

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_{CC}

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

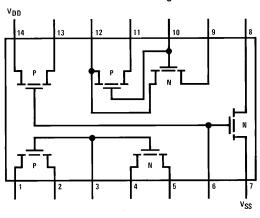
Features

- Wide supply voltage range
- High noise immunity

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

Connection Diagram

Dual-In-Line Package



TL/F/5943-1

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

Order Number CD4007

Top View

Absolute Maximum Ratings (Note 1)
If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

 $V_{\mbox{\footnotesize SS}}$ $-0.3\mbox{\footnotesize V}$ to $V_{\mbox{\footnotesize DD}}$ $+0.3\mbox{\footnotesize V}$ Voltage at Any Pin

Operating Temperature Range CD4007M -55°C to $+125^{\circ}\text{C}$ CD4007C -40°C to $+85^{\circ}\text{C}$ Storage Temperature Range

Power Dissipation (PD) Dual-In-Line Small Outline

500 mW

Operating V_{DD} Range Lead Temperature (Soldering, 10 seconds) $V_{\mbox{\footnotesize SS}} + 3.0 \mbox{\footnotesize V}$ to $V_{\mbox{\footnotesize SS}} + 15 \mbox{\footnotesize V}$

 -65°C to $+150^{\circ}\text{C}$

260°C

700 mW

DC Electrical Characteristics CD4007M

			Limits									
Symbol	Parameter	Conditions	−55°C			+ 25°C			+ 125°C			Units
			Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	
IL	Quiescent Device Current	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.05 0.1		0.001 0.001	0.05 0.1			3.0 6.0	μA μA
P _D	Quiescent Device Dissipation Package	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.25 1.0		0.005 0.001	0.25 1.0			15 60	μW μW
V _{OL}	Output Voltage Low Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.05 0.05		0	0.05 0.05			0.05 0.05	V
V _{OH}	Output Voltage High Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$	4.95 9.95			4.95 9.95	5.0 10		4.95 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 3.0		2.25 4.5	1.5 3.0			1.4 2.9	V
V _{NH}	Noise Immunity (All Inputs)	$V_{DD} = 50V, V_{O} = 0.95V$ $V_{DD} = 10V, V_{O} = 2.9V$	3.6 7.1			3.5 7.0	2.25 4.5		3.5 7.0			V
I _D N	Output Drive Current N-Channel	$\begin{aligned} V_{DD} &= 5.0 \text{V}, V_O = 0.4 \text{V}, V_I = V_{DD} \\ V_{DD} &= 10 \text{V}, V_O = 0.5 \text{V}, V_I = V_{DD} \end{aligned}$	0.75 1.6			0.6 1.3	1.0 2.5		0.4 0.95			mA mA
I _D P	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 -1.35	l .		-1.4 -1.1	-4.0 -2.5		-1.0 -0.75			mA mA
<u>lı</u>	Input Current						10					pА

DC Electrical Characteristics CD4007C

	Parameter	Conditions	Limits									
Symbol			-40°C			+ 25°C			+ 85°C			Units
			Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	
IL.	Quiescent Device Current	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.5 1.0		0.005 0.005				15 30	μA μA
P _D	Quiescent Device Dissipation Package	$V_{DD} = 5.0V$ $V_{DD} = 10V$			2.5 10		0.025 0.05	2.5 10			75 300	μW μW
V _{OL}	Output Voltage Low Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$			0.05 0.05		0	0.01 0.01			0.05 0.05	> >
V _{OH}	Output Voltage High Level	$V_{DD} = 5.0V$ $V_{DD} = 10V$	4.95 9.95			4.95 9.95	5.0 10		4.95 9.95			> >
V _{NL}	Noise Immunity (All inputs)	$V_{DD} = 5.0V, V_{O} = 3.6V$ $V_{DD} = 10V, V_{O} = 7.2V$			1.5 3.0		2.25 4.5	1.5 3.0			1.4 2.9	> >
V _{NH}	Noise Immunity (All Inputs)	$V_{DD} = 5.0V, V_{O} = 0.95V$ $V_{DD} = 10V, V_{O} = 2.9V$	3.6 7.1			3.5 7.0	2.25 4.5		3.5 7.0			> >
I _D N	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 1.2			0.3 1.0	1.0 2.5		0.24 0.8			mA mA
I _D P	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 -0.65			-1.1 -0.55	-4.0 -2.5		-0.9 -0.45			mA mA
II	Input Current						10					pА

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

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

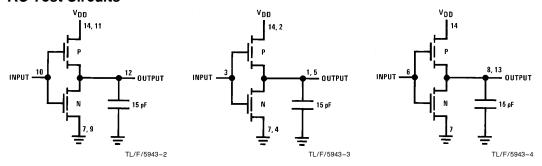
^{*}AC Parameters may be generated by DC correlated testing.

 $\begin{tabular}{lll} \textbf{AC Electrical Characteristics*} & CD4007C \\ T_A = 25^{\circ}C \ and \ C_L = 15 \ pF \ and \ rise \ and \ fall \ times = 20 \ ns. \ Typical \ temperature \ coefficient \ for \ all \ values \ of \ V_{DD} = 0.3\%/^{\circ}C \ and \ C_{DD} =$

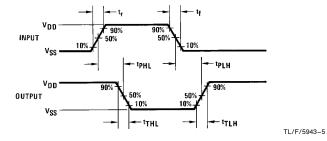
Symbol	Parameter	Conditions	Min	Тур	Max	Units
t _{PLH} = t _{PHL}	Propagation Delay Time	$V_{DD} = 5.0V$		35	75	ns
		$V_{DD} = 10V$		20	50	ns
$t_{TLH} = t_{THL}$	Transition Time	$V_{DD} = 5.0V$		50	100	ns
		$V_{DD} = 10V$		30	50	ns
C _I	Input Capacitance	Any Input		5		pF

^{*}AC Parameters are guaranteed by DC correlated testing.

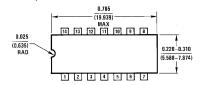
AC Test Circuits

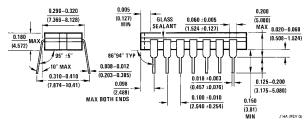


Switching Time Waveforms

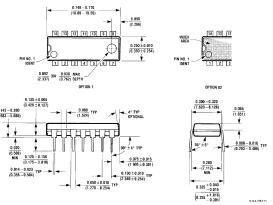


Physical Dimensions inches (millimeters)





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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