

CD4000M/CD4000C Dual 3-Input NOR Gate Plus Inverter

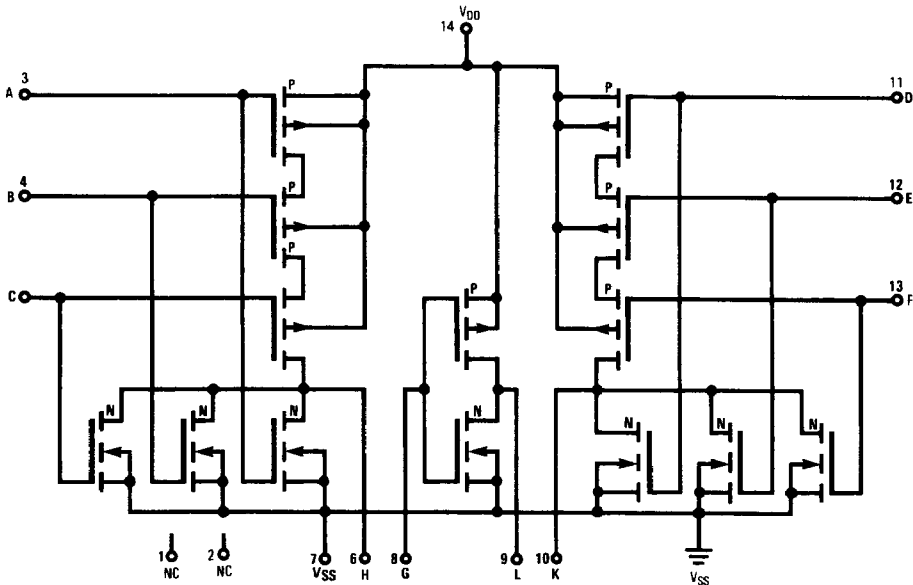
General Description

The CD4000M/CD4000C is a monolithic complementary MOS (CMOS) dual 2-input NOR gate plus an inverter. 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.

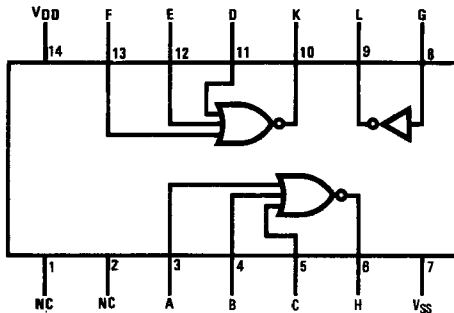
Features

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

Schematic and Connection Diagrams



TL/F/5937-1

Dual-In-Line Package

Top View

TL/F/5937-2

Order Number CD4000*

*Please look into Section 8, Appendix D for availability of various package types.

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at any Pin $V_{SS} - 0.3V$ to $V_{DD} + 0.3V$

Operating Temperature Range (T_A)
 CD4000M -55°C to $+125^\circ\text{C}$
 CD4000C -40°C to $+85^\circ\text{C}$

Storage Temperature Range (T_S) -65°C to $+150^\circ\text{C}$

Power Dissipation (P_D)
 Dual-In-Line 700 mW
 Small Outline 500 mW

Operating V_{DD} Range $V_{SS} + 3V$ to $V_{SS} + 15V$

Lead Temperature (T_L)
 (Soldering, 10 seconds) 260°C

DC Electrical Characteristics CD4000M (Note 2)

Symbol	Parameter	Conditions	-55°C		$+25^\circ\text{C}$			$+125^\circ\text{C}$		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	$V_{DD} = 5V$		0.05			0.05	3	μA	
		$V_{DD} = 10V$		0.1			0.1	6	μA	
V_{OL}	Low Level Output Voltage	$V_{DD} = 5V$		0.05			0.05	0.05	V	
		$V_{DD} = 10V$		0.05			0.05	0.05	V	
V_{OH}	High Level Output Voltage	$V_{DD} = 5V$	4.95		4.95		4.95		V	
		$V_{DD} = 10V$	9.95		9.95		9.95		V	
V_{NL}	Noise Immunity (Note 3)	$V_{DD} = 5V, V_O = 1.4V$ or $3.6V$	1.5		1.5		1.4		V	
		$V_{DD} = 10V, V_O = 2.8V$ or $7.2V$	3.0		3.0		2.9		V	
V_{NH}	Noise Immunity (Note 3)	$V_{DD} = 5V, V_O = 1.4V$ or $3.6V$	1.4		1.5		1.5		V	
		$V_{DD} = 10V, V_O = 2.8V$ or $7.2V$	2.9		3.0		3.0		V	
I_{DN}	Low Level Output Current (Note 4)	$V_{DD} = 5V, V_O = 0.4V$	0.5		0.4		0.28		mA	
		$V_{DD} = 10V, V_O = 0.5V$	1.1		0.9		0.65		mA	
I_{DP}	High Level Output Current (Note 4)	$V_{DD} = 5V, V_O = 2.5V$	-0.62		-0.5		-0.35		mA	
		$V_{DD} = 10V, V_O = 9.5V$	-0.62		-0.5		-0.35		mA	
I_{IN}	Input Current	$V_{DD} = 15V, V_{IN} = 0V$	-1.0		-0.1	-10^{-5}	-1.0		μA	
		$V_{DD} = 15V, V_{IN} = 15V$		1.0		10^{-5}	0.1	1.0	μA	

