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February 2009

74LVXC3245

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

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 proprietary EMI reduction circuitry
- Flexible V_{CCB} operating range
- Allows B Port and V_{CCB} to float simultaneously when OE
- Functionally compatible with the 74 series 245

General Description

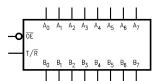
The LVXC3245 is a 24-pin dual-supply, 8-bit configurable voltage interface transceiver suited for PCMCIA and other real time configurable I/O applications. The $V_{\rm CCA}$ pin accepts a 3V supply level. The A Port is a dedicated 3V port. The $V_{\rm CCB}$ pin accepts a 3V-to-5V supply level. The B Port is configured to track the $V_{\rm CCB}$ supply level respectively. A 5V level on the $V_{\rm CC}$ pin will configure the I/O pins at a 5V level and a 3V $V_{\rm CC}$ 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 $V_{\rm CCB}$ 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.

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.

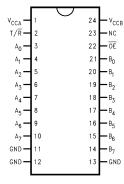
Logic Symbol/s



Pin Descriptions

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

Connection Diagram/s



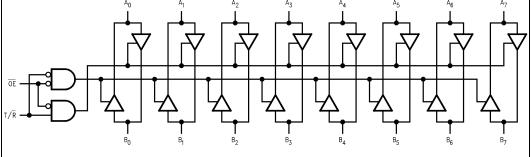
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Truth Table/s

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

- $$\begin{split} & H = HIGH \ Voltage \ Level \\ & L = LOW \ Voltage \ Level \\ & X = Immaterial \end{split}$$

Logic Diagram/s



Absolute Maximum Ratings(Note 1)

-0.5V to +7.0V Supply Voltage (V_{CCA}, V_{CCB}) DC Input Voltage (V_I) @ \overline{OE} , T/ \overline{R} -0.5V to V_{CCA} +0.5V

DC Input/Output Voltage (V_{I/O})

-0.5V to V_{CCA} +0.5V@ A_n @ B_n -0.5V to V_{CCB} +0.5V

DC Input Diode Current (I_{IK})

@ OE, T/R ±20 mA DC Output Diode (I_{OK}) Current ±50 mA DC Output Source or Sink Current (IO) $\pm 50~\text{mA}$

DC V_{CC} or Ground Current

per Output Pin (I_{CC} or I_{GND}) $\pm 50~\text{mA}$ and Max Current ±200 mA

Storage Temperature Range (T_{STG}) -65°C to +150°C ±300 mA

DC Latch-Up Source or Sink Current

Recommended Operating Conditions (Note 2)

Supply Voltage

2.7V to 3.6V V_{CCA} 3.0V to 5.5V V_{CCB} Input Voltage (V_I) @ OE, T/R 0V to $V_{\mbox{\footnotesize CCA}}$

Input Output Voltage (V_{I/O})

@ A_n 0V to V_{CCA} @ B_n 0V to $V_{\mbox{\scriptsize CCB}}$ Free Air Operating Temperature (T_A) -40°C to +85°C Minimum Input Edge Rate (Δt/ΔV) 8 ns/V

 $\rm V_{IN}$ from 30% to 70% of $\rm V_{CC}$

V_{CC} @ 3.0V, 4.5V, 5.5V

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 _{CCA}	V _{CCB}	$T_A =$	25°C	$T_A = -40^{\circ}C$ to $+85^{\circ}C$	Units	Conditions
Symbol			(V)	(V)	Тур	Gua	aranteed Limits	Units	
V _{IHA}	Minimum HIGH	A _n ,	2.7	3.0		2.0	2.0		V _{OUT} ≤ 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	\geq V _{CC} $-$ 0.1V
V _{IHB}		B _n	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 _{ILA}	Maximum LOW	A _n ,	2.7	3.0		0.8	0.8		$V_{OUT} \le 0.1V$
	Level Input	OE	3.0	3.6		0.8	0.8		or
	Voltage	T/R	3.6	5.5		0.8	0.8	V	\geq V _{CC} $-$ 0.1V
V _{ILB}		B _n	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 _{OHA}	Minimum HIGH L	.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 _{OHB}			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 _{OLA}	Maximum LOW L	.evel	3.0	3.0	0.002	0.1	0.1		I _{OUT} = 100 μA
	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 _{OLB}			3.0	3.0	0.002	0.1	0.1		I _{OUT} = 100 μA
			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 _{IN}	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	μА	
	OE, T/R								

