

January 1988

MM54HC05/MM74HC05 Hex Inverter (Open Drain)

General Description

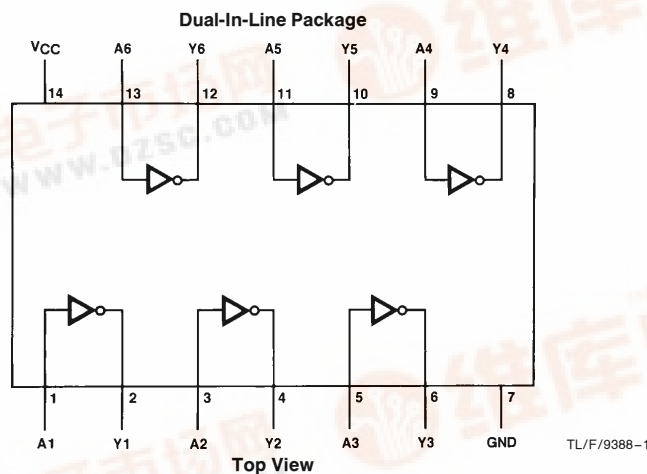
The MM54HC05/MM74HC05 are logic functions fabricated by using advanced silicon-gate CMOS technology, which provides the inherent benefits of CMOS—low quiescent power and wide power supply range. These devices are also functionally and pin-out compatible with standard DM54LS/DM74LS logic families. The MM54HC05/MM74HC05 open drain Hex Inverter requires the addition of an external resistor to perform a wire-NOR function.

All inputs are protected from static discharge damage by internal diodes to V_{CC} and ground.

Features

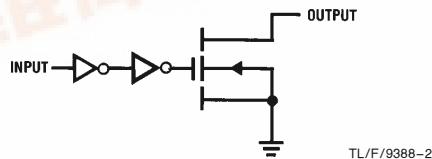
- Open drain for wire-NOR function
- Fanout of 10 LS-TTL loads
- Typical propagation delays:
 t_{pZL} (with 1 k Ω resistor) 8 ns
 t_{pLZ} (with 1 k Ω resistor) 13 ns
- Low input current: 1 μ A maximum

Connection Diagram

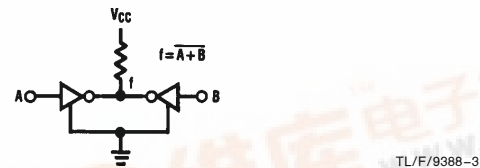


Order Number MM54HC05 or MM74HC05

Logic Diagram



Typical Application



Note: Can be extended to more than 2 inputs.



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

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage (V_{IN}, 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°C		74HC	54HC	Units
					Typ	T _A = −40°C to +85°C	T _A = −55°C to +125°C	
V _{IH}	Minimum High Level Input Voltage		2.0V		1.5	1.5	1.5	V
			4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V _{IL}	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	0.5	V
			4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V _{OL}	Maximum Low Level Output Voltage	V _{IN} = V _{IH} I _{OUT} ≤ 20 μA R _L = ∞	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
		V _{IN} = V _{IH} I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 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 _{LKG}	Maximum High Level Output Leakage Current	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC}	6.0V		0.5	5	10	μA
I _{IN}	Maximum Input Current	V _{IN} = V _{CC} or GND	6.0V		±0.1	±1.0	±1.0	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA	6.0V		2.0	20	40	μA

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 ±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} , and 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 $V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 15\text{ pF}$, $t_r = t_f = 6\text{ ns}$

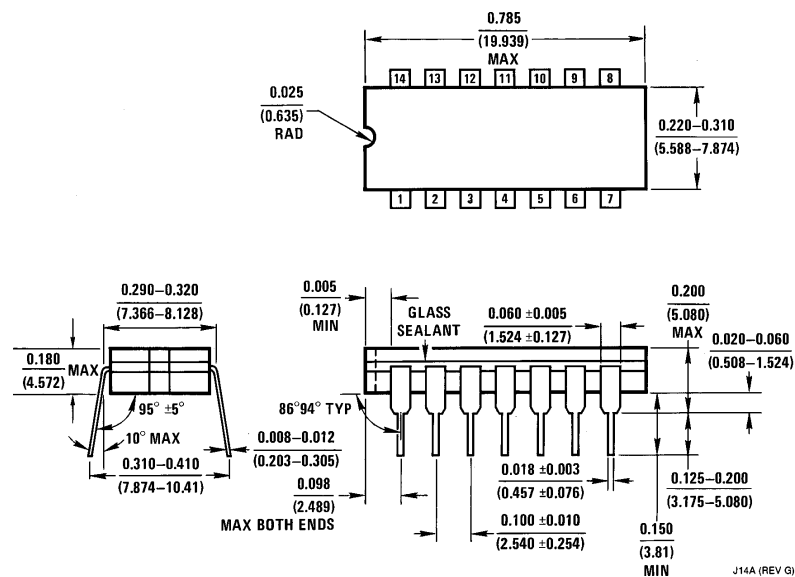
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PZL} , t_{PLZ}	Maximum Propagation Delay	$R_L = 1\text{ k}\Omega$	8		ns

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

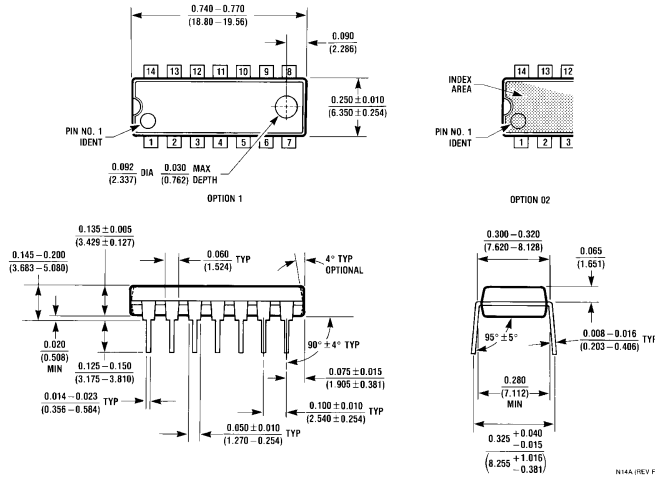
Symbol	Parameter	Conditions	V _{CC}	T _A = 25°C		74HC	54HC	Units
						T _A = −40°C to +85°C	T _A = −55°C to +125°C	
				Typ	Guaranteed Limits			
t _{PZL}	Maximum Propagation Delay	R _L = 1 kΩ	2.0V	30	75	95	110	ns
			4.5V	8	15	19	22	ns
			6.0V	7	13	16	19	ns
t _{PLZ}	Maximum Propagation Delay	R _L = 1 kΩ	2.0V	30	90	115	135	ns
			4.5V	13	18	23	27	ns
			6.0V	12	15	20	23	ns
t _{THL}	Maximum Output Fall Time		2.0V	30	75	95	110	ns
			4.5V	8	15	19	22	ns
			6.0V	7	13	16	19	ns
C _{PD}	Power Dissipation Capacitance (Note 5)	(per gate)		8				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, $I_S = C_{PD} V_{CC} f + I_{CC}$. The power dissipated by R_L is not included.

Physical Dimensions inches (millimeters)



Physical Dimensions inches (millimeters) (Continued)



Order Number MM74HC05N
NS Package Number N14A

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