## HEX INVERTERS WITH SCHMITT TRIGGER INPUTS

## Description

The 74LVC14A provides six independent schmitt trigger inverter buffers. The device is designed for operation with a power supply range of 1.65V 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 IOFF. The IOFF circuitry disables the output preventing damaging current backflow when the device is powered down.

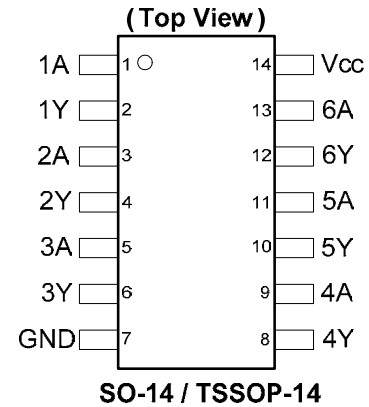The gates perform the positive Boolean function:

$$Y = \overline{A}$$

## Features

- Wide Supply Voltage Range from 1.65V to 5.5V
- Outputs sink or source 24mA at $V_{CC}$ = 3.3V
- CMOS low power consumption
- IOFF Supports Partial-Power-Down Mode Operation
- Inputs or outputs accept up to 5.5V
- Inputs can be driven by 3.3 V or 5.5V allowing for voltage translation applications.
- 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)
- Latch-Up Exceeds 250mA per JESD 78, Class II
- 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

- Voltage Level Shifting
- 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

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 | 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 | $V_{CC}$ | Supply Voltage |

## Logic Diagram
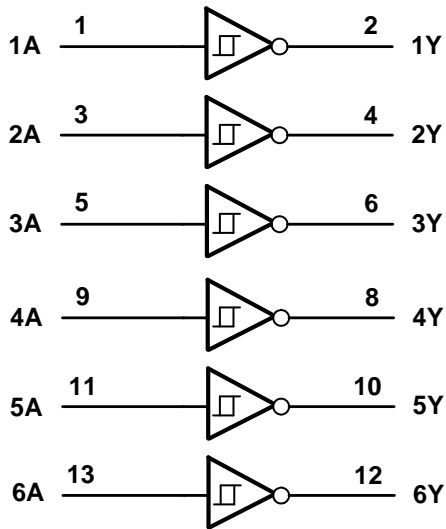


## Function Table

| Inputs | Outputs |
|---|---|
| **A** | **Y** |
| H | L |
| L | H |

## 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 6.5 | V |
| $V_I$ | Input Voltage Range | -0.5 to 6.5 | V |
| $V_O$ | Voltage applied to output in high impedance or $I_{OFF}$ state | -0.5 to 6.5 | V |
| $V_O$ | Voltage applied to output in high or low state | -0.3 to $V_{CC}$ +0.5 | V |
| $I_{IK}$ | Input Clamp Current     $V_I$ < 0 | -50 | mA |
| $I_{OK}$ | Output Clamp Current   $V_O$ < 0 | -50 | mA |
| $I_O$ | Continuous output current | 50 | mA |
|  | Continuous current through $V_{DD}$ or GND | ±100 | 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 |

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°C, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | 1.65 | 5.5 | V |
| $V_I$ | Input Voltage | | 0 | 5.5 | V |
| $V_O$ | Output Voltage | Active Mode | 0 | $V_{CC}$ | V |
|  |  | $V_{CC}$ = 0V; Power Down Mode | 0 | 5.5 | V |
| $T_A$ | Operating free-air temperature | | -40 | +125 | ºC |

Note:   5. Unused inputs should be held at $V_{CC}$ or Ground.

