

SN74LVC162244
16-BIT BUFFER/DRIVER
WITH 3-STATE OUTPUTS
SCAS546 – OCTOBER 1995

- Member of the Texas Instruments *Widebus™* Family
- *EPIC™* (Enhanced-Performance Implanted CMOS) Submicron Process
- Output Ports Have Equivalent 26-Ω Series Resistors, So No External Resistors Are Required
- Typical V_{OLP} (Output Ground Bounce) $< 0.8\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) $> 2\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model ($C = 200\text{ pF}$, $R = 0$)
- Latch-Up Performance Exceeds 250 mA Per JEDEC Standard JESD-17
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages

description

This 16-bit buffer/driver is designed for 2.7-V to 3.6-V V_{CC} operation.

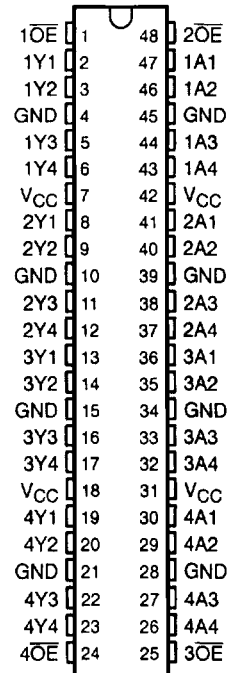
The SN74LVC162244 is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. It provides true outputs and symmetrical active-low output-enable ($\overline{OE}$) inputs. The outputs, which are designed to sink up to 12 mA, include 26-Ω resistors to reduce overshoot and undershoot.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

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 SN74LVC162244 is characterized for operation from -40°C to 85°C .

DGG OR DL PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each 4-bit buffer)

INPUTS		OUTPUT
$\overline{OE}$	A	Y
L	H	H
L	L	L
H	X	Z

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

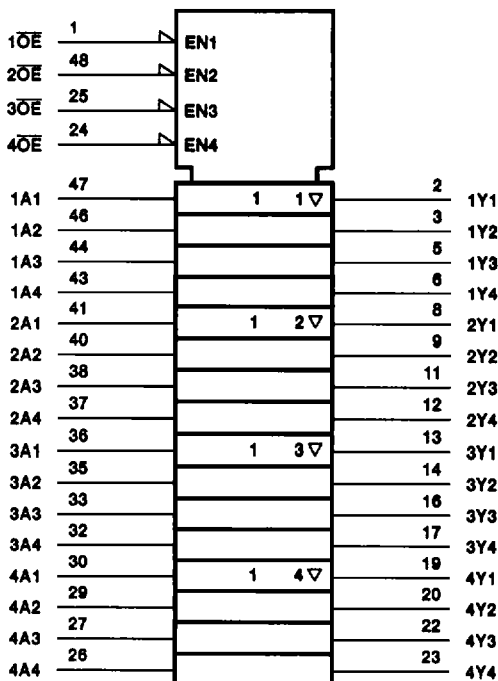
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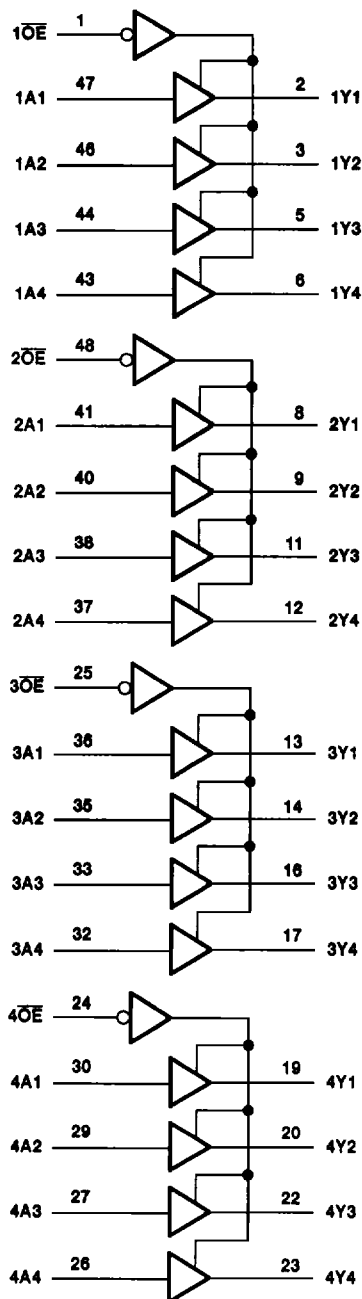
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC}	–0.5 V to 4.6 V
Input voltage range, V_I (see Note 1)	–0.5 V to 4.6 V
Output voltage range, V_O (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	±50 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±50 mA
Continuous current through V_{CC} or GND	±100 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3):	DGG package 1 W
	DL package 1.4 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. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 4.6 V maximum.
3. 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.

recommended operating conditions (see Note 4)

			MIN	MAX	UNIT
V _{CC}	Supply voltage		2.7	3.6	V
V _{IH}	High-level input voltage	V _{CC} = 2.7 V to 3.6 V	2		V
V _{IL}	Low-level input voltage	V _{CC} = 2.7 V to 3.6 V		0.8	V
V _I	Input voltage		0	V _{CC}	V
V _O	Output voltage		0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2.7 V		–8	mA
		V _{CC} = 3 V		–12	
I _{OL}	Low-level output current	V _{CC} = 2.7 V		8	mA
		V _{CC} = 3 V		12	
Δt/ΔV	Input transition rise or fall rate		0	10	ns/V
T _A	Operating free-air temperature		–40	85	°C

