



3.3V CMOS 32-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS AND 5 VOLT TOLERANT I/O

IDT74LVC4X245

FEATURES:

- 32-bit function compatible to 74LVC245A
- All inputs, outputs and I/O are 5 Volt tolerant
- Supports hot insertion
- ESD > 2000V per MIL-STD-883, Method 3015;
> 200V using machine model (C = 200pF, R = 0)
- 80-pin MilliPaQ[®]
- V_{CC} = 3.3V ±0.3V, Normal Range
- V_{CC} = 2.3V to 3.6V, Extended Range
- CMOS power levels (0.4μW typ. static)
- Rail-to-Rail output swing for increased noise margin

Drive Features for LVC4X245A:

- High Output Drivers: ±24mA
- Reduced system switching noise

APPLICATIONS:

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

DESCRIPTION:

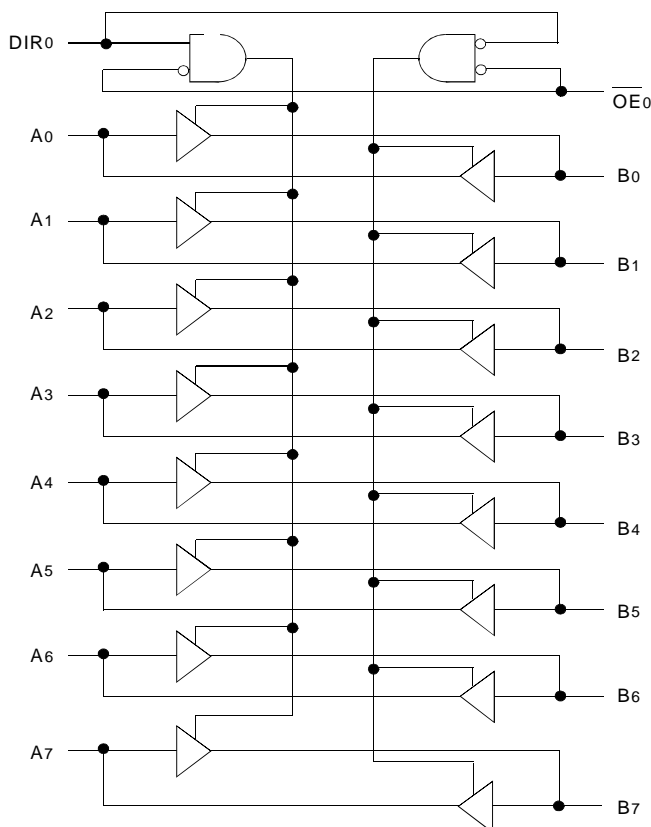
This 32-bit bus transceiver is built using advanced dual metal CMOS technology. The high-speed, low power transceiver is ideal for asynchronous communication between two busses (A and B). The direction control pin (DIR) controls the direction of data flow. The output enable pin (\overline{OE}) overrides the direction control and disables both ports. All inputs are designed with hysteresis for improved noise margin.

The LVC4X245A has been designed with ±24mA output drivers. This is capable of driving a moderate to heavy load while maintaining speed performance.

The 32-bit device is arranged as four independently controlled 8-bit slices for ease and flexibility of system design. It is available in IDT's small form factor 80-pin MilliPaQ[®] to conserve circuit board space.

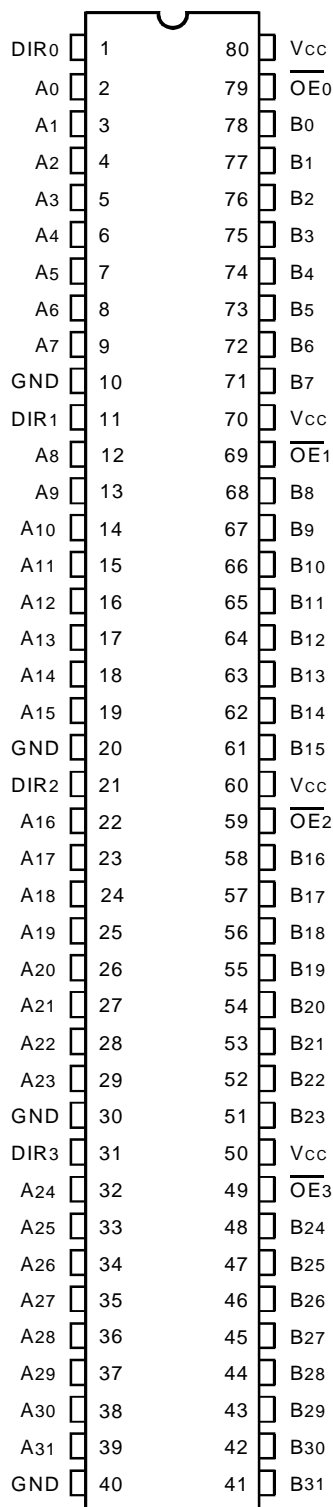
All pins can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V/5V supply system.

