MC74LCX16245

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_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 ($\overline{OE}$n), 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
- 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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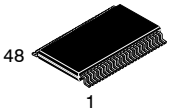
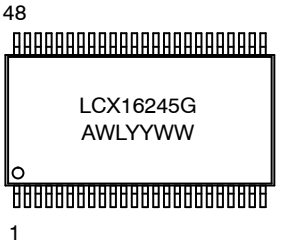


TSSOP−48
DT SUFFIX
CASE 1201

MARKING DIAGRAM



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.

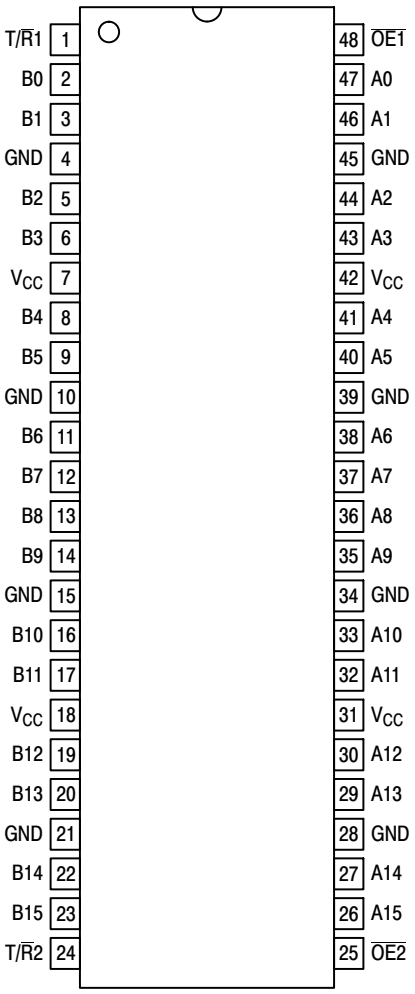


Figure 1. Pinout: 48–Lead (Top View)

Table 1. PIN NAMES

Pins	Function
$\overline{OEn}$	Output Enable Inputs
T/$\overline{Rn}$	Transmit/Receive Inputs
A0 – A15	Side A Inputs or 3–State Outputs
B0 – B15	Side B Inputs or 3–State Outputs

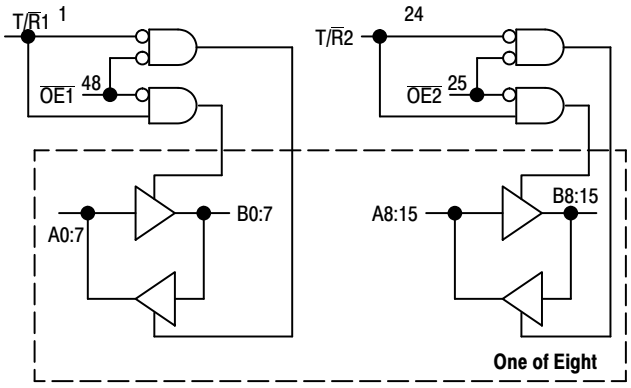


Figure 2. Logic Diagram

TRUTH TABLE

Inputs			Inputs		
$\overline{OE1}$	T/$\overline{R1}$	Outputs	$\overline{OE2}$	T/$\overline{R2}$	Outputs
L	L	Bus B0:7 Data to Bus A0:7	L	L	Bus B8:15 Data to Bus A8:15
L	H	Bus A0:7 Data to Bus B0:7	L	H	Bus A8:15 Data to Bus B8:15
H	X	High Z State on A0:7, B0:7	H	X	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.
*This package is inherently Pb−Free.

MAXIMUM RATINGS

Symbol	Parameter	Condition	Value	Units
V_{CC}	DC Supply Voltage		−0.5 to +7.0	V
V_I	DC Input Voltage		$-0.5 \le V_I \le +7.0$	V
V_O	DC Output Voltage	Output in 3−State	$-0.5 \le V_O \le +7.0$	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
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 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.
1. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	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
V_I	Input Voltage	0		5.5	V
V_O	Output Voltage (HIGH or LOW State) (3−State)	 0 0		 V_{CC} 5.5	V
I_{OH}	HIGH Level Output Current V_{CC} = 3.0 V − 3.6 V V_{CC} = 2.7 V − 3.0 V V_{CC} = 2.3 V − 2.7 V			 −24 −12 −8	mA
I_{OL}	LOW Level Output Current V_{CC} = 3.0 V − 3.6 V V_{CC} = 2.7 V − 3.0 V V_{CC} = 2.3 V − 2.7 V			 +24 +12 +8	mA
T_A	Operating Free−Air Temperature	−40		+85	°C
$\Delta t/\Delta V$	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

