



CD4069M/CD4069C Inverter Circuits

General Description

The CD4069B consists of six inverter circuits and is manufactured using complementary MOS (CMOS) to achieve wide power supply operating range, low power consumption, high noise immunity, and symmetric controlled rise and fall times.

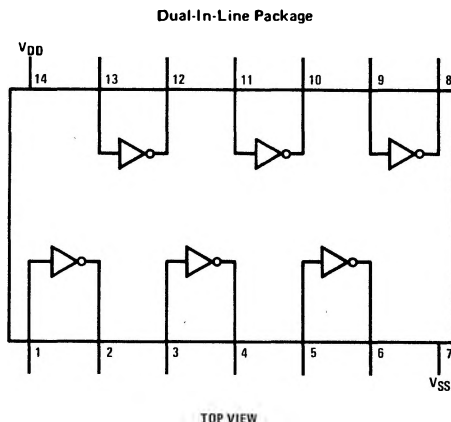
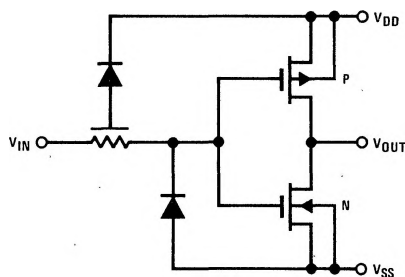
This device is intended for all general purpose inverter applications where the special characteristics of the MM74C901, MM74C903, MM74C907, and CD4049A Hex Inverter/Buffers are not required. In those applications requiring larger noise immunity the MM74C14 or MM74C914 Hex Schmitt Trigger is suggested.

All inputs are protected from damage due to static discharge by diode clamps to V_{DD} and V_{SS} .

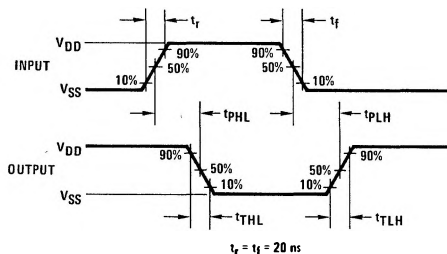
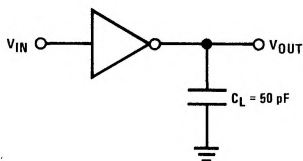
Features

- Wide supply voltage range 3.0V to 15V
- High noise immunity 0.45 V_{DD} typ.
- Low power TTL compatibility fan out of 2 driving 74L or 1 driving 74LS
- Equivalent to MM54C04/MM74C04

Schematic and Connection Diagrams



AC Test Circuits and Switching Time Waveforms



Absolute Maximum Ratings

Recommended Operating Conditions

(Notes 1 and 2)

V_{DD} dc Supply Voltage	-0.5 to +18 V_{DC}
V_{IN} Input Voltage	-0.5 to V_{DD} +0.5 V_{DC}
T_S Storage Temperature Range	-65°C to +150°C
P_D Package Dissipation	500 mW
T_L Lead Temperature (Soldering, 10 seconds)	300°C

(Note 2)

V_{DD} dc Supply Voltage	3 to 15 V_{DC}
V_{IN} Input Voltage	0 to V_{DD} V_{DC}
T_A Operating Temperature Range	-55°C to +125°C
CD4069M	-40°C to +85°C
CD4069C	

DC Electrical Characteristics

CD4069M (Note 2)

PARAMETER	CONDITIONS	-55°C		25°C			125°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD} Quiescent Device Current	$V_{DD} = 5V$		0.25			0.25		7.5	μA
	$V_{DD} = 10V$		0.5			0.5		15	μA
	$V_{DD} = 15V$		1.0			1.0		30	μA
V_{OL} Low Level Output Voltage	$ I_O < 1\mu A$								
	$V_{DD} = 5V$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V$		0.05		0	0.05		0.05	V
	$V_{DD} = 15V$		0.05		0	0.05		0.05	V
V_{OH} High Level Output Voltage	$ I_O < 1\mu A$								
	$V_{DD} = 5V$	4.95		4.95	5		4.95		V
	$V_{DD} = 10V$	9.95		9.95	10		9.95		V
	$V_{DD} = 15V$	14.95		14.95	15		14.95		V
V_{IL} Low Level Input Voltage	$ I_O < 1\mu A$								
	$V_{DD} = 5V, V_O = 4.5V$		1.5			1.5		1.5	V
	$V_{DD} = 10V, V_O = 9V$		3.0			3.0		3.0	V
	$V_{DD} = 15V, V_O = 13.5V$		4.0			4.0		4.0	V
V_{IH} High Level Input Voltage	$ I_O < 1\mu A$								
	$V_{DD} = 5V, V_O = 0.5V$	3.5		3.5			3.5		V
	$V_{DD} = 10V, V_O = 1V$	7.0		7.0			7.0		V
	$V_{DD} = 15V, V_O = 1.5V$	11.0		11.0			11.0		V
I_{OL} Low Level Output Current	$V_{DD} = 5V, V_O = 0.4V$	0.64		0.51	0.88		0.36		mA
	$V_{DD} = 10V, V_O = 0.5V$	1.6		1.3	2.25		0.9		mA
	$V_{DD} = 15V, V_O = 1.5V$	4.2		3.4	8.8		2.4		mA
I_{OH} High Level Output Current	$V_{DD} = 5V, V_O = 4.6V$	-0.64		-0.51	-0.88		-0.36		mA
	$V_{DD} = 10V, V_O = 9.5V$	-1.6		-1.3	-2.25		-0.9		mA
	$V_{DD} = 15V, V_O = 13.5V$	-4.2		-3.4	-8.8		-2.4		mA
I_{IN} Input Current	$V_{DD} = 15V, V_{IN} = 0V$		-0.10		-10^{-5}	-0.10		-1.0	μA
	$V_{DD} = 15V, V_{IN} = 15V$		0.10		10^{-5}	0.10		1.0	μA

