

MC74LVXU04

Hex Inverter (Unbuffered)

The MC74LVXU04 is an advanced high speed CMOS unbuffered hex inverter. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

Features

- High Speed: $t_{PD} = 4.1$ ns (Typ) at $V_{CC} = 3.3$ V
- Low Power Dissipation: $I_{CC} = 2$ μ A (Max) at $T_A = 25^\circ$ C
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Low Noise: $V_{OLP} = 0.5$ V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- These Devices are Pb-Free and are RoHS Compliant

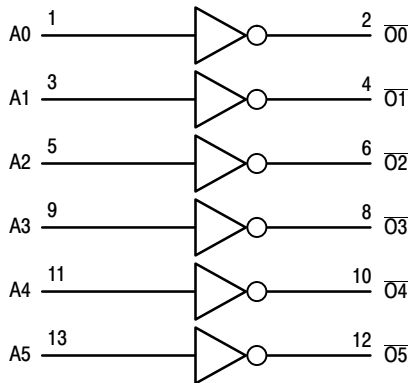


Figure 1. Logic Diagram

PIN NAMES

Pins	Function
A_n	Data Inputs
\overline{O}_n	Outputs

FUNCTION TABLE

A_n	\overline{O}_n
L	H
H	L



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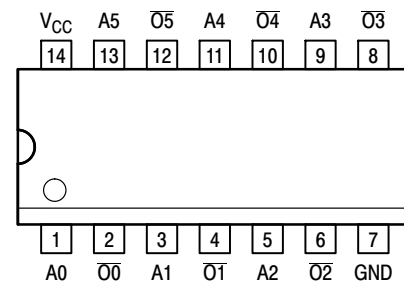


**SOIC-14 NB
D SUFFIX
CASE 751A**



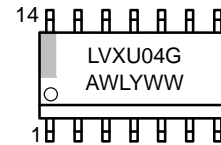
**TSSOP-14
DT SUFFIX
CASE 948G**

PIN ASSIGNMENT

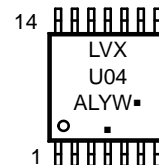


14-Lead (Top View)

MARKING DIAGRAMS



SOIC-14 NB



TSSOP-14

LVXU04 = Specific Device Code
 A = Assembly Location
 WL, L = Wafer Lot
 Y = Year
 WW, W = Work Week
 G or ▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

MC74LVXU04

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	-0.5 to +7.0	V
V_{IN}	DC Input Voltage	-0.5 to +7.0	V
V_{OUT}	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
I_{IK}	DC Input Diode Current $V_I < GND$	-20	mA
I_{OK}	DC Output Diode Current $V_O < GND$	± 20	mA
I_{OUT}	DC Output Sink Current	± 25	mA
I_{CC}	DC Supply Current per Supply Pin	± 50	mA
T_{STG}	Storage Temperature Range	-65 to +150	$^{\circ}C$
T_L	Lead Temperature, 1 mm from Case for 10 Seconds	260	$^{\circ}C$
T_J	Junction Temperature under Bias	+150	$^{\circ}C$
θ_{JA}	Thermal Resistance SOIC TSSOP	250	$^{\circ}C/W$
P_D	Power Dissipation in Still Air at 85 $^{\circ}C$ SOIC TSSOP	250	mW
MSL	Moisture Sensitivity	Level 1	
F_R	Flammability Rating Oxygen Index: 30% – 35%	UL 94-V0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3)	> 2000 > 200 2000	V
$I_{Latchup}$	Latchup Performance Above V_{CC} and Below GND at 85 $^{\circ}C$ (Note 4)	± 300	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to JESD22-C101-A.
4. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	2.0	3.6	V
V_I	Input Voltage (Note 5)	0	5.5	V
V_O	Output Voltage (HIGH or LOW State)	0	V_{CC}	V
T_A	Operating Free-Air Temperature	-40	+85	$^{\circ}C$
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate $V_{CC} = 3.0 V \pm 0.3 V$	0	100	ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

5. Unused inputs may not be left open. All inputs must be tied to a high- or low-logic input voltage level.

MC74LVXU04

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} V	T _A = 25°C			T _A = -40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
V _{IH}	High-Level Input Voltage		2.0 3.0 3.6	1.5 2.0 2.4			1.5 2.0 2.4		V
V _{IL}	Low-Level Input Voltage		2.0 3.0 3.6			0.5 0.8 0.8		0.5 0.8 0.8	V
V _{OH}	High-Level Output Voltage (V _{in} = V _{IH} or V _{IL})	I _{OH} = -50 μA I _{OH} = -50 μA I _{OH} = -4 mA	2.0 3.0 3.0	1.9 2.9 2.58	2.0 3.0		1.9 2.9 2.48		V
V _{OL}	Low-Level Output Voltage (V _{in} = V _{IH} or V _{IL})	I _{OL} = 50 μA I _{OL} = 50 μA I _{OL} = 4 mA	2.0 3.0 3.0		0.0 0.0	0.1 0.1 0.36		0.1 0.1 0.44	V
I _{in}	Input Leakage Current	V _{in} = 5.5 V or GND	3.6			±0.1		±1.0	μA
I _{CC}	Quiescent Supply Current	V _{in} = V _{CC} or GND	3.6			2.0		20.0	μA

