



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

IDT74LVC2245A

#### FEATURES:

- 0.5 MICRON CMOS Technology
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- Vcc = 3.3V ± 0.3V, Normal Range
- Vcc = 2.7V to 3.6V, Extended Range
- CMOS power levels (0.4μW typ. static)
- Rail-to-rail output swing for increased noise margin
- All inputs, outputs, and I/O are 5V tolerant
- Available in SOIC, SSOP, QSOP, and TSSOP packages

#### DRIVE FEATURES:

- Balanced Output Drivers: ±12mA (B Port)
- High Output Drivers: ±24mA (A Port)

#### APPLICATIONS:

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

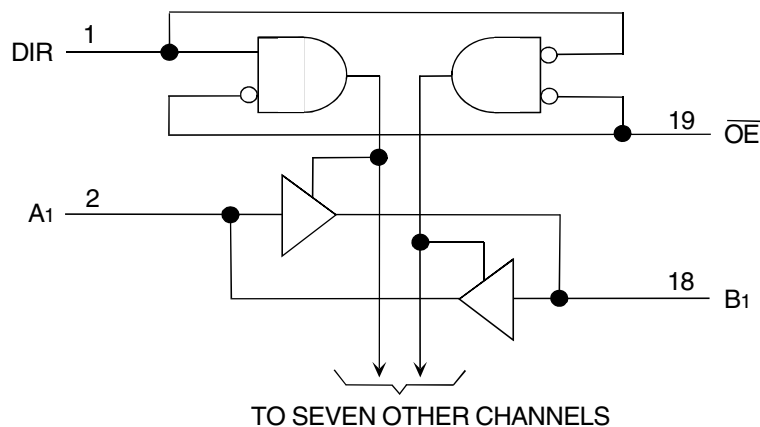
#### DESCRIPTION:

This bus transceiver is built using advanced dual metal CMOS technology. The LVC2245A device is designed for asynchronous communication between data buses. The device transmits data from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so the buses are effectively isolated.

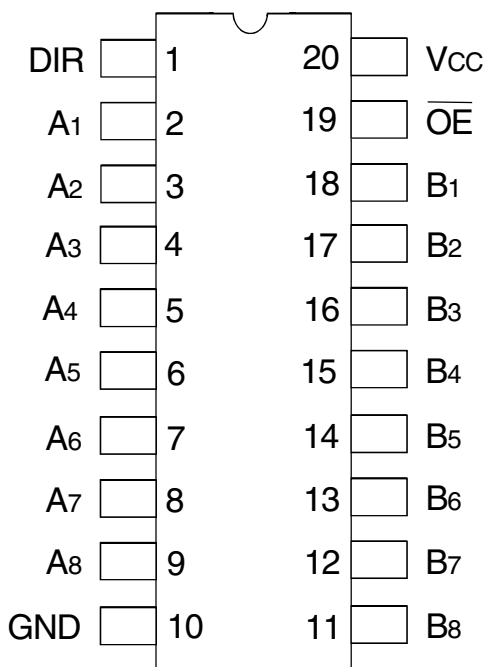
Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V/5V environment.

The LVC2245A has series resistors in the device output structure of the "B" port which will significantly reduce line noise when used with light loads. The driver has been designed to drive ±12mA at the designated threshold levels.

#### FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



SOIC/ SSOP/ QSOP/ TSSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Description	Max	Unit
VTERM	Terminal Voltage with Respect to GND	-0.5 to +6.5	V
TSTG	Storage Temperature	-65 to +150	°C
I <sub>OUT</sub>	DC Output Current	-50 to +50	mA
I <sub>IK</sub> I <sub>OK</sub>	Continuous Clamp Current, V <sub>I</sub> < 0 or V <sub>O</sub> < 0	-50	mA
I <sub>CC</sub> I <sub>SS</sub>	Continuous Current through each V <sub>CC</sub> or GND	±100	mA

### 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<sub>A</sub> = +25°C, F = 1.0MHz)

Symbol	Parameter <sup>(1)</sup>	Conditions	Typ.	Max.	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V	4.5	6	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = 0V	5.5	8	pF
C <sub>I/O</sub>	I/O Port Capacitance	V <sub>IN</sub> = 0V	6.5	8	pF

### NOTE:

- As applicable to the device type.

