

Hex inverter

74LVC04A

FEATURES

- 5 V tolerant inputs for interfacing with 5 V logic
- Wide supply voltage range from 1.2 to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5.5 V
- Complies with JEDEC standard no. 8-1A
- ESD protection:
HBM EIA/JESD22-A114-A exceeds 2000 V
MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from -40 to $+85$ °C and -40 to $+125$ °C.

DESCRIPTION

The 74LVC04A is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

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

The 74LVC04A provides six inverting buffers.

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25$ °C; $t_r = t_f \leq 2.5$ ns.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	propagation delay nA to nY	$C_L = 50$ pF; $V_{CC} = 3.3$ V	2.1	ns
C_i	input capacitance		4.0	pF
C_{PD}	power dissipation capacitance per gate	$V_{CC} = 3.3$ V; notes 1 and 2	15	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μ 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 Volts;

N = total load switching outputs;

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

2. The condition is $V_i = \text{GND}$ to V_{CC} .

FUNCTION TABLE

See note 1.

INPUT	OUTPUT
nA	nY
L	H
H	L

Note

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

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ORDERING INFORMATION

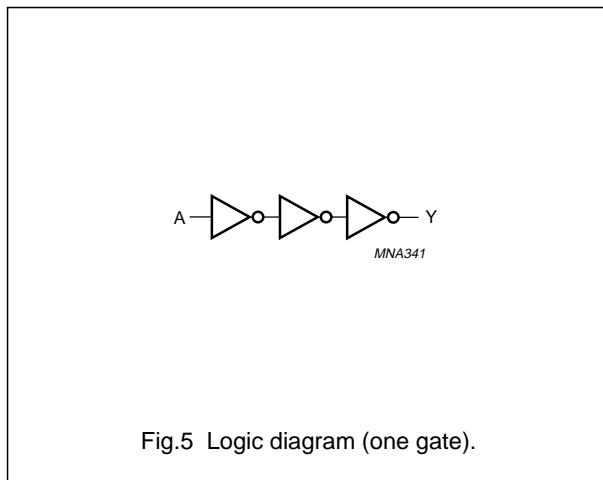
TYPE NUMBER	PACKAGE				
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE
74LVC04AD	-40 to +125 °C	14	SO14	plastic	SOT108-1
74LVC04ADB	-40 to +125 °C	14	SSOP14	plastic	SOT337-1
74LVC04APW	-40 to +125 °C	14	TSSOP14	plastic	SOT402-1
74LVC04ABQ	-40 to +125 °C	14	DHVQFN14	plastic	SOT762-1

PINNING

PIN	SYMBOL	DESCRIPTION
1	1A	data input
2	1Y	data output
3	2A	data input
4	2Y	data output
5	3A	data input
6	3Y	data output
7	GND	ground (0 V)
8	4Y	data output
9	4A	data input
10	5Y	data output
11	5A	data input
12	6Y	data output
13	6A	data input
14	V _{CC}	supply voltage

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN.	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
t_r, t_f	input rise and fall times	$V_{CC} = 1.2$ to 2.7 V	0	20	ns/V
		$V_{CC} = 2.7$ to 3.6 V	0	10	ns/V

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
I_{IK}	input diode current	$V_I < 0$	-	-50	mA
V_I	input voltage	note 1	-0.5	+6.5	V
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0$	-	±50	mA
V_O	output voltage	note 1	-0.5	$V_{CC} + 0.5$	V
I_O	output source or sink current	$V_O = 0$ to V_{CC}	-	±50	mA
I_{CC}, I_{GND}	V_{CC} or GND current		-	±100	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	power dissipation per package	$T_{amb} = -40$ to $+125$ °C; note 2	-	500	mW

Notes

- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- For SO14 packages: above 70 °C derate linearly with 8 mW/K.
For SSOP14 and TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.
For DHVQFN14 packages: above 60 °C derate linearly with 4.5 mW/K.

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DC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		OTHER	V _{CC} (V)				
T_{amb} = -40 to +85 °C							
V _{IH}	HIGH-level input voltage		1.2	V _{CC}	–	–	V
			2.7 to 3.6	2.0	–	–	V
V _{IL}	LOW-level input voltage		1.2	–	–	GND	V
			2.7 to 3.6	–	–	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} I _O = -100 µA	2.7 to 3.6	V _{CC} - 0.2	–	–	V
		I _O = -12 mA	2.7	V _{CC} - 0.5	–	–	V
		I _O = -18 mA	3.0	V _{CC} - 0.6	–	–	V
		I _O = -24 mA	3.0	V _{CC} - 0.8	–	–	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 100 µA	2.7 to 3.6	–	–	0.2	V
		I _O = 12 mA	2.7	–	–	0.4	V
		I _O = 24 mA	3.0	–	–	0.55	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	3.6	–	±0.1	±5	µA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0	3.6	–	0.1	10	µA
ΔI _{CC}	additional quiescent supply current per input pin	V _I = V _{CC} - 0.6 V; I _O = 0	2.7 to 3.6	–	5	500	µA

