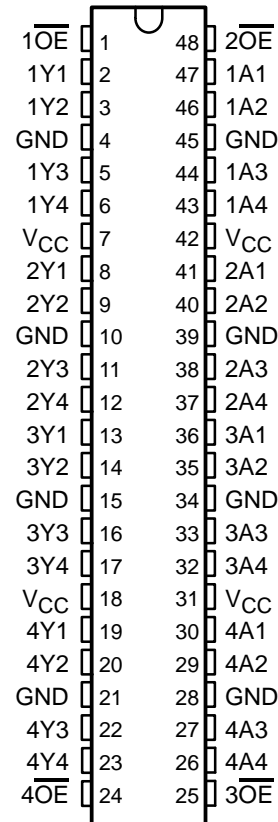


# SN54LVTH16244A, SN74LVTH16244A 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS142F – MAY 1992 – REVISED AUGUST 1996

- State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low-Static Power Dissipation
- Members of the Texas Instruments *Widebus*™ Family
- High-Impedance State During Power Up and Power Down
- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Support Unregulated Battery Operation Down to 2.7 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $< 0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- 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 500 mA Per JEDEC Standard JESD-17
- Bus-Hold Data Inputs Eliminate the Need for External Pullup/Pulldown Resistors
- Power Off Disables Inputs/Outputs, Permitting Live Insertion
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages, and 380-mil Fine-Pitch Ceramic Flat (WD) Packages Using 25-mil Center-to-Center Spacings

SN54LVTH16244A . . . WD PACKAGE  
SN74LVTH16244A . . . DGG OR DL PACKAGE  
(TOP VIEW)



## description

The 'LVTH16244A are 16-bit buffers and line drivers designed for low-voltage (3.3-V)  $V_{CC}$  operation, but with the capability to provide a TTL interface to a 5-V system environment. These devices can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. These devices provide true outputs and symmetrical active-low output-enable ( $\overline{OE}$ ) inputs.

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

When  $V_{CC}$  is between 0 and 1.5-V, the devices are in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5-V,  $\overline{OE}$  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 SN74LVTH16244A 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.



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 **TEXAS  
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3.3-V ABT 16-BIT BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS

SCBS142F – MAY 1992 – REVISED AUGUST 1996

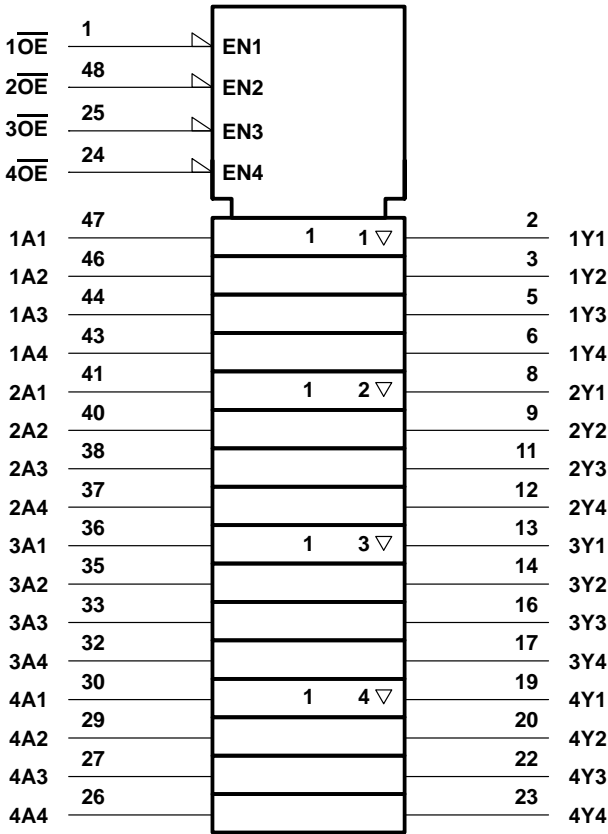
description (continued)

The SN54LVTH16244A is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74LVTH16244A is characterized for operation from –40°C to 85°C.

