

Digital Logic Gates

Name	Algebraic equation	Truth table		
		X	Y	F
AND	$F = XY$	0	0	0
		0	1	0
		1	0	0
		1	1	1
OR	$F = X+Y$	0	0	0
		0	1	1
		1	0	1
		1	1	1
NOT (inverter)	$F = \overline{X}$	0		1
		1		0
Buffer	$F = X$	0		0
		1		1
NAND	$F = \overline{XY}$	0	0	1
		0	1	1
		1	0	1
		1	1	0
NOR	$F = \overline{X+Y}$	0	0	1
		0	1	0
		1	0	0
		1	1	0
XOR (Exclusive-OR)	$F = X\overline{Y} + \overline{X}Y$ $= X \oplus Y$	0	0	0
		0	1	1
		1	0	1
		1	1	0
XNOR (Exclusive-NOR)	$F = XY + \overline{XY}$ $= \overline{X \oplus Y}$	0	0	1
		0	1	0
		1	0	0
		1	1	1

Additional identities

$$\begin{array}{llll}
 X \oplus 0 & = & X & X \oplus 1 & = & \overline{X} \\
 X \oplus X & = & 0 & X \oplus \overline{X} & = & 1 \\
 X \oplus \overline{Y} & = & \overline{X \oplus Y} & \overline{X} \oplus Y & = & \overline{X \oplus Y} \\
 \\
 A \oplus B & = & B \oplus A & & & \\
 (A \oplus B) \oplus C & = & A \oplus (B \oplus C) & = & A \oplus B \oplus C &
 \end{array}$$