8-Bit Dual Supply Bus Transceiver with 3-State Outputs

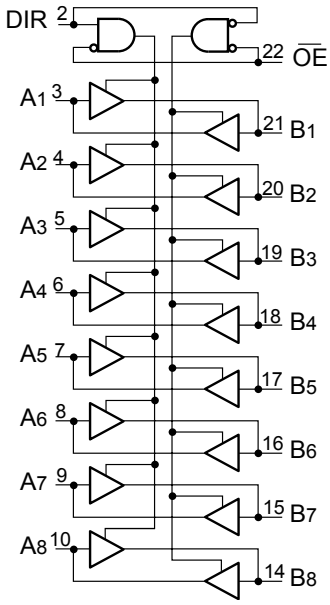
Product Features

- 4.5V to 5.5V on A-port and 2.7V to 3.6V on B-port
- Latch-up performance exceeds 200mA Per JESD78
- ESD protection exceeds JESD 22
  - 2000V Human-Body Model (A114-B)
  - 200V Machine Model (A115-A)
- Industrial Temperature: –40°C to +85°C
- Packaging (Pb-free & Green available):
  - 24-pin 173-mil wide plastic TSSOP (L)
  - 24-pin 150-mil wide plastic QSOP (Q)
  - 24-pin 300-mil wide plastic SOIC (S)

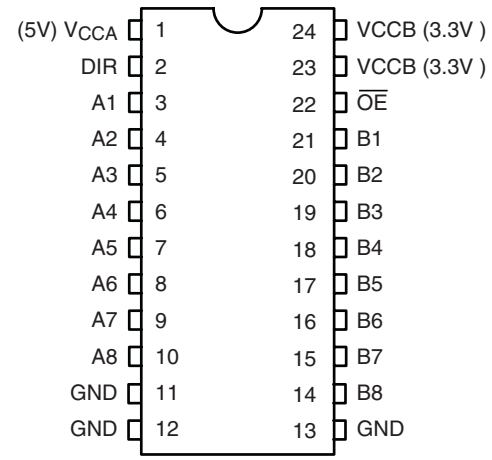
Product Description

The PI74LVC4245A is a non-inverting 8-bit Bidirectional Transceiver that uses two separate power supply rails. A-port (V_{CCA}) is set to operate at 5V and B-port (V_{CCB}) is set to operate at 3.3V. This allows for translation from a 3.3V to a 5V environment and vice-versa. This tranceiver is designed for asynchronous two-way communication between data buses. The direction control input pin (DIR) determines the dataflow from the A bus to the B bus or from the B bus to the A bus. The output enable ($\overline{OE}$) input, when HIGH, disables both A and B ports by placing them in HIGH Z condition.

Logic Block Diagram



Product Pin Configuration



Truth 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	Z (Isolation)

Note:
1. H = High Signal Level L = Low Signal Level
   X = Don't Care or Irrelevant Z = High Impedance

Product Pin Description

Pin Name	Description
$\overline{OE}$	3-State Output Enable Inputs (Active LOW)
DIR	Direction Control Input
Ax	Side A Inputs or 3-State Outputs
Bx	Side B Inputs or 3-State Outputs
GND	Ground
V_{CCA},V_{CCB}	Power

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Supply voltage range, V_{CCA} and V_{CCB} ..... –0.5V to +7V
Input voltage range, V_I(1) : I/O ports (A-port) .... –0.5V to V_{CCA} +0.5V
I/O ports (B-port) ..... –0.5V to V_{CCB}+0.5V
Control Pins ..... –0.5V to V_{CCA} +0.5V
Input clamp current, I_{IK} (V_I <0)..... –50mA
Output clamp current, I_{OK} (V_O <0)..... –50mA
Continous Output Current I_O ..... ±50mA
Continous Current through each VCC or GND pin ..... ±100mA
Package thermal impedance, θ_{JA}(2): package L..... 84°C/W
package Q..... 98°C/W
package S ..... 79°C/W
Storage Temperature range, T_{stg} ..... –65°C to 150°C

Notes:
Stresses greater than those listed under 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.

1. This value is limited to 7V maximum.
2. The package thermal impedance is calculated in accordance with JESD 51.

Recommended Operating Conditions for V_{CCA} = 4.5V to 5.5V(1)

Parameter	Description	Min.	Max.	Units
V_{CCA}	Supply Voltage	4.5	5.5	V
V_{IH}	High-Level Input Voltage	2		
V_{IL}	Low-Level Input Voltage		0.8	
V_I	Input Voltage	0	V_{CCA}	
V_O	Output Voltage	0	V_{CCA}	
I_{OH}	High-Level Output Current		–24	mA
I_{OL}	Low-Level Output Current		24	
T_A	Operating Free-Air Temperature	–40	85	°C

Notes:
1. All unused inputs of the device must be held at the associated V_{CC} or GND to ensure proper device operation.

