

HEX INVERTERS WITH OPEN DRAIN OUTPUTS

**Description**

The 74HCT05 provides provides six independent inverters with open drain outputs. The device is designed for operation with a power supply range of 4.5V to 5.5V.

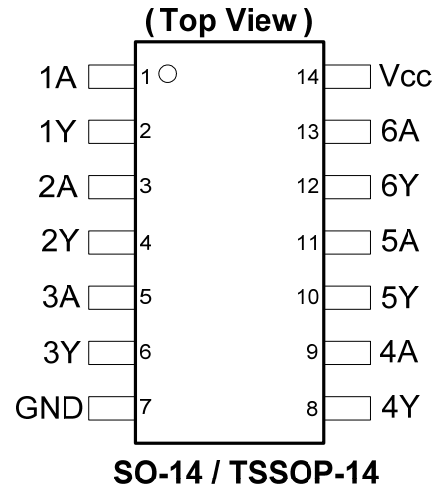
The gates perform the Boolean function:

$$Y = \overline{A}$$

**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 4mA at V<sub>CC</sub> = 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**

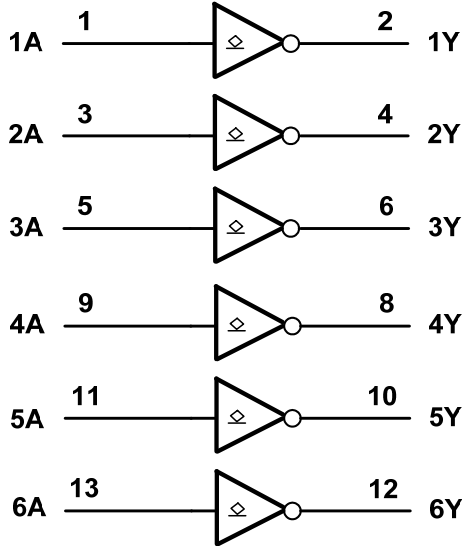
- General Purpose Logic
- Wide array of products such as:
  - PCs, networking, notebooks, netbooks
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box

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         | Vcc      | Supply Voltage |

**Logic Diagram**



**Function Table**

| Input | Output |
|-------|--------|
| A     | Y      |
| H     | L      |
| L     | Z      |

**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>IH</sub>  | High-level Input Voltage  |  | 4.5V to 5.5V    | 2.0                             |       | 2.0                              |      | V    |
| V <sub>IL</sub>  | Low-level Input Voltage   |  | 4.5V to 5.5V    |                                 | 0.8   |                                  | 0.8  | V    |
| V <sub>OL</sub>  | Low-level Output Voltage  | I <sub>OL</sub> = 20μA   | 4.5V            |                                 | 0.1   |                                  | 0.1  | V    |
|                  |                           | I <sub>OL</sub> = 4.0 mA   | 4.5V            |                                 | 0.33  |                                  | 0.4  |      |
| I <sub>OZ</sub>  | Z State Leakage Current   | V <sub>O</sub> = 0 to 5.5V<br>V <sub>I</sub> = V <sub>IL</sub>             | 5.5V            |                                 | ± 5.0 |                                  | ± 10 | μA   |
| 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    |                                 | 540   |                                  | 590  | μA   |

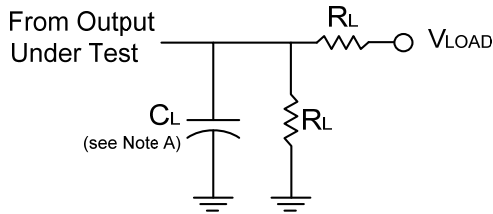
## Switching Characteristics

| 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            | —                      | 12  | 20  | 24             | 27              | ns   |
| t <sub>t</sub>  | Transition time                                    | Figure 1<br>C <sub>L</sub> = 50pF | 4.5V            | —                      | 7   | 14  | 19             | 22              | ns   |