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## 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 | |
| $V_{T+}$ | Positive Going Threshold | | 2.5V | 0.9 | 1.7 | 0.9 | 1.7 | V |
| | | | 2.7V | 1.1 | 2.0 | 1.1 | 2.0 | |
| | | | 2.7V to 3.6V | 1.1 | 2.0 | 1.1 | 2.0 | |
| $V_{T-}$ | Negative Going Threshold | | 2.5V | 0.4 | 1.2 | 0.4 | 1.2 | V |
| | | | 2.7V | 0.8 | 1.5 | 0.8 | 1.5 | |
| | | | 2.7V to 3.6V | 0.8 | 1.5 | 0.8 | 1.5 | |
| $V_H$ | Hysteresis ($V_{T+}$ - $V_{T-}$) | | 2.5V | 0.3 | | 0.2 | | |
| | | | 2.7V | 0.3 | | 0.3 | | |
| | | | 2.7V to 3.6V | 0.3 | | 0.3 | | |
| $V_{OH}$ | High Level Output Voltage | $I_{OH}$ = -100µA | 1.65V to 3.6V | $V_{CC}$ – 0.2 | | $V_{CC}$ – 0.3 | | V |
| | | $I_{OH}$ = -4mA | 1.65V | 1.2 | | | | |
| | | $I_{OH}$ = -8mA | 2.3V | 1.9 | | | | |
| | | $I_{OH}$ = -12mA | 2.7V | 2.2 | | 2.05 | | |
| | | | 3.0V | 2.3 | | 2.1 | | |
| | | $I_{OH}$ = -24mA | 3.0V | 2.2 | | 2.0 | | |
| $V_{OL}$ | High-level Output Voltage | $I_{OH}$ = 100µA | 1.65V to 5.5V | | 0.2 | | 0.3 | V |
| | | $I_{OH}$ = 4mA | 1.65V | | 0.45 | | 0.6 | |
| | | $I_{OH}$ = 8mA | 2.3V | | 0.70 | | 0.85 | |
| | | $I_{OH}$ = 12mA | 2.7V | | 0.40 | | 0.6 | |
| | | | 3.0V | | 0.55 | | 0.6 | |
| | | $I_{OH}$ =-24 mA | 3.0V | | 0.55 | | 0.6 | |
| $I_I$ | Input Current | $V_I$ =GND to 5.5V | 3.6V | | ± 5 | | ± 20 | µA |
| $I_{OFF}$ | Power Down Leakage Current | $V_I$ or $V_O$ = 0V to 3.6V | 0 | | 10 | | 20 | µA |
| $I_{CC}$ | Supply Current | $V_I$ = GND or $V_{CC}$ $I_O$=0 | 3.6V | | 10 | | 40 | µA |
| $\Delta I_{CC}$ | Additional Supply Current | One input at $V_{CC}$ –0.6 V Other | 2.7V to 3.6V | | 500 | | 5000 | µA |

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## Switching Characteristics

| Symbol | Parameter | Test Conditions | $V_{CC}$ | $T_A$ = +25°C | | | -40°C to +85°C | | -40°C to +125°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| $t_{PD}$ | Propagation Delay $A_N$ to $Y_N$ | Figure 1 | 1.65V to1.95V | 0.5 | 4.1 | 8.9 | 0.5 | 8.9 | 0.5 | 9.5 | ns |
| | | | 2.3V to 2.7V | 0.5 | 3.6 | 7.0 | 0.5 | 7.5 | 0.5 | 9.0 | |
| | | | 2.7V | 0.5 | 3.0 | 5.3 | 0.5 | 5.5 | 0.5 | 7.0 | |
| | | | 3V to 3.6V | 0.5 | 2.5 | 4.8 | 0.5 | 4.8 | 0.5 | 6.0 | |
| $t_{SK(0)}$ | Output Skew Time | | 3V to 3.6V | | | | | 1.0 | | 1.5 | ns |

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

| | Parameter | Test Conditions | $V_{CC}$ = 1.8V | $V_{CC}$ = 2.5V | $V_{CC}$ = 3.3V | $V_{CC}$ = 5V | Unit |
|---|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | Typ | |
| $C_{pd}$ | Power dissipation capacitance per gate | f = 10MHz | 7.0 | 7.5 | 8.0 | 8.6 | pF |
| $C_I$ | Input Capacitance | $V_i = V_{CC}$ – or GND | 4 | 4 | 4 | 4 | pF |

## Package Characteristics

| Symbol | Parameter | Test Conditions | $V_{CC}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $\theta_{JA}$ | Thermal Resistance Junction-to-Ambient | SO-14 | (Note 6) | | TBD | | °C/W |
| | | TSSOP-14 | | | 159 | | |
| $\theta_{JC}$ | Thermal Resistance Junction-to-Case | SO-14 | (Note 6) | | TBD | | °C/W |
| | | TSSOP-14 | | | 25 | | |

Note: 6. Test condition for SO-14 and TSSOP-14: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

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## Parameter Measuement Information

From Output
Under Test

$C_L$
(see Note A)

$R_L$
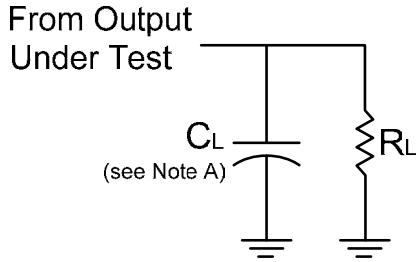
| $V_{CC}$ | Inputs | | $V_M$ | $C_L$ | $R_L$ |
|---|---|---|---|---|---|
| | $V_I$ | $t_r/t_f$ | | | |
| 1.8V±0.15V | $V_{CC}$ | ≤2ns | $V_{CC}/2$ | 30pF | 1KΩ |
| 2.5V±0.2V | $V_{CC}$ | ≤2ns | $V_{CC}/2$ | 30pF | 500Ω |
| 3.3V±0.3V | 3V | ≤2.5ns | 1.5V | 50pF | 500Ω |
| 5V±0.5V | $V_{CC}$ | ≤2.5ns | $V_{CC}/2$ | 50pF | 500Ω |

