

# QUADRUPL 2-INPUT NAND GATES WITH SCHMITT TRIGGER INPUTS

## Description

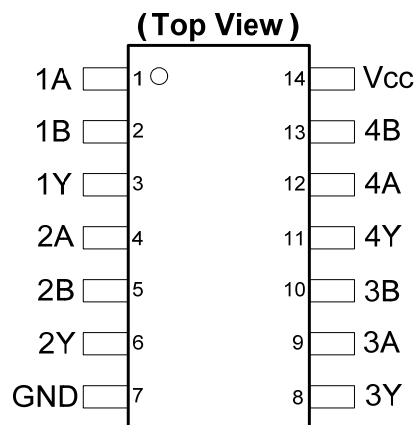
The 74LV132A provides provides four independent 2-input NAND gates with standard push-pull outputs. Each input is a Schmitt Trigger device with a significant amount of hysteresis suiting the device for noisy environments. The device is designed for operation with a power supply range of 2.0V to 5.5V.

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<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output preventing damaging current backflow when the device is powered down.

The gates perform the Boolean function:

$$Y = \overline{A \bullet B} \text{ or } Y = \overline{A} + \overline{B}$$

## Pin Assignments



**SO-14 / TSSOP-14**

## Features

- Wide Supply Voltage Range from 2.0V to 5.5V
- Sinks or sources 12mA at V<sub>CC</sub> = 4.5V
- CMOS low power consumption
- I<sub>OFF</sub> 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)**

## 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

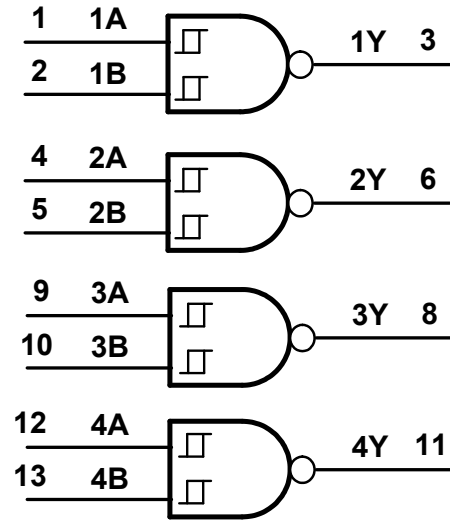
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "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          | 1B       | Data Input     |
| 3          | 1Y       | Data Output    |
| 4          | 2A       | Data Input     |
| 5          | 2B       | Data Input     |
| 6          | 2Y       | Data Output    |
| 7          | GND      | Ground         |
| 8          | 3Y       | Data Output    |
| 9          | 3A       | Data Input     |
| 10         | 3B       | Data Input     |
| 11         | 4Y       | Data Output    |
| 12         | 4A       | Data Input     |
| 13         | 4B       | Data Input     |
| 14         | Vcc      | Supply Voltage |

## Logic Diagram



## Function Table

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| H      | H | L      |
| L      | X | H      |
| X      | L | H      |

## Absolute Maximum Ratings (Note 4)

| 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 4                                                 | -0.5 to 7.0 | V    |
| I <sub>IK</sub>  | Input Clamp Current V <sub>I</sub> < 0V                                    | -20         | mA   |
| I <sub>OK</sub>  | Output Clamp Current V <sub>O</sub> < -0V                                  | -50         | 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 Vcc                                             | 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   |

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)

| Symbol          | Parameter                      | Conditions   | Min | Max             | Unit |
|-----------------|--------------------------------|--------------|-----|-----------------|------|
| V <sub>CC</sub> | Supply Voltage                 | –            | 2.0 | 5.5             | V    |
| V <sub>I</sub>  | Input Voltage                  | –            | 0   | 5.5             | V    |
| V <sub>O</sub>  | Output Voltage                 | –            | 0   | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | 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 <sub>OL</sub> | 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   |
| T <sub>A</sub>  | Operating Free-Air Temperature | –            | -40 | +125            | °C   |

Note: 5. Unused inputs should be held at V<sub>CC</sub> or Ground.

