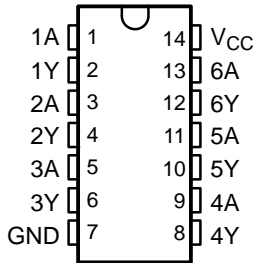


FEATURES

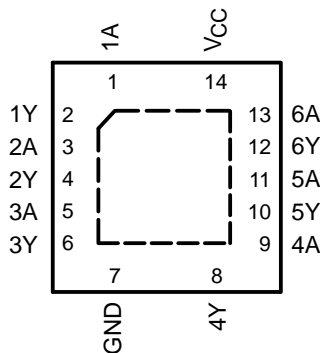
- Operate From 1.65 V to 3.6 V
- Specified From –40°C to 85°C, –40°C to 125°C, and –55°C to 125°C
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 6.4 ns at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3 V, T_A = 25^\circ C$

- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at $V_{CC} = 3.3 V, T_A = 25^\circ C$
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

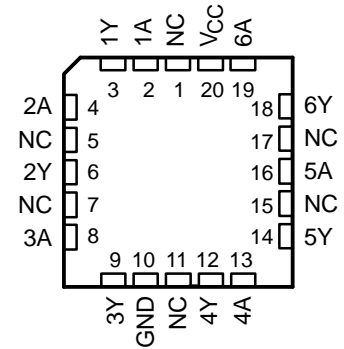
SN54LVC14A . . . J OR W PACKAGE
SN74LVC14A . . . D, DB, DGV, NS,
OR PW PACKAGE
(TOP VIEW)



SN74LVC14A . . . RGY PACKAGE
(TOP VIEW)



SN54LVC14A . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

DESCRIPTION/ORDERING INFORMATION

The SN54LVC14A hex Schmitt-trigger inverter is designed for 2.7-V to 3.6-V V_{CC} operation, and the SN74LVC14A hex Schmitt-trigger inverter is designed for 1.65-V to 3.6-V V_{CC} operation.

ORDERING INFORMATION

| T_A | PACKAGE ⁽¹⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------------------|----------------|-----------------------|------------------|
| –40°C to 85°C | QFN – RGY | Reel of 1000 | SN74LVC14ARGYR | LC14A |
| –40°C to 125°C | SOIC – D | Tube of 50 | SN74LVC14AD | LVC14A |
| | | Reel of 2500 | SN74LVC14ADR | |
| | | Reel of 250 | SN74LVC14ADT | |
| | SOP – NS | Reel of 2000 | SN74LVC14ANSR | LVC14A |
| | SSOP – DB | Reel of 2000 | SN74LVC14ADBR | LC14A |
| | TSSOP – PW | Tube of 90 | SN74LVC14APW | LC14A |
| | | Reel of 2000 | SN74LVC14APWR | |
| Reel of 250 | | SN74LVC14APWT | | |
| TVSOP – DGV | Reel of 2000 | SN74LVC14ADGVR | LC14A | |
| –55°C to 125°C | CDIP – J | Tube of 25 | SNJ54LVC14AJ | SNJ54LVC14AJ |
| | CFP – W | Tube of 150 | SNJ54LVC14AW | SNJ54LVC14AW |
| | LCCC – FK | Tube of 55 | SNJ54LVC14AFK | SNJ54LVC14AFK |

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

DESCRIPTION/ORDERING INFORMATION (CONTINUED)

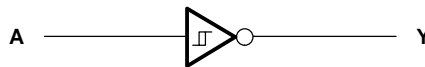
The devices contain six independent inverters and perform the Boolean function $Y = \bar{A}$.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

**FUNCTION TABLE
 (EACH INVERTER)**

| INPUT A | OUTPUT Y |
|------------|-------------|
| H | L |
| L | H |

logic diagram, each inverter (positive logic)



