

4-Bit Level Shifting Buffer/Transceiver with Configurable Dual Supply Voltage with Advanced Package Solution

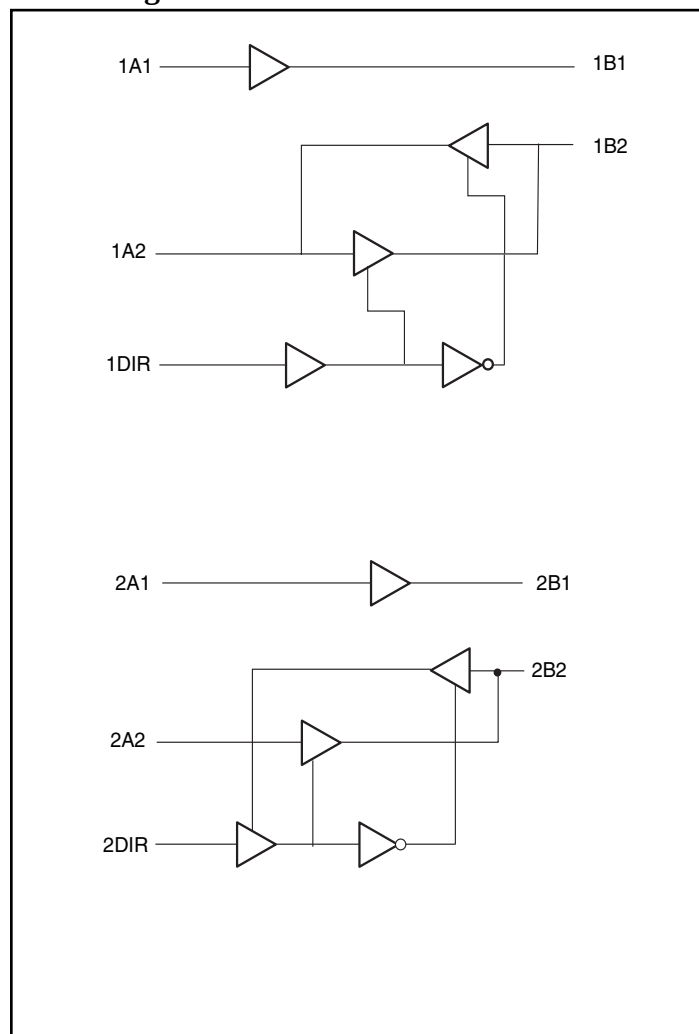
Features

- Operation Voltage: $1.65V \leq V_{CCA} \leq 3.6V$
 $2.3V \leq V_{CCB} \leq 5.5V$
 $V_{CCA} \leq V_{CCB}$
- High Speed: $t_{pd} = 5ns$ typical into $30pF$ @ $3V V_{CC}$
- Power down high-impedance inputs and outputs
- High output drive: $\pm 12mA$ at $3V V_{CCA}/V_{CCB}$
 $\pm 24mA$ at $5V V_{CCB}$
- Industrial operation at $-40^{\circ}C$ to $+85^{\circ}C$
- Packaging (Pb-free & Green available):
 – 16-pin TDFN (ZJ)

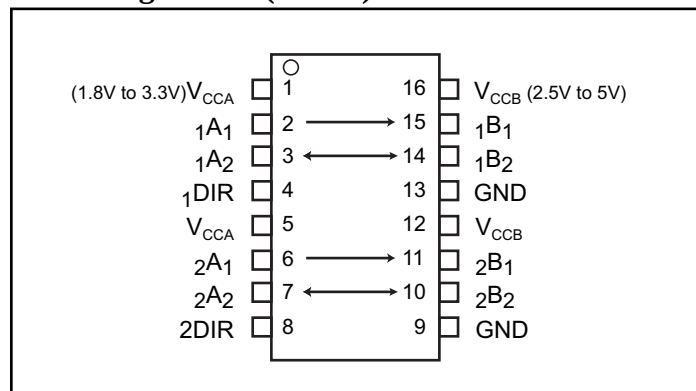
Description

Pericom Semiconductor's PI74STX4G4245, a 4-bit noninverting buffer/transceiver, contains two separate supply rails: A port (V_{CCA}), set to operate from 1.8V to 3.3V; B port (V_{CCB}), set to operate from 2.5V to 5V. The xA1 to xB1 translation is configured as an unidirectional buffer; the translation between xA2 and xB2 is bidirectional and its direction is controlled by the xDIR pin. The xDIR pin is supplied by V_{CCB} .

