



3.3V CMOS 12-BIT TRI-PORT BUS EXCHANGER WITH 5 VOLT TOLERANT I/O AND BUS-HOLD

IDT74LVCH16260A

FEATURES:

- Typical $t_{sk(0)}$ (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 0.635mm pitch SSOP, 0.50mm pitch TSSOP and 0.40mm pitch TVSOP packages
- Extended commercial range of -40°C to +85°C
- $V_{CC} = 3.3V \pm 0.3V$, Normal Range
- $V_{CC} = 2.7V$ to 3.6V, Extended Range
- CMOS power levels (0.4μW typ. static)
- All inputs, outputs and I/O are 5 Volt tolerant
- Supports hot insertion

Drive Features for LVCH16260A:

- High Output Drivers: $\pm 24mA$
- Reduced system switching noise

APPLICATIONS:

- 5V and 3.3V mixed voltage systems
- Data communication and telecommunication systems

DESCRIPTION:

The LVCH16260A tri-port bus exchanger is built using advanced dual metal CMOS technology. The LVCH16260A is a high-speed 12-bit latched

bus multiplexer/transceiver for use in high-speed microprocessor applications. This bus exchanger supports memory interleaving with latched outputs on the B ports and address multiplexing with latched inputs on the B ports.

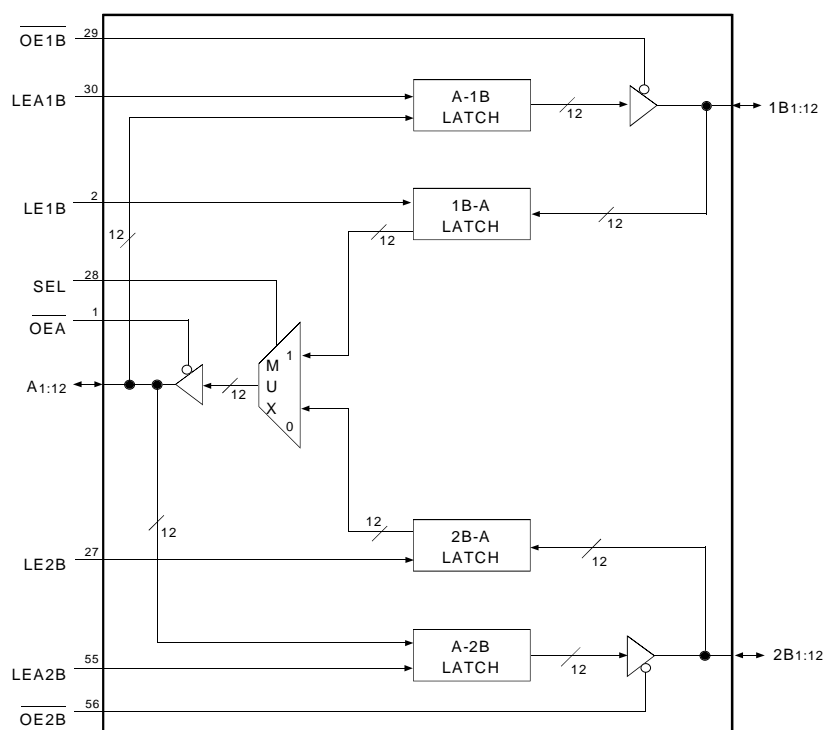
The LVCH16260A tri-port bus exchanger has three 12-bit ports. Data may be transferred between the A port and either/both of the B ports. The latch enable (LE1B, LE2B, LEA1B and LEA2B) inputs control data storage. When a latch-enable input is high, the latch is transparent. When a latch-enable input is low, the data at the input is latched and remains latched until the latch enable input is returned high. Independent output enables ($\overline{OE1B}$ and $\overline{OE2B}$) allow reading from one port while writing to the other port.

All pins of the 12-bit Bus Exchanger can be driven from either 3.3V or 5V devices. This feature allows the use of the device as a translator in a mixed 3.3V/5V supply system.

The LVCH16260A has been designed with a $\pm 24mA$ output driver. The driver is capable of driving a moderate to heavy load while maintaining speed performance.

The LVCH16260A has "bus-hold" which retains the inputs' last state whenever the input goes to a high impedance. This prevents floating inputs and eliminates the need for pull-up/down resistors.

