

FEATURES/BENEFITS

- 5V tolerant inputs and outputs
- 25Ω series resistor for low switching noise
- 10μA I_{CCQ} quiescent power supply current
- Hot insertable
- 2.0V-3.6V V_{CC} supply operation
- ±12mA balanced output drive
- $t_{PD} = 4.5ns$
- Input hysteresis for noise immunity
- Meets or exceeds JEDEC Standard 36 specifications
- Multiple power and ground pins for low noise
- Operating temperature range:
 -40°C to 85°C
- Latch-up performance exceeds 500mA
- ESD performance:
 Human body model > 2000V
 Machine model > 200V
- Packages available:
 48-pin TSSOP
 48-pin SSOP

DESCRIPTION

The QS74LCX162244 is a 16-bit bus interface buffer with three-state outputs that is ideal for driving address and data buses. Output enables are used to enable or disable Y ports by placing them in a high impedance condition. This device can be used as four 4-bit buffers, two 8-bit buffers, or a single 16-bit buffer. The 3.3V LCXPlus family features low power, low switching noise, and fast switching speeds for low power portable applications as well as high-end, advanced workstation applications. 5V tolerant inputs and outputs allow this LCXPlus product to be used in mixed 5V and 3.3V applications. The QS74LCX162244 with integrated output resistor is ideally suited for low noise environments where reduced output overshoot and undershoot are critical requirements. Easy board layout is facilitated by the use of flow-through pinouts and byte enable controls to provide architectural flexibility for systems designers. To accommodate hot-plug or live insertion applications, this product is designed not to load an active bus when V_{CC} is removed.

Figure 1. Functional Block Diagram

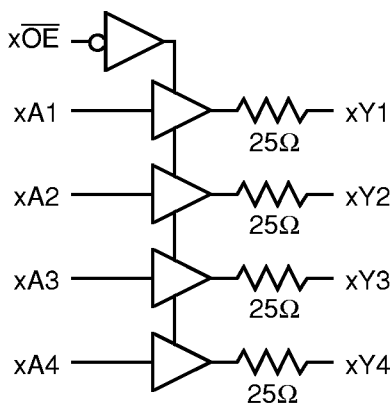


Figure 2. Pin Configuration
(All Pins Top View)
SSOP, TSSOP

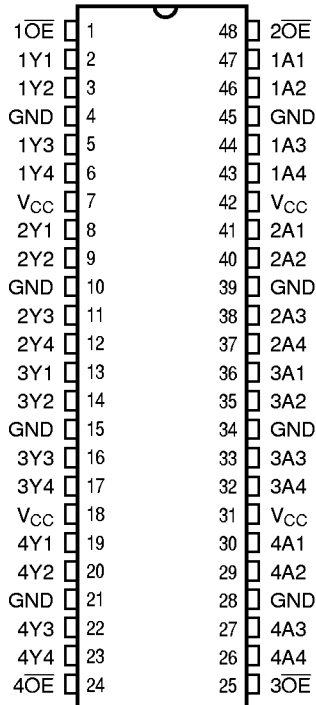


Table 1. Pin Description

Name	Description
\overline{xOE}	3-State Output Enable Inputs
xAx	Data Inputs
xYx	3-State Outputs

Table 2. Function Table

Inputs		Outputs
\overline{xOE}	xAx	xYx
L	L	L
L	H	H
H	X	Hi-Z

Table 3. Capacitance

Symbol	Pins	Typ	Unit	Conditions
C_{IN}	Input Capacitance	7.0	pF	$V_{IN} = 0V, V_{OUT} = 0V, f = 1MHz$
$C_{I/O}$	I/O Capacitance	8.0	pF	$V_{IN} = 0V, V_{OUT} = 0V, f = 1MHz$
C_{PD}	Power Dissipation Capacitance	20	pF	$V_{CC} = 3.3V, V_{IN} = 0$ or V_{CC} $f = 10MHz$

Note: Capacitance is characterized but not production tested.

