Low-Voltage CMOS Quad Buffer

With 5 V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

The MC74LCX125 is a high performance, non–inverting quad buffer operating from a 2.3 to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A V_I specification of 5.5 V allows MC74LCX125 inputs to be safely driven from 5 V devices. The MC74LCX125 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

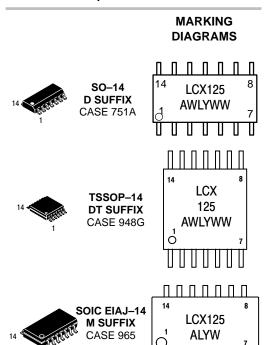
Current drive capability is 24 mA at the outputs. The Output Enable $(\overline{OE}n)$ inputs, when HIGH, disable the outputs by placing them in a HIGH Z condition.

- Designed for 2.3 to 3.6 V V_{CC} Operation
- 5 V Tolerant Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0 \text{ V}$
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μA)
 Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V; Machine Model >200 V



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A =Assembly Location
WL or L = Wafer Lot
Y = Year
WW or W = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MC74LCX125D	SO-14	55 Units/Rail
MC74LCX125DR2	SO-14	2500 Units/Reel
MC74LCX125DT	TSSOP-14	96 Untis/Rail
MC74LCX125DTR2	TSSOP-14	2500 Units/Reel
MC74LCX125M	SOIC EIAJ-14	50 Units/Rail
MC74LCX125MEL	SOIC EIAJ-14	2000 Units/Reel

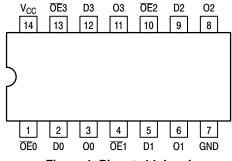


Figure 1. Pinout: 14-Lead (Top View)

Figure 2. Logic Diagram

PIN NAMES

Pins	Function
OEn Dn On	Output Enable Inputs Data Inputs 3-State Outputs

FUNCTION TABLE

INPU	JTS	OUTPUTS
OE n	Dn	On
L	L	L
L	Н	Н
Н	X	Z

 $\label{eq:Hamiltonian} H=\mbox{High Voltage Level; } Z=\mbox{High Impedance State; } X=\mbox{High or Low Voltage Level and Transitions Are Acceptable, for I_{CC}\ reasons, DO\ NOT\ FLOAT\ Inputs$

ABSOLUTE MAXIMUM RATINGS*

Symbol	Parameter	Value	Condition	Unit
V _{CC}	DC Supply Voltage	-0.5 to +7.0		V
V _I	DC Input Voltage	$-0.5 \le V_1 \le +7.0$		V
Vo	DC Output Voltage	$-0.5 \le V_{O} \le +7.0$	Output in 3-State	V
		$-0.5 \le V_{O} \le V_{CC} + 0.5$	Output in HIGH or LOW State. (Note 1.)	V
I _{IK}	DC Input Diode Current	-50	V _I < GND	mA
l _{OK}	DC Output Diode Current	-50	V _O < GND	mA
		+50	V _O > V _{CC}	mA
IO	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 Range	-65 to +150		°C

^{*} Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute—maximum—rated conditions is not implied.

^{1.} I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Paramete	r	Min	Тур	Max	Unit
V _{CC}	Supply Voltage	Operating Data Retention Only	2.0 1.5	2.5, 3.3 2.5, 3.3	3.6 3.6	V
VI	Input Voltage		0		5.5	V
Vo	Output Voltage	(HIGH or LOW State) (3–State)	0 0		V _{CC} 5.5	V
I _{OH}	HIGH Level Output Current	$V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$ $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$ $V_{CC} = 2.3 \text{ V} - 2.7 \text{ V}$			- 24 - 12 - 8	mA
I _{OL}	LOW Level Output Current	$V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$ $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$ $V_{CC} = 2.3 \text{ V} - 2.7 \text{ V}$			+ 24 + 12 + 8	mA
T _A	Operating Free–Air Temperature		-40		+85	°C
Δt/ΔV	Input Transition Rise or Fall Rate, V_{I} $V_{CC} = 3.0 \text{ V}$	N from 0.8 V to 2.0 V,	0		10	ns/V