Block Diagram



Pin Configuration (TDFN)



Function Table

Input		Output
xDIR	DATA	
L	xB2	xA2
H	xA2	xB2
X	xA1	xB1

Pin Description

Pin Name	Description
xDIR	Direction Control
xA1	Data Input
xB1	Data Output
xA2, xB2	Data Input/Output
V_{CCA}, V_{CCB}	Power Supply

Maximum Ratings

(Absolute maximum ratings over operating free-air temperature range from V_{CCB} at 2.5V & V_{CCA} at 1.2V, unless otherwise noted)

Supply voltage range: V_{CCA}	-0.5V to +6V	DC Input Diode Current, I_{IK} ($V_O < 0$).....	-50mA
V_{CCB}	-0.5V to +6V	DC Output Diode Current, I_{OK} ($V_O < 0$).....	-50mA
Input Voltage Range, V_I :		DC Output Current, (I_{OUT})	± 50 mA
Input xA1 ⁽¹⁾	-0.5V to +6V	DC V_{CC} or GND Current (I_{CC}/I_{GND}).....	± 100 mA
I/O xA2 ^(1,2)	-0.5V to $V_{CCA}+0.5$ V	Storage temperature range, T_{STG}	-65°C to 150°C
I/O xB2 ^(1,2)	-0.5V to $V_{CCB}+0.5$ V	Junction Lead Temperature (I_{OS})	260°C
Output Voltage Range, V_O		Power Dissipation: MSOP	200mW
Output B1 ^(1,2) ...	-0.5V to $V_{CCB} +0.5$ V		

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. The input negative voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. This value is limited to 6V.

Recommended Operating Conditions for A Port (V_{CCA})⁽¹⁾

Parameter	Description	Test Conditions	Min.	Max.	Units
V_{CCA}	Supply Voltage		1.65	3.6	V
V_{IH}	High-level input voltage	$V_{CCA} = 1.65$ V to 1.95V	$0.7 \times V_{CCA}$		
		$V_{CCA} = 2.3$ V to 3.6V	$0.7 \times V_{CCA}$		
V_{IL}	Low-level input voltage	$V_{CCA} = 1.65$ to 1.95V		$0.3 \times V_{CCA}$	
		$V_{CCA} = 2.3$ V to 3.6V		$0.3 \times V_{CCA}$	
V_{IA}	Input Voltage		0	V_{CCA}	
V_{OA}	Output Voltage		0	V_{CCA}	mA
I_{OH}	High-level Output Current	$V_{CCA} = 1.65$ V to 1.95V		-4	
		$V_{CCA} = 2.3$ V to 2.7V		-8	
		$V_{CCA} = 3$ V to 3.6V		-12	
I_{OL}	Low-level Output Current	$V_{CCA} = 1.65$ V to 1.95V		4	
		$V_{CCA} = 2.3$ V to 2.7V		8	
		$V_{CCA} = 3$ V to 3.6V		12	
$\Delta t/\Delta V$	Input transition rise or fall rate	$V_{CCA} = 1.65$ V to 1.95V		20	ns/V
		$V_{CCA} = 2.3$ V to 3.6V		10	
T_A	Operation free-air temperature		-40	85	°C

Notes:

