

# SN74ALVCH162244

## 16-BIT BUFFER/DRIVER WITH 3-STATE OUTPUTS

SCES065A – JANUARY 1996 – REVISED NOVEMBER 1996

- 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.
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 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 2.3-V to 3.6-V  $V_{CC}$  operation.

The SN74ALVCH162244 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.

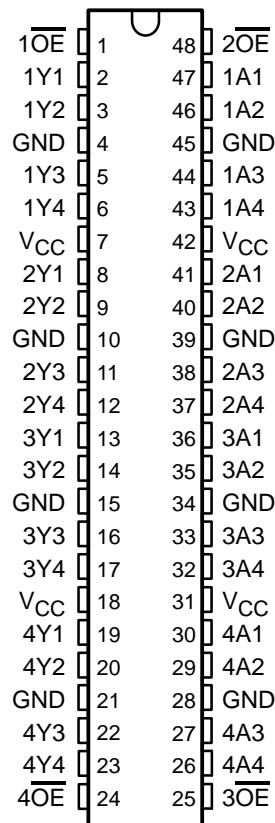
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

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

The SN74ALVCH162244 is available in TI's shrink small-outline (DL) and thin shrink small-outline (DGG) packages, which provide twice the I/O pin count and functionality of standard small-outline packages in the same printed circuit board area.

The SN74ALVCH162244 is characterized for operation from –40°C to 85°C.

DGG OR DL PACKAGE  
(TOP VIEW)



FUNCTION TABLE  
(each 4-bit buffer)

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



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**TEXAS  
INSTRUMENTS**

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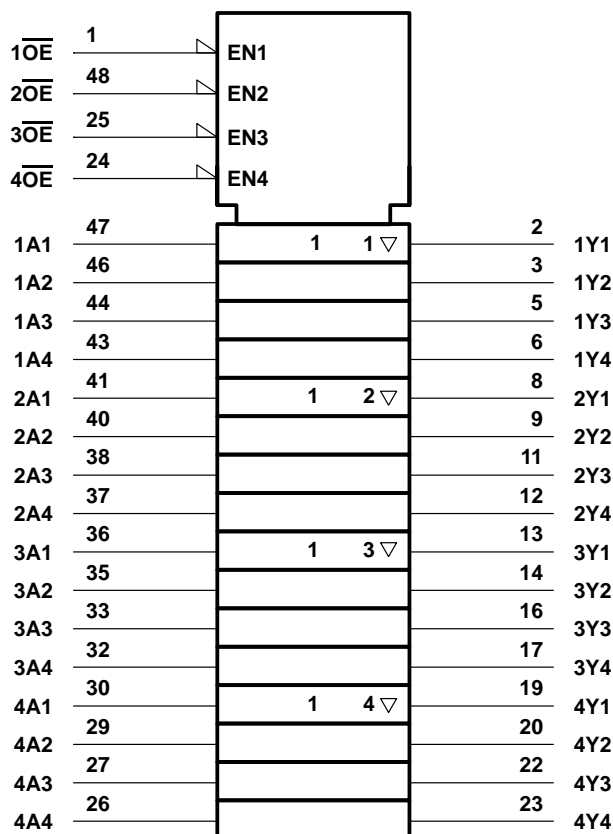
# SN74ALVCH162244

