IDT74LVCR162245A

3.3V CMOS 16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS AND 5 VOLT TOLERANT I/O

FEATURES:

- **Typical $t_{SK(o)}$ (Output Skew) < 250ps**
- **ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)**
- **V_{CC} = 3.3V ± 0.3V, Normal Range**
- **V_{CC} = 2.7V to 3.6V, Extended Range**
- **CMOS power levels (0.4μ W typ. static)**
- **All inputs, outputs, and I/O are 5V tolerant**
- **Supports hot insertion**
- **Available in SSOP, TSSOP, and TVSOP packages**

DRIVE FEATURES:

- **Balanced Output Drivers: ±12mA**
- **Low switching noise**

APPLICATIONS:

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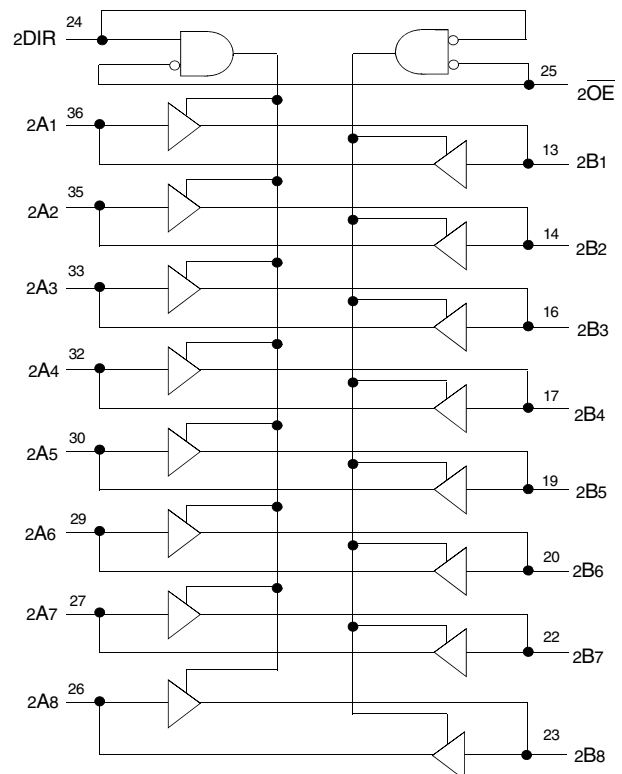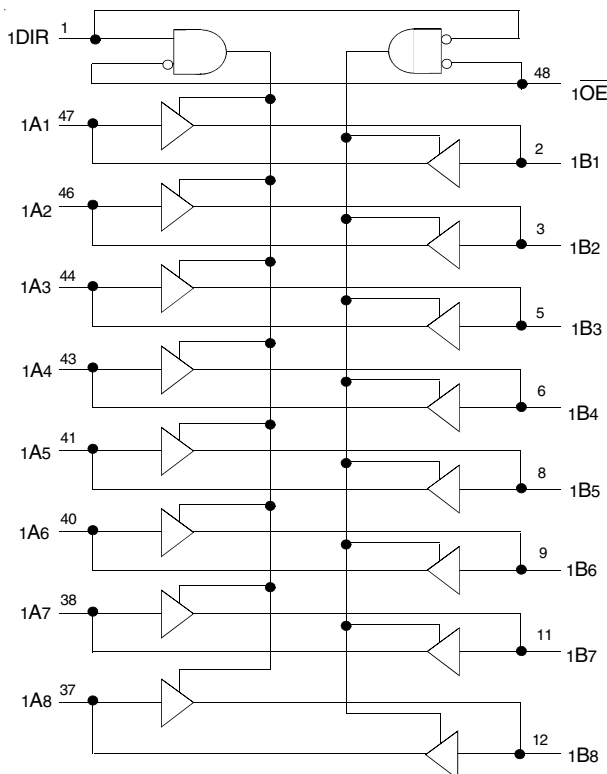- **Data communication and telecommunication systems**

DESCRIPTION:

