Low-Voltage CMOS 16-Bit Buffer
With 5V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

The MC74LCX16244 is a high performance, non–inverting 16–bit buffer operating from a 2.7 to 3.6V supply. The device is nibble controlled. Each nibble 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 5.5V allows MC74LCX16244 inputs to be safely driven from 5V devices. The MC74LCX16244 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

4.5ns maximum propagation delays support high performance applications. Current drive capability is 24mA at the outputs. The Output Enable (OEn) inputs, when HIGH, disable the outputs by placing them in a HIGH Z condition.

- Designed for 2.7 to 3.6V V_{CC} Operation
- 4.5ns Maximum t_{pd}
- 5V Tolerant — Interface Capability With 5V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When V_{CC} = 0V
- LVTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (20μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500mA
- ESD Performance: Human Body Model >2000V; Machine Model >200V

The MC74LCX16244 contains sixteen non–inverting buffers with 3–state 5V–tolerant outputs. The device is nibble controlled with each nibble functioning identically, but independently. The control pins may be tied together to obtain full 16–bit operation. The 3–state outputs are controlled by an Output Enable (OEn) input for each nibble. When OEn is LOW, the outputs are on. When OEn is HIGH, the outputs are in the high impedance state.

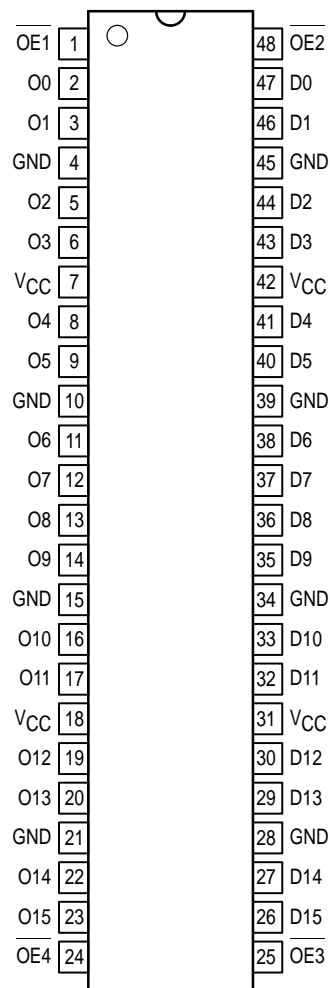# MC74LCX16244

LCX

LOW–VOLTAGE CMOS 16–BIT BUFFER
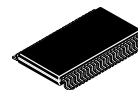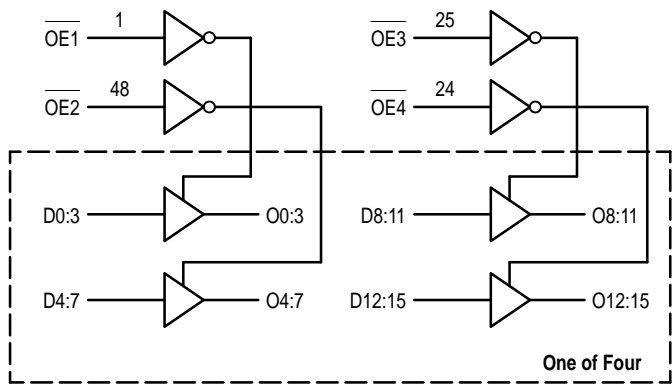
DT SUFFIX
PLASTIC TSSOP PACKAGE
CASE 1201–01

PIN NAMES

Pins	Function
OEn	Output Enable Inputs
D0–D15	Inputs
O0–O15	Outputs

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REV 1

MC74LCX16244

$\overline{OE1}$	1	
O0	2	
O1	3	
GND	4	
O2	5	
O3	6	
V_{CC}	7	
O4	8	
O5	9	
GND	10	
O6	11	
O7	12	
O8	13	
O9	14	
GND	15	
O10	16	
O11	17	
V_{CC}	18	
O12	19	
O13	20	
GND	21	
O14	22	
O15	23	
$\overline{OE4}$	24	

