HEX INVERTERS WITH OPEN DRAIN OUTPUTS

Description

The 74HC05 provides provides six independent inverters with open drain outputs. The device is designed for operation with a power supply range of 2.0V to 6.0V.
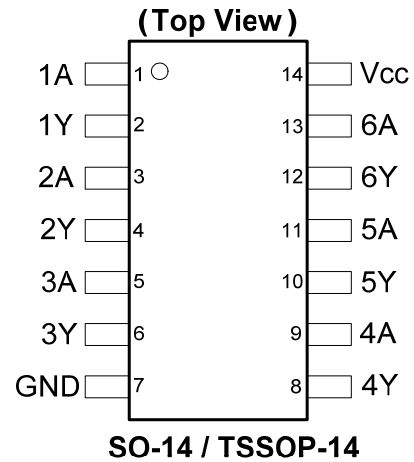
The gates perform the Boolean function:

$$Y = \overline{A}$$

Features

- Wide Supply Voltage Range from 2.0V to 6.0V
- Sinks 4mA at V_{CC} = 4.5V
- CMOS Low Power Consumption
- Schmitt Trigger Action at All Inputs
- ESD Protection Exceeds JESD 22
    - 200-V Machine Model (A115-A)
    - 2000-V Human Body Model (A114-A)
    - Exceeds 1000-V Charged Device Model (C101C)
- Range of Package Options SO-14 and TSSOP-14
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Pin Assignments

(Top View)

1A	1	14 Vcc
1Y	2	13 6A
2A	3	12 6Y
2Y	4	11 5A
3A	5	10 5Y
3Y	6	9 4A
GND	7	8 4Y

SO-14 / TSSOP-14

Applications

- General Purpose Logic
- Wide array of products such as:
    - PCs, Networking, Notebooks, Netbooks
    - Computer Peripherals, Hard Drives, CD/DVD ROM
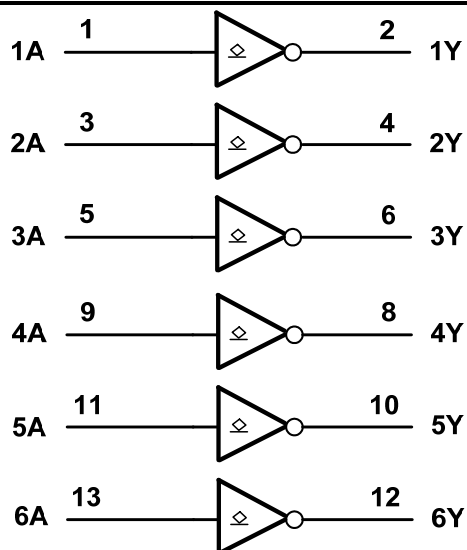   - TV, DVD, DVR, Set Top Box

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

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Pin Descriptions

Pin Number	Pin Name	Function
1	1A	Data Input
2	1Y	Data Output
3	2A	Data Input
4	2Y	Data Output
5	3A	Data Input
6	3Y	Data Output
7	GND	Ground
8	4Y	Data Output
9	4A	Data Input
10	5Y	Data Output
11	5A	Data Input
12	6Y	Data Output
13	6A	Data Input
14	V_{CC}	Supply Voltage

Logic Diagram

Input	Output
A	**Y**
H	L
L	Z

Function Table

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Absolute Maximum Ratings (Note 4) (@T$_A$ = +25°C, unless otherwise specified.)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	KV
ESD CDM	Charged Device Model ESD Protection	1	KV
ESD MM	Machine Model ESD Protection	200	V
V$_{CC}$	Supply Voltage Range	-0.5 to +7.0	V
V$_I$	Input Voltage Range (Note 5)	-0.5 to +7.0	V
I$_{IK}$	Input Clamp Current V$_I$ < -0.5V or Vi > V$_{CC}$ + 0.5V	±20	mA
I$_{OK}$	Output Clamp Current V$_O$ < -0.5V or V$_O$ > V$_{CC}$ + 0.5V	±20	mA
I$_O$	Continuous Output Current - 0.5V < V$_O$ V$_{CC}$ + 0.5V	+/- 25	mA
I$_{CC}$	Continuous Current Through V$_{CC}$	50	mA
I$_{GND}$	Continuous Current Through GND	-50	mA
T$_J$	Operating Junction Temperature	-40 to +150	°C
T$_{STG}$	Storage Temperature	-65 to +150	°C
P$_{TOT}$	Total Power Dissipation	500	mW

