FAIRCHILD

SEMICONDUCTOR ™

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74LCX16245
Low Voltage 16-Bit Bidirectional Transceiver with 5V Tolerant Inputs and Outputs

General Description

The LCX16245 contains sixteen non-inverting bidirectional buffers with 3-STATE outputs and is intended for bus oriented applications. The device is designed for low voltage (2.5V or 3.3V) V_{CC} applications with capability of interfacing to a 5V signal environment. The device is byte controlled. Each byte has separate control inputs which could be shorted together for full 16-bit operation. The $T/\overline{R}$ inputs determine the direction of data flow through the device. The $\overline{OE}$ inputs disable both the A and B ports by placing them in a high impedance state.

The LCX16245 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

Features

- 5V tolerant inputs and outputs
- 2.3V–3.6V V_{CC} specifications provided
- 4.5 ns t_{PD} max (V_{CC} = 3.3V), 20 μA I_{CC} max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal (Note 1)
- ±24 mA output drive (V_{CC} = 3.0V)
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds 500 mA
- ESD performance:
    Human body model > 2000V
   Machine model > 200V

Note 1: To ensure the high-impedance state during power up or down, $\overline{OE}$ should be tied to V_{CC} through a pull-up resistor: the minimum value or the resistor is determined by the current-sourcing capability of the driver.

Ordering Code:

Order Number	Package Number	Package Description
74LCX16245MEA	MS48A	48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
74LCX16245MTD	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Logic Symbol
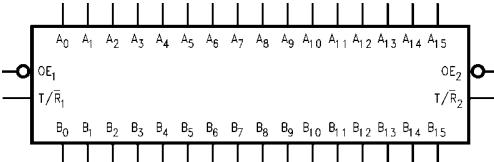
Pin Descriptions

| Pin Names	Description
$\overline{OE}_n$	Output Enable Input
$T/\overline{R}_n$	Transmit/Receive Input
A_0–A_{15}	Side A Inputs or 3-STATE Outputs
B_0–B_{15}	Side B Inputs or 3-STATE Outputs

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Connection Diagram

$T/\overline{R}_1$	1	48	$\overline{OE}_1$
B_0	2	47	A_0
B_1	3	46	A_1
GND	4	45	GND
B_2	5	44	A_2
B_3	6	43	A_3
V_{CC}	7	42	V_{CC}
B_4	8	41	A_4
B_5	9	40	A_5
GND	10	39	GND
B_6	11	38	A_6
B_7	12	37	A_7
B_8	13	36	A_8
B_9	14	35	A_9
GND	15	34	GND
B_{10}	16	33	A_{10}
B_{11}	17	32	A_{11}
V_{CC}	18	31	V_{CC}
B_{12}	19	30	A_{12}
B_{13}	20	29	A_{13}
GND	21	28	GND
B_{14}	22	27	A_{14}
B_{15}	23	26	A_{15}
$T/\overline{R}_2$	24	25	$\overline{OE}_2$
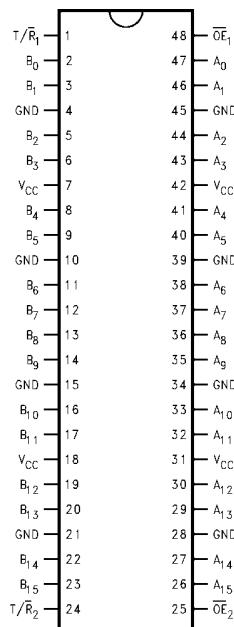
Truth Tables

Inputs		Outputs
$\overline{OE}_1$	$T/\overline{R}_1$	
L	L	Bus B_0–B_7 Data to Bus A_0–A_7
L	H	Bus A_0–A_7 Data to Bus B_0–B_7
H	X	HIGH Z State on A_0–A_7, B_0–B_7

Inputs		Outputs
$\overline{OE}_2$	$T/\overline{R}_2$	
L	L	Bus B_8–B_{15} Data to Bus A_8–A_{15}
L	H	Bus A_8–A_{15} Data to Bus B_8–B_{15}
H	X	HIGH Z State on A_8–A_{15}, B_8–B_{15}

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

Logic Diagram
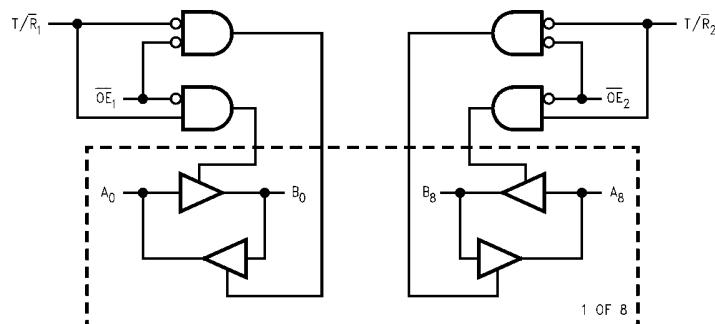
Absolute Maximum Ratings(Note 2)