48	$\overline{OE2}$
47	D0
46	D1
45	GND
44	D2
43	D3
42	V_{CC}
41	D4
40	D5
39	GND
38	D6
37	D7
36	D8
35	D9
34	GND
33	D10
32	D11
31	V_{CC}
30	D12
29	D13
28	GND
27	D14
26	D15
25	$\overline{OE3}$

LOGIC DIAGRAM

One of Four

OE1	D0:3	O0:3	OE2	D4:7	O4:7	OE3	D8:11	O8:11	OE4	D12:15	O12:15
L	L	L	L	L	L	L	L	L	L	L	L
L	H	H	L	H	H	L	H	H	L	H	H
H	X	Z	H	X	Z	H	X	Z	H	X	Z

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

ABSOLUTE MAXIMUM RATINGS*

Symbol	Parameter	Value	Condition	Unit
V_{CC}	DC Supply Voltage	−0.5 to +7.0		V
V_I	DC Input Voltage	$-0.5 \leq V_I \leq +7.0$		V
V_O	DC Output Voltage	$-0.5 \leq V_O \leq +7.0$	Output in 3–State	V
		$-0.5 \leq V_O \leq V_{CC} + 0.5$	Note 1.	V
I_{IK}	DC Input Diode Current	−50	$V_I <$ GND	mA
I_{OK}	DC Output Diode Current	−50	$V_O <$ GND	mA
		+50	$V_O > V_{CC}$	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

* Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute–maximum–rated conditions is not implied.
1. Output in HIGH or LOW State. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	2.0	3.3	3.6	V
		Data Retention Only	1.5	3.3	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}	HIGH Level Output Current, V_{CC} = 3.0V − 3.6V				−24	mA
I_{OL}	LOW Level Output Current, V_{CC} = 3.0V − 3.6V				24	mA
I_{OH}	HIGH Level Output Current, V_{CC} = 2.7V − 3.0V				−12	mA
I_{OL}	LOW Level Output Current, V_{CC} = 2.7V − 3.0V				12	mA
T_A	Operating Free–Air Temperature		−40		+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate, V_{IN} from 0.8V to 2.0V, V_{CC} = 3.0V		0		10	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	$T_A = -40°C$ to $+85°C$		Unit
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 2.)	$2.7V \leq V_{CC} \leq 3.6V$	2.0		V
V_{IL}	LOW Level Input Voltage (Note 2.)	$2.7V \leq V_{CC} \leq 3.6V$		0.8	V
V_{OH}	HIGH Level Output Voltage	$2.7V \leq V_{CC} \leq 3.6V$; $I_{OH} = -100\mu A$	$V_{CC} - 0.2$		V
		$V_{CC} = 2.7V$; $I_{OH} = -12mA$	2.2		
		$V_{CC} = 3.0V$; $I_{OH} = -18mA$	2.4		
		$V_{CC} = 3.0V$; $I_{OH} = -24mA$	2.2		
V_{OL}	LOW Level Output Voltage	$2.7V \leq V_{CC} \leq 3.6V$; $I_{OL} = 100\mu A$		0.2	V
		$V_{CC} = 2.7V$; $I_{OL} = 12mA$		0.4	
		$V_{CC} = 3.0V$; $I_{OL} = 16mA$		0.4	
		$V_{CC} = 3.0V$; $I_{OL} = 24mA$		0.55	

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

MC74LCX16244

DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Characteristic	Condition	T_A = −40°C to +85°C Min	T_A = −40°C to +85°C Max	Unit
I_I	Input Leakage Current	$2.7V \leq V_{CC} \leq 3.6V$; $0V \leq V_I \leq 5.5V$		±5.0	μA
I_{OZ}	3–State Output Current	$2.7 \leq V_{CC} \leq 3.6V$; $0V \leq V_O \leq 5.5V$; $V_I = V_{IH}$ or V_{IL}		±5.0	μA
I_{OFF}	Power–Off Leakage Current	$V_{CC} = 0V$; V_I or $V_O = 5.5V$		10	μA
I_{CC}	Quiescent Supply Current	$2.7 \leq V_{CC} \leq 3.6V$; V_I = GND or V_{CC}		20	μA
		$2.7 \leq V_{CC} \leq 3.6V$; $3.6 \leq V_I$ or $V_O \leq 5.5V$		±20	μA
ΔI_{CC}	Increase in I_{CC} per Input	$2.7 \leq V_{CC} \leq 3.6V$; $V_{IH} = V_{CC} - 0.6V$		500	μA