Absolute Maximum Ratings ⁽¹⁾

over operating free-air temperature range (unless otherwise noted)

| | | MIN | MAX | UNIT |
|---------------|--|--|----------------|---------|
| V_{CC} | Supply voltage range | -0.5 | 6.5 | V |
| V_I | Input voltage range ⁽²⁾ | -0.5 | 6.5 | V |
| V_O | Output voltage range ⁽²⁾⁽³⁾ | -0.5 | $V_{CC} + 0.5$ | V |
| I_{IK} | Input clamp current | $V_I < 0$ | | -50 mA |
| I_{OK} | Output clamp current | $V_O < 0$ | | -50 mA |
| I_O | Continuous output current | | | ±50 mA |
| | Continuous current through V_{CC} or GND | | | ±100 mA |
| θ_{JA} | Package thermal impedance | D package ⁽⁴⁾ | | 86 |
| | | DB package ⁽⁴⁾ | | 96 |
| | | DGV package ⁽⁴⁾ | | 127 |
| | | NS package ⁽⁴⁾ | | 76 |
| | | PW package ⁽⁴⁾ | | 113 |
| | | RGY package ⁽⁵⁾ | | 47 |
| T_{stg} | Storage temperature range | -65 | 150 | °C |
| P_{tot} | Power dissipation | $T_A = -40^\circ\text{C}$ to 125°C ⁽⁶⁾⁽⁷⁾ | | 500 mW |

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of V_{CC} is provided in the recommended operating conditions table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.
- (5) The package thermal impedance is calculated in accordance with JESD 51-5.
- (6) For the D package: above 70°C, the value of P_{tot} derates linearly with 8 mW/K.
- (7) For the DB, DGV, NS, and PW packages: above 60°C, the value of P_{tot} derates linearly with 5.5 mW/K.

Recommended Operating Oonditions⁽¹⁾

| | | SN54LVC14A | | UNIT | |
|-----------------|---------------------------|-------------------------|-----------------|------|----|
| | | –55 TO 125°C | | | |
| | | MIN | MAX | | |
| V _{CC} | Supply voltage | Operating | 2 | 3.6 | V |
| | | Data retention only | 1.5 | | |
| V _I | Input voltage | 0 | 5.5 | V | |
| V _O | Output voltage | 0 | V _{CC} | V | |
| I _{OH} | High-level output current | V _{CC} = 2.7 V | | –12 | mA |
| | | V _{CC} = 3 V | | –24 | |
| I _{OL} | Low-level output current | V _{CC} = 2.7 V | | 12 | mA |
| | | V _{CC} = 3 V | | 24 | |

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

Recommended Operating Conditions⁽¹⁾

| | | SN74LVC14A | | | | | | UNIT | |
|-----------------|---------------------------|--------------------------|-----------------|-------------|-----------------|--------------|-----------------|------|----|
| | | T _A = 25°C | | –40 TO 85°C | | –40 TO 125°C | | | |
| | | MIN | MAX | MIN | MAX | MIN | MAX | | |
| V _{CC} | Supply voltage | Operating | 1.65 | 3.6 | 1.65 | 3.6 | 1.65 | 3.6 | V |
| | | Data retention only | 1.5 | | 1.5 | | 1.5 | | |
| V _I | Input voltage | 0 | 5.5 | 0 | 5.5 | 0 | 5.5 | V | |
| V _O | Output voltage | 0 | V _{CC} | 0 | V _{CC} | 0 | V _{CC} | V | |
| I _{OH} | High-level output current | V _{CC} = 1.65 V | | –4 | | –4 | | –4 | mA |
| | | V _{CC} = 2.3 V | | –8 | | –8 | | –8 | |
| | | V _{CC} = 2.7 V | | –12 | | –12 | | –12 | |
| | | V _{CC} = 3 V | | –24 | | –24 | | –24 | |
| I _{OL} | Low-level output current | V _{CC} = 1.65 V | | 4 | | 4 | | 4 | mA |
| | | V _{CC} = 2.3 V | | 8 | | 8 | | 8 | |
| | | V _{CC} = 2.7 V | | 12 | | 12 | | 12 | |
| | | V _{CC} = 3 V | | 24 | | 24 | | 24 | |

