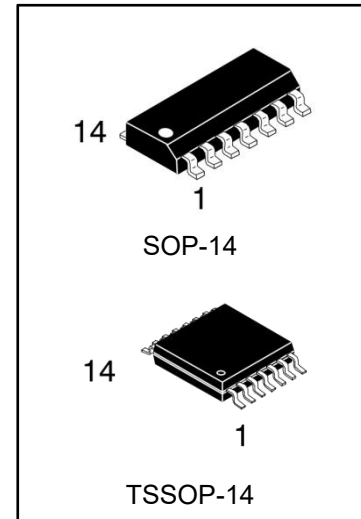


## Quad 2-Input NAND Gate with Schmitt-Trigger Inputs

### High-Performance Silicon-Gate CMOS

#### Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements as Defined by JEDEC Standard No. 7A
- ESD Performance:
  - HBM > 2000 V;
  - Machine Model > 200 V
- Chip Complexity: 72 FETs or 18 Equivalent Gates
- These are Pb-Free Device



#### ORDERING INFORMATION

| DEVICE       | Package Type | MARKING | Packing | Packing Qty  |
|--------------|--------------|---------|---------|--------------|
| 74HC132M/TR  | SOP-14       | 74HC132 | REEL    | 2500pcs/reel |
| 74HC132MT/TR | TSSOP-14     | HC132   | REEL    | 2500pcs/reel |

## GENERAL DESCRIPTION

The 74HC132 is identical in pinout to the LS132. The device inputs are compatible with standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs. The HC132 can be used to enhance noise immunity or to square up slowly changing waveforms.

## PIN CONFIGURATION

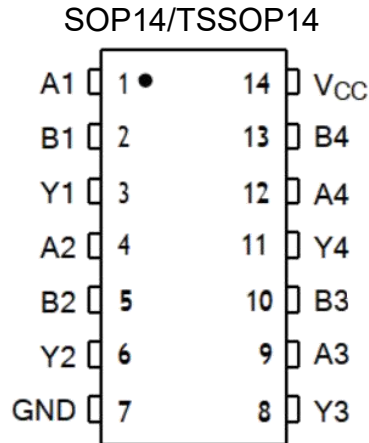
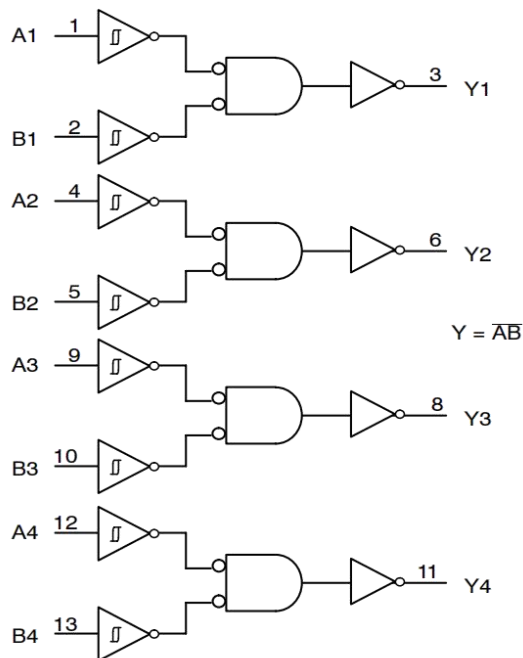


Figure 1. Pin Assignment



PIN 14 = V<sub>CC</sub>;