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3.0ns)

Symbol	Parameter	Test Conditions	T _A = 25°C			T _A = -40 to 85°C		Unit
			Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, Input to Output	V _{CC} = 2.7V C _L = 15 pF C _L = 50 pF V _{CC} = 3.3 ± 0.3V C _L = 15 pF C _L = 50 pF		5.4 7.9	10.1 13.6	1.0 1.0	12.5 16.0	ns
t _{OSSL} , t _{OSLH}	Output-to-Output Skew (Note 6)	V _{CC} = 2.7V C _L = 50 pF V _{CC} = 3.3 ± 0.3V C _L = 50 pF			1.5 1.5		1.5 1.5	ns

6. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSSL}) or LOW-to-HIGH (t_{OSLH}); parameter guaranteed by design.

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	T _A = 25°C			T _A = -40 to 85°C		Unit
		Min	Typ	Max	Min	Max	
C _{in}	Input Capacitance		4	10		10	pF
C _{PD}	Power Dissipation Capacitance (Note 7)		18				pF

7. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}/6 (per buffer). C_{PD} is used to determine the no-load dynamic power consumption: P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

NOISE CHARACTERISTICS (Input t_r = t_f = 3.0 ns, C_L = 50 pF, V_{CC} = 3.3 V, Measured in SOIC Package)

Symbol	Characteristic	T _A = 25°C		Unit
		Typ	Max	
V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	0.3	0.5	V
V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	-0.3	-0.5	V
V _{IHD}	Minimum High Level Dynamic Input Voltage		2.0	V
V _{ILD}	Maximum Low Level Dynamic Input Voltage		0.8	V

MC74LVXU04

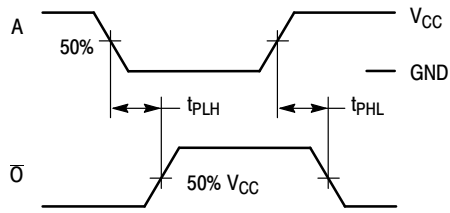
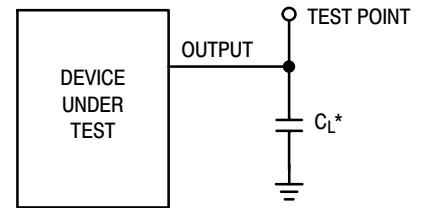


Figure 2. Switching Waveforms



*Includes all probe and jig capacitance

Figure 3. Test Circuit

ORDERING INFORMATION

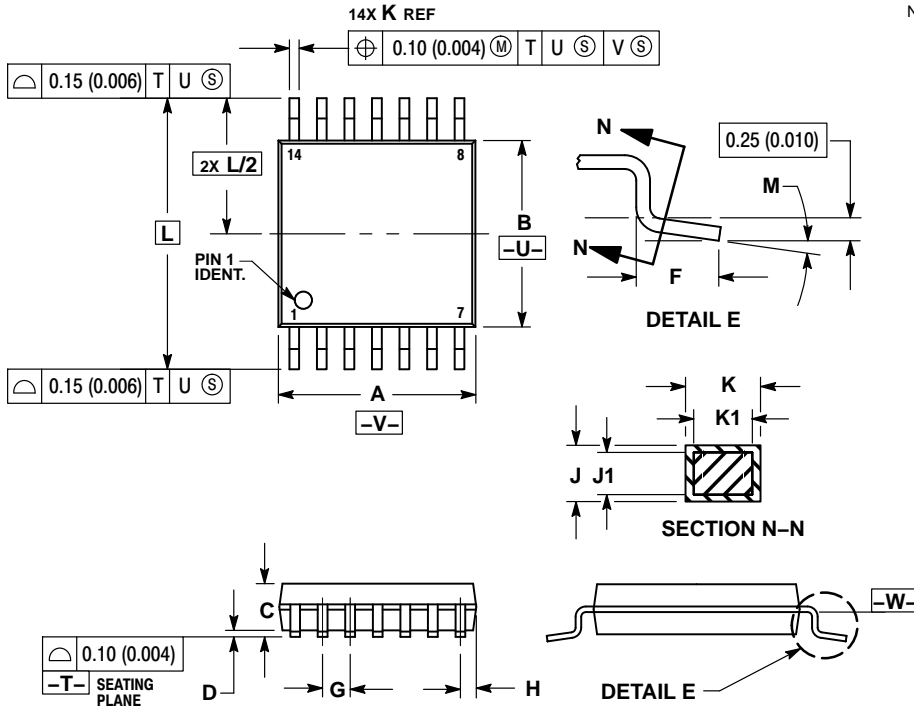
Device	Package	Shipping†
MC74LVXU04DG	SOIC-14 NB (Pb-Free)	55 Units / Rail
MC74LVXU04DR2G	SOIC-14 NB (Pb-Free)	2500 Tape & Reel
MC74LVXU04DTG	TSSOP-14 (Pb-Free)	96 Units / Rail
MC74LVXU04DTR2G	TSSOP-14 (Pb-Free)	2500 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MC74LVXU04

