FAIRCHILD SEMICONDUCTOR™

December 1997

74LCX257
Low Voltage Quad 2-Input Multiplexer with 5V Tolerant Inputs and Outputs

General Description

The LCX257 is a quad 2-input multiplexer with 3-STATE outputs. Four bits of data from two sources can be selected using a Common Data Select input. The four outputs present the selected data in true (noninverted) form. The outputs may be switched to a high impedance state by placing a logic HIGH on the common Output Enable ($\overline{OE}$) input, allowing the outputs to interface directly with bus-oriented systems.

The 74LCX257 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

Features

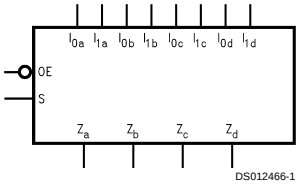
- 5V tolerant inputs and outputs
- 6.5 ns t_{PD} max, 10 µA I_{CCQ} max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal
- 2.0V–3.6V V_{CC} supply operation
- ±24 mA output drive
- Implements patented noise/EMI reduction circuitry
- Functionally compatible with 74 series 257
- Latch-up performance exceeds 500 mA
- ESD performance:
  Human body model > 2000V
  Machine model > 200V

Ordering Code:

Order Number	Package Number	Package Description
74LCX257M	M16A	16-Lead (0.150" Wide) Molded Small Outline Package, SOIC JEDEC
74LCX257SJ	M16D	16-Lead Molded Small Outline Package, SOIC EIAJ
74LCX257MTC	MTC16	16-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 Symbols



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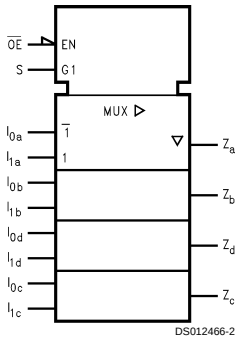
IEEE/IEC



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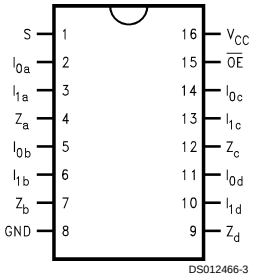
Connection Diagram

Pin Assignment for SOIC and TSSOP



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Pin Descriptions

Pin Names	Description
S	Common Data Select Input
$\overline{OE}$	3-STATE Output Enable Input
I_{0a}–I_{0d}	Data Inputs from Source 0
I_{1a}–I_{1d}	Data Inputs from Source 1
Z_a–Z_d	3-STATE Multiplexer Outputs

Functional Description

The LCX257 is a quad 2-input multiplexer with 3-STATE outputs. It selects four bits of data from two sources under control of a Common Data Select input. When the Select input is LOW, the I_{0x} inputs are selected and when Select is HIGH, the I_{1x} inputs are selected. The data on the selected inputs appears at the outputs in true (noninverted) form. The device is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the Select input. The logic equations for the outputs are shown below:

$$Z_a = \overline{OE} \bullet (1_{1a} \bullet S + I_{0a} \bullet \overline{S})$$
$$Z_b = \overline{OE} \bullet (1_{1b} \bullet S + I_{0b} \bullet \overline{S})$$
$$Z_c = \overline{OE} \bullet (1_{1c} \bullet S + I_{0c} \bullet \overline{S})$$
$$Z_d = \overline{OE} \bullet (1_{1d} \bullet S + I_{0d} \bullet \overline{S})$$

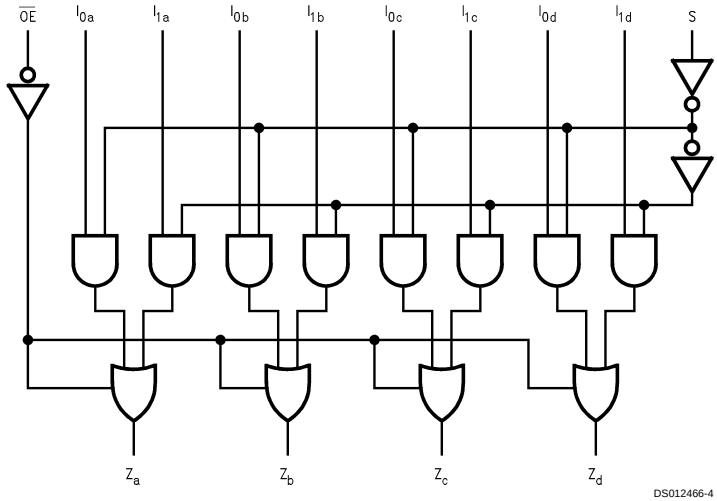
When the Output Enable ($\overline{OE}$) is HIGH, the outputs are forced to a high impedance state. If the outputs are tied together, all but one device must be in the high impedance state to avoid high currents that would exceed the maximum ratings. Designers should ensure the Output Enable signals to 3-STATE devices whose outputs are tied together are designed so there is no overlap.

