

# 74LVC14A

## Hex inverting Schmitt trigger with 5 V tolerant input

Product data sheet

### 1. General description

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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 this device as a translator in a mixed 3.3 V and 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.

### 2. Features

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- Wide supply voltage range from 1.2 V to 3.6 V
- 5 V tolerant input for interfacing with 5 V logic
- CMOS low-power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5.5 V
- Unlimited input rise and fall times
- Complies with JEDEC standard:
  - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-B exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

### 3. Applications

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

**PHILIPS**

## 4. Quick reference data

**Table 1: Quick reference data**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHL}$ , $t_{PLH}$	propagation delay nA to nY	$V_{CC} = 3.3 \text{ V}$ ; $C_L = 50 \text{ pF}$	-	3.2	-	ns
$C_I$	input capacitance		-	4.0	-	pF
$C_{PD}$	power dissipation capacitance	$V_{CC} = 3.3 \text{ V}$	[1] [2]	10	-	pF

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

[2] The condition is  $V_I = \text{GND to } V_{CC}$ .

## 5. Ordering information

**Table 2: Ordering information**

Type number	Package			Version
	Temperature range	Name	Description	
74LVC14AD	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVC14ADB	-40 °C to +125 °C	SSOP14	plastic thin shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LVC14APW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LVC14ABQ	-40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm	SOT762-1

## 8. Functional description

### 8.1 Function table

Table 4: Function table <sup>[1]</sup>

Input nA	Output nY
L	H
H	L

[1] H = HIGH voltage level;  
L = LOW voltage level.

## 9. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+6.5	V
$V_I$	input voltage		<sup>[1]</sup> -0.5	+6.5	V
$V_O$	output voltage		<sup>[1]</sup> -0.5	$V_{CC} + 0.5$	V
$I_{IK}$	input diode current	$V_I < 0$ V	-	-50	mA
$I_{OK}$	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA
$I_O$	output source or sink current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}, I_{GND}$	$V_{CC}$ or GND current		-	$\pm 100$	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C	<sup>[3]</sup> -	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] When  $V_{CC} = 0$  V (Power-down mode), the output voltage can be 3.6 V in normal operation.

[3] For SO14 packages:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

For (T)SSOP14 packages:  $P_{tot}$  derates linearly with 5.5 mW/K above 60 °C.

For DHVQFN14 packages:  $P_{tot}$  derates linearly with 4.5 mW/K above 60 °C.

## 10. Recommended operating conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	for maximum speed performance	2.7	-	3.6	V
		for low-voltage applications	1.2	-	3.6	V
$V_I$	input voltage		0	-	5.5	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	-	+125	°C

## 11. Static characteristics

**Table 7: Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math> [1]</b>						
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = -100\text{ }\mu\text{A}$ ; $V_{CC} = 2.7\text{ V to }3.6\text{ V}$	$V_{CC} - 0.2$	-	-	V
		$I_O = -8\text{ mA}$ ; $V_{CC} = 2.3\text{ V to }2.7\text{ V}$	$V_{CC} - 0.5$	-	-	V
		$I_O = -12\text{ mA}$ ; $V_{CC} = 2.7\text{ V}$	$V_{CC} - 0.5$	-	-	V
		$I_O = -18\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$	$V_{CC} - 0.6$	-	-	V
$V_{OL}$	LOW-level voltage output	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 100\text{ }\mu\text{A}$ ; $V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.2	V
		$I_O = 8\text{ mA}$ ; $V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.6	V
		$I_O = 12\text{ mA}$ ; $V_{CC} = 2.7\text{ V}$	-	-	0.4	V
		$I_O = 24\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$	-	-	0.55	V
$I_{LI}$	input leakage current	$V_{CC} = 3.6\text{ V}$ ; $V_I = 5.5\text{ V or GND}$	-	$\pm 0.1$	$\pm 5$	$\mu\text{A}$
$I_{CC}$	quiescent supply current	$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$	-	0.1	10	$\mu\text{A}$
$\Delta I_{CC}$	additional quiescent supply current per input pin	$V_{CC} = 2.7\text{ V to }3.6\text{ V}$ ; $V_I = V_{CC} - 0.6\text{ V}$ ; $I_O = 0\text{ A}$	-	5	500	$\mu\text{A}$
$C_I$	input capacitance		-	4.0	-	pF
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>						
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = -100\text{ }\mu\text{A}$ ; $V_{CC} = 2.7\text{ V to }3.6\text{ V}$	$V_{CC} - 0.3$	-	-	V
		$I_O = -8\text{ mA}$ ; $V_{CC} = 2.3\text{ V to }2.7\text{ V}$	$V_{CC} - 0.65$	-	-	V
		$I_O = -12\text{ mA}$ ; $V_{CC} = 2.7\text{ V}$	$V_{CC} - 0.65$	-	-	V
		$I_O = -18\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$	$V_{CC} - 0.75$	-	-	V
		$I_O = -24\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$	$V_{CC} - 1$	-	-	V

