

# SN54LV14, SN74LV14 HEX SCHMITT-TRIGGER INVERTERS

SCLS187C – FEBRUARY 1993 – REVISED FEBRUARY 1998

- **EPIC™ (Enhanced-Performance Implanted CMOS) 2-μ Process**
- **Typical  $V_{OLP}$  (Output Ground Bounce)  $< 0.8$  V at  $V_{CC}$ ,  $T_A = 25^\circ\text{C}$**
- **Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  $> 2$  V at  $V_{CC}$ ,  $T_A = 25^\circ\text{C}$**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model ( $C = 200$  pF,  $R = 0$ )**
- **Latch-Up Performance Exceeds 250 mA JESD 17**
- **Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), Ceramic Flat (W) Packages, Chip Carriers (FK), and (J) 300-mil DIPs**

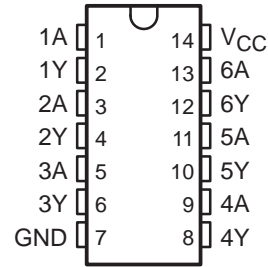
## description

These hex Schmitt-trigger inverters are designed for 2.7-V to 5.5-V  $V_{CC}$  operation.

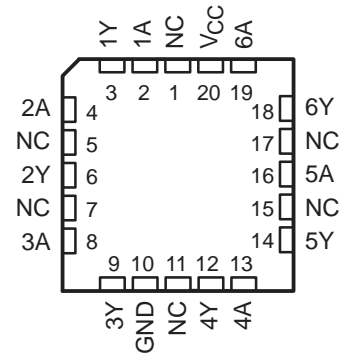
The 'LV14 devices contain six independent inverters. These devices perform the Boolean function  $Y = \bar{A}$ .

The SN54LV14 is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74LV14 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54LV14 . . . J OR W PACKAGE  
SN74LV14 . . . D, DB, OR PW PACKAGE  
(TOP VIEW)



SN54LV14 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE  
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H



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**TEXAS  
INSTRUMENTS**

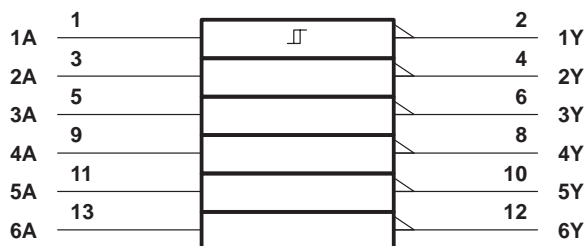
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## logic symbol†



## logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the D, DB, J, PW, and W packages.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )	±20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	±50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±25 mA
Continuous current through $V_{CC}$ or GND	±50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 3):	
D package	127°C/W
DB package	158°C/W
PW package	170°C/W
Storage temperature range, $T_{stg}$	–65°C to 150°C

‡ 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.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. This value is limited to 7 V maximum.  
3. The package thermal impedance is calculated in accordance with JESD 51.

## recommended operating conditions (see Note 4)

		SN54LV14		SN74LV14		UNIT
		MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage	2.7	5.5	2.7	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2.7$ V to 3.6 V		2.4		V
		$V_{CC} = 4.5$ V to 5.5 V		3.55		
$V_{IL}$	Low-level input voltage	$V_{CC} = 2.7$ V to 3.6 V		0.4		V
		$V_{CC} = 4.5$ V to 5.5 V		1.25		
$V_I$	Input voltage	0	$V_{CC}$	0	$V_{CC}$	V
$V_O$	Output voltage	0	$V_{CC}$	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 2.7$ V to 3.6 V		–6		mA
		$V_{CC} = 4.5$ V to 5.5 V		–12		
$I_{OL}$	Low-level output current	$V_{CC} = 2.7$ V to 3.6 V		6		mA
		$V_{CC} = 4.5$ V to 5.5 V		12		
$T_A$	Operating free-air temperature	–55	125	–40	85	°C

NOTE 4: 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.

