

**UNBUFFERED HEX INVERTERS**

**Description**

The 74HCU04 provides provides six independent unbuffered inverters with standard push-pull outputs. The device is designed for operation with a power supply range of 2.0V to 6.0V.

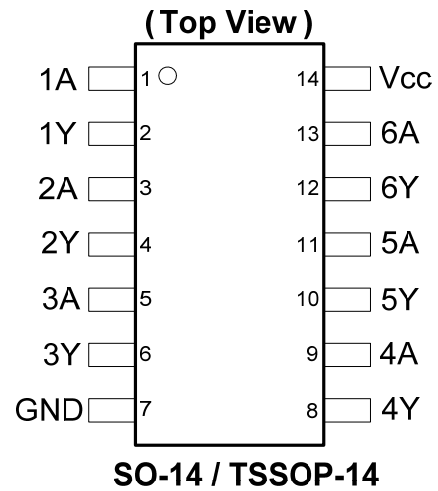
The gates perform the Boolean function:

$$Y = \overline{A}$$

**Features**

- Wide Supply Voltage Range from 2.0V to 6.0V
- Sinks or Sources 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**

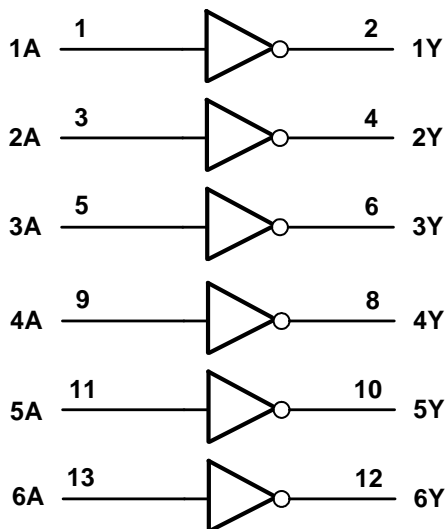
- Crystal Oscillators, Analog Inverters
- General Purpose Logic
- Wide array of products such as:
  - PCs, networking, notebooks, netbooks
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box

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	H

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### Absolute Maximum Ratings (Note 4) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

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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 <sub>CC</sub>	Supply Voltage Range	-0.5 to +7.0	V
V <sub>I</sub>	Input Voltage Range (Note 5)	-0.5 to +7.0	V
I <sub>IK</sub>	Input Clamp Current V <sub>I</sub> < -0.5V or V <sub>I</sub> > V <sub>CC</sub> +0.5V	±20	mA
I <sub>OK</sub>	Output Clamp Current V <sub>O</sub> < -0.5V or V <sub>O</sub> > V <sub>CC</sub> +0.5V	±20	mA
I <sub>O</sub>	Continuous Output Current -0.5V < V <sub>O</sub> < V <sub>CC</sub> +0.5V	+/- 25	mA
I <sub>CC</sub>	Continuous Current Through V <sub>CC</sub>	50	mA
I <sub>GND</sub>	Continuous Current Through GND	-50	mA
T <sub>J</sub>	Operating Junction Temperature	-40 to +150	°C
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C
P <sub>TOT</sub>	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<sub>CC</sub> to the extent the Maximum clamp current is exceeded.

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### Recommended Operating Conditions (Note 6) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

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Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage		2.0	6.0	V
V <sub>I</sub>	Input Voltage		0	V <sub>CC</sub>	V
V <sub>O</sub>	Output Voltage		0	V <sub>CC</sub>	V
Δt/ΔV	Input Transition Rise or Fall Rate	V <sub>CC</sub> = 2.0V		625	ns/V
		V <sub>CC</sub> = 4.5V		140	
		V <sub>CC</sub> = 6.0V		85	
T <sub>A</sub>	Operating Free-Air Temperature		-40	+125	°C

- Note: 6. Unused inputs should be held at V<sub>CC</sub> or Ground.

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

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = -40°C to +85°C		T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Max	Min	Max	
V <sub>IH</sub>	High-level Input Voltage		2.0V	1.7		1.7		V
			4.5V	3.6		3.6		
			6.0V	4.8		4.8		
V <sub>IL</sub>	Low-level Input Voltage		2.0V		0.3		0.3	V
			4.5V		0.9		0.9	
			6.0V		1.2		1.2	
V <sub>OH</sub>	High-level Output Voltage	I <sub>OH</sub> = -20μA	2.0V	1.8		1.9		V
		I <sub>OH</sub> = -20μA	4.5V	4.0		4.4		
		I <sub>OH</sub> = -20μA	6.0V	5.5		5.5		
		I <sub>OH</sub> = -4.0mA	4.5V	3.84		3.7		
		I <sub>OH</sub> = -5.2mA	6.0V	5.34		5.2		
V <sub>OL</sub>	Low-level Output Voltage	I <sub>OL</sub> = 20μA	2.0V		0.2		0.2	V
		I <sub>OL</sub> = 20μA	4.5V		0.5		0.5	
		I <sub>OL</sub> = 20μA	6.0V		0.1		0.1	
		I <sub>OL</sub> = 4mA	4.5V		0.33		0.40	
		I <sub>OL</sub> = 5.2mA	6.0V		0.33		0.40	
I <sub>I</sub>	Input Current	V <sub>I</sub> = GND to 5.5V	6.0V		± 1		± 1	μA
I <sub>CC</sub>	Supply Current	V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0	6.0V		20		40	μA

