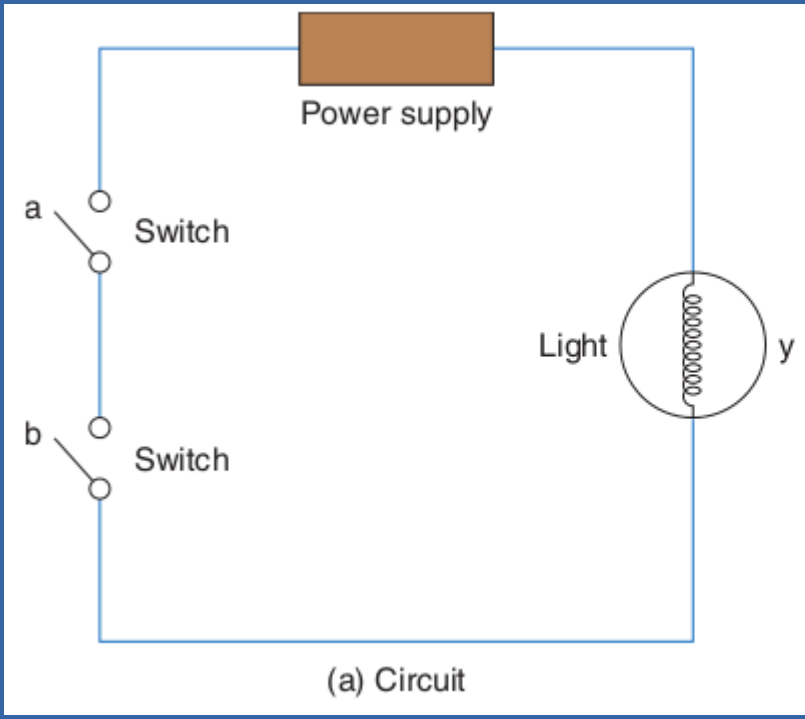
Primitive Logic Functions

Switch representation of a 2-input AND function.



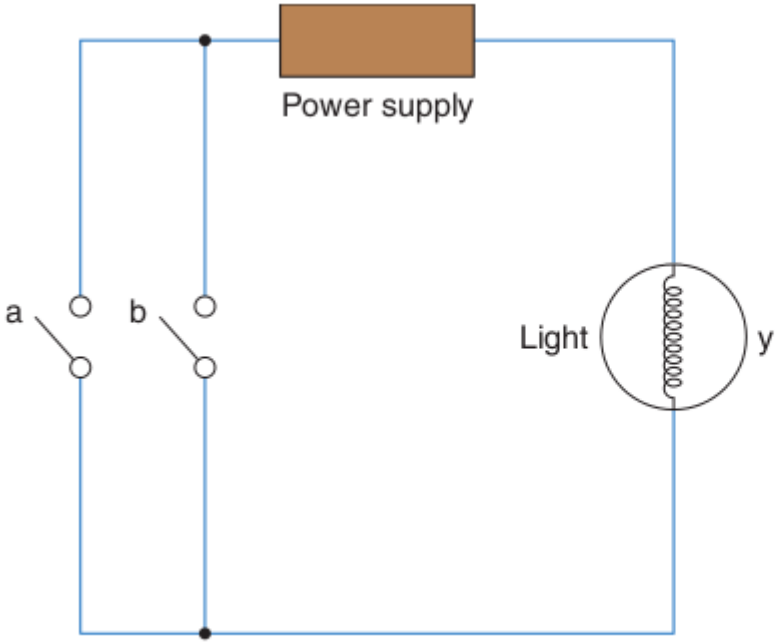
(a) Circuit

a	b	y
OPEN	OPEN	OFF
OPEN	CLOSED	OFF
CLOSED	OPEN	OFF
CLOSED	CLOSED	ON

(b) Truth table

A 3-input version could be constructed by adding a third switch in series with the first two