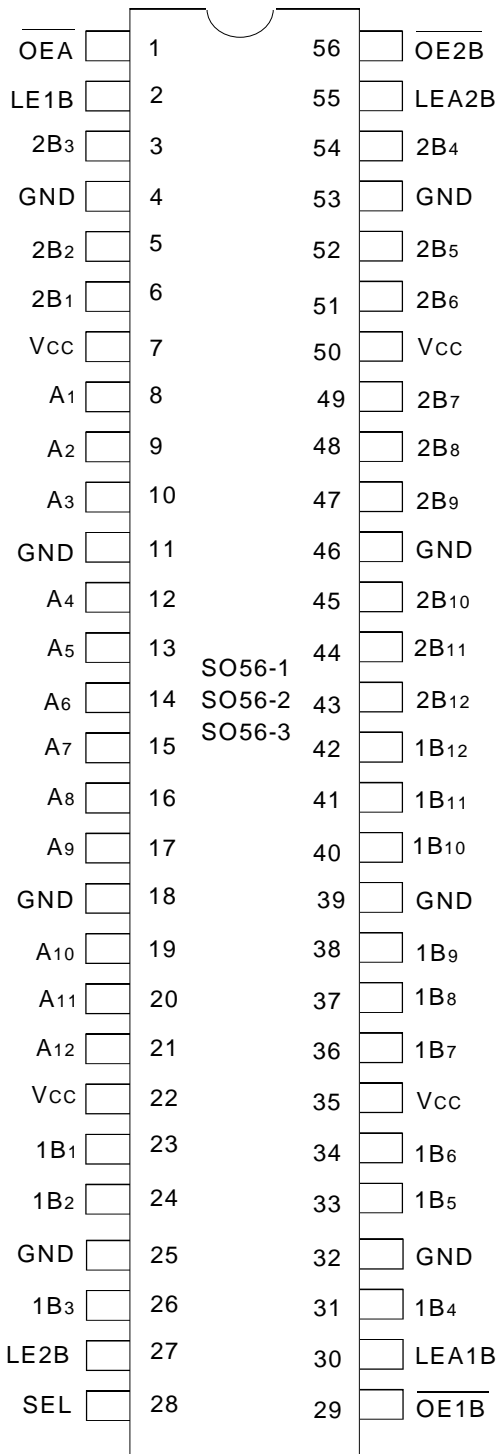
Functional Block Diagram



EXTENDED COMMERCIAL TEMPERATURE RANGE

MARCH 1999

PIN CONFIGURATION



SSOP/TSSOP/TVSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS (1)

Symbol	Description	Max.	Unit
VTERM ⁽²⁾	Terminal Voltage with Respect to GND	- 0.5 to +6.5	V
VTERM ⁽³⁾	Terminal Voltage with Respect to GND	- 0.5 to +6.5	V
TSTG	Storage Temperature	- 65 to +150	°C
I _{OUT}	DC Output Current	- 50 to +50	mA
I _{IK} I _{OK}	Continuous Clamp Current, V _I < 0 or V _O < 0	- 50	mA
I _{CC} I _{SS}	Continuous Current through each V _{CC} or GND	±100	mA

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NOTES:

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. V_{CC} terminals.
3. All terminals except V_{CC}.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	4.5	6	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	6.5	8	pF
C _{I/O}	I/O Port Capacitance	V _{IN} = 0V	6.5	8	pF

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NOTE:

1. As applicable to the device type.

FUNCTION TABLES (1)

Inputs						Outputs
1Bx	2Bx	SEL	LE1B	LE2B	$\overline{OE\bar{A}}$	Ax
H	X	H	H	X	L	H
L	X	H	H	X	L	L
X	X	H	L	X	L	A ₀ ⁽²⁾
X	H	L	X	H	L	H
X	L	L	X	H	L	L
X	X	L	X	L	L	A ₀ ⁽²⁾
X	X	X	X	X	H	Z

