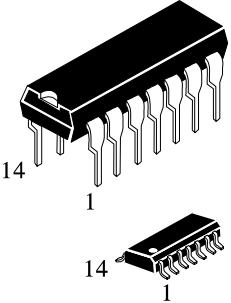# IN74HC05A

Hex Inverter
with Open-Drain Outputs

The IN74HC05A is identical in pinout to the LS/ALS05. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LS/ALS TTL outputs.

This device contains six independent gates, each of which performs the logic INVERT function. The open-drain outputs require external pull-up resistors for proper logical operation. They may be connected to other open-drain outputs to implement active-high wired-AND functions.

- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0 μA
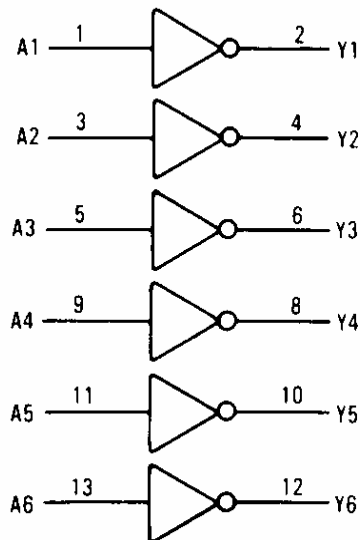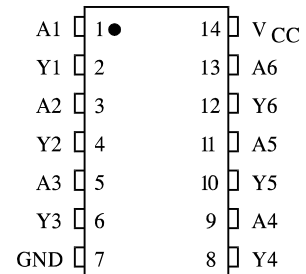- High Noise Immunity Characteristic of CMOS Devices

N SUFFIX
PLASTIC

D SUFFIX
SOIC

ORDERING INFORMATION
IN74HC05AN   Plastic
IN74HC05AD   SOIC
T_A = -55° to 125° C for all packages

LOGIC DIAGRAM

PIN 14 = V_{CC}
PIN 7 = GND

PIN ASSIGNMENT

A1	1●	14	V_{CC}
Y1	2	13	A6
A2	3	12	Y6
Y2	4	11	A5
A3	5	10	Y5
Y3	6	9	A4
GND	7	8	Y4

FUNCTION TABLE

Inputs	Output
A	Y
L	Z
H	L

Z = High Impedance

IKSemicon

MAXIMUM RATINGS[*]

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V_{IN}	DC Input Voltage (Referenced to GND)	-1.5 to V_{CC} +1.5	V
V_{OUT}	DC Output Voltage (Referenced to GND)	-0.5 to V_{CC} +0.5	V
I_{IN}	DC Input Current, per Pin	±20	mA
I_{OUT}	DC Output Current, per Pin	±25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	±50	mA
P_D	Power Dissipation in Still Air, Plastic DIP[**] SOIC Package[**]	750 500	mW
Tstg	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package)	260	°C

[*]Maximum Ratings are those values beyond which damage to the device may occur.
Functional operation should be restricted to the Recommended Operating Conditions.
[**]Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C
        SOIC Package: - 7 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V_{IN}, V_{OUT}	DC Input Voltage, Output Voltage (Referenced to GND)		0	V_{CC}	V
T_A	Operating Temperature, All Package Types		-55	+125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	V_{CC} =2.0 V V_{CC} =4.5 V V_{CC} =6.0 V	0 0 0	1000 500 400	ns

        This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range GND≤(V_{IN} or V_{OUT})≤V_{CC}.
        Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit			Unit
				25 °C to -55°C	≤85 °C	≤125 °C	
V_{IL}	Low -Level Input Voltage	$V_{OUT}= V_{CC}$ or 0 V $\vert I_{OUT}\vert \leq \pm0.5$ μA (T= -55 to 25°C)$\vert I_{OUT}\vert \leq \pm5.0$ μA (T= 85°C)$\vert I_{OUT}\vert \leq \pm10$ μA (T= 125°C)	2.0 4.5 6.0	0.5 1.35 1.8	0.5 1.35 1.8	0.5 1.35 1.8	V
V_{IH}	High-Level Input Voltage	$V_{OUT} \leq 0.1$ V $\vert I_{OUT}\vert \leq 20$ μA	2.0 4.5 6.0	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
V_{OL}	Low - Level Output Voltage	$V_{IN}=V_{IH}$ $\vert I_{OUT}\vert \leq 20$ μA	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		$V_{IN}=V_{IH}$ $\vert I_{OUT}\vert \leq 4.0$ mA	4.5	0.26	0.33	0.4	
		$V_{IN}=V_{IH}$ $\vert I_{OUT}\vert \leq 5.2$ mA	6.0	0.26	0.33	0.40	
I_{IL}	Input Leakage Current	$V_{IL}= GND$	6.0	-0.1	-1.0	-1.0	μA
I_{IH}	Input Leakage Current	$V_{IH}=V_{CC}$	6.0	-0.1	-1.0	-1.0	μA
I_{CC}	Quiescent Supply Current (per Package)	$V_{IL}=GND$ $V_{IH}=V_{CC}$ $I_{OUT}=0$ μA	6.0	1.0	10	40	μA
I_{OZL}	Three-State Leakage Current	$V_{IN}= V_{IL}$ or V_{IH} $V_{OUT}= GND$	6.0	-0.5	-5.0	-10	μA
I_{OZH}	Three-State Leakage Current	$V_{IN}= V_{IL}$ or V_{IH} $V_{OUT}= V_{CC}$	6.0	-0.5	-5.0	-10	μA

