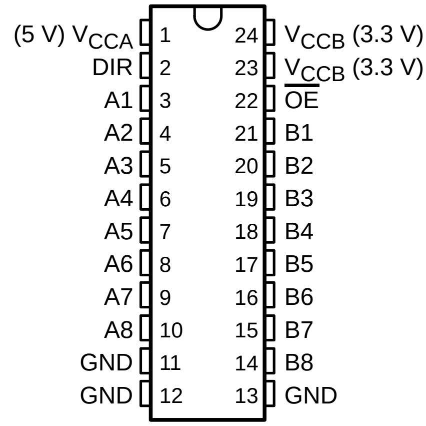
- ***EPIC*** ™ **(Enhanced-Performance Implanted CMOS) Submicron Process**
- **3.3-V to 5-V Bidirectional Level Shifter**
- **Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages**

DB, DW, OR PW PACKAGE
(TOP VIEW)



description

This 8-bit (octal) noninverting bus transceiver contains two separate supply rails; B port has V_{CCB}, which is set at 3.3 V, and A port has V_{CCA}, which is set to operate at 5 V. This allows for translation from a 3.3-V to a 5-V environment and vice versa.

The SN74LVC4245 is designed for asynchronous communication between data buses. The device transmits data from the A bus to the B bus or from the B bus to the A bus, depending upon the logic level at the direction-control (DIR) input. The output-enable ($\overline{OE}$) input can be used to disable the device so the buses are effectively isolated.

The SN74LVC4245 pinout allows the designer to switch to a normal all-3.3-V or all-5-V 20-pin ′245 device without board re-layout. The designer uses the datapaths for pins 2 through 11 and 14 through 23 of the SN74LVC4245 to achieve the conventional ′245 layout.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN74LVC4245 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

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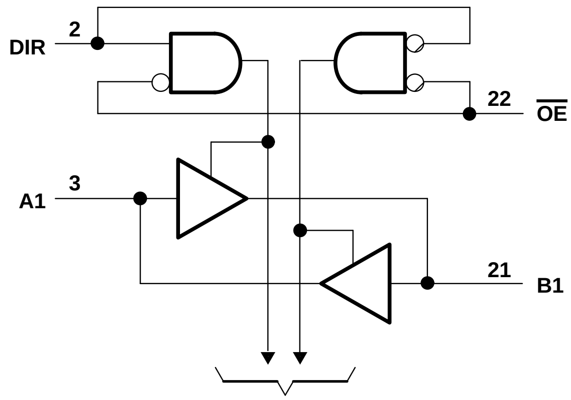
logic diagram (positive logic)



To Seven Other Channels

absolute maximum ratings over operating free-air temperature range for V_{CCA} at 5 V (unless otherwise noted)†

Supply voltage range, V_{CCA}	–0.5 V to 6.5 V
Input voltage range, V_I (see Note 1)	–0.5 V to V_{CCA} + 0.5 V
Output voltage range, V_O (see Note 1)	–0.5 V to V_{CCA} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CCA}$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CCA}$)	±50 mA
Continuous output current, I_O (V_O = 0 to V_{CCA})	±50 mA
Continuous current through each V_{CCA} or GND	±100 mA
Maximum power dissipation at T_A = 55°C (in still air) (see Note 2): DB package	0.65 W
DW package	1.7 W
PW package	0.7 W
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. This value is limited to 6 V maximum.
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

absolute maximum ratings over operating free-air temperature range for V_{CCB} at 3.3 V (unless otherwise noted)†

Supply voltage range, V_{CCB}	–0.5 V to 4.6 V
Input voltage range, V_I (except I/O ports) (see Note 3)	–0.5 V to 4.6 V
Input voltage range, V_I (I/O ports) (see Note 3)	–0.5 V to V_{CCB} + 0.5 V
Output voltage range, V_O (see Note 3)	–0.5 V to V_{CCB} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CCB}$)	±50 mA
Continuous output current, I_O (V_O = 0 to V_{CCB})	±50 mA
Continuous current through V_{CCB} or GND	±100 mA
Maximum power dissipation at T_A = 55°C (in still air) (see Note 2): DB package	0.65 W
DW package	1.7 W
PW package	0.7 W
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

3. This value is limited to 4.6 V maximum.

recommended operating conditions for V_{CCA} at 5 V (see Note 3)

