



**Truth Tables**

Inputs		Outputs
$\overline{OE}_1$	I <sub>0-3</sub>	O <sub>0-3</sub>
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_3$	I <sub>8-11</sub>	O <sub>8-11</sub>
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_2$	I <sub>4-7</sub>	O <sub>4-7</sub>
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_4$	I <sub>12-15</sub>	O <sub>12-15</sub>
L	L	L
L	H	H
H	X	Z

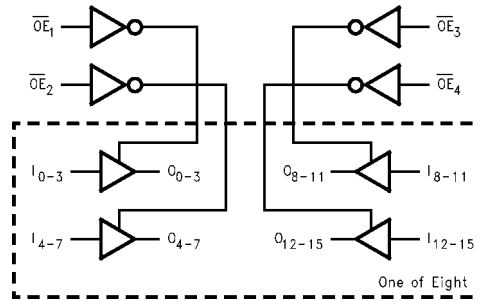
H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 Z = High Impedance

**Functional Description**

The LCX16244 contains sixteen non-inverting buffers with 3-STATE standard outputs. The device is nibble (4 bits) controlled with each nibble functioning identically, but independent of the other. The control pins can be shorted together to obtain full 16-bit operation. The 3-STATE out-

puts are controlled by an Output Enable ( $\overline{OE}_n$ ) input for each nibble. When  $\overline{OE}_n$  is LOW, the outputs are in 2-state mode. When  $\overline{OE}_n$  is HIGH, the outputs are in the high impedance mode, but this does not interfere with entering new data into the inputs.

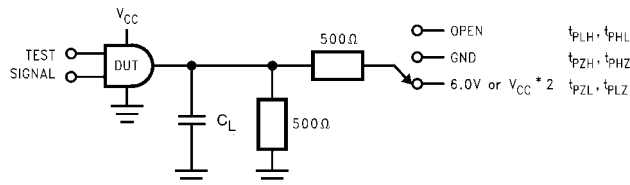
**Logic Diagram**



Absolute Maximum Ratings (Note 2)						
Symbol	Parameter	Value	Conditions	Units		
$V_{CC}$	Supply Voltage	-0.5 to +7.0		V		
$V_I$	DC Input Voltage	-0.5 to +7.0		V		
$V_O$	DC Output Voltage	-0.5 to +7.0 -0.5 to $V_{CC} + 0.5$	Output in 3-STATE Output in HIGH or LOW State (Note 3)	V		
$I_{IK}$	DC Input Diode Current	-50	$V_I < GND$	mA		
$I_{OK}$	DC Output Diode Current	-50 +50	$V_O < GND$ $V_O > V_{CC}$	mA		
$I_O$	DC Output Source/Sink Current	$\pm 50$		mA		
$I_{CC}$	DC Supply Current per Supply Pin	$\pm 100$		mA		
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 100$		mA		
$T_{STG}$	Storage Temperature	-65 to +150		°C		
Recommended Operating Conditions (Note 4)						
Symbol	Parameter	Min	Max	Units		
$V_{CC}$	Supply Voltage	Operating	2.0	3.6	V	
		Data Retention	1.5	3.6		
$V_I$	Input Voltage	0	5.5	V		
$V_O$	Output Voltage	HIGH or LOW State	0	$V_{CC}$	V	
		3-STATE	0	5.5		
$I_{OH}/I_{OL}$	Output Current	$V_{CC} = 3.0V - 3.6V$		$\pm 24$	mA	
		$V_{CC} = 2.7V - 3.0V$		$\pm 12$		
		$V_{CC} = 2.3V - 2.7V$		$\pm 8$		
$T_A$	Free-Air Operating Temperature	-40	85	°C		
$\Delta t/\Delta V$	Input Edge Rate, $V_{IN} = 0.8V - 2.0V$ , $V_{CC} = 3.0V$	0	10	ns/V		
<p><b>Note 2:</b> The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.</p> <p><b>Note 3:</b> <math>I_O</math> Absolute Maximum Rating must be observed.</p> <p><b>Note 4:</b> Unused inputs must be held HIGH or LOW. They may not float.</p>						
DC Electrical Characteristics						
Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = -40^\circ C \text{ to } +85^\circ C$		Units
				Min	Max	
$V_{IH}$	HIGH Level Input Voltage		2.3 - 2.7	1.7		V
			2.7 - 3.6	2.0		
$V_{IL}$	LOW Level Input Voltage		2.3 - 2.7		0.7	V
			2.7 - 3.6		0.8	
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$	2.3 - 3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -8 \text{ mA}$	2.3	1.8		
		$I_{OH} = -12 \text{ mA}$	2.7	2.2		
		$I_{OH} = -18 \text{ mA}$	3.0	2.4		
		$I_{OH} = -24 \text{ mA}$	3.0	2.2		
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu A$	2.3 - 3.6		0.2	V
		$I_{OL} = 8 \text{ mA}$	2.3		0.6	
		$I_{OL} = 12 \text{ mA}$	2.7		0.4	
		$I_{OL} = 16 \text{ mA}$	3.0		0.4	
		$I_{OL} = 24 \text{ mA}$	3.0		0.55	
$I_I$	Input Leakage Current	$0 \leq V_I \leq 5.5V$	2.3 - 3.6		$\pm 5.0$	$\mu A$
$I_{OZ}$	3-STATE Output Leakage	$0 \leq V_O \leq 5.5V$ $V_I = V_{IH} \text{ or } V_{IL}$	2.3 - 3.6		$\pm 5.0$	$\mu A$
$I_{OFF}$	Power-Off Leakage Current	$V_I \text{ or } V_O = 5.5V$	0		10	$\mu A$