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**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	SN54LV14			SN74LV14			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V <sub>T+</sub> Positive-going threshold		2.7 V	1		2	1		2	V
		3 V	1.2		2.2	1.2		2.2	
		3.6 V	1.5		2.4	1.5		2.4	
		4.5 V	1.7		3.2	1.7		3.2	
		5.5 V	2.1		3.9	2.1		3.9	
V <sub>T-</sub> Negative-going threshold		2.7 V	0.4		1.4	0.4		1.4	V
		3 V	0.6		1.5	0.6		1.5	
		3.6 V	0.8		1.8	0.8		1.8	
		4.5 V	0.9		2.25	0.9		2.25	
		5.5 V	1.1		2.75	1.1		2.75	
ΔV <sub>T</sub> Hysteresis (V <sub>T+</sub> – V <sub>T-</sub> )		2.7 V	0.3		1.1	0.3		1.1	V
		3 V	0.4		1.2	0.4		1.2	
		3.6 V	0.4		1.2	0.4		1.2	
		4.5 V	0.4		1.4	0.4		1.4	
		5.5 V	0.5		1.5	0.5		1.5	
V <sub>OH</sub>	I <sub>OH</sub> = –100 μA	2.7 V to 5.5 V	V <sub>CC</sub> – 0.2			V <sub>CC</sub> – 0.2			V
	I <sub>OH</sub> = –6 mA	3 V	2.4			2.4			
	I <sub>OH</sub> = –12 mA	4.5 V	3.6			3.6			
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	2.7 V to 5.5 V				0.2			V
	I <sub>OL</sub> = 6 mA	3 V				0.4			
	I <sub>OL</sub> = 12 mA	4.5 V				0.55			
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.6 V				±1			μA
		5.5 V				±1			
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	3.6 V				20			μA
		5.5 V				20			
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND	3 V to 3.6 V				500			μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V				2.5			pF
		5 V				3			

**switching characteristics over recommended operating free-air temperature range, C<sub>L</sub> = 50 pF (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LV14						UNIT		
			V <sub>CC</sub> = 5 V ± 0.5 V			V <sub>CC</sub> = 3.3 V ± 0.3 V				V <sub>CC</sub> = 2.7 V	
			MIN	TYP	MAX	MIN	TYP	MAX		MIN	MAX
t <sub>pd</sub>	A	Y		8	18		12	22		25	ns

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switching characteristics over recommended operating free-air temperature range,  $C_L = 50 \text{ pF}$  (unless otherwise noted) (see Figure 1)

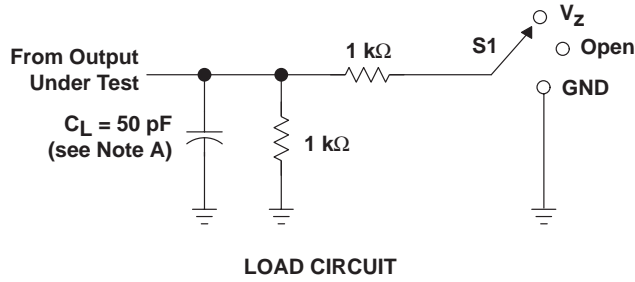
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74LV14						UNIT		
			$V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$			$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$				$V_{CC} = 2.7 \text{ V}$	
			MIN	TYP	MAX	MIN	TYP	MAX		MIN	MAX
$t_{pd}$	A	Y	8	18		12	22		25	ns	

operating characteristics,  $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	$V_{CC}$	TYP	UNIT
$C_{pd}$	Power dissipation capacitance per inverter	$C_L = 50 \text{ pF}, f = 10 \text{ MHz}$	3.3 V	22	pF
			5 V	24	

