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74LCX162373

Low Voltage 16-Bit Transparent Latch with 5V Tolerant Inputs and Outputs and 26 Ω Series Resistor

General Description

The LCX162373 contains sixteen non-inverting latches with 3-STATE outputs and is intended for bus oriented applications. The device is byte controlled. The flip-flops appear transparent to the data when the Latch Enable (LE) is HIGH. When LE is LOW, the data that meets the setup time is latched. Data appears on the bus when the Output Enable (OE) is LOW. When OE is HIGH, the outputs are in a high impedance state.

The LCX162373 is designed for low voltage (2.5V or 3.3V) V_{CC} applications with capability of interfacing to a 5V signal environment. The 26Ω series resistor in the output helps reduce output overshoot and undershoot.

The LCX162373 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
- Equivalent 26Ω series resistor outputs
- 6.2 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)
- \blacksquare ±12 mA output drive (V_{CC} = 3.0V)
- Implements proprietary noise/EMI reduction circuitry
- Latch-up performance exceeds 500 mA
- ESD performance: Human body model > 2000V
 - Machine model > 200V
- Also packaged in plastic Fine-Pitch Ball Grid Array (FBGA) (Preliminary)

Note 1: To ensure the high-impedance state during power up or down, $\overline{\text{OE}}$ 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.

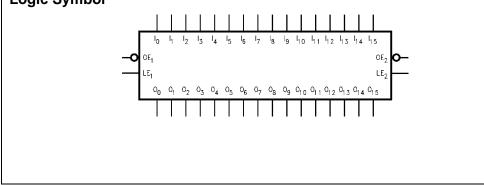
Ordering Code:

Order Number	Package Number	Package Description
74LCX162373GX (Note 2)	BGA54A (Preliminary)	54-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC MO-205, 5.5mm Wide [TAPE and REEL]
74LCX162373MEA (Note 3)	MS48A	48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
74LCX162373MTD (Note 3)	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Note 2: BGA package available in Tape and Reel only.

Note 3: Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Logic Symbol



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'4LCX162373 Low Voltage 16-Bit Transparent Latch with 5V Tolerant Inputs and Outputs and 26 Ω Series Resisto

74LCX162373

Connection Diagrams

Pin Assignment for SSOP and TSSOP 0E1 48 - LE₁ 47 00. - 1₀ 46 – կ 01. GND -45 - GND 02 44 5 - I₂ 03. 43 6 - I₃ v_{cc} 42 - v_{cc} 41 04 8 - I₄ 40 0₅ -- I₅ GND 10 39 – GND 06. 38 11 - I₆ 07 12 37 - 1₇ 36 08 13 - 1₈ 35 14 0q - I₉ GND 15 34 – GND 010 16 33 - I₁₀ 32 17 011 - 41 31 V_{CC} 18 – v_{cc} 19 30 - I_{1 2} 0_{1 2} 0₁₃ -20 29 - 4 3 GND・ 21 28 – GND 22 27 014 - I_{1 4} 015 23 26 - I₁₅ 0E2 25 24 - LE₂ Pin Assignment for FBGA 1 2 3 4 5 6 < ш 000000 υ 000000 Ω 000000 ш ш 000000 G 000000 000000 т 000000 -(Top Thru View)

Pin Descriptions

Pin Names	Description
0E _n	Output Enable Input (Active LOW)
LEn	Latch Enable Input
I ₀ —I ₁₅	Inputs
O ₀ -O ₁₅ NC	Outputs
NC	No Connect

FBGA Pin Assignments

	1	2	3	4	5	6
Α	O ₀	NC	OE ₁	LE ₁	NC	I ₀
В	0 ₂	0 ₁	NC	NC	I ₁	l ₂
С	O ₄	O ₃	V _{CC}	V _{CC}	l ₃	I ₄
D	O ₆	O ₅	GND	GND	I ₅	I ₆
E	0 ₈	0 ₇	GND	GND	۱ ₇	۱ ₈
F	O ₁₀	O ₉	GND	GND	l ₉	I ₁₀
G	O ₁₂	O ₁₁	V _{CC}	V _{CC}	I ₁₁	I ₁₂
н	0 ₁₄	0 ₁₃	NC	NC	I ₁₃	I ₁₄
J	O ₁₅	NC	OE ₂	LE_2	NC	I ₁₅

