Low-Voltage CMOS 16-Bit Transceiver

With 5 V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

The MC74LCX16245 is a high performance, non–inverting 16–bit transceiver operating from a 2.3 to 3.6 V supply. The device is byte controlled. Each byte has separate Output Enable inputs which can be tied together for full 16–bit operation. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A $V_{\rm I}$ specification of 5.5 V allows MC74LCX16245 inputs to be safely driven from 5.0 V devices. The MC74LCX16245 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

The 4.5 ns maximum propagation delays support high performance applications. Current drive capability is 24 mA at both A and B ports. The Transmit/Receive ($T/\overline{R}n$) inputs determine the direction of data flow through the bidirectional transceiver. Transmit (active–HIGH) enables data from A ports to B ports; Receive (active–LOW) enables data from B to A ports. The Output Enable inputs (\overline{OEn}), when HIGH, disable both A and B ports by placing them in a HIGH Z condition.

Features

- Designed for 2.3 to 3.6 V V_{CC} Operation
- 4.5 ns Maximum t_{pd}
- 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 (20 μA)
 Substantially Reduces System Power Requirements

1

- Latchup Performance Exceeds 500 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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TSSOP-48 DT SUFFIX CASE 1201

MARKING DIAGRAM

LCX16245G AWLYYWW

A = Assembly Location

 WL
 = Wafer Lot

 YY
 = Year

 WW
 = Work Week

 G
 = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

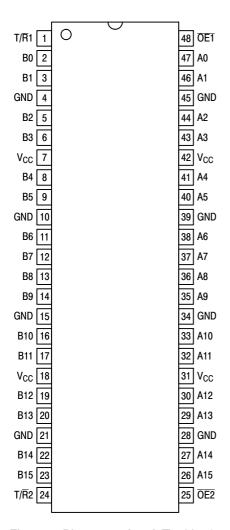


Figure 1. Pinout: 48-Lead (Top View)

Table 1. PIN NAMES

Pins	Function	
OEn	Output Enable Inputs	
T/Rn	Transmit/Receive Inputs	
A0 – A15	Side A Inputs or 3-State Outputs	
B0 – B15	Side B Inputs or 3-State Outputs	

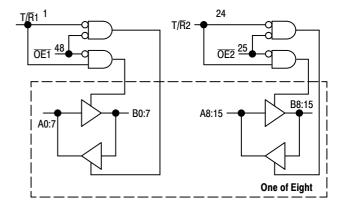


Figure 2. Logic Diagram

TRUTH TABLE

Inp	uts		Inp	uts	
OE1	T/R1	Outputs	OE2 T/R2		Outputs
L	L	Bus B0:7 Data to Bus A0:7	L	L	Bus B8:15 Data to Bus A8:15
L	Н	Bus A0:7 Data to Bus B0:7	L	Н	Bus A8:15 Data to Bus B8:15
Н	Х	High Z State on A0:7, B0:7	Н	Х	High Z State on A8:15, B8:15

H = High Voltage Level

L = Low Voltage Level

Z = High Impedance State

X = High or Low Voltage Level and Transitions Are Acceptable; for I_{CC} reasons, DO NOT FLOAT Inputs

ORDERING INFORMATION

Device	Package	Shipping [†]
MC74LCX16245DTG	TSSOP-48*	39 Units / Rail
M74LCX16245DTR2G	TSSOP-48*	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.

MAXIMUM RATINGS

Symbol	Parameter	Condition	Value	Units
V _{CC}	DC Supply Voltage		-0.5 to +7.0	V
VI	DC Input Voltage		$-0.5 \le V_1 \le +7.0$	V
Vo	DC Output Voltage	Output in 3–State	$-0.5 \le V_0 \le +7.0$	V
		Output in HIGH or LOW State. (Note 1)	$-0.5 \le V_O \le V_{CC} + 0.5$	V
I _{IK}	DC Input Diode Current	V _I < GND	-50	mA
I _{OK}	DC Output Diode Current	V _O < GND	-50	mA
		V _O > V _{CC}	+50	mA
Io	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 Range		-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	Тур	Max	Units
V _{CC}	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
Vo	Output Voltage (HIGH or LOW State) (3-State)	0		V _{CC} 5.5	V
I _{OH}	HIGH Level Output Current $V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$ $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$ $V_{CC} = 2.3 \text{ V} - 2.7 \text{ V}$			-24 -12 -8	mA
l _{OL}	LOW Level Output Current $V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$ $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$ $V_{CC} = 2.3 \text{ V} - 2.7 \text{ V}$			+24 +12 +8	mA
T _A	Operating Free–Air Temperature	-40		+85	°C
Δt/ΔV	Input Transition Rise or Fall Rate, V_{IN} from 0.8 V to 2.0 V, V_{CC} = 3.0 V	0		10	ns/V

^{*}This package is inherently Pb-Free.

