

# MM54HC4049/MM74HC4049 Hex Inverting Logic Level Down Converter

# MM54HC4050/MM74HC4050 Hex Logic Level Down Converter

## General Description

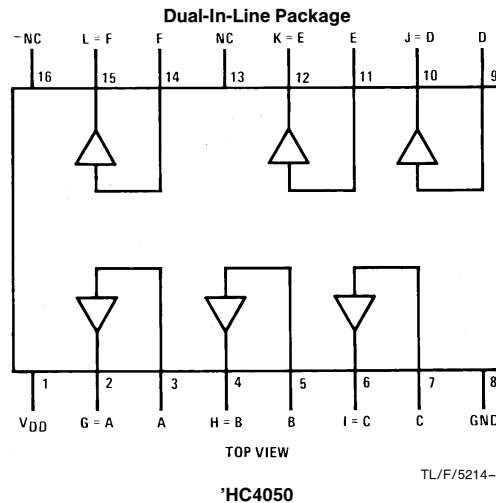
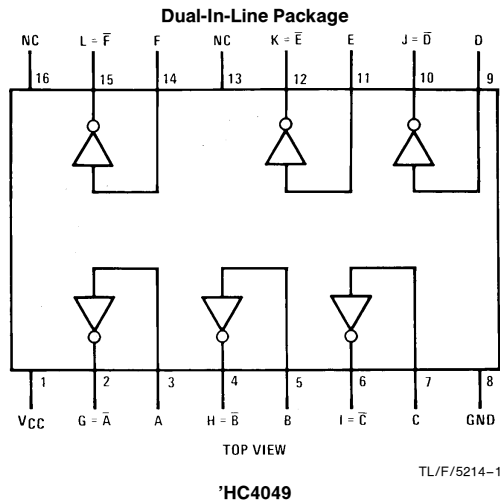
The MM54HC4049/MM74HC4049 and the MM54HC4050/MM74HC4050 utilize advanced silicon-gate CMOS technology, and have a modified input protection structure that enables these parts to be used as logic level translators which will convert high level logic to a low level logic while operating from the low logic supply. For example, 0–15V CMOS logic can be converted to 0–5V logic when using a 5V supply. The modified input protection has no diode connected to  $V_{CC}$ , thus allowing the input voltage to exceed the supply. The lower zener diode protects the input from both positive and negative static voltages. In addition each part can be used as a simple buffer or inverter without level translation. The MM54HC4049/MM74HC4049 is pin and functionally

compatible to the CD4049BM/CD4049BC and the MM54HC4050/MM74HC4050 is compatible to the CD4050BM/CD4050BC

## Features

- Typical propagation delay: 8 ns
- Wide power supply range: 2V–6V
- Low quiescent supply current: 20  $\mu$ A maximum (74HC)
- Fanout of 10 LS-TTL loads

## Connection Diagrams



Order Number MM54HC4049/MM54HC4050  
or MM74HC4049/MM74HC4050

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## Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage ( $V_{CC}$ )	-0.5 to +7.0V
DC Input Voltage ( $V_{IN}$ )	-1.5 to +18V
DC Output Voltage ( $V_{OUT}$ )	-0.5 to $V_{CC} + 0.5V$
Clamp Diode Current ( $I_{ZK}, I_{OK}$ )	-20 mA
DC Output Current, per pin ( $I_{OUT}$ )	$\pm 25$ mA
DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ )	$\pm 50$ mA
Storage Temp. Range ( $T_{STG}$ )	-65°C to +150°C
Power Dissipation ( $P_D$ ) (Note 3)	600 mW
S.O. Package only	500 mW
Lead Temp. ( $T_L$ ) (Soldering 10 seconds)	260°C

## Operating Conditions

	Min	Max	Units
Supply Voltage ( $V_{CC}$ )	2	6	V
DC Input Voltage ( $V_{IN}$ )	0	15	V
DC Output Voltage ( $V_{OUT}$ )	0	$V_{CC}$	V
Operating Temp. Range ( $T_A$ )			
MM74HC	-40	+85	°C
MM54HC	-55	+125	°C
Input Rise or Fall Times ( $t_r, t_f$ )			
$V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

## DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	$V_{CC}$	$T_A = 25^\circ C$			Units	
				74HC $T_A = -40^\circ C$ to $85^\circ C$		54HC $T_A = -55^\circ C$ to $125^\circ C$		
				Typ	Guaranteed Limits			
$V_{IH}$	Minimum High Level Input Voltage		2.0V		1.5	1.5	V	
			4.5V		3.15	3.15	V	
			6.0V		4.2	4.2	V	
$V_{IL}$	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	V	
			4.5V		1.35	1.35	V	
			6.0V		1.8	1.8	V	
$V_{OH}$	Minimum High Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 20 \mu A$	2.0V	2.0	1.9	1.9	V	
			4.5V	4.5	4.4	4.4	V	
			6.0V	6.0	5.9	5.9	V	
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 4.0$ mA $ I_{OUT}  \leq 5.2$ mA	4.5V	4.2	3.98	3.84	3.7	V
			6.0V	5.7	5.48	5.34	5.2	V
$V_{OL}$	Maximum Low Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 20 \mu A$	2.0V	0	0.1	0.1	V	
			4.5V	0	0.1	0.1	V	
			6.0V	0	0.1	0.1	V	
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 4$ mA $ I_{OUT}  \leq 5.2$ mA	4.5V	0.2	0.26	0.33	0.4	V
			6.0V	0.2	0.26	0.33	0.4	V
$I_{IN}$	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		$\pm 0.1$	$\pm 1.0$	$\mu A$	
		$V_{IN} = 15V$	2.0V		$\pm 0.5$	$\pm 5$	$\mu A$	
$I_{CC}$	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$	6.0V		2.0	20	$\mu A$	