## Electrical Characteristics

| Symbol           | Parameter                                       | Test Conditions                                              | V <sub>CC</sub> | T <sub>A</sub> = -40 to +85°C |      | T <sub>A</sub> = -40 to +125°C |      | Unit |
|------------------|-------------------------------------------------|--------------------------------------------------------------|-----------------|-------------------------------|------|--------------------------------|------|------|
|                  |                                                 |                                                              |                 | Min                           | Max  | Min                            | Max  |      |
| V <sub>T+</sub>  | Positive Going Threshold                        | –                                                            | 2.5 V           | 1                             | 1.75 | 1                              | 1.75 | V    |
|                  |                                                 | –                                                            | 3.3 V           | 1.31                          | 2.31 | 1.31                           | 2.31 |      |
|                  |                                                 | –                                                            | 5.0 V           | 1.95                          | 3.5  | 1.95                           | 3.5  |      |
| V <sub>T-</sub>  | Negative Going Threshold                        | –                                                            | 2.5 V           | 0.75                          | 1.5  | 0.75                           | 1.5  | –    |
|                  |                                                 | –                                                            | 3.3 V           | 0.99                          | 2.07 | 0.99                           | 2.07 |      |
|                  |                                                 | –                                                            | 5.0 V           | 1.5                           | 3.05 | 1.5                            | 3.05 |      |
| V <sub>H</sub>   | Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> ) | –                                                            | 2.5 V           | 0.25                          | 1    | 0.25                           | 1    | V    |
|                  |                                                 | –                                                            | 3.3 V           | 0.33                          | 1.32 | 0.33                           | 1.32 |      |
|                  |                                                 | –                                                            | 5.0 V           | 0.5                           | 2    | 0.5                            | 2    |      |
| V <sub>OH</sub>  | High-Level Output Voltage                       | I <sub>OH</sub> = -50μA                                      | 2.0V to 5.5V    | V <sub>CC</sub> -0.1          | –    | V <sub>CC</sub> -0.1           | –    | V    |
|                  |                                                 | I <sub>OH</sub> = -2mA                                       | 2.3V            | 2.0                           | –    | 2.0                            | –    |      |
|                  |                                                 | I <sub>OH</sub> = -6mA                                       | 3.0V            | 2.48                          | –    | 2.48                           | –    |      |
|                  |                                                 | I <sub>OH</sub> = -12mA                                      | 4.5V            | 3.8                           | –    | 3.8                            | –    |      |
| V <sub>OL</sub>  | Low-Level Output Voltage                        | I <sub>OL</sub> = 50μA                                       | 2.0V to 5.5V    | –                             | 0.1  | –                              | 0.1  | V    |
|                  |                                                 | I <sub>OL</sub> = 2mA                                        | 2.3V            | –                             | 0.4  | –                              | 0.4  |      |
|                  |                                                 | I <sub>OL</sub> = 6mA                                        | 3.0V            | –                             | 0.44 | –                              | 0.44 |      |
|                  |                                                 | I <sub>OL</sub> = 12mA                                       | 4.5V            | –                             | 0.55 | –                              | 0.55 |      |
| I <sub>OFF</sub> | Power Down Leakage Current                      | V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5V                 | 0V              | –                             | 5    | –                              | 5    | μA   |
| I <sub>I</sub>   | Input Current                                   | V <sub>I</sub> = GND or 5.5V                                 | 0 to 5.5V       | –                             | ±1   | –                              | ±1   | μA   |
| I <sub>CC</sub>  | Supply Current                                  | V <sub>I</sub> = GND or V <sub>CC</sub><br>I <sub>O</sub> =0 | 5.5V            | –                             | 20   | –                              | 20   | μA   |