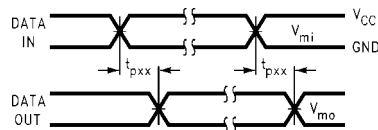
DC Electrical Characteristics (Continued)								
Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C		Units		
				Min	Max			
I <sub>CC</sub>	Quiescent Supply Current	V <sub>I</sub> = V <sub>CC</sub> or GND	2.3 – 3.6		20	μA		
		3.6V ≤ V <sub>I</sub> , V <sub>O</sub> ≤ 5.5V (Note 5)	2.3 – 3.6		±20			
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	V <sub>IH</sub> = V <sub>CC</sub> - 0.6V	2.3 – 3.6		500	μA		
<b>Note 5:</b> Outputs disabled or 3-STATE only.								
AC Electrical Characteristics								
Symbol	Parameter	T <sub>A</sub> = -40°C to +85°C, R <sub>L</sub> = 500 Ω						Units
		V <sub>CC</sub> = 3.3V ± 0.3V		V <sub>CC</sub> = 2.7V		V <sub>CC</sub> = 2.5V ± 0.2V		
		C <sub>L</sub> = 50 pF		C <sub>L</sub> = 50 pF		C <sub>L</sub> = 30 pF		
		Min	Max	Min	Max	Min	Max	
t <sub>PHL</sub>	Propagation Delay	1.5	4.5	1.5	5.2	1.5	5.4	ns
t <sub>PLH</sub>	Data to Output	1.5	4.5	1.5	5.2	1.5	5.4	
t <sub>PZL</sub>	Output Enable Time	1.5	5.5	1.5	6.3	1.5	7.2	ns
t <sub>PZH</sub>		1.5	5.5	1.5	6.3	1.5	7.2	
t <sub>PLZ</sub>	Output Disable Time	1.5	5.4	1.5	5.7	1.5	6.5	ns
t <sub>PHZ</sub>		1.5	5.4	1.5	5.7	1.5	6.5	
t <sub>OSSL</sub>	Output to Output Skew (Note 6)		1.0					ns
t <sub>OSLH</sub>			1.0					
<b>Note 6:</b> 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> ). Parameter guaranteed by design.								
Dynamic Switching Characteristics								
Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C	Units			
				Typical				
V <sub>OLP</sub>	Quiet Output Dynamic Peak V <sub>OL</sub>	C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V	3.3	0.8	V			
		C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V	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> = 3.3V, V <sub>IL</sub> = 0V	3.3	-0.8	V			
		C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V	2.5	-0.6				
Capacitance								
Symbol	Parameter	Conditions	Typical	Units				
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = Open, V <sub>I</sub> = 0V or V <sub>CC</sub>	7	pF				
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub>	8	pF				
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10 MHz	20	pF				

**AC LOADING and WAVEFORMS** Generic for LCX Family

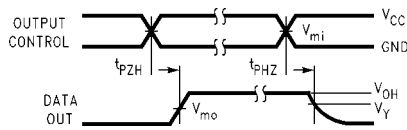


**FIGURE 1. AC Test Circuit ( $C_L$  includes probe and jig capacitance)**

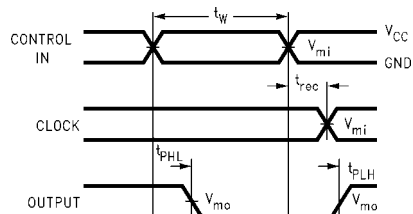
Test	Switch
$t_{PLH}, t_{PHL}$	Open
$t_{PZL}, t_{PLZ}$	6V at $V_{CC} = 3.3 \pm 0.3V$ $V_{CC} \times 2$ at $V_{CC} = 2.5 \pm 0.2V$
$t_{PZH}, t_{PHZ}$	GND