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

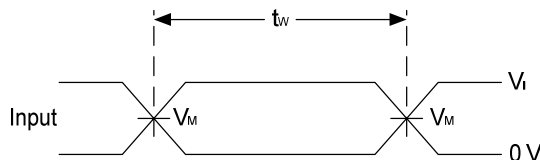
| Parameter       |  | Test Conditions                           | V <sub>CC</sub> = 5.5V | Unit |
|-----------------|--|---|------------------------|------|
|                 |  |   | Typ                    |      |
| C <sub>pd</sub> | Power Dissipation Capacitance per Gate | f = 1MHz                                  | 17                     | pF   |
| C <sub>i</sub>  | Input Capacitance                      | V <sub>i</sub> = V <sub>CC</sub> – or GND | 4                      | pF   |

## Parameter Measurement Information

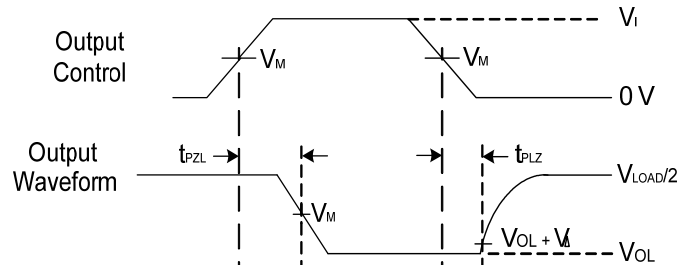


| TEST                                 | Condition         |
|--------------------------------------|-------------------|
| t <sub>PLZ</sub> (see Notes D and E) | V <sub>load</sub> |
| t <sub>PZL</sub> (see Notes D and F) | V <sub>load</sub> |

| 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> |                |                     |                |                |                        |
| 4.5V            | 1.5V           | ≤6ns                           | 3.0V           | 2 X V <sub>CC</sub> | 50pF           | 2KΩ            | 10% of V <sub>CC</sub> |



**Voltage Waveform Pulse Duration**

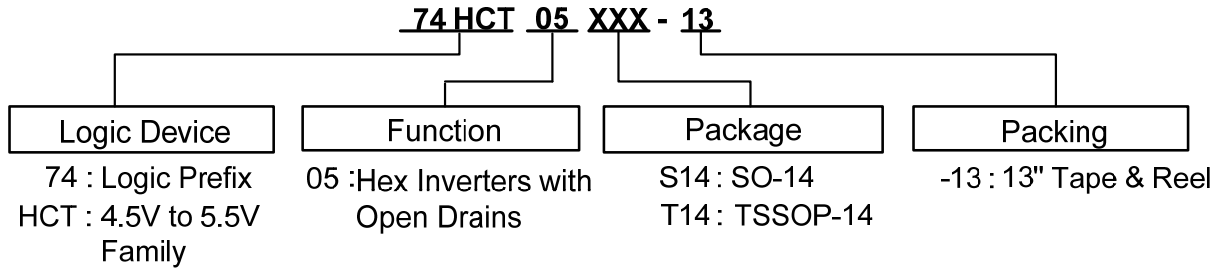


**Voltage Waveform Propagation Delay Times**

- 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>.
  - D. t<sub>PLZ</sub> is measured at V<sub>OL</sub> + V<sub>Δ</sub>
  - F. 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**