AC CHARACTERISTICS ($t_R = t_F = 2.5ns$; $C_L = 50pF$; $R_L = 500\Omega$)

Symbol	Parameter	Waveform	T_A = −40°C to +85°C / V_{CC} = 3.0V to 3.6V Min	V_{CC} = 3.0V to 3.6V Max	V_{CC} = 2.7V Max	Unit
t_{PLH} t_{PHL}	Propagation Delay Input to Output	1	1.5 1.5	4.5 4.5	5.2 5.2	ns
t_{PZH} t_{PZL}	Output Enable Time to High and Low Level	2	1.5 1.5	5.5 5.5	6.3 6.3	ns
t_{PHZ} t_{PLZ}	Output Disable Time From High and Low Level	2	1.5 1.5	5.4 5.4	5.7 5.7	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 Min	Typ	Max	Unit
V_{OLP}	Dynamic LOW Peak Voltage (Note 4.)	V_{CC} = 3.3V, C_L = 50pF, V_{IH} = 3.3V, V_{IL} = 0V		0.8		V
V_{OLV}	Dynamic LOW Valley Voltage (Note 4.)	V_{CC} = 3.3V, C_L = 50pF, V_{IH} = 3.3V, V_{IL} = 0V		0.8		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	Unit
C_{IN}	Input Capacitance	V_{CC} = 3.3V, V_I = 0V or V_{CC}	7	pF
C_{OUT}	Output Capacitance	V_{CC} = 3.3V, V_I = 0V or V_{CC}	8	pF
C_{PD}	Power Dissipation Capacitance	10MHz, V_{CC} = 3.3V, V_I = 0V or V_{CC}	20	pF

WAVEFORM 1 – PROPAGATION DELAYS
$t_R = t_F = 2.5ns$, 10% to 90%; $f = 1MHz$; $t_W = 500ns$

WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES
$t_R = t_F = 2.5ns$, 10% to 90%; $f = 1MHz$; $t_W = 500ns$
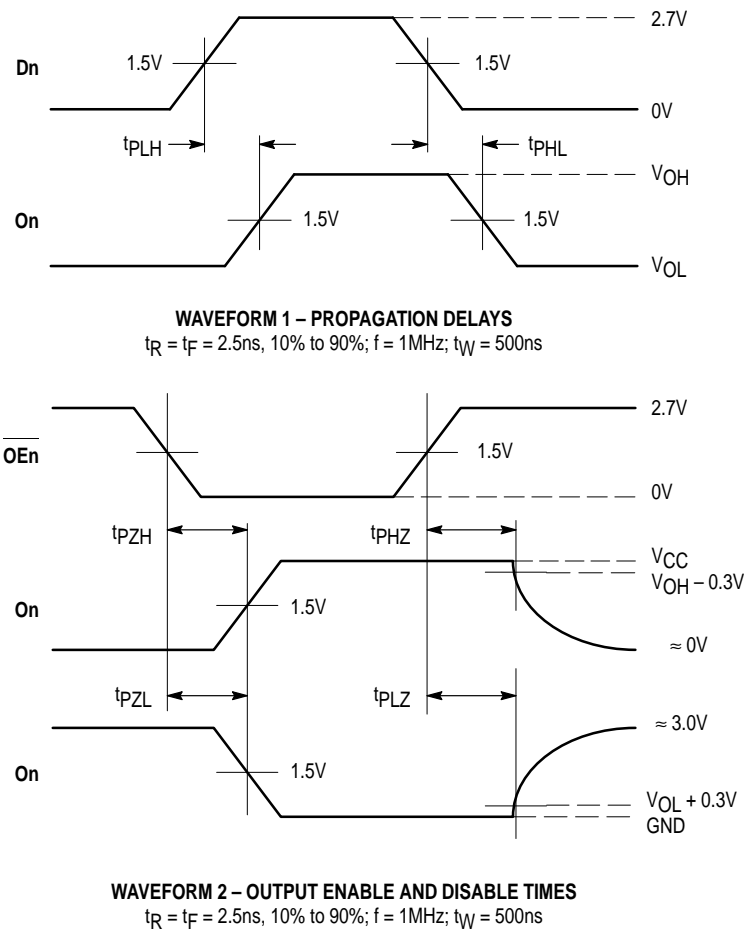
Figure 1. AC Waveforms
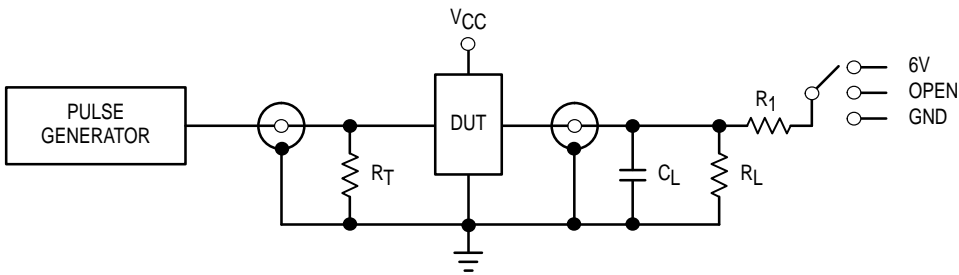
TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V
Open Collector/Drain t_{PLH} and t_{PHL}	6V
t_{PZH}, t_{PHZ}	GND

