3.3V CMOS OCTAL DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE OUTPUT VOLTAGE, 3-STATE OUTPUTS, 5 VOLT I/O

IDT74LVCC4245A
ADVANCE INFORMATION

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 LVCC4245A:

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

APPLICATIONS:

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

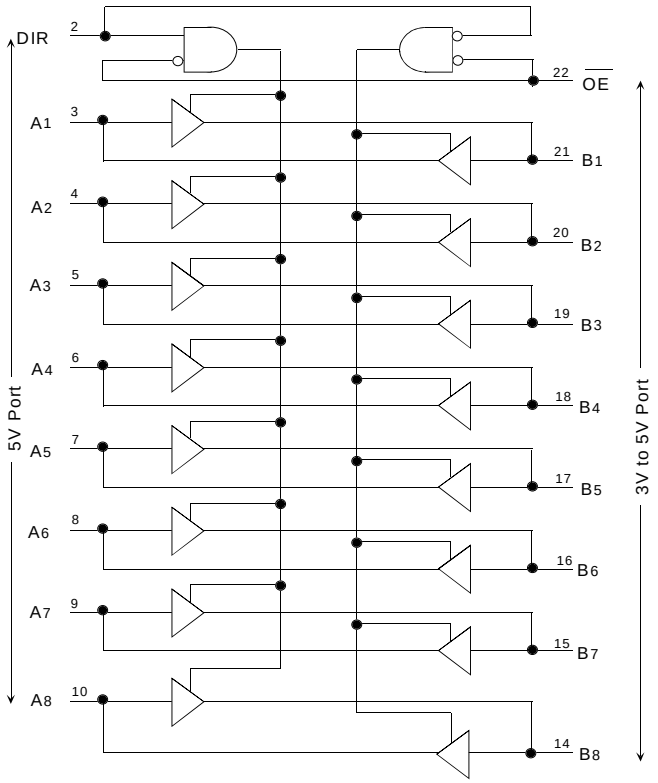
DESCRIPTION:

The LVCC4245A is built using advanced dual metal CMOS technology. This 8-bit (octal) noninverting bus transceiver contains two separate power-supply rails. The configurable B port is designed to track V_{CCB}, which accepts voltages from 3V to 5V, and the A port is dedicated to accept a 5V supply level. This allows for translation from a 3.3V to a 5V system environment and vice-versa.

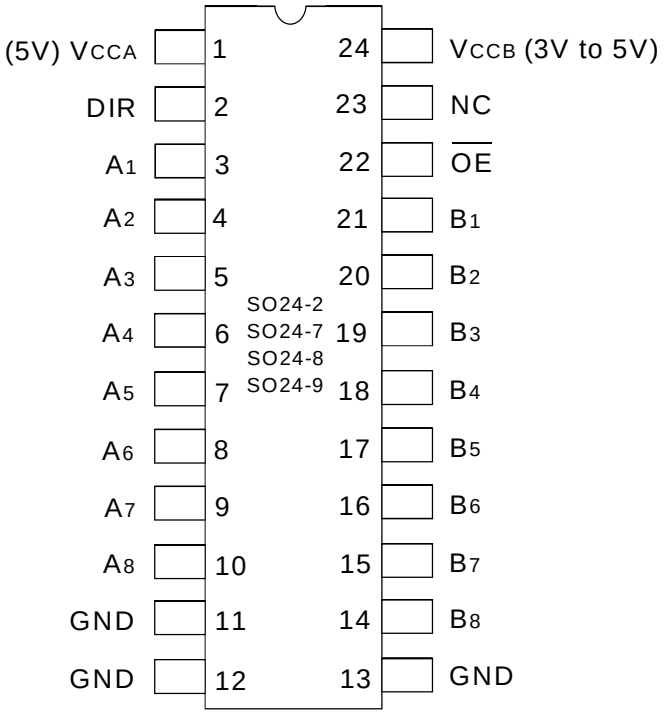
This LVCC4245A is ideal for asynchronous communication between two data buses (A and B). The device transmits data from A to B or from B to A, depending on the logic level at the direction-control (DIR) input. The output-enable ($\overline{OE}$) input can be used to disable the device so the buses are effectively isolated.

