

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

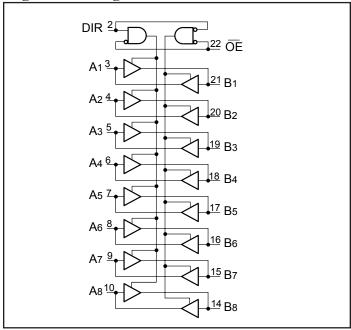
Product Features

- 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



Truth Table⁽¹⁾

Inputs		Outputs
ŌĒ	DIR	
L	L	Bus B Data to Bus A
L	Н	Bus A Data to Bus B
Н	X	Z (Isolation)

Note:

H = High Signal Level
 X = Don't Care or Irrelevant

L = Low Signal Level Z = High Impedance

Product Pin Configuration

(5V) VCCA	1	24 VCCB (3.3V)
DIR [2	23 VCCB (3.3V)
A1 [3	22 DE
A2 [4	21 B1
A3 [5	20 B2
A4 🗆	6	19 🛮 B3
A5 🗆	7	18 B4
A6 🗆	8	17 B5
A7 [9	16 B6
A8 [10	15 B7
GND [11	14 B8
GND [12	13 GND

Product Pin Description

Pin Name	Description	
ŌĒ	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	
Control Pins	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 IO	±50mA
Continous Current through each VCC or GND pin	±100mA
Package thermal impedance, $\theta_{JA}^{(2)}$: 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	
$V_{ m IH}$	High-Level Input Voltage	2		
V _{IL}	Low-Level Input Voltage		0.8	V
V _I	Input Voltage	0	V_{CCA}	
V _O	Output Voltage		V_{CCA}	
I _{OH}	I _{OH} High-Level Output Current		-24	т А
I_{OL}	I _{OL} Low-Level Output Current		24	mA
T _A	Operating Free-Air Temperature	-40	85	°C

Notes:

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

Parameter	Descri	Min.	Max.	Units		
V _{CCB}	Supply Voltage		2.7	3.6		
$V_{ m IH}$	High-Level Input Voltage	$V_{CCB} = 2.7V \text{ to } 3.6V$	2			
$V_{ m IL}$	Low-Level Input Voltage	$V_{CCB} = 2.7V \text{ to } 3.6V$		0.8	V	
VI	Input Voltage		0	V _{CCB}		
Vo	Output Voltage		0	V _{CCB}		
T	High Lavel Output Current	$V_{CCB} = 2.7V$		-12		
I _{OH}	High-Level Output Current	$V_{CCB} = 3V$		-24	A	
T	I I am I am I O dant Comment	$V_{CCB} = 2.7V$	$V_{CCB} = 2.7V$		12	mA
I_{OL}	Low-Level Output Current	$V_{CCB} = 3V$		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.

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$\begin{array}{l} \textbf{DC Electrical Characteristics} \text{ (Over Supply Voltage and Operating Temperature Ranges, unless otherwise specified)} \\ \textbf{A-Port (5V)} \end{array}$

Param- eters	Description	Test Conditions	V _{CCA}	V _{CCB}	Min.	Typ.(1)	Max.	Units
		I - 100A	4.5V	2.7V to 3.6V	4.4	4.5		
V	Minimum High Level	$I_{OH} = -100 \mu A$	5.5V	2.7V to 3.6V	5.4	5.5]
V_{OH}	Output Voltage	I 24m A	4.5V	2.7V to 3.6V	3.7	4.17		
		$I_{OH} = -24 \text{mA}$	5.5V	2.7V to 3.6V	4.7	5.2		V
		$I_{OL} = 100 \mu A$	4.5V	2.7V to 3.6V			0.1	ľ
V	Maximum Low Level	10L - 100μΑ	5.5V	2.7V to 3.6V			0.1	
V_{OL}	Output Voltage	10x - 24m A	4.5V	2.7V to 3.6V		0.19	0.5	
		$I_{OL} = 24mA$	5.5V	2.7V to 3.6V		0.19	0.5	
II	Maximum Input Leakage Current (Control Inputs)	$V_{\rm I} = V_{\rm CCA}$ or GND	5.5V	2.7V to 3.6V			±1	
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	μΑ
I _{CCA}	Quiescent V _{CCA} Supply Current	$V_I = V_{CCA}$ or GND, $I_O = 0$	5.5V	2.7V to 3.6V			10	
$\Delta I_{CCA}^{(3)}$	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		nF
C _{IO}	Input/Output Capacitance (A port)	$V_O = V_{CCA}$ or GND	5V	2.7V to 3.6V		9.5		pF

