National Semiconductor

CD4000M/CD4000C Dual 3-Input NOR Gate Plus Inverter

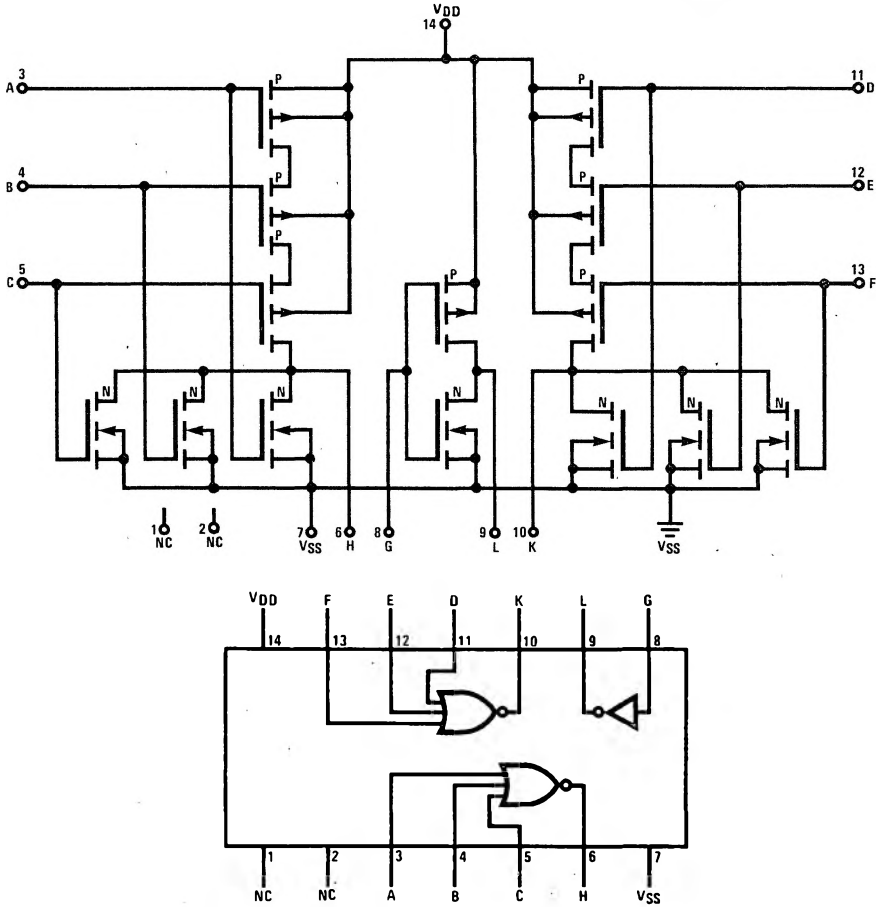
General Description

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 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.)

Schematic and Connection Diagram



Absolute Maximum Ratings (Note 1)

Voltage at Any Pin	V_{SS} −0.3 V to V_{DD} + 0.3 V
Operating Temperature Range	
CD4000M	−55°C to +125°C
CD4000C	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Package Dissipation	500 mW
Operating V_{DD} Range	V_{SS} + 3 V to V_{SS} + 15 V
Lead Temperature (Soldering, 10 seconds)	300°C

DC Electrical Characteristics CD4000M (Note 2)

PARAMETER		CONDITIONS	−55°C		+25°C			+125°C		UNITS
			MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD}	Quiescent Device Current	V_{DD} = 5 V		0.05			0.05		3	μA
		V_{DD} = 10 V		0.1			0.1		6	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5 V		0.05			0.05		0.05	V
		V_{DD} = 10 V		0.05			0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5 V	4.95		4.95			4.95		V
		V_{DD} = 10 V	9.95		9.95			9.95		V
V_{NL}	Noise Immunity (Note 3)	V_{DD} = 5 V, V_O = 1.4 V or 3.6 V	1.5		1.5			1.4		V
		V_{DD} = 10 V, V_O = 2.8 V or 7.2 V	3.0		3.0			2.9		V
V_{NH}	Noise Immunity (Note 3)	V_{DD} = 5 V, V_O = 1.4 V or 3.6 V	1.4		1.5			1.5		V
		V_{DD} = 10 V, V_O = 2.8 V or 7.2 V	2.9		3.0			3.0		V
I_{DN}	Low Level Output Current	V_{DD} = 5 V, V_O = 0.4 V	0.5		0.4			0.28		mA
		V_{DD} = 10 V, V_O = 0.5 V	1.1		0.9			0.65		mA
I_{DP}	High Level Output Current	V_{DD} = 5 V, V_O = 2.5 V	−0.62		−0.5			−0.35		mA
		V_{DD} = 10 V, V_O = 9.5 V	−0.62		−0.5			−0.35		mA
I_{IN}	Input Current	V_{DD} = 15 V, V_{IN} = 0 V	−1.0		−0.1	-10^{-5}		−1.0		μA
		V_{DD} = 15 V, V_{IN} = 15 V		1.0		10^{-5}	0.1		1.0	μA

