



# Low Power Schottky Logic – 74LS04

Hex Inverter Gates Logic IC in bare die form

Rev 1.0  
24/11/17

## Description

The 74LS04 Hex Inverter is fabricated using a 2µm 40V Bipolar process. The device contains six independent inverters with standard push-pull outputs which perform the Boolean function  $Y = \bar{A}$  in positive logic.

## Features:

- High speed – 19ns (Typ) propagation delay
- Direct drop-in replacement for obsolete components in long term programs.

## Ordering Information

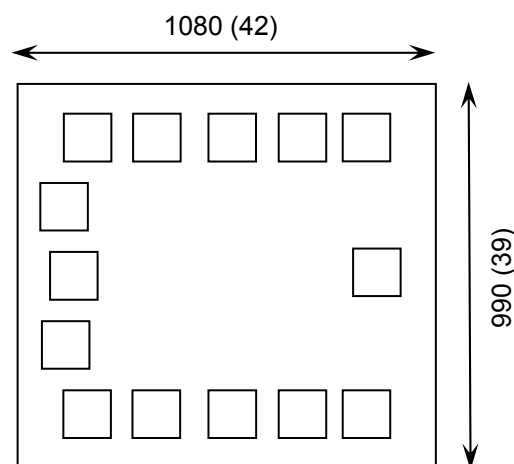
The following part suffixes apply:

- No suffix - MIL-STD-883 /2010B Visual Inspection

For High Reliability versions of this product please see

[54LS04](#)

## Die Dimensions in µm (mils)



## Supply Formats:

- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

## Mechanical Specification

|                        |                            |            |
|------------------------|----------------------------|------------|
| Die Size (Unsawn)      | 1080 x 990<br>42 x 39      | µm<br>mils |
| Minimum Bond Pad Size  | 116 x 116<br>4.6 x 4.6     | µm<br>mils |
| Die Thickness          | 350 (±20)<br>13.78 (±0.79) | µm<br>mils |
| Top Metal Composition  | Al 1%Si 1.1µm              |            |
| Back Metal Composition | N/A – Bare Si              |            |



