

- **EPIC™ (Enhanced-Performance Implanted CMOS) Submicron Process**
- **Member of the Texas Instruments Widebus™ Family**
- **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 2.5-V to 3.6-V  $V_{CC}$  operation.

The SN74ALVCH16540 provides a high-performance bus interface for wide data paths.

The 3-state control gate is a 2-input AND gate with active-low inputs so that if either output-enable ( $\overline{OE1}$  or  $\overline{OE2}$ ) input is high, all corresponding outputs are in the high-impedance state.

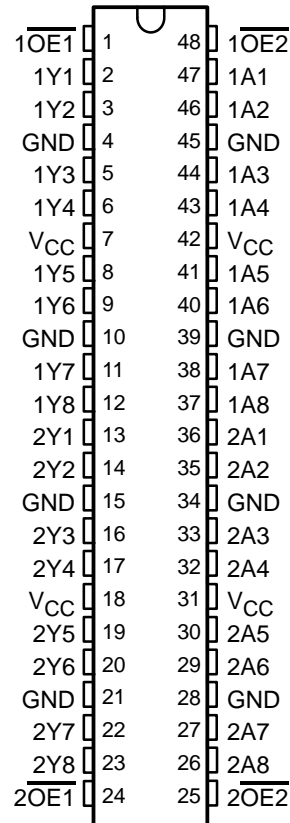
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

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

The SN74ALVCH16540 is available in TI's shrink small-outline package (DL), which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The SN74ALVCH16540 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

DGG OR DL PACKAGE  
(TOP VIEW)



FUNCTION TABLE  
(each 8-bit section)

INPUTS			OUTPUT Y
$\overline{OE1}$	$\overline{OE2}$	A	
L	L	L	H
L	L	H	L
H	X	X	Z
X	H	X	Z