PIN 7 = GND

Figure 2. Logic Diagram

**FUNCTION TABLE**

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

**MAXIMUM RATINGS**

| Symbol               | Parameter                                       | Value   | Unit                              |      |
|----------------------|---|---|-----------------------------------|------|
| VCC                  | Positive DC Supply Voltage                      | -0.5 to +7.0  | V                                 |      |
| VIN                  | Digital Input Voltage                           | -0.5 to +7.0  | V                                 |      |
| VOUT                 | DC Output Voltage                               | Output in 3-State<br>High or Low State              | -0.5 to +7.0<br>-0.5 to VCC + 0.5 | V    |
| I <sub>IK</sub>      | Input Diode Current                             | -20   | mA                                |      |
| I <sub>OK</sub>      | Output Diode Current                            | ±20   | mA                                |      |
| I <sub>OUT</sub>     | DC Output Current, per Pin                      | ±25   | mA                                |      |
| I <sub>CC</sub>      | DC Supply Current, VCC and GND Pins             | ±75   | mA                                |      |
| I <sub>GND</sub>     | DC Ground Current per Ground Pin                | ±75   | mA                                |      |
| T <sub>STG</sub>     | Storage Temperature Range                       | -65 to +150   | °C                                |      |
| T <sub>L</sub>       | Lead Temperature, 1 mm from Case for 10 Seconds | 260   | °C                                |      |
| T <sub>J</sub>       | Junction Temperature Under Bias                 | +125  | °C                                |      |
| θ <sub>JA</sub>      | Thermal Resistance                              | 14-SOP<br>14-TSSOP                                  | 125<br>170                        | °C/W |
| PD                   | Power Dissipation in Still Air at 85°C          | SOP<br>TSSOP  | 500<br>450                        | mW   |
| MSL                  | Moisture Sensitivity                            | Level 1   |                                   |      |
| FR                   | Flammability Rating                             | Oxygen Index: 30% - 35%                             | UL 94 V-0 @<br>0.125 in           |      |
| VESD                 | ESD Withstand Voltage                           | Human Body Model (Note 1)<br>Machine Model (Note 2) | >2000<br>>200                     | V    |
| I <sub>Latchup</sub> | Latchup Performance                             | Above VCC and Below GND at 85°C<br>(Note 3)         | ±300                              | mA   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to EIA/JESD78.

**RECOMMENDED OPERATING CONDITIONS**

| Symbol       | Parameter  | Min | Max                | Unit |
|--------------|--|-----|--------------------|------|
| VCC          | DC Supply Voltage (Referenced to GND)                | 2.0 | 6.0                | V    |
| VIN,<br>VOUT | DC Input Voltage, Output Voltage (Referenced to GND) | 0   | VCC                | V    |
| TA           | Operating Temperature, All Package Types             | -40 | +85                | °C   |
| tr, tf       | Input Rise and Fall Time (Figure 3)                  | -   | NoLimit<br>(Note5) | ns   |

