

## Description

The 74HC05 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.

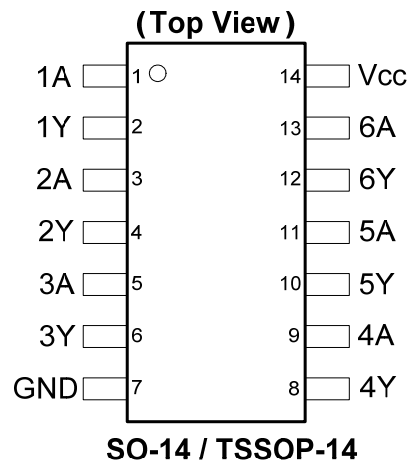
The gates perform the Boolean function:

$$Y = \overline{A}$$

## 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



## 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

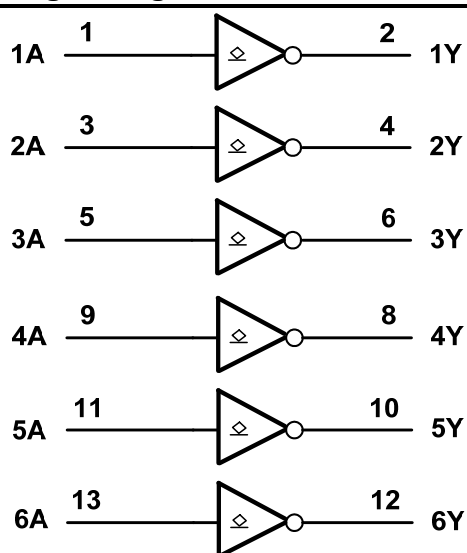
Notes:

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.

## 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 <sub>CC</sub>	Supply Voltage

## Logic Diagram



## Function Table

Input	Output
A	Y
H	L
L	Z

**Absolute Maximum Ratings** (Note 4) (@ $T_A = +25^\circ\text{C}$ , 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 $V_I < -0.5\text{V}$ or $V_I > V_{CC} + 0.5\text{V}$	$\pm 20$	mA
$I_{OK}$	Output Clamp Current $V_O < -0.5\text{V}$ or $V_O > V_{CC} + 0.5\text{V}$	$\pm 20$	mA
$I_O$	Continuous Output Current $-0.5\text{V} < V_O < V_{CC} + 0.5\text{V}$	+/- 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	$^\circ\text{C}$
$T_{STG}$	Storage Temperature	-65 to +150	$^\circ\text{C}$
$P_{TOT}$	Total Power Dissipation	500	mW

- Notes:
- 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.
  - Input Voltage cannot exceed  $V_{CC}$  to the extent the Maximum clamp current is exceeded

**Recommended Operating Conditions** (Note 6) (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	Supply Voltage		2.0	6.0	V
$V_I$	Input Voltage		0	$V_{CC}$	V
$V_O$	Output Voltage		0	$V_{CC}$	V
$\Delta t/\Delta V$	Input transition rise or fall rate	$V_{CC} = 2.0\text{V}$		625	ns/V
		$V_{CC} = 4.5\text{V}$		140	
		$V_{CC} = 6.0\text{V}$		85	
$T_A$	Operating free-air temperature		-40	+125	$^\circ\text{C}$

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

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Test Conditions	$V_{CC}$	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$		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	$I_{OL} = 20\mu\text{A}$	2.0V		0.1		0.1	V
		$I_{OL} = 20\mu\text{A}$	4.5V		0.1		0.1	
		$I_{OL} = 20\mu\text{A}$	6.0V		0.1		0.1	
		$I_{OL} = 4\text{mA}$	4.5V		0.33		0.44	
		$I_{OL} = 5.2\text{mA}$	6.0V		0.33		0.44	
$I_{OZ}$	Z State Leakage Current	$V_O = 0$ to $6.0\text{V}$ $V_I = \text{GND}$ or $6.0\text{V}$	6.0V		$\pm 5.0$		$\pm 10$	$\mu\text{A}$
$I_I$	Input Current	$V_I = \text{GND}$ to $5.5\text{V}$	6.0V		$\pm 1$		$\pm 1$	$\mu\text{A}$
$I_{CC}$	Supply Current	$V_I = \text{GND}$ or $V_{CC}$ , $I_O = 0$	6.0V		20		40	$\mu\text{A}$