^{1.} Io absolute maximum rating must be observed.

DC ELECTRICAL CHARACTERISTICS

				T _A = -40°C to +85°C		
Symbol	Characteristic	Condition	Min	Max	Units	
V_{IH}	HIGH Level Input Voltage (Note 2)	$2.3 \text{ V} \le \text{V}_{CC} \le 2.7 \text{ V}$	1.7		V	
		2.7 V ≤ V _{CC} ≤ 3.6 V	2.0		1	
V_{IL}	LOW Level Input Voltage (Note 2)	$2.3 \text{ V} \le \text{V}_{CC} \le 2.7 \text{ V}$		0.7	V	
		2.7 V ≤ V _{CC} ≤ 3.6 V		0.8		
V _{OH}	HIGH Level Output Voltage	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{ I}_{OL} = 100 \mu\text{A}$	V _{CC} - 0.2		V	
		V _{CC} = 2.3 V; I _{OH} = -8 mA	1.8			
		$V_{CC} = 2.7 \text{ V; } I_{OH} = -12 \text{ mA}$	2.2			
		$V_{CC} = 3.0 \text{ V}; I_{OH} = -18 \text{ mA}$	2.4			
		$V_{CC} = 3.0 \text{ V}; I_{OH} = -24 \text{ mA}$	2.2			
V _{OL}	LOW Level Output Voltage	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{ I}_{OL} = 100 \mu\text{A}$		0.2	V	
		V _{CC} = 2.3 V; I _{OL} = 8 mA		0.6		
		V _{CC} = 2.7 V; I _{OL} = 12 mA		0.4		
		V _{CC} = 3.0 V; I _{OL} = 16 mA		0.4		
		V _{CC} = 3.0 V; I _{OL} = 24 mA		0.55		
I _{OZ}	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 _{OFF}	Power Off Leakage Current	V _{CC} = 0, V _{IN} = 5.5 V or V _{OUT} = 5.5 V		10	μΑ	
I _{IN}	Input Leakage Current	V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND		±5	μΑ	
I _{CC}	Quiescent Supply Current	V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND		10	μΑ	
ΔI_{CC}	Increase in I _{CC} per Input	$2.3 \le V_{CC} \le 3.6 \text{ V}; V_{IH} = V_{CC} - 0.6 \text{ V}$		500	μА	

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

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

			T _A = -40°C to +85°C						
				3 V ± 0.3 V 50 pF		: 2.7 V 50 pF	V _{CC} = 2.5 C _L =	V ± 0.2 V 30 pF	
Symbol	Parameter	Waveform	Min	Max	Min	Max	Min	Max	Units
t _{PLH} t _{PHL}	Propagation Delay Input to Output	1	1.5 1.5	4.5 4.5	1.5 1.5	5.2 5.2	1.5 1.5	5.4 5.4	ns
t _{PZH} t _{PZL}	Output Enable Time to High and Low Level	2	1.5 1.5	6.5 6.5	1.5 1.5	7.2 7.2	1.5 1.5	8.5 8.5	ns
t _{PHZ} t _{PLZ}	Output Disable Time From High and Low Level	2	1.5 1.5	6.4 6.4	1.5 1.5	6.9 6.9	1.5 1.5	7.7 7.7	ns
t _{OSHL} t _{OSLH}	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_{OSHL}) or LOW-to-HIGH (t_{OSLH}); parameter guaranteed by design.

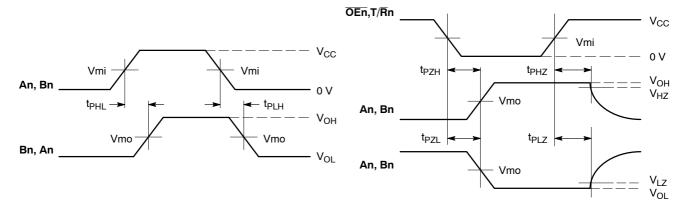
DYNAMIC SWITCHING CHARACTERISTICS

			T _A = +25°C			
Symbol	Characteristic	Condition	Min	Тур	Max	Units
V _{OLP}	Dynamic LOW Peak Voltage (Note 4)	$V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V} $ $V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$		0.8 0.6		V
V _{OLV}	Dynamic LOW Valley Voltage (Note 4)	$\begin{array}{c} V_{CC} = 3.3 \text{ V, } C_L = 50 \text{ pF, } V_{IH} = 3.3 \text{ V, } V_{IL} = 0 \text{ V} \\ V_{CC} = 2.5 \text{ V, } C_L = 30 \text{ pF, } V_{IH} = 2.5 \text{ V, } V_{IL} = 0 \text{ V} \end{array}$		-0.8 -0.6		V