**Voltage Waveform**
**Pulse Duration**

**Voltage Waveform**
**Propagation Delay Times**
**Inverting and Non Inverting Outputs**
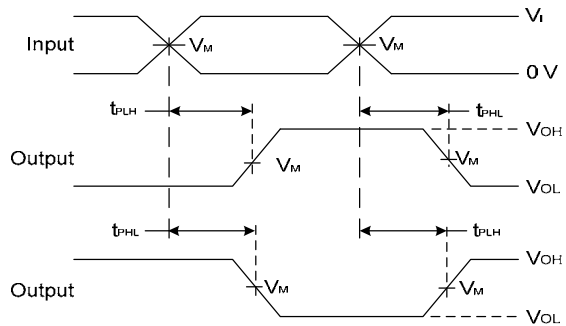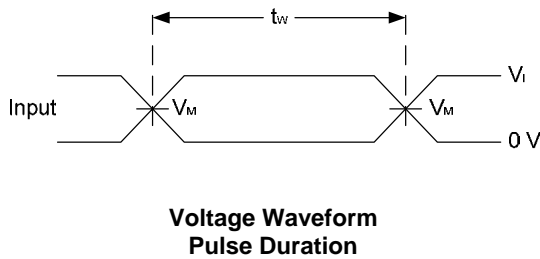
Notes: A . Includes test lead and test apparatus capacitance.
   B.  All pulses are supplied at pulse repetition rate ≤ 10 MHz
   C.  Inputs are measured separately one transition per measurement
   D.  $t_{PLH}$ and $t_{PHL}$ are the same as $t_{PD}$

**Figure 1.  Load Circuit and Voltage Waveforms**

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## Ordering Information

74 LVC 14 A XXX -13
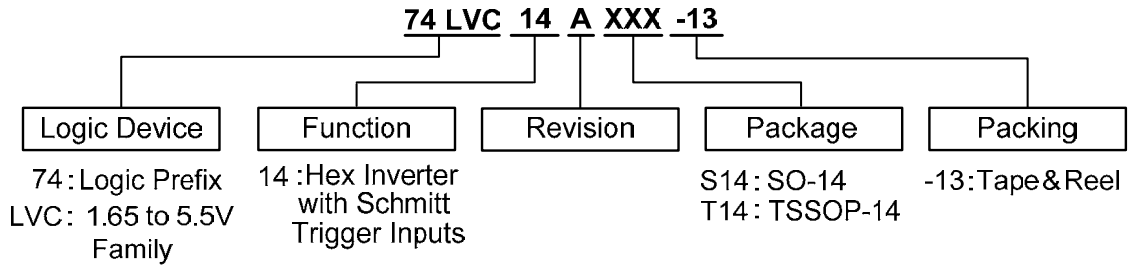
| Logic Device | Function | Revision | Package | Packing |
|---|---|---|---|---|
| 74 : Logic Prefix<br>LVC : 1.65 to 5.5V<br>Family | 14 : Hex Inverter<br>with Schmitt<br>Trigger Inputs | | S14 : SO-14<br>T14 : TSSOP-14 | -13 : Tape & Reel |

| Device | Package Code | Packaging (Note 7) | 13" Tape and Reel | |
|---|---|---|---|---|
| | | | Quantity | Part Number Suffix |
| 74LVC14AS14-13 | S14 | SO-14 | 2500/Tape & Reel | -13 |
| 74LVC14AT14-13 | T14 | TSSOP-14 | 2500/Tape & Reel | -13 |

Notes:  7. The taping orientation and tape details can be found at http://www.diodes.com/datasheets/ap02007.pdf

## Marking Information

**(1) SO-14 , TSSOP-14**

( Top View )

Logo

Part Number

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YY WW X

YY : Year : 08, 09,10~
WW : Week : 01~52; 52
represents 52 and 53 week
X : Internal Code
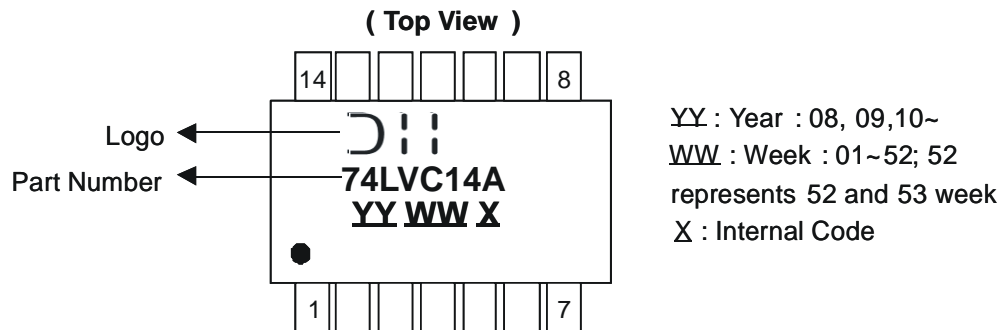
| Part Number | Package |
|---|---|
| 74LVC14AS14 | SO-14 |
| 74LVC14AT14 | TSSOP-14 |

