

CD4009M/CD4009C Hex Buffers (Inverting) **CD4010M/CD4010C Hex Buffers (Non-Inverting)**

General Description

These hex buffers are monolithic complementary MOS (CMOS) integrated circuits. The 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. These gates may be used as hex buffers, CMOS to DTL or TTL interface or as CMOS current drivers. Conversion ranges are from 3V to 15V providing $V_{CC} \leq V_{DD}$.

Features

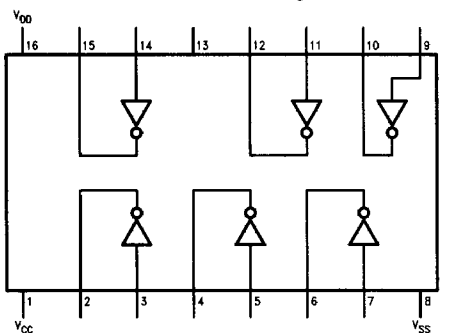
- Wide supply voltage range 3.0V to 15V
- Low power 100 nW (typ.)
- High noise immunity $0.45 V_{DD}$ (typ.)
- High current sinking capability 8 mA (min.) at $V_O = 0.5V$ and $V_{DD} = 10V$

Applications

- Automotive
- Data terminals
- Instrumentation
- Medical electronics
- Alarm system
- Industrial controls
- Remote metering
- Computers

Schematic and Connection Diagrams

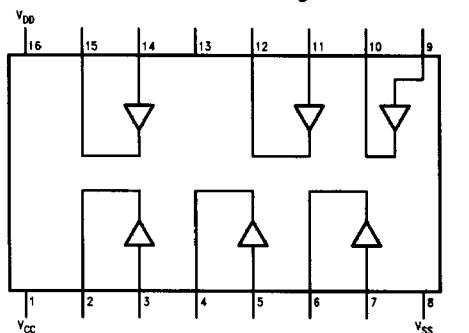
Dual-In-Line Package



Top View

TL/F/5945-2

Dual-In-Line Package



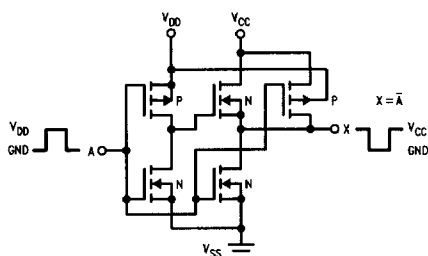
Top View

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Order Number CD4009* or CD4010*

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

CD4009M/CD4009C



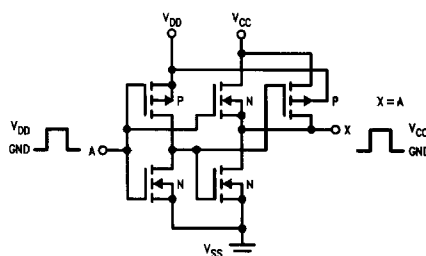
Hex COS/MOS to DTL or TTL converter (non-inverting).

Connect V_{CC} to DTL or TTL supply.

Connect V_{DD} to COS/MOS supply.

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CD4010M/CD4010C



Hex COS/MOS to DTL or TTL converter (inverting).

Connect V_{CC} to DTL or TTL supply.

Connect V_{DD} to COS/MOS supply.

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Absolute Maximum Ratings

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

Voltage at Any Pin (Note 1) $V_{SS} - 0.3V$ to $V_{SS} + 15.5V$

Operating Temperature Range

CD40XXM $-55^{\circ}C$ to $+125^{\circ}C$

CD40XXC $-45^{\circ}C$ to $+85^{\circ}C$

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

Power Dissipation (P_D)

Dual-In-Line 700 mW

Small Outline 500 mW

Lead Temperature (T_L)

(Soldering, 10 seconds) $260^{\circ}C$

Operating Range (V_{DD})

