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

IDT74LVCR2245A

FEATURES:

- 0.5 MICRON CMOS Technology
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 1.27mm pitch SOIC, 0.65mm pitch SSOP, 0.635mm pitch QSOP, 0.65mm pitch TSSOP packages
- Extended commercial range of − 40°C to +85°C
- 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
- All inputs, outputs and I/O are 5 Volt tolerant
- Supports hot insertion

Drive Features for LVCR2245A:

- Balanced Output Drivers: ±12mA
- Low Switching Noise

DESCRIPTION:

The LVCR2245A octal bus transceiver is built using advanced dual metal CMOS technology. This 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.

The LVCR2245A has series resistors in the output structure which will significantly reduce line noise when used with light loads. The driver has been designed to drive ±12mA at the designated threshold.

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.

APPLICATIONS:

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

FUNCTIONAL BLOCK DIAGRAM

TO SEVEN OTHER CHANNELS

EXTENDED COMMERCIAL TEMPERATURE RANGE

OCTOBER 1999

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PIN CONFIGURATION

DIR	1	20	V_{CC}
A_1	2	19	$\overline{OE}$
A_2	3	18	B_1
A_3	4	17	B_2
A_4	5	16	B_3
A_5	6	15	B_4
A_6	7	14	B_5
A_7	8	13	B_6
A_8	9	12	B_7
GND	10	11	B_8

SO20-2
SO20-7
SO20-8
SO20-9

SOIC/ SSOP/ QSOP/ TSSOP
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}	Continuous Clamp Current,	– 50	mA
I_{OK}	$V_I < 0$ or $V_O < 0$		
I_{CC}	Continuous Current through	±100	mA
I_{SS}	each V_{CC} or GND		

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NOTE:
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.

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:
1. As applicable to the device type.

PIN DESCRIPTION

Pin Names	Description
$\overline{OE}$	Output-enable Input (Active LOW)
Ax, Bx	Data Inputs or 3-State Outputs
DIR	Direction-control Input

FUNCTION TABLE [1]

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

NOTE:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Operating Condition: T_A = – 40°C To +85°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_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	V_{CC} = 3.6V	V_{IN} = GND or V_{CC}	—	—	10	µA
			3.6 ≤ V_{IN} ≤ 5.5V[2]	—	—	10	
ΔI_{CC}	Quiescent Power Supply Current Variation	One input at V_{CC} - 0.6V, other inputs at V_{CC} or GND		—	—	500	µA

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NOTES:
1. Typical values are at V_{CC} = 3.3V, +25°C ambient.
2. This applies in the disabled state only.

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} = – 4mA	1.9	—	
			I_{OH} = – 6mA	1.7	—	
		V_{CC} = 2.7V	I_{OH} = – 4mA	2.2	—	
			I_{OH} = – 8mA	2	—	
		V_{CC} = 3.0V	I_{OH} = – 6mA	2.4	—	
			I_{OH} = – 12mA	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} = 4mA	—	0.4	
			I_{OL} = 6mA	—	0.55	
		V_{CC} = 2.7V	I_{OL} = 4mA	—	0.4	
			I_{OL} = 8mA	—	0.6	
		V_{CC} = 3.0V	I_{OL} = 6mA	—	0.55	
			I_{OL} = 12mA	—	0.8	

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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, V_{CC} = 3.3V $\pm$ 0.3V, T_A = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
C_{PD}	Power dissipation capacitance per tranceiver Outputs enabled	C_L = 0pF, f = 10Mhz	48	pF
C_{PD}	Power dissipation capacitance per tranceiver Outputs disabled		4	pF

SWITCHING CHARACTERISTICS [1]

Symbol	Parameter	V_{CC} = 2.5V±0.2V		V_{CC} = 2.7V		V_{CC} = 3.3V±0.3V		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay Ax or Bx to Bx or Ax	—	—	—	7.3	1.5	6.3	ns
t_{PZH} t_{PZL}	Output Enable Time $\overline{OE}$ or DIR to Ax or Bx	—	—	—	9.5	1.5	8.2	ns
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{OE}$ or DIR to Ax or Bx	—	—	—	8.5	1.7	7.8	ns
$t_{SK}(0)$	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
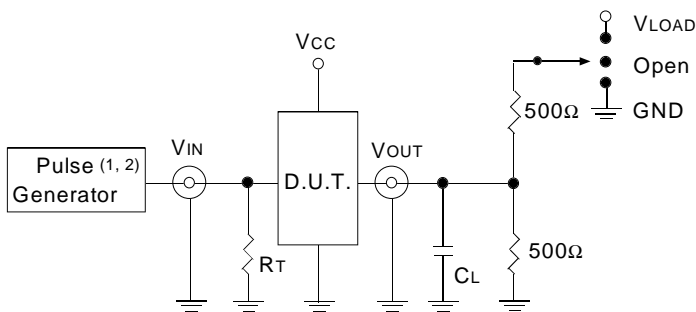
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DEFINITIONS:
C_L= Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