## PIN DESCRIPTION

Pin Names	Description
$\overline{OE}$	Output Enable Input (Active LOW)
DIR	Direction Control Output
A <sub>x</sub>	Side A Inputs or 3-State Outputs
B <sub>x</sub>	Side B Inputs or 3-State Outputs

## FUNCTION TABLE<sup>(1)</sup>

Inputs		Outputs
$\overline{OE}$	DIR	
L	L	B Data to A Bus
L	H	A Data to B Bus
H	X	Isolation

### NOTE:

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

## 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. <sup>(1)</sup>	Max.	Unit
V <sub>IH</sub>	Input HIGH Voltage Level	V <sub>CC</sub> = 2.3V to 2.7V		1.7	—	—	V
		V <sub>CC</sub> = 2.7V to 3.6V		2	—	—	
V <sub>IL</sub>	Input LOW Voltage Level	V <sub>CC</sub> = 2.3V to 2.7V		—	—	0.7	V
		V <sub>CC</sub> = 2.7V to 3.6V		—	—	0.8	
I <sub>IH</sub> I <sub>IL</sub>	Input Leakage Current	V <sub>CC</sub> = 3.6V	V <sub>I</sub> = 0 to 5.5V	—	—	±5	μA
I <sub>OZH</sub> I <sub>OZL</sub>	High Impedance Output Current (3-State Output pins)	V <sub>CC</sub> = 3.6V	V <sub>O</sub> = 0 to 5.5V	—	—	±10	μA
I <sub>OFF</sub>	Input/Output Power Off Leakage	V <sub>CC</sub> = 0V, V <sub>IN</sub> or V <sub>O</sub> ≤ 5.5V		—	—	±50	μA
V <sub>IK</sub>	Clamp Diode Voltage	V <sub>CC</sub> = 2.3V, I <sub>IN</sub> = -18mA		—	-0.7	-1.2	V
V <sub>H</sub>	Input Hysteresis	V <sub>CC</sub> = 3.3V		—	100	—	mV
I <sub>CC1</sub> I <sub>CC2</sub> I <sub>CC3</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = 3.6V	V <sub>IN</sub> = GND or V <sub>CC</sub>	—	—	10	μA
			3.6 ≤ V <sub>IN</sub> ≤ 5.5V <sup>(2)</sup>	—	—	10	
ΔI <sub>CC</sub>	Quiescent Power Supply Current Variation	One input at V <sub>CC</sub> - 0.6V, other inputs at V <sub>CC</sub> or GND		—	—	500	μA

### NOTES:

1. Typical values are at V<sub>CC</sub> = 3.3V, +25°C ambient.
2. This applies in the disabled state only.

## OUTPUT DRIVE CHARACTERISTICS (A PORT)

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Max.	Unit
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = 2.3V to 3.6V	I <sub>OH</sub> = -0.1mA	V <sub>CC</sub> - 0.2	—	V
		V <sub>CC</sub> = 2.3V	I <sub>OH</sub> = -6mA	2	—	
		V <sub>CC</sub> = 2.3V	I <sub>OH</sub> = -12mA	1.7	—	
		V <sub>CC</sub> = 2.7V		2.2	—	
		V <sub>CC</sub> = 3V		2.4	—	
		V <sub>CC</sub> = 3V	I <sub>OH</sub> = -24mA	2	—	
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = 2.3V to 3.6V	I <sub>OL</sub> = 0.1mA	—	0.2	V
		V <sub>CC</sub> = 2.3V	I <sub>OL</sub> = 6mA	—	0.4	
			I <sub>OL</sub> = 12mA	—	0.7	
		V <sub>CC</sub> = 2.7V	I <sub>OL</sub> = 12mA	—	0.4	
		V <sub>CC</sub> = 3V	I <sub>OL</sub> = 24mA	—	0.55	

### NOTE:

1. V<sub>IH</sub> and V<sub>IL</sub> must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate V<sub>CC</sub> range. T<sub>A</sub> = -40°C to +85°C.

