

# DATA SHEET

## **74LVC14A**

Hex inverting Schmitt-trigger with 5V  
tolerant input

Product specification

1998 Apr 28

# Hex inverting Schmitt-trigger with 5V tolerant input

## 74LVC14A

### FEATURES

- Wide supply voltage range of: 1.2 V to 3.6 V
- In accordance with JEDEC standard no. 8-1A
- Inputs accept voltages up to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels

### APPLICATIONS

- Wave and pulse shapers for highly noisy environments
- Astable multivibrators
- Monostable multivibrators

### DESCRIPTION

The 74LVC14A is a high-performance, low power, low-voltage Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

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 environment.

The 74LVC14A provides six inverting buffers with Schmitt-trigger action. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

### QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25^{\circ}\text{C}$ ;  $t_r \leq t_f \leq 2.5 \text{ ns}$

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	Propagation delay nA to nY	$C_L = 50 \text{ pF}$ ; $V_{CC} = 3.3 \text{ V}$	4	ns
$C_I$	Input capacitance		3.5	pF
$C_{PD}$	Power dissipation capacitance per gate	Notes 1 and 2	25	pF

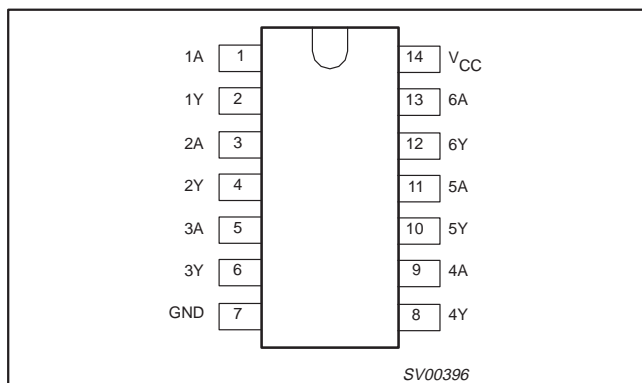
#### NOTES:

- $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ )  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  $C_L$  = output load capacity in pF;  
 $f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.
- The condition is  $V_I = \text{GND to } V_{CC}$ .

### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
14-Pin Plastic SO	$-40^{\circ}\text{C to } +85^{\circ}\text{C}$	74LVC14A D	74LVC14A D	SOT108-1
14-Pin Plastic SSOP Type II	$-40^{\circ}\text{C to } +85^{\circ}\text{C}$	74LVC14A DB	74LVC14A DB	SOT337-1
14-Pin Plastic TSSOP Type I	$-40^{\circ}\text{C to } +85^{\circ}\text{C}$	74LVC14A PW	74LVC14APW DH	SOT402-1

### PIN CONFIGURATION



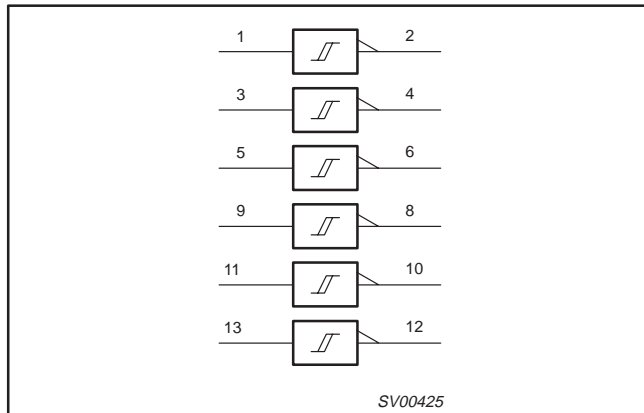
### PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 3, 5, 9, 11, 13	1A – 6A	Data inputs
2, 4, 6, 8, 10, 12	1Y – 6Y	Data outputs
7	GND	Ground (0 V)
14	$V_{CC}$	Positive supply voltage

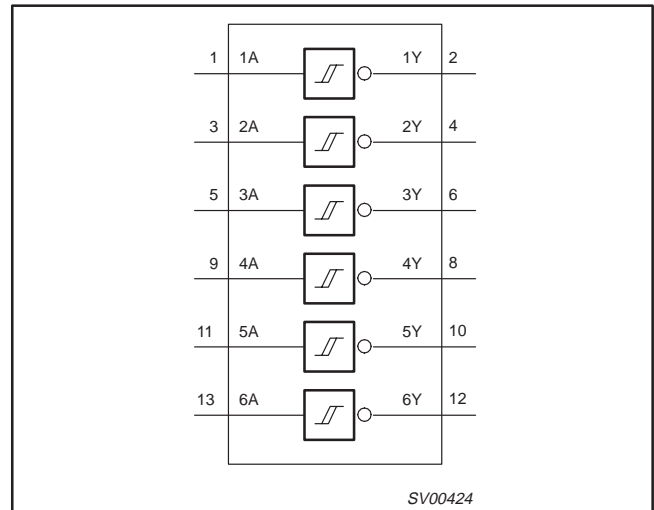
# Hex inverting Schmitt-trigger with 5V tolerant input