Truth Tables

	Inputs		Outputs
LE ₁	OE ₁	I ₀ –I ₇	0 ₀ –0 ₇
Х	Н	Х	Z
н	L	L	L
н	L	н	н
L	L	Х	O ₀
	Inputs		Outputs
LE ₂	0E2	I ₈ —I ₁₅	0 ₈ –0 ₁₅
Х	Н	Х	Z
н	L	L	L
н	L	н	н
		х	O ₀

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial Z = High Impedance

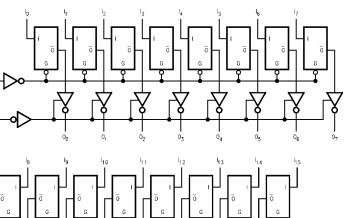
 $O_0 = Previous O_0$ before HIGH-to-LOW transition of Latch Enable

Functional Description

The LCX162373 contains sixteen D-type latches with 3-STATE standard outputs. The device is byte controlled with each byte functioning identically, but independent of the other. Control pins can be shorted together to obtain full 16-bit operation. The following description applies to each byte. When the Latch Enable (LE_n) input is HIGH, data on the I_n enters the latches. In this condition the latches are transparent, i.e. a latch output will change state each time

its I input changes. When LE_n is LOW, the latches store information that was present on the I inputs a setup time preceding the HIGH-to-LOW transition of LE_n. The 3-STATE standard outputs are controlled by the Output Enable (\overline{OE}_n) input. When \overline{OE}_n is LOW, the standard outputs are in the 2-state mode. When \overline{OE}_n is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the latches.

Logic Diagrams



014

015

013

Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

012

011

010

74LCX162373

74LCX162373

Absolute Maximum Ratings(Note 4)

Symbol	Parameter	Value	Conditions	Units
V _{CC}	Supply Voltage	-0.5 to +7.0		V
VI	DC Input Voltage	-0.5 to +7.0		V
Vo	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 5)	
lıк	DC Input Diode Current	-50	V _I < GND	mA
ок	DC Output Diode Current	-50	V _O < GND	mA
		+50	$V_{O} > V_{CC}$	IIIA
l ₀	DC Output Source/Sink Current	±50		mA
cc	DC Supply Current per Supply Pin	±100		mA
GND	DC Ground Current per Ground Pin	±100		mA
T _{STG}	Storage Temperature	-65 to +150		°C

Recommended Operating Conditions (Note 6)

Symbol	Parameter		Min	Max	Units
V _{CC}	Supply Voltage	Operating	2.0	3.6	V
		Data Retention	1.5	3.6	v
VI	Input Voltage		0	5.5	V
Vo	Output Voltage	HIGH or LOW State	0	V _{CC}	V
		3-STATE	0	5.5	v
I _{OH} /I _{OL}	Output Current	$V_{CC} = 3.0V - 3.6V$		12	
		$V_{CC} = 2.7V - 3.0V$ $V_{CC} = 2.3V - 2.7V$		±8	mA
		$V_{CC} = 2.3V - 2.7V$		±4	
Τ _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 4: 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 5: I_O Absolute Maximum Rating must be observed.