IKSemicon

AC ELECTRICAL CHARACTERISTICS (C_L=50pF,Input t_r=t_f=6.0 ns)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit			Unit
				25 °C to -55°C	≤85 °C	≤125 °C	
t_{PLZ}, t_{PZL}	Propagation Delay, Input A to Output Y (Figures 1 and 2)	V_{IL} = GND V_{IH} = V_{CC} t_{LH} = t_{HL} = 6 ns C_L = 50 pF	2.0 4.5 6.0	120 24 20	150 30 26	180 36 31	ns
t_{THL}	Output Transition Time, Any Output (Figures 1 and 2)	V_{IL} = GND V_{IH} = V_{CC} t_{LH} = t_{HL} = 6 ns C_L = 50 pF	2.0 4.5 6.0	75 15 13	95 19 16	110 22 19	ns
C_{IN}	Input Capacitance			10	10	10	pF
C_{OUT}	Three-State Output Capacitance (Output in High-Impedance State)			10	10	10	pF

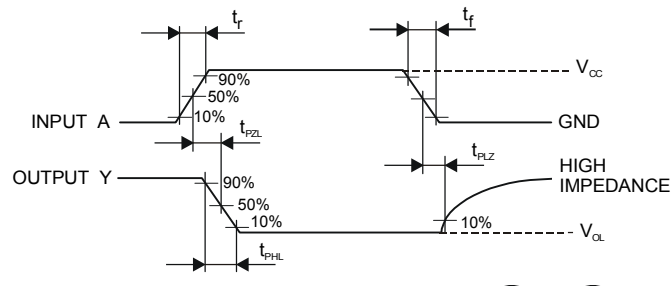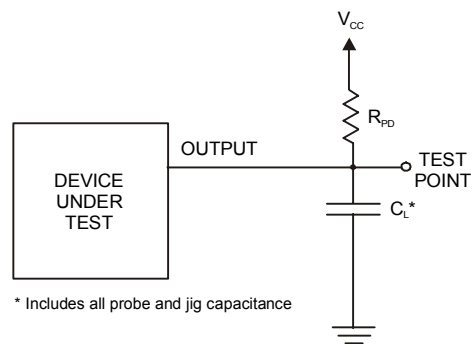|			
	Power Dissipation Capacitance (Per Gate)	Typical @25°C,V_{CC}=5.0 V	
C_{PD}	Used to determine the no-load dynamic power consumption: P_D=$C_{PD}V_{CC}^2$f+$I_{CC}V_{CC}$	8.0	pF

Figure 1. Switching Waveforms
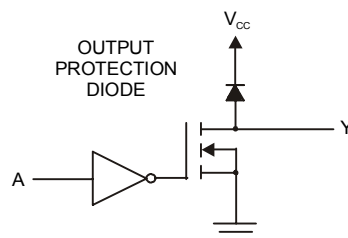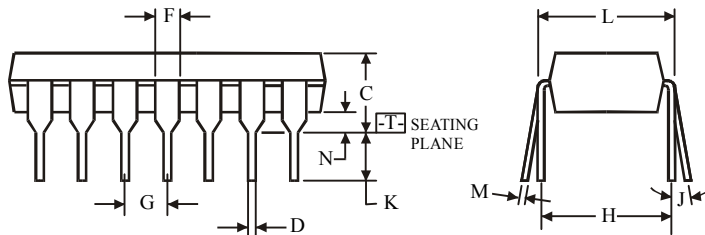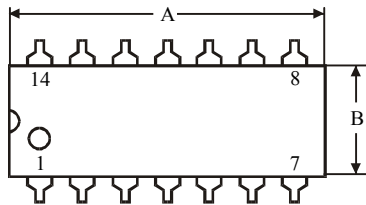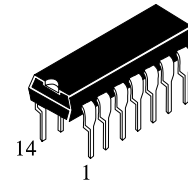

Figure 2. Test Circuit

Figure 3. Expanded Logic Diagram (1/6 of the Device)
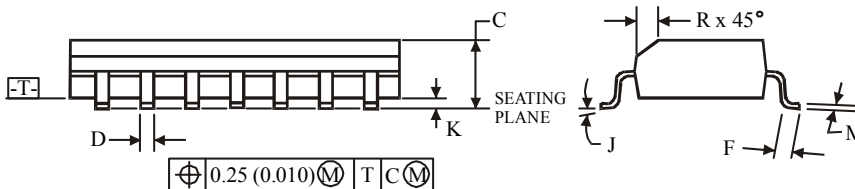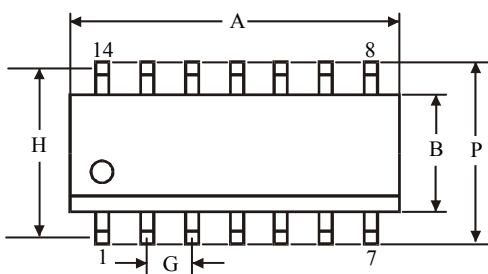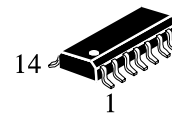
N SUFFIX PLASTIC DIP
(MS - 001AA)

NOTES:

1. Dimensions "A", "B" do not include mold flash or protrusions.

   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

	Dimension, mm	
Symbol	**MIN**	**MAX**
A	18.67	19.69
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

⊕ 0.25 (0.010) Ⓜ T

D SUFFIX SOIC
(MS - 012AB)

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.

2. Maximum mold flash or protrusion 0.15 mm (0.006) per side
   for A; for B ‑ 0.25 mm (0.010) per side.

	Dimension, mm	
Symbol	**MIN**	**MAX**
A	8.55	8.75
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.27	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

⊕ 0.25 (0.010) Ⓜ T C Ⓜ

IKSemicon

Rev. 00