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SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		OTHER	V _{CC} (V)				
T_{amb} = -40 to +125 °C							
V _{IH}	HIGH-level input voltage		1.2	V _{CC}	–	–	V
			2.7 to 3.6	2.0	–	–	V
V _{IL}	LOW-level input voltage		1.2	–	–	GND	V
			2.7 to 3.6	–	–	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = -100 μA	2.7 to 3.6	V _{CC} - 0.3	–	–	V
		I _O = -12 mA	2.7	V _{CC} - 0.65	–	–	V
		I _O = -18 mA	3.0	V _{CC} - 0.75	–	–	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = 100 μA	2.7 to 3.6	–	–	0.3	V
		I _O = 12 mA	2.7	–	–	0.6	V
		I _O = 24 mA	3.0	–	–	0.8	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	3.6	–	–	±20	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0	3.6	–	–	40	μA
ΔI _{CC}	additional quiescent supply current per input pin	V _I = V _{CC} - 0.6 V; I _O = 0	2.7 to 3.6	–	–	5000	μA

Note

1. All typical values are measured at V_{CC} = 3.3 V and T_{amb} = 25 °C.

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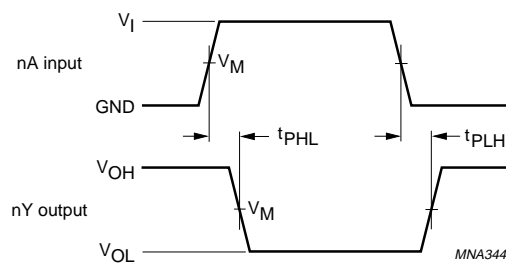
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AC CHARACTERISTICSGND = 0 V; $t_r = t_f \leq 2.5$ ns.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		WAVEFORMS	V _{CC} (V)				
T_{amb} = -40 to +85 °C							
t _{PHL} /t _{PLH}	propagation delay nA to nY	see Figs 6 and 7	1.2	–	14	–	ns
			2.7	1.0	2.2	5.5	ns
			3.0 to 3.6	1.0	1.9	4.5	ns
t _{sk(0)}	skew	note 2	3.0 to 3.6	–	–	1.0	ps
T_{amb} = -40 to +125 °C							
t _{PHL} /t _{PLH}	propagation delay nA to nY	see Figs 6 and 7	1.2	–	–	–	ns
			2.7	1.0	–	7.0	ns
			3.0 to 3.6	1.0	–	6.0	ns
t _{sk(0)}	skew	note 2	3.0 to 3.6	–	–	1.5	ps

Notes

- All typical values are measured at V_{CC} = 3.3 V.
- Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

AC WAVEFORMS

$V_M = 1.5$ V at V_{CC} ≥ 2.7 V;
 $V_M = 0.5V_{CC}$ at V_{CC} < 2.7 V;
 V_{OL} and V_{OH} are typical output voltage drop that occur with the output load.

Fig.6 The input nA to output nY propagation delays.

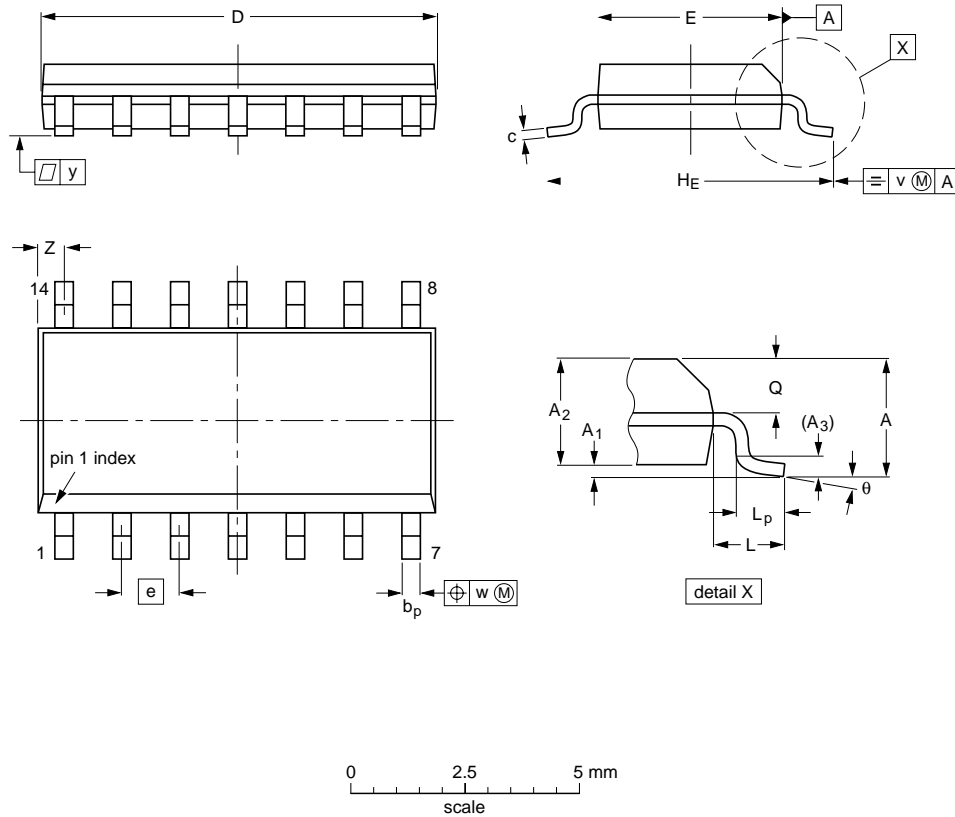
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PACKAGE OUTLINES

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 ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	1.75 0.10	0.25 1.25	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			