

# Low Voltage Quad 2-Input Multiplexer

With 5 V Tolerant Inputs

## 74LCX157

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 (non-inverted) 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

- 5 V Tolerant Inputs
- 1.65 V to 5.5 V,  $V_{CC}$  Specifications Provided
- 5.8 ns  $t_{PD}$  Max. ( $V_{CC} = 3.3$  V), 10  $\mu$ A  $I_{CC}$  Max.
- Power Down High Impedance Inputs and Outputs
- $\pm 24$  mA Output Drive ( $V_{CC} = 3.0$  V)
- Implements Patented Noise/EMI Reduction Circuitry
- Latch-up Performance Exceeds 100 mA
- ESD Performance: Human Body Model >2000 V
- These are Pb-Free Devices

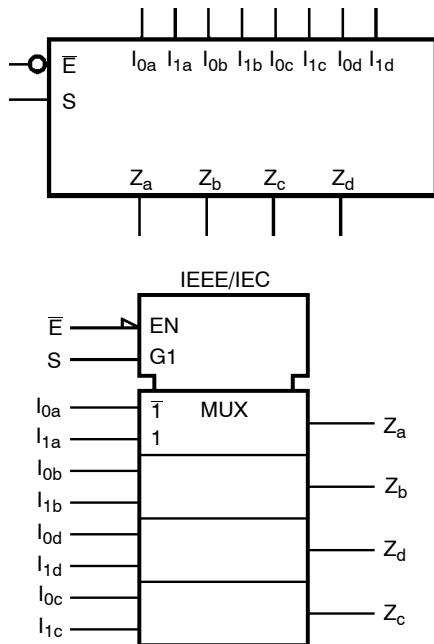
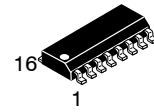
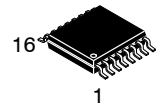
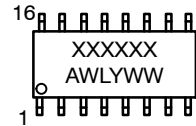


Figure 1. Logic Symbols

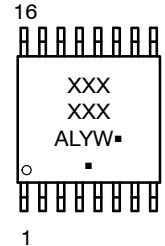
### MARKING DIAGRAMS



SOIC-16, 150 mils  
CASE 751BG



TSSOP-16  
CASE 948AH



- A = Assembly Location
- WL, L = Wafer Lot
- Y = Year
- WW, W = Work Week
- G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

# 74LCX157

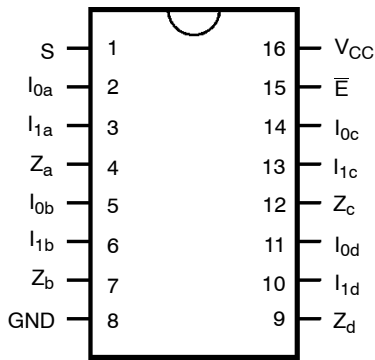


Figure 2. Connection Diagram

## PIN DESCRIPTIONS

Pin Names	Description
I <sub>0a</sub> -I <sub>0d</sub>	Source 0 Data Inputs
I <sub>1a</sub> -I <sub>1d</sub>	Source 1 Data Inputs
E	Enable Input
S	Select Inputs
Z <sub>a</sub> -Z <sub>d</sub>	Outputs