C_L = 50pF or equivalent (Includes jig and probe capacitance)
$R_L = R_1 = 500\Omega$ or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

Figure 2. Test Circuit

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MC74LCX16244

OUTLINE DIMENSIONS

DT SUFFIX
PLASTIC TSSOP PACKAGE
CASE 1201–01
ISSUE A

SECTION N–N

DETAIL E 0.25 (0.010)

DETAIL E

SEATING PLANE –T–

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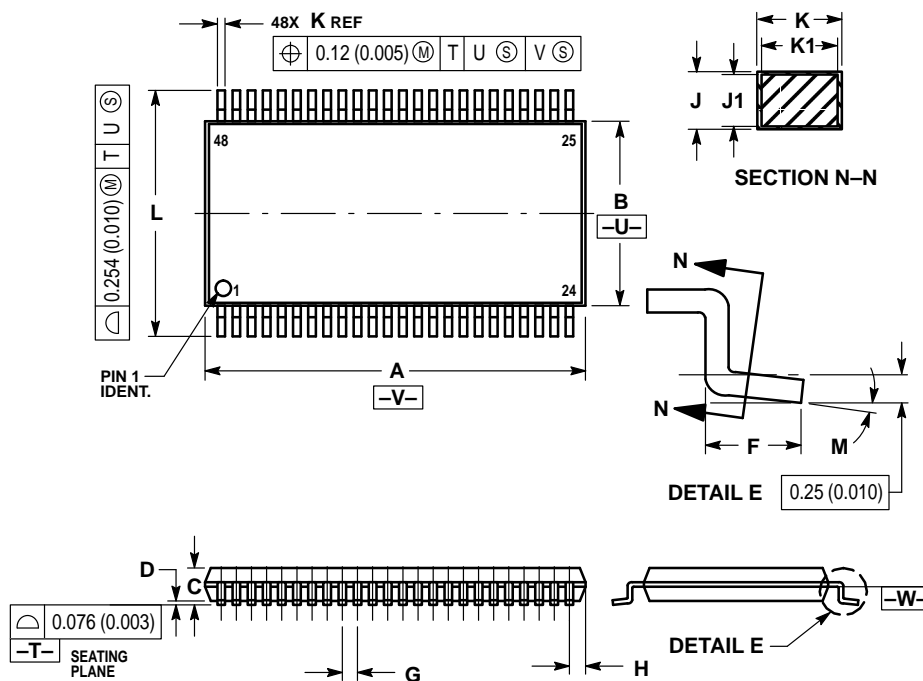
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE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

DIM	MILLIMETERS		INCHES	
	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 °

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