NOTE 4: Unused control 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 (unless otherwise noted)

PARAMETER		TEST CONDITIONS	$V_{CC}^{\dagger}$	MIN	TYP ‡	MAX	UNIT
V_{OH}		$I_{OH} = -100 \mu A$	MIN to MAX	$V_{CC} - 0.2$			V
		$I_{OH} = -6 \text{ mA}$, $V_{IH} = 2 \text{ V}$	3	2.4			
		$I_{OH} = -8 \text{ mA}$, $V_{IH} = 2 \text{ V}$	2.7	2			
		$I_{OH} = -12 \text{ mA}$, $V_{IH} = 2 \text{ V}$	3	2			
V_{OL}		$I_{OL} = 100 \mu A$	MIN to MAX	0.2			V
		$I_{OL} = 6 \text{ mA}$, $V_{IL} = 0.8 \text{ V}$	3	0.55			
		$I_{OL} = 8 \text{ mA}$, $V_{IL} = 0.8 \text{ V}$	2.7	0.6			
		$I_{OL} = 12 \text{ mA}$, $V_{IL} = 0.8 \text{ V}$	3	0.8			
I_I		$V_I = V_{CC}$ or GND	3.8	± 5			μA
$I_{I(\text{hold})}$		$V_I = 0.8 \text{ V}$	3	75			μA
		$V_I = 2 \text{ V}$	3	-75			
		$V_I = 0$ to 3.6 V	3.6	± 500			
I_{OZ}		$V_O = V_{CC}$ or GND	3.6	± 10			μA
I_{CC}		$V_I = V_{CC}$ or GND, $I_O = 0$	3.6	20			μA
ΔI_{CC}		One input at $V_{CC} - 0.6 \text{ V}$, Other inputs at V_{CC} or GND	2.7 V to 3.6 V	500			μA
C_i	Control inputs	$V_I = V_{CC}$ or GND	3.3	2.5			pF
C_o	A or B ports	$V_O = V_{CC}$ or GND	3.3	3.5			pF

† For conditions shown as MIN or MAX, use the appropriate values under recommended operating conditions.

‡ All typical values are at $V_{CC} = 3.3 \text{ V}$, $T_A = 25^{\circ}\text{C}$.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50 \text{ pF}$ (unless otherwise noted) (see Figure 1)

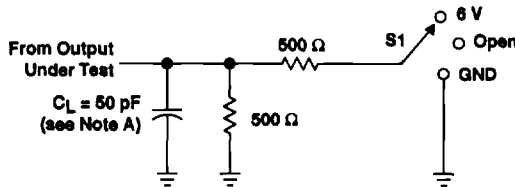
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		$V_{CC} = 2.7 \text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
t_{pd}	A	Y	1.5	7	1.5	8	ns
t_{en}	$\overline{OE}$	Y	1.5	9	1.5	10	ns
t_{dis}	$\overline{OE}$	Y	1.5	7	1.5	8	ns

operating characteristics, $V_{CC} = 3.3 \text{ V}$, $T_A = 25^{\circ}\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per buffer/driver	$C_L = 50 \text{ pF}$, $f = 10 \text{ MHz}$	20	pF
	Outputs enabled Outputs disabled		2	

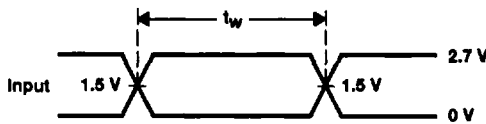


PARAMETER MEASUREMENT INFORMATION

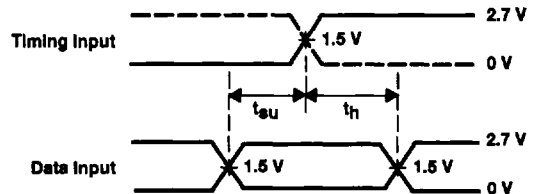


TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND

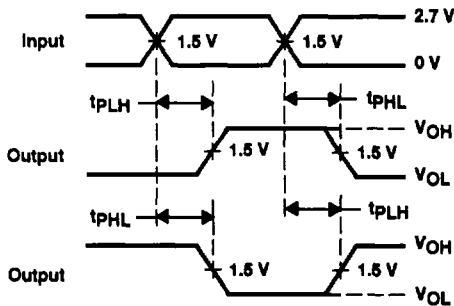
LOAD CIRCUIT FOR OUTPUTS



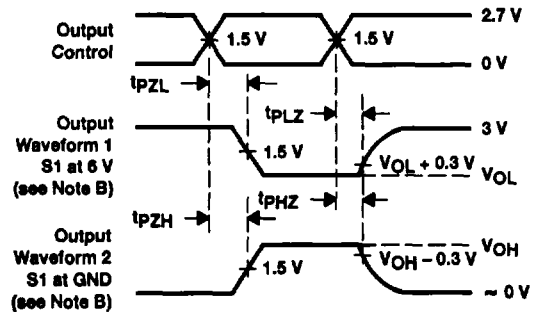
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- C_L includes probe and jig capacitance.
 - 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 pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms