

## Description

The 74LV04A provides provides six independent inverters with standard push-pull outputs. The device is designed for operation with a power supply range of 2.0V to 5.5V.

The inputs are tolerant to 5.5V allowing this device to be used in a mixed voltage environment. The device is fully specified for partial power down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output preventing damaging current backflow when the device is powered down.

The gates perform the Boolean function:

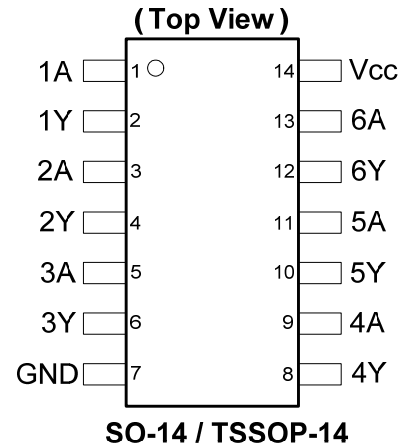
$$Y = \overline{A}$$

## Features

- Wide Supply Voltage Range from 2.0V to 5.5V
- Sinks or sources 12mA at V<sub>CC</sub> = 4.5V
- CMOS low power consumption
- I<sub>OFF</sub> Supports Partial -Power Down Operation
- Inputs or Outputs accept up to 5.5V
- Inputs can be driven by 3.3V or 5V allowing for voltage translation applications.
- Schmitt Trigger Action at All Inputs
- ESD Protection Tested per JESD 22
  - Exceeds 200-V Machine Model (A115)
  - Exceeds 2000-V Human Body Model (A114)
  - Exceeds 1000-V Charged Device Model (C101)
- Latch-Up Exceeds 100mA per JESD 78, Class I
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

- 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 Assignments



## Applications

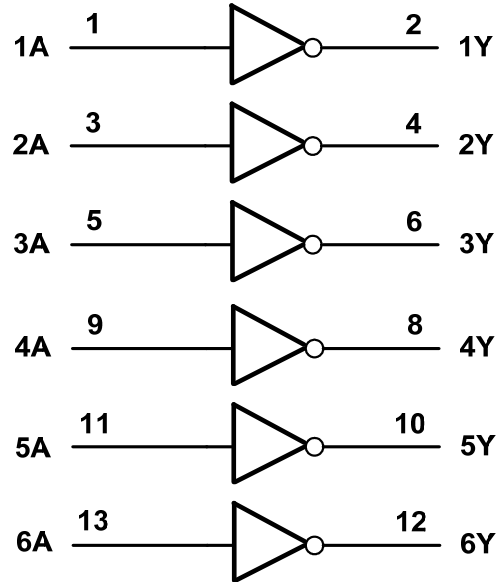
- General Purpose Logic
- Power Down Signal Isolation
- Wide array of products such as:
  - PCs, networking, notebooks, ultrabooks, netbooks
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box

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### Pin Descriptions

Pin Number	Pin Name	Description
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	Vcc	Supply Voltage

### Logic Diagram



### Function Table

Input	Output
A	Y
H	L
L	H

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

Symbol	Parameter	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 4)	-0.5 to +7.0	V
I <sub>IK</sub>	Input Clamp Current V <sub>I</sub> < 0V	-20	mA
I <sub>OK</sub>	Output Clamp Current V <sub>O</sub> < -0V	-50	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

Note: 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.