Table 4. Absolute Maximum Ratings

Supply Voltage to Ground	-0.5V to 7.0V
DC Output Voltage V_{OUT}	
Outputs HIGH-Z	-0.5V to 7.0V
Outputs Active	-0.5V to $V_{CC} + 0.5V$
DC Input Voltage V_{IN}	-0.5V to 7.0V
DC Input Diode Current with $V_{IN} < 0$	-50mA
DC Output Diode Current	
$V_O < 0$	-50mA
$V_O > V_{CC}$	50mA
DC Output Source/Sink Current (I_{OH}/I_{OL})	$\pm 50mA$
DC Supply Current per Supply Pin	$\pm 100mA$
DC Ground Current per Ground Pin	$\pm 100mA$
T_{STG} Storage Temperature	-65°C to 150°C

Note: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to this device resulting in functional or reliability type failures.

Table 5. Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit	
V _{CC}	Supply Voltage, Operating	2.0	3.6	V	
	Supply Voltage, Data Retention Only	1.5	3.6		
V _{IN}	Input Voltage	0	5.5	V	
V _{OUT}	Output Voltage in Active State	0	V _{CC}	V	
V _{OUT}	Output Voltage in "OFF" State	0	5.5	V	
I _{OH} /I _{OL}	Output Current	V _{CC} = 3.0 – 3.6V	—	±12	mA
		V _{CC} = 2.7V		±6	
Δt/Δv	Input Transition Slew Rate	—	10	ns/V	
T _A	Operating Free Air Temperature	-40	85	°C	

Table 6. DC Electrical Characteristics Over Operating Range

Industrial Temperature Range, T_A = -40°C to 85°C

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Unit
V _{IH}	Input HIGH Voltage	Logic HIGH for All Inputs	2.0	—	—	V
V _{IL}	Input LOW Voltage	Logic LOW for All Inputs	—	—	0.8	V
V _{OH}	Output HIGH Voltage	V _{CC} = 2.7V, I _{OH} = -100μA V _{CC} = 3.0V, I _{OH} = -12mA V _{CC} = 3.0V, I _{OH} = -18mA	V _{CC} -0.2 2.4 2.2	— — —	— — —	V
V _{OL}	Output LOW Voltage	V _{CC} = 2.7V, I _{OL} = 100μA V _{CC} = 3.0V, I _{OL} = 12mA V _{CC} = 3.0V, I _{OL} = 18mA	— — —	— — —	0.2 0.55 0.8	V
R _{OUT}	Output Resistance	V _{CC} = 3.0V, I _{OL} = 12mA	—	28	—	Ω
ΔV _T	Input Hysteresis ⁽³⁾	V _{TLH} - V _{THL} for All Inputs	—	150	—	mV
I _I	Input Leakage Current	V _I = 0V, V _I = 5.5V, V _{CC} = 3.6V	—	—	±1.0	μA
I _{OZ}	High-Z I/O Leakage	V _O = 0V, V _O = 5.5V V _I = V _{IH} or V _{IL} , V _{CC} = 3.6V	—	—	±1.0	μA
I _{OS}	Short Circuit Current ^(3,4)	V _{CC} = 3.6V, V _O = GND	-60	—	-200	mA
I _{OR}	Current Drive	V _{CC} = 3.6V, V _{OUT} = 2.0V	40	—	—	mA
I _{OFF}	Power Off Leakage	V _{CC} = 0V, V _I or V _O = 5.5V	—	—	10	μA
V _{IK}	Input Clamp Voltage	V _{CC} = 2.7V, I _{IN} = -18mA	—	-0.7	-1.2	V

Notes:

1. For conditions shown as Min. or Max. use appropriate value specified under Recommended Operating Conditions for the applicable device type.
2. Typical values are at V_{CC} = 3.3V, and T_A = 25°C.
3. These parameters are guaranteed by characterization, but not production tested.
4. Not more than one output should be tested at one time. Duration of test should not exceed one second.