FUNCTIONAL BLOCK DIAGRAM



ONE OF FOUR SLICES SHOWN

PIN CONFIGURATION



MILLIPAQ
TOP VIEW

ABSOLUTE MAXIMUM RATINGS ⁽¹⁾

Symbol	Description	Max.	Unit
V _{TERM}	Terminal Voltage with Respect to GND	- 0.5 to +6.5	V
T _{STG}	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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NOTE:

- 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.

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	5.5	8	pF
C _{I/O}	I/O Port Capacitance	V _{IN} = 0V	6.5	8	pF

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NOTE:

- As applicable to the device type.

PIN DESCRIPTION

Pin Names	I/O	Description
A _x	I/O	Data Bus A
B _x	I/O	Data Bus B
DIR ₀	I	Direction for A/B ₀ - A/B ₇
DIR ₁	I	Direction for A/B ₈ - A/B ₁₅
DIR ₂	I	Direction for A/B ₁₆ - A/B ₂₃
DIR ₃	I	Direction for A/B ₂₄ - A/B ₃₁
\overline{OE}_0	I	Output Enables for A/B ₀ - A/B ₇
\overline{OE}_1	I	Output Enables for A/B ₈ - A/B ₁₅
\overline{OE}_2	I	Output Enables for A/B ₁₆ - A/B ₂₃
\overline{OE}_3	I	Output Enables for A/B ₂₄ - A/B ₃₁

FUNCTION TABLE ⁽¹⁾

Inputs		Outputs
\overline{OE}	DIR	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	High Z State

NOTE:

- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High-Impedance

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: $T_A = -40^{\circ}\text{C}$ To $+85^{\circ}\text{C}$

Symbol	Parameter	Test Conditions		Min.	Typ. ⁽¹⁾	Max.	Unit
V _{IH}	Input HIGH Voltage Level	V _{CC} = 2.3V to 2.7V		1.7	—	—	V
		V _{CC} = 2.7V to 3.6V		2	—	—	
V _{IL}	Input LOW Voltage Level	V _{CC} = 2.3V to 2.7V		—	—	0.7	V
		V _{CC} = 2.7V to 3.6V		—	—	0.8	
I _{IH} I _{IL}	Input Leakage Current	V _{CC} = 3.6V	V _I = 0 to 5.5V	—	—	±5	μA
I _{OZH} I _{OZL}	High Impedance Output Current (3-State Output pins)	V _{CC} = 3.6V	V _O = 0 to 5.5V	—	—	±10	μA
I _{OFF}	Input/Output Power Off Leakage	V _{CC} = 0V, V _{IN} or V _O ≤ 5.5V		—	—	±50	μA
V _{IK}	Clamp Diode Voltage	V _{CC} = 2.3V, I _{IN} = -18mA		—	-0.7	-1.2	V
V _H	Input Hysteresis	V _{CC} = 3.3V		—	100	—	mV
I _{CC1} I _{CC2} I _{CC3}	Quiescent Power Supply Current	V _{CC} = 3.6V	V _{IN} = GND or V _{CC}	—	—	40	μA
ΔI _{CC}	Quiescent Power Supply Current Variation	One input at V _{CC} - 0.6V, other inputs at V _{CC} or GND V _{CC} = 3.0 - 3.6V		—	—	500	μA

NOTE:1. Typical values are at V_{CC} = 3.3V, +25°C ambient.**OUTPUT DRIVE CHARACTERISTICS**

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Max.	Unit
V _{OH}	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	—	
V _{OL}	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:1. 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, T_A = 25°C

Symbol	Parameter	Test Conditions	V _{CC} = 2.5V±0.2V	V _{CC} = 3.3V±0.3V	Unit
			Typical	Typical	
CPD	Power dissipation capacitance per transceiver outputs enabled	C _L = 0pF, f = 10Mhz	—	47	pF
CPD	Power dissipation capacitance per transceiver outputs disabled		—	2	pF

SWITCHING CHARACTERISTICS (1)

Symbol	Parameter	V _{CC} = 2.7V		V _{CC} = 3.3V±0.3V		Unit
		Min.	Max.	Min.	Max.	
t _{PLH} t _{PHL}	Propagation Delay Ax to Bx, Bx to Ax	—	7.3	1.5	6.3	ns
t _{PZH} t _{PZL}	Output Enable Time \overline{OE} to Ax or Bx	—	9.5	1.5	8.5	ns
t _{PHZ} t _{PLZ}	Output Disable Time \overline{OE} to Ax or Bx	—	8.5	1.7	7.5	ns
t _{SK(o)}	Output Skew (2)	—	—	—	1	ns