This 16-bit bus transceiver is built using advanced dual metal CMOS technology. This high-speed, low power transceiver is ideal for asynchronous communication between two busses (A and B). The Direction and Output Enable controls are designed to operate this device as either two independent 8-bit transceivers or one 16-bit transceiver. 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.
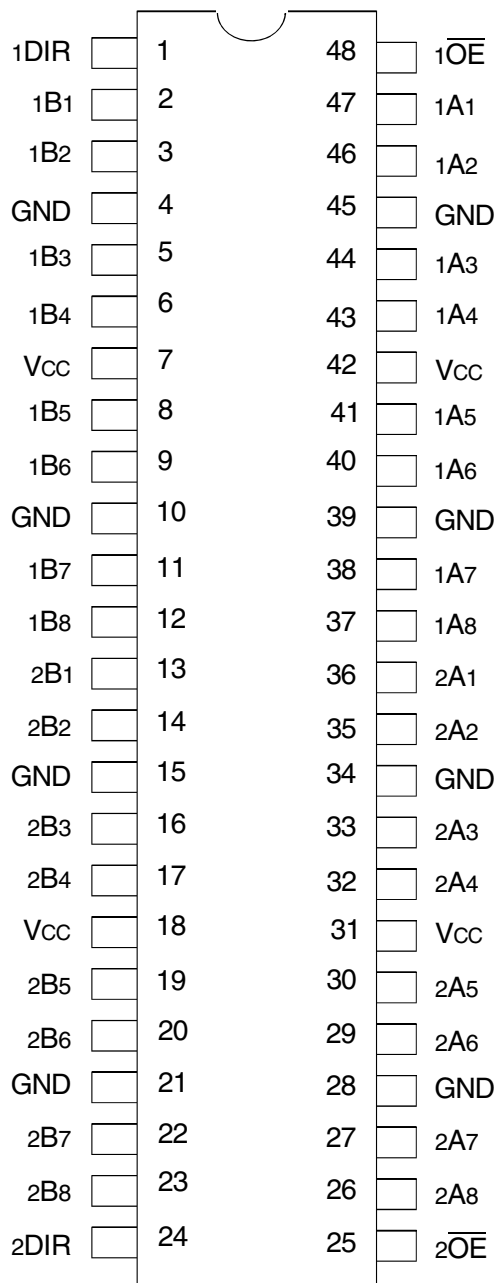
All pins can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V/5V supply system.

The LVCR162245A has series resistors in the device 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 levels.

FUNCTIONAL BLOCK DIAGRAM

INDUSTRIAL TEMPERATURE RANGE

MARCH 2006

DSC-4691/3

PIN CONFIGURATION

1DIR 1   48 1$\overline{\text{OE}}$
1B1 2   47 1A1
1B2 3   46 1A2
GND 4   45 GND
1B3 5   44 1A3
1B4 6   43 1A4
VCC 7   42 VCC
1B5 8   41 1A5
1B6 9   40 1A6
GND 10   39 GND
1B7 11   38 1A7
1B8 12   37 1A8
2B1 13   36 2A1
2B2 14   35 2A2
GND 15   34 GND
2B3 16   33 2A3
2B4 17   32 2A4
VCC 18   31 VCC
2B5 19   30 2A5
2B6 20   29 2A6
GND 21   28 GND
2B7 22   27 2A7
2B8 23   26 2A8
2DIR 24   25 2$\overline{\text{OE}}$

SSOP/ TSSOP/ TVSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Description	Max	Unit
V_{TERM}[2]	Terminal Voltage with Respect to GND	–0.5 to +6.5	V
V_{TERM}[3]	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

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

NOTE:
1. As applicable to the device type.

PIN DESCRIPTION

Pin Names	Description
x$\overline{\text{OE}}$	Output Enable Input (Active LOW)
xDIR	Direction Control Input
xAx	Side A Inputs or 3-State Outputs
xBx	Side B Inputs or 3-State Outputs

FUNCTION TABLE (EACH 8-BIT SECTION)[1]

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

NOTE:
1. 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°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

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} = 3V	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} = 3V	I_{OL} = 6mA	—	0.55	
			I_{OL} = 12mA	—	0.8	

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 ± 0.3V, T_A = 25°C

Symbol	Parameter	Test Conditions	Typical	Unit
C_{PD}	Power Dissipation Capacitance per Transceiver Outputs enabled	C_L = 0pF, f = 10Mhz	39	pF
C_{PD}	Power Dissipation Capacitance per Transceiver Outputs disabled		4	