The LVCC4245A has been designed with a ±24mA output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

Functional Block Diagram



PIN CONFIGURATION



SOIC/ SSOP/ QSOP/ TSSOP
TOP VIEW

PIN DESCRIPTION

Pin Names	Description
$\overline{OE}$	Output Enable Input (Active LOW)
DIR	Direction Control Input
Ax	Side A Inputs or 3-State Outputs
Bx	Side B Inputs or 3-State Outputs
NC	No Internal Connection

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

ABSOLUTE MAXIMUM RATING FOR V_{CCA} (1)

Symbol	Description	Max.	Unit
V_{TERM}(2)	Terminal Voltage with Respect to GND	– 0.5 to +6	V
V_{TERM}(3)	Terminal Voltage with Respect to GND	– 0.5 to V_{CCA}+0.5	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

ABSOLUTE MAXIMUM RATING FOR V_{CCB} (1)

Symbol	Description	Max.	Unit
V_{TERM}(2)	Terminal Voltage with Respect to GND	– 0.5 to +6	V
V_{TERM}(3)	Terminal Voltage with Respect to GND	– 0.5 to V_{CCB}+0.5	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	5	—	pF
$C_{I/O}$	I/O Port Capacitance	V_{IN} = 0V	11	—	pF

NOTE:
1. As applicable to the device type.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE (A PORT)

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: T_A = – 40°C To +85°C; V_{CCA} = 4.5V to 5.5V (1)

Symbol	Parameter	Test Conditions		Min.	Typ.(2)	Max.	Unit
V_{IH}	Input HIGH Voltage Level	V_{CCA} = 4.5V, V_{CCB} = 2.7V	$V_{OB} \leq$ 0.1V or	2	—	—	V
		V_{CCA} = 4.5V, V_{CCB} = 3.6V	$V_{OB} \geq V_{CCB}$ – 0.1V	2	—	—	
		V_{CCA} = 5.5V, V_{CCB} = 5.5V		2	—	—	
V_{IL}	Input LOW Voltage Level	V_{CCA} = 4.5V, V_{CCB} = 2.7V		—	—	0.8	V
		V_{CCA} = 4.5V, V_{CCB} = 3.6V		—	—	0.8	
		V_{CCA} = 5.5V, V_{CCB} = 5.5V		—	—	0.8	
I_{IH} I_{IL}	Input Leakage Current (Control Inputs)	V_{CCA} = 5.5V V_{CCB} = 3.6V or 5.5V	V_I = 0 to 5.5V	—	—	±1	µA
I_{OZH} I_{OZL}	High Impedance Output Current (3-State Output pins)	V_{CCA} = 5.5V V_{CCA} = 3.6V	V_O = 0 to 5.5V	—	—	±5	µA
V_{IK}	Clamp Diode Voltage	V_{CCA} = 4.5V, I_{IN} = – 18mA		—	– 0.7	– 1.2	V
V_H	Input Hysteresis	V_{CCA} = 5.0V		—	100	—	mV
I_{CCL} I_{CCH}	Quiescent Power Supply Current	V_{CCA} = 5.5V V_{CCB} = 3.6V or 5.5V	V_{IN} = GND or V_{CCA} I_{OB} = 0	—	—	80	µA
ΔI_{CC}	Quiescent Power Supply Current Variation	One input at 3.4V, other inputs at V_{CCA} or GND		—	—	1.5	mA

NOTES:
1. V_{CCB} = 2.7V to 5.5V unless otherwise noted.
2. Typical values are at V_{CCA} = 5.0V, +25°C ambient.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE (B PORT)

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: T_A = – 40°C To +85°C; V_{CCB} = 2.7V to 5.5V (1)

