



CD4001M/CD4001C Quadruple 2-Input NOR Gate CD4011M/CD4011C Quadruple 2-Input NAND Gate

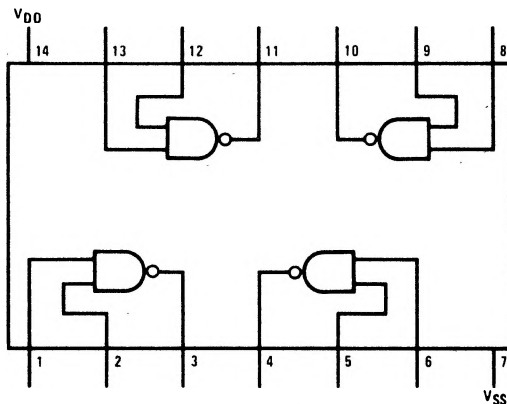
General Description

The CD4001M/CD4001C, CD4011M/CD4011C are monolithic complementary MOS (CMOS) quadruple two-input NOR and NAND gate integrated circuits. N- and P-channel enhancement mode transistors provide a symmetrical circuit with output swings essentially equal to the supply voltage. This results in high noise immunity over a wide supply voltage range. No DC power other than that caused by leakage current is consumed during static conditions. All inputs are protected against static discharge and latching conditions.

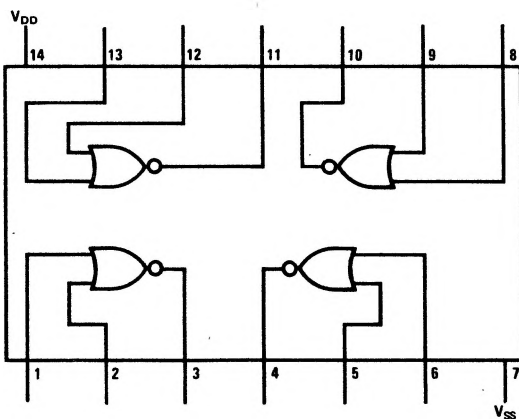
Features

- Wide supply voltage range 3.0 V to 15 V
- Low power 10 nW (typ.)
- High noise immunity 0.45 V_{DD} (typ.)

Connection Diagrams



TOP VIEW



TOP VIEW

Absolute Maximum Ratings (Note 1)

Voltage an Any Pin $V_{SS} - 0.3V$ to $V_{DD} + 0.3V$
 Operating Temperature Range
 CD4001M, CD4011M $-55^{\circ}C$ to $+125^{\circ}C$
 CD4001C, CD4011C $-40^{\circ}C$ to $+85^{\circ}C$

Storage Temperature Range $-65^{\circ}C$ to $+150^{\circ}C$
 Package Dissipation 500 mW
 Operating V_{DD} Range $V_{SS} + 3.0V$ to $V_{SS} + 15V$
 Lead Temperature (Soldering, 10 seconds) $300^{\circ}C$

DC Electrical Characteristics — CD4001M, CD4011M

Parameter	Conditions	Limits						Units	
		$-55^{\circ}C$		$25^{\circ}C$			$125^{\circ}C$		
		Min.	Max.	Min.	Typ.	Max.	Min.		Max.
I_L Quiescent Device Current	$V_{DD} = 5.0V$		0.05		0.001	0.05		3.0	μA
	$V_{DD} = 10V$		0.1		0.001	0.1		6.0	μA
P_D Quiescent Device Dissipation/Package	$V_{DD} = 5.0V$		0.25		0.005	0.25		15	μW
	$V_{DD} = 10V$		1.0		0.01	1.0		60	μW
V_{OL} Output Voltage Low Level	$V_{DD} = 5.0V, V_I = V_{DD}, I_O = 0A$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V, V_I = V_{DD}, I_O = 0A$		0.05		0	0.05		0.05	V
V_{OH} Output Voltage High Level	$V_{DD} = 5.0V, V_I = V_{SS}, I_O = 0A$	4.95		4.95	5.0		4.95		V
	$V_{DD} = 10V, V_I = V_{SS}, I_O = 0A$	9.95		9.95	10		9.95		V
V_{NL} Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 3.6V, I_O = 0A$	1.5		1.5	2.25		1.4		V
	$V_{DD} = 10V, V_O = 7.2V, I_O = 0A$	3.0		3.0	4.5		2.9		V
V_{NH} Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 0.95V, I_O = 0A$	1.4		1.5	2.25		1.5		V
	$V_{DD} = 10V, V_O = 2.9V, I_O = 0A$	2.9		3.0	4.5		3.0		V
I_{DN} Output Drive Current N-Channel (4001)	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$	0.5		0.40	1.0		0.28		mA
	$V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	1.1		0.9	2.5		0.65		mA
I_{DP} Output Drive Current P-Channel (4001)	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$	-0.62		-0.5	-2.0		-0.35		mA
	$V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-0.62		-0.5	-1.0		-0.35		mA
I_{DN} Output Drive Current N-Channel (4011)	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$	0.31		0.25	0.5		0.175		mA
	$V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	0.63		0.5	0.6		0.35		mA
I_{DP} Output Drive Current P-Channel (4011)	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$	-0.31		-0.25	-0.5		-0.175		mA
	$V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-0.75		-0.6	-1.2		-0.4		mA
I_I Input Current					10				pA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