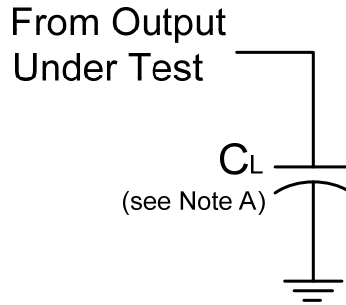
**Switching Characteristics**

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> = 50pF	2.0V	—	19	70	90	105	ns
			4.5V	—	7	14	18	21	
			6.0V	—	5	12	15	18	
t <sub>t</sub>	Transition Time	Figure 1 C <sub>L</sub> = 50pF	2.0V	—	19	75	95	110	ns
			4.5V	—	7	15	19	22	
			6.0V	—	6	13	16	19	

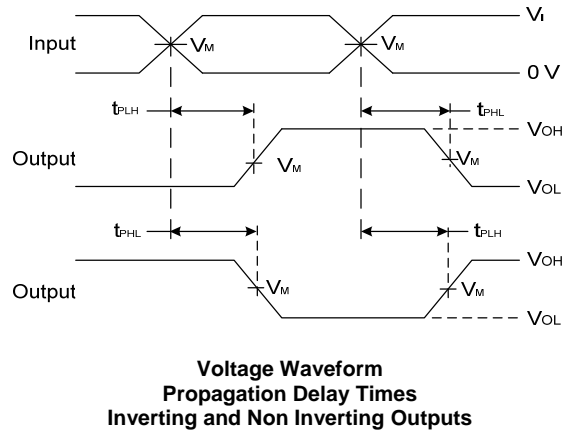
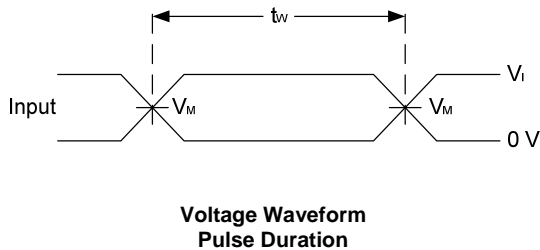
**Operating Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Parameter		Test Conditions	V <sub>CC</sub> = 6V	Unit
			Typ	
C <sub>pd</sub>	Power Dissipation Capacitance per Gate	f = 1MHz	10	pF
C <sub>I</sub>	Input Capacitance	V <sub>I</sub> = V <sub>CC</sub> – or GND	4	pF

**Parameter Measurement Information**



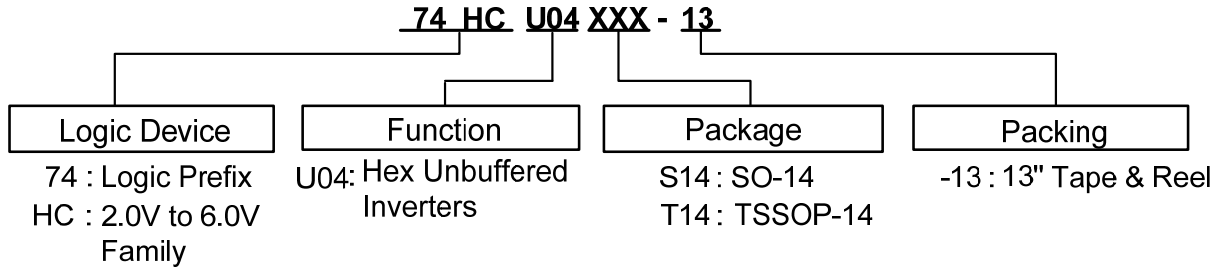
$V_{CC}$	Inputs		$V_M$	$C_L$
	$V_I$	$t_r/t_f$		
2.0V to 6.0V	$V_{CC}$	6ns	$V_{CC}/2$	15pF, 50pF



- Notes: A. Includes test lead and test apparatus capacitance.  
 B. All pulses are supplied at pulse repetition rate  $\leq 1$  MHz.  
 C. Inputs are measured separately one transition per measurement.  
 D.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{PD}$ .