Switch representation of a 2-input OR function



(a) Circuit

a	b	y
OPEN	OPEN	OFF
OPEN	CLOSED	ON
CLOSED	OPEN	ON
CLOSED	CLOSED	ON

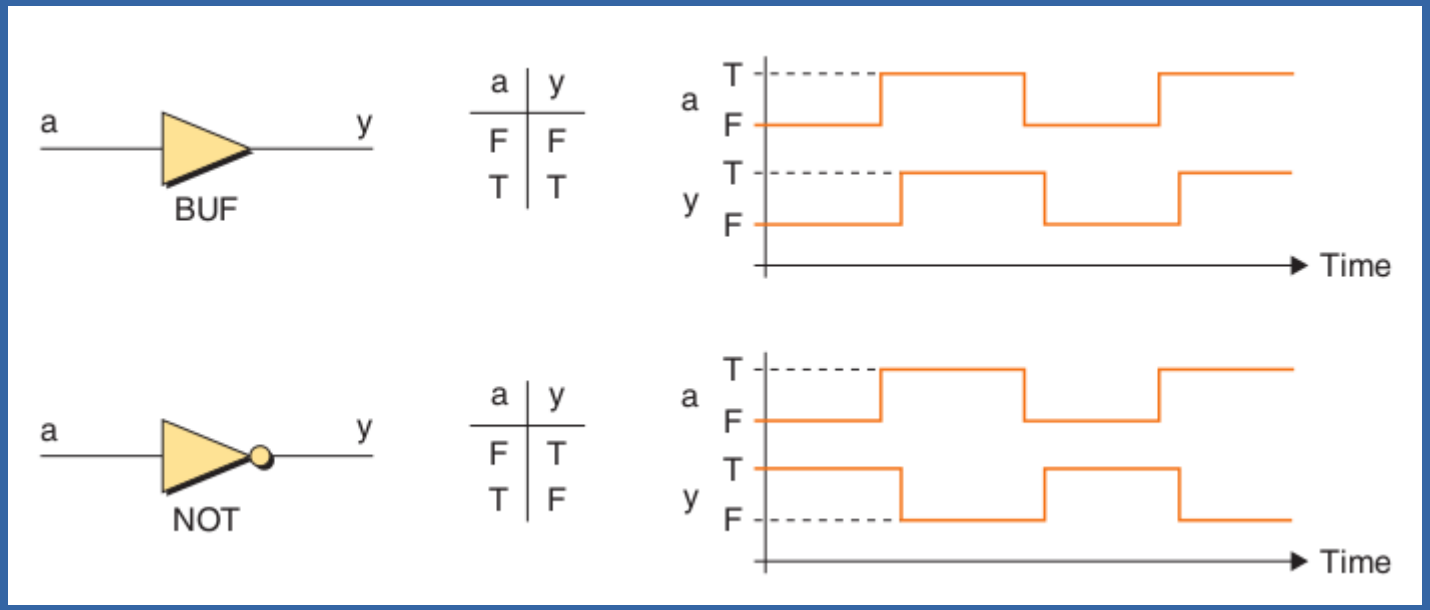
(b) Truth table

Logic Gate

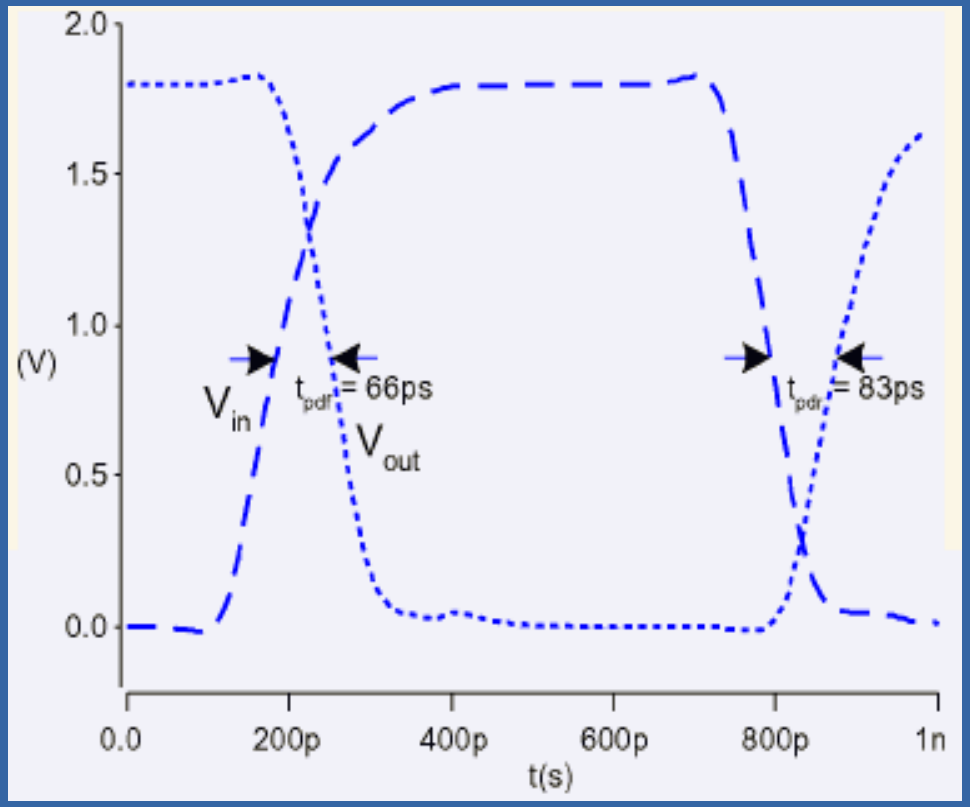
In electronics, a logic gate is an idealized or physical device implementing a Boolean function; that is, it performs a logical operation on one or more logical inputs, and produces a single logical output.

