

February 1994 Revised October 2003

#### 74LVXC3245

# 8-Bit Dual Supply Configurable Voltage Interface Transceiver with 3-STATE Outputs

#### **General Description**

The LVXC3245 is a 24-pin dual-supply, 8-bit configurable voltage interface transceiver suited for PCMCIA and other real time configurable I/O applications. The  $\rm V_{CCA}$  pin accepts a 3V supply level. The A Port is a dedicated 3V port. The  $\rm V_{CCB}$  pin accepts a 3V-to-5V supply level. The B Port is configured to track the  $\rm V_{CCB}$  supply level respectively. A 5V level on the  $\rm V_{CC}$  pin will configure the I/O pins at a 5V level and a 3V  $\rm V_{CC}$  will configure the I/O pins at a 3V level. The A Port should interface with a 3V host system and the B Port to the card slots. This device will allow the  $\rm V_{CCB}$  voltage source pin and I/O pins on the B Port to float when  $\overline{\rm OE}$  is HIGH. This feature is necessary to buffer data to and from a PCMCIA socket that permits PCMCIA cards to be inserted and removed during normal operation.

#### **Features**

- Bidirectional interface between 3V and 3V-to-5V buses
- Control inputs compatible with TTL level
- Outputs source/sink up to 24 mA
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Implements patented EMI reduction circuitry
- Flexible V<sub>CCB</sub> operating range
- Allows B Port and V<sub>CCB</sub> to float simultaneously when <del>OE</del> is HIGH
- Functionally compatible with the 74 series 245

#### **Ordering Code:**

Order Number	Package Number	Package Description
74LVXC3245WM	M24B	224-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74LVXC3245QSC	MQA24	24-Lead Quarter Size Outline Package (QSOP), JEDEC MO-137, 0.150" Wide
74LVXC3245MTC	MTC24	24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

#### **Logic Symbol**



#### **Pin Descriptions**

Pin Names	Description
ŌĒ	Output Enable Input
T/R	Transmit/Receive Input
A <sub>0</sub> -A <sub>7</sub>	Side A Inputs or 3-STATE Outputs
B <sub>0</sub> –B <sub>7</sub>	Side B Inputs or 3-STATE Outputs

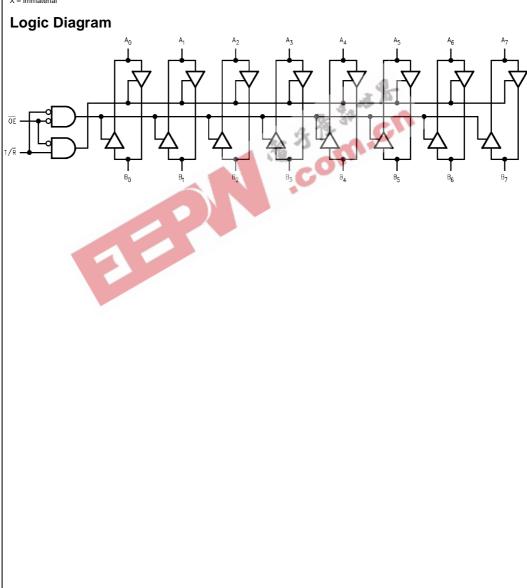
#### **Connection Diagram**



### **Truth Table**

Inp	outs	Outputs
OE	T/R	
L	L	Bus B Data to Bus A
L	Н	Bus A Data to Bus B
Н	Х	HIGH-Z State

- H = HIGH Voltage Level L = LOW Voltage Level X = Immaterial



#### Absolute Maximum Ratings(Note 1)

Supply Voltage ( $V_{CCA}, V_{\underline{CCB}}$ ) -0.5V to +7.0V DC Input Voltage (V<sub>I</sub>) @ OE, T/R -0.5V to  $V_{CCA}$  +0.5V

DC Input/Output Voltage (V<sub>I/O</sub>)