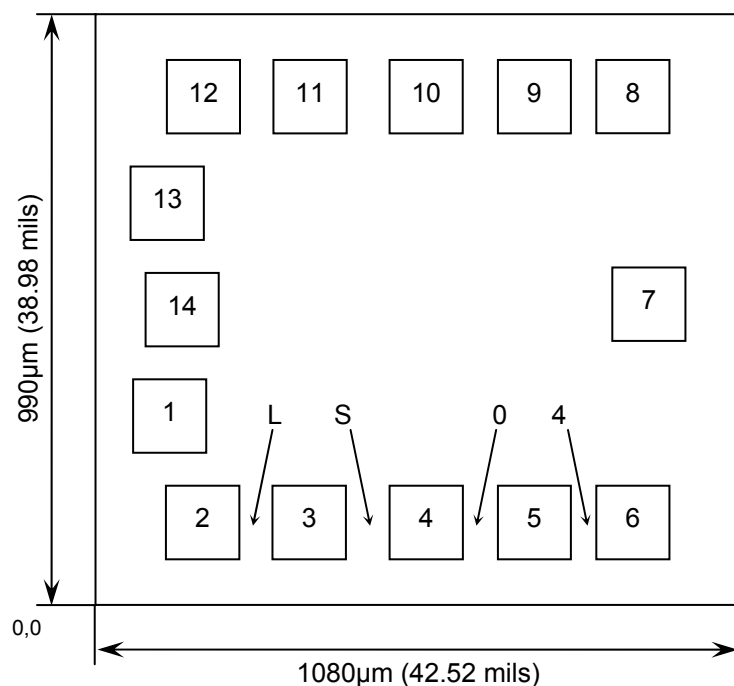


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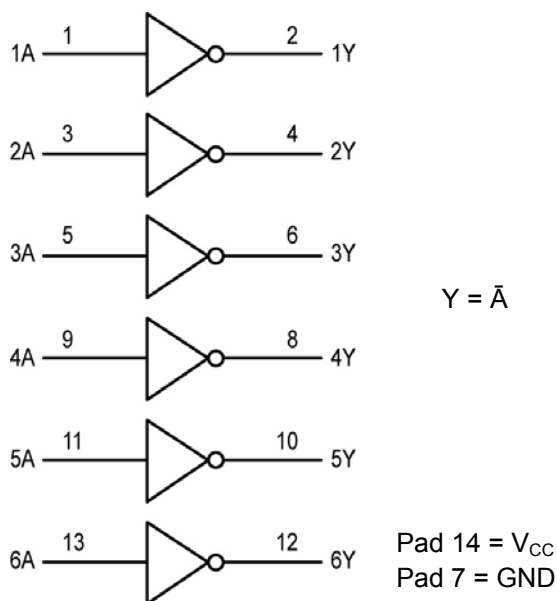
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## Pad Layout and Functions



| PAD                               | FUNCTION        | COORDINATES (mm) |       |
|-----------------------------------|-----------------|------------------|-------|
|                                   |                 | X                | Y     |
| 1                                 | 1A              | 0.073            | 0.268 |
| 2                                 | 1Y              | 0.132            | 0.092 |
| 3                                 | 2A              | 0.308            | 0.092 |
| 4                                 | 2Y              | 0.503            | 0.092 |
| 5                                 | 3A              | 0.685            | 0.092 |
| 6                                 | 3Y              | 0.854            | 0.092 |
| 7                                 | GND             | 0.880            | 0.456 |
| 8                                 | 4Y              | 0.854            | 0.804 |
| 9                                 | 4A              | 0.685            | 0.804 |
| 10                                | Y5              | 0.503            | 0.804 |
| 11                                | 5A              | 0.308            | 0.804 |
| 12                                | 6Y              | 0.132            | 0.804 |
| 13                                | 6A              | 0.073            | 0.628 |
| 14                                | V <sub>CC</sub> | 0.094            | 0.450 |
| CONNECT CHIP BACK TO GND OR FLOAT |                 |                  |       |

## Logic Diagram



## Truth Table

| INPUTS                        |  | OUTPUT |
|-------------------------------|--|--------|
| A                             |  | Y      |
| H                             |  | L      |
| L                             |  | H      |
| H = High level (steady state) |  |        |
| L = Low level (steady state)  |  |        |





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## Absolute Maximum Ratings<sup>1</sup>

| PARAMETER                 | SYMBOL    | VALUE      | UNIT |
|---------------------------|-----------|------------|------|
| DC Supply Voltage         | $V_{CC}$  | 7.0        | V    |
| DC Input Voltage          | $V_{IN}$  | 7.0        | V    |
| Storage Temperature Range | $T_{STG}$ | -65 to 150 | °C   |

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

## Recommended Operating Conditions

| PARAMETER                   | SYMBOL   | MIN  | MAX  | UNITS |
|-----------------------------|----------|------|------|-------|
| Supply Voltage              | $V_{CC}$ | 4.75 | 5.25 | V     |
| High-Level Input Voltage    | $V_{IH}$ | 2    | -    | V     |
| Low-Level Input Voltage     | $V_{IL}$ | -    | 0.8  | V     |
| High-Level Output Current   | $I_{OH}$ | -    | -0.4 | mA    |
| Low-Level Output Current    | $I_{OL}$ | -    | 8    | mA    |
| Operating Temperature Range | $T_J$    | 0    | +85  | °C    |

