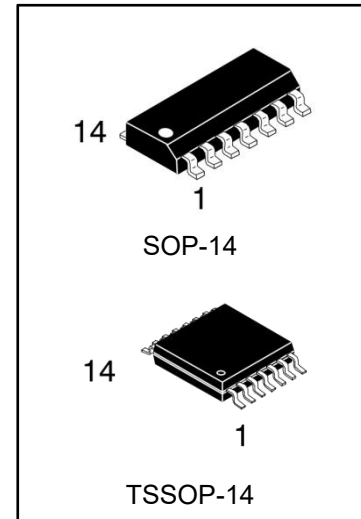


## Quad 2-Input NAND Gate with Schmitt-Trigger Inputs

### 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

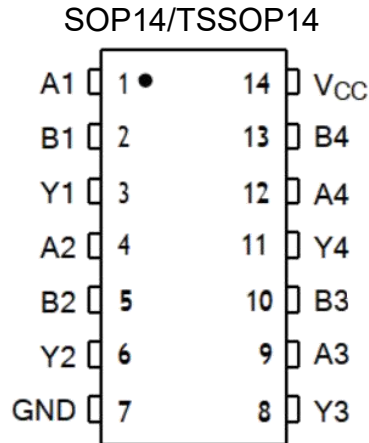
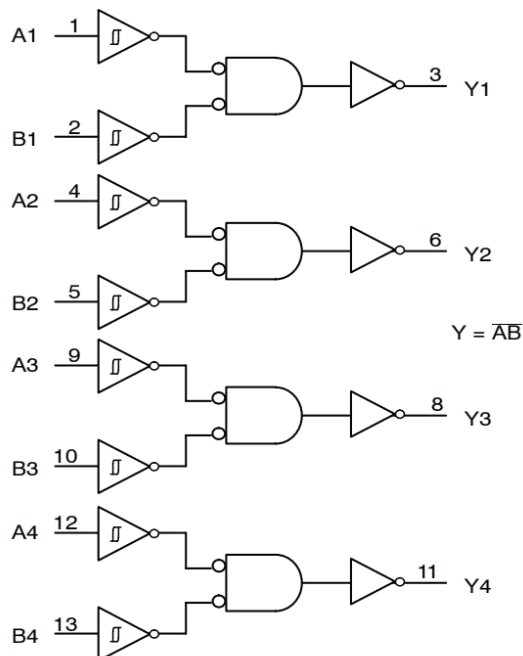


Figure 1. Pin Assignment



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 High or Low State	-0.5 to +7.0 -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 14-TSSOP	125 170	°C/W
PD	Power Dissipation in Still Air at 85°C	SOP TSSOP	500 450	mW
MSL	Moisture Sensitivity	Level 1		
FR	Flammability Rating	Oxygen Index: 30% - 35%	UL 94 V-0 @ 0.125 in	
VESD	ESD Withstand Voltage	Human Body Model (Note 1) Machine Model (Note 2)	>2000 >200	V
I <sub>Latchup</sub>	Latchup Performance	Above VCC and Below GND at 85°C (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, 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 (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)