DC Electrical Characteristics (Continued)

Symbol	Parameter		V _{CCA}	V _{CCB}	$T_A = 25^{\circ}C$		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	Units	Conditions	
Symbol	Parameter	raiailletei		(V)	Тур	Guaranteed Limits		Units	Conditions	
I _{OZA}	Maximum 3-STATE		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 _n								$V_O = V_{CCA}$, GND	
I _{OZB}	Maximum 3-STATE		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 _n								$V_O = V_{CCB}$, GND	
Δl _{CC}	Maximum	B _n	3.6	5.5	1.0	1.35	1.5	mA	$V_I = V_{CCB} - 2.1V$	
	I _{CC} /Input	All Inputs	3.6	3.6		0.35	0.5	IIIA	$V_I = V_{CC} - 0.6V$	
I _{CCA1}	Quiescent V _{CCA}								$A_n = V_{CCA}$ 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 _{CCA2}	Quiescent V _{CCA}		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,	
									$\overline{OE} = GND, T/\overline{R} = GND$	
I _{CCB}	Quiescent V _{CCB}		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,	
									$\overline{OE} = GND, T/\overline{R} = V_{CCA}$	
V_{OLPA}	Quiet Output		3.3	3.3		0.8		V	(Note 3)(Note 4)	
	Maximum Dynamic		3.3	5.0		0.8		·		
V_{OLPB}	V _{OL}		3.3	3.3		0.8		V	(Note 3)(Note 4)	
			3.3	5.0		1.5		·		
V _{OLVA}	Quiet Output		3.3	3.3		-0.8		V	(Note 3)(Note 4)	
	Minimum Dynamic		3.3	5.0		-0.8		·		
V _{OLVB}	V _{OL}		3.3	3.3		-0.8		V	(Note 3)(Note 4)	
			3.3	5.0		-1.2		·		
V_{IHDA}	Minimum HIGH		3.3	3.3		2.0		V	(Note 3)(Note 5)	
	Level Dynamic		3.3	5.0		2.0		•		
V_{IHDB}	Input Voltage		3.3	3.3		2.0		V	(Note 3)(Note 5)	
			3.3	5.0		3.5		•		
V_{ILDA}	Maximum LOW		3.3	3.3		8.0		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.