DC Electrical Characteristics CD4069C (Note 2)

PARAMETER	CONDITIONS	-40°C		25°C			85°C		UNITS
		MIN	MAX	MIN	TYP	MAX	MIN	MAX	
I_{DD} Quiescent Device Current	$V_{DD} = 5V$		1.0			1.0		7.5	μA
	$V_{DD} = 10V$		2.0			2.0		15	μA
	$V_{DD} = 15V$		4.0			4.0		30	μA
V_{OL} Low Level Output Voltage	$ I_{OL} < 1\mu A$								
	$V_{DD} = 5V$		0.05		0	0.05		0.05	V
	$V_{DD} = 10V$		0.05		0	0.05		0.05	V
V_{OH} High Level Output Voltage	$ I_{OL} < 1\mu A$								
	$V_{DD} = 5V$	4.95		4.95			4.95		V
	$V_{DD} = 10V$	9.95		9.95			9.95		V
V_{IL} Low Level Input Voltage	$ I_{OL} < 1\mu A$								
	$V_{DD} = 5V, V_O = 4.5V$		1.5			1.5		1.5	V
	$V_{DD} = 10V, V_O = 9V$		3.0			3.0		3.0	V
V_{IH} High Level Input Voltage	$ I_{OL} < 1\mu A$								
	$V_{DD} = 5V, V_O = 0.5V$	3.5		3.5			3.5		V
	$V_{DD} = 10V, V_O = 1V$	7.0		7.0			7.0		V
I_{OL} Low Level Output Current	$V_{DD} = 5V, V_O = 0.4V$	0.52		0.44	0.88		0.36		mA
	$V_{DD} = 10V, V_O = 0.5V$	1.3		1.1	2.25		0.9		mA
	$V_{DD} = 15V, V_O = 1.5V$	3.6		8.0	8.8		2.4		mA
I_{OH} High Level Output Current	$V_{DD} = 5V, V_O = 4.6V$	-0.52		-0.44	-0.88		-0.36		mA
	$V_{DD} = 10V, V_O = 9.5V$	-1.3		-1.1	-2.25		-0.9		mA
	$V_{DD} = 15V, V_O = 13.5V$	-3.6		-8.0	-8.8		-2.4		mA
I_{IN} Input Current	$V_{DD} = 15V, V_{IN} = 0V$		-0.30		-10^{-5}	-0.30		-1.0	μA
	$V_{DD} = 15V, V_{IN} = 15V$		0.30		10^{-5}	0.30		1.0	μA

AC Electrical Characteristics $T_A = 25^\circ C$, $C_L = 50$ pF, $R_L = 200$ k Ω , t_r and $t_f \leq 20$ ns,
 unless otherwise specified

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
t_{PHL} or t_{PLH} Propagation Delay Time From Input To Output	$V_{DD} = 5V$		50	90	ns
	$V_{DD} = 10V$		30	60	ns
	$V_{DD} = 15V$		25	50	ns
t_{THL} or t_{TLH} Transition Time	$V_{DD} = 5V$		80	150	ns
	$V_{DD} = 10V$		50	100	ns
	$V_{DD} = 15V$		40	80	ns
C_{IN} Average Input Capacitance	Any Gate		6	7.5	pF
C_{PD} Power Dissipation Capacitance	Any Gate (Note 3)		12		pF

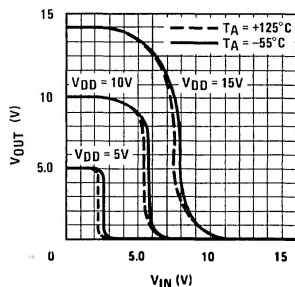
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

Note 2: $V_{SS} = 0V$ unless otherwise specified.

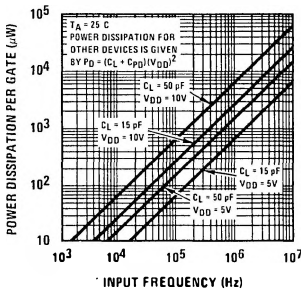
Note 3: C_{PD} determines the no load ac power consumption of any CMOS device. For complete explanation, see 54C/74C Family Characteristics application note—AN-90.

Typical Performance Characteristics

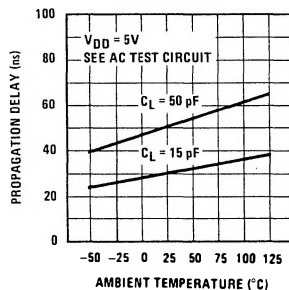
Gate Transfer Characteristics



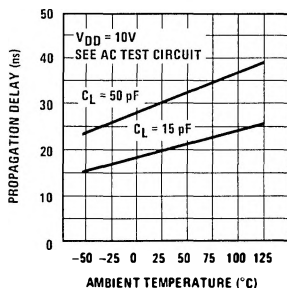
Power Dissipation vs Frequency



Propagation Delay vs Ambient Temperature



Propagation Delay vs Ambient Temperature



Propagation Delay Time vs Load Capacitance