Inputs					Outputs	
Ax	LEA1B	LEA2B	$\overline{OE1B}$	$\overline{OE2B}$	1Bx	2Bx
H	H	H	L	L	H	H
L	H	H	L	L	L	L
H	H	L	L	L	H	B ₀ ⁽²⁾
L	H	L	L	L	L	B ₀ ⁽²⁾
H	L	H	L	L	B ₀ ⁽²⁾	H
L	L	H	L	L	B ₀ ⁽²⁾	L
X	L	L	L	L	B ₀ ⁽²⁾	B ₀ ⁽²⁾
X	X	X	H	H	Z	Z
X	X	X	L	H	Active	Z
X	X	X	H	L	Z	Active
X	X	X	L	L	Active	Active

NOTES:

- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High-Impedance
- A₀, B₀ = Output level before the indicated steady-state input conditions were established.

PIN DESCRIPTION

Signal	I/O	Description
A _(1:12)	I/O	Bidirectional Data Port A. Usually connected to the CPU's Address/Data bus. ⁽¹⁾
1B _(1:12)	I/O	Bidirectional Data Port 1B. Connected to the even path or even bank of memory. ⁽¹⁾
2B _(1:12)	I/O	Bidirectional Data Port 2B. Connected to the odd path or odd bank of memory. ⁽¹⁾
LEA1B	I	Latch Enable Input for A-1B Latch. The Latch is open when LEA1B is HIGH. Data from the A-port is latched on the HIGH to LOW transition of LEA1B.
LEA2B	I	Latch Enable Input for A-2B Latch. The Latch is open when LEA2B is HIGH. Data from the A-port is latched on the HIGH to LOW transition of LEA2B.
LE1B	I	Latch Enable Input for 1B-A Latch. The Latch is open when LE1B is HIGH. Data from the 1B port is latched on the HIGH to LOW transition of LE1B.
LE2B	I	Latch Enable Input for 2B-A Latch. The Latch is open when LE2B is HIGH. Data from the 2B port is latched on the HIGH to LOW transition of LE2B.
SEL	I	1B or 2B Path Selection. When HIGH, SEL enables data transfer from 1B Port to A Port. When LOW, SEL enables data transfer from 2B Port to A Port.
$\overline{OE\bar{A}}$	I	Output Enable for A Port (Active LOW).
$\overline{OE1B}$	I	Output Enable for 1B Port (Active LOW).
$\overline{OE2B}$	I	Output Enable for 2B Port (Active LOW).

NOTE:

- These pins have "Bus-hold". All other pins are standard inputs, outputs, or I/Os.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: TA = -40°C to +85°C

Symbol	Parameter	Test Conditions		Min.	Typ. ⁽¹⁾	Max.	Unit
VIH	Input HIGH Voltage Level	VCC = 2.3V to 2.7V		1.7	—	—	V
		VCC = 2.7V to 3.6V		2	—	—	
VIL	Input LOW Voltage Level	VCC = 2.3V to 2.7V		—	—	0.7	V
		VCC = 2.7V to 3.6V		—	—	0.8	
IIH IIL	Input Leakage Current	VCC = 3.6V	VI = 0 to 5.5V	—	—	±5	µA
IOZH IOZL	High Impedance Output Current (3-State Output pins)	VCC = 3.6V	VO = 0 to 5.5V	—	—	±10	µA
IOFF	Input/Output Power Off Leakage	VCC = 0V, VIN or VO ≤ 5.5V		—	—	±50	µA
VIK	Clamp Diode Voltage	VCC = 2.3V, IIN = -18mA		—	-0.7	-1.2	V
VH	Input Hysteresis	VCC = 3.3V		—	100	—	mV
ICCL ICCH IC CZ	Quiescent Power Supply Current	VCC = 3.6V	VIN = GND or VCC	—	—	10	µA
			3.6 ≤ VIN ≤ 5.5V ⁽²⁾	—	—	10	
ΔICC	Quiescent Power Supply Current Variation	One input at VCC - 0.6V other inputs at VCC or GND		—	—	500	µA

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NOTES:

1. Typical values are at VCC = 3.3V, +25°C ambient.
2. This applies in the disabled state only.

BUS-HOLD CHARACTERISTICS

Symbol	Parameter ⁽¹⁾	Test Conditions		Min.	Typ. ⁽²⁾	Max.	Unit
IBHH IBHL	Bus-Hold Input Sustain Current	VCC = 3.0V	VI = 2.0V	-75	—	—	µA
			VI = 0.8V	75	—	—	
IBHH IBHL	Bus-Hold Input Sustain Current	VCC = 2.3V	VI = 1.7V	—	—	—	µA
			VI = 0.7V	—	—	—	
IBHHO IBHLO	Bus-Hold Input Overdrive Current	VCC = 3.6V	VI = 0 to 3.6V	—	—	±500	µA

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NOTES:

1. Pins with Bus-hold are identified in the pin description.
2. Typical values are at VCC = 3.3V, +25°C ambient.

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Max.	Unit
		V _{CC}	I _{OH}			
VOH	Output HIGH Voltage	V _{CC} = 2.3V to 3.6V	I _{OH} = -0.1mA	V _{CC} - 0.2	—	V
		V _{CC} = 2.3V	I _{OH} = -6mA	2	—	
		V _{CC} = 2.3V	I _{OH} = -12mA	1.7	—	
		V _{CC} = 2.7V		2.2	—	
		V _{CC} = 3.0V		2.4	—	
		V _{CC} = 3.0V	I _{OH} = -24mA	2.2	—	
VOL	Output LOW Voltage	V _{CC} = 2.3V to 3.6V	I _{OL} = 0.1mA	—	0.2	V
		V _{CC} = 2.3V	I _{OL} = 6mA	—	0.4	
			I _{OL} = 12mA	—	0.7	
		V _{CC} = 2.7V	I _{OL} = 12mA	—	0.4	
		V _{CC} = 3.0V	I _{OL} = 24mA	—	0.55	

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NOTE:

- V_{IH} and V_{IL} must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate V_{CC} range. T_A = -40°C to +85°C.

OPERATING CHARACTERISTICS, V_{CC} = 3.3V ± 0.3V, T_A = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
CPD	Power Dissipation Capacitance per bus exchanger Outputs enabled	C _L = 0pF, f = 10Mhz		pF
CPD	Power Dissipation Capacitance per bus exchanger Outputs disabled			pF

SWITCHING CHARACTERISTICS (1)

Symbol	Parameter	V _{CC} = 2.7V ± 0.2V		V _{CC} = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	
t _{PLH} t _{PHL}	Propagation Delay Ax to 1Bx or Ax to 2Bx	1.5	5.7	1.5	5	ns
t _{PLH} t _{PHL}	Propagation Delay 1Bx to Ax or 2Bx to Ax	1.5	6.1	1.5	5.2	ns
t _{PLH} t _{PHL}	Propagation Delay LExB to Ax	1.5	6.1	1.5	5.2	ns
t _{PLH} t _{PHL}	Propagation Delay LEA1B to 1Bx or LEA2B to 2Bx	1.5	6.1	1.5	5	ns
t _{PLH} t _{PHL}	Propagation Delay SEL to Ax	1.5	6.3	1.5	5.2	ns
t _{PZH} t _{PZL}	Output Enable Time $\overline{OE}A$ to Ax, $\overline{OE}1B$ to 1Bx, or $\overline{OE}2B$ to 2Bx	1.5	6.7	1.5	5.5	ns
t _{PHZ} t _{PLZ}	Output Disable Time $\overline{OE}A$ to Ax, $\overline{OE}1B$ to 1Bx, or $\overline{OE}2B$ to 2Bx	1.5	5.9	1.5	5.2	ns
t _{SU}	Set-Up Time, HIGH or LOW Data to Latch	1	—	1	—	ns
t _H	Hold Time, Latch to Data	1.2	—	1	—	ns
t _w	Pulse Width, Latch HIGH	3	—	3	—	ns
t _{sk(o)}	Output Skew ⁽²⁾	—	—	—	500	ps

NOTES:

- See test circuits and waveforms. T_A = -40°C to +85°C.
- Skew between any two outputs of the same package and switching in the same direction.