DC ELECTRICAL CHARACTERISTICS

			T _A = −40°C	to +85°C	
Symbol	Characteristic	Condition	Min	Max	Unit
V _{IH}	HIGH Level Input Voltage (Note 2.)	2.3 V ≤ V _{CC} ≤ 2.7 V	1.7		V
		2.7 V ≤ V _{CC} ≤ 3.6 V	2.0		
V _{IL}	LOW Level Input Voltage (Note 2.)	2.3 V ≤ V _{CC} ≤ 2.7 V		0.7	V
		2.7 V ≤ V _{CC} ≤ 3.6 V		0.8	
V _{OH}	HIGH Level Output Voltage	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{I}_{OL} = 100 \mu\text{A}$	V _{CC} - 0.2		V
		V _{CC} = 2.3 V; I _{OH} = -8 mA	1.8		
		$V_{CC} = 2.7 \text{ V; } I_{OH} = -12 \text{ mA}$	2.2		
		$V_{CC} = 3.0 \text{ V; } I_{OH} = -18 \text{ mA}$	2.4		
		$V_{CC} = 3.0 \text{ V; } I_{OH} = -24 \text{ mA}$	2.2		
V _{OL}	LOW Level Output Voltage	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{I}_{OL} = 100 \mu\text{A}$		0.2	V
		V _{CC} = 2.3 V; I _{OL} = 8 mA		0.6	
		V _{CC} = 2.7 V; I _{OL} = 12 mA		0.4	
		V _{CC} = 3.0 V; I _{OL} = 16 mA		0.4	
		V _{CC} = 3.0 V; I _{OL} = 24 mA		0.55	
I	Input Leakage Current	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; 0 \text{ V} \le \text{V}_{I} \le 5.5 \text{ V}$		±5	μΑ
I _{CC}	Quiescent Supply Current	$2.3 \le V_{CC} \le 3.6 \text{ V}; V_I = \text{GND or } V_{CC}$		10	μΑ
		$2.3 \le V_{CC} \le 3.6 \text{ V}; 3.6 \le V_{I} \text{ or } V_{O} \le 5.5 \text{ V}$		±10	
Δl _{CC}	Increase in I _{CC} per Input	$2.3 \le V_{CC} \le 3.6 \text{ V}; V_{IH} = V_{CC} - 0.6 \text{ V}$		500	μΑ

^{2.} These values of V_I are used to test DC electrical characteristics only.

AC CHARACTERISTICS t_R = t_F = 2.5 ns; R_L = 500 Ω

			Limits T _A = -40°C to +85°C					Unit	
			V_{CC} = 3.3 V \pm 0.3 V		V _{CC} = 2.7 V		$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$		
			C _L =	50 pF	C _L =	50 pF	C _L =	30 pF	
Symbol	Parameter	Waveform	Min	Max	Min	Max	Min	Max	
t _{PLH} t _{PHL}	Propagation Delay Time Input to Output	1	1.5 1.5	6.0 6.0	1.5 1.5	6.5 6.5	1.5 1.5	7.2 7.2	ns
t _{PZH} t _{PZL}	Output Enable Time to High and Low Level	2	1.5 1.5	7.0 7.0	1.5 1.5	8.0 8.0	1.5 1.5	9.1 9.1	ns
t _{PHZ} t _{PLZ}	Output Disable Time From High and Low Level	2	1.5 1.5	6.0 6.0	1.5 1.5	7.0 7.0	1.5 1.5	7.2 7.2	ns
t _{OSHL} t _{OSLH}	Output-to-Output Skew (Note 3.)			1.0 1.0					ns

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}); parameter guaranteed by design.