@ A<sub>n</sub> -0.5V to  $V_{CCA}$  +0.5V @ B<sub>n</sub> -0.5V to  $V_{CCB}$  +0.5V DC Input Diode Current (I<sub>IK</sub>)

@  $\overline{OE}$ ,  $T/\overline{R}$ ±20 mA DC Output Diode ( $I_{OK}$ ) Current ±50 mA DC Output Source or Sink Current (I<sub>O</sub>) ±50 mA

DC  $V_{CC}$  or Ground Current

per Output Pin ( $I_{CC}$  or  $I_{GND}$ ) ±50 mA and Max Current ±200 mA Storage Temperature Range  $(T_{STG})$ 

DC Latch-Up Source or Sink Current

#### **Recommended Operating** Conditions (Note 2)

Supply Voltage

2.7V to 3.6V  $V_{CCA}$  $V_{\text{CCB}}$ 3.0V to 5.5V Input Voltage  $(V_I)$  @  $\overline{OE}$ ,  $T/\overline{R}$ 0V to  $V_{\mbox{\scriptsize CCA}}$ Input Output Voltage (V<sub>I/O</sub>)

@ A<sub>n</sub> 0V to  $V_{\text{CCA}}$ @ B<sub>n</sub> 0V to  $V_{\mbox{\scriptsize CCB}}$ -40°C to +85°C Free Air Operating Temperature (T<sub>A</sub>) Minimum Input Edge Rate  $(\Delta V/\Delta t)$ 8 ns/V

 $\rm V_{IN}$  from 30% to 70% of  $\rm V_{CC}$ V<sub>CC</sub> @ 3.0V, 4.5V, 5.5V

 $-65^{\circ}C$  to  $+150^{\circ}C$  Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: The A Port unused pins (inputs or I/Os) must be held HIGH or LOW. They may not float.

#### **DC Electrical Characteristics**

Symbol	Parameter		V <sub>CCA</sub>	V <sub>CCB</sub>	$T_A =$	25°C	$T_A = -40^{\circ}C$ to $+85^{\circ}C$	Units	Conditions
Symbol	Faramet	CI	(V)	(V)	Тур	Typ Guaranteed Limits			Conditions
V <sub>IHA</sub>	Minimum HIGH	A <sub>n</sub> ,	2.7	3.0		2.0	2.0		V <sub>OUT</sub> ≤ 0.1V
	Level Input	OE	3.0	3.6		2.0	2.0		or
	Voltage	T/R	3.6	5.5		2.0	2.0	V	≥V <sub>CC</sub> - 0.1V
V <sub>IHB</sub>		B <sub>n</sub>	2.7	3.0		2.0	2.0	V	
			3.0	3.6		2.0	2.0		
			3.6	5.5		3.85	3.85		
V <sub>ILA</sub>	Maximum LOW	A <sub>n</sub> ,	2.7	3.0		0.8	0.8		V <sub>OUT</sub> ≤ 0.1V
	Level Input	ŌE	3.0	3.6		0.8	0.8		or
	Voltage	T/R	3.6	5.5		0.8	0.8	V	≥V <sub>CC</sub> - 0.1V
V <sub>ILB</sub>	1	B <sub>n</sub>	2.7	3.0		0.8	0.8	V	
			3.0	3.6		0.8	0.8		
			3.6	5.5		1.65	1.65		
V <sub>OHA</sub>	Minimum HIGH Le	evel	3.0	3.0	2.99	2.9	2.9		$I_{OUT} = -100 \mu A$
	Output Voltage		3.0	3.0	2.85	2.56	2.46		$I_{OH} = -12 \text{ mA}$
			3.0	3.0	2.65	2.35	2.25	V	$I_{OH} = -24 \text{ mA}$
			2.7	3.0	2.5	2.3	2.2		$I_{OH} = -12 \text{ mA}$
			2.7	4.5	2.3	2.1	2.0		$I_{OH} = -24 \text{ mA}$
V <sub>OHB</sub>			3.0	3.0	2.99	2.9	2.9		$I_{OUT} = -100 \mu A$
			3.0	3.0	2.85	2.56	2.46	V	$I_{OH} = -12 \text{ mA}$
			3.0	3.0	2.65	2.35	2.25	V	$I_{OH} = -24 \text{ mA}$
			3.0	4.5	4.25	3.86	3.76		$I_{OH} = -24 \text{ mA}$
V <sub>OLA</sub>	Maximum LOW Lo	evel	3.0	3.0	0.002	0.1	0.1		$I_{OUT} = 100  \mu A$
	Output Voltage		3.0	3.0	0.21	0.36	0.44	V	$I_{OL} = 24 \text{ mA}$
			2.7	3.0	0.11	0.36	0.44	V	$I_{OL} = 12 \text{ mA}$
			2.7	4.5	0.22	0.42	0.5		$I_{OL} = 24 \text{ mA}$
V <sub>OLB</sub>	1		3.0	3.0	0.002	0.1	0.1		$I_{OUT} = 100 \mu\text{A}$
			3.0	3.0	0.21	0.36	0.44	V	$I_{OL} = 24 \text{ mA}$
			3.0	4.5	0.18	0.36	0.44		$I_{OL} = 24 \text{ mA}$
I <sub>IN</sub>	Maximum Input		3.6	3.6		±0.1	±1.0		$V_I = V_{CCA}$ , GND
	Leakage Current	@	3.6	5.5		±0.1	±1.0	μΑ	
	OE, T/R								