Depending on the context, the term may refer to an ideal logic gate, one that has for instance zero rise time and unlimited fan-out, or it may refer to a non-ideal physical device

BUF and NOT functions



Inverter Delay



t_{pdr}: rising propagation delay

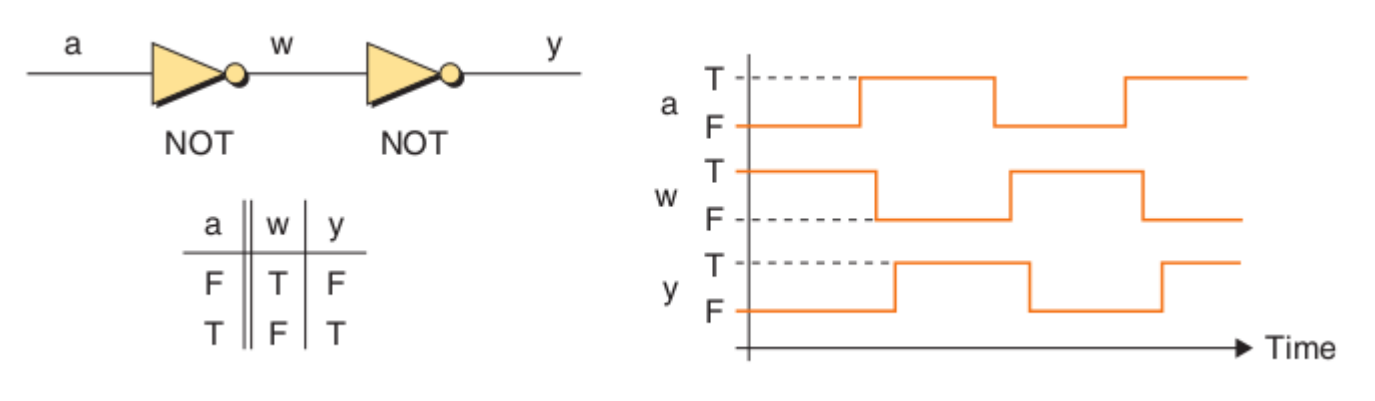
- From input to rising output crossing $V_{DD}/2$

