

# 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.

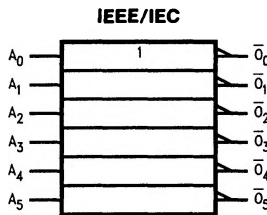
The 74LCX04 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

- ±24 mA output drive
- Implements patented Quiet Series™ 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

### Features

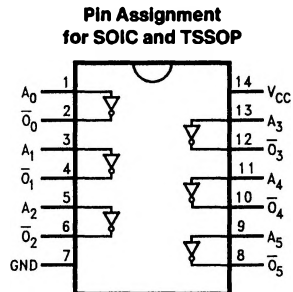
- 5V tolerant inputs
- 5.2 ns  $t_{PD}$  max, 10  $\mu$ A  $I_{CCQ}$  max
- Power down high impedance inputs and outputs
- 2.0V–3.6V  $V_{CC}$  supply operation

### Logic Symbol



TL/F/12410-1

### Connection Diagram



TL/F/12410-2

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

	SOIC JEDEC	SOIC EIAJ	TSSOP
Order Number	74LCX04M 74LCX04MX	74LCX04SJ 74LCX04SJX	74LCX04MTC 74LCX04MTCX
See NS Package Number	M14A	M14D	MTC14

Preliminary Data: National Semiconductor reserves the right to make changes at any time without notice.

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Symbol	Parameter	Value	Conditions	Units
$V_{CC}$	Supply Voltage	-0.5 to +7.0		V
$V_I$	DC Input Voltage	-0.5 to +7.0		V
$V_O$	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	Output in High or Low State (Note 2)	V
$I_{IK}$	DC Input Diode Current	-50	$V_I < GND$	mA
$I_{OK}$	DC Output Diode Current	-50 +50	$V_O < GND$ $V_O > V_{CC}$	mA
$I_O$	DC Output Source/Sink Current	$\pm 50$		mA
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 100$		mA
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 100$		mA
$T_{STG}$	Storage Temperature	-65 to +150		°C

**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" table are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:**  $I_O$  Absolute Maximum Rating must be observed.

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units	
$V_{CC}$	Supply Voltage	Operating	2.0	3.6	V
		Data Retention	1.5	3.6	
$V_I$	Input Voltage	0	5.5	V	
$V_O$	Output Voltage	0	$V_{CC}$	V	
$I_{OH}/I_{OL}$	Output Current		$\pm 24$ $\pm 12$	mA	
$T_A$	Free-Air Operating Temperature	-40	85	°C	
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8V-2.0V$ , $V_{CC} = 3.0V$	0	10	ns/V	

## DC Electrical Characteristics

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units
				Min	Max	
$V_{IH}$	HIGH Level Input Voltage		2.7-3.6	2.0		V
$V_{IL}$	LOW Level Input Voltage		2.7-3.6		0.8	V
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu\text{A}$	2.7-3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -12 \text{ mA}$	2.7	2.2		V
		$I_{OH} = -18 \text{ mA}$	3.0	2.4		V
		$I_{OH} = -24 \text{ mA}$	3.0	2.2		V
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu\text{A}$	2.7-3.6		0.2	V
		$I_{OL} = 12 \text{ mA}$	2.7		0.4	V
		$I_{OL} = 16 \text{ mA}$	3.0		0.4	V
		$I_{OL} = 24 \text{ mA}$	3.0		0.55	V
$I_I$	Input Leakage Current	$0 \leq V_I \leq 5.5V$	2.7-3.6		$\pm 5.0$	$\mu\text{A}$
$I_{OFF}$	Power-Off Leakage Current	$V_I$ or $V_O = 5.5V$	0		100	$\mu\text{A}$
$I_{CC}$	Quiescent Supply Current	$V_I = V_{CC}$ or GND	2.7-3.6		10	$\mu\text{A}$
		$3.6V \leq V_I, V_O \leq 5.5V$	2.7-3.6		$\pm 10$	$\mu\text{A}$
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6V$	2.7-3.6		500	$\mu\text{A}$

**AC Electrical Characteristics** (Preliminary)

Symbol	Parameter	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		Min	Max	Min	Max	
$t_{PHL}$ $t_{PLH}$	Propagation Delay Time	1.5 1.5	5.2 5.2	1.5 1.5	6.0 6.0	ns
$t_{OSHL}$ , $t_{OSLH}$	Output to Output Skew (Note 1)		1.0 1.0			ns

Note 1: 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**

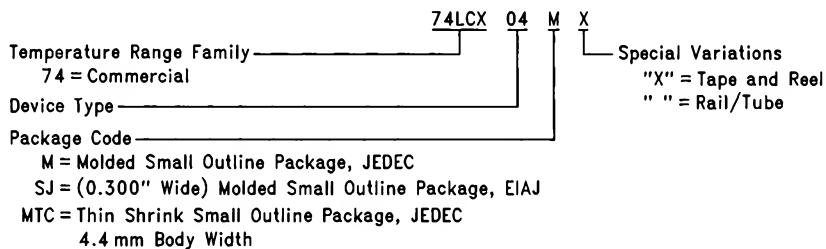
Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = 25^{\circ}\text{C}$	Units
				Typical	
$V_{OLP}$	Quiet Output Dynamic Peak $V_{OL}$	$C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	0.8	V
$V_{OLV}$	Quiet Output Dynamic Valley $V_{OL}$	$C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	0.8	V

**Capacitance**

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

## 74LCX04 Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



TL/F/12410-3