**Recommended Operating Conditions** (Note 5) (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	Supply Voltage		2.0	5.5	V
$V_I$	Input Voltage		0	5.5	V
$V_O$	Output Voltage		0	$V_{CC}$	V
$I_{OH}$	High-Level Output Current	2.0V		-50	mA
		2.3V to 2.7V		-2	$\mu\text{A}$
		3.0V to 3.6V		-6	mA
		4.5V to 5.5V		-12	mA
$I_{OL}$	Low-Level Output Current	2.0V		50	$\mu\text{A}$
		2.3V to 2.7V		2	mA
		3.0V to 3.6V		6	mA
		4.5V to 5.5V		12	mA
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate	2.3V to 2.7V		200	ns/V
		3.0V to 3.6V		100	
		4.5V to 5.5V		20	
$T_A$	Operating Free-Air Temperature		-40	125	$^\circ\text{C}$

 Note: 5. 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
			2.3V to 2.7V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
			3.0V to 3.6V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
			4.5V to 5.5V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
$V_{IL}$	Low-Level Input Voltage		2.0V		0.5		0.5	V
			2.3V to 2.7V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
			3.0V to 3.6V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
			4.5V to 5.5V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
$V_{OH}$	High-Level Output Voltage	$I_{OH} = -50\mu\text{A}$	2.0V to 5.5V	$V_{CC}-0.1$		$V_{CC}-0.1$		V
		$I_{OH} = -2\text{mA}$	2.3V	2.0		2.0		
		$I_{OH} = -6\text{mA}$	3.0V	2.48		2.48		
		$I_{OH} = -12\text{mA}$	4.5V	3.8		3.8		
$V_{OL}$	Low-Level Output Voltage	$I_{OL} = 50\mu\text{A}$	2.0V to 5.5V		0.1		0.1	V
		$I_{OL} = 2\text{mA}$	2.3V		0.4		0.4	
		$I_{OL} = 6\text{mA}$	3.0V		0.44		0.44	
		$I_{OL} = 12\text{mA}$	4.5V		0.55		0.55	
$I_{OFF}$	Power Down Leakage Current	$V_I$ or $V_O = 0$ to 5.5V	0V		5		5	$\mu\text{A}$
$I_I$	Input Current	$V_I = \text{GND}$ or 5.5V	0 to 5.5V		$\pm 1$		$\pm 1$	$\mu\text{A}$
$I_{CC}$	Supply Current	$V_I = \text{GND}$ or $V_{CC}$ $I_O = 0$	5.5V		20		20	$\mu\text{A}$

### 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	Min	Max	Min	Max	
t <sub>PD</sub>	Propagation Delay A <sub>N</sub> to Y <sub>N</sub>	Figure 1 C <sub>L</sub> = 15pF	2.5V ± 0.2V	—	7.1	11.7	1	14	1	14	ns
			3.3V ± 0.3V	—	5.1	7.1	1	8.5	1	8.5	
			5.0V ± 0.5V	—	3.6	5.5	1	6.5	1	6.5	
		Figure 1 C <sub>L</sub> = 50 pF	2.5V ± 0.2V	—	10	15.5	1	18	1	18	ns
			3.3V ± 0.3V	—	7.3	10.6	1	12	1	12	
			5.0V ± 0.5V	—	5.1	7.5	1	8.5	1	8.5	

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

Parameter		Test Conditions	V <sub>CC</sub>	Typ	Unit
C <sub>pd</sub>	Power Dissipation Capacitance per Gate	F = 10 MHz C <sub>L</sub> = 50pF	3.3V	9.6	pF
			5.0V	11.4	

### Noise Characteristics

V<sub>CC</sub> = 3V, C<sub>L</sub> = 50pF T<sub>A</sub> = +25°C

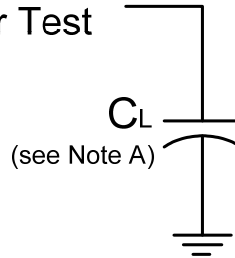
Symbol	Parameter	Min	Typ	Max	Unit
V <sub>OL(p)</sub>	Quiet output, maximum dynamic V <sub>OL</sub>	—	0.2	0.8	V
V <sub>OL(v)</sub>	Quiet output, minimum dynamic V <sub>OL</sub>	—	-0.1	-0.8	V
V <sub>OH(v)</sub>	Quiet output, minimum dynamic V <sub>OH</sub>	—	3.1	—	V
V <sub>IH(D)</sub>	High Level dynamic input voltage	2.31	—	—	V
V <sub>IL(D)</sub>	Low Level dynamic input voltage	—	—	0.99	V