4. When  $V_{IN} \sim 0.5 V_{CC}$ ,  $I_{CC} \gg$  quiescent current.

5. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

**DC ELECTRICAL CHARACTERISTICS** (Voltages Referenced to GND)

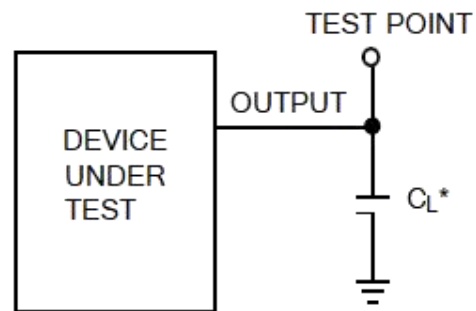
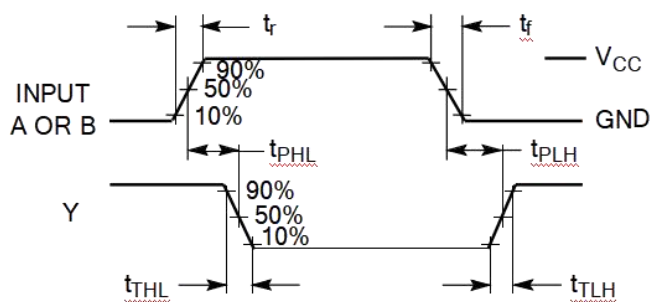
| Symbol            | Parameter   | Test Conditions   | VCC<br>(V) | Guaranteed Limit |       | Unit |
|-------------------|---|---|------------|------------------|-------|------|
|                   |   |   |            | -40°C to 25°C    | ≤85°C |      |
| VT+max            | Maximum Positive Going Input Threshold Voltage (Figure 5) | VOUT = 0.1 V<br> IOUT  ≤ 20 μA                                | 2.0        | 1.5              | 1.5   | V    |
|                   |   |   | 4.5        | 3.15             | 3.15  |      |
|                   |   |   | 6.0        | 4.2              | 4.2   |      |
| VT+min            | Minimum Positive-Going Input Threshold Voltage (Figure 5) | VOUT = 0.1 V<br> IOUT  ≤ 20 μA                                | 2.0        | 1.0              | 0.95  | V    |
|                   |   |   | 4.5        | 2.3              | 2.25  |      |
|                   |   |   | 6.0        | 3.0              | 2.95  |      |
| VT-max            | Maximum Negative-Going Input Threshold Voltage (Figure 5) | VOUT = VCC - 0.1 V<br> IOUT  ≤ 20 μA                          | 2.0        | 0.9              | 0.95  | V    |
|                   |   |   | 4.5        | 2.0              | 2.05  |      |
|                   |   |   | 6.0        | 2.6              | 2.65  |      |
| VT-min            | Minimum Negative-Going Input Threshold Voltage (Figure 5) | VOUT = VCC - 0.1 V<br> IOUT  ≤ 20 μA                          | 2.0        | 0.3              | 0.3   | V    |
|                   |   |   | 4.5        | 0.9              | 0.9   |      |
|                   |   |   | 6.0        | 1.2              | 1.2   |      |
| VHmax<br>(Note 7) | Maximum Hysteresis Voltage (Figure 5)                     | VOUT = 0.1 V or VCC - 0.1 V<br> IOUT  ≤ 20 μA                 | 2.0        | 1.2              | 1.2   | V    |
|                   |   |   | 4.5        | 2.25             | 2.25  |      |
|                   |   |   | 6.0        | 3.0              | 3.0   |      |
| VHmin<br>(Note 7) | Minimum Hysteresis Voltage (Figure 5)                     | VOUT = 0.1 V or VCC - 0.1 V<br> IOUT  ≤ 20 μA                 | 2.0        | 0.2              | 0.2   | V    |
|                   |   |   | 4.5        | 0.4              | 0.4   |      |
|                   |   |   | 6.0        | 0.5              | 0.5   |      |
| VOH               | Minimum High-Level Output Voltage                         | VIN ≤ VT-min or VT+max<br> IOUT  ≤ 20 μA                      | 2.0        | 1.9              | 1.9   | V    |
|                   |   |   | 4.5        | 4.4              | 4.4   |      |
|                   |   | 6.0   | 5.9        | 5.9              |       |      |
|                   |   | VIN ≤ -VT-min or VT+max<br> IOUT  ≤ 4.0 mA<br> IOUT  ≤ 5.2 mA | 4.5        | 3.98             | 3.84  |      |
| 6.0               | 5.48  |   | 5.34       |                  |       |      |

|     |  |                                 |     |      |      |    |
|-----|--|---------------------------------|-----|------|------|----|
| VOL | Maximum Low-Level Output Voltage               | VIN ≥ VT+max<br> IOUT  ≤ 20 μA  | 2.0 | 0.1  | 0.1  | V  |
|     |  | VIN ≥ VT+max<br> IOUT  ≤ 4.0 mA | 4.5 | 0.1  | 0.1  |    |
|     |  | VIN = VCC or GND                | 6.0 | ±0.1 | ±1.0 | μA |
|     |  |                                 | 6.0 | ±0.1 | ±1.0 |    |
| ICC | Maximum Quiescent Supply Current (per Package) | VIN = VCC or GND<br>IOUT = 0 μA | 6.0 | 2.0  | 20   | μA |

6.  $V_{Hmin} > (V_{T+min}) - (V_{T-max})$ ;  $V_{Hmax} = (V_{T+max}) + (V_{T-min})$ .