Symbol	Parameter	Test Conditions		Min.	Typ.(2)	Max.	Unit
V_{IH}	Input HIGH Voltage Level	V_{CCB} = 2.7V, V_{CCA} = 4.5V	$V_{OA} \leq$ 0.1V or	2	—	—	V
		V_{CCB} = 3.6V, V_{CCA} = 4.5V	$V_{OA} \geq V_{CCA}$ – 0.1V	2	—	—	
		V_{CCB} = 5.5V, V_{CCA} = 5.5V		3.85	—	—	
V_{IL}	Input LOW Voltage Level	V_{CCB} = 2.7V, V_{CCA} = 4.5V		—	—	0.8	V
		V_{CCB} = 3.6V, V_{CCA} = 4.5V		—	—	0.8	
		V_{CCB} = 5.5V, V_{CCA} = 5.5V		—	—	1.65	
I_{OZH} I_{OZL}	High Impedance Output Current (3-State Output pins)	V_{CCB} = 3.6V V_{CCA} = 5.5V	V_O = 0 to 5.5V	—	—	±5	µA
V_{IK}	Clamp Diode Voltage	V_{CCB} = 2.3V, I_{IN} = – 18mA		—	– 0.7	– 1.2	V
V_H	Input Hysteresis	V_{CCB} = 3.3V		—	100	—	mV
I_{CCL} I_{CCH}	Quiescent Power Supply Current	V_{CCB} = 3.6V or 5.5V V_{CCA} = 5.5V	V_{IN} = GND or V_{CCB} I_{OA} = 0	—	—	80	µA
ΔI_{CC}	Quiescent Power Supply Current Variation	One input at V_{CCB} - 0.6V, other inputs at V_{CCB} or GND		—	—	500	µA

NOTES:
1. V_{CCA} = 4.5V to 5.5V unless otherwise noted.
2. Typical values are at V_{CCB} = 3.3V, +25°C ambient.

OUTPUT DRIVE CHARACTERISTICS (A PORT)

Symbol	Parameter	Test Conditions[1]		Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CCA} = 4.5V, V_{CCB} = 3V	I_{OH} = – 0.1mA	4.4	—	V
	(B port to A port)		I_{OH} = – 24mA	3.76	—	
V_{OL}	Output LOW Voltage	V_{CCA} = 4.5V, V_{CCB} = 3V	I_{OL} = 0.1mA	—	0.1	V
	(B port to A port)		I_{OH} = 24mA	—	0.44	

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.

OUTPUT DRIVE CHARACTERISTICS (B PORT)

Symbol	Parameter	Test Conditions[1]		Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CCB} = 3V	I_{OH} = – 0.1mA	2.9	—	V
	(A port to B port)	V_{CCB} = 2.7V	I_{OH} = – 12mA	2.2	—	
		V_{CCB} = 3V		2.46	—	
		V_{CCB} = 2.7V	I_{OH} = – 24mA	2.1	—	
		V_{CCB} = 3V		2.25	—	
		V_{CCB} = 4.5V		3.76	—	
V_{OL}	Output LOW Voltage	V_{CCB} = 3V	I_{OL} = 0.1mA	—	0.1	V
	(A port to B port)	V_{CCB} = 2.7V	I_{OL} = 12mA	—	0.44	
		V_{CCB} = 2.7V	I_{OL} = 24mA	—	0.5	
		V_{CCB} = 3V		—	0.44	
		V_{CCB} = 4.5V		—	0.44	

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, V_{CCA} = 4.5V.

OPERATING CHARACTERISTICS, T_A = 25°C

Symbol	Parameter	Test Conditions	V_{CCA} = 5V, V_{CCB} = 3.3V Typical	Unit
C_{PD}	Power Dissipation Capacitance per transceiver Outputs Enabled	C_L = 0pF, f = 10Mhz	20	pF
C_{PD}	Power Dissipation Capacitance per transceiver Outputs Disabled		6.5	pF

SWITCHING CHARACTERISTICS (1)