Notes: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.
5. Input Voltage cannot exceed V$_{CC}$ to the extent the Maximum clamp current is exceeded

Recommended Operating Conditions (Note 6) (@T$_A$ = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
V$_{CC}$	Supply Voltage		2.0	6.0	V
V$_I$	Input Voltage		0	Vcc	V
V$_O$	Output Voltage		0	V$_{CC}$	V
Δt/ΔV	Input transition rise or fall rate	V$_{CC}$ = 2.0V		625	ns/V
		V$_{CC}$ = 4.5V		140	
		V$_{CC}$ = 6.0V		85	
T$_A$	Operating free-air temperature		-40	+125	°C

Note: 6. Unused inputs should be held at V$_{CC}$ or Ground.

Electrical Characteristics (@T$_A$ = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	V$_{CC}$	T$_A$ = -40°C to +85°C		T$_A$ = -40°C to +125°C		Unit
				Min	Max	Min	Max	
V$_{IH}$	High-level Input Voltage		2.0V	1.5		1.5		V
			4.5V	3.15		3.15		
			6.0V	4.2		4.2		
V$_{IL}$	Low-level input voltage		2.0V		0.5		0.5	V
			4.5V		1.35		1.35	
			6.0V		1.8		1.8	
V$_{OL}$	Low-level Output Voltage	I$_{OL}$ = 20µA	2.0V		0.1		0.1	V
		I$_{OL}$ = 20µA	4.5V		0.1		0.1	
		I$_{OL}$ = 20µA	6.0V		0.1		0.1	
		I$_{OL}$ = 4mA	4.5V		0.33		0.44	
		I$_{OL}$ = 5.2mA	6.0V		0.33		0.44	
I$_{OZ}$	Z State Leakage Current	V$_O$ =0 to 6.0V V$_I$ =GND or 6.0V	6.0V		± 5.0		± 10	µA
I$_I$	Input Current	V$_I$ =GND to 5.5V	6.0V		± 1		± 1	µA
I$_{CC}$	Supply Current	V$_I$ = GND or V$_{CC}$, I$_O$=0	6.0V		20		40	µA

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Switching Characteristics

Symbol	Parameter	Test Conditions	Vcc	T_A = +25°C			-40°C to +85°C	-40°C to +125°C	Unit
				Min	Typ	Max	Max	Max	
t_{PD}	Propagation Delay A_N to Y_N	Figure 1 C_L = 50 pF	2.0V	—	25	90	115	125	ns
			4.5V	—	9	18	23	27	
			6.0V	—	7	15	20	23	
t_t	Transition time	Figure 1 C_L = 50 pF	2.0V	—	19	75	95	110	ns
			4.5V	—	7	15	19	22	
			6.0V	—	6	13	16	19	

Operating Characteristics (@T_A = +25°C, unless otherwise specified.)

	Parameter	Test Conditions	V_{CC} = 6V	Unit
			Typ	
C_{pd}	Power dissipation capacitance per gate	f = 1 MHz	22	pF
C_I	Input Capacitance	V_I = V_{CC} – or GND	4	pF

Parameter Measurement Information
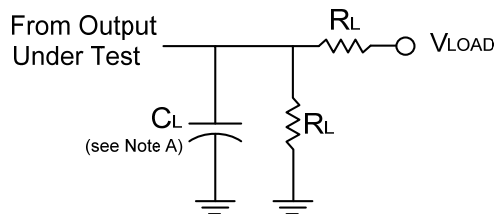
	TEST	Condition
	t_{PLZ} (see Notes D and E)	Vload
	t_{PZL} (see Notes D and F)	Vload

