

74LCX257

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

General Description

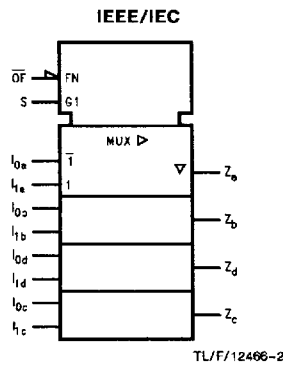
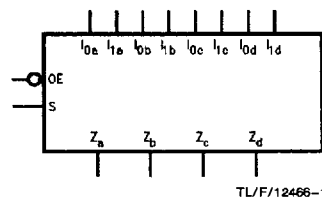
The LCX257 is a quad 2-input multiplexer with TRI-STATE® outputs. Four bits of data from two sources can be selected using a Common Data Select input. The four outputs present the selected data in true (noninverted) form. The outputs may be switched to a high impedance state by placing a logic HIGH on the common Output Enable (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.

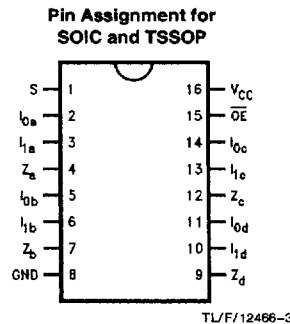
Features

- 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 Quiet Series™ 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

Logic Symbols



Connection Diagram



Pin Names	Description
S	Common Data Select Input
OE	TRI-STATE Output Enable Input
l_{0a} – l_{0d}	Data Inputs from Source 0
l_{1a} – l_{1d}	Data Inputs from Source 1
Z_a – Z_d	TRI-STATE Multiplexer Outputs

	SOIC JEDEC	SOIC EIAJ	TSSOP
Order Number	74LCX257M 74LCX257MX	74LCX257SJ 74LCX257SJX	74LCX257MTC 74LCX257MTCX
See NS Package Number	M16A	M16D	MTC16

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

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Quiet Series™ is a trademark of National Semiconductor Corporation.

Functional Description

The LCX257 is quad 2-input multiplexer with TRI-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:

$$Z_a = \overline{OE} \cdot (I_{1a} \cdot S + I_{0a} \cdot \overline{S})$$

$$Z_b = \overline{OE} \cdot (I_{1b} \cdot S + I_{0b} \cdot \overline{S})$$

$$Z_c = \overline{OE} \cdot (I_{1c} \cdot S + I_{0c} \cdot \overline{S})$$

$$Z_d = \overline{OE} \cdot (I_{1d} \cdot S + I_{0d} \cdot \overline{S})$$

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 maxi-

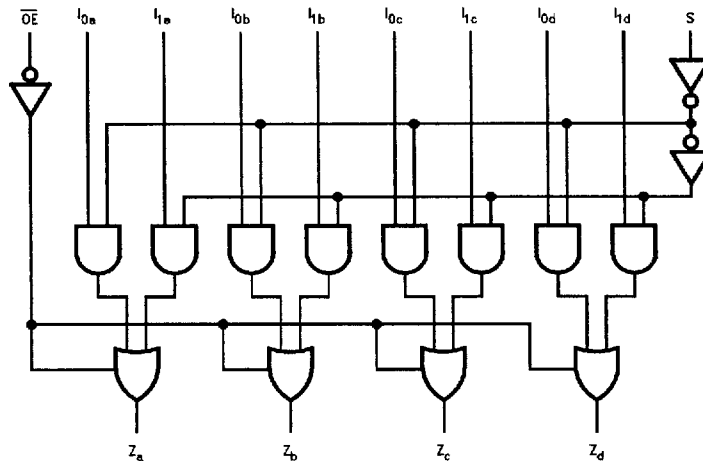
imum ratings. Designers should ensure the Output Enable signals to TRI-STATE devices whose outputs are tied together are designed so there is no overlap.