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

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°C			$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		T _A = +25°C			$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	
	$C_L = 50 \text{ pF}$			$C_L = 50 \text{ pF}$ $V_{CCA} = 2.7V - 3.6V$ $V_{CCB} = 4.5V - 5.5V$		$C_L = 50 \text{ pF}$ $V_{CCA} = 2.7V - 3.6V$ $V_{CCB} = 3.0V - 3.6V$			C _L =	50 pF	
Parameter	V _{CCA} = 2.7V-3.6V V _{CCB} = 4.5V-5.5V		$V_{CCA} = 2.7V - 3.6V$ $V_{CCB} = 3.0V - 3.6V$						Units		
rarameter											
	Min	Тур	Max	Min	Max	Min	Тур	Max	Min	Max	
		(Note 6)					(Note 7)				
Propagation Delay	1.0	4.8	8.0	1.0	8.5	1.0	5.5	8.5	1.0	9.0	ns
A to B	1.0	3.9	6.5	1.0	7.0	1.0	5.2	8.0	1.0	8.5	115
Propagation Delay	1.0	3.8	6.5	1.0	7.0	1.0	4.4	7.0	1.0	7.5	ns
B to A	1.0	4.3	7.5	1.0	8.0	1.0	5.1	7.5	1.0	8.0	115
Output Enable Time	1.0	4.7	8.0	1.0	8.5	1.0	6.0	9.0	1.0	9.5	ns
OE to B	1.0	4.8	8.5	1.0	9.0	1.0	6.1	9.5	1.0	10.0	115
Output Enable Time	1.0	5.9	9.5	1.0	10.0	1.0	6.4	10.0	1.0	10.5	ns
OE to A	1.0	5.4	9.0	1.0	9.5	1.0	5.8	9.0	1.0	9.5	115
Output Disable Time	1.0	4.0	8.0	1.0	8.5	1.0	6.3	9.5	1.0	10.0	
OE to B	1.0	3.8	7.5	1.0	8.0	1.0	4.5	8.0	1.0	8.5	ns
Output Disable Time	1.0	4.6	9.5	1.0	10.0	1.0	5.2	9.5	1.0	10.0	
OE to A	1.0	3.1	6.5	1.0	7.0	1.0	3.4	6.5	1.0	7.0	ns
Output to Output											
Skew (Note 8)		1.0	1.5		1.5		1.0	1.5		1.5	ns
Data to Output											
	A to B Propagation Delay B to A Output Enable Time OE to B Output Enable Time OE to A Output Disable Time OE to B Output Disable Time OE to B Output Disable Time OE to A Output Disable Time OE to A	Parameter V _{CC} V _{CC} Min Propagation Delay 1.0 A to B 1.0 Propagation Delay 1.0 B to A 1.0 Output Enable Time 1.0 Output Enable Time 1.0 Output Enable Time 1.0 Output Disable Time 1.0 Output Disable Time 1.0 Output Disable Time 1.0 Output Disable Time 1.0 Output to A 1.0 Output to Output Skew (Note 8)	Parameter C _L = 50 pF	V _{CCA} = 2.7V−3.6V V _{CCB} = 4.5V−5.5V Min Typ Max (Note 6) Max Propagation Delay 1.0 4.8 8.0 A to B 1.0 3.9 6.5 Propagation Delay 1.0 3.8 6.5 B to A 1.0 4.3 7.5 Output Enable Time 1.0 4.7 8.0 OE to B 1.0 4.8 8.5 Output Enable Time 1.0 5.4 9.0 Output Disable Time 1.0 4.0 8.0 OE to B 1.0 3.8 7.5 Output Disable Time 1.0 4.6 9.5 OE to A 1.0 3.1 6.5 Output to Output Skew (Note 8) 1.0 1.5	C _L = 50 pF C _L = V _{CCA} = 2.7V−3.6V C _{CA} = 4.5V−5.5V C _{CB} = 4.5V−5.5V V _{CCB} = 4.5V−5.5V Min Typ Max Min Min <td>C_L = 50 pF C_L = 50 pF V_{CCA} = 2.7V−3.6V V_{CCA} = 2.7V−3.6V V_{CCB} = 4.5V−5.5V Min Typ Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Min<td>$\begin{array}{c ccccccccccccccccccccccccccccccccccc$</td><td>C_L = 50 pF C_L = 50 pF V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCB} = 3.0V-3 Min Max Min Max Min My CC_L = 50 pF V_{CCA} = 2.7V-3.6V V_{CCB} = 2.7V-3.6V V_{CCB} = 3.0V-3 V_{CCB} = 3.0V-3 My Min Ms Ms <th< td=""><td>$\begin{array}{c ccccccccccccccccccccccccccccccccccc$</td><td>C_L = 50 pF C_L = 50 pF V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCB} = 3.0V-3.6V V_{CCB} = 3.0V-3.6V</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td></th<></td></td>	C _L = 50 pF C _L = 50 pF V _{CCA} = 2.7V−3.6V V _{CCA} = 2.7V−3.6V V _{CCB} = 4.5V−5.5V Min Typ Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Max Min Min <td>$\begin{array}{c ccccccccccccccccccccccccccccccccccc$</td> <td>C_L = 50 pF C_L = 50 pF V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCB} = 3.0V-3 Min Max Min Max Min My CC_L = 50 pF V_{CCA} = 2.7V-3.6V V_{CCB} = 2.7V-3.6V V_{CCB} = 3.0V-3 V_{CCB} = 3.0V-3 My Min Ms Ms <th< td=""><td>$\begin{array}{c ccccccccccccccccccccccccccccccccccc$</td><td>C_L = 50 pF C_L = 50 pF V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCB} = 3.0V-3.6V V_{CCB} = 3.0V-3.6V</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td></th<></td>	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	C _L = 50 pF V _{CCA} = 2.7V-3.6V V _{CCA} = 2.7V-3.6V V _{CCB} = 3.0V-3 Min Max Min Max Min My CC _L = 50 pF V _{CCA} = 2.7V-3.6V V _{CCB} = 2.7V-3.6V V _{CCB} = 3.0V-3 V _{CCB} = 3.0V-3 My Min Ms Ms <th< td=""><td>$\begin{array}{c ccccccccccccccccccccccccccccccccccc$</td><td>C_L = 50 pF C_L = 50 pF V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCA} = 2.7V-3.6V V_{CCB} = 3.0V-3.6V V_{CCB} = 3.0V-3.6V</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td></th<>	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	C _L = 50 pF V _{CCA} = 2.7V-3.6V V _{CCA} = 2.7V-3.6V V _{CCA} = 2.7V-3.6V V _{CCB} = 3.0V-3.6V V _{CCB} = 3.0V-3.6V	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $

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

Note 7: Typical values at $V_{CCA} = 3.3V$, $V_{CCB} = 3.3V$ @ 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 (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}). Parameter guaranteed by design.