AC Electrical Characteristics* CD4000M $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}	Propagation Delay Time, High to Low Level	$V_{DD} = 5V$		40	50	ns
		$V_{DD} = 10V$		20	40	ns
t_{PLH}	Propagation Delay Time, Low to High Level	$V_{DD} = 5V$		50	95	ns
		$V_{DD} = 10V$		25	45	ns
t_{THL}	Transition Time, High to Low Level	$V_{DD} = 5V$		50	125	ns
		$V_{DD} = 10V$		20	70	ns
t_{TLH}	Transition Time, Low to High Level	$V_{DD} = 5V$		70	175	ns
		$V_{DD} = 10V$		35	75	ns
C_I	Input Capacitance	Any Input		5		pF
C_{PD}	Power Dissipation Capacitance	(Note 5)		35		pF

*AC Parameters are guaranteed by DC correlated testing.

DC Electrical Characteristics CD4000C (Note 2)

Symbol	Parameter	Conditions	-40°C		+25°C			+85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I _{DD}	Quiescent Device Current	V _{DD} = 5V V _{DD} = 10V		0.05			0.05		15	μA
				5			5		30	μA
V _{OL}	Low Level Output Voltage	V _{DD} = 5V V _{DD} = 10V		0.05			0.05		0.05	V
				0.05			0.05		0.05	V
V _{OH}	High Level Output Voltage	V _{DD} = 5V V _{DD} = 10V	4.95		4.95		4.95			V
			9.95		9.95		9.95			V
V _{NL}	Noise Immunity (Note 3)	V _{DD} = 5V, V _O = 1.4V or 3.6V V _{DD} = 10V, V _O = 2.8V or 7.2V	1.5		1.5		1.4			V
			3.0		3.0		2.9			V
V _{NH}	Noise Immunity (Note 3)	V _{DD} = 5V, V _O = 1.4V or 3.6V V _{DD} = 10V, V _O = 2.8V or 7.2V	1.4		1.5		1.5			V
			2.9		3.0		3.0			V
I _{DL}	Low Level Output Current (Note 4)	V _{DD} = 5V, V _O = 0.4V V _{DD} = 10V, V _O = 0.5V	0.35		0.3		0.24			mA
			0.72		0.6		0.48			mA
I _{DP}	High Level Output Current (Note 4)	V _{DD} = 5V, V _O = 2.5V V _{DD} = 10V, V _O = 9.5V	-0.35		-0.3		-0.24			mA
			-0.3		-0.25		-0.2			mA
I _{IN}	Input Current	V _{DD} = 15V, V _{IN} = 0V V _{DD} = 15V, V _{IN} = 15V	-0.3		-0.3	-10 ⁻⁵	-1.0			μA
				0.3		10 ⁻⁵	0.1	1.0		μA

AC Electrical Characteristics* CD4000C T_A = 25°C, C_L = 50 pF, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t _{PHL}	Propagation Delay Time, High to Low Level	V _{DD} = 5V		40	80	ns
		V _{DD} = 10V		20	55	ns
t _{PLH}	Propagation Delay Time Low to High Level	V _{DD} = 5V		50	120	ns
		V _{DD} = 10V		25	65	ns
t _{THL}	Transition Time, High to Low Level	V _{DD} = 5V		50	200	ns
		V _{DD} = 10V		20	115	ns
t _{TLH}	Transition Time, Low to High Level	V _{DD} = 5V		70	300	ns
		V _{DD} = 10V		35	125	ns
C _i	Input Capacitance	Any Input		5		pF
C _{PD}	Power Dissipation Capacitance	(Note 5)		35		pF

*AC Parameters are guaranteed by DC correlated testing.

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.

Note 2: V_{SS} = 0V unless otherwise specified.

Note 3: For the NOR gates V_{NH} and V_{NL} are tested at each input while all other inputs are at V_{SS}.

Note 4: I_{DN} and I_{DP} are tested one output at a time.

Note 5: C_{PD} determines the no load AC power consumption of any CMOS device. For explanation see 54C/74C Family Characteristics Application Note, AN-90.