FUNCTION TABLE  
(each buffer)

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

logic symbol†

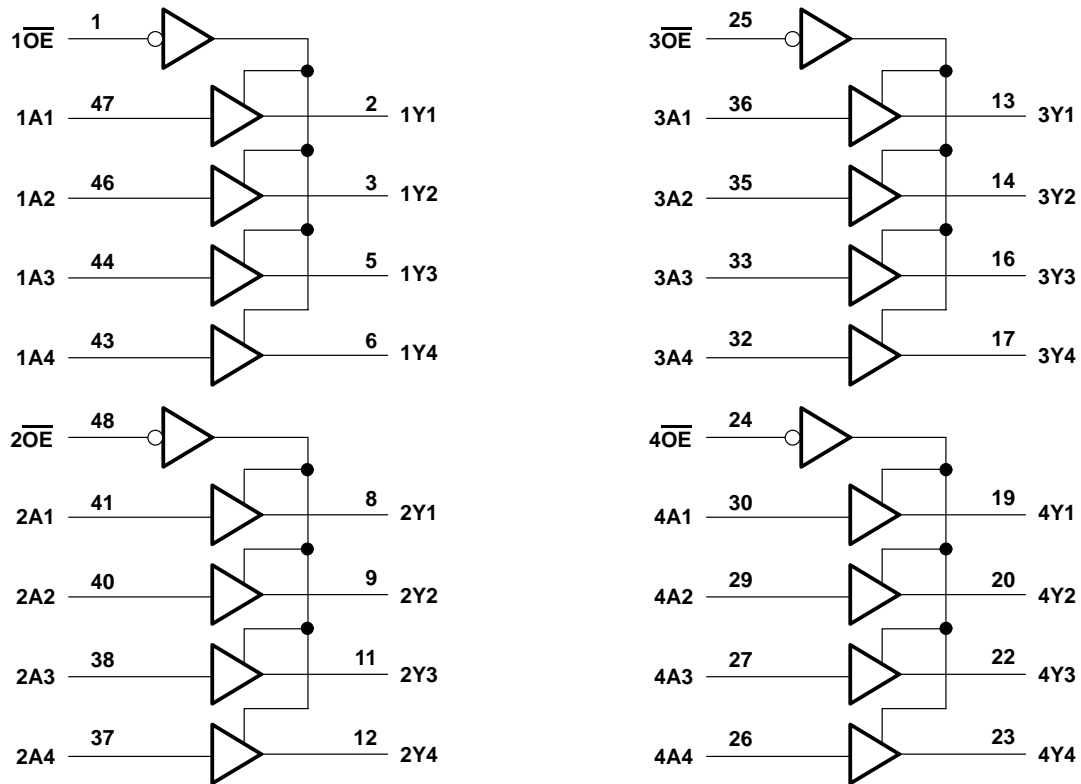


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

# SN54LVTH16244A, SN74LVTH16244A 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS142F – MAY 1992 – REVISED AUGUST 1996

## logic diagram (positive logic)



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	–0.5 V to 4.6 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, $V_O$ (see Note 1)	–0.5 V to 7 V
Current into any output in the low state, $I_{OL}$ : SN54LVTH16244A	96 mA
SN74LVTH16244A	128 mA
Current into any output in the high state, $I_{OH}$ (see Note 2): SN54LVTH16244A	48 mA
SN74LVTH16244A	64 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–50 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3): DGG package	0.85 W
DL package	1.2 W
Storage temperature range, $T_{stg}$	–65°C to 150°C

<sup>†</sup> 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 current flows only when the output is in the high state and  $V_O > V_{CC}$ .
  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*.

# SN54LVTH16244A, SN74LVTH16244A

## 3.3-V ABT 16-BIT BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

SCBS142F – MAY 1992 – REVISED AUGUST 1996

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

			SN54LVTH16244A		SN74LVTH16244A		UNIT
			MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage		2.7	3.6	2.7	3.6	V
$V_{IH}$	High-level input voltage		2		2		V
$V_{IL}$	Low-level input voltage			0.8		0.8	V
$V_I$	Input voltage			5.5		5.5	V
$I_{OH}$	High-level output current			–24		–32	mA
$I_{OL}$	Low-level output current			48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate		200		200		$\mu$ s/V
$T_A$	Operating free-air temperature		–55	125	–40	85	°C

NOTE 4: Unused control inputs must be held high or low to prevent them from floating.