Capacitance

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

Note 9: C_{PD} is measured at 10 MHz.

Power Up Considerations

To insure the system does not experience unnecessary $I_{\rm CC}$ 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 $V_{\mbox{\scriptsize CCA}}$ side.
- OE should ramp with or ahead of V_{CCA}. This will help guard against bus contention.
- The Transmit/Receive control pin (T/R) should ramp with V_{CCA}, this will ensure that the A Port data pins are con-

figured as inputs. With V_{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.

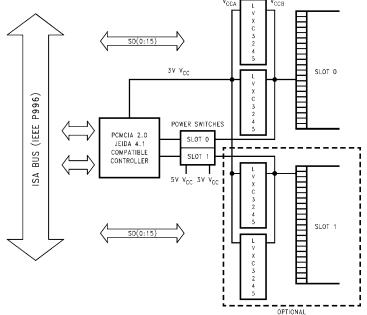
TABLE 1. Low Voltage Translator Power Up Sequencing Table

Device Type	V _{CCA}	V _{CCB}	T/R	ŌĒ	A Side I/O	B Side I/O	Floatable Pin Allowed
74LVXC3245	3V (power up 1st)	3V to 5.5V configurable	ramp with V _{CCA}	ramp with V _{CCA}	logic 0V or V _{CCA}	outputs	yes, V _{CCB} and B 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

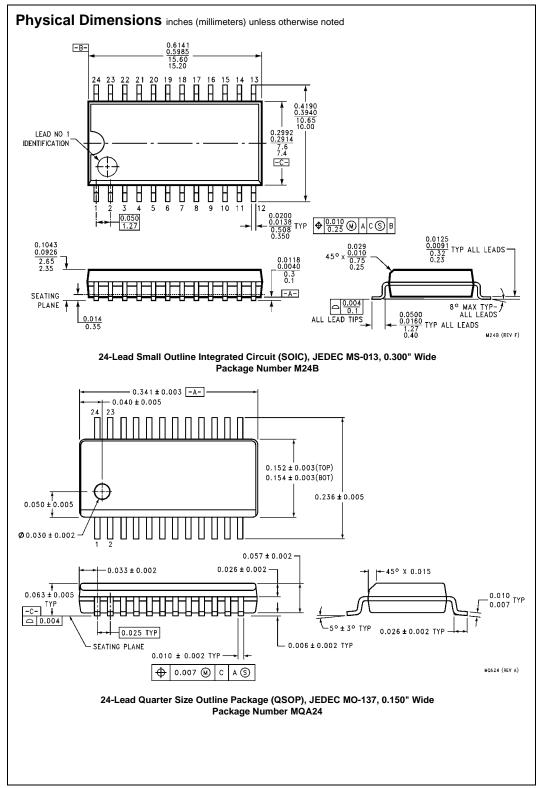
Block Diagram

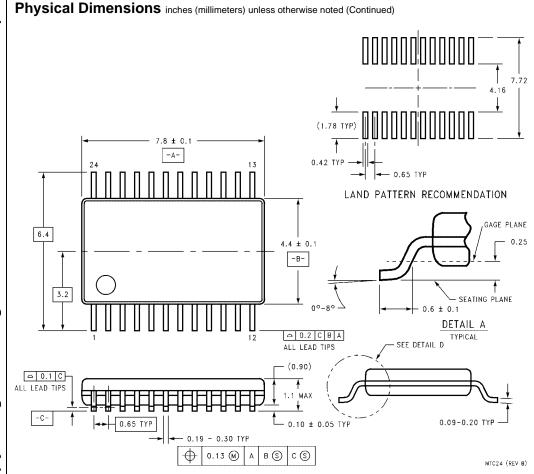


The LVXC3245 is a 24-pin dual supply device well suited for PCMCIA configurable I/O applications. Ideal for low power notebook designs, the LVXC3245 consumes less than 1 mW of quiescent power in all modes of operation. The LVXC3245 meets all PCMCIA I/O voltage requirements at 5V and 3.3V operation. By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