## 16-BIT BUFFER/DRIVER

### WITH 3-STATE OUTPUTS

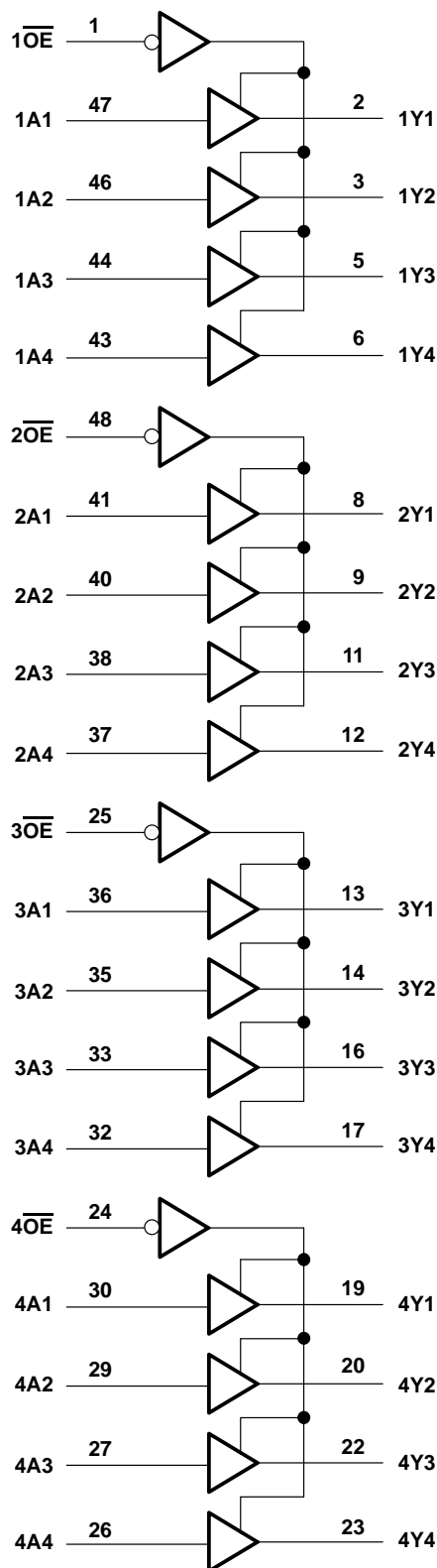
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logic symbol†



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

logic diagram (positive logic)



**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 each $V_{CC}$ 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 *ABT Advanced BiCMOS Technology Data Book*.

**recommended operating conditions (see Note 4)**

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage		2.3	3.6	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2.3$ V to 2.7 V	1.7		V
		$V_{CC} = 2.7$ V to 3.6 V	2		
$V_{IL}$	Low-level input voltage	$V_{CC} = 2.3$ V to 2.7 V		0.7	V
		$V_{CC} = 2.7$ V to 3.6 V		0.8	
$V_I$	Input voltage		0	$V_{CC}$	V
$V_O$	Output voltage		0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 2.3$ V		–6	mA
		$V_{CC} = 2.7$ V		–8	
		$V_{CC} = 3$ V		–12	
$I_{OL}$	Low-level output current	$V_{CC} = 2.3$ V		6	mA
		$V_{CC} = 2.7$ V		8	
		$V_{CC} = 3$ V		12	
$\Delta t/\Delta v$	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 <sub>CC</sub>	MIN	TYP†	MAX	UNIT
V <sub>OH</sub>		I <sub>OH</sub> = –100 µA	2.3 V to 3.6 V	V <sub>CC</sub> –0.2			V
		I <sub>OH</sub> = –4 mA      V <sub>IH</sub> = 1.7 V	2.3 V	1.9			
		I <sub>OH</sub> = –6 mA      V <sub>IH</sub> = 1.7 V	2.3 V	1.7			
		I <sub>OH</sub> = –8 mA      V <sub>IH</sub> = 2 V	2.7 V	2			
		I <sub>OH</sub> = –6 mA      V <sub>IH</sub> = 2 V	3 V	2.4			
		I <sub>OH</sub> = –12 mA      V <sub>IH</sub> = 2 V	3 V	2			
V <sub>OL</sub>		I <sub>OL</sub> = 100 µA	2.3 V to 3.6 V			0.2	V
		I <sub>OL</sub> = 4 mA      V <sub>IL</sub> = 0.7 V	2.3 V			0.4	
		I <sub>OL</sub> = 6 mA      V <sub>IL</sub> = 0.7 V	2.3 V			0.55	
		I <sub>OL</sub> = 8 mA      V <sub>IL</sub> = 0.8 V	2.7 V			0.6	
		I <sub>OL</sub> = 6 mA      V <sub>IL</sub> = 0.8 V	3 V			0.55	
		I <sub>OL</sub> = 12 mA      V <sub>IL</sub> = 0.8 V	3 V			0.8	
I <sub>I</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND	3.6 V			±5	µA
I <sub>I</sub> (hold)		V <sub>I</sub> = 0.7 V	2.3 V	45			µA
		V <sub>I</sub> = 1.7 V		–45			
		V <sub>I</sub> = 0.8 V	3 V	75			
		V <sub>I</sub> = 2 V		–75			
		V <sub>I</sub> = 0 to 3.6 V‡	3.6 V			±500	
I <sub>OZ</sub>		V <sub>O</sub> = V <sub>CC</sub> or GND	3.6 V			±10	µA
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND,      I <sub>O</sub> = 0	3.6 V			40	µA
ΔI <sub>CC</sub>		One input at V <sub>CC</sub> – 0.6 V,      Other inputs at V <sub>CC</sub> or GND	3 V to 3.6 V			750	µA
C <sub>i</sub>	Control inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V	3			pF
	Data inputs			6			
C <sub>o</sub>	Outputs	V <sub>O</sub> = V <sub>CC</sub> or GND	3.3 V	7			pF