**SN54LVTH16244A, SN74LVTH16244A**  
**3.3-V ABT 16-BIT BUFFERS/DRIVERS**  
**WITH 3-STATE OUTPUTS**

SCBS142F – MAY 1992 – REVISED AUGUST 1996

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

PARAMETER	TEST CONDITIONS			SN54LVTH16244A			SN74LVTH16244A			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = 2.7 V, I <sub>I</sub> = −18 mA			−1.2			−1.2			V
V <sub>OH</sub>	V <sub>CC</sub> = MIN to MAX‡, I <sub>OH</sub> = −100 μA			V <sub>CC</sub> − 0.2			V <sub>CC</sub> − 0.2			V
	V <sub>CC</sub> = 2.7 V, I <sub>OH</sub> = −8 mA			2.4			2.4			
	V <sub>CC</sub> = 3 V	I <sub>OH</sub> = −24 mA		2						
		I <sub>OH</sub> = −32 mA					2			
V <sub>OL</sub>	V <sub>CC</sub> = 2.7 V	I <sub>OL</sub> = 100 μA		0.2			0.2			V
		I <sub>OL</sub> = 24 mA		0.5			0.5			
	V <sub>CC</sub> = 3 V	I <sub>OL</sub> = 16 mA		0.4			0.4			
		I <sub>OL</sub> = 32 mA		0.5			0.5			
		I <sub>OL</sub> = 48 mA		0.55						
		I <sub>OL</sub> = 64 mA					0.55			
I <sub>I</sub>	V <sub>CC</sub> = 0 or MAX‡, V <sub>I</sub> = 5.5 V			10			10			μA
	V <sub>CC</sub> = 3.6 V	V <sub>I</sub> = V <sub>CC</sub> or GND	Control inputs	±1			±1			
		V <sub>I</sub> = V <sub>CC</sub>	Data inputs	1			1			
		V <sub>I</sub> = 0			−5			−5		
I <sub>off</sub>	V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> = 0 to 4.5 V			±100			±100			μA
I <sub>I</sub> (hold)	V <sub>CC</sub> = 3 V	V <sub>I</sub> = 0.8 V	Data inputs	75			75			μA
		V <sub>I</sub> = 2 V		−75			−75			
I <sub>OZH</sub>	V <sub>CC</sub> = 3.6 V, V <sub>O</sub> = 3 V,			5			5			μA
I <sub>OZL</sub>	V <sub>CC</sub> = 3.6 V, V <sub>O</sub> = 0.5 V,			−5			−5			μA
I <sub>OZPU</sub> §	V <sub>CC</sub> = 0 to 1.5 V, V <sub>O</sub> = 0.5 V to 3 V, $\overline{OE}$ = 0			±100			±100			μA
I <sub>OZPD</sub> §	V <sub>CC</sub> = 0 to 1.5 V, V <sub>O</sub> = 0.5 V to 3 V, $\overline{OE}$ = 0			±100			±100			μA
I <sub>CC</sub>	V <sub>CC</sub> = 3.6 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND	Outputs high		0.19			0.19			mA
		Outputs low		5			5			
		Outputs disabled		0.19			0.19			
ΔI <sub>CC</sub> ¶	V <sub>CC</sub> = 3 V to 3.6 V, One input at V <sub>CC</sub> − 0.6 V, Other inputs at V <sub>CC</sub> or GND			0.2			0.2			mA
C <sub>i</sub>	V <sub>I</sub> = 3 V or 0			4			4			pF
C <sub>o</sub>	V <sub>O</sub> = 3 V or 0			9			9			pF

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

‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

§ This parameter is warranted by characterization but not production tested.

¶ This is the increase in supply current for each input that is at the specified TTL voltage level rather than  $V_{CC}$  or GND.