±300 mA

# DC Electrical Characteristics (Continued)

Symbol	Param	otor	V <sub>CCA</sub>	V <sub>CCB</sub>	T <sub>A</sub> =	25°C	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	Units	Conditions	
Syllibol	Faraiii	etei	(V)	(V)	Тур	Guaranteed Limits		Ullits	Conditions	
I <sub>OZA</sub>	Maximum 3-STA	ATE	3.6	3.6		±0.5	±5.0		$V_I = V_{IL}, \ V_{IH},$	
	Output Leakage	•	3.6	5.5		±0.5	±5.0	μΑ	$\overline{OE} = V_{CCA}$	
	@ A <sub>n</sub>								$V_O = V_{CCA}$ , GND	
I <sub>OZB</sub>	Maximum 3-STA	ATE	3.6	3.6		±0.5	±5.0		$V_I = V_{IL}, \ V_{IH},$	
	Output Leakage	,	3.6	5.5		±0.5	±5.0	μΑ	$\overline{OE} = V_{CCA}$	
	@ B <sub>n</sub>								$V_O = V_{CCB}$ , GND	
$\Delta I_{CC}$	Maximum	B <sub>n</sub>	3.6	5.5	1.0	1.35	1.5	mA	$V_I = V_{CCB} - 2.1V$	
	I <sub>CC</sub> /Input	All Inputs	3.6	3.6		0.35	0.5	1117 (	V <sub>I</sub> = V <sub>CC</sub> -0.6V	
I <sub>CCA1</sub>	Quiescent V <sub>CCA</sub>								$A_n = V_{CCA}$ or GND	
	Supply Current		3.6	Open		5	50	μΑ	$B_n = Open, \overline{OE} = V_{CCA},$	
	as B Port Floats	;							$T/\overline{R} = V_{CCA}, V_{CCB} =$ Open	
I <sub>CCA2</sub>	Quiescent V <sub>CCA</sub>		3.6	3.6		5	50		$A_n = V_{CCA}$ or GND,	
	Supply Current		3.6	5.5		5	50	μΑ	$B_n = V_{CCB}$ or GND,	
							2 %	10-	$\overline{OE} = GND, T/\overline{R} = GND$	
I <sub>CCB</sub>	Quiescent V <sub>CCB</sub>	3	3.6	3.6		5	50		$A_n = V_{CCA}$ or GND,	
	Supply Current		3.6	5.5		8	80	μΑ	$B_n = V_{CCB}$ or GND,	
						3	19 6		$\overline{OE} = GND, T/\overline{R} = V_{CCA}$	
V <sub>OLPA</sub>	Quiet Output		3.3	3.3	4	0.8	-00	V	(Note 3)(Note 4)	
	Maximum Dyna	mic	3.3	5.0		0.8		•		
V <sub>OLPB</sub>	$V_{OL}$		3.3	3.3		0.8		V	(Note 3)(Note 4)	
			3.3	5.0		1.5		•		
V <sub>OLVA</sub>	Quiet Output		3.3	3.3		-0.8		V	(Note 3)(Note 4)	
	Minimum Dynan	nic	3.3	5.0		-0.8		•		
V <sub>OLVB</sub>	V <sub>OL</sub>		3.3	3.3		-0.8		V	(Note 3)(Note 4)	
			3.3	5.0		-1.2		•		
V <sub>IHDA</sub>	Minimum HIGH		3.3	3.3		2.0		V	(Note 3)(Note 5)	
	Level Dynamic		3.3	5.0		2.0		•		
V <sub>IHDB</sub>	Input Voltage		3.3	3.3		2.0		V	(Note 3)(Note 5)	
			3.3	5.0		3.5		•		
V <sub>ILDA</sub>	Maximum LOW		3.3	3.3		0.8		V	(Note 3)(Note 5)	
	Level Dynamic		3.3	5.0		8.0		•		
$V_{ILDB}$	Input Voltage		3.3	3.3		0.8		V	(Note 3)(Note 5)	
			3.3	5.0		1.5		·		