**Table 7: Static characteristics ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>OL</sub>	LOW-level voltage output	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.3	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.75	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.8	V
I <sub>LI</sub>	input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND	-	-	±20	μA
I <sub>CC</sub>	quiescent supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	-	40	μA
ΔI <sub>CC</sub>	additional quiescent supply current per input pin	V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	-	5	mA

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

## 12. Dynamic characteristics

**Table 8: Dynamic characteristics**Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C [1]</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay nA to nY	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 1.2 V	-	16	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	4.0	7.8	ns
		V <sub>CC</sub> = 2.7 V	1.5	3.6	7.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	3.2	6.4	ns
t <sub>sk(0)</sub>	skew		[2]	-	1.0	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>CC</sub> = 3.3 V	[3] [4]	10	-	pF
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay nA to nY	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 1.2 V	-	-	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	-	10.0	ns
		V <sub>CC</sub> = 2.7 V	1.5	-	9.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	-	8.0	ns
t <sub>sk(0)</sub>	skew		[2]	-	1.5	ns

[1] All typical values are measured at nominal V<sub>CC</sub> and T<sub>amb</sub> = 25 °C.

[2] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N + Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:f<sub>i</sub> = input frequency in MHz;f<sub>o</sub> = output frequency in MHz;C<sub>L</sub> = output load capacitance in pF;V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.[4] The condition is V<sub>I</sub> = GND to V<sub>CC</sub>.

## 14. Transfer characteristics

**Table 11: Transfer characteristics**

The  $V_{IH}$  and  $V_{IL}$  from the family static characteristics are superseded by the  $V_{T+}$  and  $V_{T-}$ . Voltages are referenced to GND (ground = 0 V); see [Figure 8](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math> [1]</b>						
$V_{T+}$	positive-going threshold	$V_{CC} = 1.2\text{ V}$	-	-	1.2	V
		$V_{CC} = 2.5\text{ V}$	0.9	-	1.7	V
		$V_{CC} = 2.7\text{ V}$	1.1	-	2.0	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	1.1	-	2.0	V
$V_{T-}$	negative-going threshold	$V_{CC} = 1.2\text{ V}$	0	-	-	V
		$V_{CC} = 2.5\text{ V}$	0.4	-	1.2	V
		$V_{CC} = 2.7\text{ V}$	0.8	-	1.5	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	0.8	-	1.5	V
$V_H$	hysteresis ( $V_{T+} - V_{T-}$ )	$V_{CC} = 1.2\text{ V}$	-	-	-	V
		$V_{CC} = 2.5\text{ V}$	0.3	-	-	V
		$V_{CC} = 2.7\text{ V}$	0.3	0.4	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$ [2]	0.3	0.45	-	V
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>						
$V_{T+}$	positive-going threshold	$V_{CC} = 1.2\text{ V}$	-	-	1.2	V
		$V_{CC} = 2.5\text{ V}$	0.9	-	1.7	V
		$V_{CC} = 2.7\text{ V}$	1.1	-	2.0	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	1.1	-	2.0	V
$V_{T-}$	negative-going threshold	$V_{CC} = 1.2\text{ V}$	0	-	-	V
		$V_{CC} = 2.5\text{ V}$	0.4	-	1.2	V
		$V_{CC} = 2.7\text{ V}$	0.8	-	1.5	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	0.8	-	1.5	V
$V_H$	hysteresis ( $V_{T+} - V_{T-}$ )	$V_{CC} = 1.2\text{ V}$	-	-	-	V
		$V_{CC} = 2.5\text{ V}$	0.2	-	-	V
		$V_{CC} = 2.7\text{ V}$	0.3	-	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	0.3	-	-	V

