

## 74LCX04 Low Voltage Hex Inverter with 5V Tolerant Inputs

### General Description

The LCX04 contains six inverters. The inputs tolerate voltages up to 7V allowing the interface of 5V systems to 3V systems.

The 74LCX04 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

### Features

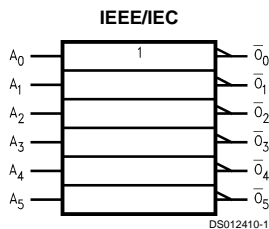
- 5V tolerant inputs
- 5.2 ns  $t_{PD}$  max, 10  $\mu$ A  $I_{CCQ}$  max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal
- 2.0V–3.6V  $V_{CC}$  supply operation
- $\pm 24$  mA output drive
- Implements patented noise/EMI reduction circuitry
- Functionally compatible with 74 series 04
- Latch-up performance exceeds 500 mA
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

### Ordering Code:

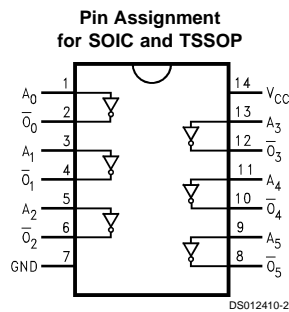
Order Number	Package Number	Package Description
74LCX04M	M14A	14-Lead Small Outline Package, SOIC, JEDEC
74LCX04SJ	M14D	14-Lead Small Outline Package, SOIC, EIAJ
74LCX04MTC	MTC14	14-Lead Thin Shrink Small Outline Package, TSSOP

Devices also available in Tape and Reel. Specify by appending the 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)

Symbol	Parameter	Value	Conditions	Units
V <sub>CC</sub>	Supply Voltage	-0.5 to +7.0		V
V <sub>I</sub>	DC Input Voltage	-0.5 to +7.0		V
V <sub>O</sub>	DC Output Voltage	-0.5 to V <sub>CC</sub> + 0.5	Output in High or Low State (Note 2)	V
I <sub>IK</sub>	DC Input Diode Current	-50	V <sub>I</sub> < GND	mA
I <sub>OK</sub>	DC Output Diode Current	-50	V <sub>O</sub> < GND	mA
		+50	V <sub>O</sub> > V <sub>CC</sub>	
I <sub>O</sub>	DC Output Source/Sink Current	±50		mA
I <sub>CC</sub>	DC Supply Current per Supply Pin	±100		mA
I <sub>GND</sub>	DC Ground Current per Ground Pin	±100		mA
T <sub>STG</sub>	Storage Temperature	-65 to +150		°C

## Recommended Operating Conditions (Note 3)

Symbol	Parameter	Min	Max	Units	
V <sub>CC</sub>	Supply Voltage	Operating	2.0	3.6	V
		Data Retention	1.5	3.6	
V <sub>I</sub>	Input Voltage	0	5.5	V	
V <sub>O</sub>	Output Voltage	0	V <sub>CC</sub>	V	
I <sub>OH</sub> /I <sub>OL</sub>	Output Current	HIGH or LOW State		mA	
		V <sub>CC</sub> = 3.0V-3.6V	±24		
		V <sub>CC</sub> = 2.7V	±12		
T <sub>A</sub>	Free-Air Operating Temperature	-40	85	°C	
Δt/ΔV	Input Edge Rate, V <sub>IN</sub> = 0.8V-2.0V, V <sub>CC</sub> = 3.0V	0	10	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:** I<sub>O</sub> Absolute Maximum Rating must be observed.