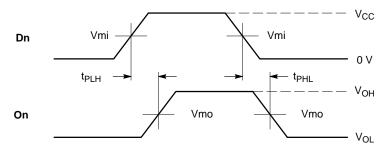
DYNAMIC SWITCHING CHARACTERISTICS

			T _A = +25°C			
Symbol	Characteristic	Condition	Min	Тур	Max	Unit
V _{OLP}	Dynamic LOW Peak Voltage (Note 4.)	$\begin{array}{c} V_{CC} = 3.3 \text{ V, } C_L = 50 \text{ pF, } V_{IH} = 3.3 \text{ V, } V_{IL} = 0 \text{ V} \\ V_{CC} = 2.5 \text{ V, } C_L = 30 \text{ pF, } V_{IH} = 2.5 \text{ V, } V_{IL} = 0 \text{ V} \end{array}$		0.8 0.6		V V
V _{OLV}	Dynamic LOW Valley Voltage (Note 4.)	$V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$ $V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$		-0.8 -0.6		V V

^{4.} Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

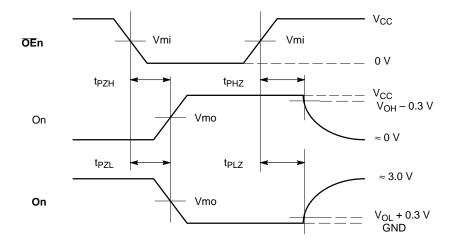
CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
C _{IN}	Input Capacitance	V_{CC} = 3.3 V, V_{I} = 0 V or V_{CC}	7	pF
C _{OUT}	Output Capacitance	$V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$	8	pF
C _{PD}	Power Dissipation Capacitance	10 MHz, V_{CC} = 3.3 V, V_{I} = 0 V or V_{CC}	25	pF



WAVEFORM 1 - PROPAGATION DELAYS

 $t_R = t_F = 2.5 \text{ ns}, 10\% \text{ to } 90\%; f = 1 \text{ MHz}; t_W = 500 \text{ ns}$

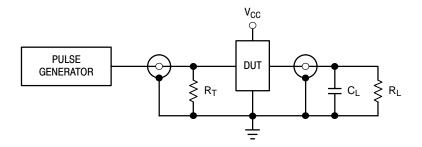


WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES

 $t_R = t_F = 2.5 \text{ ns}$, 10% to 90%; f = 1 MHz; $t_W = 500 \text{ ns}$

	V _{CC}					
Symbol	$3.3~\text{V}\pm0.3~\text{V}$	2.7 V	2.5 V ± 0.2 V			
Vmi	1.5 V	1.5 V	V _{CC} /2			
Vmo	1.5 V	1.5 V	V _{CC} /2			

Figure 3. AC Waveforms

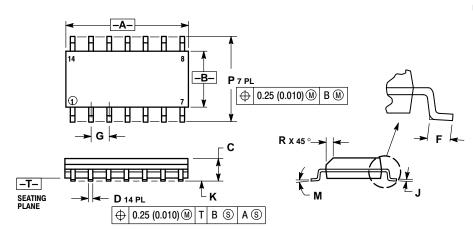


 $C_L=50$ pF at $V_{CC}=3.3\pm0.3$ V or equivalent (includes jig and probe capacitance) $C_L=30$ pF at $V_{CC}=2.5\pm0.2$ V or equivalent (includes jig and probe capacitance) $R_L=R_1=500~\Omega$ or equivalent $R_T=Z_{OUT}$ of pulse generator (typically $50~\Omega)$

Figure 4. Test Circuit

PACKAGE DIMENSIONS

SO-14 CASE 751A-03 ISSUE F



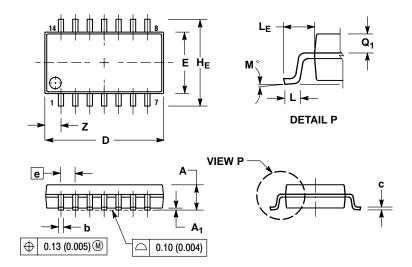
NOTES:

- IOLES:
 1. DIMENSIONING AND TOLERANCING PER ANSI
 Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSIONS A AND B DO NOT INCLUDE
 MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006)
- PER SIDE.

