

74LCX157

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

General Description

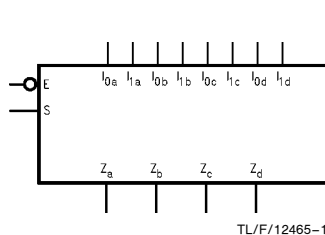
The LCX157 is a high-speed quad 2-input multiplexer. Four bits of data from two sources can be selected using the common Select and Enable inputs. The four outputs present the selected data in the true (noninverted) form. The LCX157 can also be used as a function generator.

The 74LCX157 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

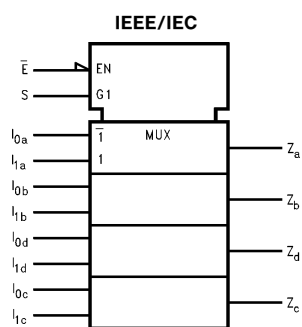
Features

- 5V tolerant inputs
- 6.5 ns t_{PD} max, 10 μ A 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 157
- Latch-up performance exceeds 500 mA
- ESD performance:
 - Human body model > 2000V
 - Machine model > 200V

Logic Symbols



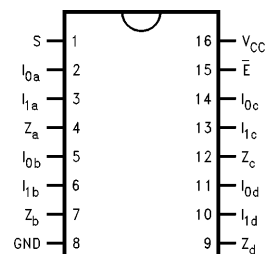
TL/F/12465-1



TL/F/12465-2

Connection Diagram

Pin Assignment
for SOIC and TSSOP



TL/F/12465-3

	SOIC JEDEC	SOIC EIAJ	TSSOP
Order Number	74LCX157M 74LCX157MX	74LCX157SJ 74LCX157SJX	74LCX157MTC 74LCX157MTCX
See NS Package Number	M16A	M16D	MTC16

Pin Names	Description
I0a–I0d	Source 0 Data Inputs
I1a–I1d	Source 1 Data Inputs
E	Enable Input
S	Select Input
Za–Zd	Outputs

Quiet Series™ is a trademark of National Semiconductor Corporation.

Functional Description

The LCX157 is a quad 2-input multiplexer. It selects four bits of data from two sources under the control of a common Select input (S). The Enable input ($\bar{E}$) is active-LOW. When $\bar{E}$ is HIGH, all of the outputs (Z) are forced LOW regardless of all other inputs. The LCX157 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:

$$Z_a = \bar{E} \cdot (I_{1a} \cdot S + I_{0a} \cdot \bar{S})$$

$$Z_b = \bar{E} \cdot (I_{1b} \cdot S + I_{0b} \cdot \bar{S})$$

$$Z_c = \bar{E} \cdot (I_{1c} \cdot S + I_{0c} \cdot \bar{S})$$

$$Z_d = \bar{E} \cdot (I_{1d} \cdot S + I_{0d} \cdot \bar{S})$$

A common use of the LCX157 is the moving of data from two groups of registers to four common output busses. The particular register from which the data comes is determined by the state of the Select input. A less obvious use is as a

function generator. The LCX157 can generate any four of the sixteen different functions of two variables with one variable common. This is useful for implementing gating functions.

Truth Table

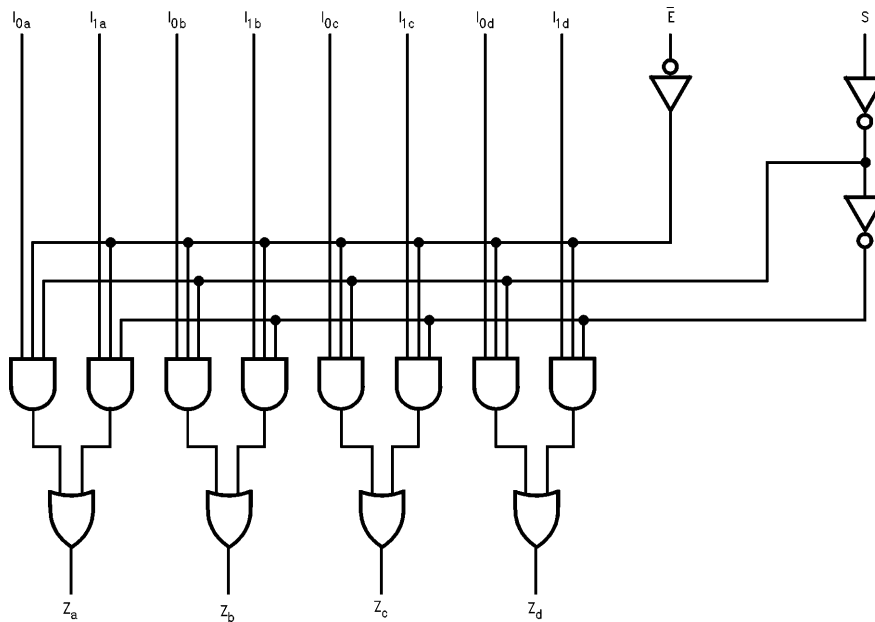
Inputs				Outputs
$\bar{E}$	S	I_0	I_1	Z
H	X	X	X	L
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