**Note 3:** Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C		Units
				Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage		2.7-3.6	2.0		V
V <sub>IL</sub>	LOW Level Input Voltage		2.7-3.6		0.8	V
V <sub>OH</sub>	HIGH Level Output Voltage	I <sub>OH</sub> = -100 μA	2.7-3.6	V <sub>CC</sub> - 0.2		V
		I <sub>OH</sub> = -12 mA	2.7	2.2		V
		I <sub>OH</sub> = -18 mA	3.0	2.4		V
		I <sub>OH</sub> = -24 mA	3.0	2.2		V
V <sub>OL</sub>	LOW Level Output Voltage	I <sub>OL</sub> = 100 μA	2.7-3.6		0.2	V
		I <sub>OL</sub> = 12 mA	2.7		0.4	V
		I <sub>OL</sub> = 16 mA	3.0		0.4	V
		I <sub>OL</sub> = 24 mA	3.0		0.55	V
I <sub>I</sub>	Input Leakage Current	0 ≤ V <sub>I</sub> ≤ 5.5V	2.7-3.6		±5.0	μA
I <sub>OFF</sub>	Power-Off Leakage Current	V <sub>I</sub> or V <sub>O</sub> = 5.5V	0		10	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>I</sub> = V <sub>CC</sub> or GND	2.7-3.6		10	μA
		3.6V ≤ V <sub>I</sub> ≤ 5.5V	2.7-3.6		±10	μA
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	V <sub>IH</sub> = V <sub>CC</sub> - 0.6V	2.7-3.6		500	μA

## AC Electrical Characteristics

Symbol	Parameter	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}, C_L = 50\text{pF}, R_L = 500\Omega$				Units
		$V_{CC} = 3.3\text{V} \pm 0.3\text{V}$		$V_{CC} = 2.7\text{V}$		
		Min	Max	Min	Max	
$t_{PHL}$	Propagation Delay Time	1.5	5.2	1.5	6.0	ns
$t_{PLH}$		1.5	5.2	1.5	6.0	
$t_{OSHL}$	Output to Output Skew (Note 4)		1.0			ns
$t_{OSLH}$			1.0			

**Note 4:** 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 ( $t_{OSHL}$ ) or LOW to HIGH ( $t_{OSLH}$ ).

## Dynamic Switching Characteristics

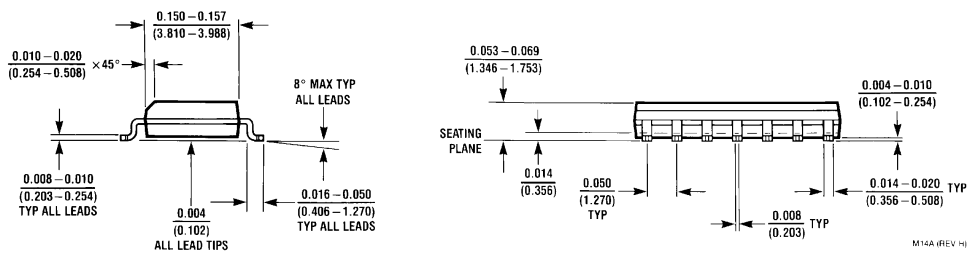
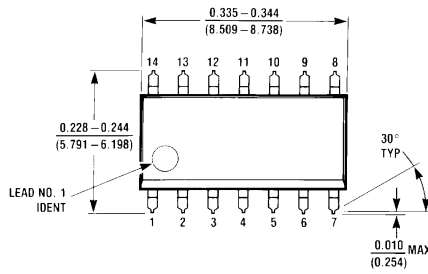
Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = 25^{\circ}\text{C}$	Units
				Typical	
$V_{OLP}$	Quiet Output Dynamic Peak $V_{OL}$	$C_L = 50\text{ pF}, V_{IH} = 3.3\text{V}, V_{IL} = 0\text{V}$	3.3	0.8	V
$V_{OLV}$	Quiet Output Dynamic Valley $V_{OL}$	$C_L = 50\text{ pF}, V_{IH} = 3.3\text{V}, V_{IL} = 0\text{V}$	3.3	-0.8	V