**Note 1:** Absolute Maximum Ratings are those values beyond which damage to the device may occur.

**Note 2:** Unless otherwise specified all voltages are referenced to ground.

**Note 3:** Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C; ceramic "J" package: -12 mW/°C from 100°C to 125°C.

**Note 4:** For a power supply of 5V  $\pm 10\%$  the worst case output voltages ( $V_{OH}$  and  $V_{OL}$ ) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case  $V_{IH}$  and  $V_{IL}$  occur at  $V_{CC} = 5.5V$  and 4.5V respectively. (The  $V_{IH}$  value at 5.5V is 3.85V.) The worst case leakage current ( $I_{IN}$ ,  $I_{CC}$ ,  $I_{OZ}$ ) occur for CMOS at the higher voltage and so the 6.0V values should be used.

\*\* $V_{IL}$  limits are currently tested at 20% of  $V_{CC}$ . The above  $V_{IL}$  specification (30% of  $V_{CC}$ ) will be implemented no later than Q1, CY'89.

**AC Electrical Characteristics**  $V_{CC}=5V$ ,  $T_A=25^{\circ}C$ ,  $C_L=15\text{ pF}$ ,  $t_r=t_f=6\text{ ns}$

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
$t_{PHL}$ , $t_{PLH}$	Maximum Propagation Delay		8	15	ns

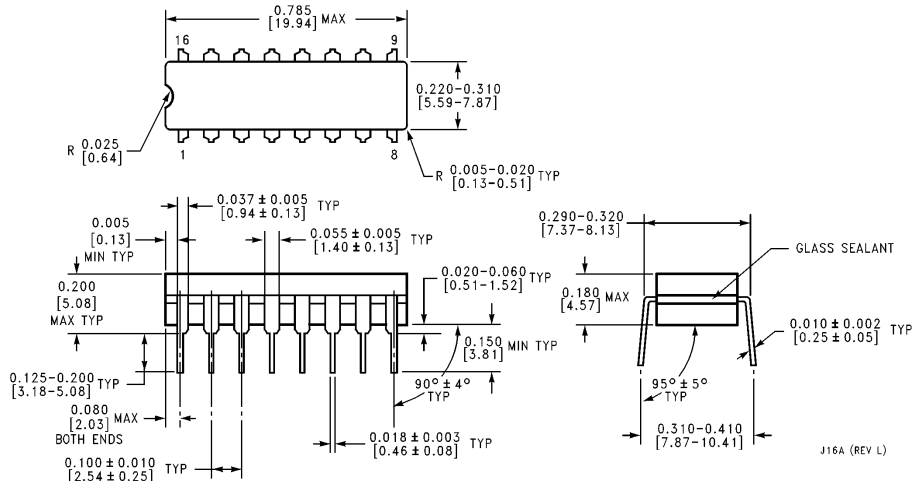
**AC Electrical Characteristics**  $V_{CC}=2.0V$  to  $6.0V$ ,  $C_L=50\text{ pF}$ ,  $t_r=t_f=6\text{ ns}$  (unless otherwise specified)

Symbol	Parameter	Conditions	$V_{CC}$	$T_A=25^{\circ}C$		74HC	54HC	Units
						$T_A=-40^{\circ}$ to $85^{\circ}C$	$T_A=-55^{\circ}$ to $125^{\circ}C$	
				Typ	Guaranteed Limits			
$t_{PHL}$ , $t_{PLH}$	Maximum Propagation Delay		2.0V	30	85	100	130	ns
			4.5V	10	17	20	26	ns
			6.0V	9	15	18	22	ns
$t_{THL}$ , $t_{TLH}$	Maximum Output Rise and Fall Time		2.0V	25	75	95	110	ns
			4.5V	7	15	19	22	ns
			6.0V	6	13	16	19	ns
$C_{PD}$	Power Dissipation Capacitance (Note 5)	(per gate)		25				pF
$C_{IN}$	Maximum Input Capacitance			5	10	10	10	pF

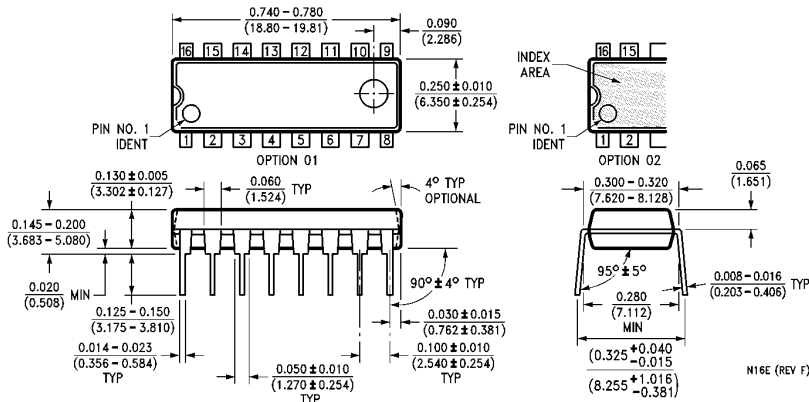
**Note 5:**  $C_{PD}$  determines the no load dynamic power consumption,  $P_D=C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S=C_{PD} V_{CC} f + I_{CC}$ .

**MM54HC4049/MM74HC4049 Hex Inverting Logic Level Down Converter**  
**MM54HC4050/MM74HC4050 Hex Logic Level Down Converter**

**Physical Dimensions** inches (millimeters)



**Order Number MM54HC4049J, MM54HC4050J, MM74HC4049J, or MM54HC4049J, NS Package J16A**



**Order Number MM74HC4049N, or MM54HC4049N NS Package N16E**

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