Recommended Operating Conditions for V_{CCB} = 2.7V to 3.6V(1)

Parameter	Description		Min.	Max.	Units
V_{CCB}	Supply Voltage		2.7	3.6	V
V_{IH}	High-Level Input Voltage	V_{CCB} = 2.7V to 3.6V	2		
V_{IL}	Low-Level Input Voltage	V_{CCB} = 2.7V to 3.6V		0.8	
V_I	Input Voltage		0	V_{CCB}	
V_O	Output Voltage		0	V_{CCB}	
I_{OH}	High-Level Output Current	V_{CCB} = 2.7V		–12	mA
		V_{CCB} = 3V		–24	
I_{OL}	Low-Level Output Current	V_{CCB} = 2.7V		12	
		V_{CCB} = 3V		24	
T_A	Operating Free-Air Temperature		–40	85	°C

Notes:
1. All unused inputs of the device must be held at the associated V_{CC} or GND to ensure proper device operation.

DC Electrical Characteristics (Over Supply Voltage and Operating Temperature Ranges, unless otherwise specified)
A-Port (5V)

Parameters	Description	Test Conditions	V_{CCA}	V_{CCB}	Min.	Typ.(1)	Max.	Units
V_{OH}	Minimum High Level Output Voltage	I_{OH} = –100µA	4.5V	2.7V to 3.6V	4.4	4.5		V
			5.5V	2.7V to 3.6V	5.4	5.5		
		I_{OH} = –24mA	4.5V	2.7V to 3.6V	3.7	4.17		
			5.5V	2.7V to 3.6V	4.7	5.2		
V_{OL}	Maximum Low Level Output Voltage	I_{OL} = 100µA	4.5V	2.7V to 3.6V			0.1	
			5.5V	2.7V to 3.6V			0.1	
		I_{OL} = 24mA	4.5V	2.7V to 3.6V		0.19	0.5	
			5.5V	2.7V to 3.6V		0.19	0.5	
I_I	Maximum Input Leakage Current (Control Inputs)	$V_I = V_{CCA}$ or GND	5.5V	2.7V to 3.6V			±1	µA
I_{OZ}(2)	Maximum 3-State Output Leakage Current (A port)	$V_O = V_{CCA}$ or GND	5.5V	2.7V to 3.6V			±5	
I_{CCA}	Quiescent V_{CCA} Supply Current	$V_I = V_{CCA}$ or GND, $I_O = 0$	5.5V	2.7V to 3.6V			10	
ΔI_{CCA}(3)	I_{CCA} per input (A port and Control Inputs)	One Input at 3.4V, other inputs at V_{CCA} or GND	5.5V	2.7V to 3.6V		0.65	1.5	mA
C_I	Input Capacitance (Control Inputs)	$V_I = V_{CCA}$ or GND	Open	2.7V to 3.6V		2.4		pF
C_{IO}	Input/Output Capacitance (A port)	$V_O = V_{CCA}$ or GND	5V	2.7V to 3.6V		9.5		

Notes:
5. All typical values are measured at V_{CCA} = 5V, T_A = 25°C
6. For I/O ports, the parameter I_{OZ} includes the input leakage current.
7. This is the increase in supply current for each input that is at one of the specified voltage levels, rather than 0V or the associated V_{CC}.

DC Electrical Characteristics (Over Supply Voltage and Operating Temperature Ranges, unless otherwise specified)
B-Port (3.3V)

Parameters	Description	Test Conditions	V_{CCA}	V_{CCB}	Min.	Typ.(1)	Max.	Units
V_{OH}	Minimum High Level Output Voltage	I_{OH} = –100µA	4.5V to 5.5V	2.7V to 3.6V	V_{CC} –0.1			V
		I_{OH} = –12mA	4.5V to 5.5V	2.7V	2.2	2.56		
			4.5V to 5.5V	3V	2.4	2.85		
		I_{OH} = –24mA	4.5V to 5.5V	3V	2	2.70		
V_{OL}	Maximum Low Level Output Voltage	I_{OL} = 100µA	4.5V to 5.5V	2.7V to 3.6V			0.1	
		I_{OL} = 12mA	4.5V to 5.5V	2.7V		0.09	0.4	
		I_{OL} = 24mA	4.5V to 5.5V	3V		0.18	0.5	
I_{OZ}(2)	Maximum 3-State Output Leakage Current (B port)	$V_O = V_{CCB}$ or GND	4.5V to 5.5V	3.6V			±5	µA
I_{CCB}	Quiescent V_{CCB} Supply Current	$V_I = V_{CCB}$ or GND, I_O = 0	4.5V to 5.5V	3.6V			10	
ΔI_{CCB}(3)	I_{CCB} per input	One Input at V_{CCB} –0.6V, other inputs at V_{CCB} or GND	4.5V to 5.5V	2.7V to 3.6V			50	
C_{IO}	Input/Output Capacitance (B port)	$V_O = V_{CCB}$ or GND	4.5V to 5.5V	3.3V		9.7		pF

