

## HEX INVERTERS WITH SCHMITT TRIGGER INPUTS

### Description

The 74HCT14 provides six independent Schmitt trigger input inverters with standard push-pull outputs. The device is designed for operation with a power supply range of 4.5V to 5.5V.

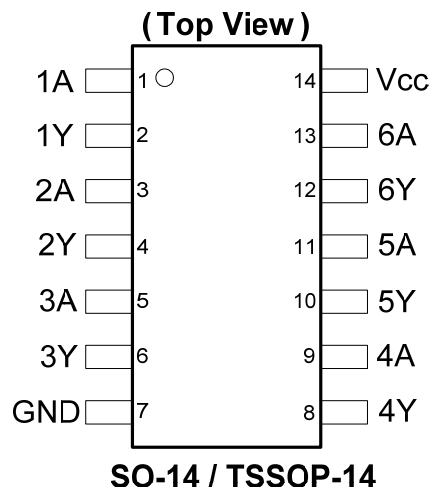
The gates perform the Boolean function:

$$Y = \overline{A}$$

### Features

- Wide Supply Voltage Range from 4.5V to 5.5V
- Pin Compatible with Low Power Schottky (LSTTL)
- Inputs Are TTL Voltage Level Compatible
- 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

- 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

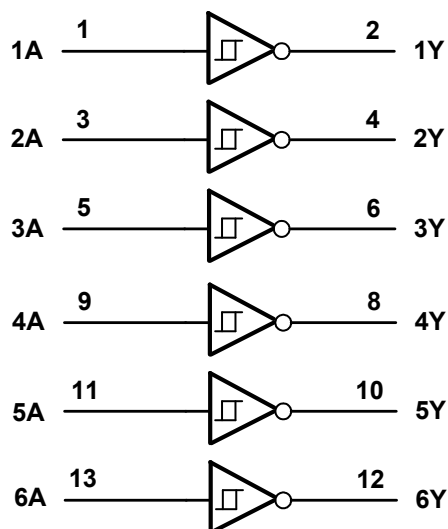
Notes:

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      |

**Absolute Maximum Ratings** (Note 4) (@T<sub>A</sub> = +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 <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:
- 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<sub>CC</sub> to the extent the maximum clamp current is exceeded.

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

| Symbol          | Parameter                          | Conditions                     | Min | Max             | Unit |
|-----------------|------------------------------------|--------------------------------|-----|-----------------|------|
| V <sub>CC</sub> | Supply Voltage                     |                                | 4.5 | 5.5             | 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> = 4.5V to 5.5V | —   | 500             | ns/V |
| 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>T+</sub>  | Positive-Going Input Threshold Voltage          |                                                                            | 4.5V            |                                 | 1.9  |                                  | 1.9 | V    |
|                  |                                                 |                                                                            | 5.5V            |                                 | 2.1  |                                  | 2.1 |      |
| V <sub>T-</sub>  | Negative-Going Input Threshold Voltage          |                                                                            | 4.5V            | 0.5                             |      | 0.5                              |     | V    |
|                  |                                                 |                                                                            | 5.5V            | 0.6                             |      | 0.6                              |     |      |
| ΔV <sub>T</sub>  | Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> ) |                                                                            | 4.5V            | 0.4                             |      | 0.4                              |     | V    |
|                  |                                                 |                                                                            | 5.5V            | 0.4                             |      | 0.4                              |     |      |
| V <sub>OH</sub>  | High-Level Output Voltage                       | I <sub>OH</sub> = -20μA                                                    | 4.5V            | 4.4                             |      | 4.4                              |     | V    |
|                  |                                                 | I <sub>OH</sub> = -4mA                                                     | 4.5V            | 3.84                            |      | 3.70                             |     |      |
| V <sub>OL</sub>  | Low Level Output Voltage                        | I <sub>OL</sub> = 20μA                                                     | 4.5V            |                                 | 0.1  |                                  | 0.1 | V    |
|                  |                                                 | I <sub>OL</sub> = 4mA                                                      | 4.5V            |                                 | 0.33 |                                  | 0.4 |      |
| I <sub>I</sub>   | Input Current                                   | V <sub>I</sub> = GND to 6.0V                                               | 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   |
| ΔI <sub>CC</sub> | Additional Supply Current                       | One input at V <sub>CC</sub> -2.1V<br>Other pins at V <sub>CC</sub> or GND | 4.5V to 5.5V    |                                 | 135  |                                  | 147 | μA   |