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
	Minimum High	$I_{OH} = -100 \mu A$	4.5V to 5.5V	2.7V to 3.6V	V _{CC} -0.1			
V_{OH}	Level Output Volt-	I = 12m A	4.5V to 5.5V	2.7V	2.2	2.56		
	age	$I_{OH} = -12mA$	4.5V to 5.5V	3V	2.4	2.85		
		$I_{OH} = -24mA$	4.5V to 5.5V	3V	2	2.70		V
	Maximum Low	$I_{OL} = 100 \mu A$	4.5V to 5.5V	2.7V to 3.6V			0.1	
V _{OL}	Level Output Volt-	$I_{OL} = 12mA$	4.5V to 5.5V	2.7V		0.09	0.4	
	age	$I_{OL} = 24mA$	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	
I _{CCB}	Quiescent V _{CCB} Supply Current	$V_I = V_{CCB}$ or GND, $I_O = 0$	4.5V to 5.5V	3.6V			10	μА
$\Delta I_{CCB}^{(3)}$	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 ($V_{CCA} = 4.5V \text{ to } 5.5V, V_{CCB} = 2.7V \text{ to } 3.6V, T_A = 25^{\circ}C$)

Parameters	Description	Test Conditions		Тур.	Units
C	Power Dissipation Capaci-	Outputs Enabled	C = 0.5 f = 10 MH=	20	"E
C_{PD}	tance (1)	Outputs Disabled	$C_L = 0$ pF, $f = 10$ MHz	2.3	pF

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: $I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CC} \text{ static})$

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AC Electrical Characteristics

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

	_	Tr.	$V_{\text{CCA}} = 5V \pm 0.5V, V_{\text{C}}$	$C_{CB} = 2.7 \text{V to } 3.6 \text{V}$	
Parameters	From (Input)	To (Output)	$C_L = 50 pF, 1$	$R_L = 500\Omega$	Units
	(Input)	(Output)	Min.	Max.	
t _{PHL}	A	В	1	5.7	
$t_{\rm PLH}$	A	Б	1	5.5	
$t_{ m PHL}$	В	A	1	6.1	
t _{PLH}	В	A	1	5.9	
t _{PZL}	ŌĒ	A	1	8	
t _{PZH}	OE	A	1	7.6	
t _{PZL}	ŌĒ	В	1	8	ns
t _{PZH}	OE	Б	1	7.7	
$t_{\rm PLZ}$	OE	A	1	6.2]
t _{PHZ}	OE	A	1	5.8	
$t_{\rm PLZ}$	OE	D	1	7]
t _{PHZ}	OE OE	В	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 $\overline{\text{OE}}$ 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

 $V_{CCA} = 5V \pm 0.5V$ and $V_{CCB} = 2.7V$ to 3.6V

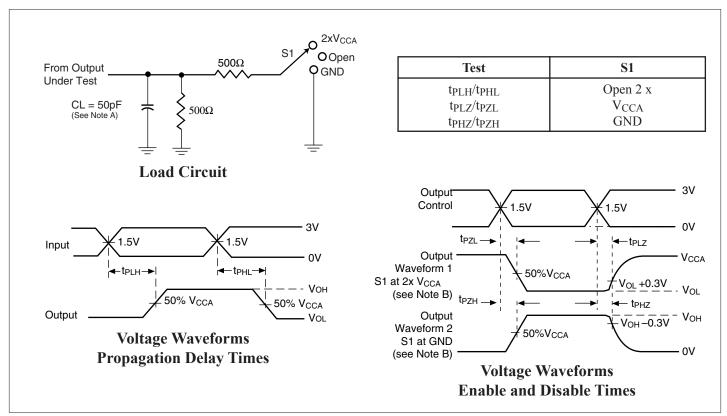


Figure 1. Load Circuit and Voltage Waveforms

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 ≤ 2.5ns, t_F ≤ 2.5ns.
- The outputs are measured one at a time with one transition per measurement.