Notes:
1. All typical values are measured at V_{CCB} = 3.3V, T_A = 25°C
2. For I/O ports, the parameter I_{OZ} includes the input leakage current.
3. This is the increase in supply current for each input that is at one of the specified voltage levels, rather than 0V or the associated V_{CC}.

Capacitance (V_{CCA} = 4.5V to 5.5V, V_{CCB} = 2.7V to 3.6V, T_A = 25°C)

Parameters	Description	Test Conditions		Typ.	Units
C_{PD}	Power Dissipation Capacitance (1)	Outputs Enabled	C_L = 0pF, f = 10 MHz	20	pF
		Outputs Disabled		2.3	

Notes:
1. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle, C_{PD} is related to I_{CCD} dynamic operating current by the expression:
$I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC}$ static)

AC Electrical Characteristics

(Over Recommended Operating Free-Air Temperature Range unless otherwise noted, See Figure 1 and 2)

Parameters	From (Input)	To (Output)	V_{CCA} =5V ± 0.5V,V_{CCB} = 2.7V to 3.6V C_L = 50pF, R_L = 500Ω		Units
			Min.	Max.	
t_{PHL}	A	B	1	5.7	ns
t_{PLH}			1	5.5	
t_{PHL}	B	A	1	6.1	
t_{PLH}			1	5.9	
t_{PZL}	$\overline{OE}$	A	1	8	
t_{PZH}			1	7.6	
t_{PZL}	$\overline{OE}$	B	1	8	
t_{PZH}			1	7.7	
t_{PLZ}	$\overline{OE}$	A	1	6.2	
t_{PHZ}			1	5.8	
t_{PLZ}	$\overline{OE}$	B	1	7	
t_{PHZ}			1	6.8	
$t_{SK(O)}$	Output-to-Output Skew(1)			1.5	

Notes:

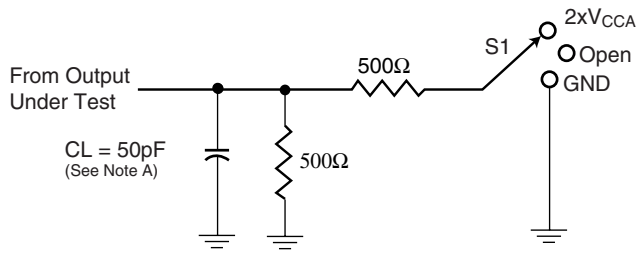
1. Skew between any two outputs of the same device, switching in the same direction. Parameter guaranteed by design.

Power- Up Considerations

To avoid excessive supply current, bus contention or oscillation during power-up, the following guidelines should be followed:

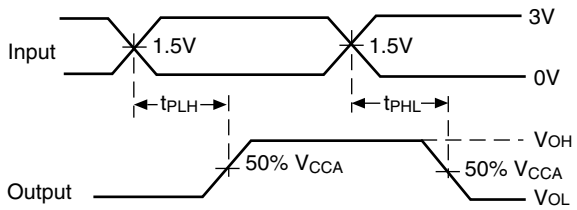
1. Connect ground first before any supply voltage is applied.
2. Then Power up V_{CCA}, which is the control side of the device.
3. Ramp $\overline{OE}$ ahead of or with V_{CCA} to help prevent bus contention
4. Ramp DIR with V_{CCA} if DIR HIGH is needed (A bus to B bus). Otherwise keep DIR LOW.