## Switching Characteristics

| Symbol          | Parameter                                          | Test Conditions                   | V <sub>CC</sub> | T <sub>A</sub> = +25°C |      |      | -40 to +85°C |      | -40 to +125°C |      | Unit |
|-----------------|----------------------------------------------------|-----------------------------------|-----------------|------------------------|------|------|--------------|------|---------------|------|------|
|                 |                                                    |                                   |                 | Min                    | Typ. | Max  | Min          | Max  | Min           | Max  |      |
| t <sub>PD</sub> | Propagation Delay A <sub>N</sub> to Y <sub>N</sub> | Figure 1<br>C <sub>L</sub> =15pF  | 2.5V ± 0.2V     | —                      | 7.9  | 16.5 | 1            | 18.5 | 1             | 18.5 | ns   |
|                 |                                                    |                                   | 3.3V ± 0.3V     | —                      | 5.6  | 11.9 | 1            | 14   | 1             | 14   |      |
|                 |                                                    |                                   | 5.0V ± 0.5V     | —                      | 3.9  | 7.7  | 1            | 9    | 1             | 9    |      |
|                 |                                                    | Figure 1<br>C <sub>L</sub> =50 pF | 2.5V ± 0.2V     | —                      | 10.8 | 20.2 | 1            | 23   | 1             | 23   | ns   |
|                 |                                                    |                                   | 3.3V ± 0.3V     | —                      | 7.6  | 15.4 | 1            | 17.5 | 1             | 17.5 |      |
|                 |                                                    |                                   | 5.0V ± 0.5V     | —                      | 5.3  | 9.7  | 1            | 11   | 1             | 11   |      |

## Operating Characteristics

 T<sub>A</sub> = +25°C

| Parameter       |                                        | Test Conditions                    | V <sub>CC</sub> | TYP  | Unit |
|-----------------|----------------------------------------|------------------------------------|-----------------|------|------|
| C <sub>pd</sub> | Power Dissipation Capacitance per Gate | F = 10 MHz<br>C <sub>L</sub> =50pF | 3.3V            | 7.5  | pF   |
|                 |                                        |                                    | 5.0V            | 11.2 |      |

## Noise Characteristics

 V<sub>CC</sub> = 3V, C<sub>L</sub> = 50pF, T<sub>A</sub> = +25°C

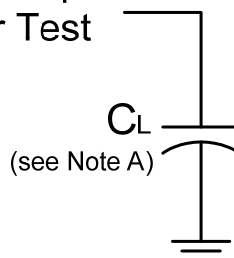
| Symbol             | Parameter                                     | Min  | Typ. | Max  | Unit |
|--------------------|-----------------------------------------------|------|------|------|------|
| V <sub>OL(p)</sub> | Quiet output, maximum dynamic V <sub>OL</sub> | —    | 0.2  | 0.8  | V    |
| V <sub>OL(V)</sub> | Quiet output, minimum dynamic V <sub>OL</sub> | —    | -0.1 | -0.8 | V    |
| V <sub>OH(V)</sub> | Quiet output, minimum dynamic V <sub>OH</sub> | —    | 3.1  | —    | V    |
| V <sub>IH(D)</sub> | High Level dynamic input voltage              | 2.31 | —    | —    | V    |
| V <sub>IL(D)</sub> | Low Level dynamic input voltage               | —    | —    | 0.99 | V    |

## Package Characteristics

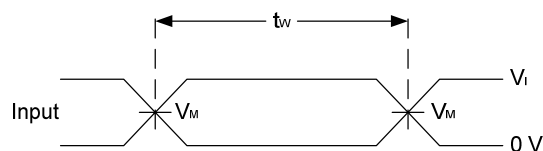
| Symbol         | Parameter         | Test Conditions                           | V <sub>CC</sub> | Min | Typ. | Max | Unit |
|----------------|-------------------|-------------------------------------------|-----------------|-----|------|-----|------|
| C <sub>i</sub> | Input Capacitance | V <sub>i</sub> = V <sub>CC</sub> — or GND | 2.0 to 5.5V     | —   | 3.3  | 10  | pF   |