**AC ELECTRICAL CHARACTERISTICS** (CL = 50 pF, Input tr = tf = 6.0 ns)

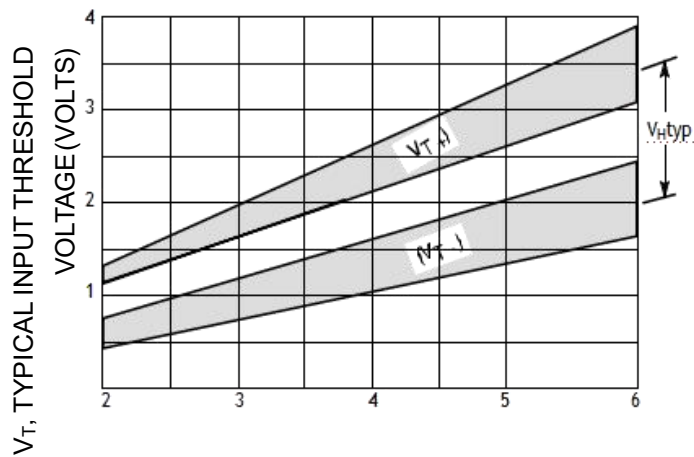
| Symbol     | Parameter   | VCC (V)                | Guaranteed Limit |       | Unit |
|------------|---|------------------------|------------------|-------|------|
|            |   |                        | -40°C to 25°C    | ≤85°C |      |
| tPLH, tPHL | Maximum Propagation Delay, Input A or B to Output Y (Figures 3 and 4) | 2.0                    | 125              | 155   | ns   |
|            |   | 4.5                    | 25               | 31    |      |
|            |   | 6.0                    | 21               | 26    |      |
| tTLH, tTHL | Maximum Output Transition Time, Any Output (Figures 3 and 4)          | 2.0                    | 75               | 95    | ns   |
|            |   | 4.5                    | 15               | 19    |      |
|            |   | 6.0                    | 13               | 16    |      |
| Cin        | Maximum Input Capacitance   | —                      | 10               | 10    | pF   |
| CPD        | Power Dissipation Capacitance(per Gate)(Note 10)                      | Typical@25°C, VCC=5.0V |                  | 24    | pF   |
|            |   |                        |                  |       |      |