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



TL/F/12466-4

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)

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 +7.0	Output in TRI-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

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	HIGH or LOW State	0	V _{CC}	V
		TRI-STATE	0	5.5	
I _{OH} /I _{OL}	Output Current		±24 ±12	mA	
T _A	Free-Air Operating Temperature	-40	85	°C	
Δt/ΔV	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°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}	TRI-STATE Output Leakage	0 ≤ V _O ≤ 5.5V V _I = V _{IH} or V _{IL}	2.7-3.6		±5.0	μA
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	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$				Units
		$V_{CC} = 3.3\text{V} \pm 0.3\text{V}$		$V_{CC} = 2.7\text{V}$		
		Min	Max	Min	Max	
t_{PHL} t_{PLH}	Propagation Delay $S \rightarrow Z_n$	1.5 1.5	6.5 6.5	1.5 1.5	7.5 7.5	ns
t_{PHL} t_{PLH}	Propagation Delay $I_n \rightarrow Z_n$	1.5 1.5	6.0 6.0	1.5 1.5	7.0 7.0	ns
t_{PZL} t_{PZH}	Output Enable Time $\overline{OE} \rightarrow Z_n$	1.5 1.5	6.5 6.5	1.5 1.5	7.5 7.5	ns
t_{PLZ} t_{PHZ}	Output Disable Time $\overline{OE} \rightarrow Z_n$	1.5 1.5	5.0 5.0	1.5 1.5	6.0 6.0	ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 3)		1.0 1.0			ns

Note 3: 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

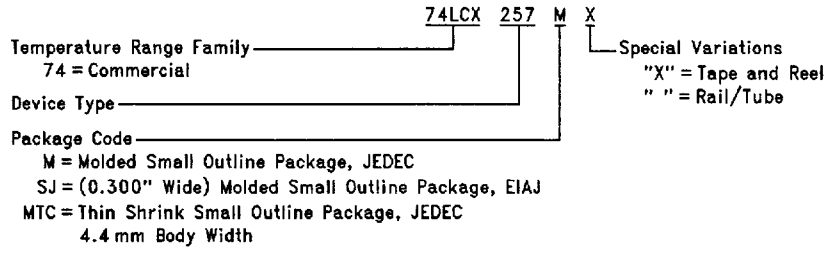
Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25^{\circ}\text{C}$	Units
				Typical	
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	$C_L = 50\text{ pF}, V_{IH} = 3.3\text{V}, V_{IL} = 0\text{V}$	3.3	0.8	V
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	$C_L = 50\text{ pF}, V_{IH} = 3.3\text{V}, V_{IL} = 0\text{V}$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