DC Electrical Characteristics — CD4001C, CD4011C

Parameter	Conditions	Limits						Units	
		-40°C		25°C			80°C		
		Min.	Max.	Min.	Typ.	Max.	Min.		Max.
I_L Quiescent Device Current	$V_{DD} = 5.0V$		0.5		0.005	0.5		15	μA
	$V_{DD} = 10V$		5.0		0.005	5.0		30	μA
P_D Quiescent Device Dissipation/Package	$V_{DD} = 5.0V$		2.5		0.025	2.5		75	μW
	$V_{DD} = 10V$		50		0.05	50		300	μW
V_{OL} Output Voltage Low Level	$V_{DD} = 5.0V, V_I = V_{DD}, I_O = 0A$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V, V_I = V_{DD}, I_O = 0A$		0.05		0	0.05		0.05	V
V_{OH} Output Voltage High Level	$V_{DD} = 5.0V, V_I = V_{SS}, I_O = 0A$	4.95		4.95	5.0		4.95		V
	$V_{DD} = 10V, V_I = V_{SS}, I_O = 0A$	9.95		9.95	10		9.95		V
V_{NL} Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 3.6V, I_O = 0A$	1.5		1.5	2.25		1.4		V
	$V_{DD} = 10V, V_O = 7.2V, I_O = 0A$	3.0		3.0	4.5		2.9		V
V_{NH} Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 0.95V, I_O = 0A$	1.4		1.5	2.25		1.5		V
	$V_{DD} = 10V, V_O = 2.9V, I_O = 0A$	2.9		3.0	4.5		3.0		V
I_{DN} Output Drive Current N-Channel (4001)	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$	0.35		0.3	1.0		0.24		mA
	$V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	0.72		0.6	2.5		0.48		mA
I_{DP} Output Drive Current P-Channel (4001)	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$	-0.35		-0.3	-2.0		-0.24		mA
	$V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-0.3		-0.25	-1.0		-0.2		mA
I_{DN} Output Drive Current N-Channel (4011)	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$	0.145		0.12	0.5		0.095		mA
	$V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	0.3		0.25	0.6		0.2		mA
I_{DP} Output Drive Current P-Channel (4011)	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$	-0.145		-0.12	-0.5		-0.095		mA
	$V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-0.35		-0.3	-1.2		-0.24		mA
I_I Input Current					10				pA

AC Electrical Characteristics $T_A = 25^\circ\text{C}$, $C_L = 15\text{ pF}$, and input rise and fall times = 20 ns.
 Typical temperature coefficient for all values of $V_{DD} = 0.3\%/^\circ\text{C}$

Parameter	Conditions	Min.	Typ.	Max.	Units
CD4001M					
t_{PHL} Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		35	50	ns
	$V_{DD} = 10\text{V}$		25	40	ns
t_{PLH} Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		35	65	ns
	$V_{DD} = 10\text{V}$		25	40	ns
t_{THL} Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		65	125	ns
	$V_{DD} = 10\text{V}$		35	70	ns
t_{TLH} Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		65	175	ns
	$V_{DD} = 10\text{V}$		35	75	ns
C_{IN} Input Capacitance	Any Input		5.0		pF
CD4001C					
t_{PHL} Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		35	80	ns
	$V_{DD} = 10\text{V}$		25	55	ns
t_{PLH} Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		35	120	ns
	$V_{DD} = 10\text{V}$		25	65	ns
t_{THL} Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		65	200	ns
	$V_{DD} = 10\text{V}$		35	115	ns
t_{TLH} Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		65	300	ns
	$V_{DD} = 10\text{V}$		35	125	ns
C_{IN} Input Capacitance	Any Input		5.0		pF

AC Electrical Characteristics $T_A = 25^\circ\text{C}$, $C_L = 15\text{ pF}$, and input rise and fall times = 20 ns.
 Typical temperature coefficient for all values of $V_{DD} = 0.3\%/^\circ\text{C}$

Parameter	Conditions	Min.	Typ.	Max.	Units
CD4011M					
t_{PHL} Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		50	75	ns
	$V_{DD} = 10\text{V}$		25	40	ns
t_{PLH} Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		50	75	ns
	$V_{DD} = 10\text{V}$		25	40	ns
t_{THL} Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		75	125	ns
	$V_{DD} = 10\text{V}$		50	75	ns
t_{TLH} Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		75	100	ns
	$V_{DD} = 10\text{V}$		40	60	ns
C_{IN} Input Capacitance	Any Input		5.0		pF
CD4011C					
t_{PHL} Propagation Delay Time High to Low Level	$V_{DD} = 5.0\text{V}$		50	100	ns
	$V_{DD} = 10\text{V}$		25	50	ns
t_{PLH} Propagation Delay Time Low to High Level	$V_{DD} = 5.0\text{V}$		50	100	ns
	$V_{DD} = 10\text{V}$		25	50	ns
t_{THL} Transition Time High to Low Level	$V_{DD} = 5.0\text{V}$		75	150	ns
	$V_{DD} = 10\text{V}$		50	100	ns
t_{TLH} Transition Time Low to High Level	$V_{DD} = 5.0\text{V}$		75	125	ns
	$V_{DD} = 10\text{V}$		40	75	ns
C_{IN} Input Capacitance	Any Input		5.0		pF