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

### Package Type: SO-14
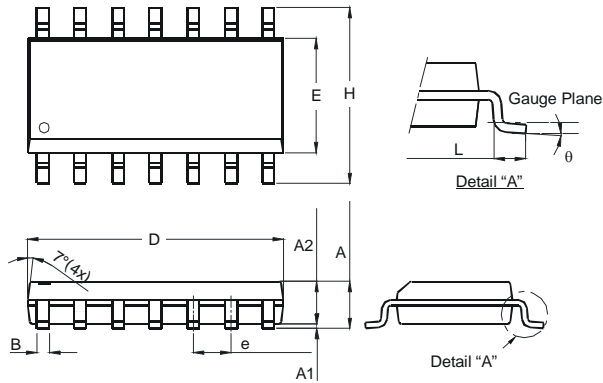


| SO-14 | | |
|---|---|---|
| Dim | Min | Max |
| A | 1.47 | 1.73 |
| A1 | 0.10 | 0.25 |
| A2 | 1.45 Typ | |
| B | 0.33 | 0.51 |
| D | 8.53 | 8.74 |
| E | 3.80 | 3.99 |
| e | 1.27 Typ | |
| H | 5.80 | 6.20 |
| L | 0.38 | 1.27 |
| θ | 0° | 8° |
| All Dimensions in mm | | |

### Package Type: TSSOP-14
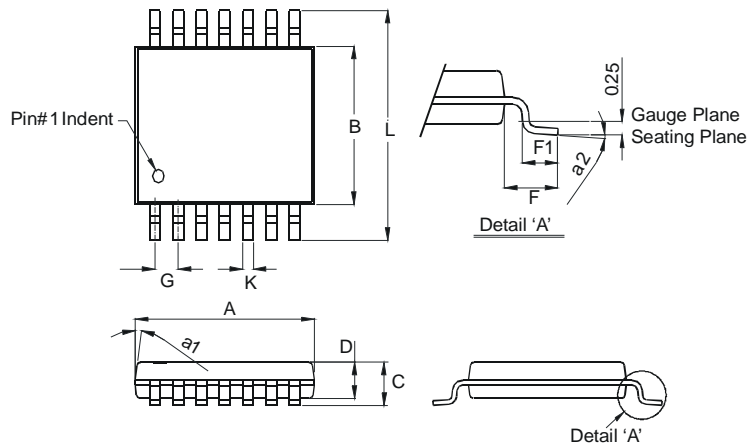


| TSSOP-14 | | |
|---|---|---|
| Dim | Min | Max |
| a1 | 7° (4X) | |
| a2 | 0° | 8° |
| A | 4.9 | 5.10 |
| B | 4.30 | 4.50 |
| C | — | 1.2 |
| D | 0.8 | 1.05 |
| F | 1.00 Typ | |
| F1 | 0.45 | 0.75 |
| G | 0.65 Typ | |
| K | 0.19 | 0.30 |
| L | 6.40 Typ | |
| All Dimensions in mm | | |

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## Suggested Pad Layout

**Package Type: SO-14**
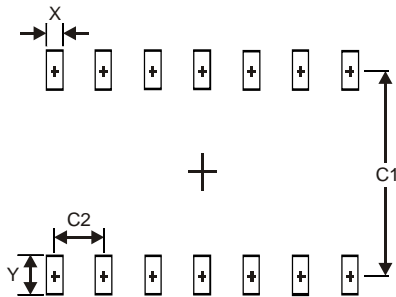


| Dimensions | Value (in mm) |
|---|---|
| X | 0.60 |
| Y | 1.50 |
| C1 | 5.4 |
| C2 | 1.27 |

**Package Type: TSSOP-14**
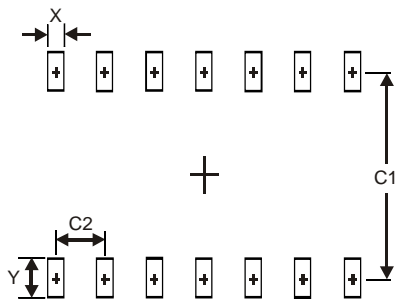


| Dimensions | Value (in mm) |
|---|---|
| X | 0.45 |
| Y | 1.45 |
| C1 | 5.9 |
| C2 | 0.65 |

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## IMPORTANT NOTICE

## LIFE SUPPORT

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