† Typical values are measured at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

‡ This is the bus-hold maximum dynamic current required to switch the input from one state to another.

**switching characteristics over recommended operating free-air temperature range, C<sub>L</sub> = 50 pF (unless otherwise noted) (see Figures 1 and 2)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	1	5.5		4.7	1	4.2	ns
t <sub>en</sub>	$\overline{\text{OE}}$	Y	1	7.3		6.7	1	5.6	ns
t <sub>dis</sub>	$\overline{\text{OE}}$	Y	1	6.5		5.7	1	5.5	ns

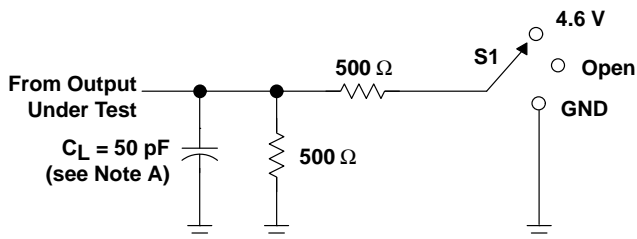
**operating characteristics, T<sub>A</sub> = 25°C**

PARAMETER		TEST CONDITIONS	V <sub>CC</sub> = 2.5 V ± 0.2 V	V <sub>CC</sub> = 3.3 V ± 0.3 V	UNIT
			TYP	TYP	
C <sub>pd</sub>	Power dissipation capacitance	Outputs enabled	16	19	pF
		Outputs disabled	4	5	



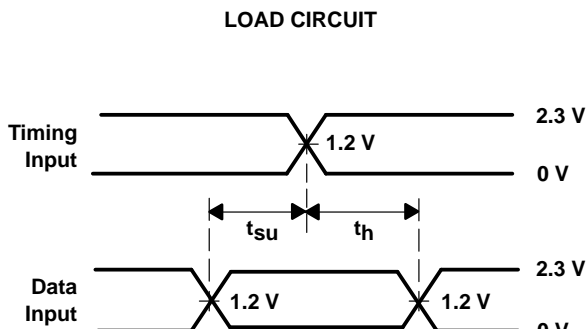
# PARAMETER MEASUREMENT INFORMATION

$$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$$

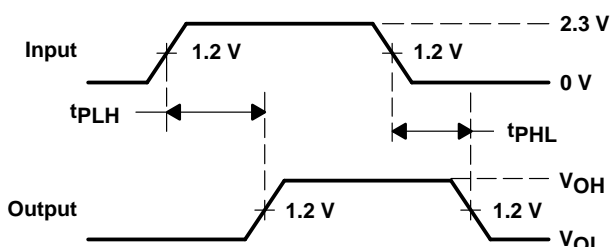


LOAD CIRCUIT

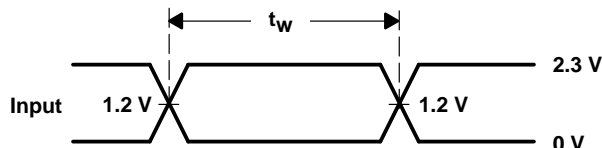
TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	4.6 V
$t_{PHZ}/t_{PZH}$	GND