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

SN54LVC14A, SN74LVC14A HEX SCHMITT-TRIGGER INVERTERS

SCAS285W – MARCH 1993 – REVISED APRIL 2005

Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | V _{CC} | SN54LVC14A | | | UNIT |
|---|--|-----------------|-----------------------|-----|-----|------|
| | | | -55 TO 125°C | | | |
| | | | MIN | TYP | MAX | |
| V _{T+} Positive-going threshold | | 2.7 V | 0.8 | 2 | V | |
| | | 3 V | 0.9 | 2 | | |
| | | 3.6 V | 1.1 | 2 | | |
| V _{T-} Negative-going threshold | | 2.7 V | 0.4 | 1.4 | V | |
| | | 3 V | 0.6 | 1.5 | | |
| | | 3.6 V | 0.8 | 1.7 | | |
| ΔV _T Hysteresis (V _{T+} - V _{T-}) | | 2.7 V | 0.3 | 1.1 | V | |
| | | 3 V | 0.3 | 1.2 | | |
| | | 3.6 V | 0.3 | 1.2 | | |
| V _{OH} | I _{OH} = -100 μA | 2.7 V to 3.6 V | V _{CC} - 0.2 | | V | |
| | I _{OH} = -12 mA | 2.7 V | 2.2 | | | |
| | | 3 V | 2.4 | | | |
| I _{OH} = -24 mA | 3 V | 2.2 | | | | |
| V _{OL} | I _{OL} = 100 μA | 2.7 V to 3.6 V | 0.2 | | V | |
| | I _{OL} = 12 mA | 2.7 V | 0.4 | | | |
| | I _{OL} = 24 mA | 3 V | 0.55 | | | |
| I _I | V _I = 5.5 V or GND | 3.6 V | ±5 | | μA | |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 3.6 V | 10 | | μA | |
| ΔI _{CC} | One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND | 2.7 V to 3.6 V | 500 | | μA | |
| C _i | V _I = V _{CC} or GND | 3.3 V | 5 ⁽¹⁾ | | pF | |

