# MC74LCX125

# 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<sub>I</sub> specification of 5.5 V allows MC74LCX125 inputs to be safely driven from 5.0 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  $(\overline{OEn})$  inputs, when HIGH, disable the outputs by placing them in a HIGH Z condition.

## Features

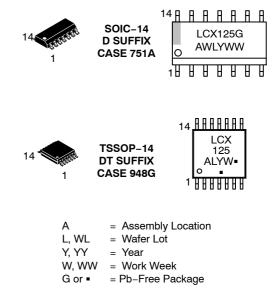
- Designed for 2.3 to 3.6 V V<sub>CC</sub> Operation
- 5.0 V Tolerant Interface Capability With 5.0 V TTL Logic
- Supports Live Insertion and Withdrawal
- $I_{OFF}$  Specification Guarantees High Impedance When  $V_{CC} = 0 V$
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source 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
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q100 Qualified and PPAP Capable
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant



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MARKING DIAGRAMS



(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.

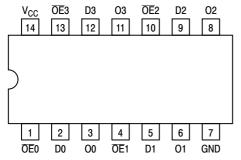
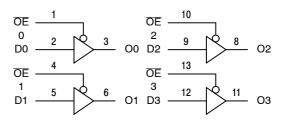


Figure 1. Pinout: 14-Lead (Top View)

#### **PIN NAMES**

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



#### Figure 2. Logic Diagram

## TRUTH TABLE

INP	OUTPUTS	
ŌĒn	On	
L	L	L
L	Н	н
Н	х	Z

H = High Voltage Level

L = Low Voltage Level

Z = High Impedance State

 $\label{eq:X} \begin{array}{rcl} \mathsf{X} & = & \mathsf{High} \text{ or Low Voltage Level and Transitions Are} \\ \mathsf{Acceptable; for } \mathsf{I}_{\mathsf{CC}} \text{ reasons, DO NOT FLOAT Inputs} \end{array}$ 

#### MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Units
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0		V
VI	DC Input Voltage	$-0.5 \le V_{ } \le +7.0$		V
Vo	DC Output Voltage	$-0.5 \le V_0 \le +7.0$	Output in 3-State	V
		$-0.5 \leq V_{\rm O} \leq V_{\rm CC} + 0.5$	Output in HIGH or LOW State. (Note 1)	V
I <sub>IK</sub>	DC Input Diode Current	-50	V <sub>I</sub> < GND	mA
I <sub>OK</sub>	DC Output Diode Current	-50	V <sub>O</sub> < GND	mA
		+50	V <sub>O</sub> > V <sub>CC</sub>	mA
Ι <sub>Ο</sub>	DC Output Source/Sink Current	±50		mA
I <sub>CC</sub>	DC Supply Current Per Supply Pin	±100		mA
I <sub>GND</sub>	DC Ground Current Per Ground Pin	±100		mA
T <sub>STG</sub>	Storage Temperature Range	-65 to +150		°C
MSL	Moisture Sensitivity		Level 1	

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.

1. Io absolute maximum rating must be observed.

# **RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min	Тур	Max	Units
V <sub>CC</sub>	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
V <sub>O</sub>	Output Voltage HIGH or LOW State 3-State	0 0		V <sub>CC</sub> 5.5	V
I <sub>OH</sub>				-24 -12 -8	mA
I <sub>OL</sub>				+24 +12 +8	mA
T <sub>A</sub>	Operating Free-Air Temperature	-40		+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate, V <sub>IN</sub> from 0.8 V to 2.0 V, V <sub>CC</sub> = 3.0 V	0		10	ns/V