## 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:

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

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

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

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

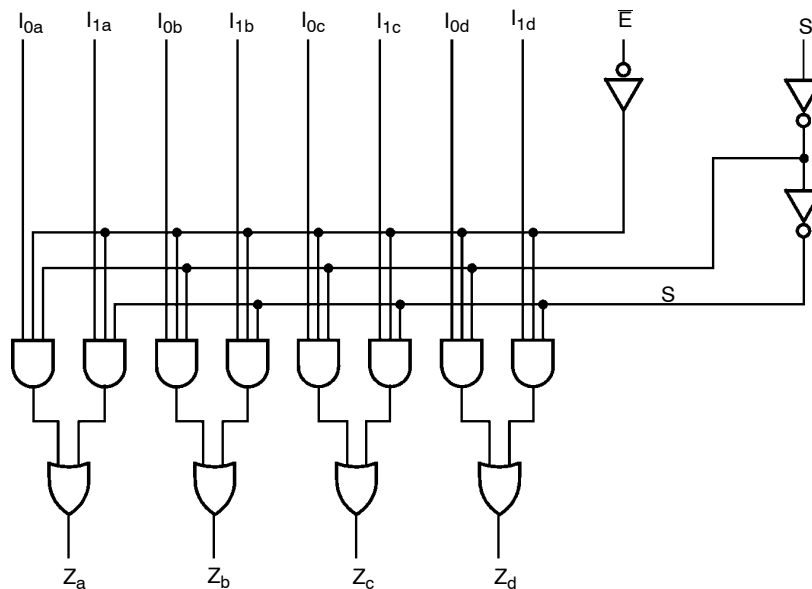
A common use of the LCX157 is the moving of data from two groups of registers to four common output busses. The particular register from which the data comes is determined

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 <sub>0</sub>	I <sub>1</sub>	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



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

Figure 3. Logic Diagram

# 74LCX157

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	DC Supply Voltage	-0.5 to +6.5	V
$V_I$	DC Input Voltage (Note 1)	-0.5 to +6.5	V
$V_O$	DC Output Voltage (Note 1) Active-Mode (High or Low State) Tri-State Mode Power-Down Mode ( $V_{CC} = 0$ V)	-0.5 to $V_{CC} + 0.5$ -0.5 to +6.5 -0.5 to +6.5	V
$I_{IK}$	DC Input Diode Current $V_I < \text{GND}$	-50	mA
$I_{OK}$	DC Output Diode Current $V_O < \text{GND}$	-50	mA
$I_O$	DC Output Source/Sink Current	$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC Supply Current per Supply Pin or Ground Pin	$\pm 100$	mA
$T_{STG}$	Storage Temperature Range	-65 to +150	$^{\circ}\text{C}$
$T_L$	Lead Temperature, 1 mm from Case for 10 secs	260	$^{\circ}\text{C}$
$T_J$	Junction Temperature Under Bias	+150	$^{\circ}\text{C}$
$\theta_{JA}$	Thermal Resistance (Note 1) SOIC-16 TSSOP-16	126 159	$^{\circ}\text{C}/\text{W}$
$P_D$	Power Dissipation in Still Air at 125 $^{\circ}\text{C}$ SOIC-16 TSSOP-16	995 787	mW
MSL	Moisture Sensitivity	Level 1	-
$F_R$	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
$V_{ESD}$	ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model	2000 N/A	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- $I_O$  absolute maximum rating must be observed.
- Measured with minimum pad spacing on an FR4 board, using 76 mm-by-114 mm, 2-ounce copper trace no air flow per JESD51-7.
- HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit
$V_{CC}$	Supply Voltage Operating Data Retention Only	1.65 1.5	3.3 3.3	5.5 5.5	V
$V_I$	Digital Input Voltage	0	-	5.5	V
$V_O$	Output Voltage Active Mode (High or Low State) Tri-State Mode Power Down Mode ( $V_{CC} = 0$ V)	0 0 0	- - -	$V_{CC}$ 5.5 5.5	V
$T_A$	Operating Free-Air Temperature	-40	-	+125	$^{\circ}\text{C}$
$t_r, t_f$	Input Rise or Fall Rate $V_{CC} = 1.65$ V to 1.95 V $V_{CC} = 2.3$ V to 2.7 V $V_{IN}$ from 0.8 V to 2.0 V, $V_{CC} = 3.0$ V $V_{CC} = 4.5$ V to 5.5 V	0 0 0 0	- - - -	20 20 10 5	nS/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

- Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

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## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C		T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Max	Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage		1.65 – 1.95	0.65 x V <sub>CC</sub>	–	0.65 x V <sub>CC</sub>	–	V
			2.3 – 2.7	1.7	–	1.7	–	
			3.0 – 3.6	2.0	–	2.0	–	
			4.5 – 5.5	0.70 x V <sub>CC</sub>	–	0.70 x V <sub>CC</sub>	–	
V <sub>IL</sub>	LOW Level Input Voltage		1.65 – 1.95	–	0.35 x V <sub>CC</sub>	–	0.35 x V <sub>CC</sub>	V
			2.3 – 2.7	–	0.7	–	0.7	
			3.0 – 3.6	–	0.8	–	0.8	
			4.5 – 5.5	–	0.30 x V <sub>CC</sub>	–	0.30 x V <sub>CC</sub>	
V <sub>OH</sub>	High-Level Output Voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -100 μA I <sub>OH</sub> = -4 mA I <sub>OH</sub> = -8 mA I <sub>OH</sub> = -12 mA I <sub>OH</sub> = -16 mA I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -32 mA	1.65 – 5.5	V <sub>CC</sub> – 0.1	–	V <sub>CC</sub> – 0.1	–	V
			1.65	1.29	–	1.29	–	
			2.3	1.8	–	1.8	–	
			2.7	2.2	–	2.2	–	
			3.0	2.4	–	2.4	–	
			3.0	2.2	–	2.2	–	
			4.5	3.7	–	3.7	–	
V <sub>OL</sub>	Low-Level Output Voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 100 μA I <sub>OL</sub> = 4 mA I <sub>OL</sub> = 8 mA I <sub>OL</sub> = 12 mA I <sub>OL</sub> = 16 mA I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 32 mA	1.65 – 5.5	–	0.1	–	0.1	V
			1.65	–	0.24	–	0.24	
			2.3	–	0.3	–	0.3	
			2.7	–	0.4	–	0.4	
			3.0	–	0.4	–	0.4	
			3.0	–	0.55	–	0.55	
			4.5	–	0.6	–	0.6	
I <sub>I</sub>	Input Leakage Current	V <sub>I</sub> = 0 to 5.5 V	1.65 – 5.5	–	±5.0	–	±5.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>I</sub> = 5.5 V or V <sub>O</sub> = 5.5 V	0	–	10	–	10	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>I</sub> = 5.5 V or GND	1.65 – 5.5	–	10	–	10	μA
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	V <sub>IH</sub> = V <sub>CC</sub> – 0.6 V	2.3 – 3.6	–	500	–	500	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# 74LCX157

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C		T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, S to Z <sub>n</sub>	See Figures 4 and 5	1.65 to 1.95	-	11.6	-	11.6	ns
			2.3 to 2.7	-	8.4	-	8.4	
			2.7	-	8.0	-	8.0	
			3.0 to 3.6	-	7.0	-	7.0	
			4.5 to 5.5	-	5.8	-	5.8	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, E to Z <sub>n</sub>	See Figures 4 and 5	1.65 to 1.95	-	11.6	-	11.6	ns
			2.3 to 2.7	-	8.4	-	8.4	
			2.7	-	8.0	-	8.0	
			3.0 to 3.6	-	7.0	-	7.0	
			4.5 to 5.5	-	5.8	-	5.8	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, I <sub>n</sub> to Z <sub>n</sub>	See Figures 4 and 5	1.65 to 1.95	-	11.2	-	11.2	ns
			2.3 to 2.7	-	7.0	-	7.0	
			2.7	-	6.3	-	6.3	
			3.0 to 3.6	-	5.8	-	5.8	
			4.5 to 5.5	-	4.8	-	4.8	
t <sub>OSSL</sub> , t <sub>OSLH</sub>	Output to Output Skew (Note 5)		1.65 to 1.95	-	-	-	-	ns
			2.3 to 2.7	-	-	-	-	
			2.7	-	-	-	-	
			3.0 to 3.6	-	1.0	-	1.0	
			4.5 to 5.5	-	-	-	-	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. 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<sub>OSSL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>).