**Figure 1 Load Circuit and Voltage Waveforms**

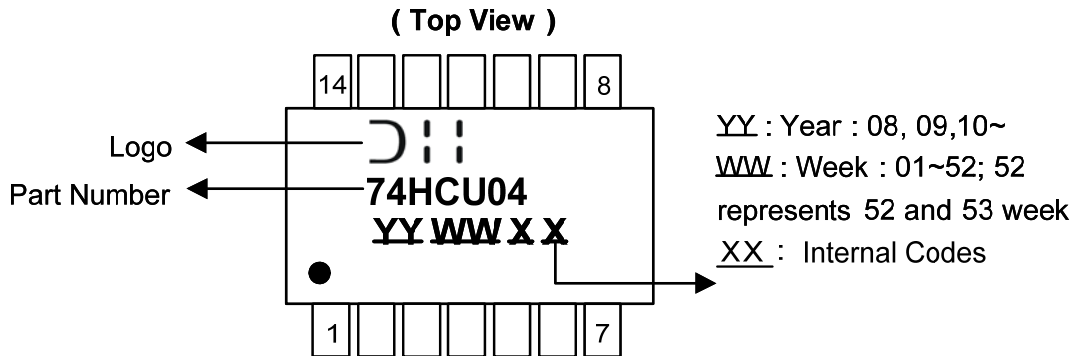
**Ordering Information**



Device	Package Code	Packaging (Note 7)	7" Tape and Reel	
			Quantity	Part Number Suffix
74HCU04S14-13	S14	SO-14	2500/Tape & Reel	-13
74HCU04T14-13	T14	TSSOP-14	2500/Tape & Reel	-13

**Marking Information**

(1) SO-14, TSSOP-14

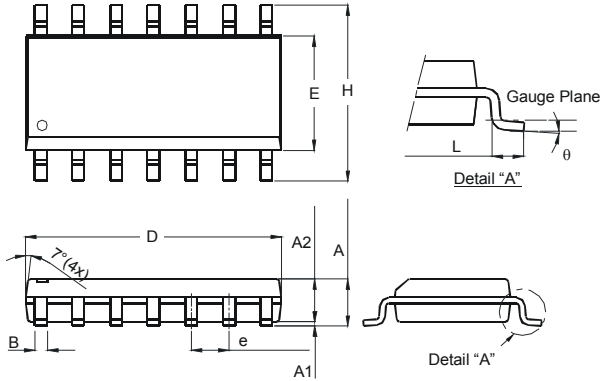


Part Number	Package
74HCU04S14	SO-14
74HCU04T14	TSSOP-14

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

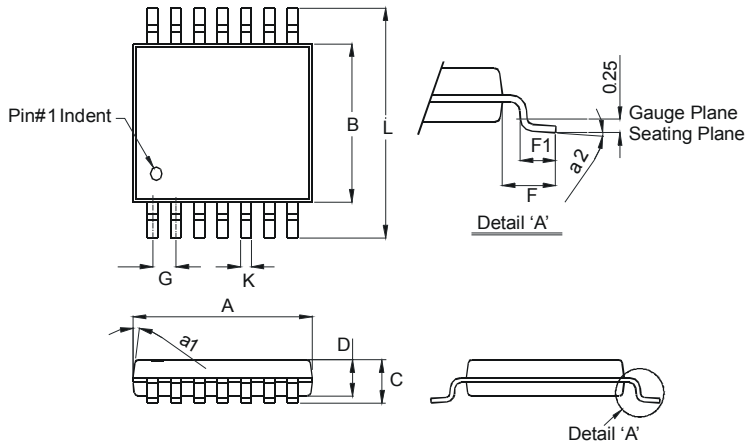
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

**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
θ	0°	8°
All Dimensions in mm		

**Package Type: TSSOP-14**

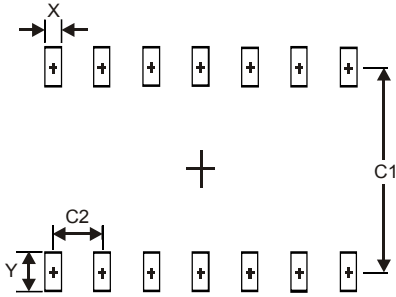


TSSOP-14		
Dim	Min	Max
a1	7° (4X)	
a2	0°	8°
A	4.9	5.10
B	4.30	4.50
C	—	1.2
D	0.8	1.05
F	1.00 Typ	
F1	0.45	0.75
G	0.65 Typ	
K	0.19	0.30
L	6.40 Typ	
All Dimensions in mm		

## Suggested Pad Layout

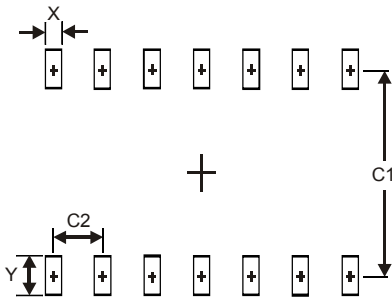
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for latest version.

### Package Type: SO-14



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

### Package Type: TSSOP-14



Dimensions	Value (in mm)
X	0.45
Y	1.45
C1	5.9
C2	0.65



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