



**THE DATASHEET OF  
SN74LV14ATPWRG4Q1**

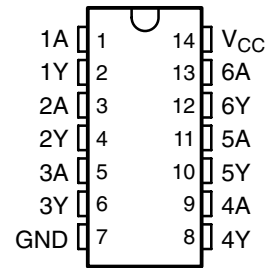


# SN74LV14A-Q1 HEX SCHMITT-TRIGGER INVERTER

SCLS466C – FEBRUARY 2003 – REVISED SEPTEMBER 2008

- Qualified for Automotive Applications
- Typical  $V_{OLP}$  (Output Ground Bounce)  
<0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  
>2.3 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Supports Mixed-Mode Voltage Operation on All Ports
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

PW PACKAGE  
(TOP VIEW)



w

## description/ordering information

This hex Schmitt-trigger inverter is designed for 2-V to 5.5-V  $V_{CC}$  operation.

The SN74LV14A contains six independent inverters. This device performs the Boolean function  $Y = \bar{A}$ .

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

## ORDERING INFORMATION†

$T_A$	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 105°C	TSSOP – PW	Tape and reel	SN74LV14ATPWRQ1	LV14ATQ

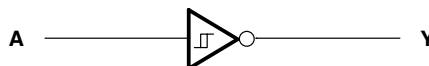
† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at <http://www.ti.com>.

‡ Package drawings, thermal data, and symbolization are available at <http://www.ti.com/packaging>.

FUNCTION TABLE  
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

## logic diagram, each inverter (positive logic)



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 **TEXAS  
INSTRUMENTS**

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# SN74LV14A-Q1

## HEX SCHMITT-TRIGGER INVERTER

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### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	-0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	-0.5 V to 7 V
Voltage range applied to any output in the high-impedance or power-off state, $V_O$ (see Note 1)	-0.5 V to 7 V
Output voltage range, $V_O$ (see Notes 1 and 2)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	-20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	-50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	$\pm 25$ mA
Continuous current through $V_{CC}$ or GND	$\pm 50$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 3)	113°C/W
Storage temperature range, $T_{stg}$	-65°C to 150°C

<sup>†</sup> 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 negative-voltage ratings may be exceeded if the input and output current ratings are observed.  
 2. This value is limited to 5.5 V maximum.  
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions (see Note 4)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	2	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2$ V	1.5	V
		$V_{CC} = 2.3$ V to 2.7 V	$V_{CC} \times 0.7$	
		$V_{CC} = 3$ V to 3.6 V	$V_{CC} \times 0.7$	
		$V_{CC} = 4.5$ V to 5.5 V	$V_{CC} \times 0.7$	
$V_{IL}$	Low-level input voltage	$V_{CC} = 2$ V	0.5	V
		$V_{CC} = 2.3$ V to 2.7 V	$V_{CC} \times 0.3$	
		$V_{CC} = 3$ V to 3.6 V	$V_{CC} \times 0.3$	
		$V_{CC} = 4.5$ V to 5.5 V	$V_{CC} \times 0.3$	
$V_I$	Input voltage	0	5.5	V
$V_O$	Output voltage	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 2$ V	-50	$\mu$ A
		$V_{CC} = 2.3$ V to 2.7 V	-2	mA
		$V_{CC} = 3$ V to 3.6 V	-6	
		$V_{CC} = 4.5$ V to 5.5 V	-12	
$I_{OL}$	Low-level output current	$V_{CC} = 2$ V	50	$\mu$ A
		$V_{CC} = 2.3$ V to 2.7 V	2	mA
		$V_{CC} = 3$ V to 3.6 V	6	
		$V_{CC} = 4.5$ V to 5.5 V	12	
$T_A$	Operating free-air temperature	-40	105	°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>	MIN TYP MAX			UNIT	
			MIN	TYP	MAX		
V <sub>T+</sub> Positive-going threshold		2.5 V			1.75	V	
		3.3 V			2.31		
		5 V			3.5		
V <sub>T-</sub> Negative-going threshold		2.5 V	0.75			V	
		3.3 V	0.99				
		5 V	1.5				
$\Delta V_T$ Hysteresis (V <sub>T+</sub> – V <sub>T-</sub> )		2.5 V	0.25		1	V	
		3.3 V	0.33		1.32		
		5 V	0.5		2		
V <sub>OH</sub>	I <sub>OH</sub> = –50 $\mu$ A	2 V to 5.5 V	V <sub>CC</sub> –0.1			V	
	I <sub>OH</sub> = –2 mA	2.3 V	2				
	I <sub>OH</sub> = –6 mA	3 V	2.48				
	I <sub>OH</sub> = –12 mA	4.5 V	3.8				
V <sub>OL</sub>	I <sub>OL</sub> = 50 $\mu$ A	2 V to 5.5 V	0.1			V	
	I <sub>OL</sub> = 2 mA	2.3 V	0.4				
	I <sub>OL</sub> = 6 mA	3 V	0.44				
	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	0 V to 5.5 V				$\pm 1$	$\mu$ A
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V				20	$\mu$ A
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5 V	0 V				5	$\mu$ A
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V	2.3			pF	
		5 V	2.3				

**switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V  $\pm$  0.3 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t <sub>pd</sub>	A	Y	C <sub>L</sub> = 50 pF	9.6	16.3		1	20.4	ns

**switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V  $\pm$  0.5 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t <sub>pd</sub>	A	Y	C <sub>L</sub> = 50 pF	6.7	10.6		1	14	ns