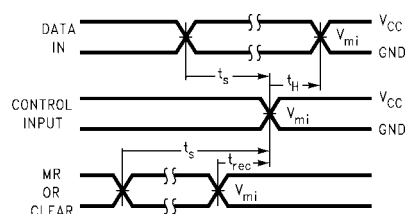
**Waveform for Inverting and Non-Inverting Functions**



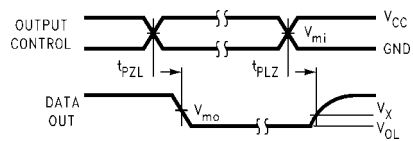
**3-STATE Output High Enable and Disable Times for Logic**



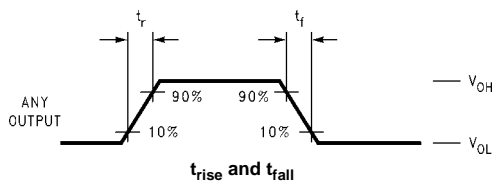
**Propagation Delay, Pulse Width and  $t_{rec}$  Waveforms**



**Setup Time, Hold Time and Recovery Time for Logic**



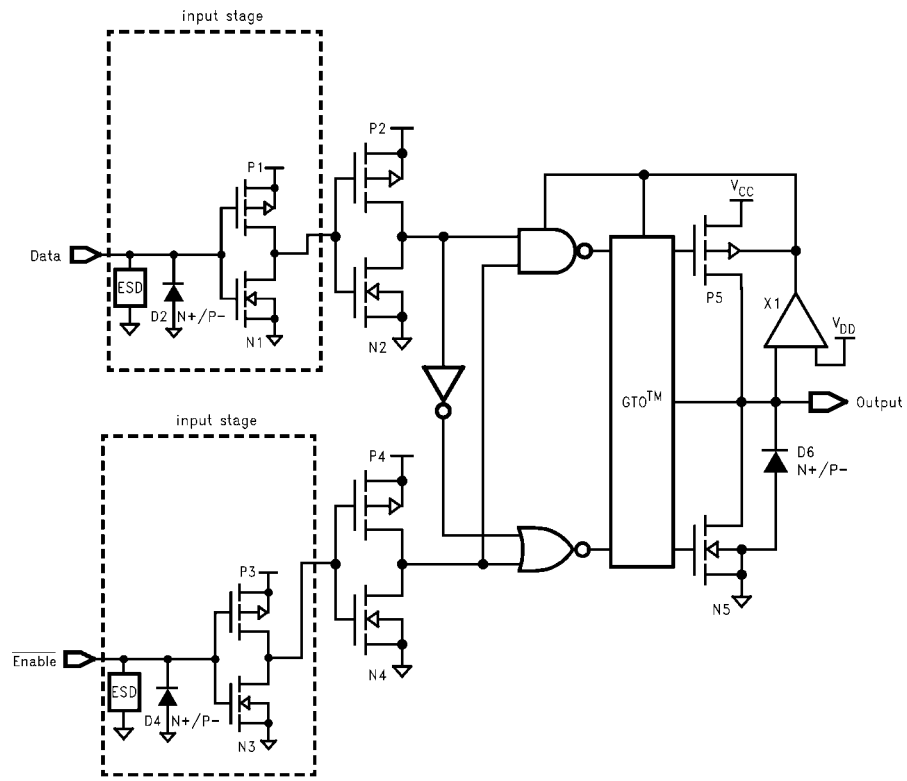
**3-STATE Output Low Enable and Disable Times for Logic**