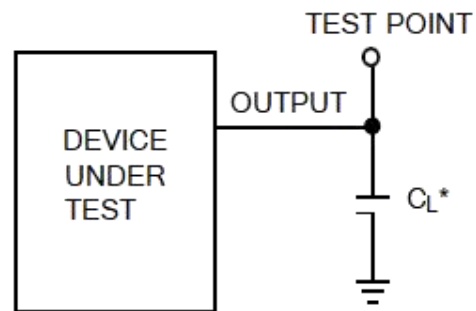
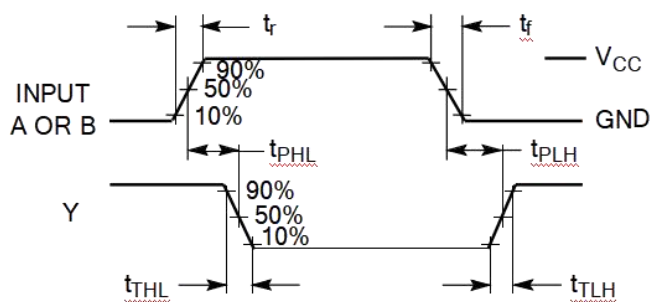
Symbol	Parameter	Test Conditions	VCC (V)	Guaranteed Limit		Unit
				-40°C to 25°C	≤85°C	
VT+max	Maximum Positive Going Input Threshold Voltage (Figure 5)	VOUT = 0.1 V  IOUT  ≤ 20 μA	2.0	1.5	1.5	V
			4.5	3.15	3.15	
			6.0	4.2	4.2	
VT+min	Minimum Positive-Going Input Threshold Voltage (Figure 5)	VOUT = 0.1 V  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  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  IOUT  ≤ 20 μA	2.0	0.3	0.3	V
			4.5	0.9	0.9	
			6.0	1.2	1.2	
VHmax (Note 7)	Maximum Hysteresis Voltage (Figure 5)	VOUT = 0.1 V or VCC - 0.1 V  IOUT  ≤ 20 μA	2.0	1.2	1.2	V
			4.5	2.25	2.25	
			6.0	3.0	3.0	
VHmin (Note 7)	Minimum Hysteresis Voltage (Figure 5)	VOUT = 0.1 V or VCC - 0.1 V  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  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  IOUT  ≤ 4.0 mA  IOUT  ≤ 5.2 mA	4.5	3.98	3.84	
6.0	5.48		5.34			

VOL	Maximum Low-Level Output Voltage	$V_{IN} \geq V_{T+max}$ $ I_{OUT}  \leq 20 \mu A$	2.0	0.1	0.1	V
		$V_{IN} \geq V_{T+max}$ $ I_{OUT}  \leq 4.0$ mA $ I_{OUT}  \leq 5.2$ mA	4.5	0.1	0.1	
IIN	Maximum Input Leakage Current	$V_{IN} = V_{CC}$ or GND	6.0	$\pm 0.1$	$\pm 1.0$	$\mu A$
ICC	Maximum Quiescent Supply Current (per Package)	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$	6.0	2.0	20	$\mu A$

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

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50$  pF, Input  $t_r = t_f = 6.0$  ns)

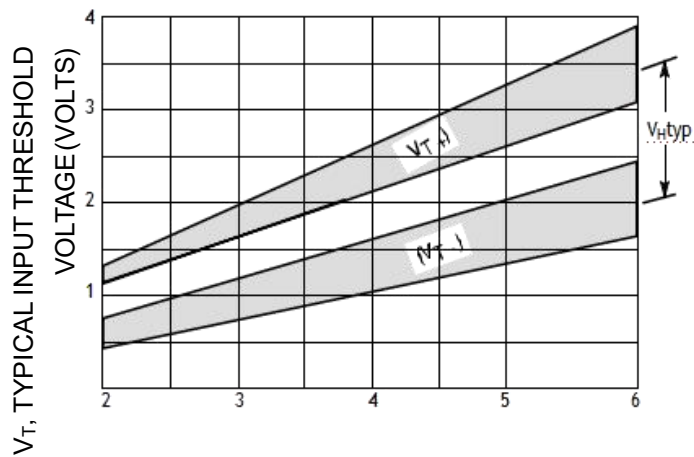
Symbol	Parameter	VCC (V)	Guaranteed Limit		Unit
			-40°C to 25°C	$\leq 85^\circ C$	
tPLH, tPHL	Maximum Propagation Delay, Input A or B to Output Y (Figures 3 and 4)	2.0	125	155	ns
		4.5	25	31	
		6.0	21	26	
tTLH, tTHL	Maximum Output Transition Time, Any Output (Figures 3 and 4)	2.0	75	95	ns
		4.5	15	19	
		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			pF
		24			