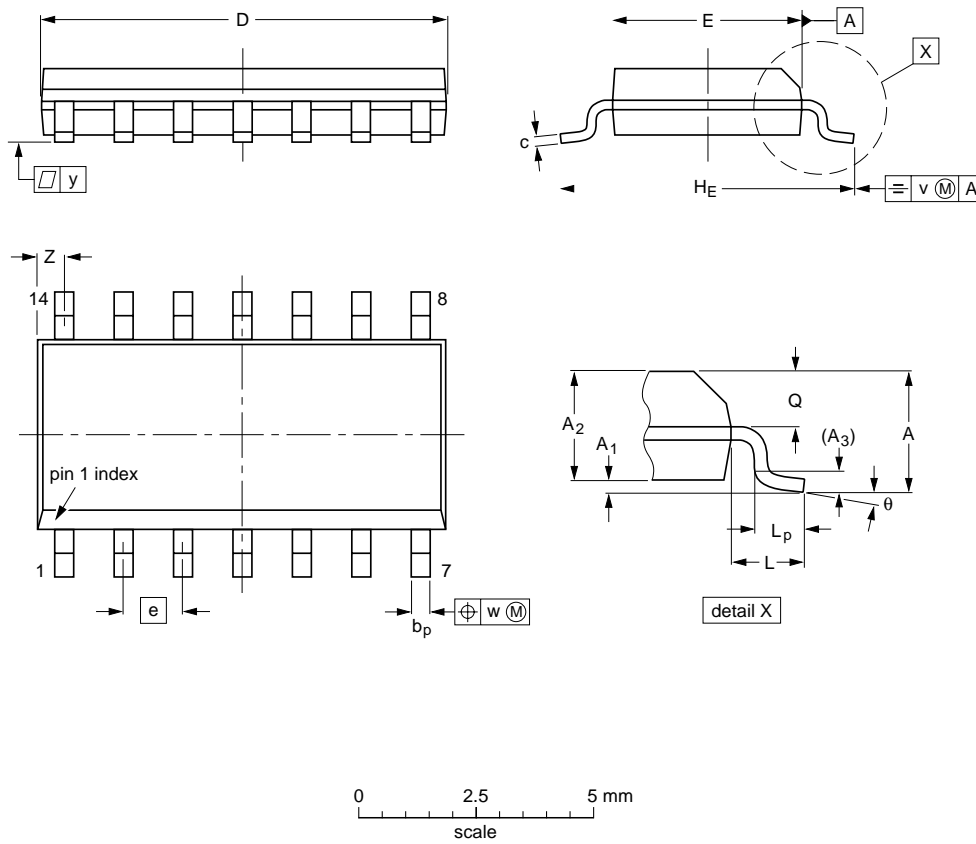
[1] All typical values are measured at nominal  $V_{CC}$  and  $T_{amb} = 25\text{ °C}$ .

[2] Typical transfer characteristic is displayed in [Figure 9](#).

17. Package outline

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	0.05	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

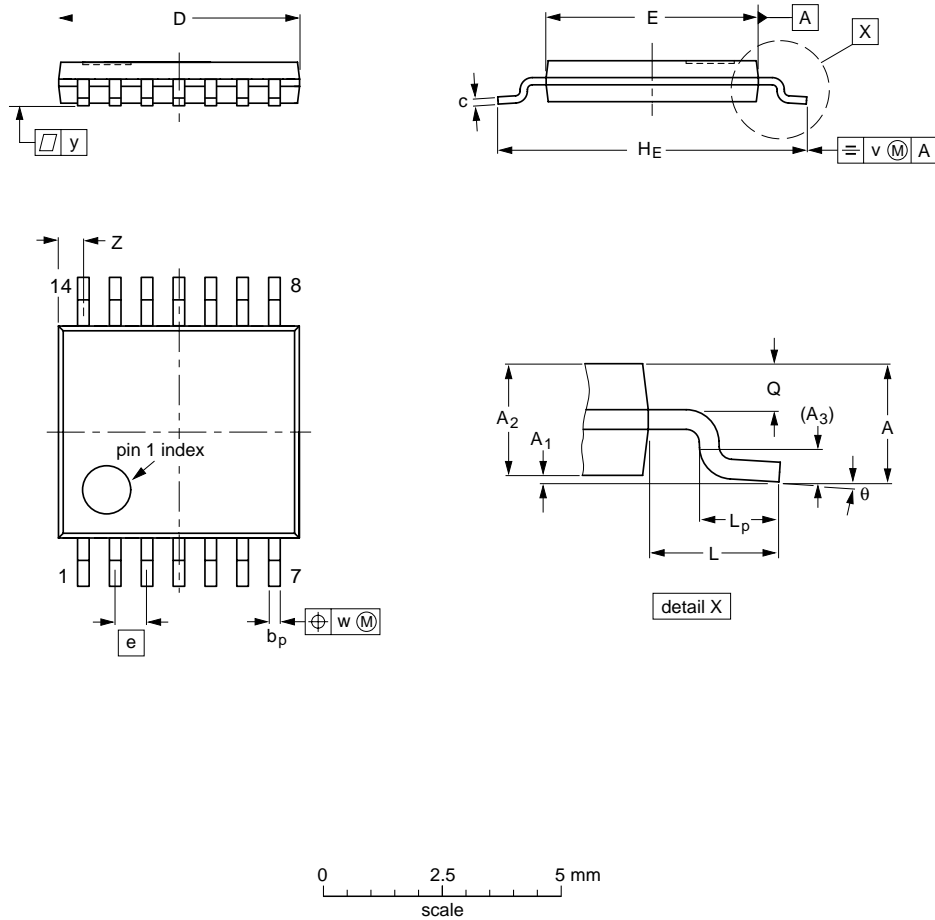
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION
	IEC	JEDEC	JEITA	
SOT108-1	076E06	MS-012		

Fig 12. Package outline SOT108-1 (SO14)

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	1.1	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	0.75 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
	IEC	JEDEC	JEITA	
SOT402-1		MO-153		

Fig 14. Package outline SOT402-1 (TSSOP14)