

## 74LVX04 Low Voltage Hex Inverter

### General Description

The LVX04 contains six inverters. The inputs tolerate voltages up to 7V allowing the interface of 5V systems to 3V systems.

### Features

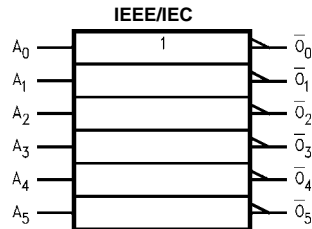
- Input voltage level translation from 5V to 3V
- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance

### Ordering Code

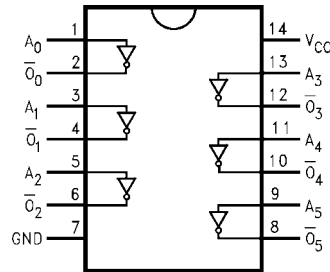
Order Number	Package Number	Package Description
74LVX04M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
74LVX04SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LVX04MTC	MTC14	14-Lead Thin Shrink Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

### Logic Symbol



### Connection Diagram



### Pin Descriptions

Pin Names	Description
$A_n$	Inputs
$\bar{O}_n$	Outputs

**Absolute Maximum Ratings** (Note 1)

Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V
DC Input Diode Current ( $I_{IK}$ )	
$V_I = -0.5V$	-20 mA
DC Input Voltage ( $V_I$ )	-0.5V to 7V
DC Output Diode Current ( $I_{OK}$ )	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Source	
or Sink Current ( $I_O$ )	$\pm 25$ mA
DC $V_{CC}$ or Ground Current	
( $I_{CC}$ or $I_{GND}$ )	$\pm 50$ mA
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Power Dissipation	180 mW

**Recommended Operating Conditions** (Note 2)

Supply Voltage ( $V_{CC}$ )	2.0V to 3.6V
Input Voltage ( $V_I$ )	0V to 5.5V
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	-40°C to +85°C
Input Rise and Fall Time ( $\Delta t/\Delta V$ )	0 ns/V to 100 ns/V

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:** Unused inputs must be held HIGH or LOW. They may not float.

**DC Electrical Characteristics**

Symbol	Parameter	$V_{CC}$	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units	Conditions
			Min	Typ	Max	Min	Max		
$V_{IH}$	HIGH Level Input Voltage	2.0	1.5			1.5		V	
		3.0	2.0			2.0			
		3.6	2.4			2.4			
$V_{IL}$	LOW Level Input Voltage	2.0			0.5		0.5	V	
		3.0			0.8		0.8		
		3.6			0.8		0.8		
$V_{OH}$	HIGH Level Output Voltage	2.0	1.9	2.0		1.9		V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -50 \mu\text{A}$ $I_{OH} = -50 \mu\text{A}$ $I_{OH} = -4 \text{mA}$
		3.0	2.9	3.0		2.9			
		3.0	2.58			2.48			
$V_{OL}$	LOW Level Output Voltage	2.0		0.0	0.1		0.1	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OL} = 50 \mu\text{A}$ $I_{OL} = 50 \mu\text{A}$ $I_{OL} = 4 \text{mA}$
		3.0		0.0	0.1		0.1		
		3.0			0.36		0.44		
$I_{IN}$	Input Leakage Current	3.6			$\pm 0.1$		$\pm 1.0$	$\mu\text{A}$	$V_{IN} = 5.5V$ or GND
$I_{CC}$	Quiescent Supply Current	3.6			2.0		20.0	$\mu\text{A}$	$V_{IN} = V_{CC}$ or GND

**Noise Characteristics** (Note 3)

Symbol	Parameter	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$		Units	$C_L$ (pF)	
			Typ	Limit			
$V_{OLP}$	Quiet Output Maximum Dynamic $V_{OL}$	3.3	0.3	0.5	V	50	
$V_{OLV}$	Quiet Output Minimum Dynamic $V_{OL}$	3.3	-0.3	-0.5	V	50	
$V_{IHD}$	Minimum HIGH Level Dynamic Input Voltage	3.3			2.0	V	50
$V_{ILD}$	Maximum LOW Level Dynamic Input Voltage	3.3			0.8	V	50

**Note 3:** Input  $t_r = t_f = 3\text{ns}$

AC Electrical Characteristics									
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		Units	C <sub>L</sub> (pF)
			Min	Typ	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay Time	2.7		5.4	10.1	1.0	12.5	ns	15
t <sub>PHL</sub>				7.9	13.6	1.0	16.0		50
		3.3 ± 0.3		4.1	6.2	1.0	7.5		15
				6.6	9.7	1.0	11.0		50
t <sub>OSLH</sub>	Output to Output Skew (Note 4)	2.7			1.5		1.5	ns	50
t <sub>OSHL</sub>		3.3			1.5		1.5		

**Note 4:** Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>PLHm</sub> - t<sub>PLHn</sub>|. t<sub>OSHL</sub> = |t<sub>PHLm</sub> - t<sub>PHLn</sub>|.