(1) T_A = 25°C

Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | V _{CC} | SN74LVC14A | | | | | | UNIT | |
|---|---|-----------------|-----------------------|------|-----------------------|-------------|-----------------------|--------------|------|-----|
| | | | T _A = 25°C | | | –40 TO 85°C | | –40 TO 125°C | | |
| | | | MIN | TYP | MAX | MIN | MAX | MIN | | MAX |
| V _{T+} Positive-going threshold | | 1.65 V | 0.4 | 1.3 | 0.4 | 1.3 | 0.4 | 1.3 | V | |
| | | 1.95 V | 0.6 | 1.5 | 0.6 | 1.5 | 0.6 | 1.5 | | |
| | | 2.3 V | 0.8 | 1.7 | 0.8 | 1.7 | 0.8 | 1.7 | | |
| | | 2.5 V | 0.8 | 1.7 | 0.8 | 1.7 | 0.8 | 1.7 | | |
| | | 2.7 V | 0.8 | 2 | 0.8 | 2 | 0.8 | 2 | | |
| | | 3 V | 0.9 | 2 | 0.9 | 2 | 0.9 | 2 | | |
| | | 3.6 V | 1.1 | 2 | 1.1 | 2 | 1.1 | 2 | | |
| V _{T-} Negative-going threshold | | 1.65 V | 0.15 | 0.85 | 0.15 | 0.85 | 0.15 | 0.85 | V | |
| | | 1.95 V | 0.25 | 0.95 | 0.25 | 0.95 | 0.25 | 0.95 | | |
| | | 2.3 V | 0.4 | 1.2 | 0.4 | 1.2 | 0.4 | 1.2 | | |
| | | 2.5 V | 0.4 | 1.2 | 0.4 | 1.2 | 0.4 | 1.2 | | |
| | | 2.7 V | 0.4 | 1.4 | 0.4 | 1.4 | 0.4 | 1.4 | | |
| | | 3 V | 0.6 | 1.5 | 0.6 | 1.5 | 0.6 | 1.5 | | |
| | | 3.6 V | 0.8 | 1.7 | 0.8 | 1.7 | 0.8 | 1.7 | | |
| ΔV _T Hysteresis (V _{T+} - V _{T-}) | | 1.65 V | 0.1 | 1.15 | 0.1 | 1.15 | 0.1 | 1.15 | V | |
| | | 1.95 V | 0.15 | 1.25 | 0.15 | 1.25 | 0.15 | 1.25 | | |
| | | 2.3 V | 0.25 | 1.3 | 0.25 | 1.3 | 0.25 | 1.3 | | |
| | | 2.5 V | 0.25 | 1.3 | 0.25 | 1.3 | 0.25 | 1.3 | | |
| | | 2.7 V | 0.3 | 1.1 | 0.3 | 1.1 | 0.3 | 1.1 | | |
| | | 3 V | 0.3 | 1.2 | 0.3 | 1.2 | 0.3 | 1.2 | | |
| | | 3.6 V | 0.3 | 1.2 | 0.3 | 1.2 | 0.3 | 1.2 | | |
| V _{OH} | I _{OH} = –100 μA | 1.65 V to 3.6 V | V _{CC} – 0.2 | | V _{CC} – 0.2 | | V _{CC} – 0.3 | | V | |
| | I _{OH} = –4 mA | 1.65 V | 1.29 | | 1.2 | | 1.05 | | | |
| | I _{OH} = –8 mA | 2.3 V | 1.9 | | 1.7 | | 1.65 | | | |
| | I _{OH} = –12 mA | 2.7 V | 2.2 | | 2.2 | | 2.05 | | | |
| | | 3 V | 2.4 | | 2.4 | | 2.25 | | | |
| | I _{OH} = –24 mA | 3 V | 2.3 | | 2.2 | | 2 | | | |
| V _{OL} | I _{OL} = 100 μA | 1.65 V to 3.6 V | 0.1 | | 0.2 | | 0.3 | | V | |
| | I _{OL} = 4 mA | 1.65 V | 0.24 | | 0.45 | | 0.6 | | | |
| | I _{OL} = 8 mA | 2.3 V | 0.3 | | 0.7 | | 0.75 | | | |
| | I _{OL} = 12 mA | 2.7 V | 0.4 | | 0.4 | | 0.6 | | | |
| | I _{OL} = 24 mA | 3 V | 0.55 | | 0.55 | | 0.8 | | | |
| I _I | V _I = 5.5 V or GND | 3.6 V | ±1 | | ±5 | | ±20 | | μA | |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 3.6 V | 1 | | 10 | | 40 | | μA | |
| ΔI _{CC} | One input at V _{CC} – 0.6 V, Other inputs at V _{CC} or GND | 2.7 V to 3.6 V | 500 | | 500 | | 5000 | | μA | |
| C _i | V _I = V _{CC} or GND | 3.3 V | 5 | | | | | | pF | |

SN54LVC14A, SN74LVC14A HEX SCHMITT-TRIGGER INVERTERS

SCAS285W—MARCH 1993—REVISED APRIL 2005

Switching Characteristics

over operating free-air temperature range (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V_{CC} | SN54LVC14A | | UNIT |
|-----------|-----------------|----------------|-------------------|--------------|-----|------|
| | | | | -55 TO 125°C | | |
| | | | | MIN | MAX | |
| t_{pd} | A | Y | 2.7 V | 7.5 | | ns |
| | | | $3.3 V \pm 0.3 V$ | 1 | 6.4 | |