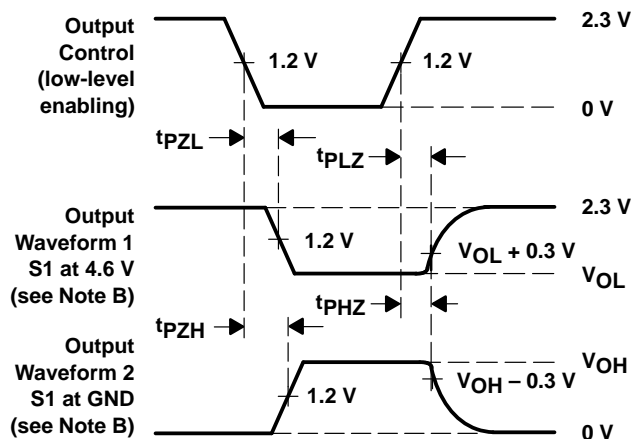
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES

- 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

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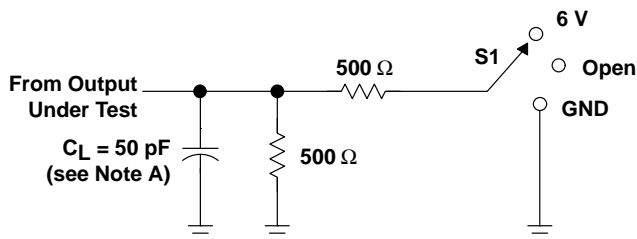
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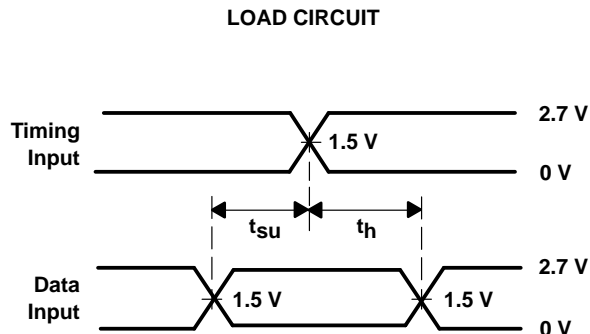
#### PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7\text{ V}$  AND  $3.3\text{ V} \pm 0.3\text{ V}$

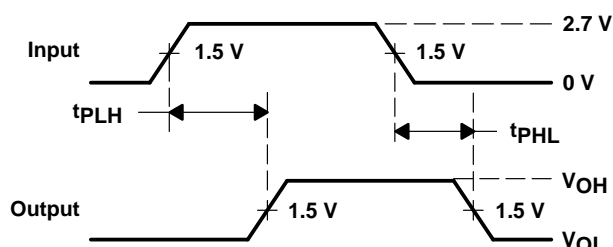


LOAD CIRCUIT

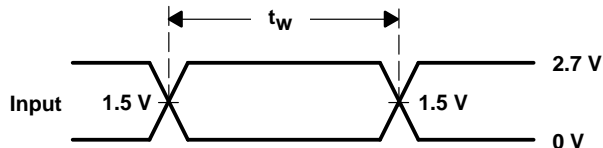
TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND



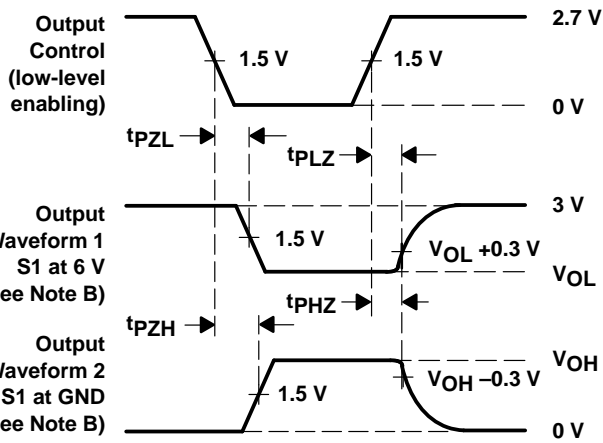
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



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  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ ,  $t_r \leq 2.5\text{ ns}$ ,  $t_f \leq 2.5\text{ ns}$ .
  - 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 2. Load Circuit and Voltage Waveforms

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