Note 6: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	Conditions	v _{cc}	$T_A = -40^{\circ}C$	to +85°C	Units
Symbol	Farameter	Conditions	(V)	Min	Max	onita
V _{IH}	HIGH Level Input Voltage		2.3 – 2.7	1.7		V
			2.7 - 3.6	2.0		v
V _{IL}	LOW Level Input Voltage		2.3 – 2.7		0.7	V
			2.7 - 3.6		0.8	v
V _{OH}	HIGH Level Output Voltage	I _{OH} = -100 μA	2.3 - 3.6	V _{CC} - 0.2		
		$I_{OH} = -4 \text{ mA}$	2.3	1.8		v
		$I_{OH} = -4 \text{ mA}$	2.7	2.2		
		$I_{OH} = -6 \text{ mA}$	3.0	2.4		
		I _{OH} = -8 mA	2.7	2.0		
		$I_{OH} = -12 \text{ mA}$	3.0	2.0		
V _{OL}	LOW Level Output Voltage	I _{OL} = 100 μA	2.3 - 3.6		0.2	
		$I_{OL} = 4 \text{ mA}$	2.3		0.6	
		$I_{OL} = 4 \text{ mA}$	2.7		0.4	v
		$I_{OL} = 6 \text{ mA}$	3.0		0.55	v
		I _{OL} = 8 mA	2.7		0.6	
		I _{OL} = 12 mA	3.0		0.8	
lı –	Input Leakage Current	$0 \leq V_I \leq 5.5 V$	2.3 - 3.6		±5.0	μA
l _{oz}	3-STATE Output Leakage	$0 \le V_O \le 5.5 V$	2.3 - 3.6		±5.0	
		$V_I = V_{IH} \text{ or } V_{IL}$				μA

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V _{cc}	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		Units
	Faranieler	Conditions	(V)	Min	Max	Units
I _{OFF}	Power-Off Leakage Current	V _I or V _O = 5.5V	0		10	μA
Icc	Quiescent Supply Current	$V_I = V_{CC}$ or GND	2.3 – 3.6		20	
		$3.6V \leq V_I, \ V_O \leq 5.5V \ (\text{Note 7})$	2.3 – 3.6		±20	μA
∆l _{CC}	Increase in I _{CC} per Input	$V_{IH} = V_{CC} - 0.6V$	2.3 - 3.6		500	μA

Note 7: Outputs disabled or 3-STATE only.

AC Electrical Characteristics

			T _A	= -40°C to +	-85°C, R _L = 50	00 Ω		
Symbol	Parameter	V _{CC} = 3.	$.3V \pm 0.3V$	V _{CC}	= 2.7V	V _{CC} = 2.4	5V ± 0.2V	Units
		C _L =	C _L = 50 pF		C _L = 50 pF		C _L = 30 pF	
		Min	Max	Min	Max	Min	Max	-
t _{PHL}	Propagation Delay	1.5	6.2	1.5	6.7	1.5	7.4	ns
t _{PLH}	I _n to O _n	1.5	6.2	1.5	6.7	1.5	7.4	115
t _{PHL}	Propagation Delay	1.5	6.3	1.5	7.2	1.5	7.6	ns
t _{PLH}	LE to O _n	1.5	6.3	1.5	7.2	1.5	7.6	115
t _{PZL}	Output Enable Time	1.5	6.9	1.5	7.3	1.5	9.0	ns
t _{PZH}		1.5	6.9	1.5	7.3	1.5	9.0	115
t _{PLZ}	Output Disable Time	1.5	6.0	1.5	6.3	1.5	7.2	ns
t _{PHZ}		1.5	6.0	1.5	6.3	1.5	7.2	115
t _S	Setup Time, In to LE	2.5		2.5		3.0		ns
t _H	Hold Time, I _n to LE	1.5		1.5		2.0		ns
t _W	LE Pulse Width	3.0		3.0		3.5		ns
t _{OSHL}	Output to Output Skew (Note 8)		1.0					ns
t _{OSLH}			1.0					113

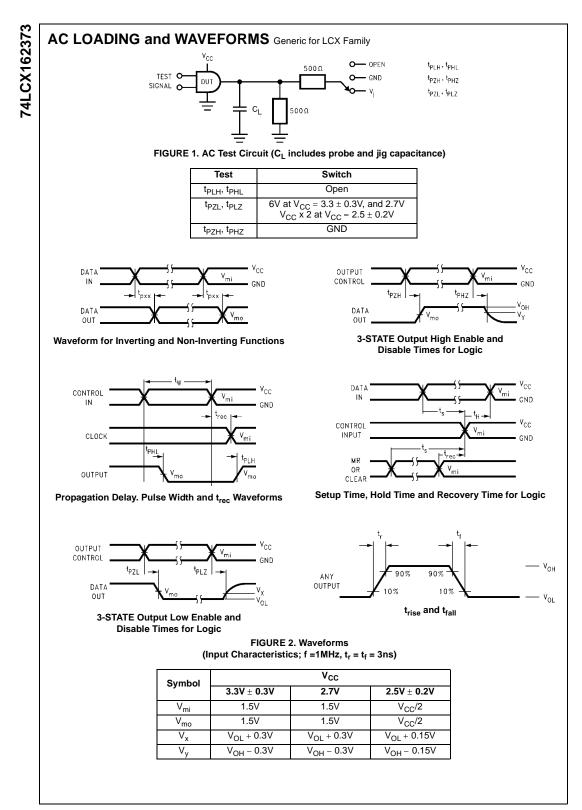
Note 8: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}). Parameter guaranteed by design.