Symbol	Parameter	V_{CCA} = 5V±0.5V				Unit
		V_{CCB} = 5V±0.5V		V_{CCB} = 2.7V to 3.6V		
		Min.	Max.	Min.	Max.	
t_{PHL}	Propagation Delay	1	7.1	1	7	ns
t_{PLH}	Ax to Bx	1	6	1	7	
t_{PHL}	Propagation Delay	1	6.8	1	6.2	ns
t_{PLH}	Bx to Ax	1	6.1	1	5.3	
t_{PZL}	Output Enable Time	1	8.2	1	10	ns
t_{PZH}	$\overline{OE}$ to Bx	1	8.1	1	10.2	
t_{PZL}	Output Enable Time	1	9	1	9	ns
t_{PZH}	$\overline{OE}$ to Ax	1	8.3	1	8	
t_{PLZ}	Output Disable Time	1	4.7	1	5.2	ns
t_{PHZ}	$\overline{OE}$ to Ax	1	4.9	1	5.2	
t_{PLZ}	Output Disable Time	1	5.4	1	5.4	ns
t_{PHZ}	$\overline{OE}$ to Bx	1	6.3	1	7.4	
$t_{SK}(o)$	Output Skew(2)	—	—	—	500	ps

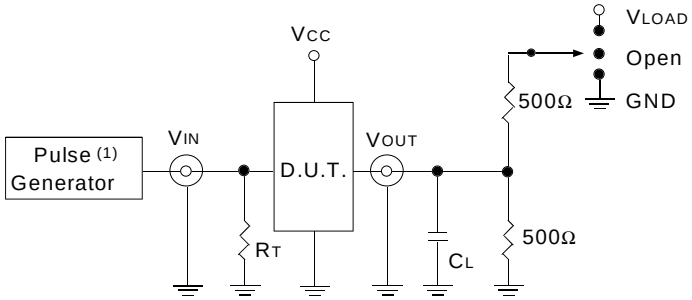
NOTES:
1. See test circuits and waveforms. T_A = – 40°C to + 85°C.
2. Skew between any two outputs of the same package and switching in the same direction.

TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	V_{CCA}= 4.5V to 5.5V(1) V_{CCB}= 2.7V to 3.6V	V_{CCA}= 4.5V to 5.5V V_{CCB}= 3.6V to 5.5V	Unit
V_{LOAD}	2xV_{CCA}	2xV_{CCA}	V
V_{IH}	3	V_{CCB}	V
V_T	1.5	V_{CCB}/2	V
V_{LZ}	300	300	mV
V_{HZ}	300	300	mV
C_L	50	50	pF

TEST CIRCUITS 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.

NOTE:

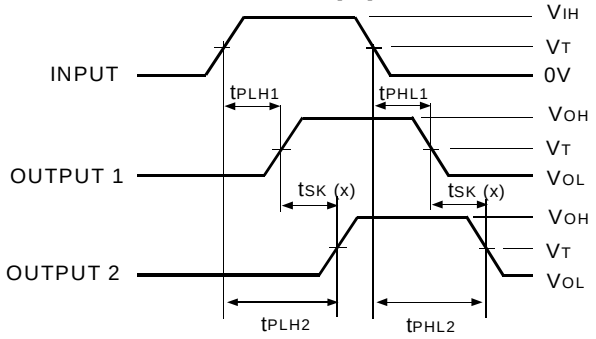
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.

SWITCH POSITION

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

8LVC Link

OUTPUT SKEW - tsk (x)

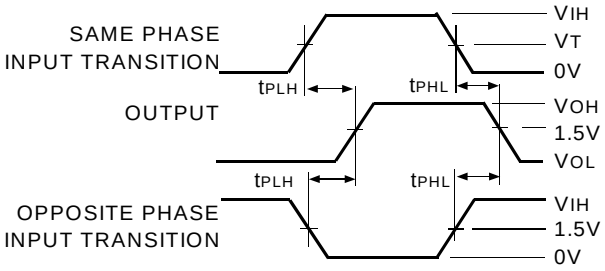


$t_{SK(x)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

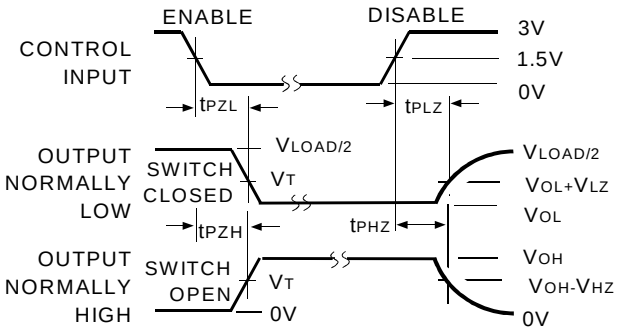
NOTES:

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.