## DC ELECTRICAL CHARACTERISTICS

			T <sub>A</sub> = −40°C	to +85°C		
Symbol	Characteristic	Condition	Min	Max	Units	
V <sub>IH</sub>	HIGH Level Input Voltage (Note 2)	$2.3 \text{ V} \le \text{V}_{\text{CC}} \le 2.7 \text{ V}$	1.7		V	
		$2.7 \text{ V} \le \text{V}_{\text{CC}} \le 3.6 \text{ V}$	2.0			
V <sub>IL</sub>	LOW Level Input Voltage (Note 2)	$2.3 \text{ V} \le \text{V}_{\text{CC}} \le 2.7 \text{ V}$		0.7	V	
		$2.7 \text{ V} \le \text{V}_{\text{CC}} \le 3.6 \text{ V}$		0.8		
V <sub>OH</sub>	HIGH Level Output Voltage	$2.3 \text{ V} \le \text{V}_{\text{CC}} \le 3.6 \text{ V}; \text{ I}_{\text{OL}} = 100 \ \mu\text{A}$	V <sub>CC</sub> – 0.2		V	
		$V_{CC} = 2.3 \text{ V}; \text{ I}_{OH} = -8 \text{ mA}$	1.8			
		$V_{CC} = 2.7 \text{ V}; I_{OH} = -12 \text{ mA}$	2.2			
		$V_{CC} = 3.0 \text{ V}; \text{ I}_{OH} = -18 \text{ mA}$	2.4			
		V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -24 mA	2.2			
V <sub>OL</sub>	LOW Level Output Voltage	$2.3 \text{ V} \le \text{V}_{\text{CC}} \le 3.6 \text{ V}; \text{ I}_{\text{OL}} = 100 \ \mu\text{A}$		0.2	V	
		V <sub>CC</sub> = 2.3 V; I <sub>OL</sub> = 8 mA		0.6		
		V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 12 mA		0.4		
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 16 mA		0.4		
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 24 mA		0.55		
I <sub>OZ</sub>	3-State Output Current	$V_{CC} = 3.6 \text{ V}, V_{IN} = V_{IH} \text{ or } V_{IL}, \\ V_{OUT} = 0 \text{ to } 5.5 \text{ V}$		±5	μΑ	
I <sub>OFF</sub>	Power Off Leakage Current	$V_{CC}$ = 0, $V_{IN}$ = 5.5 V or $V_{OUT}$ = 5.5 V		10	μA	
I <sub>IN</sub>	Input Leakage Current	$V_{CC}$ = 3.6 V, $V_{IN}$ = 5.5 V or GND		±5	μΑ	
I <sub>CC</sub>	Quiescent Supply Current	$V_{CC}$ = 3.6 V, $V_{IN}$ = 5.5 V or GND		10	μΑ	
$\Delta I_{CC}$	Increase in I <sub>CC</sub> per Input	$2.3 \le V_{CC} \le 3.6 \text{ V}; \text{ V}_{IH} = V_{CC} - 0.6 \text{ V}$		500	μA	

2. These values of  $V_{I}$  are used to test DC electrical characteristics only.

# MC74LCX125

#### AC CHARACTERISTICS ( $t_R = t_F = 2.5 \text{ ns}; R_L = 500 \Omega$ )

						nits			
					T <sub>A</sub> = -40°C	C to +85°C			
			V <sub>CC</sub> = 3.3	8 V ± 0.3 V	V <sub>CC</sub> =	2.7 V	V <sub>CC</sub> = 2.5	V $\pm$ 0.2 V	
			C <sub>L</sub> =	50 pF	C <sub>L</sub> =	50 pF	C <sub>L</sub> = 5	30 pF	
Symbol	Parameter	Waveform	Min	Max	Min	Max	Min	Max	Units
t <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PZH</sub> t <sub>PZL</sub>	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 <sub>PHZ</sub> t <sub>PLZ</sub>	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 <sub>OSHL</sub> t <sub>OSLH</sub>	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<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.