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = −40°C to +85°C		Units
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 2)	2.3 V ≤ V_{CC} ≤ 2.7 V	1.7		V
		2.7 V ≤ V_{CC} ≤ 3.6 V	2.0		
V_{IL}	LOW Level Input Voltage (Note 2)	2.3 V ≤ V_{CC} ≤ 2.7 V		0.7	V
		2.7 V ≤ V_{CC} ≤ 3.6 V		0.8	
V_{OH}	HIGH Level Output Voltage	2.3 V ≤ V_{CC} ≤ 3.6 V; I_{OL} = 100 μA	V_{CC} − 0.2		V
		V_{CC} = 2.3 V; I_{OH} = −8 mA	1.8		
		V_{CC} = 2.7 V; I_{OH} = −12 mA	2.2		
		V_{CC} = 3.0 V; I_{OH} = −18 mA	2.4		
		V_{CC} = 3.0 V; I_{OH} = −24 mA	2.2		
V_{OL}	LOW Level Output Voltage	2.3 V ≤ V_{CC} ≤ 3.6 V; I_{OL} = 100 μA		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 V, V_{IN} = V_{IH} or V_{IL}, V_{OUT} = 0 to 5.5 V		±5	μA
I_{OFF}	Power Off Leakage Current	V_{CC} = 0, V_{IN} = 5.5 V or V_{OUT} = 5.5 V		10	μA
I_{IN}	Input Leakage Current	V_{CC} = 3.6 V, V_{IN} = 5.5 V or GND		±5	μA
I_{CC}	Quiescent Supply Current	V_{CC} = 3.6 V, V_{IN} = 5.5 V or GND		10	μA
ΔI_{CC}	Increase in I_{CC} per Input	2.3 ≤ V_{CC} ≤ 3.6 V; V_{IH} = V_{CC} − 0.6 V		500	μA

2. These values of V_I are used to test DC electrical characteristics only.

AC CHARACTERISTICS (t_R = t_F = 2.5 ns; R_L = 500 Ω)

Symbol	Parameter	Waveform	T_A = −40°C to +85°C						Units
			V_{CC} = 3.3 V ± 0.3 V, C_L = 50 pF		V_{CC} = 2.7 V, C_L = 50 pF		V_{CC} = 2.5 V ± 0.2 V, C_L = 30 pF		
			Min	Max	Min	Max	Min	Max	
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

3. 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.

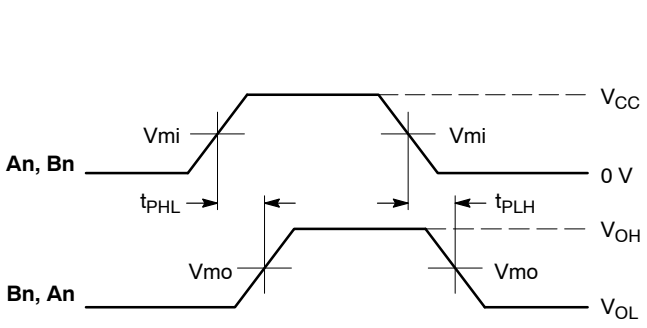
DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = +25°C			Units
			Min	Typ	Max	
V_{OLP}	Dynamic LOW Peak Voltage (Note 4)	V_{CC} = 3.3 V, C_L = 50 pF, V_{IH} = 3.3 V, V_{IL} = 0 V V_{CC} = 2.5 V, C_L = 30 pF, V_{IH} = 2.5 V, V_{IL} = 0 V		0.8 0.6		V V
V_{OLV}	Dynamic LOW Valley Voltage (Note 4)	V_{CC} = 3.3 V, C_L = 50 pF, V_{IH} = 3.3 V, V_{IL} = 0 V V_{CC} = 2.5 V, C_L = 30 pF, V_{IH} = 2.5 V, V_{IL} = 0 V		−0.8 −0.6		V V

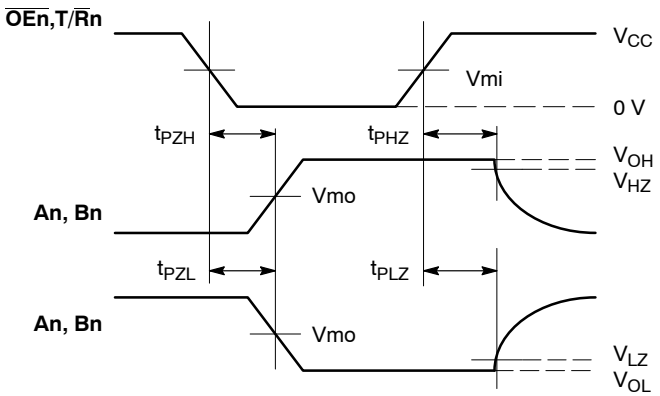
4. Number of outputs defined as “n”. Measured with “n−1” outputs switching from HIGH−to−LOW or LOW−to−HIGH. The remaining output is measured in the LOW state.