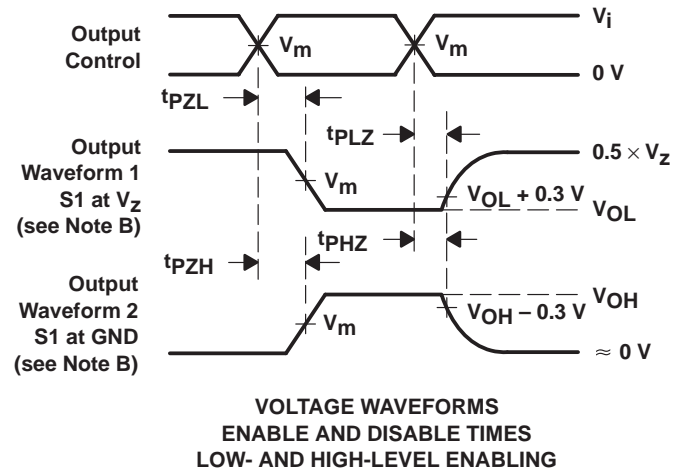
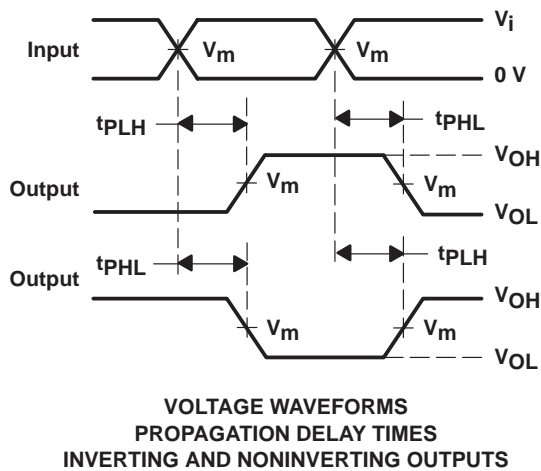
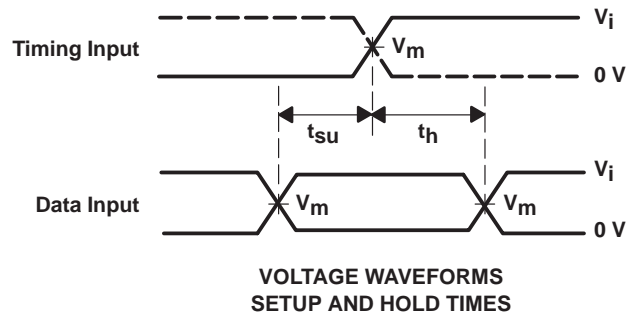
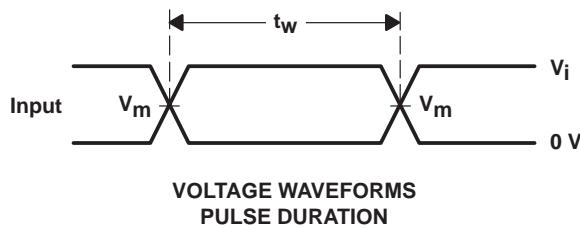


## PARAMETER MEASUREMENT INFORMATION



TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PLZ</sub> /t <sub>PZL</sub>	V <sub>Z</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND

WAVEFORM CONDITION	V <sub>CC</sub> = 4.5 V to 5.5 V	V <sub>CC</sub> = 2.7 V to 3.6 V
V <sub>m</sub>	0.5 × V <sub>CC</sub>	1.5 V
V <sub>i</sub>	V <sub>CC</sub>	2.7 V
V <sub>Z</sub>	2 × V <sub>CC</sub>	6 V



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
  - The outputs are measured one at a time with one transition per measurement.
  - t<sub>PLZ</sub> and t<sub>PHZ</sub> are the same as t<sub>dis</sub>.
  - t<sub>PZL</sub> and t<sub>PZH</sub> are the same as t<sub>en</sub>.
  - t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd</sub>.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74LV14D	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI
SN74LV14DBLE	OBSOLETE	SSOP	DB	14		TBD	Call TI	Call TI
SN74LV14DR	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI
SN74LV14PWLE	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

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<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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