1. To ensure proper device operation, all unused inputs must be held at V_{CCA} or GND.

Recommended Operating Conditions for B Port (V_{CCB})⁽¹⁾

Parameters	Description		Test Conditions	Min.	Max.	Units
V _{CCB}	Supply Voltage			2.3	5.5	V
V _{IH}	High-level input voltage	Data Inputs	V _{CCB} = 2.3V to 5.5V	0.7 x V _{CCB}		
		DIR pin				
V _{IL}	Low-level input voltage	Data Inputs	V _{CCB} = 2.3V to 5.5V		0.3 x V _{CCB}	
		DIR pin				
V _{IB}	Input Voltage			0	V _{CCB}	
V _{OB}	Output Votage			0	V _{CCB}	
I _{OH}	High-level Output Current		V _{CCB} = 2.3 V to 2.7V		-8	mA
			V _{CCB} = 3V to 3.6V		-12	
			V _{CCB} = 4.5V to 5.5V		-24	
I _{OL}	Low-level Output Current		V _{CCB} = 2.3V to 2.7V		8	
			V _{CCB} = 3V to 3.6V		12	
			V _{CCB} = 4.5V to 5.5V		24	
Δt/ΔV	Input transition rise or fall rate		V _{CCB} = 2.3V to 5.5V		10	m/V
T _A	Operation free-air temperature			-40	85	°C

Notes:

- To ensure proper device operation, all unused inputs must be held at V_{CCB} or GND.

Electrical Characteristics (Over recommended operating free-air temperature range)

Parameters		Test Conditions	$V_{CCA}^{(1)}$	$V_{CCB}^{(1)}$	Min.	Typ. ⁽²⁾	Max.	Units
V_{OHA} (B to A)		$I_{OH} = -100\mu A$	1.65V to 3.6V	$2.3V \leq V_{CCB} \leq 5.5V$ and $V_{CCB} \geq V_{CCA}$	$V_{CCB}-0.1$			V
		$I_{OH} = -4mA$	1.65V		1.3			
		$I_{OH} = -8mA$	2.3V		1.8			
		$I_{OH} = -12mA$	3.0V		2.4			
V_{OLA} (B to A)		$I_{OH} = 100\mu A$	1.65V to 3.6V				0.1	
		$I_{OH} = 4mA$	1.65V				0.24	
		$I_{OH} = 8mA$	2.3V				0.3	
		$I_{OH} = 12mA$	3.0V				0.4	
V_{OHB} (A to B)		$I_{OH} = -100\mu A$	$1.65V \leq V_{CCA} \leq 3.6V$ and $V_{CCB} \geq V_{CCA}$	2.3V to 5.5V	$V_{CCB}-0.1$			
		$I_{OH} = -8mA$		2.3V	1.8			
		$I_{OH} = -12mA$		3.0V	2.4			
		$I_{OH} = -24mA$		4.5V	3.8			
V_{OLB} (A to B)		$I_{OH} = 100\mu A$		2.3V to 5.5V			0.1	
		$I_{OH} = 8mA$		2.3V			0.3	
		$I_{OH} = 12mA$		3.0V			0.4	
		$I_{OH} = 24mA$		4.5V			0.55	
$I_I^{(3)}$		$V_I = V_{CCA}/V_{CCB}$ or GND	1.65V to 3.6V and $V_{CCB} \geq V_{CCA}$	2.3V to 5.5V and $V_{CCB} \geq V_{CCA}$			± 5	μA
I_{OFF}		V_I or $V_O = V_{CCB}$ or GND	0V	0 to 5.5V			± 10	
		V_I or $V_O = V_{CCA}$ or GND	0 to 3.6V	0V			± 10	
I_{CCA}		$V_I = V_{CCA}$ or GND, $I_O = 0$	1.65V to 3.6V and $V_{CCB} \geq V_{CCA}$	2.3 to 5.5V and $V_{CCB} \geq V_{CCA}$			10	
I_{CCB}		$V_I = V_{CCB}$ or GND, $I_O = 0$					10	
C_I	A1, DIR	$V_I = V_{CCA}$ or GND	1.8V	3.3V		4.5		pF
C_O	B1	$V_O = V_{CCB}$ or GND	1.8V	3.3V		4.5		
C_{IO}	A2, B2	V_I or $V_O = V_{CCA}/V_{CCB}$ or GND	1.8V	3.3V		6.0		

Notes:

- When $1.65 \leq V_{CCA} \leq 1.95V$, V_{CCB} can not be greater than 3.6V
- All Typical values are at $T_A = 25^\circ C$
- For I/O ports, the parameter I_I includes the output leakage current.