### Package Characteristics

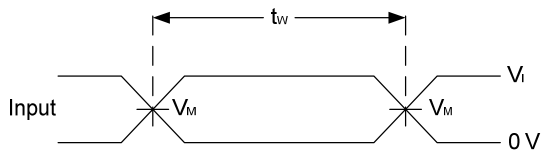
Symbol	Parameter	Test Conditions	V <sub>CC</sub>	Min	Typ	Max	Unit
C <sub>i</sub>	Input Capacitance	V <sub>i</sub> = V <sub>CC</sub> – or GND	2.0 to 5.5V		3.3	10	pF

**Parameter Measurement Information**

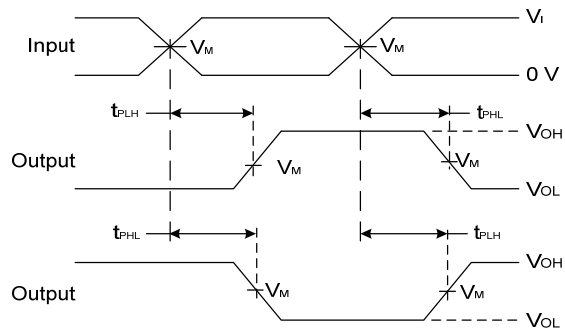
From Output Under Test



$V_{CC}$	Inputs		$V_M$	$C_L$
	$V_I$	$t_r/t_f$		
2.0V to 5.5V	$V_{CC}$	<3ns	$V_{CC}/2$	15pF or 50pF



**Voltage Waveform Pulse Duration**

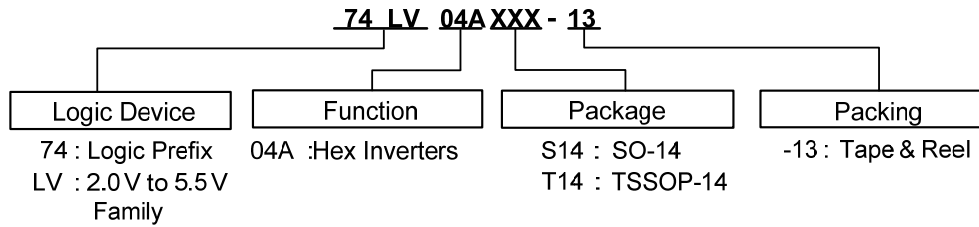


**Voltage Waveform Propagation Delay Times Inverting and Non Inverting Outputs**

- Notes:
- A. Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate  $\leq 10$ 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

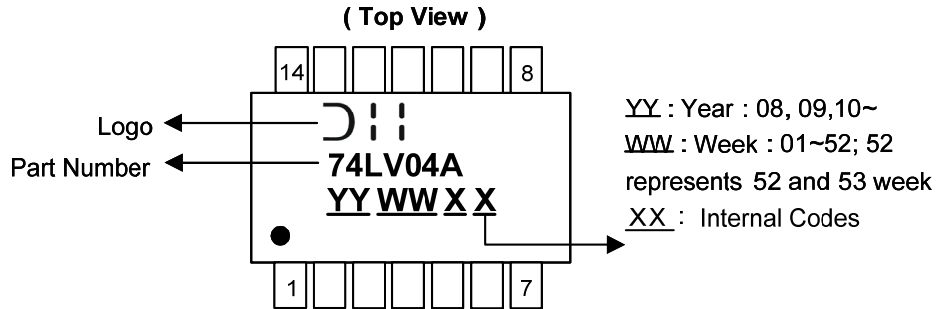


Device	Package Code	Packaging (Note 6)	13" Tape and Reel	
			Quantity	Part Number Suffix
74LV04AS14-13	S14	SO-14	2500/Tape & Reel	-13
74LV04AT14-13	T14	TSSOP-14	2500/Tape & Reel	-13