## OUTPUT DRIVE CHARACTERISTICS (B PORT)

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Max.	Unit
VOH	Output HIGH Voltage	VCC = 2.3V to 3.6V	IOH = - 0.1mA	VCC - 0.2	—	V
		VCC = 2.3V	IOH = - 4mA	1.9	—	
			IOH = - 6mA	1.7	—	
		VCC = 2.7V	IOH = - 4mA	2.2	—	
			IOH = - 8mA	2	—	
		VCC = 3V	IOH = - 6mA	2.4	—	
IOH = - 12mA	2		—			
VOL	Output LOW Voltage	VCC = 2.3V to 3.6V	IOL = 0.1mA	—	0.2	V
		VCC = 2.3V	IOL = 4mA	—	0.4	
			IOL = 6mA	—	0.55	
		VCC = 2.7V	IOL = 4mA	—	0.4	
			IOL = 8mA	—	0.6	
		VCC = 3V	IOL = 6mA	—	0.55	
IOL = 12mA	—		0.8			

**NOTE:**

1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate VCC range. TA = - 40°C to + 85°C.

## OPERATING CHARACTERISTICS, VCC = 3.3V ± 0.3V, TA = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
CPD	Power Dissipation Capacitance per Transceiver Outputs enabled	CL = 0pF, f = 10Mhz	48	pF
CPD	Power Dissipation Capacitance per Transceiver Outputs disabled		4	

## SWITCHING CHARACTERISTICS (A PORT)<sup>(1)</sup>

Symbol	Parameter	VCC = 2.7V		VCC = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	
tPLH tPHL	Propagation Delay Bx to Ax	—	7.3	1.5	6.3	ns
tPZH tPZL	Output Enable Time OE to Ax	—	9.5	1.5	8.5	ns
tPHZ tPLZ	Output Disable Time OE to Ax	—	8.5	1.7	7.5	ns
tSk(0)	Output Skew <sup>(2)</sup>	—	—	—	500	ps

**NOTES:**

1. See TEST CIRCUITS AND WAVEFORMS. TA = - 40°C to + 85°C.
2. Skew between any two outputs of the same package and switching in the same direction.

**SWITCHING CHARACTERISTICS (B PORT)<sup>(1)</sup>**

Symbol	Parameter	V <sub>CC</sub> = 2.7V		V <sub>CC</sub> = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay A <sub>x</sub> to B <sub>x</sub>	—	8.1	1.5	7.1	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time $\overline{OE}$ to B <sub>x</sub>	—	10	1.5	9	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time $\overline{OE}$ to B <sub>x</sub>	—	9.2	1.7	8.2	ns
t <sub>SK(O)</sub>	Output Skew <sup>(2)</sup>	—	—	—	500	ps

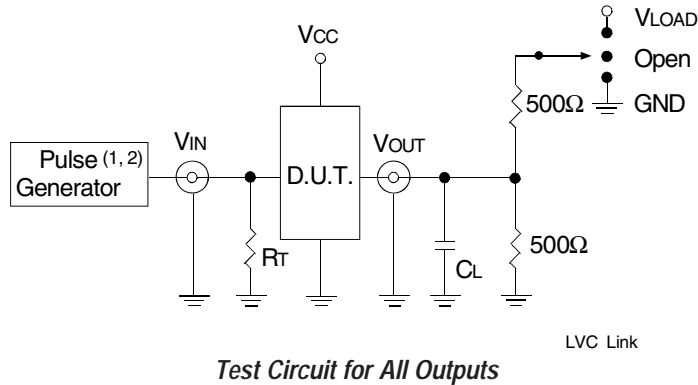
**NOTES:**

1. See TEST CIRCUITS AND WAVEFORMS. T<sub>A</sub> = - 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 <sub>CC</sub> <sup>(1)</sup> = 3.3V ± 0.3V	V <sub>CC</sub> <sup>(1)</sup> = 2.7V	V <sub>CC</sub> <sup>(2)</sup> = 2.5V ± 0.2V	Unit
V <sub>LOAD</sub>	6	6	2 x V <sub>CC</sub>	V
V <sub>IH</sub>	2.7	2.7	V <sub>CC</sub>	V
V <sub>T</sub>	1.5	1.5	V <sub>CC</sub> / 2	V
V <sub>LZ</sub>	300	300	150	mV
V <sub>HZ</sub>	300	300	150	mV
C <sub>L</sub>	50	50	30	pF



#### DEFINITIONS:

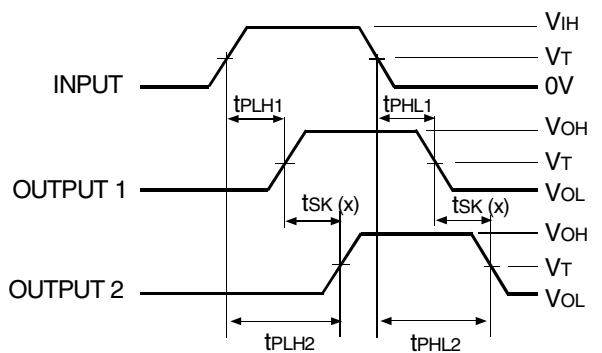
C<sub>L</sub> = Load capacitance: includes jig and probe capacitance.  
R<sub>T</sub> = Termination resistance: should be equal to Z<sub>OUT</sub> of the Pulse Generator.