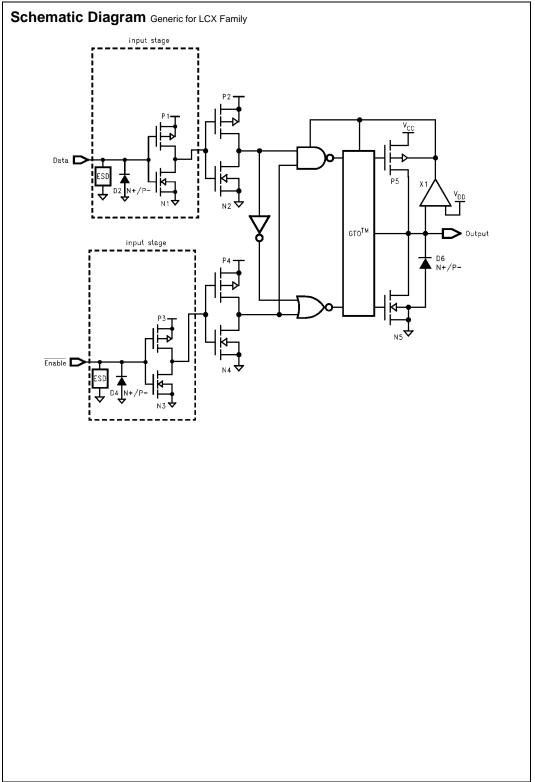
Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V _{CC}	$T_A = 25^\circ C$	Units
Symbol	Falanielei	Conditions	(V)	Typical	Units
V _{OLP}	Quiet Output Dynamic Peak V _{OL}	$C_L = 50 \text{ pF}, \text{ V}_{IH} = 3.3 \text{V}, \text{ V}_{IL} = 0 \text{V}$	3.3	0.35	V
		$C_L = 30 \text{ pF}, \text{ V}_{IH} = 2.5 \text{V}, \text{ V}_{IL} = 0 \text{V}$	2.5	0.25	v
V _{OLV}	Quiet Output Dynamic Valley V _{OL}	$C_{L} = 50 \text{ pF}, \text{ V}_{IH} = 3.3 \text{V}, \text{ V}_{IL} = 0 \text{V}$	3.3	-0.35	V
		$C_L = 30 \text{ pF}, \text{ V}_{IH} = 2.5 \text{V}, \text{ V}_{IL} = 0 \text{V}$	2.5	-0.25	~