PROPAGATION DELAY



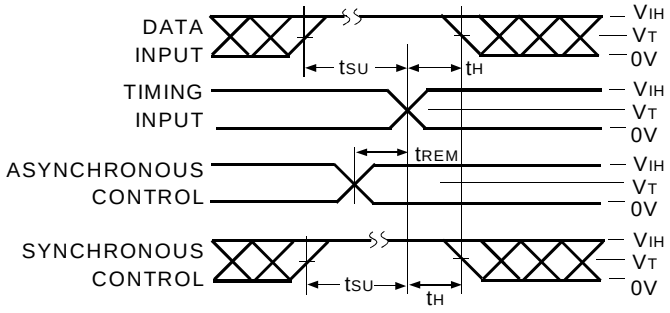
ENABLE AND DISABLE TIMES



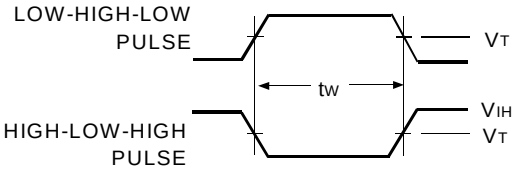
NOTE:

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

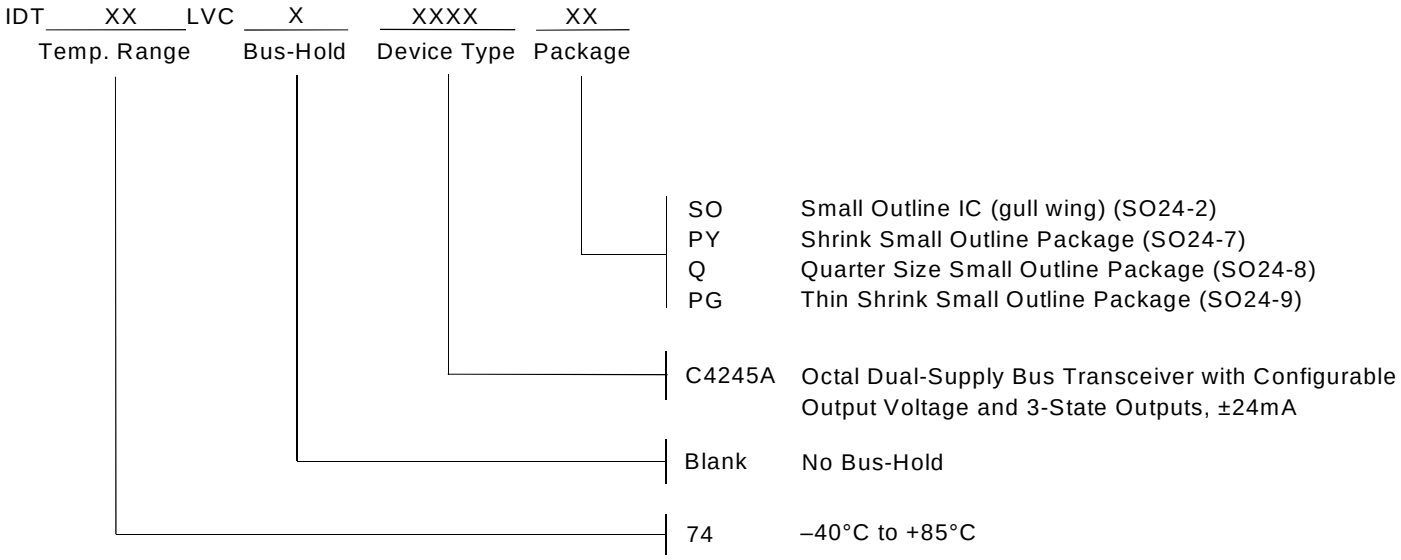
SET-UP, HOLD, AND RELEASE TIMES



PULSE WIDTH



ORDERING INFORMATION



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