		MIN	MAX	UNIT
V_{CCA}	Supply voltage	4.5	5.5	V
V_{IH}	High-level input voltage	2		V
V_{IL}	Low-level input voltage		0.8	V
V_I	Input voltage	0	V_{CCA}	V
V_O	Output voltage	0	V_{CCA}	V
I_{OH}	High-level output current		–24	mA
I_{OL}	Low-level output current		24	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	ns/V
T_A	Operating free-air temperature	–40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

recommended operating conditions for V_{CCB} at 3.3 V (see Note 3)

			MIN	MAX	UNIT
V_{CCB}	Supply voltage		2.7	3.6	V
V_{IH}	High-level input voltage	V_{CCB} = 2.7 V to 3.6 V	2		V
V_{IL}	Low-level input voltage	V_{CCB} = 2.7 V to 3.6 V		0.8	V
V_I	Input voltage		0	V_{CCB}	V
V_O	Output voltage		0	V_{CCB}	V
I_{OH}	High-level output current	V_{CCB} = 2.7 V		–12	mA
		V_{CCB} = 3 V		–24	
I_{OL}	Low-level output current	V_{CCB} = 2.7 V		12	mA
		V_{CCB} = 3 V		24	
$\Delta t/\Delta v$	Input transition rise or fall rate		0	10	ns/V
T_A	Operating free-air temperature		–40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

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electrical characteristics over recommended operating free-air temperature range for V_{CCA} = 5 V (unless otherwise noted) (see Note 4)

PARAMETER		TEST CONDITIONS		V_{CCA}	MIN	TYP†	MAX	UNIT
V_{OH}		I_{OH} = –100 µA		4.5 V	4.3			V
				5.5 V	5.3			
		I_{OH} = –24 mA		4.5 V	3.7			
				5.5 V	4.7			
V_{OL}		I_{OL} = 100 µA		4.5 V			0.2	V
				5.5 V			0.2	
		I_{OL} = 24 mA		4.5 V			0.55	
				5.5 V			0.55	
I_I	Control inputs	$V_I = V_{CCA}$ or GND		5.5 V			5	µA
I_{OZ}‡	A or B ports	$V_O = V_{CCA}$ or GND		5.5 V				µA
I_{CC}		$V_I = V_{CCA}$ or GND,	I_O = 0	5.5 V				µA
ΔI_{CC}§		One input at 3.4 V,	Other inputs at V_{CCA} or GND					µA
C_i	Control inputs	$V_I = V_{CCA}$ or GND		5 V				pF
C_{io}	A or B ports	$V_O = V_{CCA}$ or GND		5 V				pF

† All typical values are measured at V_{CC} = 3.3 V, T_A = 25°C.
‡ For I/O ports, the parameter I_{OZ} includes the input leakage current.
§ This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or the corresponding V_{CC}.
NOTE 4: V_{CCB} = 2.7 V to 3.6 V

electrical characteristics over recommended operating free-air temperature range for V_{CCB} = 3.3 V (unless otherwise noted) (see Note 5)

PARAMETER		TEST CONDITIONS		V_{CCB}¶	MIN	TYP†	MAX	UNIT
V_{OH}		I_{OH} = –100 µA		MIN to MAX	V_{CC}–0.2			V
		I_{OH} = –12 mA		2.7 V	2.2			
				3 V	2.4			
		I_{OH} = –24 mA		3 V	2			
V_{OL}		I_{OL} = 100 µA		MIN to MAX			0.2	V
		I_{OL} = 12 mA		2.7 V			0.4	
		I_{OL} = 24 mA		3 V			0.55	
I_I	Control inputs	$V_I = V_{CCB}$ or GND		3.6 V			5	µA
I_{OZ}‡		$V_O = V_{CCB}$ or GND		3.6 V				µA
I_{CC}		$V_I = V_{CCB}$ or GND,	I_O = 0	3.6 V				µA
ΔI_{CC}§		One input at V_{CCB} – 0.6 V,	Other inputs at V_{CCB} or GND	2.7 V to 3.6 V				µA
C_i	Control inputs	$V_I = V_{CCB}$ or GND		3.3 V				pF
C_{io}	A or B ports	$V_O = V_{CCB}$ or GND		3.3 V				pF

† All typical values are measured at V_{CC} = 3.3 V, T_A = 25°C.
‡ For I/O ports, the parameter I_{OZ} includes the input leakage current.
§ This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or the corresponding V_{CC}.
¶ For conditions shown as MIN or MAX, use the appropriate values under recommended operating conditions.
NOTE 5: V_{CCA} = 5 V ± 0.5 V