^{4.} 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 _{IN}	Input Capacitance	V_{CC} = 3.3 V, V_{I} = 0 V or V_{CC}	7	pF
C _{I/O}	Input/Output Capacitance	V_{CC} = 3.3 V, V_{I} = 0 V or V_{CC}	8	pF
C _{PD}	Power Dissipation Capacitance	10 MHz, V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	20	pF



WAVEFORM 1 - PROPAGATION DELAYS

 t_R = t_F = 2.5 ns, 10% to 90%; f = 1 MHz; t_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

Figure 3. AC Waveforms

Table 2. AC WAVEFORMS

	V _{CC}				
Symbol	3.3 V \pm 0.3 V	2.7 V	2.5 V ± 0.2 V		
Vmi	1.5 V	1.5 V	V _{CC} / 2		
Vmo	1.5 V	1.5 V	V _{CC} / 2		
V_{HZ}	V _{OL} + 0.3 V	V _{OL} + 0.3 V	V _{OL} + 0.15 V		
V_{LZ}	V _{OH} – 0.3 V	V _{OH} – 0.3 V	V _{OH} – 0.15 V		

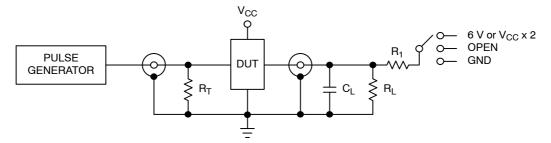


Figure 4. Test Circuit

Table 3. TEST CIRCUIT

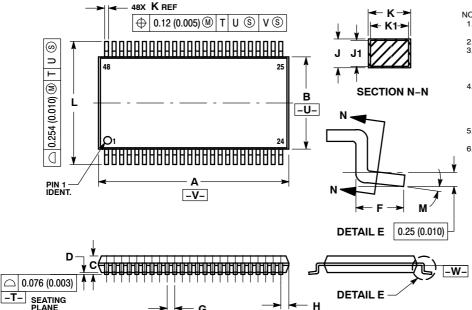
Test	Switch
t _{PLH} , t _{PHL}	Open
t _{PZL} , t _{PLZ}	6 V at $V_{CC} = 3.3 \pm 0.3 \text{ V}$ 6 V at $V_{CC} = 2.5 \pm 0.2 \text{ V}$
Open Collector/Drain t _{PLH} and t _{PHL}	6 V
t _{PZH} , t _{PHZ}	GND

 C_L = 50 pF at V_{CC} = 3.3 ± 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 Ω or equivalent R_T = Z_{OUT} of pulse generator (typically 50 Ω)

PACKAGE DIMENSIONS

TSSOP-48 DT SUFFIX

CASE 1201-01 ISSUE B



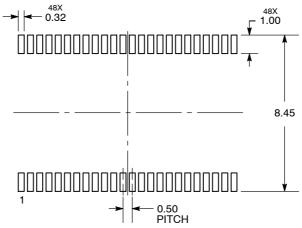
NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
 DIMENSIONS A AND B DO NOT INCLUDE
 MOLD FLASH, PROTRUSIONS OR GATE
 BURRS, MOLD FLASH OR GATE BURRS
- SHALL NOT EXCEED 0.15 (0.006) PER SIDE.

 4. 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.
 5. TERMINAL NUMBERS ARE SHOWN FOR
- REFERENCE ONLY.
 6. DIMENSIONS A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-

	MILLIN	IETERS	INC	HES	
DIM	MIN	MAX	MIN	MAX	
Α	12.40	12.60	0.488	0.496	
В	6.00	6.20	0.236	0.244	
С		1.10		0.043	
D	0.05	0.15	0.002	0.006	
F	0.50	0.75	0.020	0.030	
G	0.50	BSC	0.0197 BSC		
Н	0.37		0.015		
J	0.09	0.20	0.004	0.008	
J1	0.09	0.16	0.004	0.006	
K	0.17	0.27	0.007	0.011	
K1	0.17	0.23	0.007	0.009	
L	7.95	8.25	0.313	0.325	
М	0 °	8 °	0 °	8 °	

RECOMMENDED SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

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