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)

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	$V_I < \text{GND}$	mA
I_{OK}	DC Output Diode Current	-50 $+50$	$V_O < \text{GND}$ $V_O > V_{CC}$	mA
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 $+150$		$^{\circ}\text{C}$

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 Data Retention	2.0 1.5	3.6 3.6	V
V_I	Input Voltage	0	5.5	V
V_O	Output Voltage HIGH or LOW State	0	V_{CC}	V
I_{OH}/I_{OL}	Output Current $V_{CC} = 3.0\text{V}-3.6\text{V}$ $V_{CC} = 2.7\text{V}$		± 24 ± 12	mA
T_A	Free-Air Operating Temperature	-40	85	$^{\circ}\text{C}$
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8\text{V}-2.0\text{V}$, $V_{CC} = 3.0\text{V}$	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 _{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 ≤ 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°C to +85°C				Units
		V _{CC} = 3.3V ± 0.3V		V _{CC} = 2.7V		
		Min	Max	Min	Max	
t _{PHL} t _{PLH}	Propagation Delay S → Z _n	1.5 1.5	7.0 7.0	1.5 1.5	8.0 8.0	ns
t _{PHL} t _{PLH}	Propagation Delay Eb → Z _n	1.5 1.5	7.0 7.0	1.5 1.5	8.0 8.0	ns
t _{PHL} t _{PLH}	Propagation Delay I _n → Z _n	1.5 1.5	5.8 5.8	1.5 1.5	6.3 6.3	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

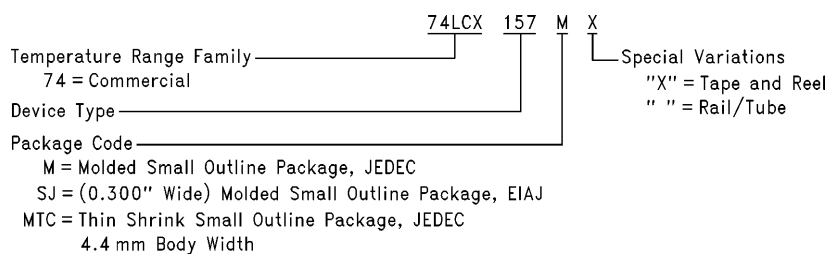
Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C	Units
				Typical	
V _{OLP}	Quiet Output Dynamic Peak V _{OL}	C _L = 50 pF, V _{IH} = 3.3V, V _{IL} = 0V	3.3	0.8	V
V _{OLV}	Quiet Output Dynamic Valley V _{OL}	C _L = 50 pF, V _{IH} = 3.3V, V _{IL} = 0V	3.3	−0.8	V

Capacitance

Symbol	Parameter	Conditions	Typical	Units
C _{IN}	Input Capacitance	V _{CC} = Open, V _I = 0V or V _{CC}	7	pF
C _{OUT}	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

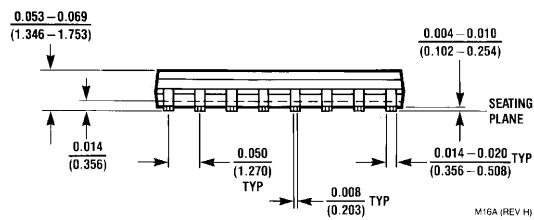
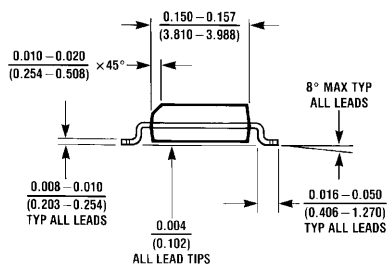
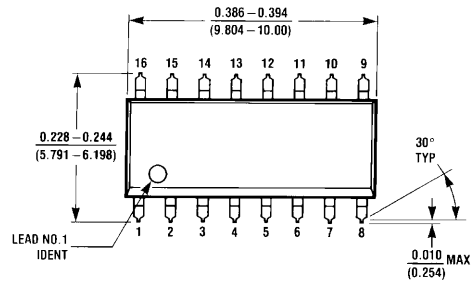
74LCX157 Ordering Information