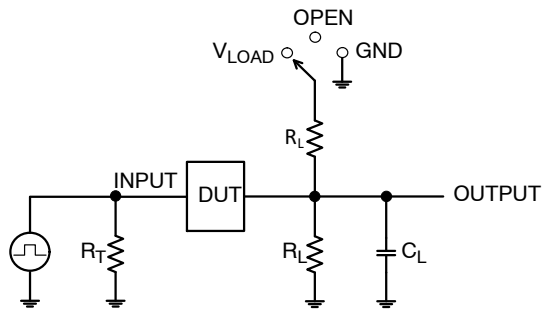
## DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C	Unit
				Typical	
V <sub>OLP</sub>	Quiet Output Dynamic Peak V <sub>OL</sub>	C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V	3.3	0.8	V
		C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5 V, V <sub>IL</sub> = 0 V	2.5	0.6	
V <sub>OLV</sub>	Quiet Output Dynamic Valley V <sub>OL</sub>	C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V	3.3	-0.8	V
		C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5 V, V <sub>IL</sub> = 0 V	2.5	-0.6	

## CAPACITANCE

Symbol	Parameter	Condition	Typical	Units
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = Open, V <sub>I</sub> = 0 V or V <sub>CC</sub>	7	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>	8	pF
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub> , f = 10 MHz	25	pF

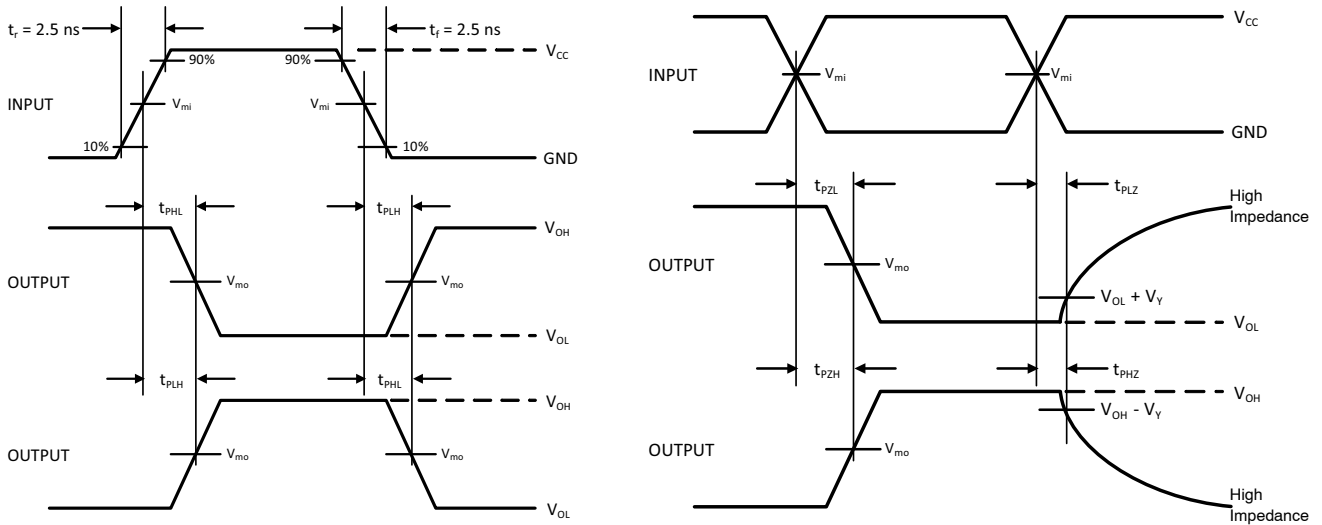
# 74LCX157



$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

Test	Switch Position
$t_{PLH} / t_{PHL}$	Open
$t_{PLZ} / t_{PZL}$	$V_{LOAD}$
$t_{PHZ} / t_{PZH}$	GND