V_{CC}	Inputs		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
2.0V to 6.0V	V_{CC}	≤6ns	V_{CC}/2	2 X V_{CC}	50 pF	2 KΩ	10% of Vcc
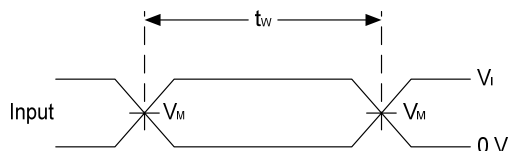
Voltage Waveform Pulse Duration
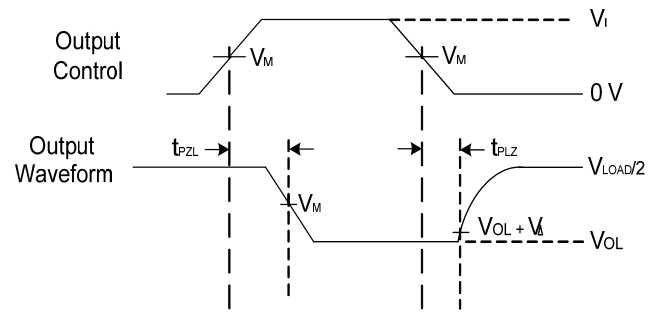
Voltage Waveform Propagation Delay Times

Notes:
A. Includes test lead and test apparatus capacitance.
B. All pulses are supplied at pulse repetition rate ≤ 1 MHz.
C. The inputs are measured one at a time with one transition per measurement.
D. For the open drain device t_{PLZ} and t_{PZL} are the same as t_{PD}.
E. t_{PZL} is measured at V_M.
F. t_{PLZ} is measured at V_{OL} +V_Δ.
D. A Thevenin equivalent load may be used in place of V_{CC} X 2 and resistor divider.

Figure 1 Load Circuit and Voltage Waveforms

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Ordering Information

<u>74</u> <u>HC</u>   <u>05</u> <u>XXX</u> - <u>13</u>

Logic Device	Function	Package	Packing
74 : Logic Prefix HC : 2.0V to 6.0V Family	05 : Hex Inverters With Open Drains	S14 : SO-14 T14 : TSSOP-14	-13 : 13" Tape & Reel
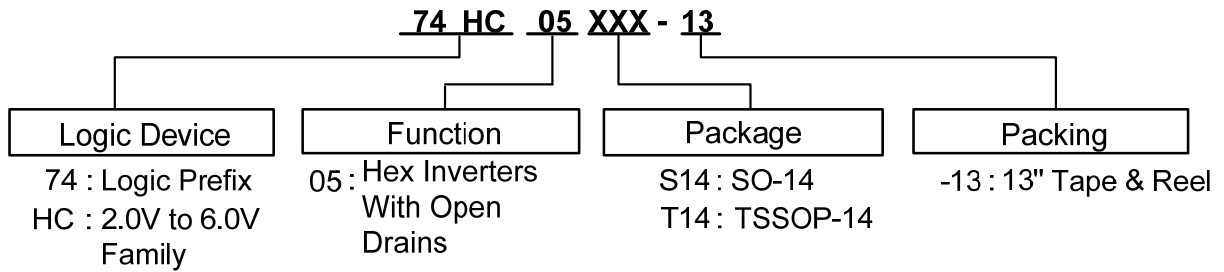
Device	Package Code	Packaging	7" Tape and Reel	
			Quantity	**Part Number Suffix**
74HC05S14-13	S14	SO-14	2500/Tape & Reel	-13
74HC05T14-13	T14	TSSOP-14	2500/Tape & Reel	-13

Marking Information

(1) SO-14, TSSOP-14

(Top View)

Logo ←
Part Number ←

74HC05
YY WW X X

YY : Year : 08, 09,10~
WW : Week : 01~52; 52 represents 52 and 53 week
XX : Internal Codes
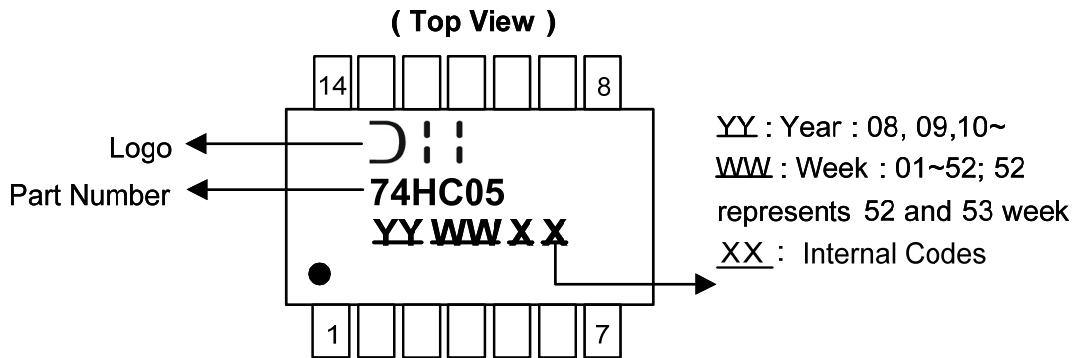
Part Number	Package
74HC05S14	SO-14
74HC05T14	TSSOP-14

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Package Outline Dimensions (All dimensions in mm.)