# SN74LV14A-Q1

## HEX SCHMITT-TRIGGER INVERTER

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### noise characteristics, $V_{CC} = 3.3\text{ V}$ , $C_L = 50\text{ pF}$ , $T_A = 25^\circ\text{C}$ (see Note 5)

PARAMETER		MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic $V_{OL}$		0.2	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic $V_{OL}$		-0.1	-0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic $V_{OH}$		3.1		V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	V

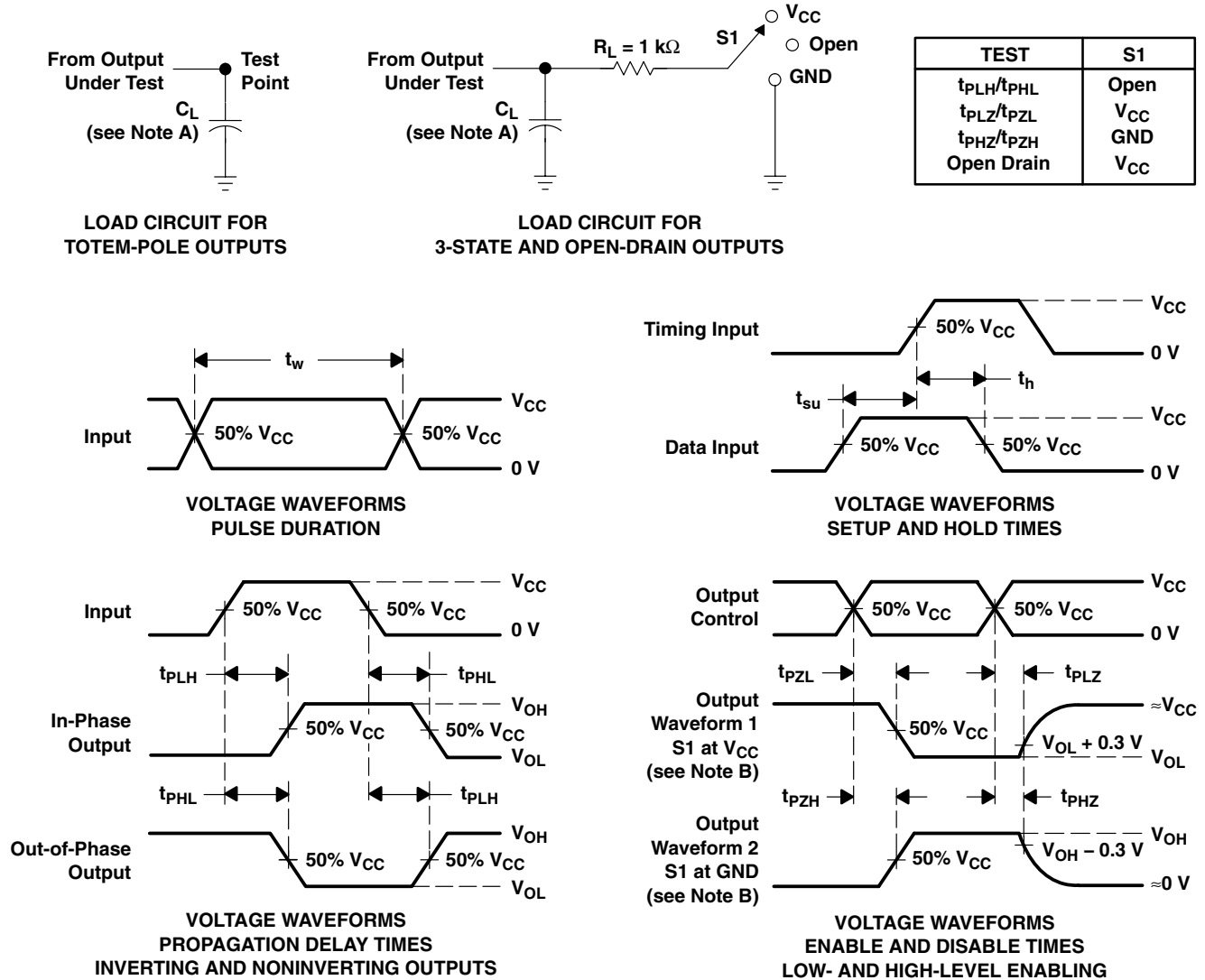
NOTE 5: Characteristics are for surface-mount packages only.

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

PARAMETER		TEST CONDITIONS	$V_{CC}$	TYP	UNIT
$C_{pd}$	Power dissipation capacitance	$C_L = 50\text{ pF}$ , $f = 10\text{ MHz}$	3.3 V	8.8	pF
			5 V	9.6	



PARAMETER MEASUREMENT INFORMATION



- 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  $\leq$  1 MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 3$  ns,  $t_f \leq 3$  ns.
  - D. The outputs are measured one at a time, with one input transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .
  - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LV14ATPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 105	LV14ATQ	<a href="#">Samples</a>
SN74LV14ATPWRQ1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 105	LV14ATQ	<a href="#">Samples</a>

(1) 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.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF SN74LV14A-Q1 :**

- Catalog: [SN74LV14A](#)
- Enhanced Product: [SN74LV14A-EP](#)

## NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LV14ATPWRG4Q1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV14ATPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV14ATPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV14ATPWRG4Q1	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74LV14ATPWRQ1	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74LV14ATPWRQ1	TSSOP	PW	14	2000	356.0	356.0	35.0



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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