Truth Table

Output Enable	Select Input	Data Inputs		Outputs
$\overline{OE}$	S	I_0	I_1	Z
H	X	X	X	Z
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance

Logic Diagram



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Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 1)

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 +7.0	Output in 3-STATE	V
		−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	V_O < GND	mA
		+50	V_O > V_{CC}	
I_O	DC Output Source/Sink Current	±50		mA
I_{CC}	DC Supply Current per Supply Pin	±100		mA
I_{GND}	DC Ground Current per Ground Pin	±100		mA
T_{STG}	Storage Temperature	−65 to +150		˚C

Recommended Operating Conditions (Note 3)

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	HIGH or LOW State	0	V_{CC}	V
		3-STATE	0	5.5	
I_{OH}/I_{OL}	Output Current	V_{CC} = 3.0V–3.6V		±24	mA
		V_{CC} = 2.7V		±12	
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

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_O 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_{CC} (V)	T_A = −40˚C to +85˚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 µA	2.7–3.6	V_{CC} − 0.2		V
		I_{OH} = −12 mA	2.7	2.2		V
		I_{OH} = −18 mA	3.0	2.4		V
		I_{OH} = −24 mA	3.0	2.2		V
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	2.7–3.6		0.2	V
		I_{OL} = 12 mA	2.7		0.4	V
		I_{OL} = 16 mA	3.0		0.4	V
		I_{OL} = 24 mA	3.0		0.55	V
I_I	Input Leakage Current	0 ≤ V_I ≤ 5.5V	2.7–3.6		±5.0	µA
I_{OZ}	3-STATE Output Leakage	0 ≤ V_O ≤ 5.5V	2.7–3.6		±5.0	µA
		V_I = V_{IH} or V_{IL}				
I_{OFF}	Power-Off Leakage Current	V_I or V_O = 5.5V	0		10	µA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	2.7–3.6		10	µA
		3.6V ≤ V_I, V_O ≤ 5.5V	2.7–3.6		±10	µA
ΔI_{CC}	Increase in I_{CC} per Input	V_{IH} = V_{CC} −0.6V	2.7–3.6		500	µA

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40^\circ C$ to $+85^\circ C$, $C_L = 50pF$, $R_L = 500\ \Omega$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		Min	Max	Min	Max	
t_{PHL}	Propagation Delay	1.5	7.0	1.5	8.5	ns
t_{PLH}	$S \rightarrow Z_n$	1.5	7.0	1.5	8.5	
t_{PHL}	Propagation Delay	1.5	6.0	1.5	6.5	ns
t_{PLH}	$I_n \rightarrow Z_n$	1.5	6.0	1.5	6.5	
t_{PZL}	Output Enable Time	1.5	7.0	1.5	8.5	ns
t_{PZH}	$\overline{OE} \rightarrow Z_n$	1.5	7.0	1.5	8.5	
t_{PLZ}	Output Disable Time	1.5	5.5	1.5	6.0	ns
t_{PHZ}	$\overline{OE} \rightarrow Z_n$	1.5	5.5	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}).