Figure 4. Test Circuit



$V_{CC}, V$	$R_L, \Omega$	$C_L, pF$	$V_{LOAD}$	$V_m, V$	$V_Y, V$
1.65 to 1.95	500	30	$2 \times V_{CC}$	$V_{CC}/2$	0.15
2.3 to 2.7	500	30	$2 \times V_{CC}$	$V_{CC}/2$	0.15
2.7	500	50	6 V	1.5	0.3
3.0 to 3.6	500	50	6 V	1.5	0.3
4.5 to 5.5	500	50	$2 \times V_{CC}$	$V_{CC}/2$	0.3

Figure 5. Switching Waveforms

# 74LCX157

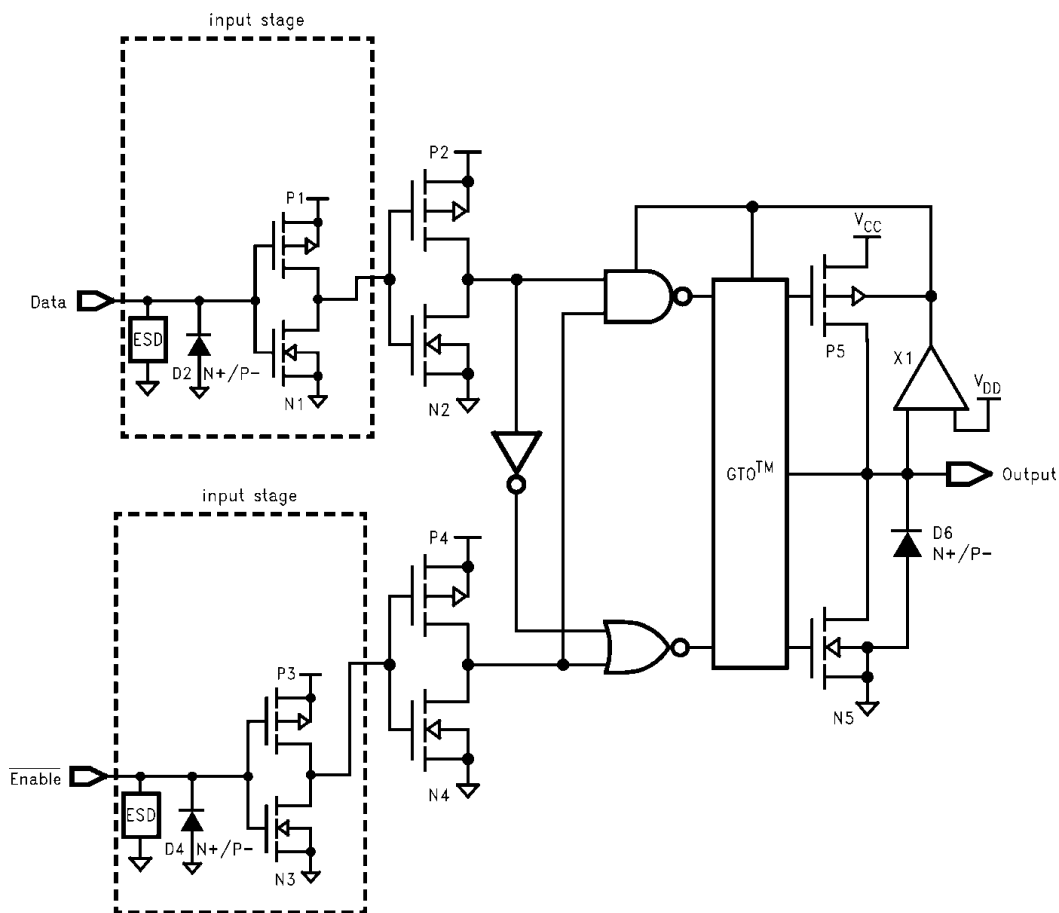


Figure 6. Schematic Diagram (Generic for LCX Family)