t_{pdf}: falling propagation delay

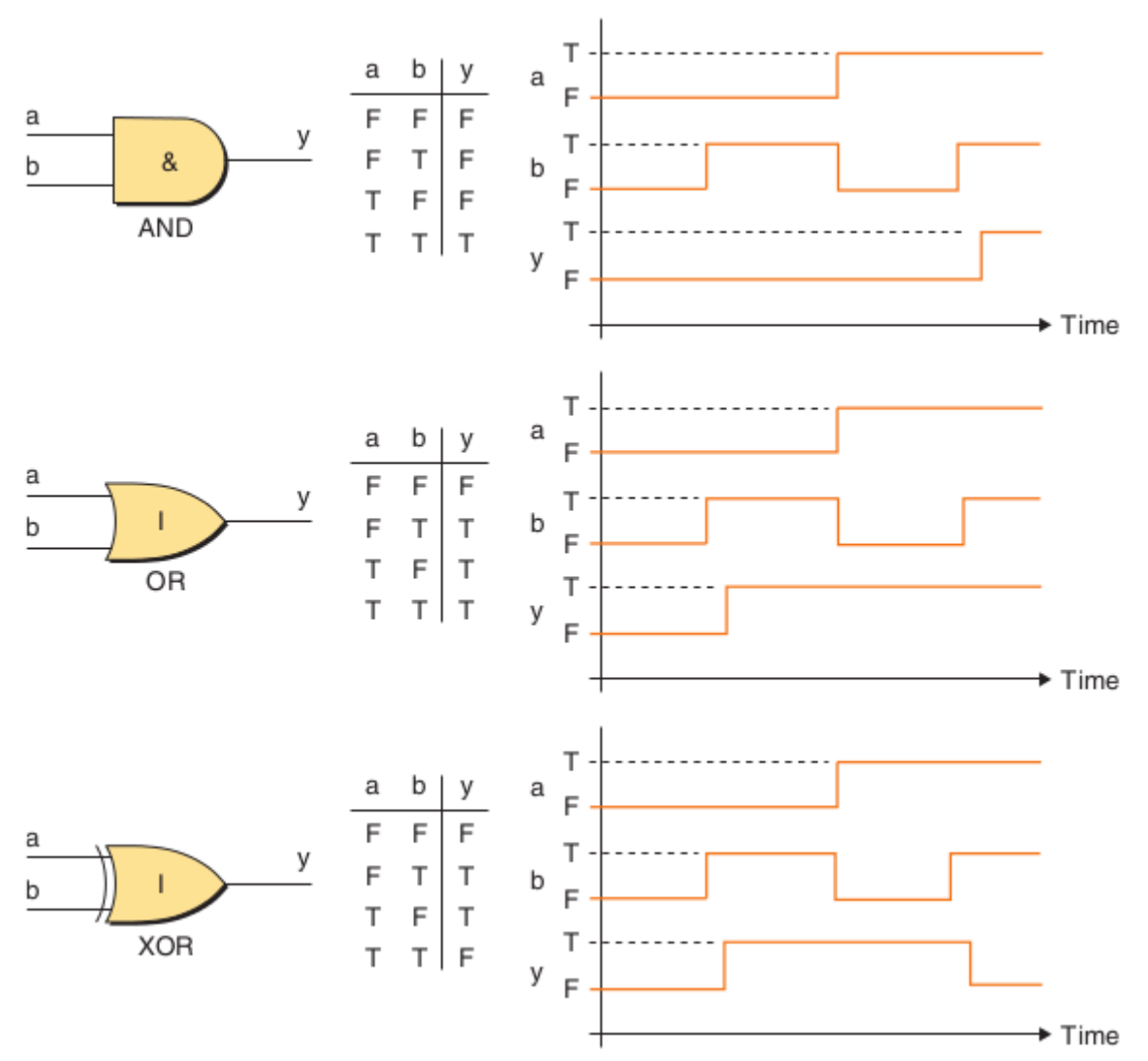
- From input to falling output crossing $V_{DD}/2$

Pico is a unit prefix in the metric system denoting one trillionth, a factor of 10^−12 (0.000000000001). this was one of the original 12 prefixes defined in 1960 when the International System of Units was established.

