# **Quad Bus Buffer**

# With 5 V-Tolerant Inputs

The MC74LVX125 is an advanced high speed CMOS quad bus buffer. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

The MC74LVX125 requires the 3-state control input  $(\overline{OE})$  to be set High to place the output into the high impedance state.

#### **Features**

- High Speed:  $t_{PD} = 4.4 \text{ ns}$  (Typ) at  $V_{CC} = 3.3 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 4 \mu A$  (Max) at  $T_A = 25^{\circ}C$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Low Noise: V<sub>OLP</sub> = 0.5 V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: Human Body Model >2000 V

Machine Model >200 V

• These Devices are Pb-Free and are RoHS Compliant



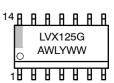
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SOIC-14 D SUFFIX CASE 751A





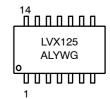
TSSOP-14 DT SUFFIX CASE 948G





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SOEIAJ-14 M SUFFIX CASE 965



LVX125 = Specific Device Code 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 4 of this data sheet.

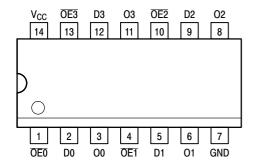


Figure 1. 14-Lead Pinout (Top View)

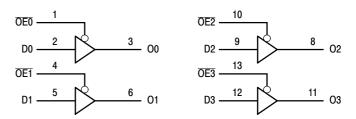


Figure 2. Logic Diagram

## **PIN NAMES**

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

## **FUNCTION TABLE**

INP	JTS	OUTPUTS
OEn	Dn	On
L	L	L
L	Н	Н
Н	X	Z

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

## **MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0	V
V <sub>in</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>out</sub>	DC Output Voltage	-0.5 to V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	Input Diode Current	-20	mA
lok	Output Diode Current	±20	mA
l <sub>out</sub>	DC Output Current, per Pin	±25	mA
Icc	DC Supply Current, V <sub>CC</sub> and GND Pins	±50	mA
P <sub>D</sub>	Power Dissipation	180	mW
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage	2.0	3.6	V
V <sub>in</sub>	DC Input Voltage	0	5.5	V
V <sub>out</sub>	DC Output Voltage	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature, All Package Types	-40	+85	°C
Δt/ΔV	Input Rise and Fall Time	0	100	ns/V

#### DC ELECTRICAL CHARACTERISTICS

			Vcc	T <sub>A</sub> = 25°C			T <sub>A</sub> = - 40 to 85°C		
Symbol	Parameter	Test Conditions	v	Min	Тур	Max	Min	Max	Unit
V <sub>IH</sub>	High-Level Input Voltage		2.0 3.0 3.6	1.5 2.0 2.4			1.5 2.0 2.4		V
V <sub>IL</sub>	Low-Level Input Voltage		2.0 3.0 3.6			0.5 0.8 0.8		0.5 0.8 0.8	V
V <sub>OH</sub>	High-Level Output Voltage (V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> )	$I_{OH} = -50\mu A$ $I_{OH} = -50\mu A$ $I_{OH} = -4mA$	2.0 3.0 3.0	1.9 2.9 2.58	2.0 3.0		1.9 2.9 2.48		V
V <sub>OL</sub>	Low-Level Output Voltage (V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> )	$I_{OL} = 50\mu A$ $I_{OL} = 50\mu A$ $I_{OL} = 4mA$	2.0 3.0 3.0		0.0 0.0	0.1 0.1 0.36		0.1 0.1 0.44	V
l <sub>in</sub>	Input Leakage Current	V <sub>in</sub> = 5.5V or GND	3.6			±0.1		±1.0	μΑ
I <sub>OZ</sub>	Maximum Three-State Leakage Current	$V_{in} = V_{IL} \text{ or } V_{IH}$ $V_{out} = V_{CC} \text{ or GND}$	3.6			±0.25		±2.5	μΑ
I <sub>CC</sub>	Quiescent Supply Current	V <sub>in</sub> = V <sub>CC</sub> or GND	3.6			4.0		40.0	μΑ

## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ns}$ )