74LVC14A

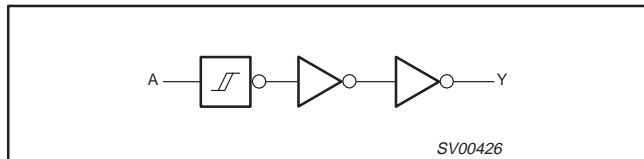
### LOGIC SYMBOL (IEEE/IEC)



### LOGIC SYMBOL



### LOGIC DIAGRAM (ONE SCHMITT-TRIGGER)



### FUNCTION TABLE

INPUT	OUTPUT
nA	nY
L	H
H	L

**NOTES:**

H = HIGH voltage level  
L = LOW voltage level

### RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V <sub>CC</sub>	DC supply voltage (for max. speed performance)		2.7	3.6	V
	DC supply voltage (for low-voltage applications)		1.2	3.6	
V <sub>I</sub>	DC input voltage range		0	5.5	V
V <sub>I/O</sub>	DC output voltage range; output HIGH or LOW state		0	V <sub>CC</sub>	V
	DC input voltage range; output 3-State		0	5.5	
T <sub>amb</sub>	Operating free-air temperature range		-40	+85	°C
t <sub>p</sub> , t <sub>f</sub>	Input rise and fall times	V <sub>CC</sub> = 1.2 to 2.7V	0	20	ns/V
		V <sub>CC</sub> = 2.7 to 3.6V	0	10	

# Hex inverting Schmitt-trigger with 5V tolerant input

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## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

In accordance with the Absolute Maximum Rating System (IEC 134).  
Voltages are referenced to GND (ground = 0V).

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 to +6.5	V
$I_{IK}$	DC input diode current	$V_I < 0$	-50	mA
$V_I$	DC input voltage	Note 2	-0.5 to +6.5	V
$I_{OK}$	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	± 50	mA
$V_{I/O}$	DC output voltage; output HIGH or LOW	Note 2	-0.5 to $V_{CC} + 0.5$	V
	DC input voltage; output 3-State	Note 2	-0.5 to 6.5	
$I_O$	DC output source or sink current	$V_O = 0$ to $V_{CC}$	± 50	mA
$I_{GND}, I_{CC}$	DC $V_{CC}$ or GND current		± 100	mA
$T_{stg}$	Storage temperature range		-65 to +150	°C
$P_{TOT}$	Power dissipation per package			
	- plastic mini-pack (SO) - plastic shrink mini-pack (SSOP and TSSOP)	above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	500 500	mW

### NOTES:

- Stresses beyond those listed 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.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions. Voltages are referenced to GND (ground = 0V).

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP <sup>1</sup>	MAX	
$V_{IH}$	HIGH level Input voltage	$V_{CC} = 1.2V$	$V_{CC}$			V
		$V_{CC} = 2.7$ to $3.6V$	2.0			
$V_{IL}$	LOW level Input voltage	$V_{CC} = 1.2V$			GND	V
		$V_{CC} = 2.7$ to $3.6V$			0.8	
$V_{OH}$	HIGH level output voltage	$V_{CC} = 2.7V; V_I = V_{IH}$ or $V_{IL}; I_O = -12mA$	$V_{CC} - 0.5$			V
		$V_{CC} = 3.0V; V_I = V_{IH}$ or $V_{IL}; I_O = -100\mu A$	$V_{CC} - 0.2$	$V_{CC}$		
		$V_{CC} = 3.0V; V_I = V_{IH}$ or $V_{IL}; I_O = -18mA$	$V_{CC} - 0.6$			
		$V_{CC} = 3.0V; V_I = V_{IH}$ or $V_{IL}; I_O = -24mA$	$V_{CC} - 0.8$			
$V_{OL}$	LOW level output voltage	$V_{CC} = 2.7V; V_I = V_{IH}$ or $V_{IL}; I_O = 12mA$			0.40	V
		$V_{CC} = 3.0V; V_I = V_{IH}$ or $V_{IL}; I_O = 100\mu A$		GND	0.20	
		$V_{CC} = 3.0V; V_I = V_{IH}$ or $V_{IL}; I_O = 24mA$			0.55	
$I_I$	Input leakage current	$V_{CC} = 3.6V; V_I = 5.5V$ or GND		± 0.1	± 5	μA
$I_{CC}$	Quiescent supply current	$V_{CC} = 3.6V; V_I = V_{CC}$ or GND; $I_O = 0$		0.1	10	μA
$\Delta I_{CC}$	Additional quiescent supply current per input pin	$V_{CC} = 2.3V$ to $3.6V; V_I = V_{CC} - 0.6V; I_O = 0$		5	500	μA