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PRODUCT PREVIEW

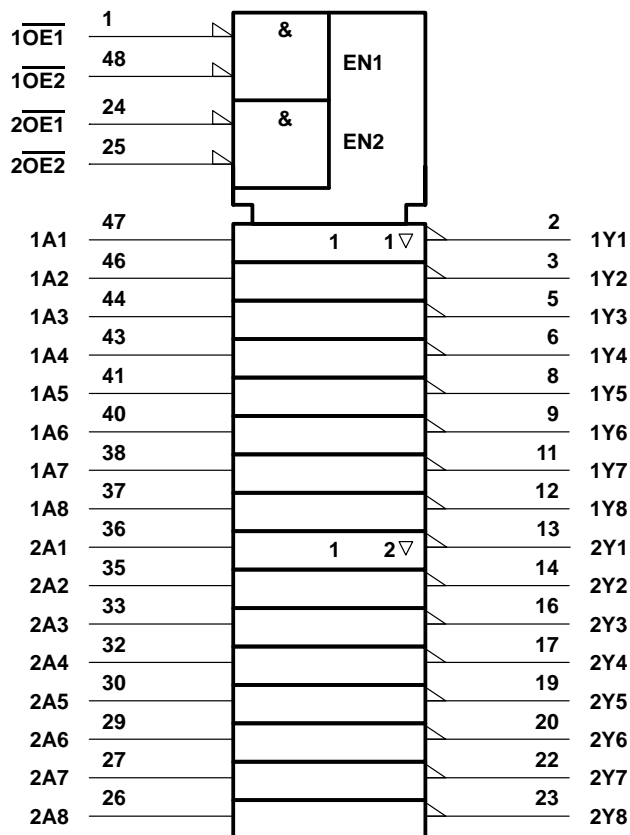
# SN74ALVCH16540

## 16-BIT BUFFER/DRIVER

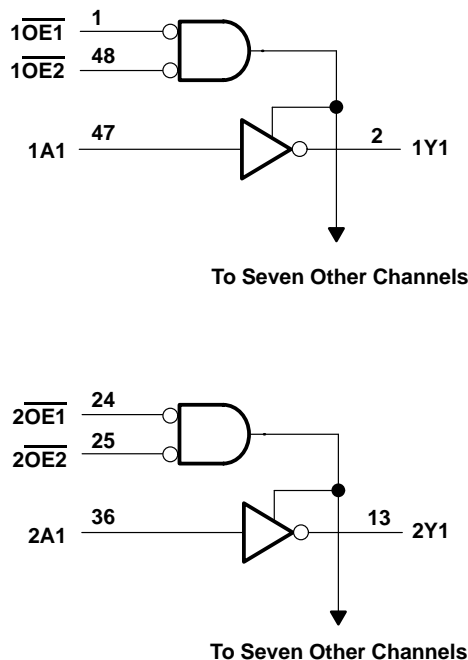
### WITH 3-STATE OUTPUTS

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#### logic symbol†



#### logic diagram (positive logic)



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

#### 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 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.



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

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage		2.3	3.6	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7		V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2		
$V_{IL}$	Low-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.7	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$		0.8	
$V_I$	Input voltage		0	$V_{CC}$	V
$V_O$	Output voltage		0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 2.3 \text{ V}$		-12	mA
		$V_{CC} = 2.7 \text{ V}$		-12	
		$V_{CC} = 3 \text{ V}$		-24	
$I_{OL}$	Low-level output current	$V_{CC} = 2.3 \text{ V}$		12	mA
		$V_{CC} = 2.7 \text{ V}$		12	
		$V_{CC} = 3 \text{ V}$		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 4: Unused control inputs must be held high or low to prevent them from floating.

**PRODUCT PREVIEW**

**SN74ALVCH16540**  
**16-BIT BUFFER/DRIVER**  
**WITH 3-STATE OUTPUTS**

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**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$V_{CC}^{\dagger}$	MIN	TYP $^{\ddagger}$	MAX	UNIT
$V_{OH}$	$I_{OH} = -100 \mu A$	MIN to MAX	$V_{CC} - 0.2$			V
	$I_{OH} = -6 \text{ mA}$ , $V_{IH} = 1.7 \text{ V}$	2.3 V	2			
	$I_{OH} = -12 \text{ mA}$	$V_{IH} = 1.7 \text{ V}$	2.3 V		1.7	
		$V_{IH} = 2 \text{ V}$	2.7 V		2.2	
		$V_{IH} = 2 \text{ V}$	3 V		2.4	
	$I_{OH} = -24 \text{ mA}$ , $V_{IH} = 2 \text{ V}$	3 V	2			
$V_{OL}$	$I_{OL} = 100 \mu A$	MIN to MAX			0.2	V
	$I_{OL} = 6 \text{ mA}$ , $V_{IL} = 0.7 \text{ V}$	2.3 V			0.4	
	$I_{OL} = 12 \text{ mA}$	$V_{IL} = 0.7 \text{ V}$	2.3 V		0.7	
		$V_{IL} = 0.8 \text{ V}$	2.7 V		0.4	
	$I_{OL} = 24 \text{ mA}$ , $V_{IL} = 0.8 \text{ V}$	3 V			0.55	
$I_I$	$V_I = V_{CC}$ or GND	3.6 V			$\pm 5$	$\mu A$
$I_{I(\text{hold})}$	$V_I = 0.7 \text{ V}$	2.3 V	45			$\mu A$
	$V_I = 1.7 \text{ V}$		-45			
	$V_I = 0.8 \text{ V}$	3 V	75			
	$V_I = 2 \text{ V}$		-75			
	$V_I = 0$ to 3.6 V	3.6 V			$\pm 500$	
$I_{OZ}$	$V_O = V_{CC}$ or GND	3.6 V			$\pm 10$	$\mu A$
$I_{CC}$	$V_I = V_{CC}$ or GND, $I_O = 0$	3.6 V			40	$\mu A$
$\Delta I_{CC}$	One input at $V_{CC} - 0.6 \text{ V}$ , Other inputs at $V_{CC}$ or GND	3 V to 3.6 V			750	$\mu A$
$C_i$	$V_I = V_{CC}$ or GND	3.3 V				pF
$C_o$	$V_O = V_{CC}$ or GND	3.3 V				pF

$^{\dagger}$  For conditions shown as MIN or MAX, use the appropriate values under recommended operating conditions.