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} = 0 V 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: C_{PD} determines the no load AC power consumption of any CMOS device. For explanation see 54C/74C Family Characteristics application note, AN-90.

AC Electrical Characteristics CD4000M T_A = 25°C, C_L = 50 pF, unless otherwise noted

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
t_{PHL}	Propagation Delay Time, High to Low Level	V_{DD} = 5 V		40	50	ns
		V_{DD} = 10 V		20	40	ns
t_{PLH}	Propagation Delay Time, Low to High Level	V_{DD} = 5 V		50	95	ns
		V_{DD} = 10 V		25	45	ns
t_{THL}	Transition Time, High to Low Level	V_{DD} = 5 V		50	125	ns
		V_{DD} = 10 V		20	70	ns
t_{TLH}	Transition Time, Low to High Level	V_{DD} = 5 V		70	175	ns
		V_{DD} = 10 V		35	75	ns
C_I	Input Capacitance	Any Input		5		pF
C_{PD}	Power Dissipation Capacitance	(Note 4)		35		pF

DC Electrical Characteristics C4000C (Note 2)

PARAMETER		CONDITIONS	−40°C		+25°C			+85°C		UNITS
			MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD}	Quiescent Device Current	V_{DD} = 5 V		0.5			0.5		15	μA
		V_{DD} = 10 V		5			5		30	μA
V_{OL}	Low Level Output Voltage	V_{DD} = 5 V		0.05			0.05		0.05	V
		V_{DD} = 10 V		0.05			0.05		0.05	V
V_{OH}	High Level Output Voltage	V_{DD} = 5 V	4.95		4.95			4.95		V
		V_{DD} = 10 V	9.95		9.95			9.95		V
V_{NL}	Noise Immunity (Note 3)	V_{DD} = 5 V, V_O = 1.4 V or 3.6 V	1.5		1.5			1.4		V
		V_{DD} = 10 V, V_O = 2.8 V or 7.2 V	3.0		3.0			2.9		V
V_{NH}	Noise Immunity (Note 3)	V_{DD} = 5 V, V_O = 1.4 V or 3.6 V	1.4		1.5			1.5		V
		V_{DD} = 10 V, V_O = 2.8 V or 7.2 V	2.9		3.0			3.0		V
I_{DN}	Low Level Output Current	V_{DD} = 5 V, V_O = 0.4 V	0.35		0.3			0.24		mA
		V_{DD} = 10 V, V_O = 0.5 V	0.72		0.6			0.48		mA
I_{DP}	High Level Output Current	V_{DD} = 5 V, V_O = 2.5 V	−0.35		−0.3			−0.24		mA
		V_{DD} = 10 V, V_O = 9.5 V	−0.3		−0.25			−0.2		mA
I_{IN}	Input Current	V_{DD} = 15 V, V_{IN} = 0 V	−0.3		−0.3	-10^{-5}		−1.0		μA
		V_{DD} = 15 V, V_{IN} = 15 V		0.3		10^{-5}	0.1		1.0	μA

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

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
t_{PHL}	Propagation Delay Time, High to Low Level	V_{DD} = 5 V		40	80	ns
		V_{DD} = 10 V		20	55	ns
t_{PLH}	Propagation Delay Time, Low to High Level	V_{DD} = 5 V		50	120	ns
		V_{DD} = 10 V		25	65	ns
t_{THL}	Transition Time, High to Low Level	V_{DD} = 5 V		50	200	ns
		V_{DD} = 10 V		20	115	ns
t_{TLH}	Transition Time, Low to High Level	V_{DD} = 5 V		70	300	ns
		V_{DD} = 10 V		35	125	ns
C_I	Input Capacitance	Any Input		5		pF
C_{PD}	Power Dissipation Capacitance	(Note 4)		35		pF