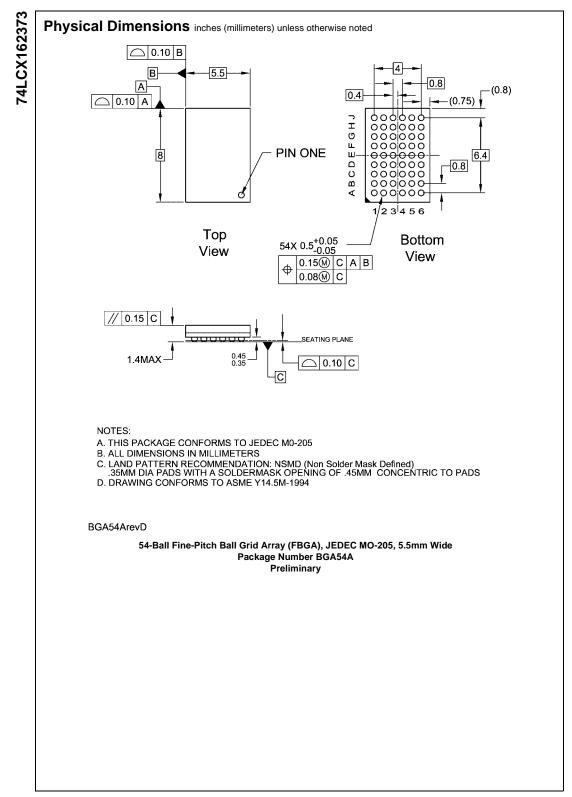
Capacitance

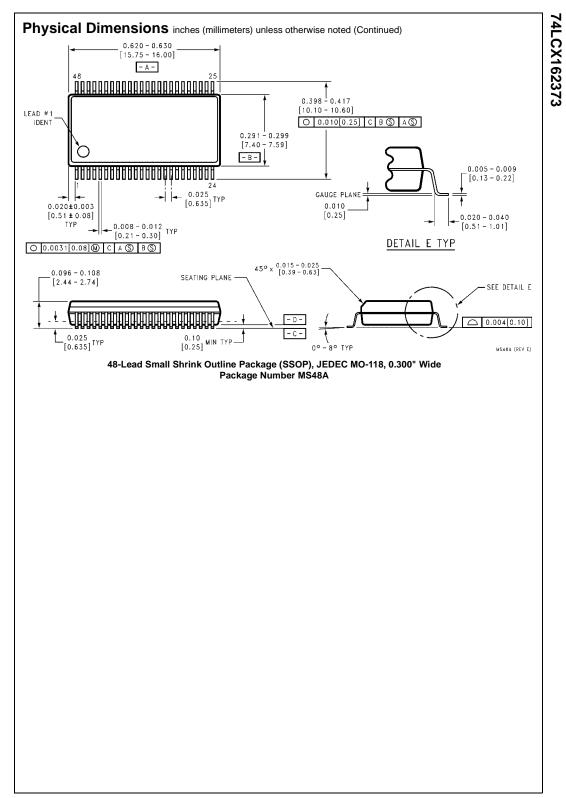
Symbol	Parameter	Conditions	Typical	Units
CIN	Input Capacitance	$V_{CC} = Open, V_I = 0V \text{ or } V_{CC}$	7	pF
C _{OUT}	Output Capacitance	$V_{CC} = 3.3V$, $V_I = 0V$ or V_{CC}	8	pF
C _{PD}	Power Dissipation Capacitance	$V_{CC} = 3.3V$, $V_I = 0V$ or V_{CC} , f = 10 MHz	20	pF

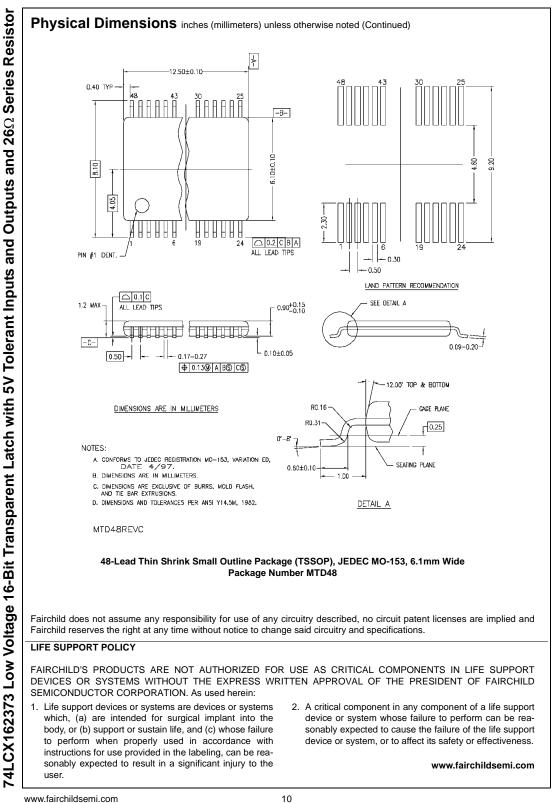




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