## DC Electrical Characteristics<sup>2</sup> $T_J = 0^\circ\text{C}$ to $85^\circ\text{C}$ unless otherwise specified

| PARAMETER                          | SYMBOL   | CONDITIONS  | LIMITS |       |      | UNITS         |
|------------------------------------|----------|---|--------|-------|------|---------------|
|                                    |          |   | MIN    | TYP   | MAX  |               |
| Minimum High-Level Input Voltage   | $V_{IH}$ | -   | 2      | -     | -    | V             |
| Maximum Low-Level Input Voltage    | $V_{IL}$ | -   | -      | -     | 0.8  | V             |
| Input Clamp Diode Voltage          | $V_{IK}$ | $V_{CC} = \text{MIN}$<br>$I_{IN} = -18\text{mA}$  | -      | -0.65 | -1.5 | V             |
| Output Voltage High                | $V_{OH}$ | $V_{CC} = \text{MIN}, I_{OH} = \text{MAX}$<br>$V_{IN} = V_{IL}$ or $V_{IH}$<br>per Truth Table                                      | 2.7    | 3.5   | -    | V             |
| Output Voltage Low                 | $V_{OL}$ | $V_{CC} = V_{CC} \text{ MIN}$<br>$I_{OH} = \text{MAX}$<br>$V_{IN} = V_{IL}$ or $V_{IH}$<br>per Truth Table<br>$I_{OL} = 8\text{mA}$ | -      | 0.35  | 0.5  | V             |
| Input High Current                 | $I_{IH}$ | $V_{CC} = \text{MAX}, V_{IN} = 2.7\text{V}$   | -      | -     | 20   | $\mu\text{A}$ |
|                                    |          | $V_{CC} = \text{MAX}, V_{IN} = 7.0\text{V}$   | -      | -     | 0.1  | mA            |
| Input Low Current                  | $I_{IL}$ | $V_{CC} = \text{MAX}, V_{IN} = 0.4\text{V}$   | -      | -     | -0.4 | mA            |
| Short Circuit Current <sup>3</sup> | $I_{OS}$ | $V_{CC} = \text{MAX}$   | -20    | -     | -100 | mA            |
| Power Supply Current (Total)       | $I_{CC}$ | $V_{CC} = \text{MAX}$ , Output High   | -      | 1.2   | 2.4  | mA            |
|                                    |          | $V_{CC} = \text{MAX}$ , Output Low  | -      | 3.6   | 6.6  |               |

2. All typical values @  $V_{CC} = 5\text{V}$ ,  $T_J = 25^\circ\text{C}$ . 3. Not more than one output should be shorted at a time, nor for more than 1 second.





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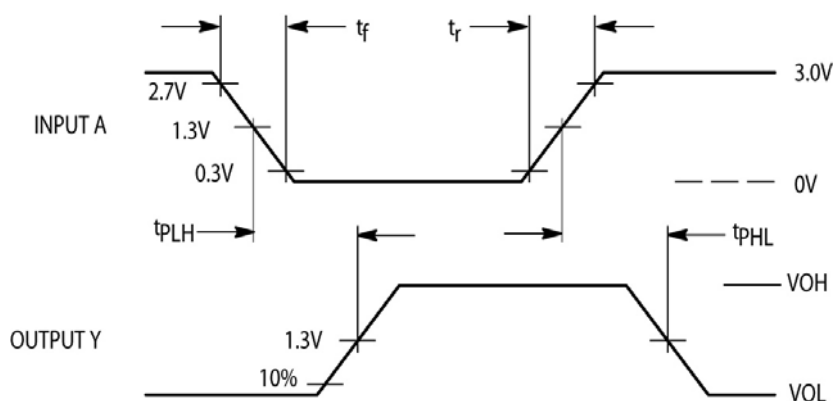
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## AC Electrical Characteristics<sup>4</sup>

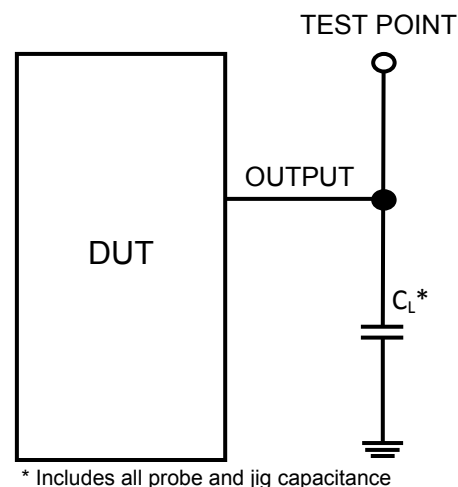
| PARAMETER                          | SYMBOL    | CONDITIONS                | LIMITS |     |     | UNITS |
|------------------------------------|-----------|---------------------------|--------|-----|-----|-------|
|                                    |           |                           | MIN    | TYP | MAX |       |
| Turn-Off Delay,<br>Input to Output | $t_{PLH}$ | $V_{CC} = 5V, C_L = 15pF$ | -      | 9.0 | 15  | ns    |
| Turn-On Delay,<br>Input to Output  | $t_{PHL}$ | $V_{CC} = 5V, C_L = 15pF$ | -      | 10  | 15  |       |

4. Not production tested in die form, characterized by chip design and tested in package.

## Switching Waveform



## Test Circuit



\* Includes all probe and jig capacitance

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