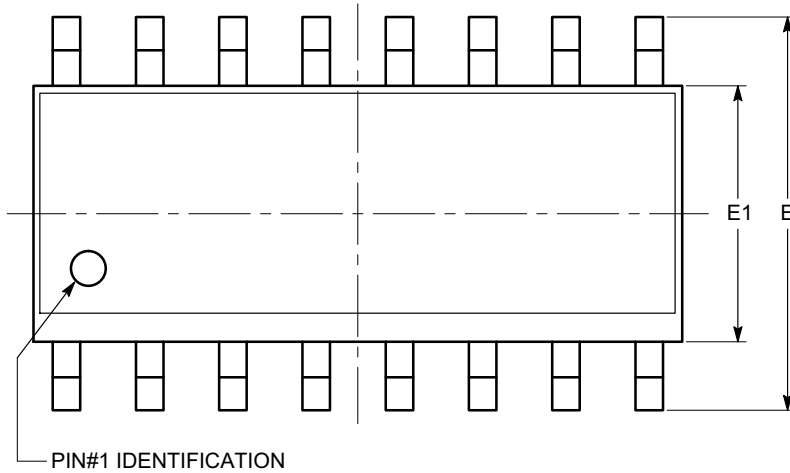
## ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
74LCX157MX	LCX157G	SOIC-16 (Pb-Free)	2500 Units / Tape & Reel
74LCX157MTCX	LCX 157	TSSOP-16 (Pb-Free)	2500 Units / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

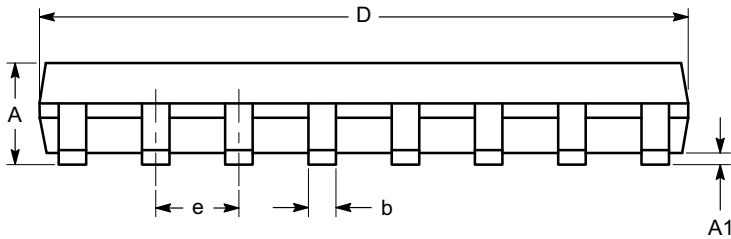
**SOIC-16, 150 mils**  
**CASE 751BG**  
**ISSUE O**

DATE 19 DEC 2008

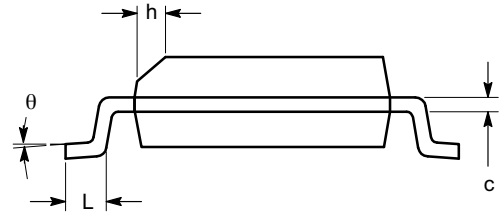


SYMBOL	MIN	NOM	MAX
A	1.35		1.75
A1	0.10		0.25
b	0.33		0.51
c	0.19		0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
h	0.25		0.50
L	0.40		1.27
$\theta$	0°		8°

**TOP VIEW**



**SIDE VIEW**



**END VIEW**

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MS-012.

