



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} .

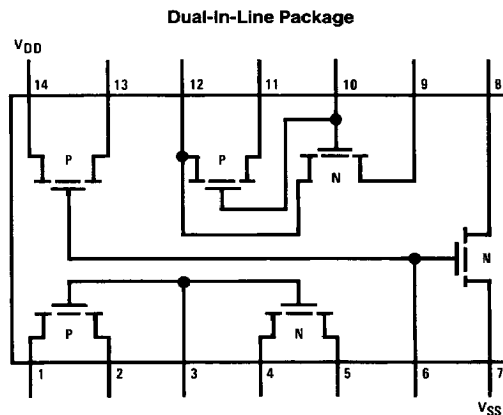
For proper operation the voltages at all pins must be constrained to be between $V_{SS} - 0.3V$ and $V_{DD} + 0.3V$ at all times.

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*

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

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, 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°C			+25°C			+125°C			
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I _L	Quiescent Device Current	V _{DD} = 5.0V V _{DD} = 10V			0.05 0.1		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	0.05 0.05			0.05 0.05	V 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
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
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 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 1.6			0.6 1.3	1.0 2.5		0.4 0.95			mA 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 −1.35			−1.4 −1.1	−4.0 −2.5		−1.0 −0.75			mA mA
I _I	Input Current						10					pA

DC Electrical Characteristics CD4007C

Symbol	Parameter	Conditions	Limits									Units
			− 40°C			+ 25°C			+ 85°C			
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I _L	Quiescent Device Current	V _{DD} = 5.0V V _{DD} = 10V			0.5 1.0		0.005 0.005	0.05 1.0			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	0.01 0.01			0.05 0.05	V 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
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
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			V 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 1.2			0.3 1.0	1.0 2.5		0.24 0.8			mA 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 −0.65			−1.1 −0.55	−4.0 −2.5		−0.9 −0.45			mA 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

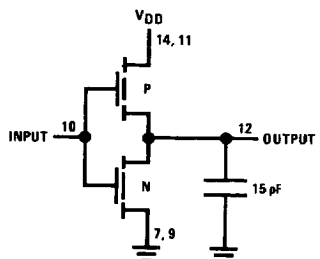
*AC Parameters may be generated by DC correlated testing.

AC Electrical Characteristics* CD4007C

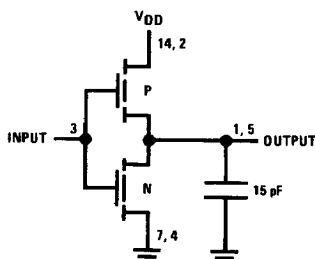
$T_A = 25^\circ\text{C}$ and $C_L = 15\text{ pF}$ and rise and fall times = 20 ns. Typical temperature coefficient for all values of $V_{DD} = 0.3\%/^\circ\text{C}$

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

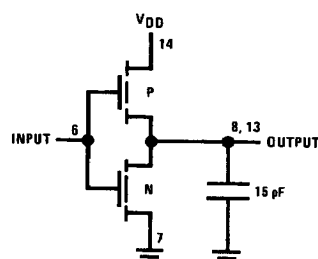
*AC Parameters are guaranteed by DC correlated testing.

AC Test Circuits

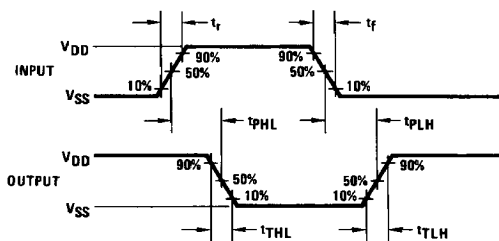
TL/F/5943-2



TL/F/5943-3



TL/F/5943-4

Switching Time Waveforms

TL/F/5943-5