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 - tsk (x)
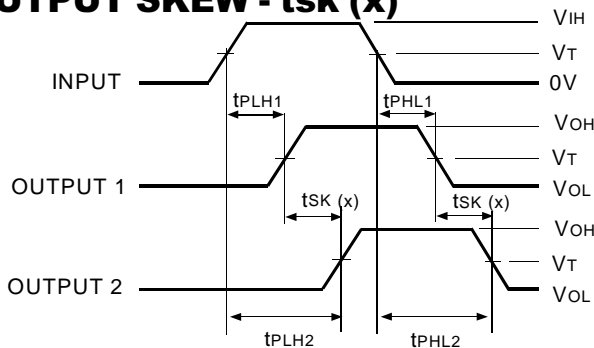
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$
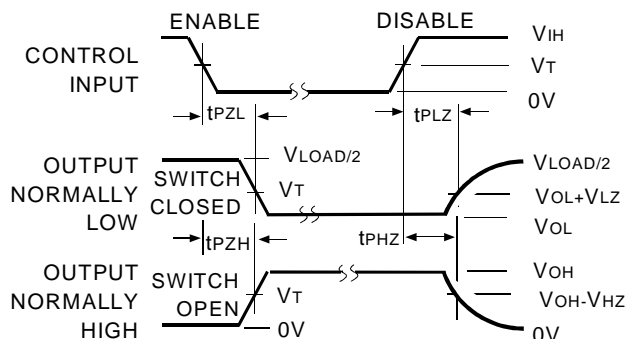
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NOTES:
1. For $t_{SK}(o)$ OUTPUT1 and OUTPUT2 are any two outputs.
2. For $t_{SK}(b)$ OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY
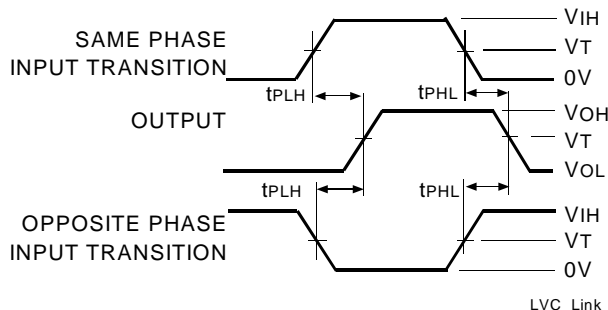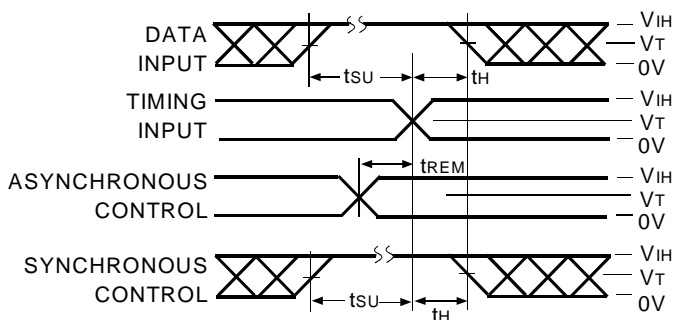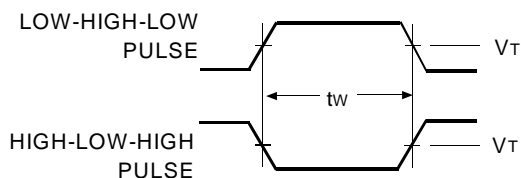

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ENABLE AND DISABLE TIMES

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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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ORDERING INFORMATION

IDT_____XX_____ LVC ___X___ ___XXXX___ ___XX___
     Temp. Range   Bus-Hold Device Type Package

SO	Small Outline IC (gull wing) (SO20-2)
PY	Shrink Small Outline Package (SO20-7)
Q	Quarter Size Small Outline Package (SO20-8)
PG	Thin Shrink Small Outline Package (SO20-9)

R2245A	Octal Bus Transceiver with 3-State Outputs, ±12mA

Blank	No Bus-hold

74	−40°C to +85°C