Two NOT functions connected in series

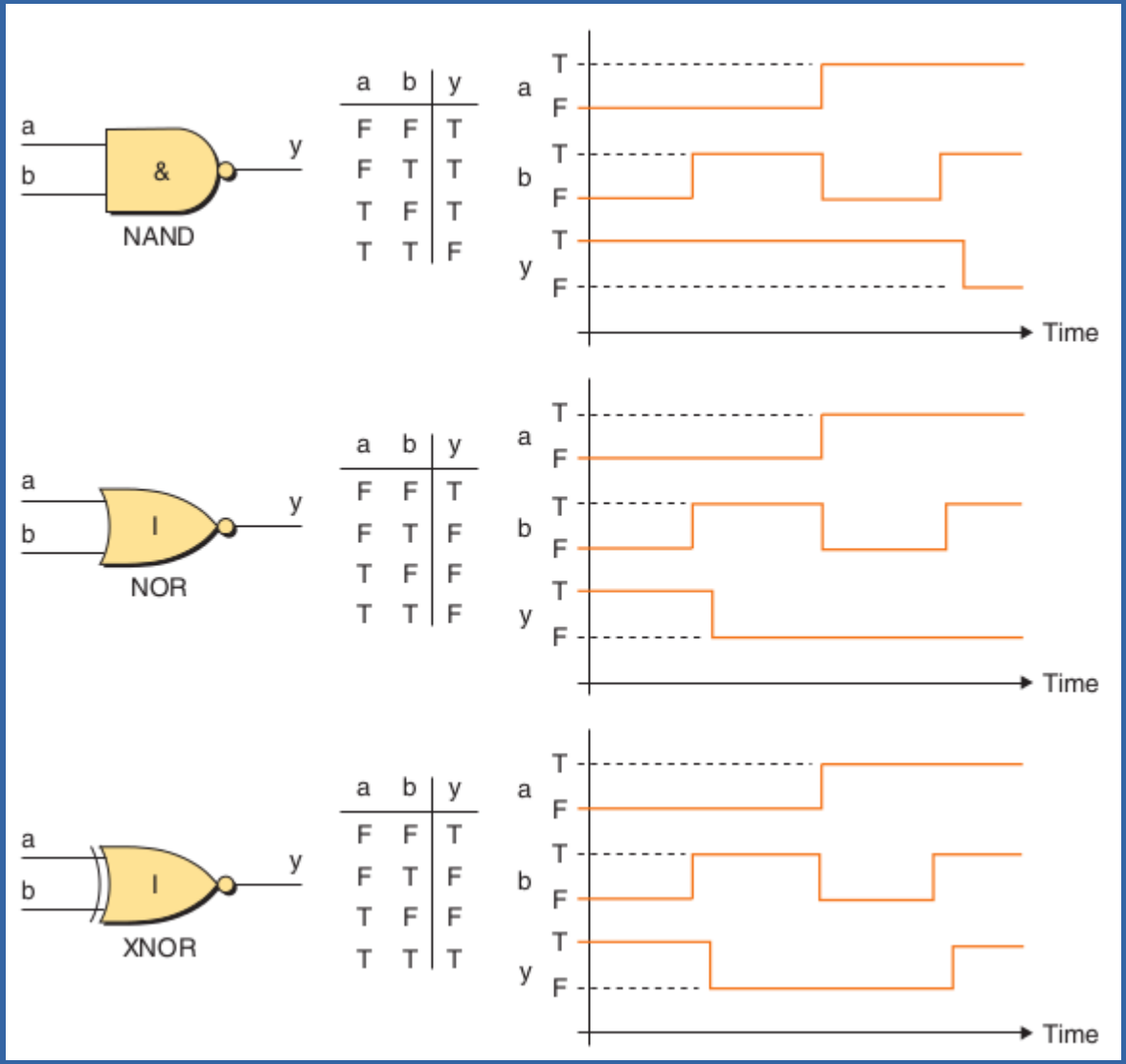


AND, OR, and XOR functions.