Note 3: Worst case package.

Note 4: Max number of outputs defined as (n). Data inputs are driven 0V to  $V_{CC}$  level; one output at GND.

Note 5: Max number of Data Inputs (n) switching. (n–1) inputs switching 0V to  $V_{CC}$  level. Input-under-test switching:  $V_{CC}$  level to threshold  $(V_{IHD})$ , 0V to threshold  $(V_{ILD})$ , f = 1 MHz.

# **AC Electrical Characteristics**

			$T_A = +25^{\circ}C$	;	T <sub>A</sub> = -40°	C to +85°C		T <sub>A</sub> = +25°C	;	$T_A = -40^\circ$	C to +85°C	
		$C_L = 50 \text{ pF}$ $V_{CCA} = 2.7V - 3.6V$		C <sub>L</sub> =	C <sub>L</sub> = 50 pF		C <sub>L</sub> = 50 pF		C <sub>L</sub> =			
Symbol	Parameter			V <sub>CCA</sub> = 2.7V-3.6V V <sub>CCB</sub> = 4.5V-5.5V		$V_{CCA} = 2.7V - 3.6V$ $V_{CCB} = 3.0V - 3.6V$			V <sub>CCA</sub> = 2	Units		
Symbol	Parameter	V <sub>CCB</sub> = 4.5V-5.5V							$V_{CCB} = 3.0V - 3.6V$		Ullits	
		Min	Тур	Max	Min	Max	Min	Тур	Max	Min	Max	1
			(Note 6)					(Note 7)				
t <sub>PHL</sub>	Propagation Delay	1.0	4.8	8.0	1.0	8.5	1.0	5.5	8.5	1.0	9.0	ns
$t_{PLH}$	A to B	1.0	3.9	6.5	1.0	7.0	1.0	5.2	8.0	1.0	8.5	115
t <sub>PHL</sub>	Propagation Delay	1.0	3.8	6.5	1.0	7.0	1.0	4.4	7.0	1.0	7.5	ns
$t_{PLH}$	B to A	1.0	4.3	7.5	1.0	8.0	1.0	5.1	7.5	1.0	8.0	115
t <sub>PZL</sub>	Output Enable Time	1.0	4.7	8.0	1.0	8.5	1.0	6.0	9.0	1.0	9.5	ns
$t_{PZH}$	OE to B	1.0	4.8	8.5	1.0	9.0	1.0	6.1	9.5	1.0	10.0	113
t <sub>PZL</sub>	Output Enable Time	1.0	5.9	9.5	1.0	10.0	1.0	6.4	10.0	1.0	10.5	ns
$t_{PZH}$	OE to A	1.0	5.4	9.0	1.0	9.5	1.0	5.8	9.0	1.0	9.5	115
t <sub>PHZ</sub>	Output Disable Time	1.0	4.0	8.0	1.0	8.5	1.0	6.3	9.5	1.0	10.0	ns
$t_{PLZ}$	OE to B	1.0	3.8	7.5	1.0	8.0	1.0	4.5	8.0	1.0	8.5	115
t <sub>PHZ</sub>	Output Disable Time	1.0	4.6	9.5	1.0	10.0	1.0	5.2	9.5	1.0	10.0	ns
$t_{PLZ}$	OE to A	1.0	3.1	6.5	1.0	7.0	1.0	3.4	6.5	1.0	7.0	113
toshl	Output to Output						- 35-	5				
toslh	Skew (Note 8)		1.0	1.5		1.5	12 19	1.0	1.5	1	1.5	ns
	Data to Output					30	<b>4</b> ) ,	A.	1			