## Parameter Measurement Information

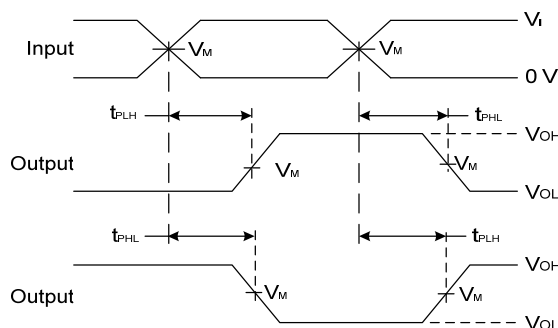
From Output  
Under Test



| $V_{CC}$     | 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**

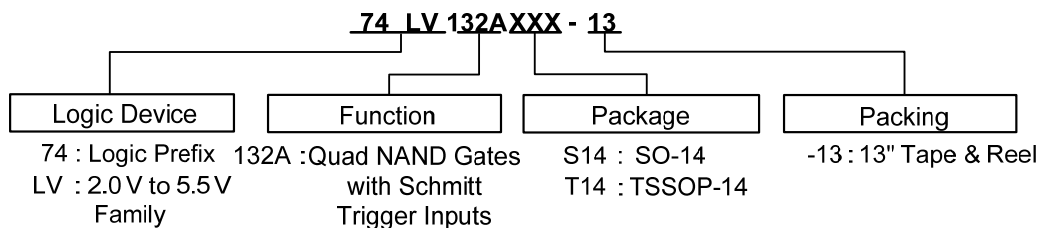


**Voltage Waveform  
Propagation Delay Times  
Inverting and Non Inverting Outputs**

- Notes:
- A. Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate  $\leq 10\text{MHz}$
  - 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

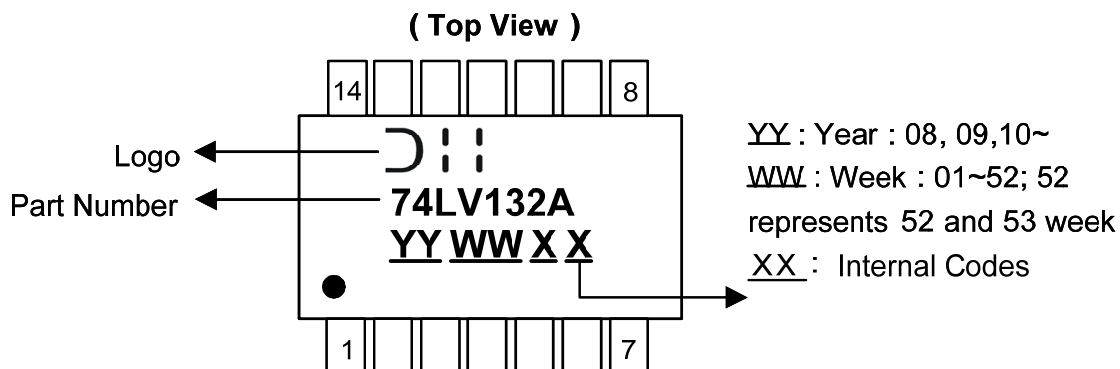


| Device         | Package Code | Packaging (Note 6) | 13" Tape and Reel |                    |
|----------------|--------------|--------------------|-------------------|--------------------|
|                |              |                    | Quantity          | Part Number Suffix |
| 74LV132AS14-13 | S14          | SO-14              | 2500/Tape & Reel  | -13                |
| 74LV132AT14-13 | T14          | TSSOP-14           | 2500/Tape & Reel  | -13                |

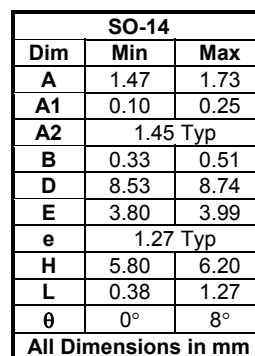
Note: 6. The taping orientation and tape details can be found at <http://www.diodes.com/datasheets/ap02007.pdf>

## Marking Information

(1) SO14, TSSOP14



| Part Number | Package  |
|-------------|----------|
| 74LV132AS14 | SO-14    |
| 74LV132AT14 | TSSOP-14 |

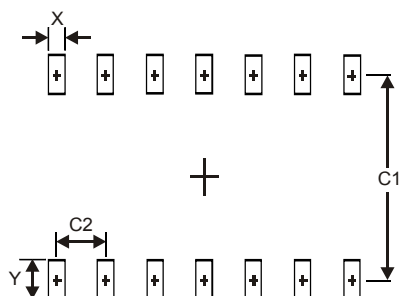
**Package Type: SO-14**

| 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**

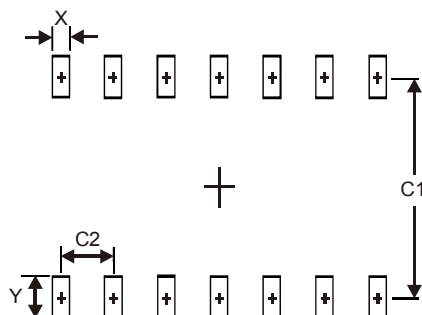
## Suggested Pad Layout

### 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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