$^{\ddagger}$  Typical values are measured at  $V_{CC} = 3.3 \text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ .

**switching characteristics over recommended operating free-air temperature range,  $C_L = 50 \text{ pF}$  (unless otherwise noted) (see Figures 1 and 2)**

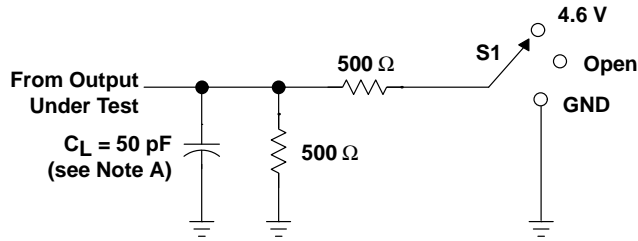
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CC} = 2.7 \text{ V}$		$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y							ns
$t_{en}$	$\overline{OE}$	Y							ns
$t_{dis}$	$\overline{OE}$	Y							ns

**operating characteristics,  $T_A = 25^{\circ}\text{C}$**

PARAMETER		TEST CONDITIONS	VCC = 2.5 V ± 0.2 V	VCC = 3.3 V ± 0.3 V	UNIT
			TYP	TYP	
Cpd	Power dissipation capacitance	Outputs enabled	CL = 50 pF, f = 10 MHz		pF
	Outputs disabled				

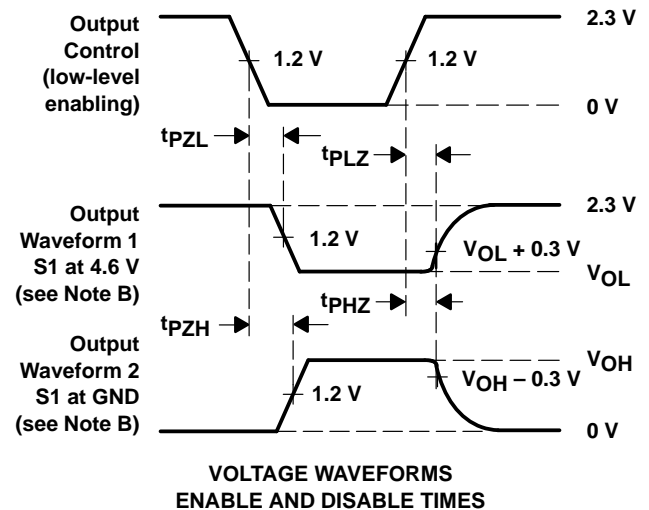
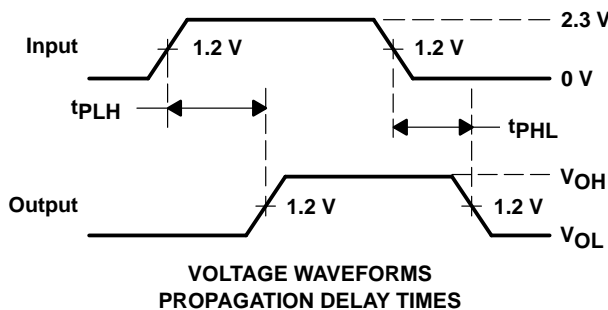
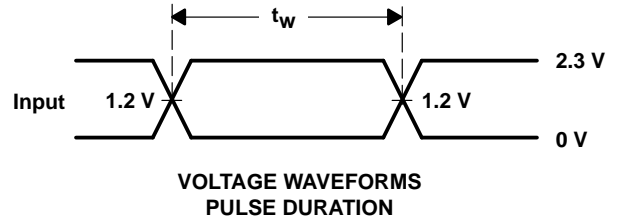
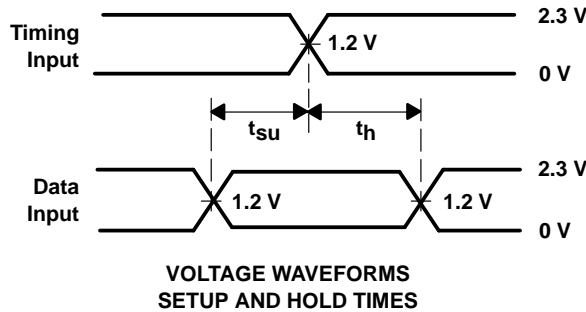