					T <sub>A</sub> = 25°C		$T_A = -40$	0 to 85°C	
Symbol	Parameter	Test Condi	tions	Min	Тур	Max	Min	Max	Unit
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Input to Output	V <sub>CC</sub> = 2.7V	C <sub>L</sub> = 15pF C <sub>L</sub> = 50pF		5.8 8.3	10.1 13.6	1.0 1.0	13.5 17.0	ns
		$V_{CC} = 3.3 \pm 0.3 V$	C <sub>L</sub> = 15pF C <sub>L</sub> = 50pF		4.4 6.9	6.2 9.7	1.0 1.0	8.5 12.0	=
t <sub>PZL</sub> , t <sub>PZH</sub>	Output Enable Time OE to O	$V_{CC} = 2.7V$ $R_L = 1k\Omega$	$C_L = 15pF$ $C_L = 50pF$		5.3 7.8	9.3 12.8	1.0 1.0	12.5 16.0	ns
		$\begin{aligned} V_{CC} &= 3.3 \pm 0.3 V \\ R_L &= 1 k \Omega \end{aligned}$	$C_L = 15pF$ $C_L = 50pF$		4.0 6.5	5.6 9.1	1.0 1.0	7.5 11.0	
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Output Disable Time OE to O	$V_{CC} = 2.7V$ $R_L = 1k\Omega$	C <sub>L</sub> = 50pF		10.0	15.7	1.0	19.0	ns
		$\begin{aligned} V_{CC} &= 3.3 \pm 0.3 V \\ R_L &= 1 k \Omega \end{aligned}$	C <sub>L</sub> = 50pF		8.3	11.2	1.0	13.0	
t <sub>OSHL</sub> t <sub>OSLH</sub>	Output-to-Output Skew (Note 1)	$V_{CC} = 2.7V$ $V_{CC} = 3.3 \pm 0.3V$	C <sub>L</sub> = 50pF C <sub>L</sub> = 50pF			1.5 1.5		1.5 1.5	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<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.

#### **CAPACITIVE CHARACTERISTICS**

			T <sub>A</sub> = 25°C		) to 85°C		
Symbol	Parameter	Min	Тур	Max	Min	Max	Unit
C <sub>in</sub>	Input Capacitance		4	10		10	pF
C <sub>out</sub>	Maximum Three-State Output Capacitance		6				pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 2)		14				pF

<sup>2.</sup> C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}/4$  (per bit). C<sub>PD</sub> is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

**NOISE CHARACTERISTICS** (Input  $t_r = t_f = 3.0$ ns,  $C_L = 50$ pF,  $V_{CC} = 3.3$ V, Measured in SOIC Package)

		T <sub>A</sub> =	25°C	
Symbol	Characteristic	Тур	Max	Unit
V <sub>OLP</sub>	Quiet Output Maximum Dynamic V <sub>OL</sub>	0.3	0.5	V
V <sub>OLV</sub>	Quiet Output Minimum Dynamic V <sub>OL</sub>	-0.3	-0.5	V
V <sub>IHD</sub>	Minimum High Level Dynamic Input Voltage		2.0	V
V <sub>ILD</sub>	Maximum Low Level Dynamic Input Voltage		0.8	V

## **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
MC74LVX125DG	SOIC-14 (Pb-Free)	55 Units / Rail
MC74LVX125DR2G	SOIC-14 (Pb-Free)	2500 Tape & Reel
MC74LVX125DTG	TSSOP-14*	96 Units / Rail
MC74LVX125DTR2G	TSSOP-14*	2500 Tape & Reel
MC74LVX125MG	SOEIAJ-14	2000 Tape & Reel
MC74LVX125MELG	SOEIAJ-14	2000 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.

## **SWITCHING WAVEFORMS**

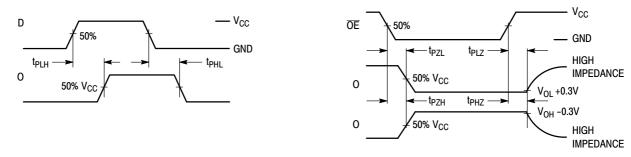
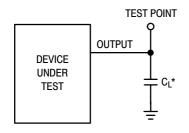


Figure 3. Figure 4.