Note 6: Typical values at  $V_{CCA} = 3.3V$ ,  $V_{CCB} = 5.0V$  @  $25^{\circ}C$ .

Note 7: Typical values at  $\rm V_{CCA}$  = 3.3V,  $\rm V_{CCB}$  = 3.3V @ 25°C.

Note 8: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (toSHL) or LOW-to-HIGH (toSLH). Parameter guaranteed by design.

#### Capacitance

Symbol	Parameter		Тур	Units	Conditions
C <sub>IN</sub>	Input Capacitance		4.5	pF	V <sub>CC</sub> = Open
C <sub>I/O</sub>	Input/Output Capacitance		10		V <sub>CCA</sub> = 3.3V
					V <sub>CCB</sub> = 5.0V
C <sub>PD</sub>	Power Dissipation	A→B	50	pF	V <sub>CCB</sub> = 5.0V
	Capacitance (Note 9)	B→A	40	pF	$V_{CCA} = 3.3V$

Note 9: C<sub>PD</sub> is measured at 10 MHz.

#### **Power Up Considerations**

To insure the system does not experience unnecessary  $I_{\mbox{\footnotesize{CC}}}$ current draw, bus contention, or oscillations during power up, the following guidelines should be adhered to (refer to Table 1):

- · Power up the control side of the device first. This is the V<sub>CCA</sub> side.
- $\overline{\text{OE}}$  should ramp with or ahead of  $\text{V}_{\text{CCA}}.$  This will help guard against bus contention.
- The Transmit/Receive control pin  $(T/\overline{R})$  should ramp with V<sub>CCA</sub>, this will ensure that the A Port data pins are con-

figured as inputs. With  $V_{\mbox{\footnotesize{CCA}}}$  receiving power first, the A I/O Port should be configured as inputs to help guard against bus contention and oscillations.

A side data inputs should be driven to a valid logic level. This will prevent excessive current draw.

The above steps will ensure that no bus contention or oscillations, and therefore no excessive current draw occurs during the power up cycling of these devices. These steps will help prevent possible damage to the translator devices and potential damage to other system components.