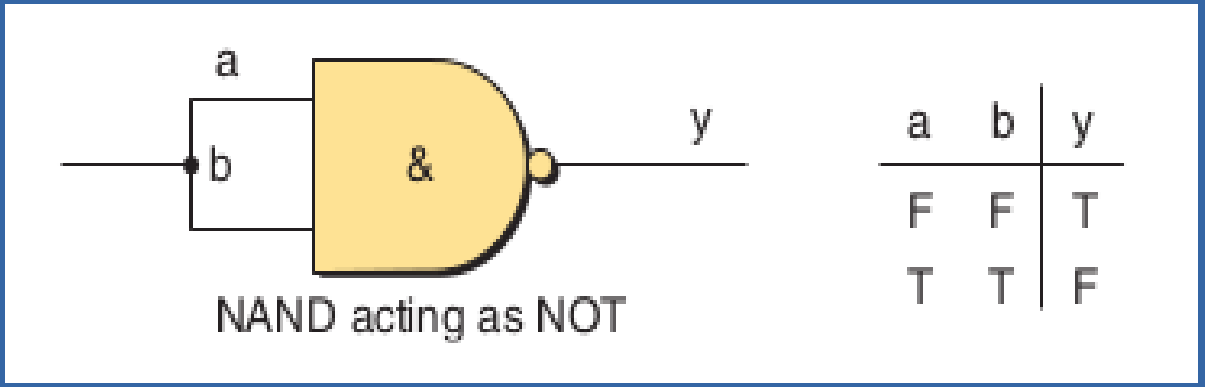
There are different points of view regarding how an exclusive-OR gate with more than two inputs should behave. Most often such an XOR gate behaves like a cascade of 2-input gates and performs an odd-parity function. However, some people interpret the meaning of exclusive-OR more literally and say that the output should be a 1 if and only if exactly one of the inputs is a 1.

NAND, NOR, and XNOR functions

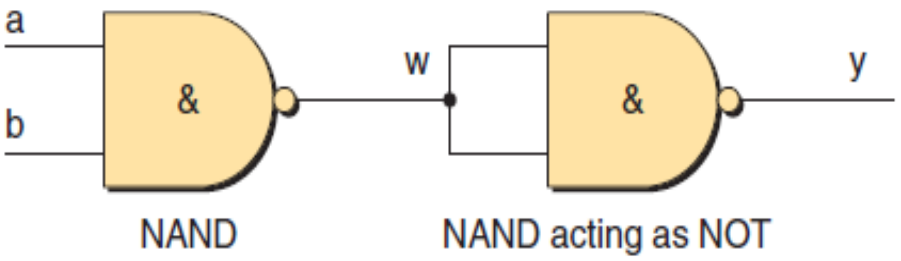


Eight simple functions (BUF, NOT, AND, NAND, OR, NOR, XOR, and XNOR) from which everything else is constructed

Construct all of the above functions using one or more NAND gates (or one or more NOR gates)



a	b	y
F	F	T
T	T	F



a	b	w	y
F	F	T	F
F	T	T	F
T	F	T	F
T	T	F	T

In the NASA Apollo space missions to the moon in the 1960s and 1970s, all on board computations for primary guidance, navigation and control were provided by a small custom processor called "The Apollo Guidance Computer". It used wire wrap circuit boards whose only logic elements were three-input NOR gates.

You can build the other gates from either NAND or NOR, this Property is sometimes called adequate.
Can’t do inversion with AND or OR