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 xAx to xBx, xBx to xAx	—	5.7	1.5	4.8	ns
t_{PZH} t_{PZL}	Output Enable Time x$\overline{OE}$ to xAx or xBx	—	7.9	1.5	6.3	ns
t_{PHZ} t_{PLZ}	Output Disable Time x$\overline{OE}$ to xAx or xBx	—	8.3	2.2	7.4	ns
$t_{SK(O)}$	Output Skew[2]	—	—	—	500	ps

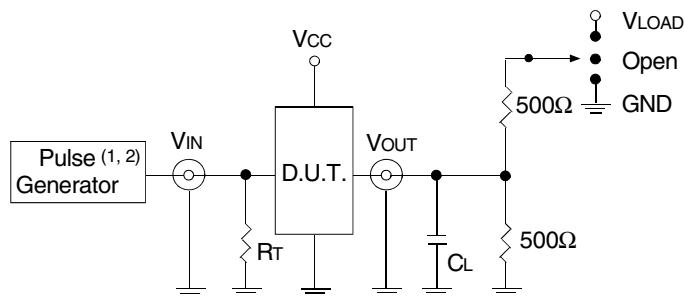**NOTES:**
1. See TEST CIRCUITS AND WAVEFORMS. T_A = – 40°C to + 85°C.
2. Skew between any two outputs of the same package and switching in the same direction.

TEST CIRCUITS AND WAVEFORMS
TEST CONDITIONS

Symbol	$V_{CC}^{(1)} = 3.3V \pm 0.3V$	$V_{CC}^{(1)} = 2.7V$	$V_{CC}^{(2)} = 2.5V \pm 0.2V$	Unit
V_{LOAD}	6	6	$2 \times V_{CC}$	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

Test Circuit for All Outputs

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 $\leq$ 10MHz; $t_F \leq$ 2.5ns; $t_R \leq$ 2.5ns.
2. Pulse Generator for All Pulses: Rate $\leq$ 10MHz; $t_F \leq$ 2ns; $t_R \leq$ 2ns.

SWITCH POSITION

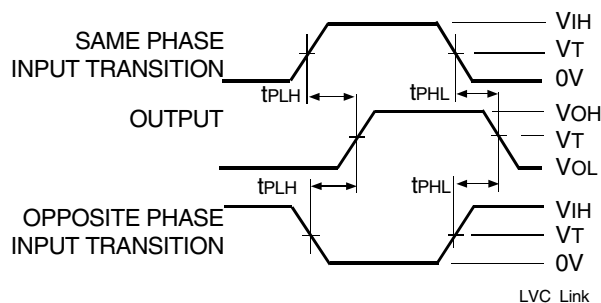| Test	Switch
Open Drain Disable Low Enable Low	V_{LOAD}
Disable High Enable High	GND
All Other Tests	Open
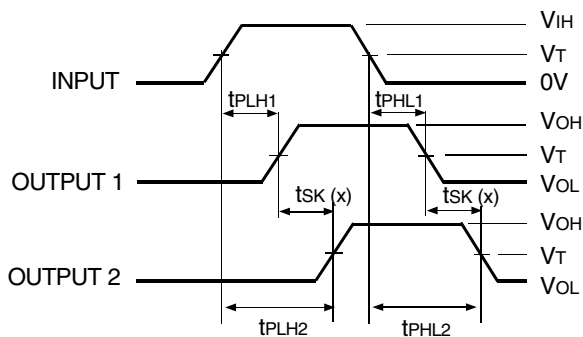
$t_{SK}(x) = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$
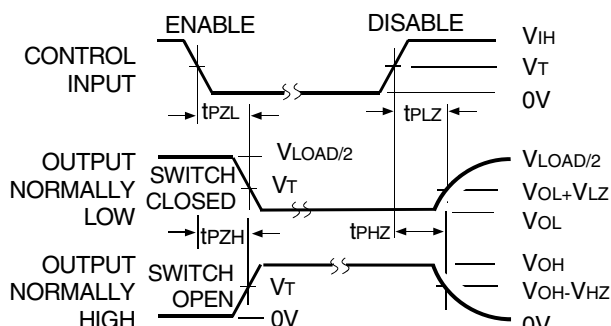
Output Skew - $t_{SK}(x)$