# SN54LVTH16244A, SN74LVTH16244A

## 3.3-V ABT 16-BIT BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

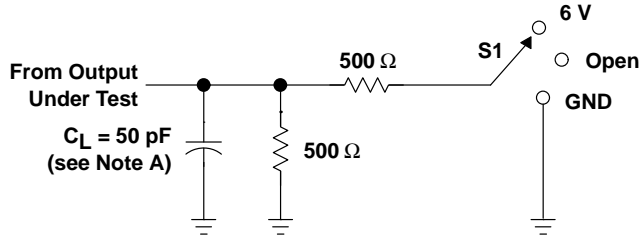
SCBS142F – MAY 1992 – REVISED AUGUST 1996

switching characteristics over recommended operating free-air temperature range,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH16244A				SN74LVTH16244A				UNIT	
			V <sub>CC</sub> = 3.3 V ± 0.3 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V			V <sub>CC</sub> = 2.7 V		
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN		MAX
t <sub>PLH</sub>	A	Y	1.1	3.4		3.9	1.2	2.3	3.2		3.7	ns
t <sub>PHL</sub>			1.1	3.4		3.9	1.2	2	3.2		3.7	
t <sub>PZH</sub>	$\overline{\text{OE}}$	Y	1.1	4.2		5.2	1.2	2.6	4		5	ns
t <sub>PZL</sub>			1.1	4.2		5.2	1.2	2.7	4		5	
t <sub>PHZ</sub>	$\overline{\text{OE}}$	Y	2.1	4.7		5.2	2.2	3.3	4.5		5	ns
t <sub>PLZ</sub>			1.9	4.5		4.7	2	3.1	4.2		4.4	

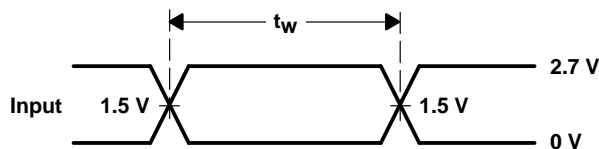
† All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

## PARAMETER MEASUREMENT INFORMATION

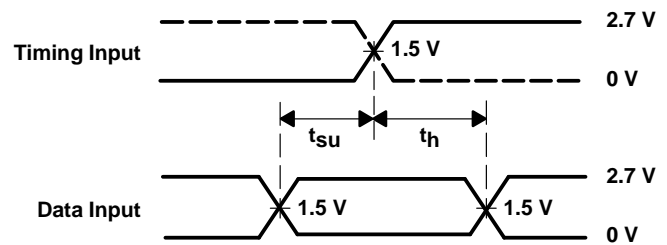


TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND

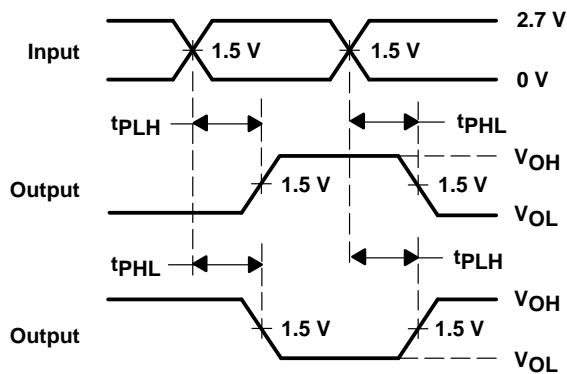
LOAD CIRCUIT



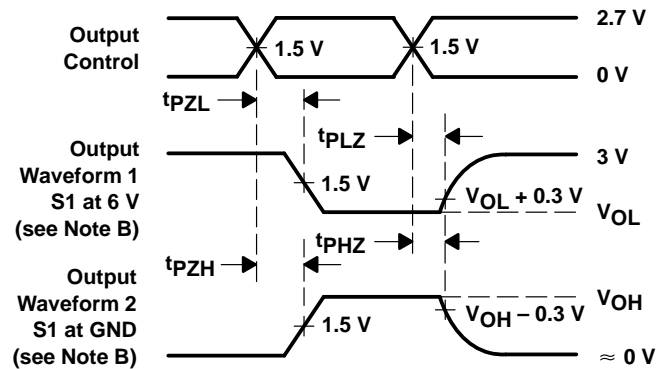
VOLTAGE WAVEFORMS  
PULSE DURATION



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:
- 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.

Figure 1. Load Circuit and Voltage Waveforms

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