Note: 6. The taping orientation and tape details can be found at <http://www.diodes.com/datasheets/ap02007.pdf>

## Marking Information

(1) SO14, TSSOP14

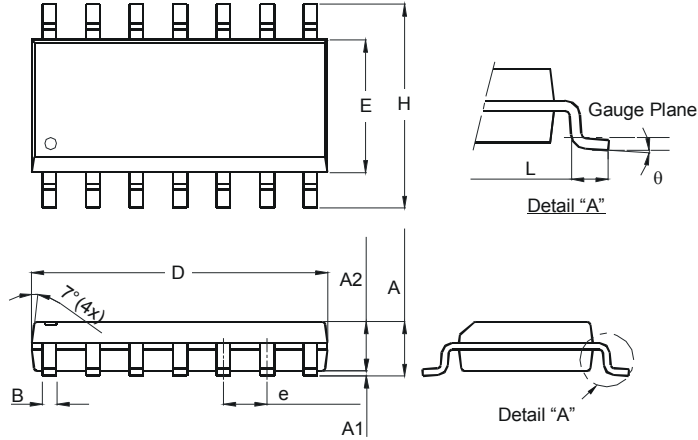


Part Number	Package
74LV04AS14	SO-14
74LV04AT14	TSSOP-14

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

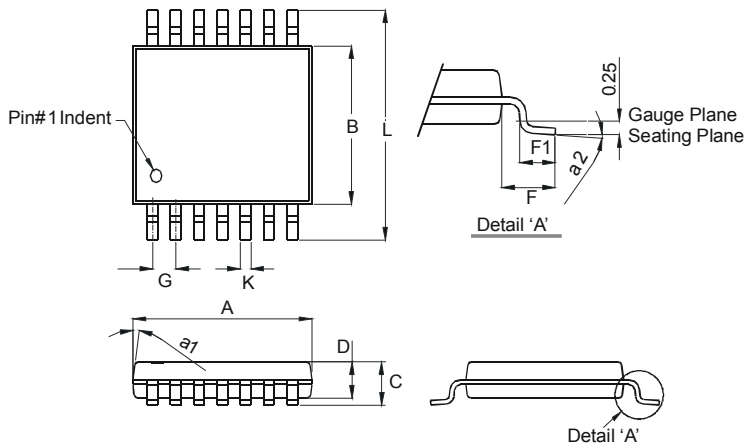
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

**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°
All Dimensions in mm		

**Package Type: TSSOP-14**

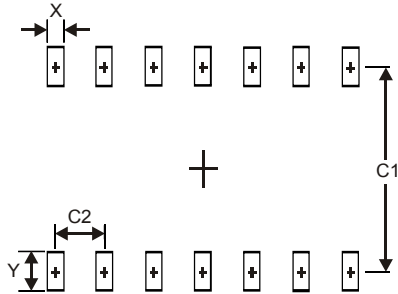


TSSOP-14		
Dim	Min	Max
a1	7° (4X)	
a2	0°	8°
A	4.9	5.10
B	4.30	4.50
C	—	1.2
D	0.8	1.05
F	1.00 Typ	
F1	0.45	0.75
G	0.65 Typ	
K	0.19	0.30
L	6.40 Typ	
All Dimensions in mm		

## Suggested Pad Layout

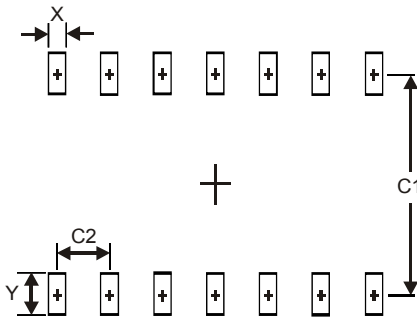
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

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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