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	Output in 3-STATE	V
		−0.5 to V_{CC} + 0.5	Output in HIGH or LOW State (Note 3)	
I_{IK}	DC Input Diode Current	−50	$V_I <$ GND	mA
I_{OK}	DC Output Diode Current	−50	$V_O <$ GND	mA
		+50	$V_O > V_{CC}$	
I_O	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	−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		±24	mA
		V_{CC} = 2.7V − 3.0V		±12	
		V_{CC} = 2.3V − 2.7V		±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

Note 2: 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.

Note 3: I_O Absolute Maximum Rating must be observed.

Note 4: Unused inputs or I/O's must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = -40°C$ to $+85°C$ Min	Max	Units
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 µA	2.3 – 3.6	V_{CC} − 0.2		V
		I_{OH} = −8 mA	2.3	1.8		
		I_{OH} = −12 mA	2.7	2.2		
		I_{OH} = −18 mA	3.0	2.4		
		I_{OH} = −24 mA	3.0	2.2		
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	2.3 – 3.6		0.2	V
		I_{OL} = 8mA	2.3		0.6	
		I_{OL} = 12 mA	2.7		0.4	
		I_{OL} = 16 mA	3.0		0.4	
		I_{OL} = 24 mA	3.0		0.55	
I_I	Input Leakage Current	0 ≤ V_I ≤ 5.5V	2.3 – 3.6		±5.0	µA
I_{OZ}	3-STATE I/O Leakage	0 ≤ V_O ≤ 5.5V, $V_I = V_{IH}$ or V_{IL}	2.3 – 3.6		±5.0	µA
I_{OFF}	Power-Off Leakage Current	V_I or V_O = 5.5V	0		10	µA

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V_CC (V)	T_A = −40°C to +85°C Min	T_A = −40°C to +85°C Max	Units
I_CC	Quiescent Supply Current	V_I = V_CC or GND	2.3–3.6		20	µA
		3.6V ≤ V_I, V_O ≤ 5.5V (Note 5)	2.3–3.6		±20	
ΔI_CC	Increase in I_CC per Input	V_IH = V_CC −0.6V	2.3–3.6		500	µA

Note 5: Outputs disabled or 3-STATE only.

AC Electrical Characteristics

Symbol	Parameter	T_A = −40°C to +85°C, R_L = 500Ω V_CC = 3.3V ± 0.3V C_L = 50 pF Min	T_A = −40°C to +85°C, R_L = 500Ω V_CC = 3.3V ± 0.3V C_L = 50 pF Max	V_CC = 2.7V C_L = 50 pF Min	V_CC = 2.7V C_L = 50 pF Max	V_CC = 2.5V ± 0.2V C_L = 30 pF Min	V_CC = 2.5V ± 0.2V C_L = 30 pF Max	Units
t_PHL	Propagation Delay	1.5	4.5	1.5	5.2	1.5	5.4	ns
t_PLH	A_n to B_n or B_n to A_n	1.5	4.5	1.5	5.2	1.5	5.4	
t_PZL	Output Enable Time	1.5	6.5	1.5	7.2	1.5	8.5	ns
t_PZH		1.5	6.5	1.5	7.2	1.5	8.5	
t_PLZ	Output Disable Time	1.5	6.4	1.5	6.9	1.5	7.7	ns
t_PHZ		1.5	6.4	1.5	6.9	1.5	7.7	
t_OSHL	Output to Output Skew (Note 6)		1.0					ns
t_OSLH			1.0					

Note 6: 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

Symbol	Parameter	Conditions	V_CC (V)	T_A = 25°C Typical	Units
V_OLP	Quiet Output Dynamic Peak V_OL	C_L = 50 pF, V_IH = 3.3V, V_IL = 0V	3.3	0.8	V
		C_L = 30 pF, V_IH = 2.5V, V_IL = 0V	2.5	0.6	
V_OLV	Quiet Output Dynamic Valley V_OL	C_L = 50 pF, V_IH = 3.3V, V_IL = 0V	3.3	−0.8	V
		C_L = 30 pF, V_IH = 2.5V, V_IL = 0V	2.5	−0.6	

Capacitance

| Symbol	Parameter	Conditions	Typical	Units
C_IN	Input Capacitance	V_CC = Open, V_I = 0V or V_CC	7	pF
C_I/O	Input/Output Capacitance	V_CC = 3.3V, V_I = 0V or V_CC	8	pF
C_PD	Power Dissipation Capacitance	V_CC = 3.3V, V_I = 0V or V_CC, f = 10 MHz	20	pF