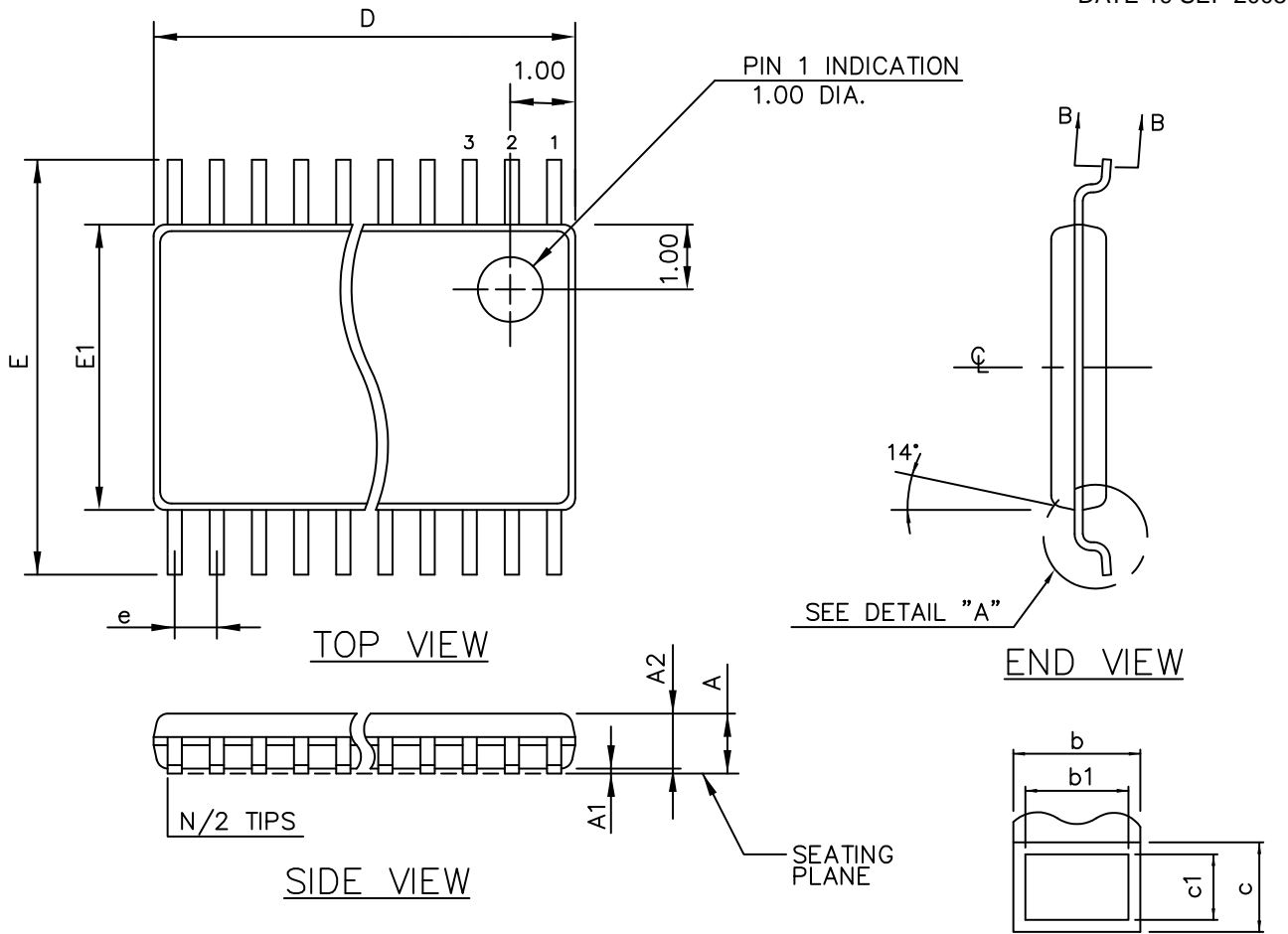
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**TSSOP 16**  
**CASE 948AH**  
**ISSUE O**

DATE 19 SEP 2008



THIS TABLE FOR 0.65mm PITCH

SYMBOL	COMMON DIMENSIONS			NOTE VARIATIONS	D	N
	MIN.	NOM.	MAX.			
A	—	—	1.10	AA/AAT	3.00 BSC	8
A <sub>1</sub>	0.05	—	0.15	AB-1/ABT	5.00 BSC	14
A <sub>2</sub>	0.85	0.90	0.95	AB/ABT	5.00 BSC	16
b	0.19	—	0.30	AD/ADT	7.80 BSC	24
b1	0.19	0.22	0.25			
c	0.09	—	0.20			
c1	0.09	0.127	0.16			
D	SEE VARIATIONS					
E1	4.30	4.40	4.50			
e	0.65 BSC					
E	6.40 BSC					
L	0.50	0.60	0.70			
L1	1.00 REF					
N	SEE VARIATIONS					
X	0°	—	8°			

ALL DIMENSIONS IN MILLIMETERS

MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15mm ON D PER SIDE

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