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

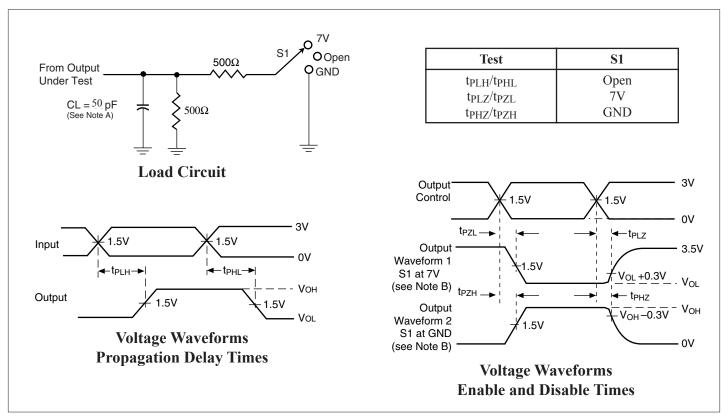


Figure 2. Load Circuit and Voltage Waveforms

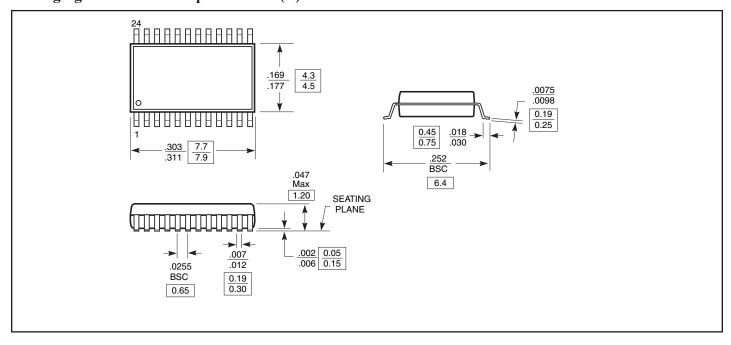
Notes:

- 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: $PRR \le 10 \text{ MHz}$, $Z_Q = 50\Omega$, $t_R \le 2.5 \text{ns}$, $t_F \le 2.5 \text{ns}$.
- The outputs are measured one at a time with one transition per measurement.

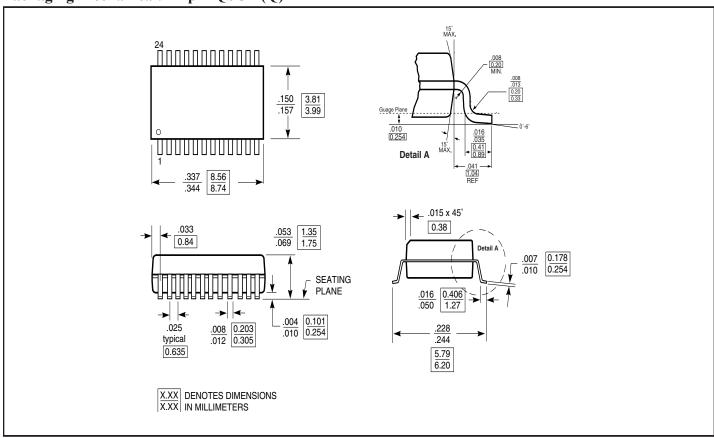
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Packaging Mechanical: 24-pin TSSOP (L)

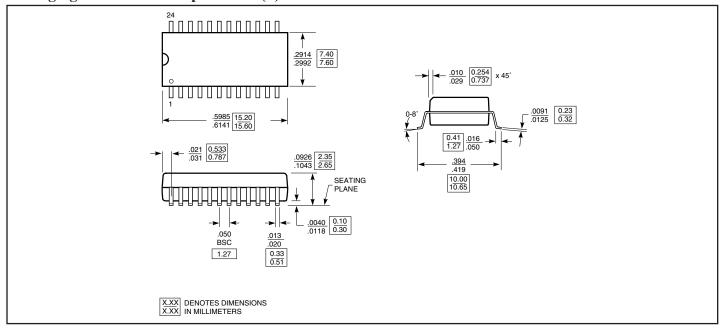


Packaging Mechanical: 24-pin QSOP (Q)





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

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