AC LOADING and WAVEFORMS Generic for LCX Family
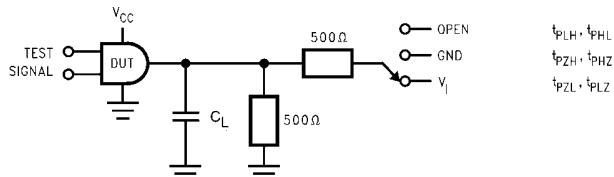
**FIGURE 1. AC Test Circuit (C$_L$ includes probe and jig capacitance)**

| Test	Switch
t$_{PLH}$, t$_{PHL}$	Open
t$_{PZL}$, t$_{PLZ}$	6V at V$_{CC}$ = 3.3 ± 0.3V V$_{CC}$ x 2 at V$_{CC}$ = 2.5 ± 0.2V
t$_{PZH}$, t$_{PHZ}$	GND
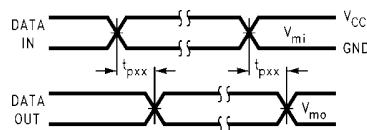
Waveform for Inverting and Non-Inverting Functions
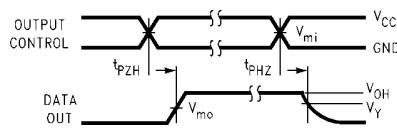

3-STATE Output High Enable and Disable Times for Logic
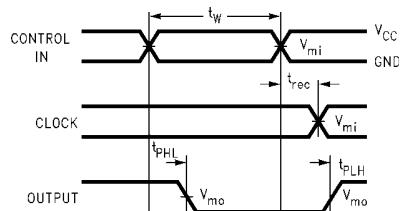

Propagation Delay. Pulse Width and t$_{rec}$ Waveforms
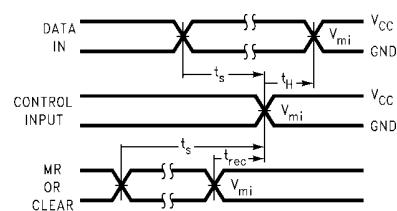
Setup Time, Hold Time and Recovery Time for Logic
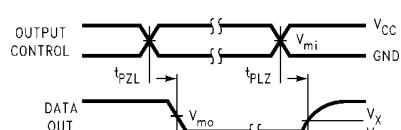
3-STATE Output Low Enable and Disable Times for Logic

t$_{rise}$ and t$_{fall}$
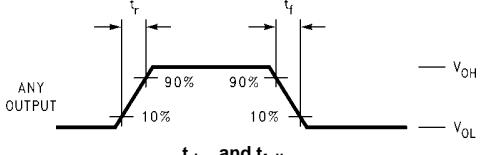
FIGURE 2. Waveforms
(Input Characteristics; f =1MHz, t$_R$ = t$_F$ = 3ns)

Symbol	V$_{CC}$		
	3.3V ± 0.3V	2.7V	2.5V ± 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
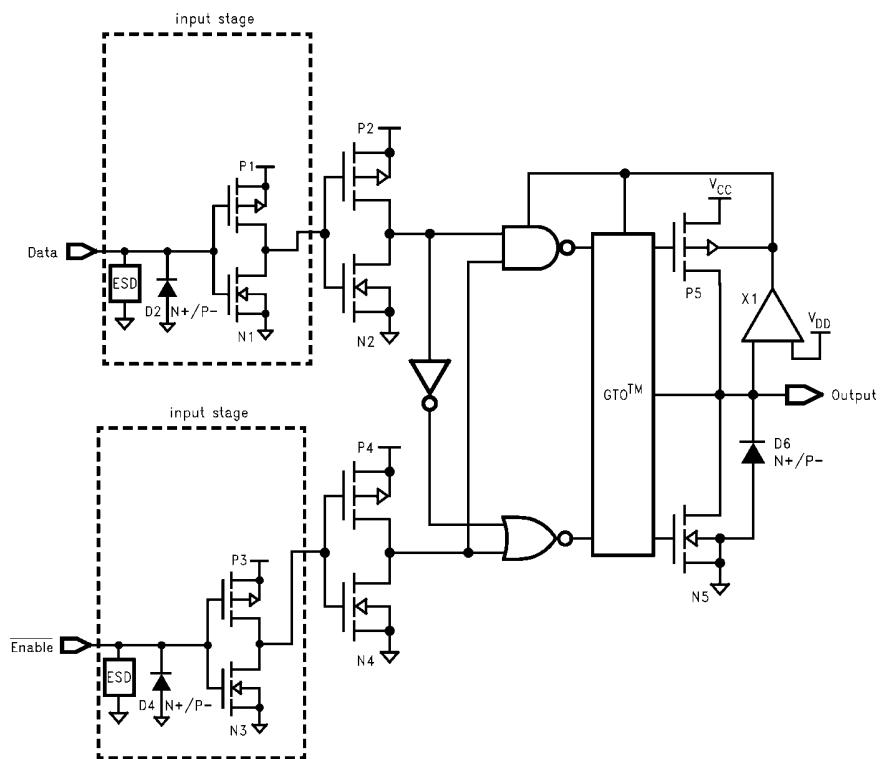
Physical Dimensions inches (millimeters) unless otherwise noted