\*Includes all probe and jig capacitance

Figure 3. Switching Waveforms

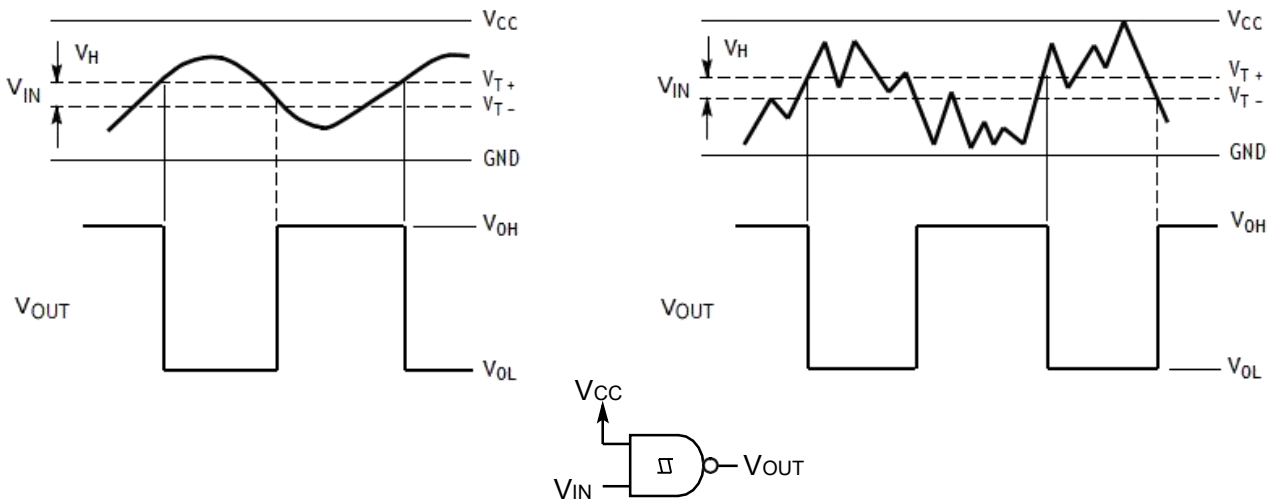
Figure 4. Test Circuit



$V_{CC}$ , 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**



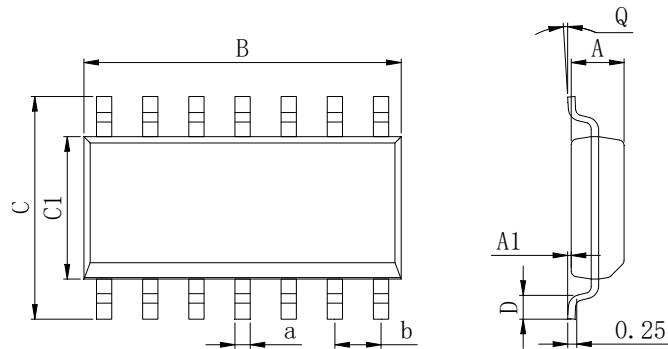
(A) A SCHMITT TRIGGER SQUARES UP INPUTS WITH SLOW RISE AND FALL TIMES

(B) A SCHMITT TRIGGER OFFERS MAXIMUM NOISE IMMUNITY

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

## Physical Dimensions

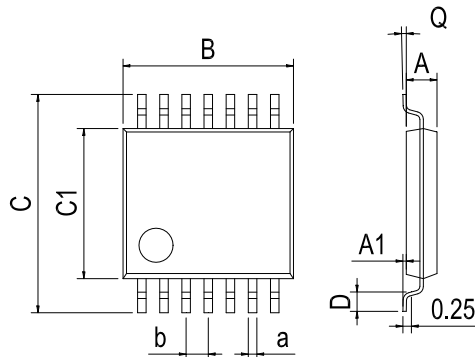
### SOP14



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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