### NOTE:

- All typical values are at  $V_{CC} = 3.3V$  and  $T_{amb} = 25^\circ C$ .

# Hex inverting Schmitt-trigger with 5V tolerant input

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### TRANSFER CHARACTERISTICS

Voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)			UNIT	TEST CONDITIONS	
		-40 TO +85				V <sub>CC</sub> (V)	WAVEFORMS
		MIN	TYP <sup>1</sup>	MAX			
V <sub>T+</sub>	Positive-going threshold	–	–	1.2	V	1.2	Figures 1 and 2
		1.1	–	2.0		2.7	
		1.1	–	2.0		2.7 to 3.6	
V <sub>T-</sub>	Negative-going threshold	0	–	–	V	1.2	Figures 1 and 2
		0.8	–	1.5		2.7	
		0.8	–	1.5		2.7 to 3.6	
V <sub>H</sub>	Hysteresis (V <sub>T+</sub> – V <sub>T-</sub> )	–	–	–	V	1.2	Figures 1, 2 and 3
		0.3	0.4	–		2.7	
		0.3	0.45*	–		2.7 to 3.6	

**NOTES:**

1. All typical values are measured at T<sub>amb</sub> = 25°C
2. The V<sub>IH</sub> and V<sub>IL</sub> from the DC family characteristics are superseded by the V<sub>T+</sub> and V<sub>T-</sub>.

### TRANSFER CHARACTERISTIC WAVEFORMS

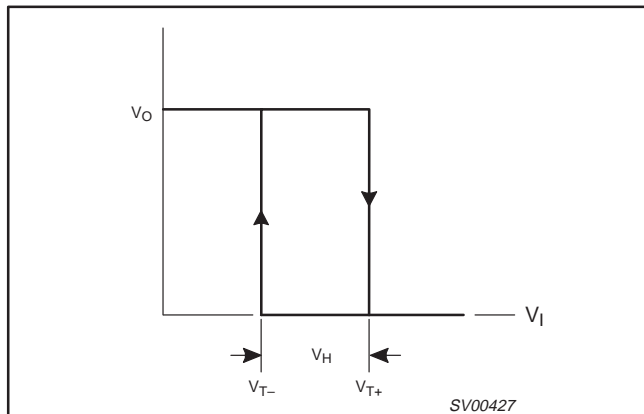


Figure 1. Transfer characteristic.

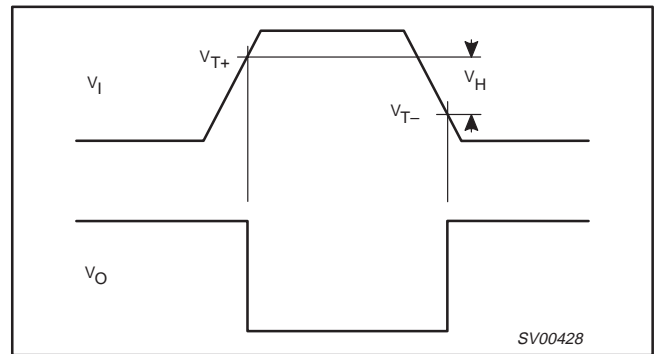


Figure 2. Definition of V<sub>T+</sub>, V<sub>T-</sub> and V<sub>H</sub>; where V<sub>T+</sub> and V<sub>T-</sub> are between limits of 20% and 70%