#### DYNAMIC SWITCHING CHARACTERISTICS

			Т	A = +25°0	2	
Symbol	Characteristic	Condition	Min	Тур	Max	Units
V <sub>OLP</sub>	Dynamic LOW Peak Voltage (Note 4)			0.8 0.6		V
V <sub>OLV</sub>	Dynamic LOW Valley Voltage (Note 4)	$ \begin{array}{l} 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

 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	Units
C <sub>IN</sub>	Input Capacitance	$V_{CC}$ = 3.3 V, $V_{I}$ = 0 V or $V_{CC}$	7	pF
C <sub>OUT</sub>	Output Capacitance	$V_{CC}$ = 3.3 V, $V_{I}$ = 0 V or $V_{CC}$	8	pF
C <sub>PD</sub>	Power Dissipation Capacitance	10 MHz, $V_{CC}$ = 3.3 V, $V_{I}$ = 0 V or $V_{CC}$	25	pF

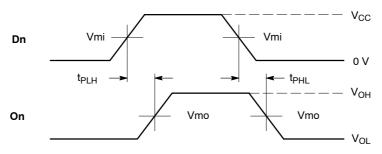
#### **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
MC74LCX125DG	SOIC-14 (Pb-Free)	55 Units / Rail
MC74LCX125DR2G	SOIC-14 (Pb-Free)	2500 Tape & Reel
MC74LCX125DTG	TSSOP-14 (Pb-Free)	96 Units / Rail
MC74LCX125DTR2G	TSSOP-14 (Pb-Free)	2500 Tape & Reel
NLVLCX125DTR2G	TSSOP-14* (Pb-Free)	2500 Tape & Reel

+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.

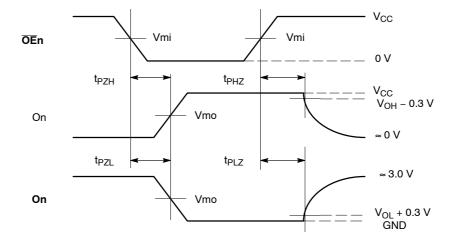
\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified.

# **MC74LCX125**



WAVEFORM 1 - PROPAGATION DELAYS

 $t_{\rm B} = t_{\rm F} = 2.5$  ns, 10% to 90%; f = 1 MHz;  $t_{\rm W} = 500$  ns

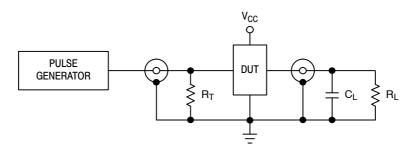


WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES

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

	V <sub>CC</sub>				
Symbol	3.3 V ± 0.3 V	2.7 V	2.5 V ± 0.2 V		
Vmi	1.5 V	1.5 V	V <sub>CC</sub> /2		
Vmo	1.5 V	1.5 V	V <sub>CC</sub> /2		



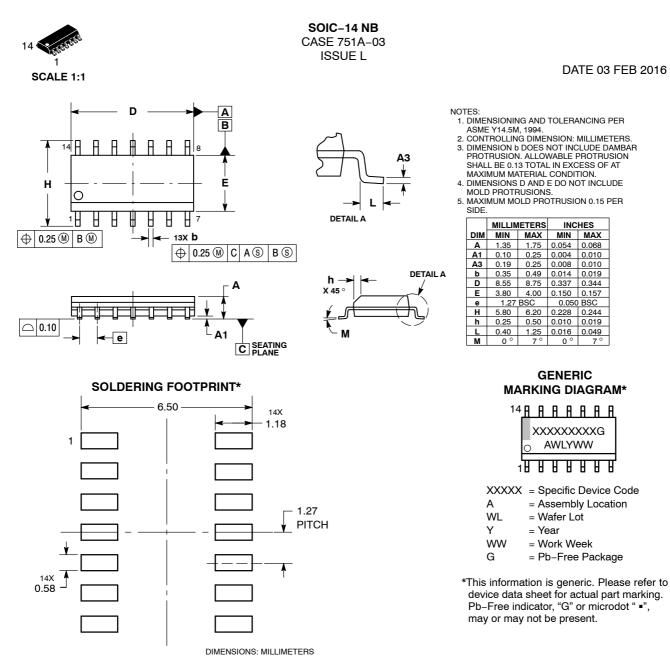


 $C_L$  = 50 pF at V\_{CC} = 3.3  $\pm 0.3$  V or equivalent (includes jig and probe capacitance)  $C_L$  = 30 pF at  $V_{CC}$  = 2.5 ±0.2 V or equivalent (includes jig and probe capacitance)  $R_L$  =  $R_1$  = 500  $\Omega$  or equivalent