## **TEST CIRCUITS**



\*Includes all probe and jig capacitance

 $\begin{array}{c|c} & & \text{TEST POINT} \\ \hline & \text{DEVICE} \\ & \text{UNDER} \\ & \text{TEST} \end{array} \begin{array}{c} \text{OUTPUT} & \begin{array}{c} \text{1 k}\Omega \\ \\ \text{TESTING } t_{PLZ} \text{ AND } t_{PZL}. \\ \text{CONNECT TO GND WHEN} \\ \text{TESTING } t_{PHZ} \text{ AND } t_{PZH}. \end{array}$ 

\*Includes all probe and jig capacitance

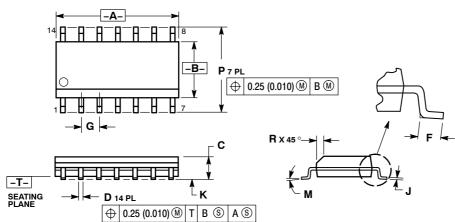
Figure 5. Propagation Delay Test Circuit

Figure 6. Three-State Test Circuit

<sup>\*</sup>This package is inherently Pb-Free.

## **PACKAGE DIMENSIONS**

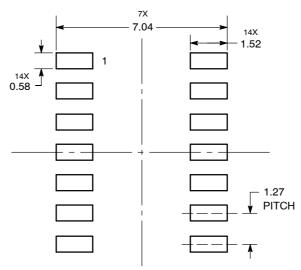
SOIC-14 **D SUFFIX** CASE 751A-03 **ISSUE J** 



- NOTES:
  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 PROTRUSION. ALLOWABLE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

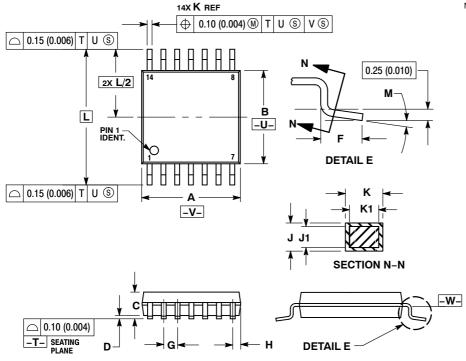
	MILLIN	IETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
Α	8.55	8.75	0.337	0.344
В	3.80	4.00	0.150	0.157
С	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27	BSC	0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
М	0 °	7 °	0 °	7°
Р	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

## **SOLDERING FOOTPRINT**



#### PACKAGE DIMENSIONS

## TSSOP-14 **DT SUFFIX** CASE 948G-01 ISSUE B



- NOTES:

  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

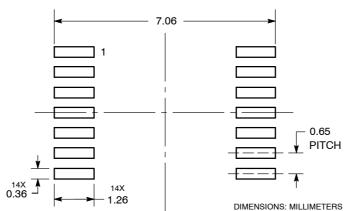
  2. CONTROLLING DIMENSION: MILLIMETER.

  3. 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.
  - DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
  - 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.
    6. TERMINAL NUMBERS ARE SHOWN FOR
    REFERENCE ONLY

  - REFERENCE ONLY.
    7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

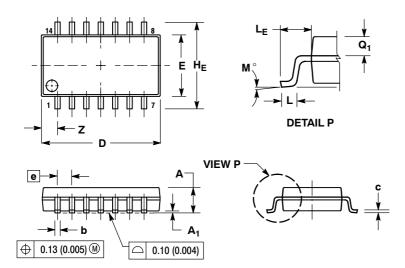
	MILLIN	IETERS	INCHES		
DIM	MIN	MAX	MIN	MAX	
Α	4.90	5.10	0.193	0.200	
В	4.30	4.50	0.169	0.177	
С		1.20		0.047	
D	0.05	0.15	0.002	0.006	
F	0.50	0.75	0.020	0.030	
G	0.65	BSC	0.026 BSC		
Н	0.50	0.60	0.020	0.024	
J	0.09	0.20	0.004	0.008	
J1	0.09	0.16	0.004	0.006	
Κ	0.19	0.30	0.007	0.012	
K1	0.19	0.25	0.007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

#### **SOLDERING FOOTPRINT**



### PACKAGE DIMENSIONS

## SOEIAJ-14 CASE 965-01 **ISSUE B**



#### NOTES:

- 1. DIMENO... Y14.5M, 1982. DIMENSIONING AND TOLERANCING PER ANSI
- CONTROLLING DIMENSION: MILLIMETER.
  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 (0.006) PER SIDE.
- TERMINAL NUMBERS ARE SHOWN FOR
- REFERENCE ONLY.

  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. 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	LLIMETERS INCHES		
DIM	MIN	MAX	MIN	MAX
Α		2.05		0.081
A <sub>1</sub>	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
С	0.10	0.20	0.004	0.008
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
L	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
Z		1.42		0.056

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