PACKAGE DIMENSIONS

TSSOP-14
CASE 948G
ISSUE B

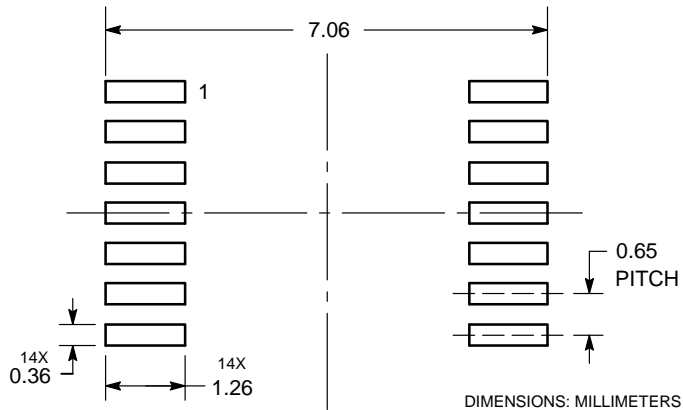


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

SOLDERING FOOTPRINT*

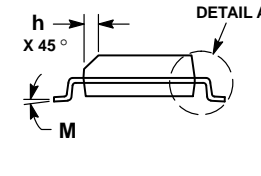
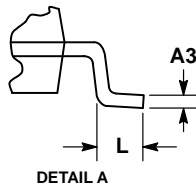
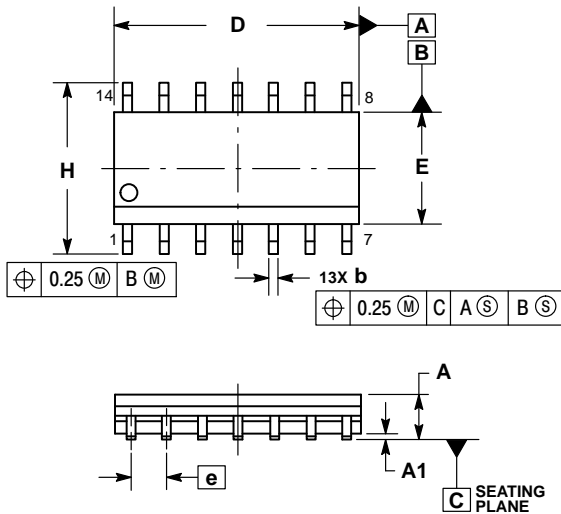


For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MC74LVXU04

PACKAGE DIMENSIONS

SOIC-14 NB CASE 751A-03 ISSUE K

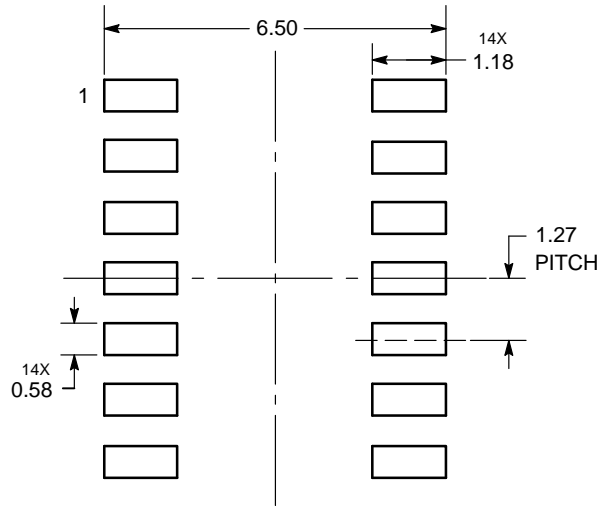


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
A3	0.19	0.25	0.008	0.010
b	0.35	0.49	0.014	0.019
D	8.55	8.75	0.337	0.344
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.019
L	0.40	1.25	0.016	0.049
M	0°	7°	0°	7°

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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