Switching Characteristics for $V_{CCA} = 1.8V \pm 0.15V$

(Over recommended operating free-air temperature range, see figure 1)

Parameter	From (Input)	To (Output)	V _{CCB} = 2.5V ±0.2V		V _{CCB} = 3.3V ±0.3V		Units
			Min.	Max.	Min.	Max.	
t _{PHL}	A	B	1.0	8	1.0	8	ns
t _{PLH}			1.0	8	1.0	8	
t _{PHL}	B	A	1.0	7	1.0	7	
t _{PLH}			1.0	7	1.0	7	
t _{SK(O)}				1.5		1	

Switching Characteristics for $V_{CCA} = 2.5V \pm 0.2V$

(Over recommended operating free-air temperature range, see figure 1)

Parameter	From (Input)	To (Output)	V _{CCB} = 2.5V ±0.2V		V _{CCB} = 3.3V ±0.3V		V _{CCB} = 5V ±0.5V		Units
			Min.	Max.	Min.	Max.	Min.	Max.	
t _{PHL}	A	B	1.0	7	1.0	6.5	1.0	6	ns
t _{PLH}			1.0	7	1.0	6.5	1.0	6	
t _{PHL}	B	A	1.0	6	1.0	6	1.0	5	
t _{PLH}			1.0	6	1.0	6	1.0	5	
t _{SK(O)}				1.5		1		1	

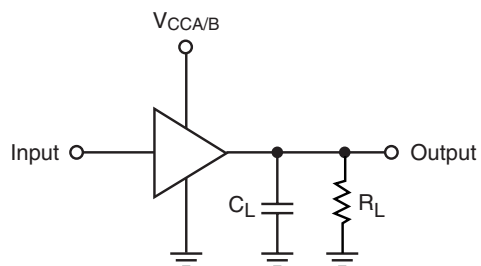
Switching Characteristics for $V_{CCA} = 3.3V \pm 0.3V$

(Over recommended operating free-air temperature range, see figure 1)

Parameter	From (Input)	To (Output)	V _{CCB} = 3.3V ±0.3V		V _{CCB} = 5V ±0.5V		Units
			Min.	Max.	Min.	Max.	
t _{PHL}	A	B	1.0	5	1.0	5	ns
t _{PLH}			1.0	5	1.0	5	
t _{PHL}	B	A	1.0	5	1.0	5	
t _{PLH}			1.0	5	1.0	5	
t _{SK(O)}				1		1	

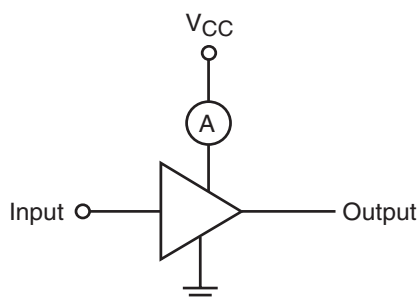
AC Loading and Waveforms

$V_{CCA/B}$	C_L	R_L
$1.8 \pm 0.15V$	15pF	1K Ω
$2.5V \pm 0.2V$	15pF	500 Ω
3.0V to 3.6V	30pF	500 Ω
$5V \pm 0.5V$	50pF	500 Ω



