

February 1988

CD4007M/CD4007C Dual Complementary Pair Plus Inverter

General Description

The CD4007M/CD4007C consists of three complementary pairs of N- and P-channel enhancement mode MOS transistors suitable for series/shunt applications. All inputs are protected from static discharge by diode clamps to V_{DD} and V_{SS} .

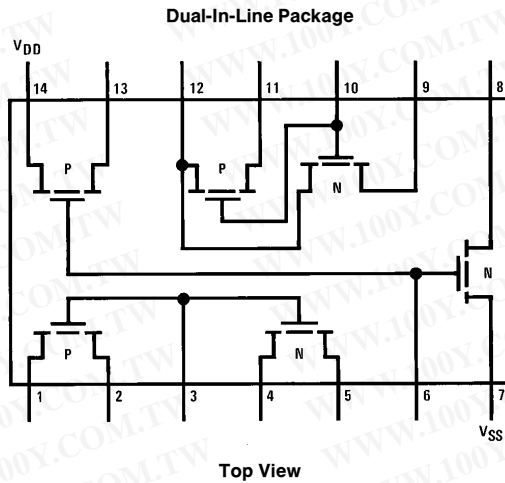
For proper operation the voltages at all pins must be constrained to be between $V_{SS} - 0.3V$ and $V_{DD} + 0.3V$ at all times.

Features

- Wide supply voltage range
- High noise immunity

3.0V to 15V
 0.45 V_{CC} (typ.)

Connection Diagram



Note: All P-channel substrates are connected to V_{DD}
 and all N-channel substrates are connected to V_{SS} .

Order Number CD4007

CD4007M/CD4007C Dual Complementary Pair Plus Inverter

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please 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
 CD4007M $-55^{\circ}C$ to $+125^{\circ}C$
 CD4007C $-40^{\circ}C$ to $+85^{\circ}C$

Storage Temperature Range $-65^{\circ}C$ to $+150^{\circ}C$
 Power Dissipation (P_D)
 Dual-In-Line 700 mW
 Small Outline 500 mW
 Operating V_{DD} Range $V_{SS} + 3.0V$ to $V_{SS} + 15V$
 Lead Temperature (Soldering, 10 seconds) $260^{\circ}C$

DC Electrical Characteristics CD4007M

Symbol	Parameter	Conditions	Limits									Units
			$-55^{\circ}C$			$+25^{\circ}C$			$+125^{\circ}C$			
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_L	Quiescent Device Current	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.05		0.001	0.05			3.0	μA
					0.1		0.001	0.1			6.0	μA
P_D	Quiescent Device Dissipation Package	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.25		0.005	0.25			15	μW
					1.0		0.001	1.0			60	μW
V_{OL}	Output Voltage Low Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.05		0	0.05			0.05	V
					0.05		0	0.05			0.05	V
V_{OH}	Output Voltage High Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$	4.95		4.95	5.0		4.95				V
			9.95		9.95	10		9.95				V
V_{NL}	Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 3.6V$ $V_{DD} = 10V, V_O = 7.2V$			1.5		2.25	1.5			1.4	V
					3.0		4.5	3.0			2.9	V
V_{NH}	Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 0.95V$ $V_{DD} = 10V, V_O = 2.9V$	3.6		3.5	2.25		3.5				V
			7.1		7.0	4.5		7.0				V
I_{DN}	Output Drive Current N-Channel	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$ $V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	0.75		0.6	1.0		0.4				mA
			1.6		1.3	2.5		0.95				mA
I_{DP}	Output Drive Current P-Channel	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$ $V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-1.75		-1.4	-4.0		-1.0				mA
			-1.35		-1.1	-2.5		-0.75				mA
I_I	Input Current					10					pA	

DC Electrical Characteristics CD4007C

Symbol	Parameter	Conditions	Limits									Units
			$-40^{\circ}C$			$+25^{\circ}C$			$+85^{\circ}C$			
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_L	Quiescent Device Current	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.5		0.005	0.05			15	μA
					1.0		0.005	1.0			30	μA
P_D	Quiescent Device Dissipation Package	$V_{DD} = 5.0V$ $V_{DD} = 10V$			2.5		0.025	2.5			75	μW
					10		0.05	10			300	μW
V_{OL}	Output Voltage Low Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.05		0	0.01			0.05	V
					0.05		0	0.01			0.05	V
V_{OH}	Output Voltage High Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$	4.95		4.95	5.0		4.95				V
			9.95		9.95	10		9.95				V
V_{NL}	Noise Immunity (All inputs)	$V_{DD} = 5.0V, V_O = 3.6V$ $V_{DD} = 10V, V_O = 7.2V$			1.5		2.25	1.5			1.4	V
					3.0		4.5	3.0			2.9	V
V_{NH}	Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_O = 0.95V$ $V_{DD} = 10V, V_O = 2.9V$	3.6		3.5	2.25		3.5				V
			7.1		7.0	4.5		7.0				V
I_{DN}	Output Drive Current N-Channel	$V_{DD} = 5.0V, V_O = 0.4V, V_I = V_{DD}$ $V_{DD} = 10V, V_O = 0.5V, V_I = V_{DD}$	0.35		0.3	1.0		0.24				mA
			1.2		1.0	2.5		0.8				mA
I_{DP}	Output Drive Current P-Channel	$V_{DD} = 5.0V, V_O = 2.5V, V_I = V_{SS}$ $V_{DD} = 10V, V_O = 9.5V, V_I = V_{SS}$	-1.3		-1.1	-4.0		-0.9				mA
			-0.65		-0.55	-2.5		-0.45				mA
I_I	Input Current					10					pA	