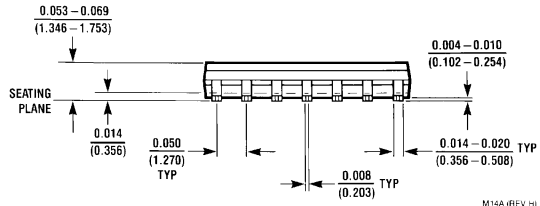
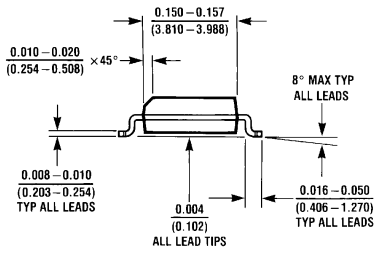
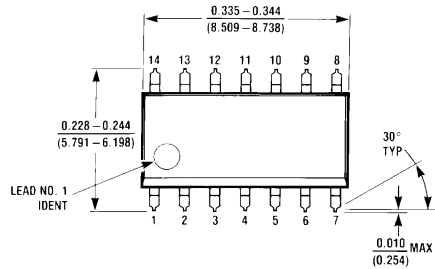
### Capacitance

Symbol	Parameter	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		Units
		Min	Typ	Max	Min	Max	
C <sub>IN</sub>	Input Capacitance		4	10		10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)		18				pF

**Note 5:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

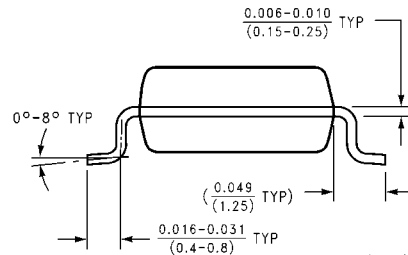
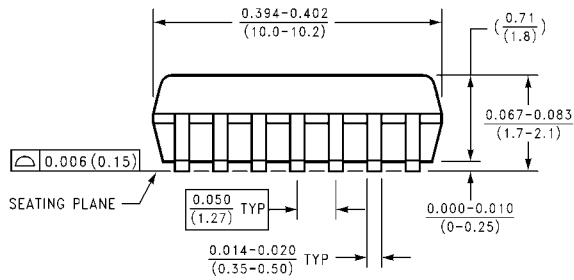
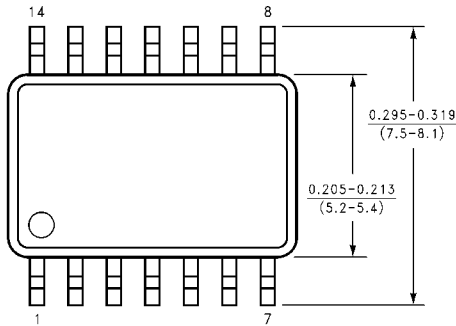
Average operating current can be obtained by the equation:  $I_{CC(opr.)} = \frac{C_{PD} \times V_{CC} \times f_{IN} + I_{CC}}{6}$  (per Gate)

**Physical Dimensions** inches (millimeters) unless otherwise noted



M14A (REV H)

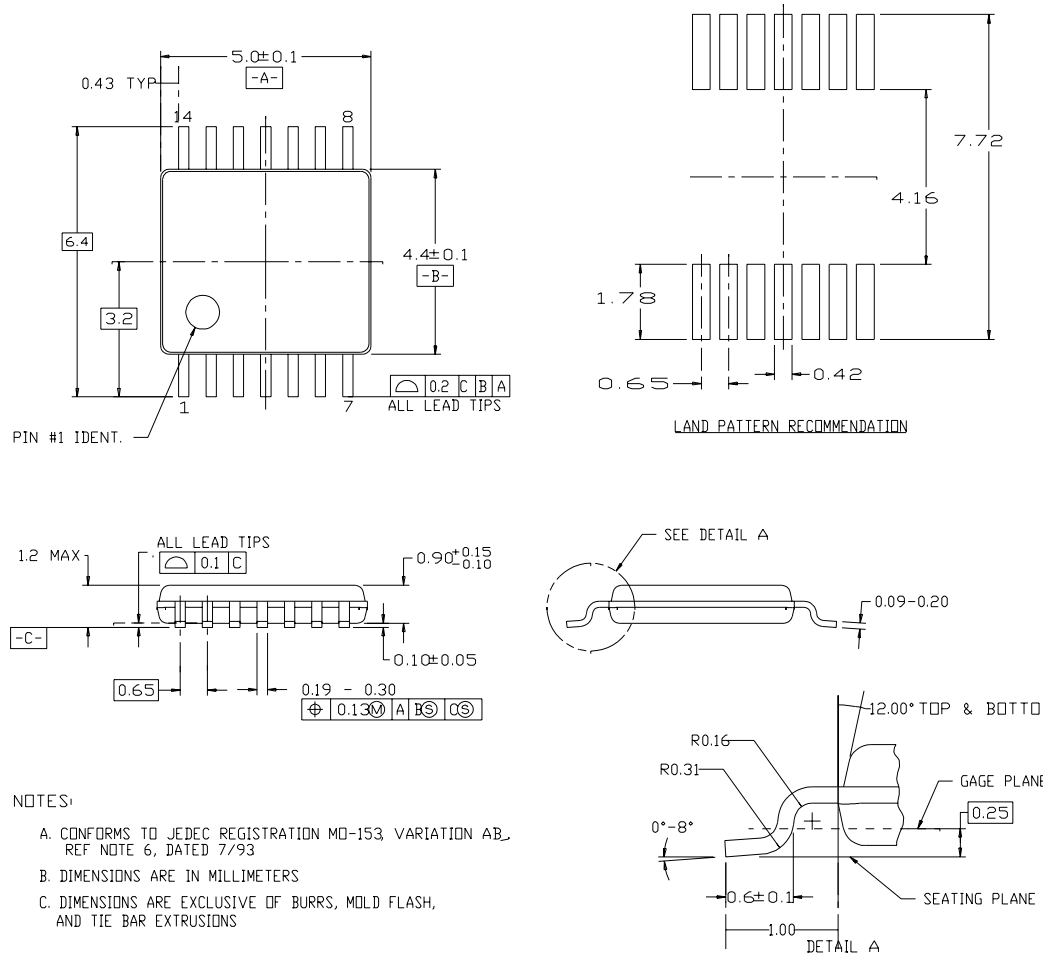
**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Package Number M14A**



M14D (REV B)

**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M14D**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC14**

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