NOTES:

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

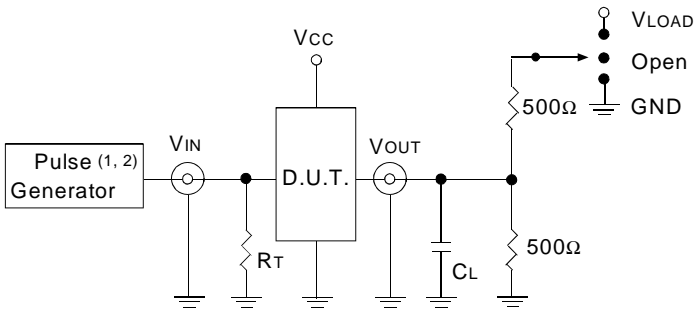
TEST CIRCUITS AND WAVEFORMS

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.

NOTES:

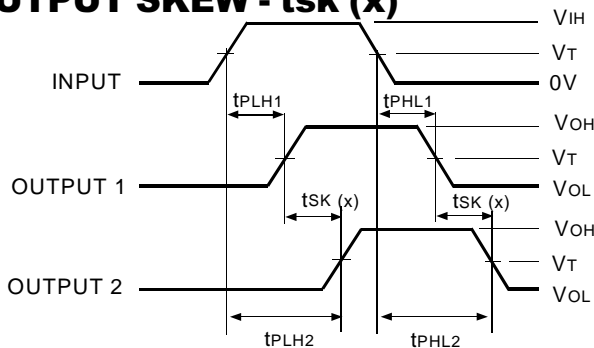
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2ns; t_R ≤ 2ns.

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)



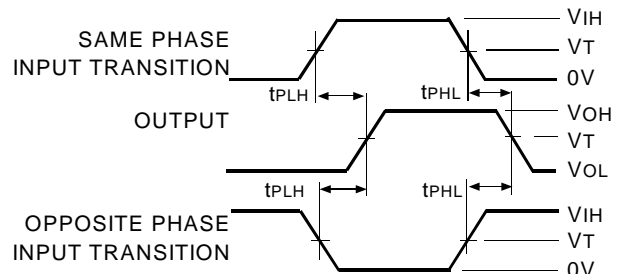
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

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.

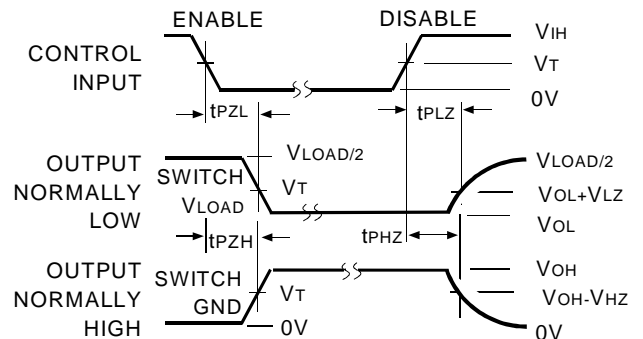
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PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

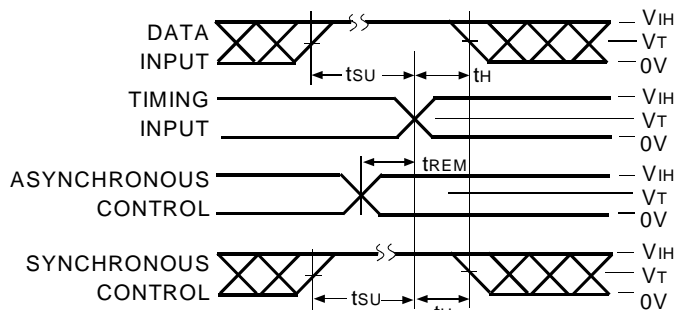


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NOTE:

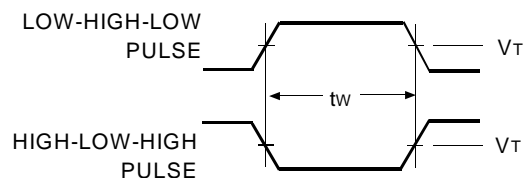
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

SET-UP, HOLD, AND RELEASE TIMES



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PULSE WIDTH



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ORDERING INFORMATION

IDT	XX	LVC	X	XXXX	XX		
Temp. Range			Bus-Hold	Device Type	Package		
					Q3	80-pin MilliPaQ	
				4X245		32-bit Bus Transceiver with 3-State Outputs, ±24mA	
			Blank			No Bus-hold	
74						-40°C to +85°C	



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