Table 7. Power Supply Characteristics

Symbol	Parameter	Test Conditions ⁽¹⁾	Typ ⁽²⁾	Max	Unit	
I_{CC}	Quiescent Power Supply Current	$V_{CC} = 3.6V$, Freq = 0 $V_{IN} = GND$ or V_{CC}	0.1	10	μA	
ΔI_{CC}	Supply Current per Input @ TTL HIGH	$V_{CC} = 3.6V$, $V_{IN} = V_{CC}-0.6V^{(3)}$	2.0	30	μA	
I_{CCD}	Supply Current per Input per MHz ⁽⁴⁾	$V_{CC} = 3.6V$, Outputs Open One Bit Toggling @ 50% Duty Cycle $x\overline{OE} = GND$	50	75	$\mu A/MHz$	
I_C	Total Power Supply Current ⁽⁶⁾	$V_{CC} = 3.6V$, Outputs Open One Bit Toggling @ 50% Duty Cycle $x\overline{OE} = GND$, $f_1 = 10MHz$	$V_{IN} = V_{CC}-0.6V$ $V_{IN} = GND$	0.5 ⁽⁵⁾	0.8 ⁽⁵⁾	mA
		$V_{CC} = 3.6V$, Outputs Open Sixteen Bits Toggling @ 50% Duty Cycle $x\overline{OE} = GND$, $f_1 = 2.5MHz$	$V_{IN} = V_{CC}-0.6V$ $V_{IN} = GND$	2.0 ⁽⁵⁾	3.3 ⁽⁵⁾	

Notes:

- For conditions shown as Min. or Max., use the appropriate values specified under Recommended Operating Conditions for applicable device type.
- Typical values are at $V_{CC} = 3.3V$, 25°C ambient.
- Per TTL driven input. All other inputs at V_{CC} or GND.
- This parameter is not directly testable, but is derived for use in total power supply calculations.
- Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed by design but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CCQ} + \Delta I_{CC} D_H N_T + I_{CCD} f N_O$
 $I_{CCQ} =$ Quiescent Current (I_{CCL} , I_{CCH} , and I_{CCZ}).
 $\Delta I_{CC} =$ Power Supply Current for a TTL-High Input ($V_{IN} = V_{CC}-0.6V$).
 $D_H =$ Duty Cycle for TTL High Inputs.
 $N_T =$ Number of TTL High Inputs.
 $I_{CCD} =$ Dynamic Current Caused by an Input Transition Pair (HLH or LHL).
 $f =$ Average Switching Frequency per Output.
 $N_O =$ Number of Outputs Switching.

Table 8. Dynamic Switching Characteristics⁽¹⁾

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25^\circ C$	
				Typical	Units
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	$C_L = 30pF$, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	0.8	V
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	$C_L = 30pF$, $V_{IH} = 3.3V$, $V_{IL} = 0V$	3.3	0.8	V

Note:

- Characterized but not production tested.

Table 9. Switching Characteristics Over Operating Range

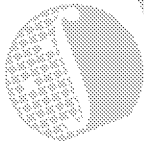
Industrial Temperature Range, $T_A = -40^{\circ}\text{C}$ to 85°C .

$C_{\text{LOAD}} = 30\text{pF}$, $R_{\text{LOAD}} = 500\Omega$ unless otherwise noted.

Symbol	Description ⁽¹⁾	$V_{\text{CC}} = 3.3 \pm 0.3\text{V}$		$V_{\text{CC}} = 2.7\text{V}^{(2)}$		Unit
		Min	Max	Min	Max	
t_{PHL} t_{PLH}	Propagation Delay xAx to xYx	1.5	4.5	1.5	5.2	ns
t_{PZH} t_{PZL}	Output Enable Time x $\overline{\text{OE}}$ to xYx	1.5	5.5	1.5	6.3	ns
t_{PHZ} t_{PLZ}	Output Disable Time ⁽²⁾ x $\overline{\text{OE}}$ to xYx	1.5	5.4	1.5	5.7	ns
$t_{\text{SK(O)}}$	Output Skew ⁽³⁾	—	0.5	—	—	ns

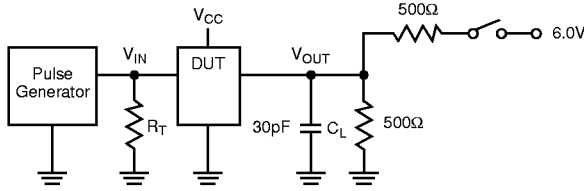
Notes:

1. Minimums guaranteed but not tested. See Test Circuit and Waveforms.
2. Guaranteed by characterization.
3. Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by characterization but not production tested.