#### NOTES:

1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t<sub>r</sub> ≤ 2.5ns; t<sub>r</sub> ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t<sub>r</sub> ≤ 2ns; t<sub>r</sub> ≤ 2ns.

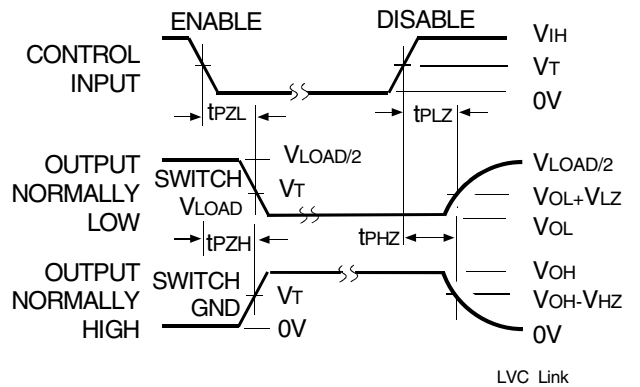
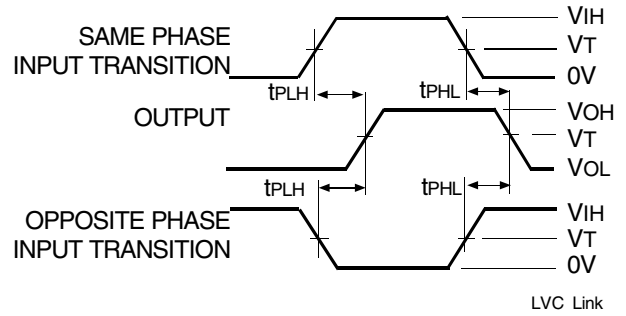
### SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	V <sub>LOAD</sub>
Disable High Enable High	GND
All Other Tests	Open



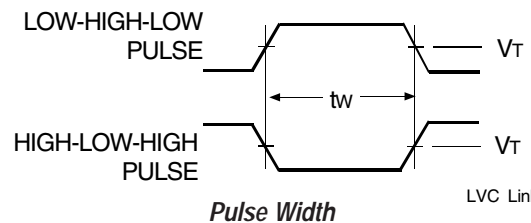
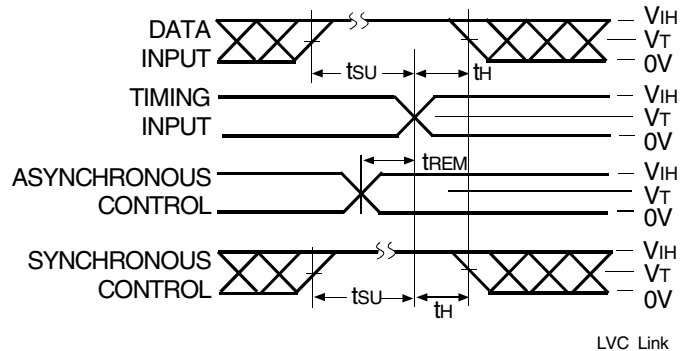
#### NOTES:

1. For tsk(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For tsk(b) OUTPUT1 and OUTPUT2 are in the same bank.



#### NOTE:

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



## ORDERING INFORMATION

IDT	XX	LVC	X	XXXX	XX	
Temp. Range	Bus-Hold		Device Type		Package	
					SO	Small Outline IC (gull wing)
					PY	Shrink Small Outline Package
					Q	Quarter Size Small Outline Package
					PG	Thin Shrink Small Outline Package
				2245A		Octal Bus Transceiver with 3-State Outputs, $\pm 12\text{mA}$ (B port) $\pm 24\text{mA}$ (A port)
			Blank			No Bus-hold
74						$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$



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