PARAMETER MEASUREMENT INFORMATION  
 $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$



LOAD CIRCUIT

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



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

Figure 1. Load Circuit and Voltage Waveforms

# SN74ALVCH16540

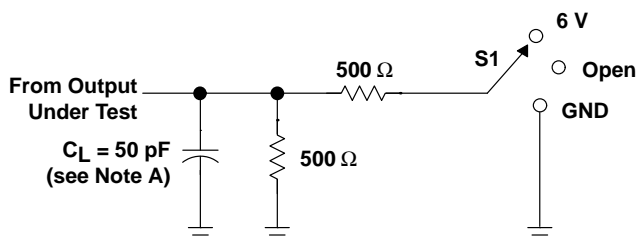
## 16-BIT BUFFER/DRIVER

### WITH 3-STATE OUTPUTS

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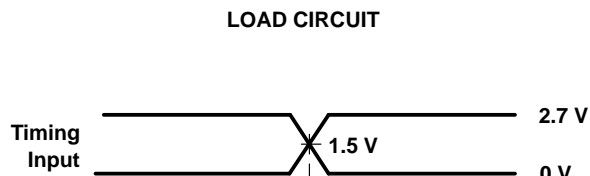
#### PARAMETER MEASUREMENT INFORMATION

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

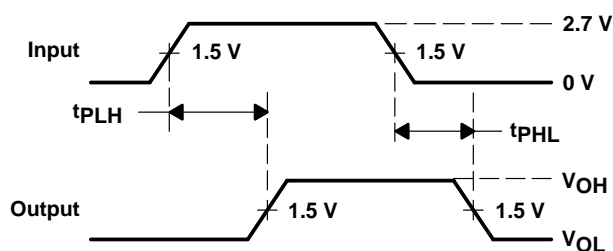


LOAD CIRCUIT

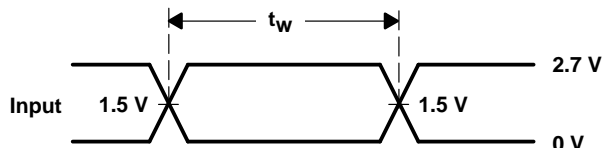
TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND



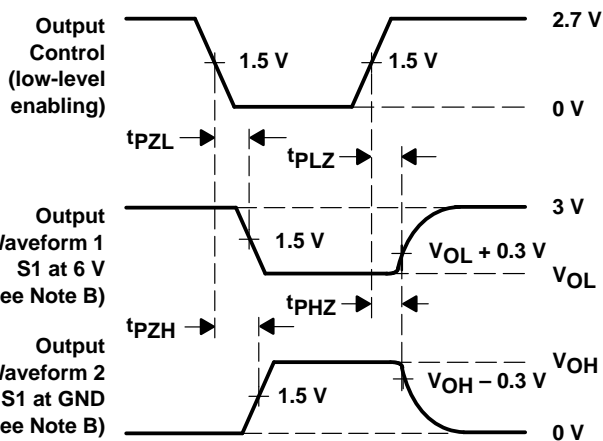
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



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:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ ,  $t_r \leq 2.5\text{ ns}$ ,  $t_f \leq 2.5\text{ ns}$ .
  - 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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