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TEST CIRCUIT AND WAVEFORMS

Figure 3. Test Circuit



SWITCH POSITION	
Test	Switch
Open Drain	6V
Disable LOW	
Enable LOW	
Disable HIGH	GND
Enable HIGH	
All Other Inputs	Open

DEFINITIONS:
 C_L = Load capacitance: includes jig and probe capacitance.
 R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

Figure 4. Setup, Hold, and Release Timing

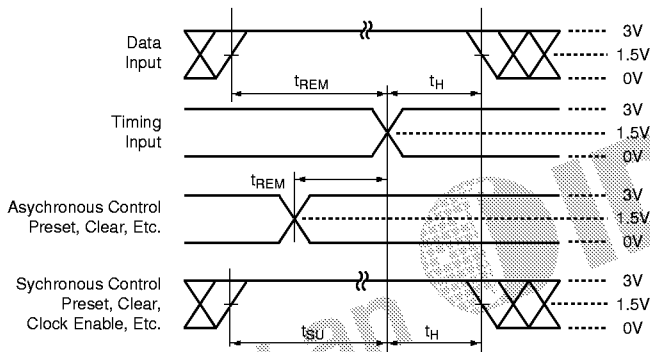


Figure 6. Pulse Width

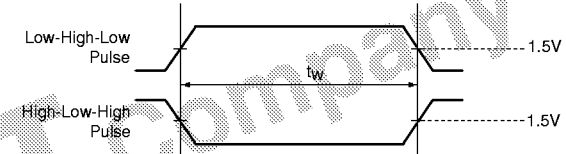


Figure 5. Enable and Disable Timing

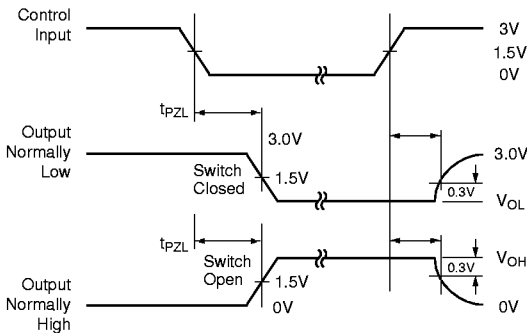
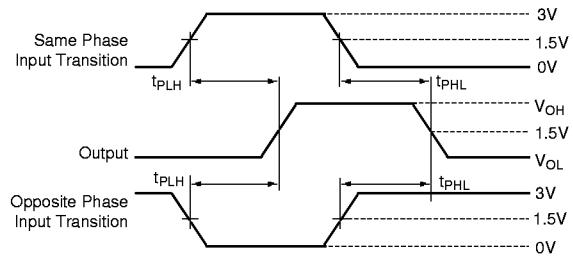


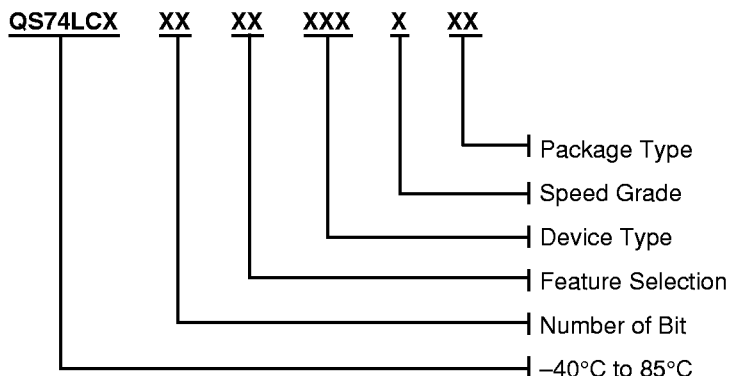
Figure 7. Propagation Delay



Notes:

1. Input Control Enable = LOW and Input Control Disable = HIGH.
2. Pulse Generator for All Pulses: Rate \leq 1.0MHz;
 $Z_{OUT} \leq 50\Omega$; $t_F, t_R \leq 2.5ns$.

ORDERING INFORMATION



Device Type:

244

Speed Grades:

Blank – Standard

Package Type:

PV – SSOP, 300 mil

PA – TSSOP, 240 mil

Feature Selection:

2 – Output Resistor

Number of Bit:

16 – 16-Bit

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