PARAMETER MEASUREMENT INFORMATION FOR B TO A PORT
V_{CCA} = 5V ± 0.5V and V_{CCB} = 2.7V to 3.6V

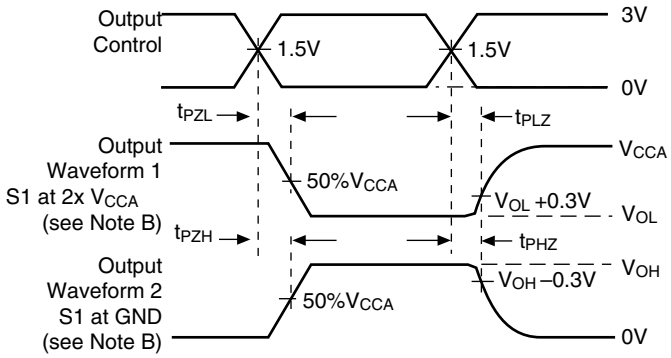


Load Circuit

Test	S1
t_{PLH}/t_{PHL}	Open 2 x
t_{PLZ}/t_{PZL}	V_{CCA}
t_{PHZ}/t_{PZH}	GND



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

Figure 1. Load Circuit and Voltage Waveforms

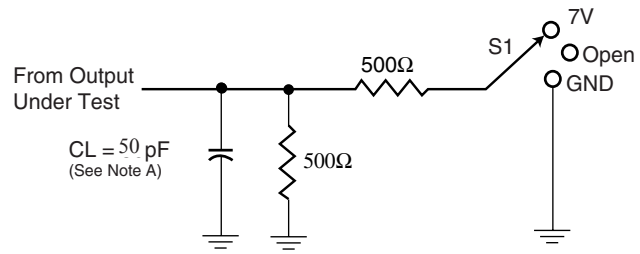
Notes:

A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

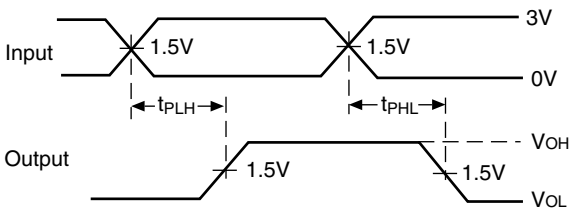
- All input impulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω, $t_R \leq 2.5$ns, $t_F \leq 2.5$ns.
- The outputs are measured one at a time with one transition per measurement.

PARAMETER MEASUREMENT INFORMATION FOR A TO B PORT
V_{CCA} = 4.5V to 5.5V and V_{CCB} = 2.7V to 3.6V

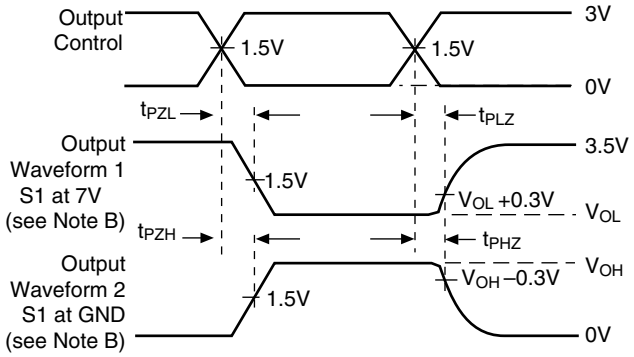


Load Circuit

Test	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7V
t_{PHZ}/t_{PZH}	GND



Voltage Waveforms
Propagation Delay Times



Voltage Waveforms
Enable and Disable Times

Figure 2. Load Circuit and Voltage Waveforms

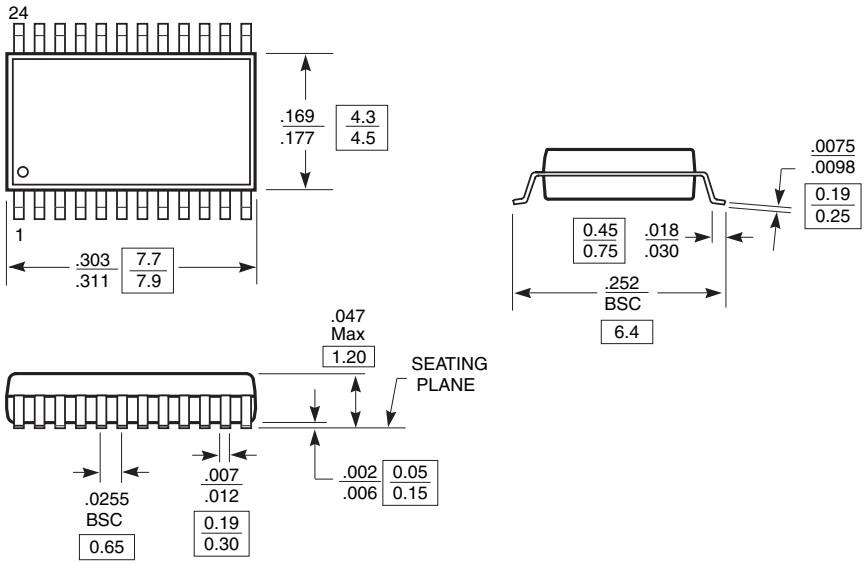
Notes:

A. C_L includes probe and jig capacitance.

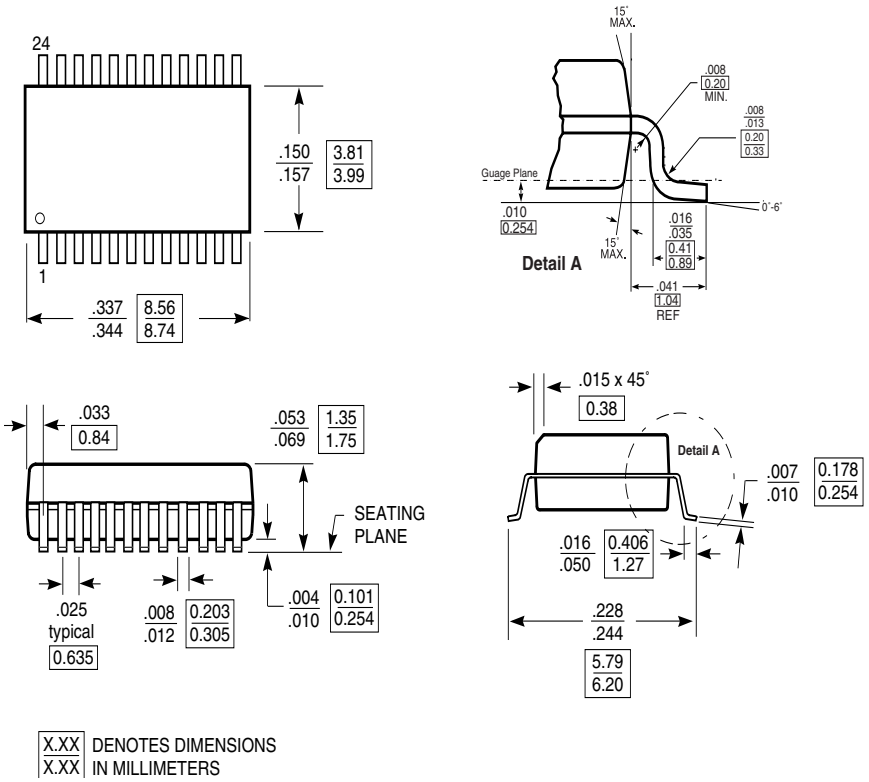
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

- All input impulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω, t_R ≤ 2.5ns, t_F ≤ 2.5ns.
- The outputs are measured one at a time with one transition per measurement.

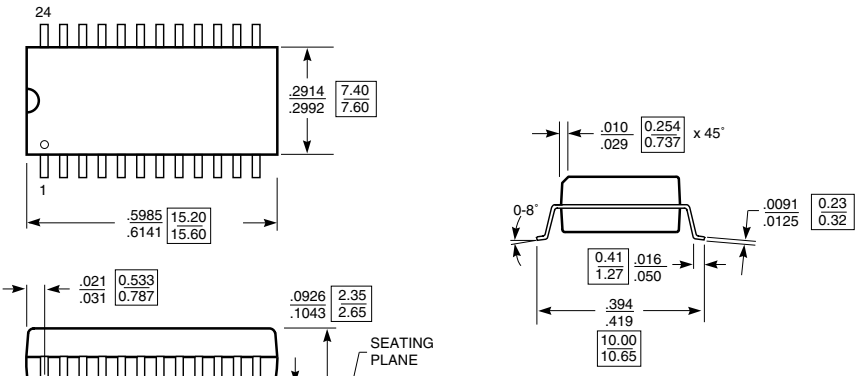
Packaging Mechanical: 24-pin TSSOP (L)



Packaging Mechanical: 24-pin QSOP (Q)



Packaging Mechanical: 24-pin SOIC (S)



Ordering Information

Ordering Code	Package Code	Package Type
PI74LVC4245AL	L	24-pin, 173-mil wide plastic TSSOP
PI74LVC4245ALE	L	Pb-free, 24-pin, 173-mil wide plastic TSSOP
PI74LVC4245AQ	Q	24-pin, 150-mil wide plastic QSOP
PI74LVC4245AS	S	24-pin, 300-mil wide plastic SOIC
PI74LVC4245ASE	S	Pb-free & Green, 24-pin, 300-mil wide plastic SOIC

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- E = Pb-free & Green
- Adding an X suffix = Tape/Reel