

## 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  $V_{SS}$ .

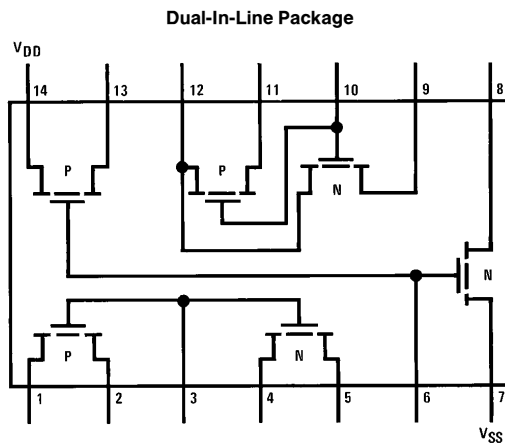
For proper operation the voltages at all pins must be constrained to be between  $V_{SS} - 0.3V$  and  $V_{DD} + 0.3V$  at all times.

### Features

- Wide supply voltage range
- High noise immunity

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

### Connection Diagram



TL/F/5943-1

**Top View**

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

**Order Number CD4007**

## 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°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	$\mu A$
					0.1		0.001	0.1			6.0	$\mu A$
$P_D$	Quiescent Device Dissipation Package	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.25		0.005	0.25			15	$\mu W$
					1.0		0.001	1.0			60	$\mu W$
$V_{OL}$	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	$\mu A$
					1.0		0.005	1.0			30	$\mu A$
$P_D$	Quiescent Device Dissipation Package	$V_{DD} = 5.0V$ $V_{DD} = 10V$			2.5		0.025	2.5			75	$\mu W$
					10		0.05	10			300	$\mu W$
$V_{OL}$	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	$V_{DD} = 5.0\text{V}$		35	60	ns
		$V_{DD} = 10\text{V}$		20	40	ns
$t_{TLH} = t_{THL}$	Transition Time	$V_{DD} = 5.0\text{V}$		50	75	ns
		$V_{DD} = 10\text{V}$		30	40	ns
$C_I$	Input Capacitance	Any Input		5.0		pF

\*AC Parameters may be generated by DC correlated testing.

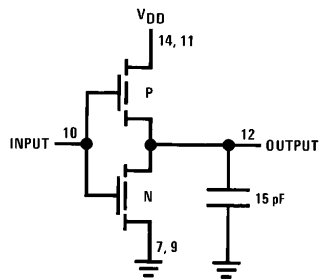
### AC Electrical Characteristics\* CD4007C

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

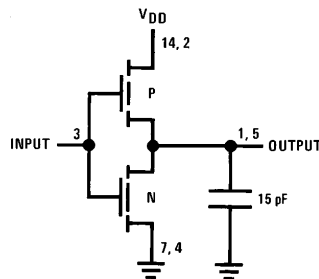
Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PLH} = t_{PHL}$	Propagation Delay Time	$V_{DD} = 5.0\text{V}$		35	75	ns
		$V_{DD} = 10\text{V}$		20	50	ns
$t_{TLH} = t_{THL}$	Transition Time	$V_{DD} = 5.0\text{V}$		50	100	ns
		$V_{DD} = 10\text{V}$		30	50	ns
$C_I$	Input Capacitance	Any Input		5		pF

\*AC Parameters are guaranteed by DC correlated testing.

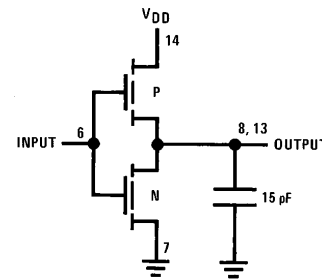
### AC Test Circuits



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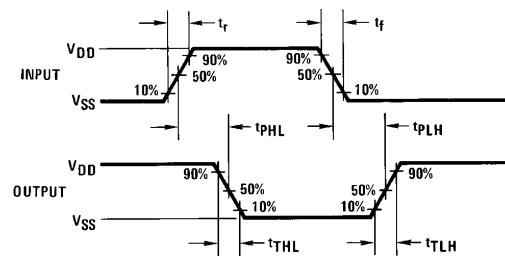


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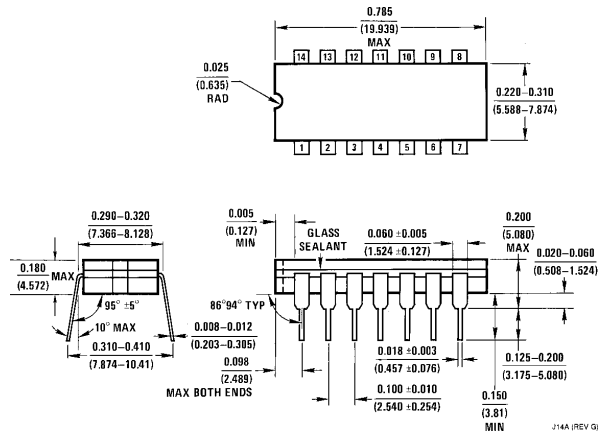
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### Switching Time Waveforms

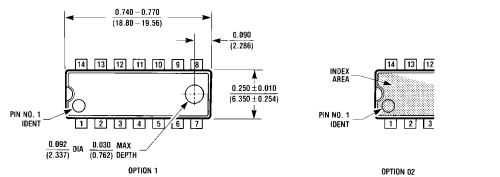


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**Physical Dimensions** inches (millimeters)



**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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