 $R_T = Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )

#### Figure 4. Test Circuit





\*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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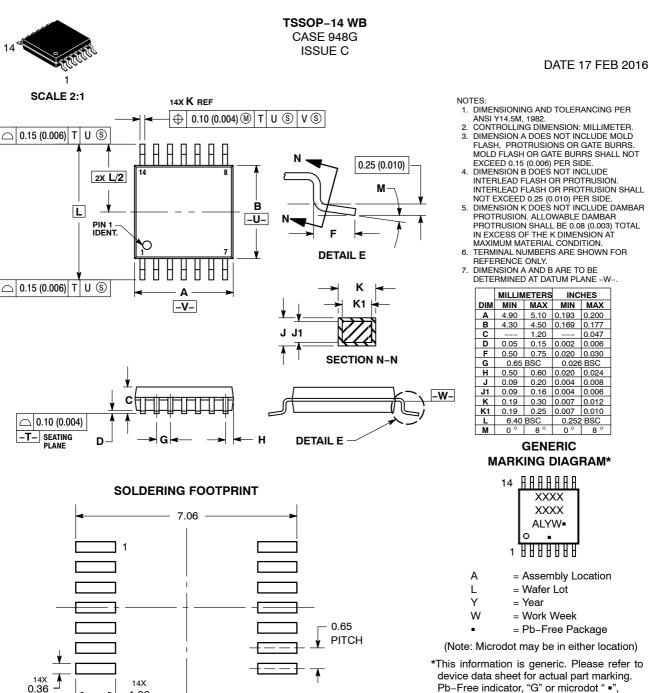
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STYLE 1: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. NO CONNECTION 5. ANODE/CATHODE 6. NO CONNECTION 7. ANODE/CATHODE 8. ANODE/CATHODE 9. ANODE/CATHODE 10. NO CONNECTION 11. ANODE/CATHODE 12. ANODE/CATHODE 13. NO CONNECTION 14. COMMON ANODE	STYLE 2: CANCELLED	STYLE 3: PIN 1. NO CONNECTION 2. ANODE 3. ANODE 4. NO CONNECTION 5. ANODE 6. NO CONNECTION 7. ANODE 9. ANODE 10. NO CONNECTION 11. ANODE 12. ANODE 13. NO CONNECTION 14. COMMON CATHODE	STYLE 4: PIN 1. NO CONNECTION 2. CATHODE 3. CATHODE 4. NO CONNECTION 5. CATHODE 6. NO CONNECTION 7. CATHODE 8. CATHODE 9. CATHODE 10. NO CONNECTION 11. CATHODE 12. CATHODE 13. NO CONNECTION 14. COMMON ANODE
STYLE 5: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. ANODE/CATHODE 5. ANODE/CATHODE 6. NO CONNECTION 7. COMMON ANODE 8. COMMON CATHODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. ANODE/CATHODE 12. ANODE/CATHODE 13. NO CONNECTION 14. COMMON ANODE	STYLE 6: PIN 1. CATHODE 2. CATHODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE 7. CATHODE 8. ANODE 10. ANODE 10. ANODE 11. ANODE 13. ANODE 14. ANODE	STYLE 7: PIN 1. ANODE/CATHODE 2. COMMON ANODE 3. COMMON CATHODE 4. ANODE/CATHODE 5. ANODE/CATHODE 6. ANODE/CATHODE 7. ANODE/CATHODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. COMMON CATHODE 12. COMMON CATHODE 13. ANODE/CATHODE 14. ANODE/CATHODE	STYLE 8: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. NO CONNECTION 5. ANODE/CATHODE 6. ANODE/CATHODE 7. COMMON ANODE 8. COMMON ANODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. NO CONNECTION 12. ANODE/CATHODE 13. ANODE/CATHODE 14. COMMON CATHODE

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