Switching Characteristics

over operating free-air temperature range (unless otherwise noted) (see Figure 1)

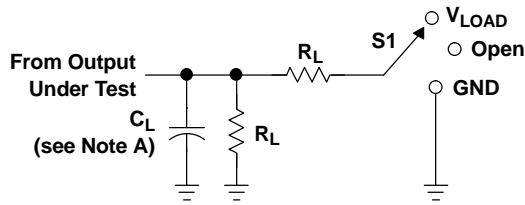
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V_{CC} | SN74LVC14A | | | | | | UNIT | |
|-------------|-----------------|----------------|--------------------|--------------------|-----|------|-------------|-----|--------------|------|-----|
| | | | | $T_A = 25^\circ C$ | | | -40 TO 85°C | | -40 TO 125°C | | |
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | | MAX |
| t_{pd} | A | Y | $1.8 V \pm 0.15 V$ | 1 | 5 | 10.5 | 1 | 11 | 1 | 13 | ns |
| | | | $2.5 V \pm 0.2 V$ | 1 | 3.4 | 7.3 | 1 | 7.8 | 1 | 10 | |
| | | | 2.7 V | 1 | 3.6 | 7.3 | 1 | 7.5 | 1 | 9.5 | |
| | | | $3.3 V \pm 0.3 V$ | 1 | 3.2 | 6.2 | 1 | 6.4 | 1 | 8 | |
| $t_{sk(o)}$ | | | $3.3 V \pm 0.3 V$ | | | 1 | | 1 | 1.5 | ns | |

Operating Characteristics

$T_A = 25^\circ C$

| PARAMETER | | TEST CONDITIONS | V_{CC} | TYP | UNIT |
|-----------|--|--------------------|----------|-----|------|
| C_{pd} | Power dissipation capacitance per inverter | f = 10 MHz | 1.8 V | 11 | pF |
| | | | 2.5 V | 12 | |
| | | | 3.3 V | 15 | |

Parameter Measurement Information



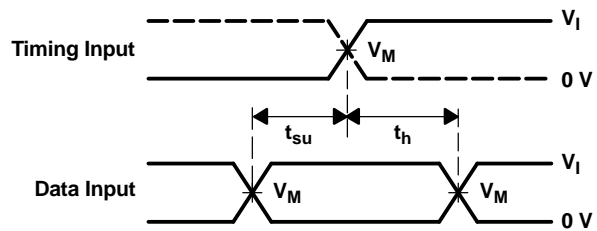
LOAD CIRCUIT

| TEST | S1 |
|-------------------|------------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | V_{LOAD} |
| t_{PHZ}/t_{PZH} | GND |

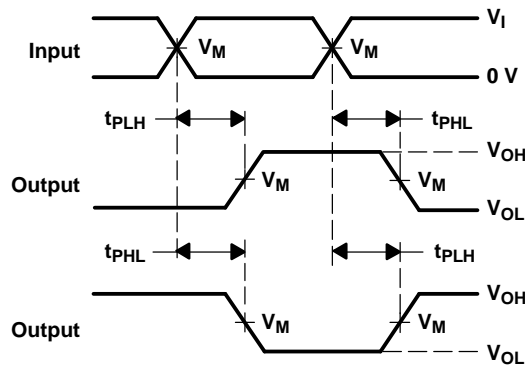
| V_{CC} | INPUTS | | V_M | V_{LOAD} | C_L | R_L | V_{Δ} |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
| | V_I | t_r/t_f | | | | | |
| $1.8\text{ V} \pm 0.15\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k Ω | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| 2.7 V | 2.7 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| $3.3\text{ V} \pm 0.3\text{ V}$ | 2.7 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 - C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$.
 - D. The outputs are measured one at a time, with one transition per measurement.
 - E. t_{PZL} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PLH} and t_{PHL} are the same as t_{pd} .
 - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms