

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_{OFF}. The I_{OFF} circuitry disables the output preventing damaging current backflow when the device is powered down.

The gates perform the Boolean function:

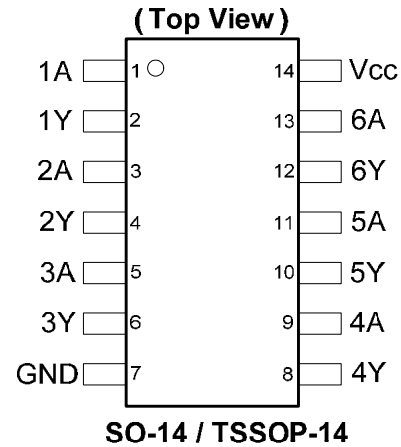
$$Y = \bar{A}$$

Features

- Wide Supply Voltage Range from 2.0V to 5.5V
- Sinks or sources 12mA at V_{CC} = 4.5V
- CMOS low power consumption
- I_{OFF} 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

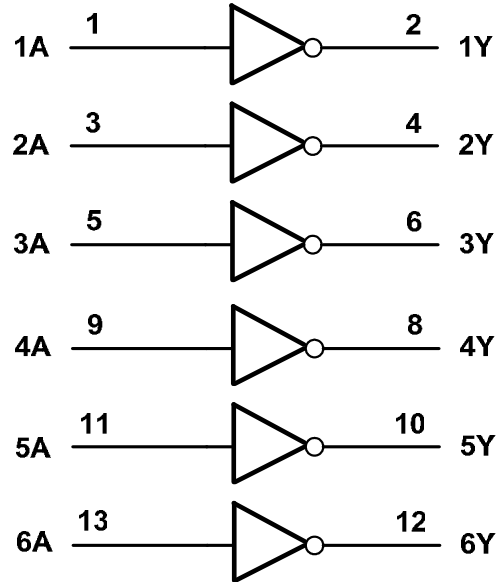
- General Purpose Logic
- Power Down Signal Isolation
- Wide array of products such as:
 - PCs, networking, notebooks, ultrabooks, netbooks
 - Computer peripherals, hard drives, CD/DVD ROM
 - TV, DVD, DVR, set top box

[Click here for ordering information, located at the end of datasheet](#)

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_A = +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 _{CC} | Supply Voltage Range | -0.5 to +7.0 | V |
| V _I | Input Voltage Range (Note 4) | -0.5 to +7.0 | V |
| I _{IK} | Input Clamp Current V _I < 0V | -20 | mA |
| I _{OK} | Output Clamp Current V _O < -0V | -50 | mA |
| I _O | Continuous Output Current - 0.5V < V _O < V _{CC} + 0.5V | ±25 | mA |
| I _{CC} | Continuous Current Through V _{CC} | 50 | mA |
| I _{GND} | Continuous Current Through GND | -50 | 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) (@ $T_A = +25^\circ\text{C}$, 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 | μA |
| | | 3.0V to 3.6V | | -6 | mA |
| | | 4.5V to 5.5V | | -12 | mA |
| I_{OL} | Low-Level Output Current | 2.0V | | 50 | μA |
| | | 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 | μA |
| I_I | Input Current | $V_I = \text{GND}$ or 5.5V | 0 to 5.5V | | ± 1 | | ± 1 | μA |
| I_{CC} | Supply Current | $V_I = \text{GND}$ or V_{CC} $I_O = 0$ | 5.5V | | 20 | | 20 | μA |

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 C _L = 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 _L = 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_A = +25°C, unless otherwise specified.)

| Parameter | | Test Conditions | V _{CC} | Typ | Unit |
|-----------------|--|-------------------------------------|-----------------|------|------|
| C _{pd} | Power Dissipation Capacitance per Gate | F = 10 MHz C _L = 50pF | 3.3V | 9.6 | pF |
| | | | 5.0V | 11.4 | |

Noise Characteristics

V_{CC} = 3V, C_L = 50pF T_A = +25°C

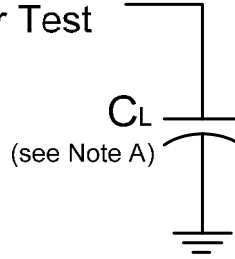
| Symbol | Parameter | Min | Typ | Max | Unit |
|--------------------|---|------|------|------|------|
| V _{OL(p)} | Quiet output, maximum dynamic V _{OL} | — | 0.2 | 0.8 | V |
| V _{OL(v)} | Quiet output, minimum dynamic V _{OL} | — | -0.1 | -0.8 | V |
| V _{OH(v)} | Quiet output, minimum dynamic V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

Package Characteristics

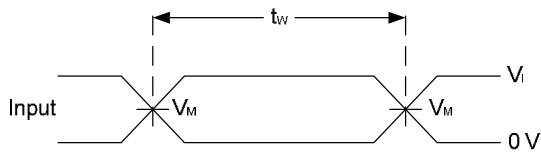
| Symbol | Parameter | Test Conditions | V _{CC} | Min | Typ | Max | Unit |
|----------------|-------------------|---|-----------------|-----|-----|-----|------|
| C _i | Input Capacitance | V _i = V _{CC} – or GND | 2.0 to 5.5V | | 3.3 | 10 | pF |

Parameter Measurement Information

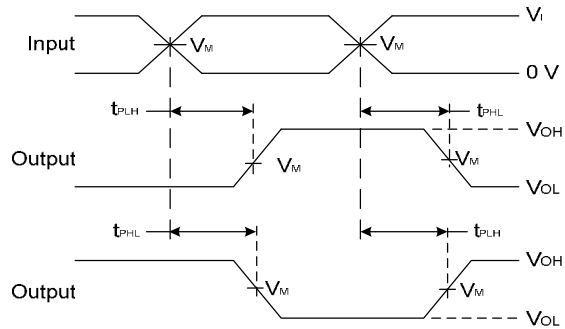
From Output Under Test



| 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

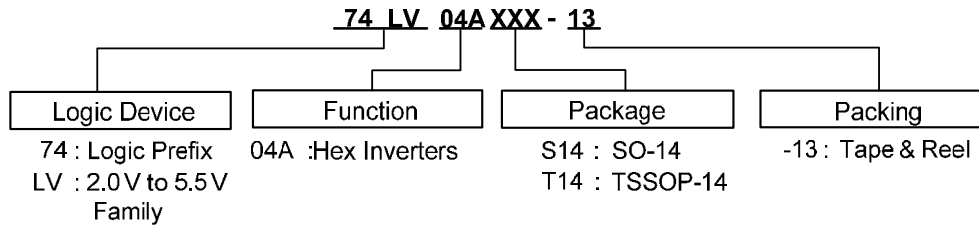


Voltage Waveform Propagation Delay Times Inverting and Non Inverting Outputs

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

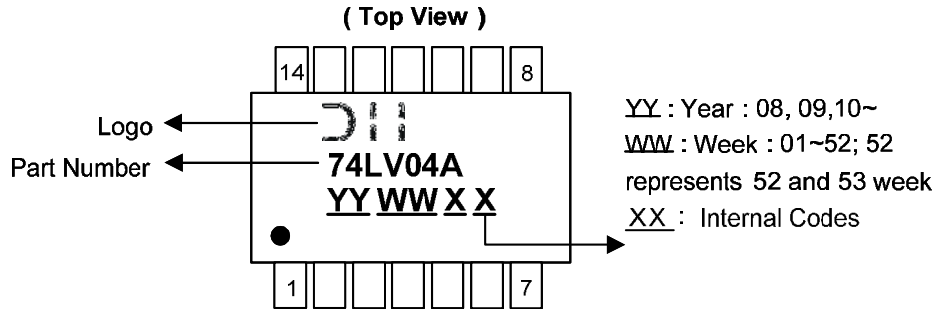


| Device | Package Code | Packaging (Note 6) | 13" Tape and Reel | |
|---------------|--------------|-----------------------|-------------------|--------------------|
| | | | Quantity | Part Number Suffix |
| 74LV04AS14-13 | S14 | SO-14 | 2500/Tape & Reel | -13 |
| 74LV04AT14-13 | T14 | TSSOP-14 | 2500/Tape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

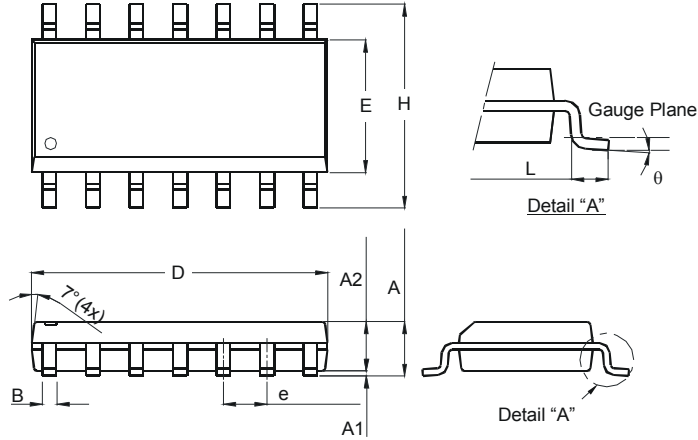


| Part Number | Package |
|-------------|----------|
| 74LV04AS14 | SO-14 |
| 74LV04AT14 | TSSOP-14 |

Package Outline Dimensions (All dimensions in mm.)

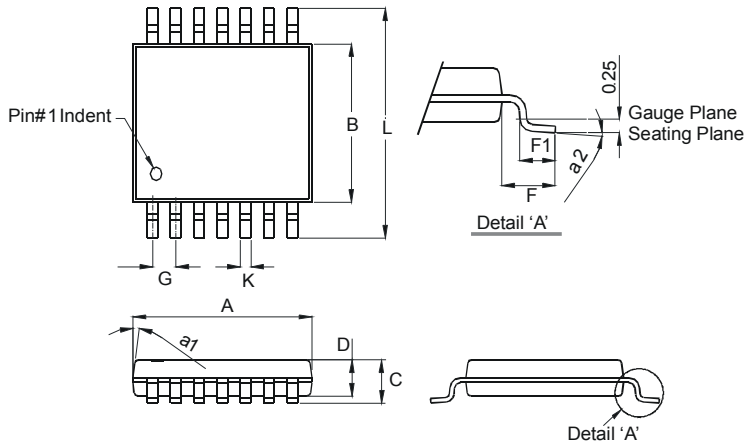
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

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 |
| θ | 0° | 8° |
| All Dimensions in mm | | |

Package Type: TSSOP-14

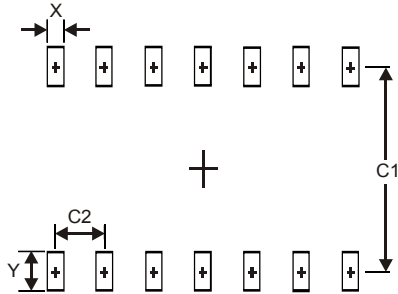


| TSSOP-14 | | |
|----------------------|----------|------|
| Dim | Min | Max |
| a1 | 7° (4X) | |
| a2 | 0° | 8° |
| A | 4.9 | 5.10 |
| B | 4.30 | 4.50 |
| C | — | 1.2 |
| D | 0.8 | 1.05 |
| F | 1.00 Typ | |
| F1 | 0.45 | 0.75 |
| G | 0.65 Typ | |
| K | 0.19 | 0.30 |
| L | 6.40 Typ | |
| All Dimensions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

Suggested Pad Layout

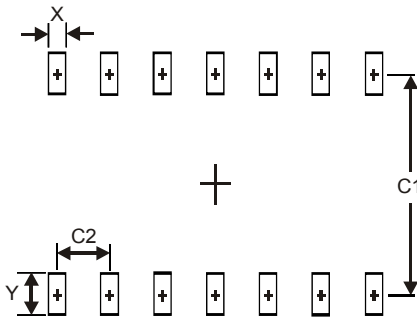
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

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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