\*Includes all probe and jig capacitance

Figure 3. Switching Waveforms

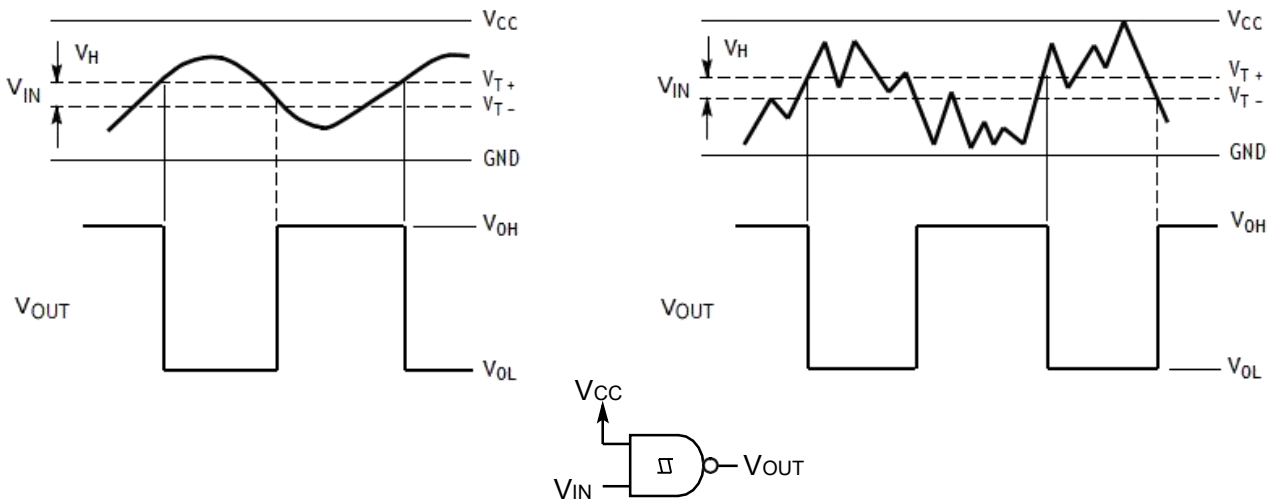
Figure 4. Test Circuit



$V_{CC}$ , POWER SUPPLY VOLTAGE (VOLTS)

$$V_{Htyp} = (V_{T+typ}) - (V_{T-typ})$$

**Figure 5. Typical Input Threshold,  $V_{T+}$ ,  $V_{T-}$  Versus Power Supply Voltage**



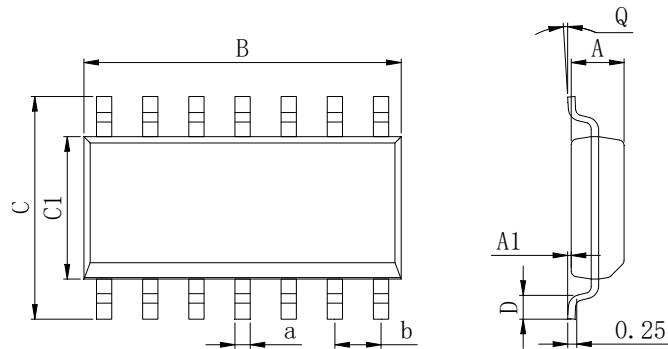
(A) A SCHMITT TRIGGER SQUARES UP INPUTS WITH SLOW RISE AND FALL TIMES

(B) A SCHMITT TRIGGER OFFERS MAXIMUM NOISE IMMUNITY

**Figure 6. Typical Schmitt-Trigger Applications**

## Physical Dimensions

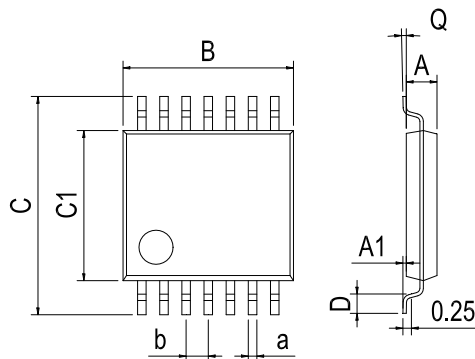
### SOP14



Dimensions In Millimeters(SOP14)

| Symbol: | A    | A1   | B    | C    | C1   | D    | Q  | a    | b        |
|---------|------|------|------|------|------|------|----|------|----------|
| Min:    | 1.35 | 0.05 | 8.55 | 5.80 | 3.80 | 0.40 | 0° | 0.35 | 1.27 BSC |
| Max:    | 1.55 | 0.20 | 8.75 | 6.20 | 4.00 | 0.80 | 8° | 0.45 |          |

### TSSOP14



Dimensions In Millimeters(TSSOP14)

| Symbol: | A    | A1   | B    | C    | C1   | D    | Q  | a    | b        |
|---------|------|------|------|------|------|------|----|------|----------|
| Min:    | 0.85 | 0.05 | 4.90 | 6.20 | 4.30 | 0.40 | 0° | 0.20 | 0.65 BSC |
| Max:    | 0.95 | 0.20 | 5.10 | 6.60 | 4.50 | 0.80 | 8° | 0.25 |          |

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