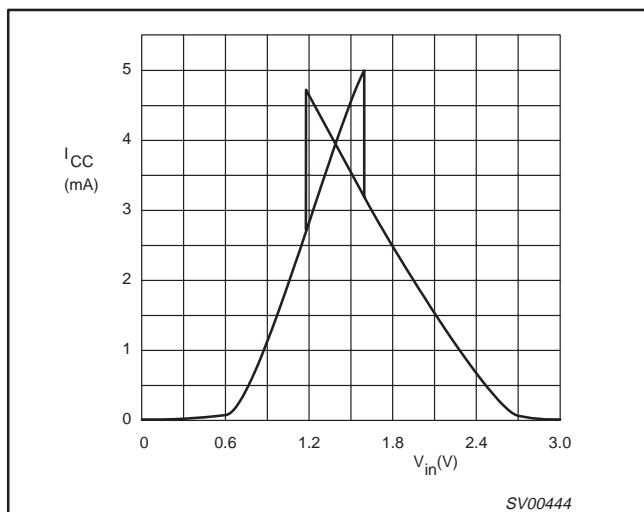


Figure 3. Typical 74LVC14 transfer characteristics; V<sub>CC</sub> = 3.3 V.

# Hex inverting Schmitt-trigger with 5V tolerant input

## 74LVC14A

### AC CHARACTERISTICS

GND = 0 V;  $t_r = t_f \leq 2.5$  ns;  $C_L = 50$  pF;  $R_L = 500\Omega$ ;  $T_{amb} = -40^\circ\text{C}$  to  $+85^\circ\text{C}$

SYMBOL	PARAMETER	WAVEFORM	LIMITS							UNIT
			$V_{CC} = 3.3V \pm 0.3V$			$V_{CC} = 2.7V$			$V_{CC} = 1.2V$	
			MIN	TYP <sup>1</sup>	MAX	MIN	TYP	MAX	TYP	
$t_{PHL}/t_{PLH}$	Propagation delay nA to nY	Figure 1, 2	1.5	4.5	6.4	1.5	5.0	7.5	18	ns

**NOTE:**

1. These typical values are at  $V_{CC} = 3.3V$  and  $T_{amb} = 25^\circ\text{C}$ .

### AC WAVEFORMS

$V_M = 1.5$  V at  $V_{CC} \geq 2.7$  V

$V_M = 0.5 \cdot V_{CC}$  at  $V_{CC} < 2.7$  V

$V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.

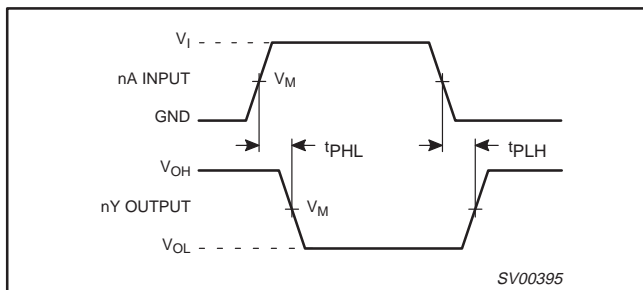


Figure 1. Input (nA) to output (nY) propagation delays.

### TEST CIRCUIT

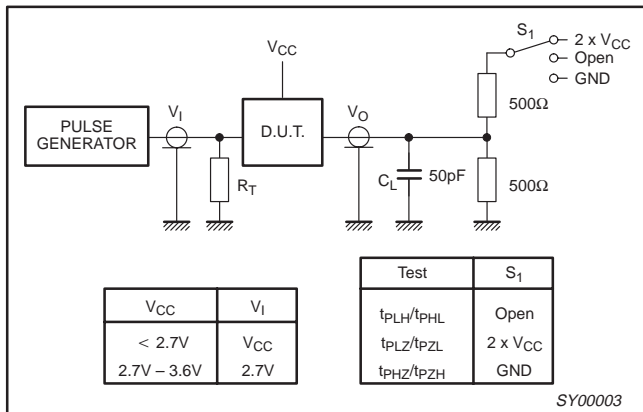


Figure 2. Load circuitry for switching times.

### APPLICATION INFORMATION

All values given are typical unless otherwise specified.

Note to Figure 7:  $f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$

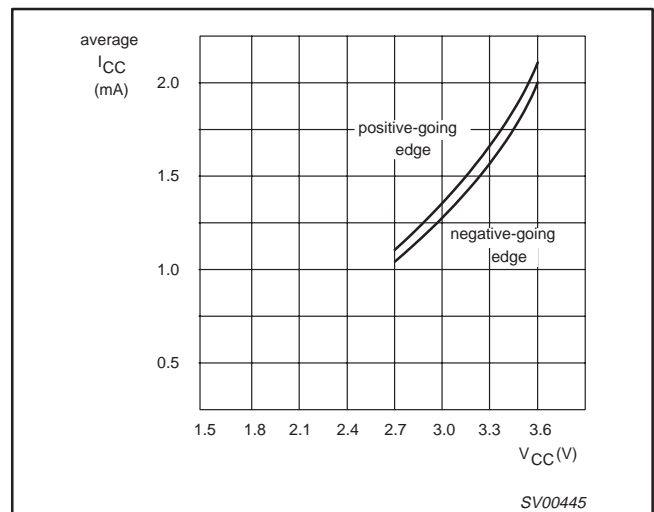


Figure 3. Average  $I_{CC}$  for LVC Schmitt-trigger devices; linear change of  $V_i$  between 0.8 V to 2.0 V.