## Switching Characteristics

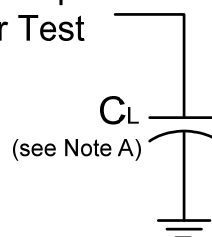
| Symbol          | Parameter                                          | Test Conditions                   | V <sub>CC</sub> | T <sub>A</sub> = +25°C |     |     | -40°C to +85°C | -40°C to +125°C | Unit |
|-----------------|----------------------------------------------------|-----------------------------------|-----------------|------------------------|-----|-----|----------------|-----------------|------|
|                 |                                                    |                                   |                 | Min                    | Typ | Max | Max            | Max             |      |
| t <sub>PD</sub> | Propagation Delay A <sub>N</sub> to Y <sub>N</sub> | Figure 1<br>C <sub>L</sub> = 50pF | 4.5V            | —                      | 20  | 34  | 43             | 51              | ns   |
| t <sub>t</sub>  | Transition Time                                    | Figure 1<br>C <sub>L</sub> = 50pF | 4.5V            | —                      | 7   | 15  | 19             | 22              | ns   |

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

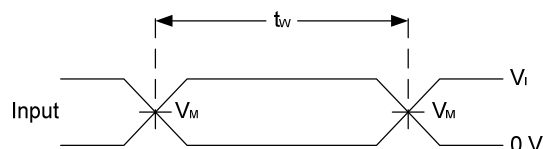
| Parameter       |                                        | Test Conditions                           | V <sub>CC</sub> = 5.5 V | Unit |
|-----------------|----------------------------------------|-------------------------------------------|-------------------------|------|
|                 |                                        |                                           | Typ                     |      |
| C <sub>pd</sub> | Power Dissipation Capacitance per Gate | f = 1MHz                                  | 15                      | pF   |
| C <sub>i</sub>  | Input Capacitance                      | V <sub>i</sub> = V <sub>CC</sub> – or GND | 4                       | pF   |

## Parameter Measurement Information

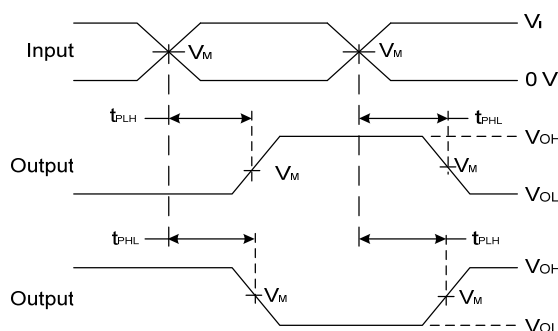
From Output  
Under Test



| V <sub>CC</sub> | Inputs         |                                | V <sub>M</sub> | C <sub>L</sub>     |
|-----------------|----------------|--------------------------------|----------------|--------------------|
|                 | V <sub>i</sub> | t <sub>r</sub> /t <sub>f</sub> |                |                    |
| 4.5V            | 3.0V           | 3ns                            | 1.5V           | V <sub>OH</sub> /2 |



**Voltage Waveform  
Pulse Duration**

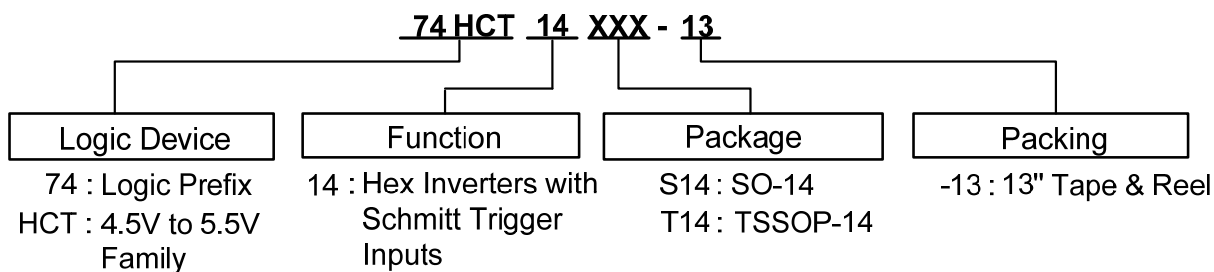


**Voltage Waveform  
Propagation Delay Times  
Inverting and Non Inverting Outputs**

- Notes:
- A. Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate ≤ 1 MHz.
  - C. Inputs are measured separately one transition per measurement.
  - D. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>PD</sub>.