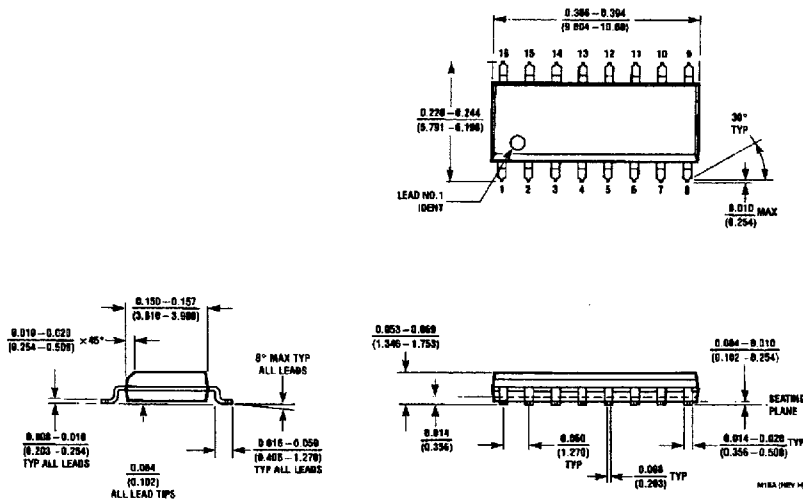
74LCX257 Ordering Information

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



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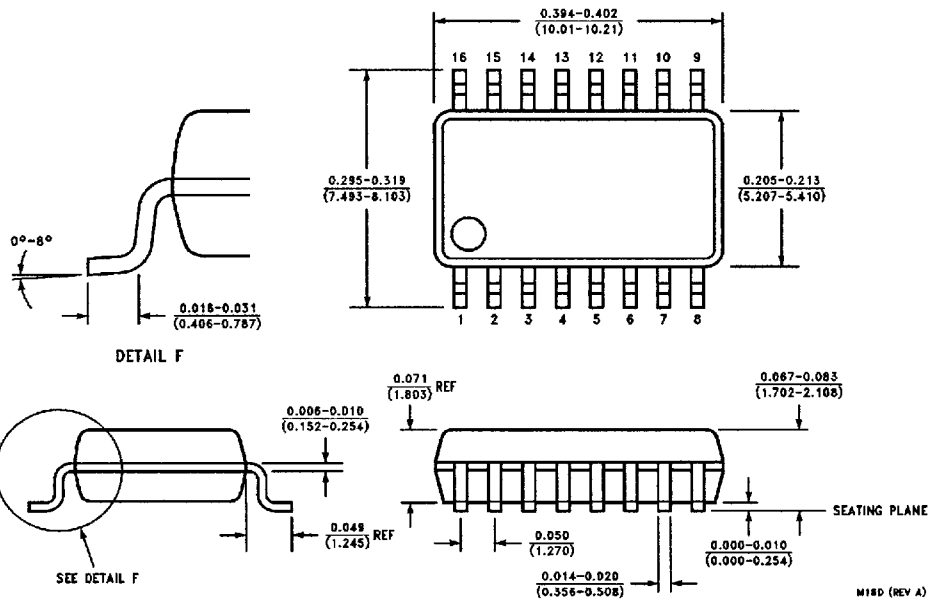
Physical Dimensions inches (millimeters)



**14-Lead (0.150" Wide) Molded Small Outline Package, JEDEC
Order Number 74LCX257M or 74LCX257MX
NS Package Number M16A**

■ 6501122 0084540 638 ■

Physical Dimensions inches (millimeters) (Continued)

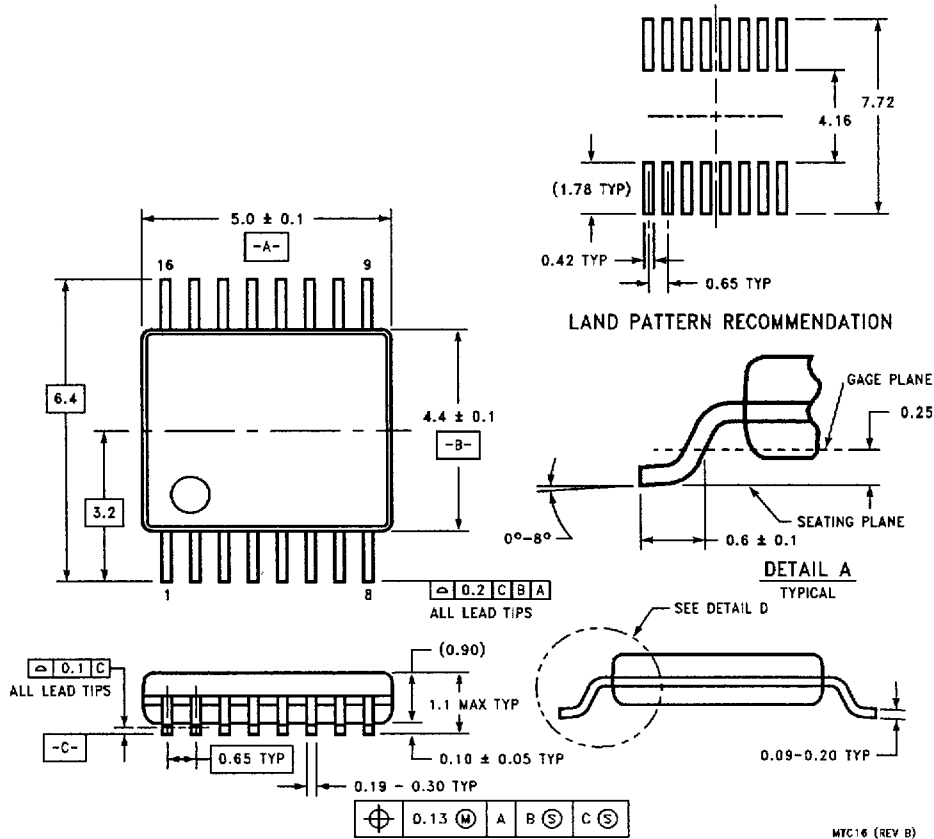


14-Lead (0.300" Wide) Molded Small Outline Package, EIAJ
Order Number 74LCX257SJ or 74LCX257SJX
NS Package Number M16D

M16D (REV A)

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Physical Dimensions millimeters (Continued)



14-Lead Thin Shrink Small Outline Package (MTC)
Order Number 74LCX257MTC or 74LCX257MTCX
NS Package Number MTC16

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