0.620 – 0.630
[15.75 – 16.00]

– A –

48   25

LEAD #1
IDENT

0.398 – 0.417
[10.10 – 10.60]

○ 0.010[0.25] C B Ⓢ A Ⓢ

0.291 – 0.299
[7.40 – 7.59]

– B –

1   24

0.025
[0.635] TYP

0.020±0.003
[0.51 ± 0.08]
TYP

0.008 – 0.012
[0.21 – 0.30] TYP

○ 0.0031[0.08] Ⓜ C A Ⓢ B Ⓢ

GAUGE PLANE

0.005 – 0.009
[0.13 – 0.22]

0.010
[0.25]

0.020 – 0.040
[0.51 – 1.01]

DETAIL E TYP

0.096 – 0.108
[2.44 – 2.74]

SEATING PLANE

45° x 0.015 – 0.025
[0.39 – 0.63]

SEE DETAIL E

– D –
– C –

0.025
[0.635] TYP

0.10
[0.25] MIN TYP

0° – 8° TYP

△ 0.004[0.10]

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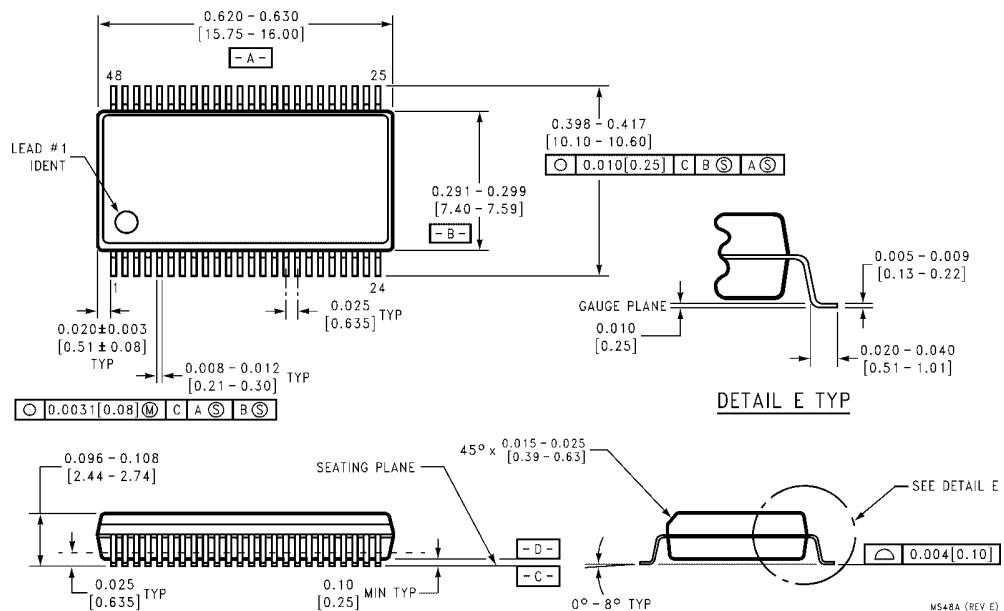
48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
Package Number MS48A

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

12.50±0.10
-A-

0.40 TYP

8.10

4.05

6.10±0.10
-B-

PIN #1 IDENT.

△ 0.2 C B A
ALL LEAD TIPS

4.60 9.20

2.30

0.30

0.50

LAND PATTERN RECOMMENDATION

△ 0.1 C
ALL LEAD TIPS

1.2 MAX

-C-

0.50

0.17-0.27

0.90 +0.15 -0.10

0.10±0.05

⊕ 0.13(M) A B(S) C(S)

DIMENSIONS ARE IN MILLIMETERS

SEE DETAIL A

0.09-0.20

12.00° TOP & BOTTOM

R0.16

R0.31

GAGE PLANE

1.25

0°-8°

0.60±0.10

1.00

SEATING PLANE

DETAIL A

NOTES:
A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATE 7/93.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTD48RevB1

**48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
Package Number MTD48**

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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