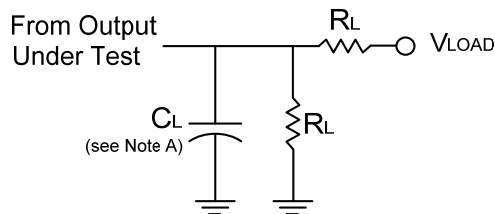
### Switching Characteristics

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = +25°C			-40°C to +85°C	-40°C to +125°C	Unit
				Min	Typ	Max	Max	Max	
t <sub>PD</sub>	Propagation Delay A <sub>N</sub> to Y <sub>N</sub>	Figure 1 C <sub>L</sub> = 50 pF	2.0V	—	25	90	115	125	ns
			4.5V	—	9	18	23	27	
			6.0V	—	7	15	20	23	
t <sub>t</sub>	Transition time	Figure 1 C <sub>L</sub> = 50 pF	2.0V	—	19	75	95	110	ns
			4.5V	—	7	15	19	22	
			6.0V	—	6	13	16	19	

### Operating Characteristics (@T<sub>A</sub> = +25°C, unless otherwise specified.)

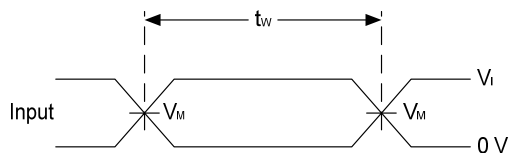
Parameter		Test Conditions	V <sub>CC</sub> = 6V	Unit
			Typ	
C <sub>pd</sub>	Power dissipation capacitance per gate	f = 1 MHz	22	pF
C <sub>I</sub>	Input Capacitance	V <sub>I</sub> = V <sub>CC</sub> – or GND	4	pF

### Parameter Measurement Information

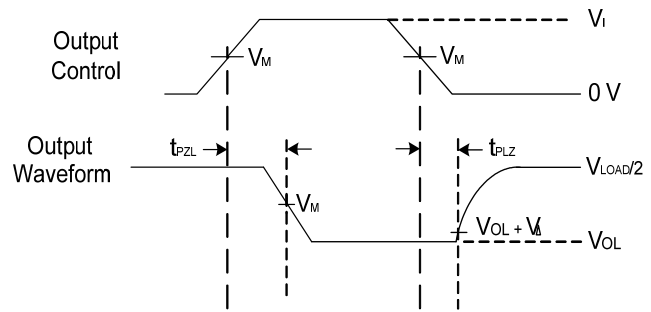


TEST	Condition
t <sub>PLZ</sub> (see Notes D and E)	V <sub>load</sub>
t <sub>PZL</sub> (see Notes D and F)	V <sub>load</sub>

V <sub>CC</sub>	Inputs		V <sub>M</sub>	V <sub>LOAD</sub>	C <sub>L</sub>	R <sub>L</sub>	V <sub>Δ</sub>
	V <sub>I</sub>	t <sub>r</sub> /t <sub>f</sub>					
2.0V to 6.0V	V <sub>CC</sub>	≤6ns	V <sub>CC</sub> /2	2 X V <sub>CC</sub>	50 pF	2 KΩ	10% of V <sub>CC</sub>



**Voltage Waveform Pulse Duration**

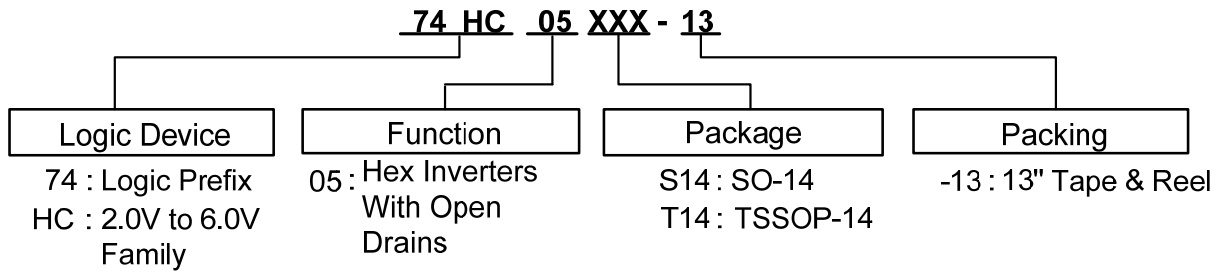


**Voltage Waveform Propagation Delay Times**

- 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<sub>PLZ</sub> and t<sub>PZL</sub> are the same as t<sub>PD</sub>.
  - E. t<sub>PZL</sub> is measured at V<sub>M</sub>.
  - F. t<sub>PLZ</sub> is measured at V<sub>OL</sub> + V<sub>Δ</sub>.
  - D. A Thevenin equivalent load may be used in place of V<sub>CC</sub> X 2 and resistor divider.