C_L includes load and stray capacitance
Input PRR = 1.0 MHz; $t_W = 500ns$

Figure 1. AC Test Circuit



Input = AC Waveform; $t_r = t_f = 1.8ns$;
PRR = 10 MHz; Duty Cycle = 50%

Figure 2. I_{CCD} Test Circuit

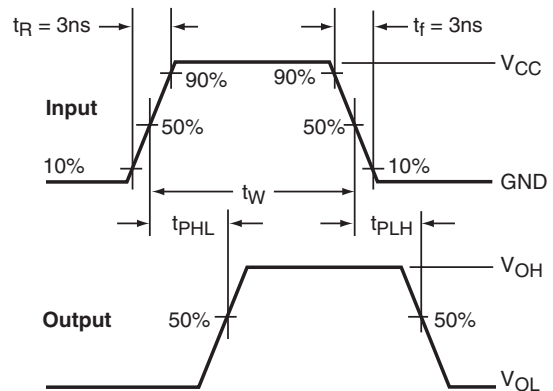
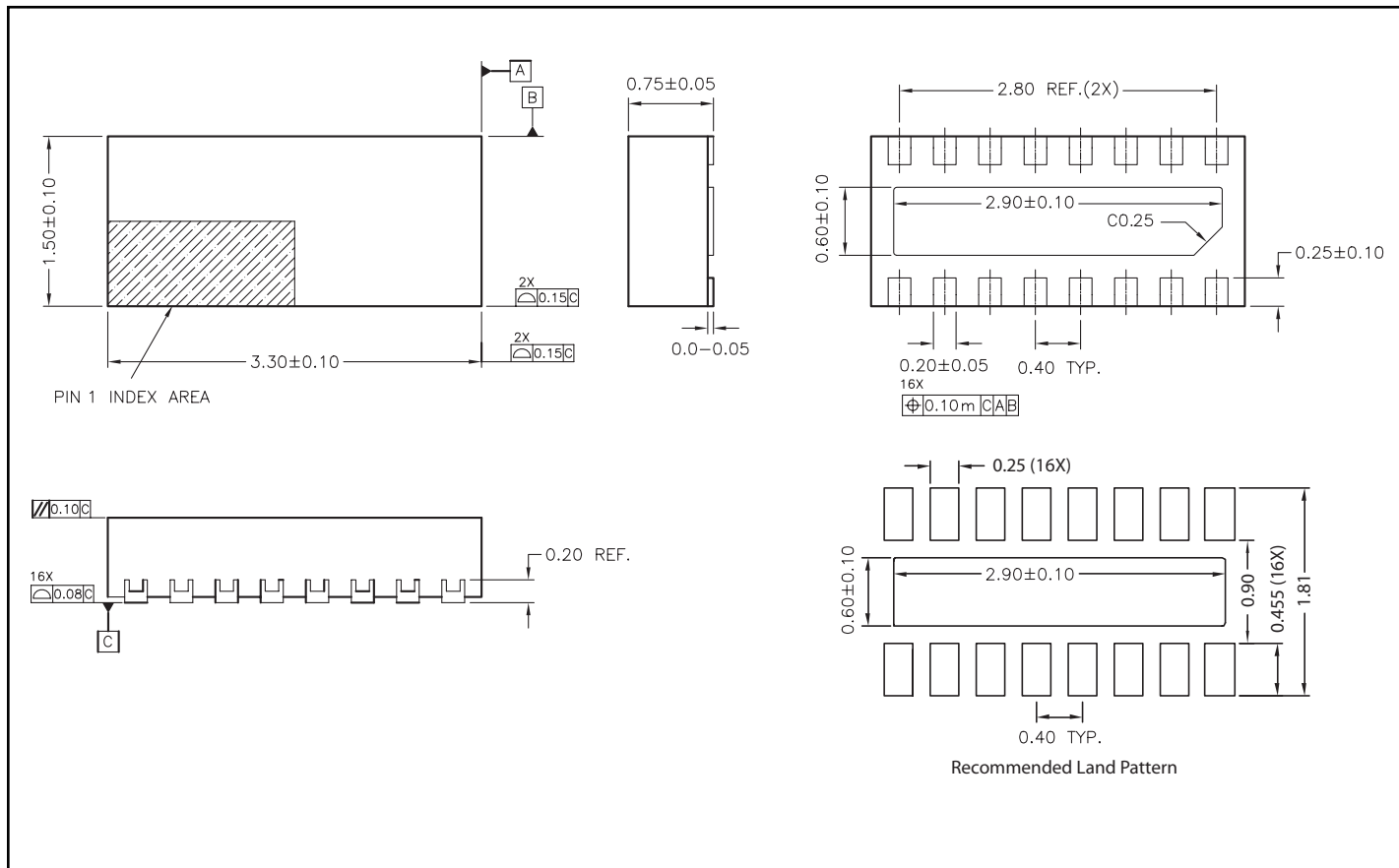


Figure 3. AC Waveforms

Packaging Mechanical: 16-pin TDFN

Ordering Information

Ordering Code	Package Code	Package Type	Top Mark
PI74STX4G4245ZJE	ZJ	Pb-free & Green, 16-pin TDFN	4G

Notes:

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