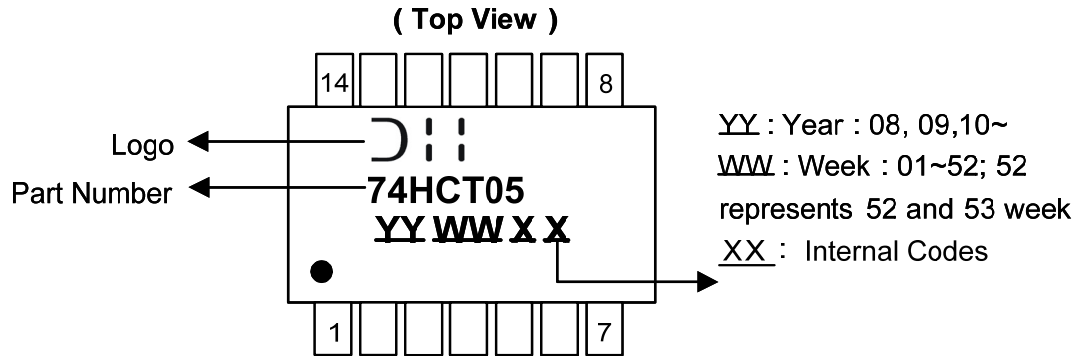
**Ordering Information**



| Device        | Package Code | Packaging | 7" Tape and Reel |                    |
|---------------|--------------|-----------|------------------|--------------------|
|               |              |           | Quantity         | Part Number Suffix |
| 74HCT05S14-13 | S14          | SO-14     | 2500/Tape & Reel | -13                |
| 74HCT05T14-13 | T14          | TSSOP-14  | 2500/Tape & Reel | -13                |

**Marking Information**

(1) SO-14, TSSOP-14

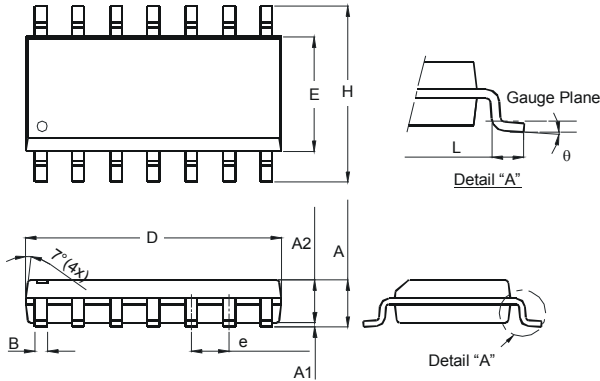


| Part Number | Package  |
|-------------|----------|
| 74HCT05S14  | SO-14    |
| 74HCT05T14  | TSSOP-14 |

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

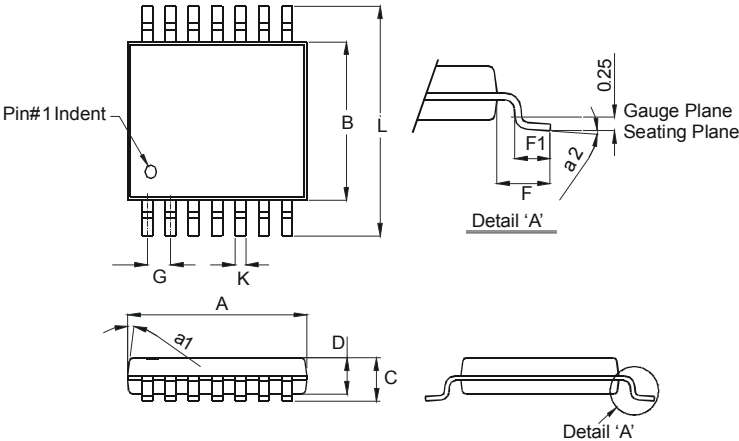
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

**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°   |
| <b>All Dimensions in mm</b> |          |      |

**Package Type: TSSOP-14**

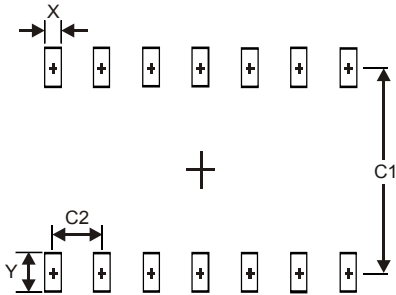


| TSSOP-14                    |          |      |
|-----------------------------|----------|------|
| Dim                         | Min      | Max  |
| a1                          | 7° (4X)  |      |
| a2                          | 0°       | 8°   |
| A                           | 4.9      | 5.10 |
|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

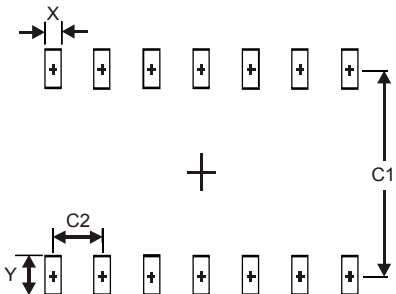
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for latest version.

**Package Type: SO-14**



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

**Package Type: TSSOP-14**



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

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