$V_{SS} + 3V$ to $V_{SS} + 15V$

DC Electrical Characteristics

Symbol	Characteristics	Test Conditions (Volts)		Limits														Units
				CD40XXM						CD40XXC								
				-55°C		+25°C		+125°C		-40°C		+25°C			+85°C			
		V _O	V _{DD}	Min	Max	Min	Typ	Max	Min	Max	Min	Max	Min	Typ	Max	Min	Max	
I _{CC}	Quiescent Device Current		5 10		0.3 0.5		0.01 0.01	0.3 0.5		20 30		3 5		0.03 0.05	3 5		42 70	μA μA
P _D	Quiescent Device Dissipation/Package		5 10		1.5 5		0.05 0.1	1.5 5		100 300		15 50		0.15 0.5	15 50		210 700	μW μW
V _{OL}	Output Voltage Low Level		5 10		0.01 0.01		0 0	0.01 0.01		0.05 0.05		0.01 0.01		0 0	0.01 0.01		0.05 0.05	V V
V _{OH}	High Level		5 10	4.99 9.99		4.99 9.99	5 10		4.95 9.95		4.99 9.99		4.99 9.99	5 10		4.95 9.95		V V
V _{NL}	Noise Immunity (All Inputs)																	
	CD4009M	$V_O \geq 4.0$	5	1		1	2.25		0.9		1		1	2.25		0.9		V
		$V_O \geq 8.0$	10	2		2	4.5		1.9		2		2	4.5		1.9		V
V _{NL}	CD4010M	$V_O \geq 1.5$	5	1.6		1.5	2.25		1.4		1.6		1.5	2.25		1.4		V
		$V_O \geq 3.0$	10	3.2		3	4.5		2.9		3.2		3	4.5		2.9		V
V _{NH}		$V_O \geq 3.5$	5	1.4		1.5	2.25		1.5		1.4		1.5	2.25		1.5		V
		$V_O \geq 7.0$	10	2.9		3	4.5		3		2.9		3	4.5		3		V
I _{DN}	Output Drive Current N-Channel (Note 2)	0.4 0.5	5 10	3.75 10		3 8	4 10		2.1 5.6		3.6 9.6		3 8			2.4 6.4		mA mA
I _{DP}	P-Channel (Note 2)	2.5 9.5	5 10	-1.85 -0.9		-1.25 -0.6	-1.75 -0.8		-0.9 -0.4		-1.5 -0.72		-1.25 -0.6			-1 -0.48		mA mA
I _{IN}	Input Current						10							10				pA

Note 1: This device should not be connected to circuits with the power on because high transient voltage may cause permanent damage.

Note 2: I_{DN} and I_{DP} are tested one output at a time.

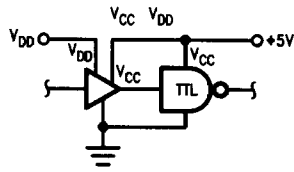
AC Electrical Characteristics*

$T_A = 25^{\circ}C$, $C_L = 15$ pF, unless otherwise noted. Typical Temperature coefficient for all values of $V_{DD} = 0.3\%/^{\circ}C$

Characteristics	Test Conditions	Limits							Units
		V _{DD} (Volts)	CD40XXM			CD40XXC			
			Min	Typ	Max	Min	Typ	Max	
Propagation Delay Time: High-to-Low Level (t _{PHL})	V _{CC} = V _{DD}	5	—	15	55	—	15	70	ns
	V _{DD} = 10V V _{CC} = 5V	10	—	10	30	—	10	40	
			—	10	25	—	10	35	
Low-to-High Level (t _{PLH})	V _{CC} = V _{DD}	5	—	50	80	—	50	100	ns
	V _{DD} = 10V V _{CC} = 5V	10	—	25	55	—	25	70	
			—	15	30	—	15	40	
Transition Time: High-to-Low Level (t _{THL})	V _{CC} = V _{DD}	5	—	20	45	—	20	60	ns
		10	—	16	40	—	16	50	
Low-to-High Level (t _{TLH})	V _{CC} = V _{DD}	5	—	80	125	—	80	160	ns
		10	—	50	100	—	50	120	
Input Capacitance (C _i)	Any Input		—	5	—	—	5	—	pF

*AC Parameters are guaranteed by DC correlated testing.

Typical Application



TL/F/5945-5