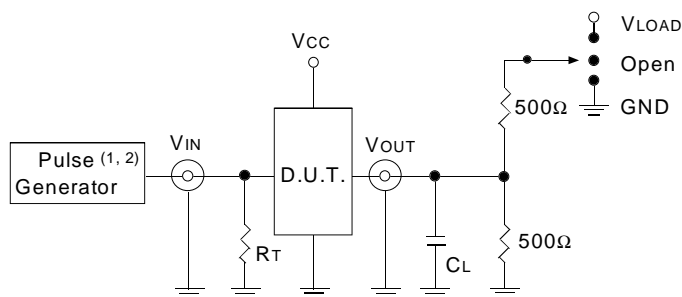
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	V _{CC} (1) = 3.3V ± 0.3V	V _{CC} (1) = 2.7V	V _{CC} (2) = 2.5V ± 0.2V	Unit
V _{LOAD}	6	6	2 x V _{CC}	V
V _{IH}	2.7	2.7	V _{CC}	V
V _T	1.5	1.5	V _{CC} / 2	V
V _{LZ}	300	300	150	mV
V _{HZ}	300	300	150	mV
C _L	50	50	30	pF

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TEST CIRCUITS FOR ALL OUTPUTS



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DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTE:

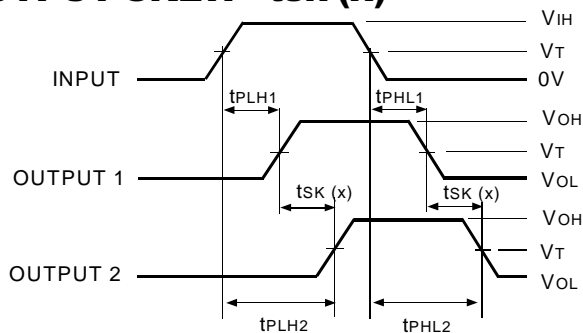
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2ns; t_R ≤ 2ns.

SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	V _{LOAD}
Disable High Enable High	GND
All Other tests	Open

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OUTPUT SKEW - t_{SK}(x)



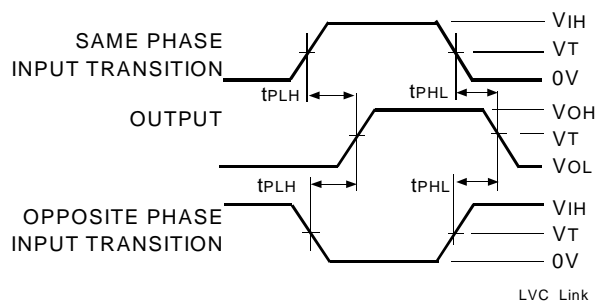
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

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NOTES:

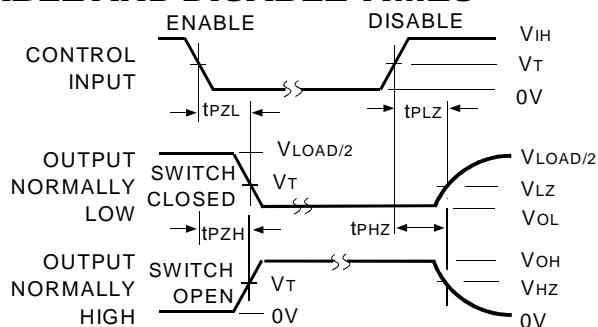
1. For t_{SK}(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

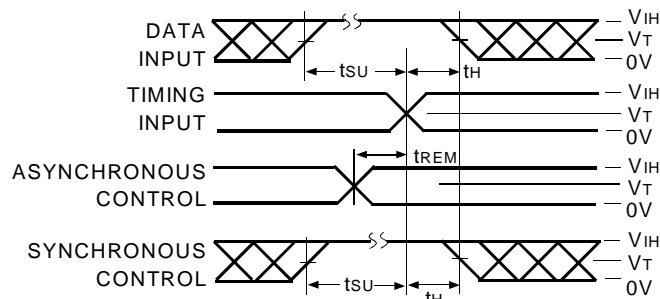


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NOTE:

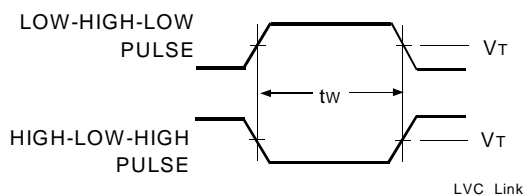
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

SET-UP, HOLD, AND RELEASE TIMES



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PULSE WIDTH



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