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

AC Electrical Characteristics* CD4007M

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PLH} = t_{PHL}$	Propagation Delay Time	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$		35 20	60 40	ns
$t_{TLH} = t_{THL}$	Transition Time	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$		50 30	75 40	ns
C_i	Input Capacitance	Any Input		5.0		pF

*AC Parameters may be generated by DC correlated testing.

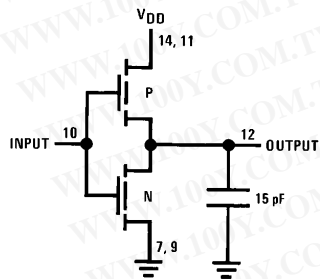
AC Electrical Characteristics* CD4007C

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

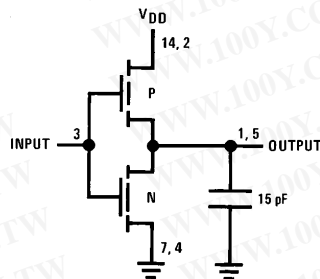
Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PLH} = t_{PHL}$	Propagation Delay Time	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$		35 20	75 50	ns
$t_{TLH} = t_{THL}$	Transition Time	$V_{DD} = 5.0\text{V}$ $V_{DD} = 10\text{V}$		50 30	100 50	ns
C_i	Input Capacitance	Any Input		5		pF

*AC Parameters are guaranteed by DC correlated testing.

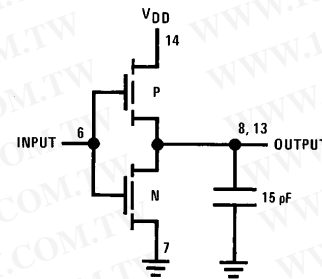
AC Test Circuits



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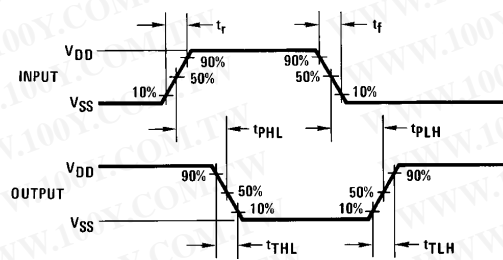


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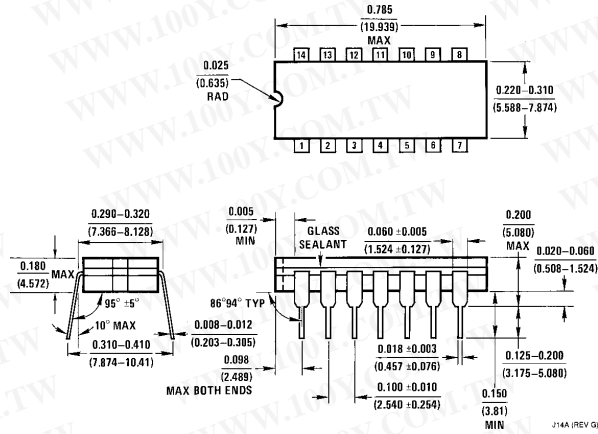
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Switching Time Waveforms

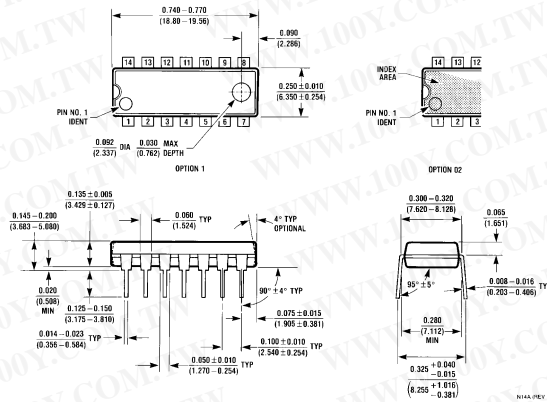


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Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number CD4007MJ or CD4007CJ
NS Package Number J14A



Molded Dual-In-Line Package (N)
Order Number CD4007MN or CD4007CN
NS Package Number N14A

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