## Capacitance

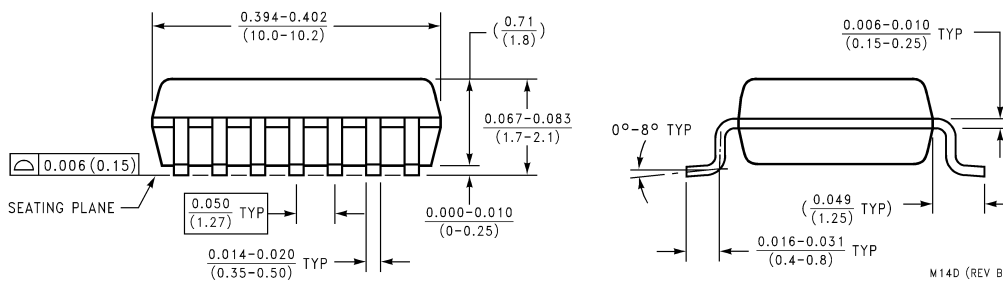
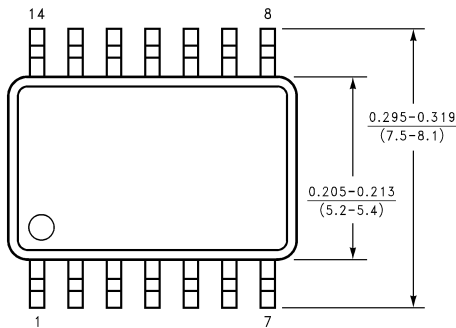
Symbol	Parameter	Conditions	Typical	Units
$C_{IN}$	Input Capacitance	$V_{CC} = \text{Open}, V_I = 0\text{V or } V_{CC}$	7	pF
$C_{OUT}$	Output Capacitance	$V_{CC} = 3.3\text{V}, V_I = 0\text{V or } V_{CC}$	8	pF
$C_{PD}$	Power Dissipation Capacitance	$V_{CC} = 3.3\text{V}, V_I = 0\text{V or } V_{CC}, f = 10\text{ MHz}$	25	pF



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

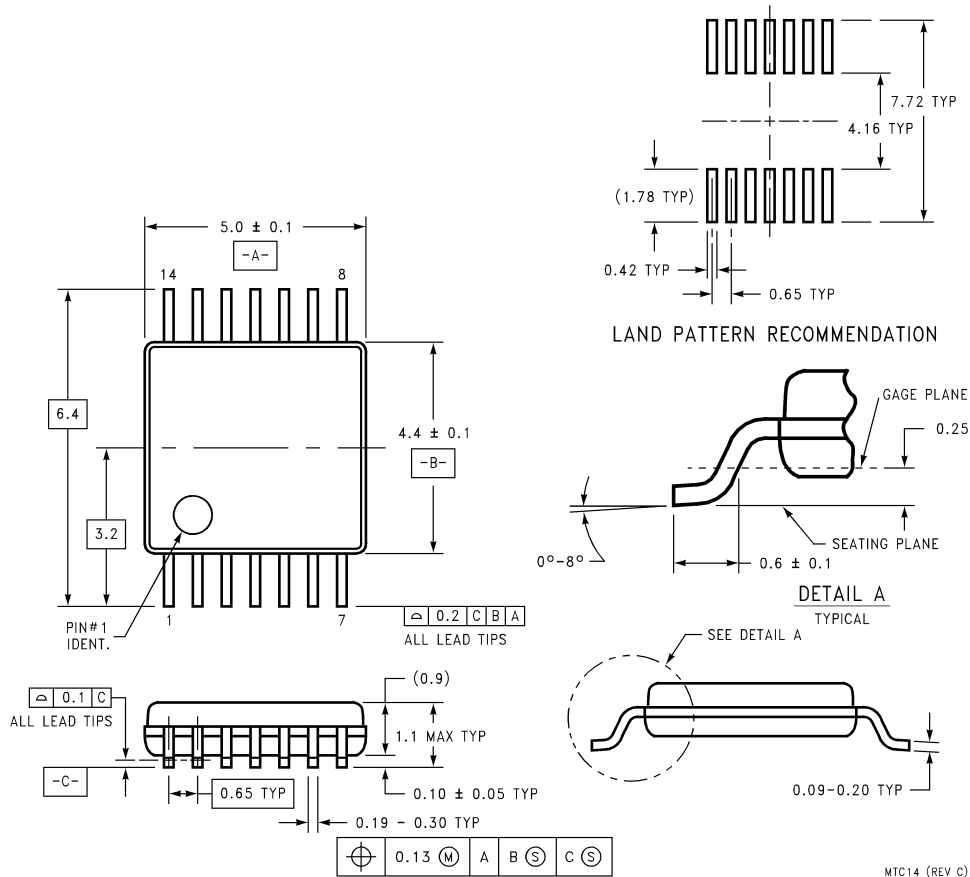


**14-Lead Small Outline Package SOIC JEDEC (M)**  
Package Number M14A



**14-Lead Small Outline Package SOIC EIAJ (SJ)**  
Package Number M14D

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



MTC14 (REV C)

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