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

Symbol	V_{CC}		
	3.3 V ± 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

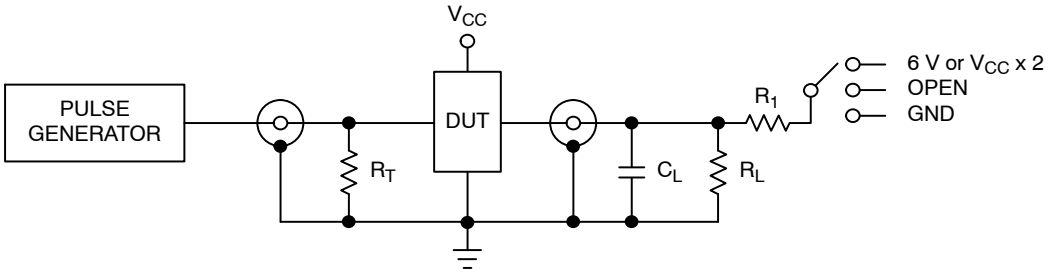


Figure 4. Test Circuit

Table 3. TEST CIRCUIT

Test	Switch
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6 V at V_{CC} = 3.3 ± 0.3 V 6 V at V_{CC} = 2.5 ± 0.2 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)

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

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SCALE 1:1

TSSOP−48
CASE 1201−01
ISSUE B

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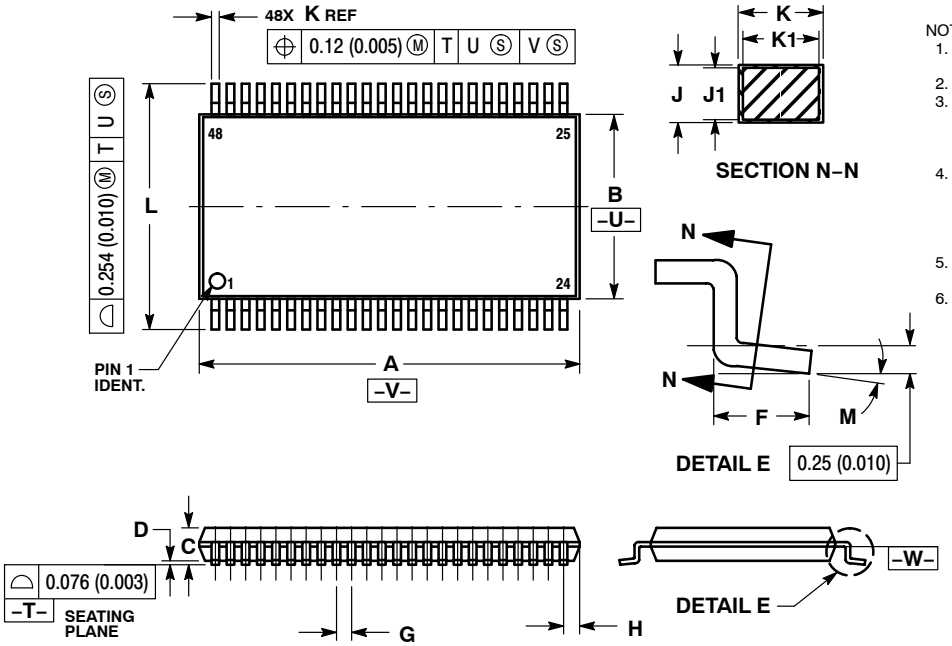
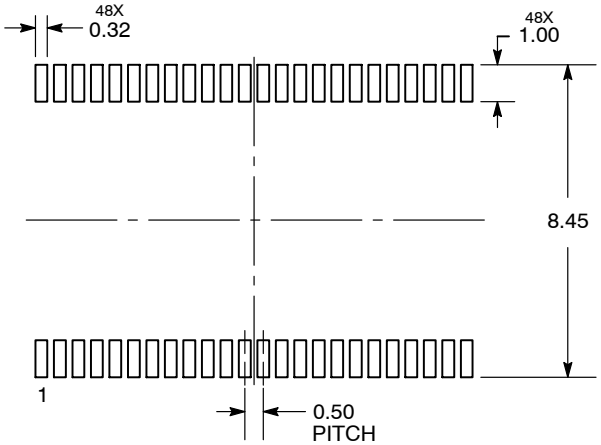


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE 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−.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	12.40	12.60	0.488	0.496
B	6.00	6.20	0.236	0.244
C	−−−	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	
H	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
M	0 °	8 °	0 °	8 °

RECOMMENDED SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

GENERIC MARKING DIAGRAM*

XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking.

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