 5. DIMENSION D DOES NOT INCLUDE DAMBAR DIMENSION D DUES NOT INCLUDE DAMBAR
 PROTRUSION. ALLOWABLE DAMBAR
 PROTRUSION SHALL BE 0.127 (0.005) TOTAL
 IN EXCESS OF THE D DIMENSION AT
 MAXIMUM MATERIAL CONDITION.

	MILLIN	IETERS	INCHES		
DIM	MIN	MAX	MIN	MAX	
Α	8.55	8.75	0.337	0.344	
В	3.80	4.00	0.150	0.157	
С	1.35	1.75	0.054	0.068	
D	0.35	0.49	0.014	0.019	
F	0.40	1.25	0.016	0.049	
G	1.27	BSC	0.050 BSC		
J	0.19	0.25	0.008	0.009	
K	0.10	0.25	0.004	0.009	
M	0 °	7°	0 °	7°	
P	5.80	6.20	0.228	0.244	
R	0.25	0.50	0.010	0.019	

SO-14 CASE 965-01 **ISSUE O**



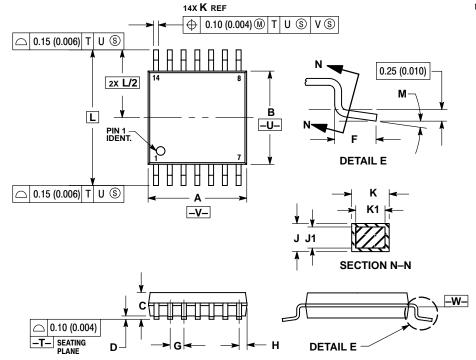
NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI DIMENSIONING AND TOLERANCING PER A Y14.5M, 1982.
 CONTROLLING DIMENSION: MILLIMETER.
- 3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15
- OR PROTRUSIONS SHALL NOT EXCEED 0.15
 (0.006) PER SIDE.
 4. TERMINAL NUMBERS ARE SHOWN FOR
 REFERENCE ONLY.
 5. THE LEAD WIDTH DIMENSION (b) DOES NOT
 INCLUDE DAMBAR PROTRUSION. ALLOWABLE
 DAMBAR PROTRUSION SHALL BE 0.08 (0.003)
 TOTAL IN EXCESS OF THE LEAD WIDTH
 DIMENSION AT MAXIMUM MATERIAL CONDITION IOIAL IN EXCESS OF THE LEAD WIDTH
 DIMENSION AT MAXIMUM MATERIAL CONDITION.
 DAMBAR CANNOT BE LOCATED ON THE LOWER
 RADIUS OR THE FOOT. MINIMUM SPACE
 BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

	MILLIN	IETERS	INC	HES	
DIM	MIN	MAX	MIN	MAX	
Α		2.05		0.081	
A ₁	0.05	0.20	0.002	0.008	
b	0.35	0.50	0.014	0.020	
O	0.18	0.27	0.007	0.011	
D	9.90	10.50	0.390	0.413	
Е	5.10	5.45	0.201	0.215	
е	1.27	BSC	0.050 BSC		
HE	7.40	8.20	0.291	0.323	
0.50	0.50	0.85	0.020	0.033	
LE	1.10	1.50	0.043	0.059	
M	0 °	10 °	0 °	10°	
Q_1	0.70	0.90	0.028	0.035	
7		1 //2		0.056	

PACKAGE DIMENSIONS

TSSOP CASE 948G-01 **ISSUE O**



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
- i. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- (U.006) PEH SIDE.

 4. DIMENSION B DOES NOT INCLUDE INTERLEAD
 FLASH OR PROTRUSION. INTERLEAD FLASH OR
 PROTRUSION SHALL NOT EXCEED
 0.25 (0.010) PER SIDE.
 5. DIMENSION K DOES NOT INCLUDE DAMBAR
 PROTRUSION. ALLOWABLE DAMBAR PROTRUSION.
- SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY
- DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	4.90	5.10	0.193	0.200
В	4.30	4.50	0.169	0.177
С		1.20		0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
Н	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

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