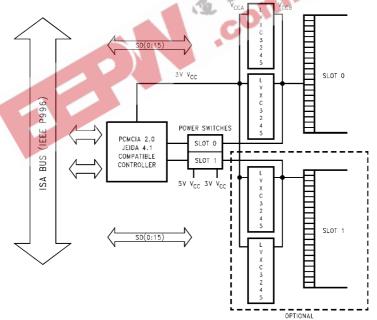
TABLE 1. Low Voltage Translator Power Up Sequencing Table

Device Type	V <sub>CCA</sub>	V <sub>CCB</sub>	T/R	ŌĒ	A Side I/O	B Side I/O	Floatable Pin Allowed
74LVXC3245	3V	3V to 5.5V	ramp	ramp	logic	outputs	yes, V <sub>CCB</sub> and B
74LVXC3245	(power up 1st)	configurable	with V <sub>CCA</sub>	with V <sub>CCA</sub>	0V or V <sub>CCA</sub>	outputs	I/O's w/ OE HIGH

Please reference Application Note AN-5001 for more detailed information on using Fairchild's LVX Low Voltage Dual Supply CMOS Translating Transceivers.

# Configurable I/O Application for PCMCIA Cards Block Diagram

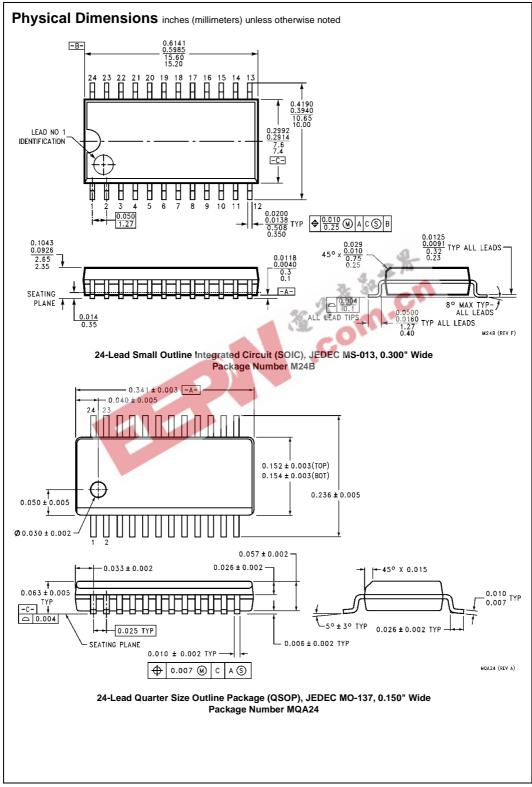
#### **Block Diagram**

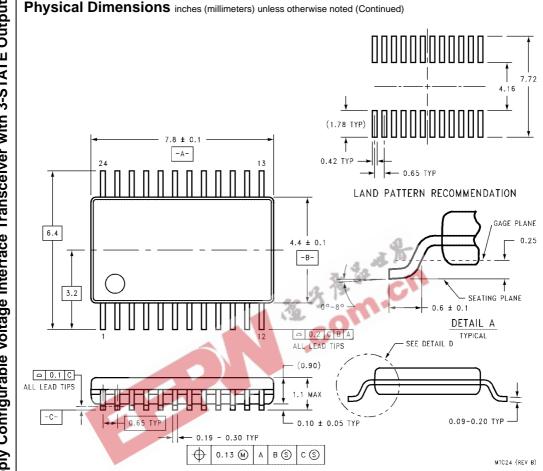


The LVXC3245 is a 24-pin dual supply device well suited for PCMCIA configurable I/O applications. Ideal for low power notebook designs, the LVXC3245 consumes less than 1 mW of quiescent power in all modes of operation. The LVXC3245 meets all PCMCIA I/O voltage requirements at 5V and 3.3V operation. By tying  $V_{\mbox{\scriptsize CCB}}$  of the LVXC3245 to the card voltage supply, the PCMCIA card

will always experience rail to rail output swings, maximizing the reliability of the interface.

The  $V_{\text{CCA}}$  pin on the LVXC3245 must always be tied to a 3V power supply. This voltage connection provides internal references needed to account for variations in  $V_{\mbox{\scriptsize CCB}}.$  When connected as in the figure above, the LVXC3245 meets all the voltage and current requirements of the ISA bus standard (IEEE P996).





24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC24

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