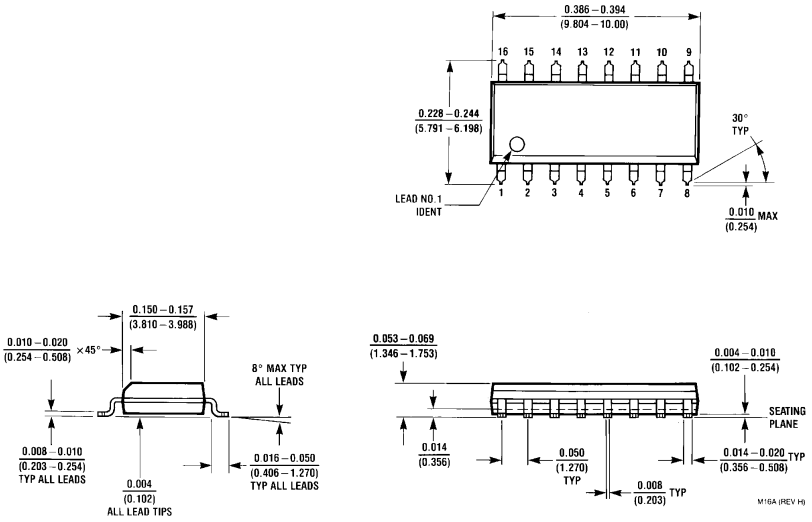
Dynamic Switching Characteristics

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

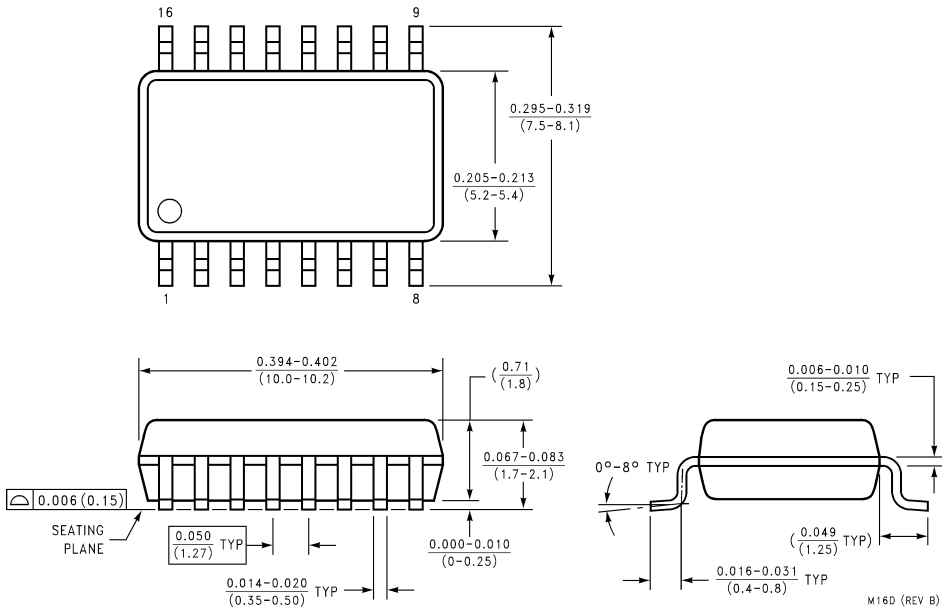
Capacitance

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

Physical Dimensions inches (millimeters) unless otherwise noted

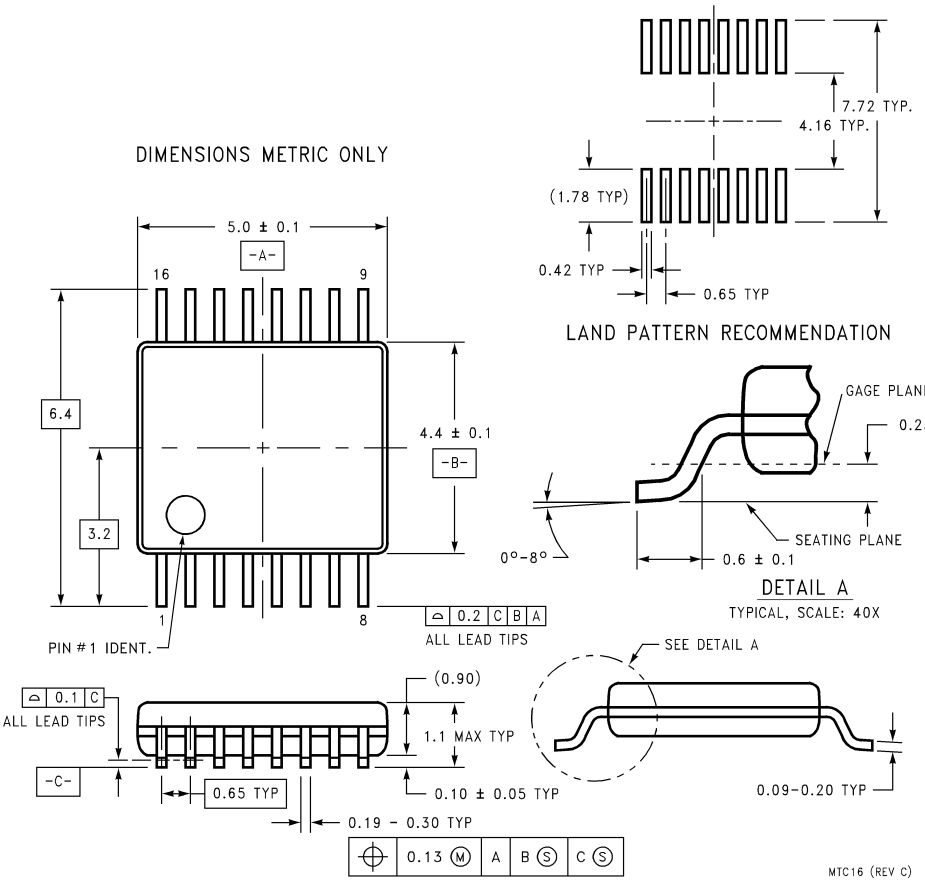


16-Lead (0.150" Wide) Molded Small Outline Package, JEDEC
Package Number M16A



16-Lead Molded Small Outline Package, EIAJ
Package Number M16D

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



16-Lead Thin Shrink Small Outline Package (MTC)
Package Number MTC16

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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