the output. On this page the inputs are shown on the left and the output on the right.



The inverting circle (o)

Some gate symbols have a circle on their output which means that their function includes **inverting** of the output. It is equivalent to feeding the output through a NOT gate. For example the NAND (Not AND) gate symbol shown on the right is the same as an AND gate symbol but with the addition of an inverting circle on the output.



Gate Type	Traditional Symbol	IEC Symbol	Function of Gate
<u>NOT</u>			A NOT gate can only have one input. The 'o' on the output means 'not'. The output of a NOT gate is the inverse (opposite) of its input, so the output is true when the input is false. A NOT gate is also called an inverter.
<u>AND</u>			An AND gate can have two or more inputs. The output of an AND gate is true when all its inputs are true.
<u>NAND</u>			A NAND gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a <u>Not AND</u> gate. The output of a NAND gate is true unless all its inputs are true.
<u>OR</u>			An OR gate can have two or more inputs. The output of an OR gate is true when at least one of its inputs is true.
<u>NOR</u>			A NOR gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a <u>Not OR</u> gate. The output of a NOR gate is true when none of its inputs are true.
<u>EX-OR</u>			An EX-OR gate can only have two inputs. The output of an EX-OR gate is true when its inputs are different (one true, one false).
<u>EX-NOR</u>			An EX-NOR gate can only have two inputs. The 'o' on the output means 'not' showing that it is a <u>Not EX-OR</u> gate. The output of an EX-NOR gate is true when its inputs are the same (both true or both false).

Truth tables

4000 series

<http://www.kpsec.freeuk.com/components/cmos.htm>



7400 series

<http://www.kpsec.freeuk.com/components/74series.htm>



Flip Flops

<http://www.howstuffworks.com/boolean3.htm>



Binary numbers

0	=	0
1	=	1
2	=	10
3	=	11
4	=	100
5	=	101
6	=	110
7	=	111
8	=	1000
9	=	1001
10	=	1010
11	=	1011
12	=	1100
13	=	1101
14	=	1110
15	=	1111
16	=	10000
17	=	10001
18	=	10010
19	=	10011
20	=	10100