**Figure 1 Load Circuit and Voltage Waveforms**

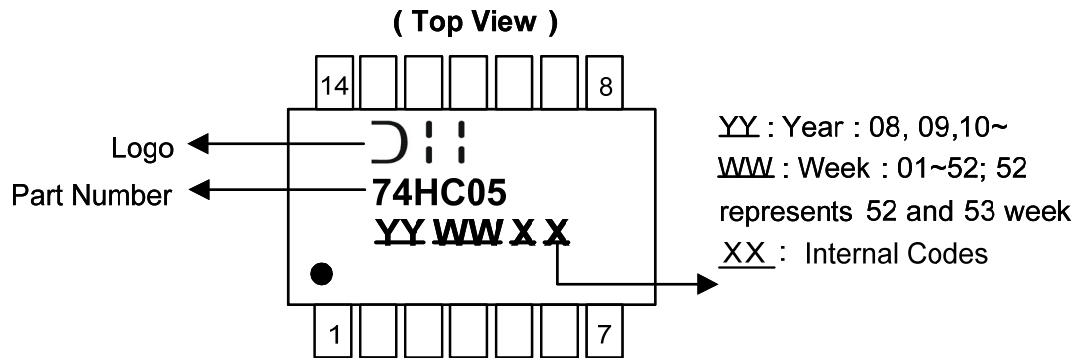
**Ordering Information**



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

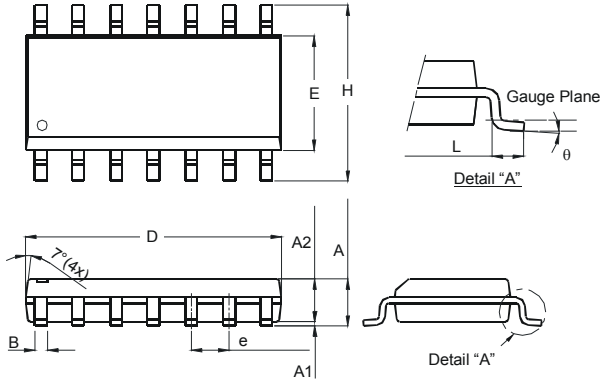


Part Number	Package
74HC05S14	SO-14
74HC05T14	TSSOP-14

**Package Outline Dimensions** (All dimensions in mm.)

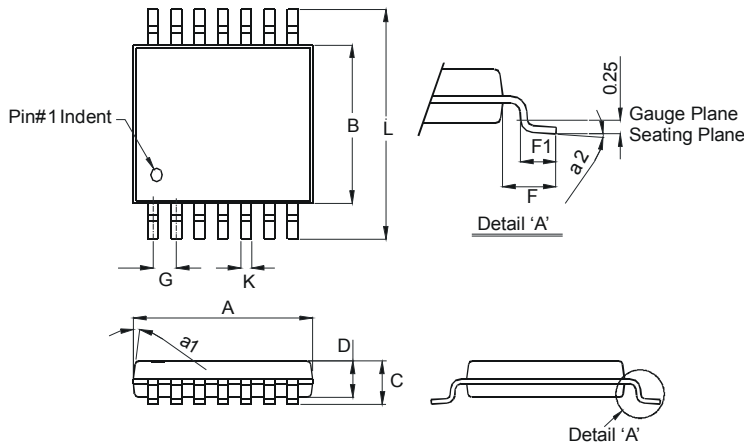
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

**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
$\theta$	0°	8°
<b>All Dimensions in mm</b>		

**Package Type: TSSOP-14**

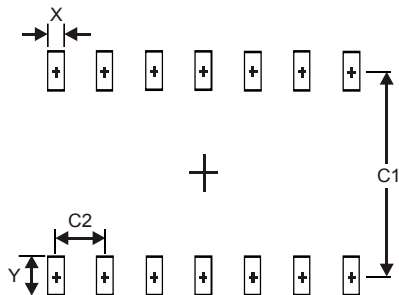


TSSOP-14		
Dim	Min	Max
a1	7° (4X)	
a2	0°	8°
A	4.9	5.10
B	4.30	4.50
C	—	1.2
D	0.8	1.05
F	1.00 Typ	
F1	0.45	0.75
G	0.65 Typ	
K	0.19	0.30
L	6.40 Typ	
<b>All Dimensions in mm</b>		

**Suggested Pad Layout**

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for latest version.

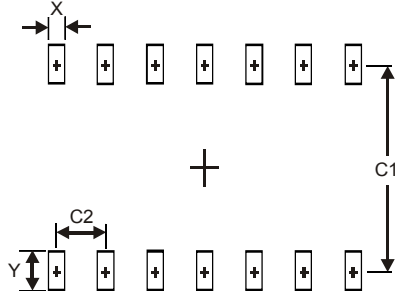
**Package Type: SO-14**



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

**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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