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

Package Type: SO-14
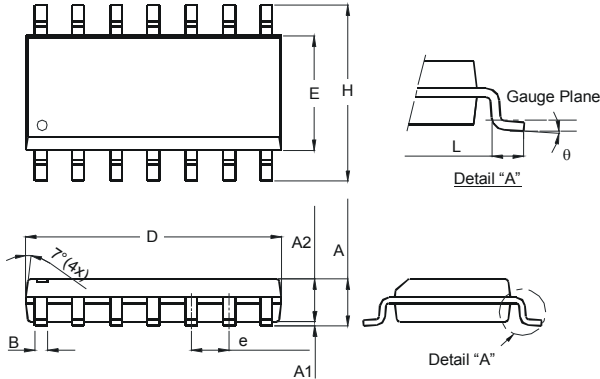
SO-14		
Dim	**Min**	**Max**
A	1.47	1.73
A1	0.10	0.25
A2	1.45 Typ	
B	0.33	0.51
D	8.53	8.74
E	3.80	3.99
e	1.27 Typ	
H	5.80	6.20
L	0.38	1.27
θ	0°	8°
All Dimensions in mm		

Package Type: TSSOP-14
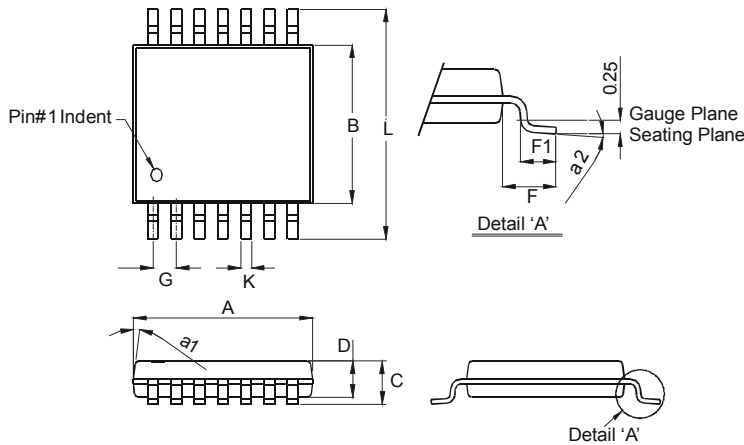
TSSOP-14		
Dim	**Min**	**Max**
a1	7° (4X)	
a2	0°	8°
A	4.9	5.10
B	4.30	4.50
C	—	1.2
D	0.8	1.05
F	1.00 Typ	
F1	0.45	0.75
G	0.65 Typ	
K	0.19	0.30
L	6.40 Typ	
All Dimensions in mm		

Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for latest version.
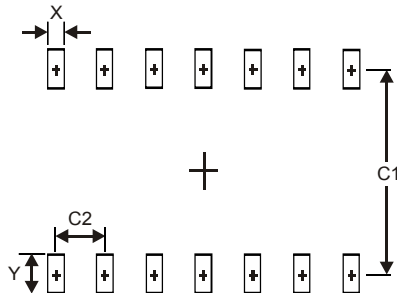
Package Type: SO-14

Dimensions	Value (in mm)
X	0.60
Y	1.50
C1	5.4
C2	1.27

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Suggested Pad Layout (cont.)

Package Type: TSSOP-14
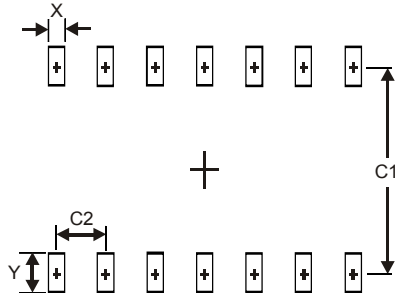
Dimensions	Value (in mm)
X	0.45
Y	1.45
C1	5.9
C2	0.65

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