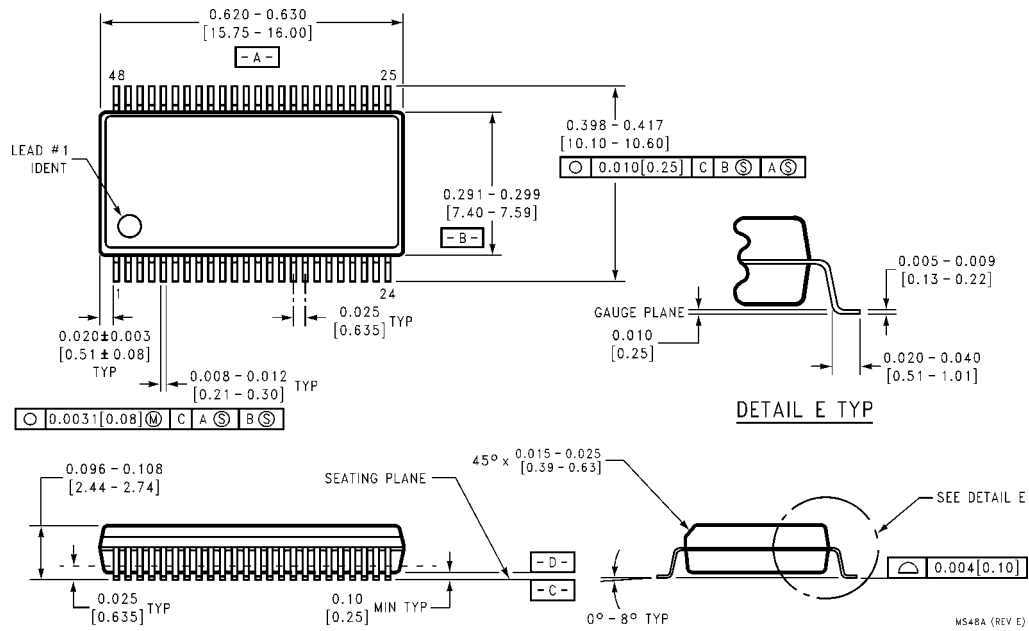
**FIGURE 2. Waveforms**  
(Input Characteristics;  $f = 1MHz, t_R = t_F = 3ns$ )

Symbol	$V_{CC}$		
	$3.3V \pm 0.3V$	2.7V	$2.5V \pm 0.2V$
$V_{mi}$	1.5V	1.5V	$V_{CC}/2$
$V_{mo}$	1.5V	1.5V	$V_{CC}/2$
$V_X$	$V_{OL} + 0.3V$	$V_{OL} + 0.3V$	$V_{OL} + 0.15V$
$V_Y$	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$	$V_{OH} - 0.15V$

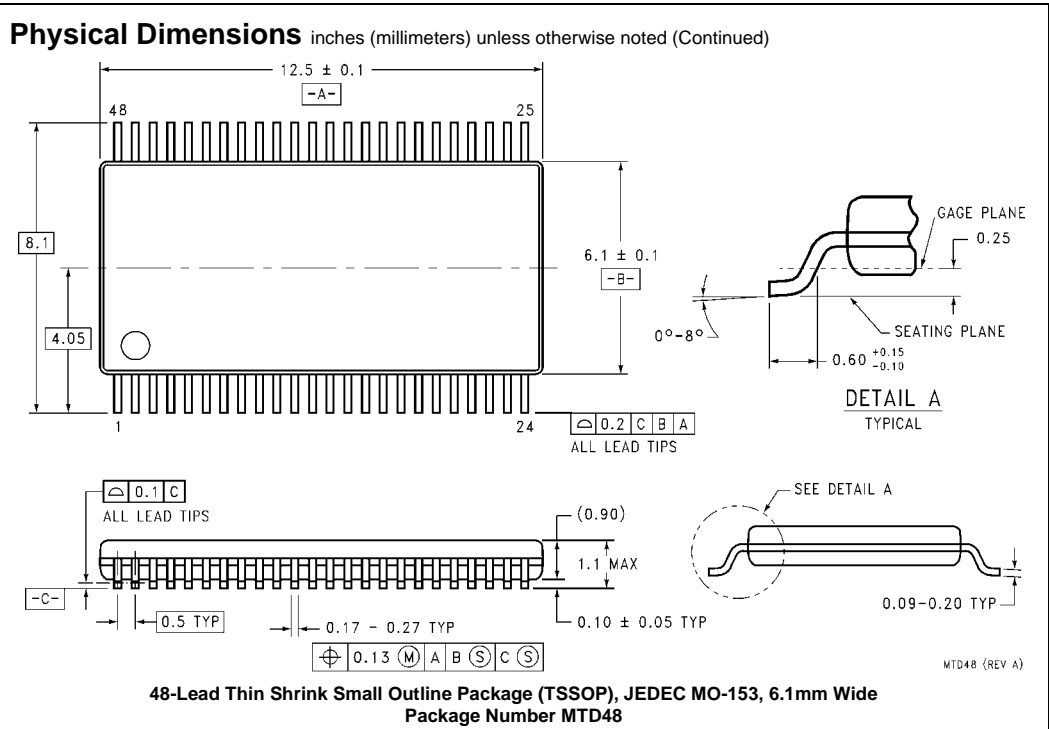
**Schematic Diagram** Generic for LCX Family



**Physical Dimensions** inches (millimeters) unless otherwise noted



**48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide  
Package Number MS48A**



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