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/12465-5

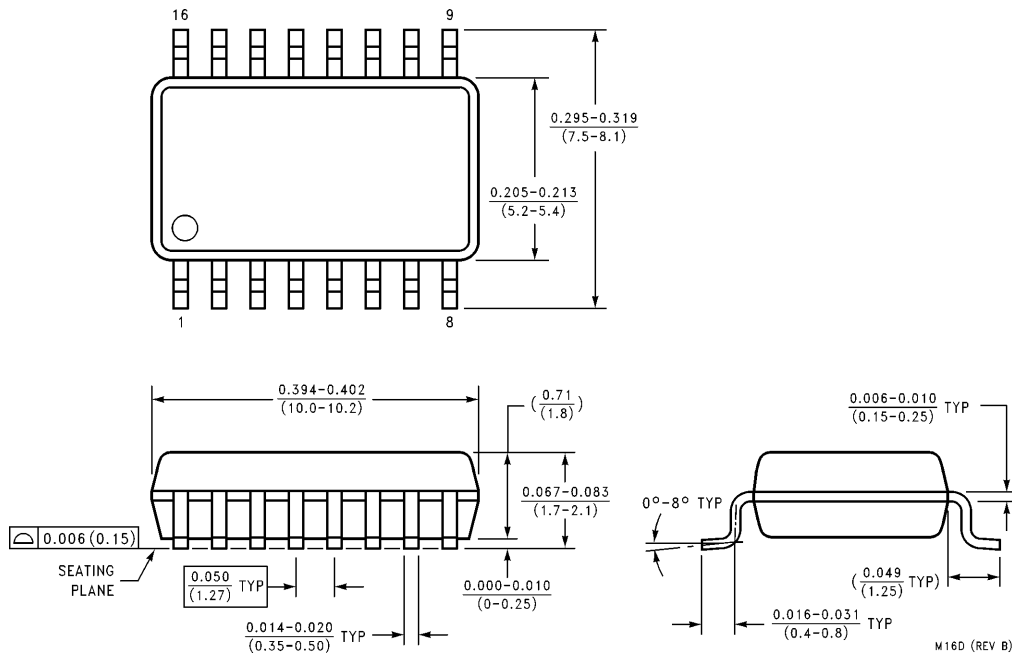
Physical Dimensions inches (millimeters) unless otherwise noted



M16A (REV H)

16-Lead (0.0150" Wide) Molded Small Outline Package, JEDEC
Order Number 74LCX157M or 74LCX157MX
NS Package Number M16A

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

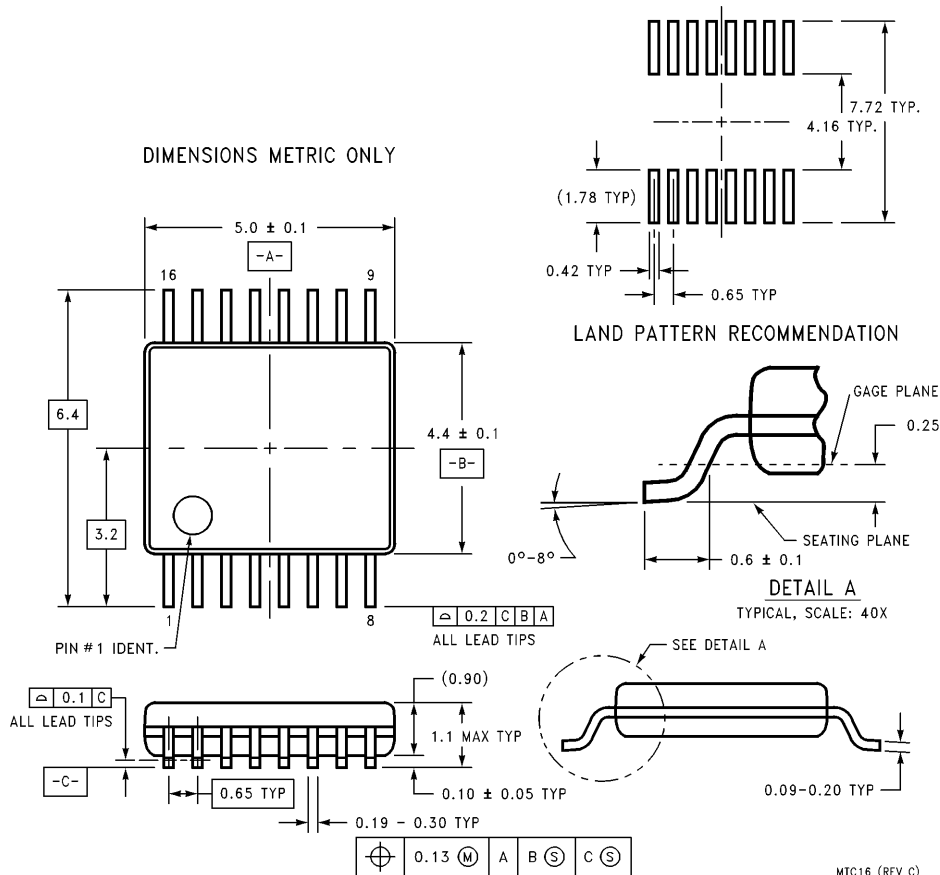


16-Lead Small Outline Package EIAJ (SJ)
Order Number 74LCX157SJ or 74LCX157SJX
NS Package Number M16D

M16D (REV B)

Physical Dimensions

All dimensions are in millimeters



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