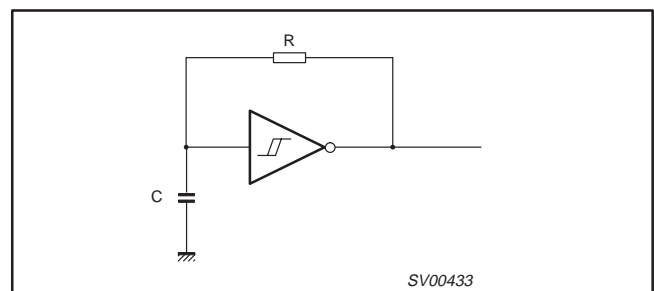


Figure 4. Relaxation oscillator using the LVC14.

# Hex inverting Schmitt-trigger with 5V tolerant input

## 74LVC14A

**SO14: plastic small outline package; 14 leads; body width 3.9 mm**

**SOT108-1**



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.35 0.34	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT108-1	076E06S	MS-012AB			95-01-29 97-05-22

# Hex inverting Schmitt-trigger with 5V tolerant input

# 74LVC14A

**SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm**

**SOT337-1**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT337-1		MO-150AB				<del>95-02-04</del> 96-01-18

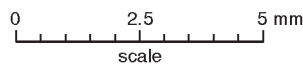
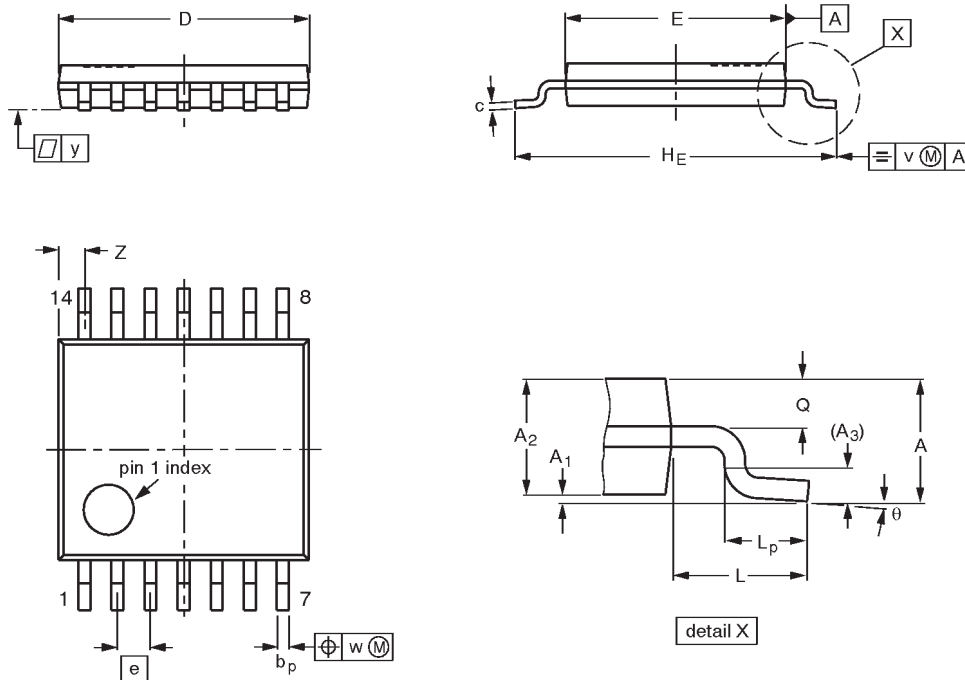


# Hex inverting Schmitt-trigger with 5V tolerant input

## 74LVC14A

**TSSOP14:** plastic thin shrink small outline package; 14 leads; body width 4.4 mm

**SOT402-1**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT402-1		MO-153				-94-07-12- 95-04-04

## Hex inverting Schmitt-trigger with 5V tolerant input

74LVC14A

## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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print code

Date of release: 07-98

Document order number:

9397-750-04484

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