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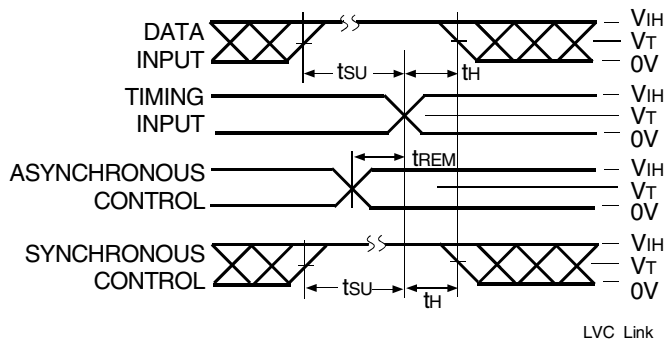2. For $t_{SK}(b)$ OUTPUT1 and OUTPUT2 are in the same bank.
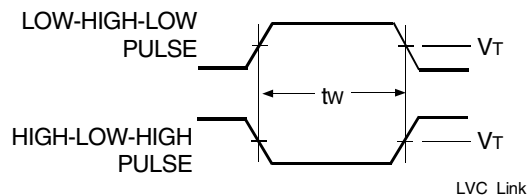

Propagation Delay

Enable and Disable Times

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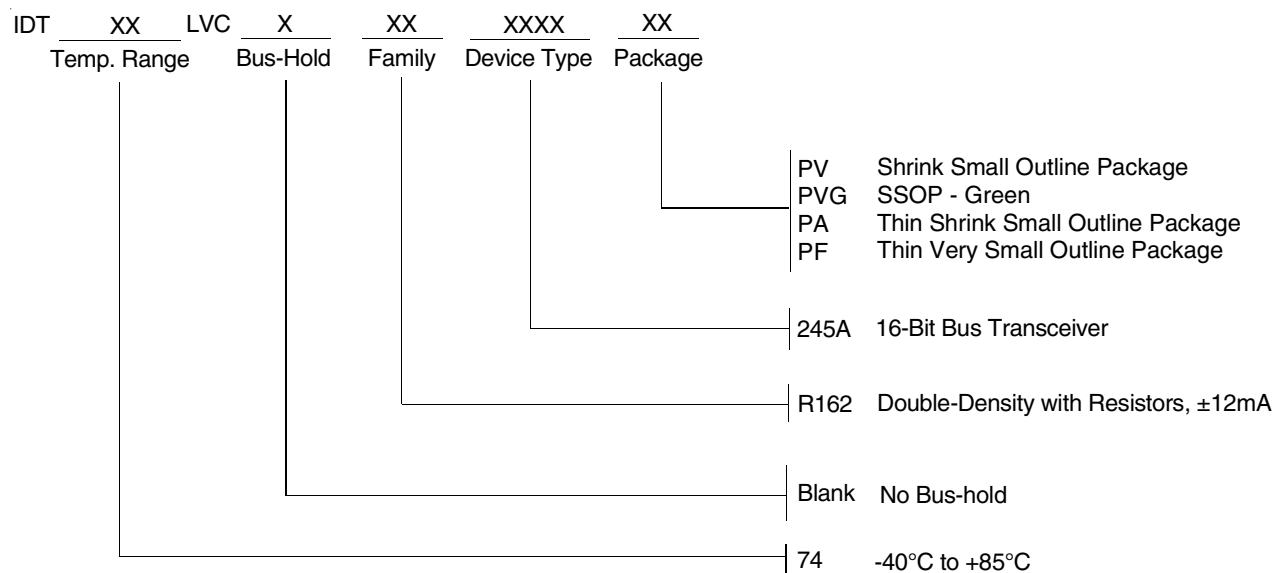1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Set-up, Hold, and Release Times

Pulse Width

ORDERING INFORMATION

IDT	XX	LVC	X	XX	XXXX	XX
	Temp. Range		Bus-Hold	Family	Device Type	Package

PV   Shrink Small Outline Package
PVG   SSOP - Green
PA   Thin Shrink Small Outline Package
PF   Thin Very Small Outline Package

245A   16-Bit Bus Transceiver

R162   Double-Density with Resistors, ±12mA

Blank   No Bus-hold

74   -40°C to +85°C