**Figure 1 Load Circuit and Voltage Waveforms**

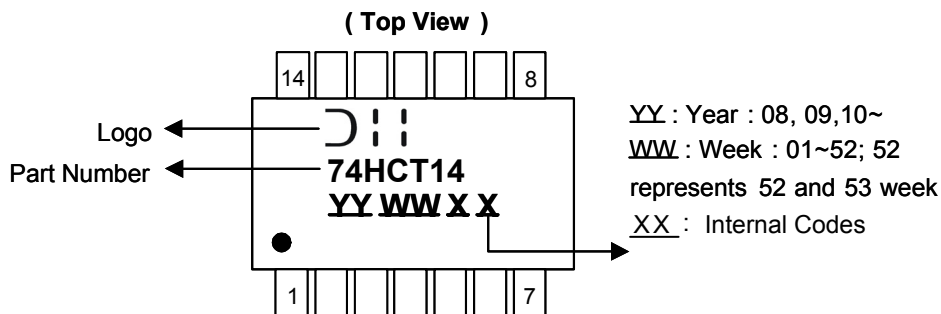
## Ordering Information



| Device        | Package Code | Packaging | 7" Tape and Reel |                    |
|---------------|--------------|-----------|------------------|--------------------|
|               |              |           | Quantity         | Part Number Suffix |
| 74HCT14S14-13 | S14          | SO-14     | 2500/Tape & Reel | -13                |
| 74HCT14T14-13 | T14          | TSSOP-14  | 2500/Tape & Reel | -13                |

## Marking Information

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

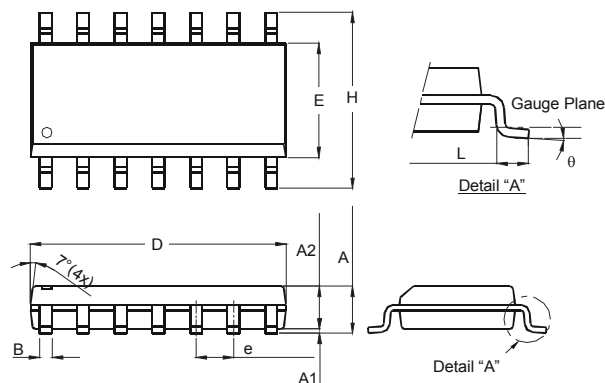


| Part Number | Package  |
|-------------|----------|
| 74HCT14S14  | SO-14    |
| 74HCT14T14  | TSSOP-14 |

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

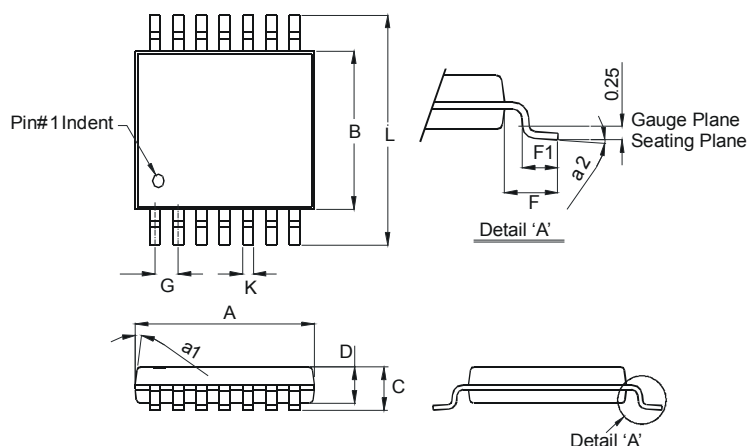
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

### 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

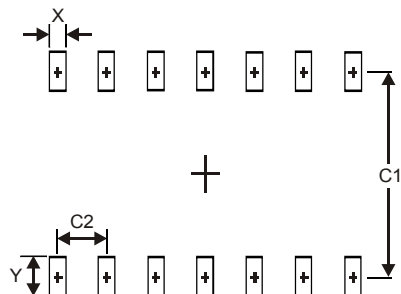


| TSSOP-14             |          |      |
|----------------------|----------|------|
| Dim                  | Min      | Max  |
| a1                   | 7° (4X)  |      |
| a2                   | 0°       | 8°   |
| A                    | 4.9      | 5.10 |
| B                    | 4.30     | 4.50 |
| 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

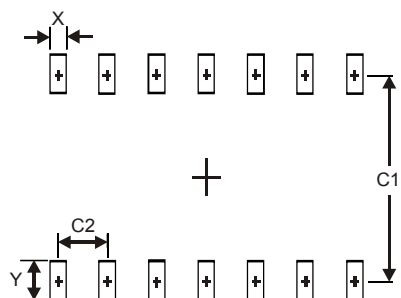
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for latest version.

### 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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