

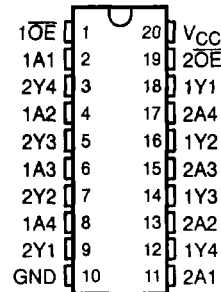
# SN74LVCH244

## OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

SCES009 – JULY 1995

- EPIC™ (Enhanced-Performance Implanted CMOS) Submicron Process
- Typical  $V_{OLP}$  (Output Ground Bounce) < 0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot) > 2 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model ( $C = 200$  pF,  $R = 0$ )
- Latch-Up Performance Exceeds 250 mA Per JEDEC Standard JESD-17
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Package Options include Shrink Small-Outline (DB), Plastic Small-Outline (DW), and Thin Shrink Small-Outline (PW) Packages

DB, DW, OR PW PACKAGE  
(TOP VIEW)



### description

This octal buffer/line driver is designed for 2.7-V to 3.6-V  $V_{CC}$  operation; it can interface to a 5-V system environment.

The SN74LVCH244 is organized as two 4-bit line drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

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 SN74LVCH244 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

FUNCTION TABLE  
(each 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.

 **TEXAS  
INSTRUMENTS**

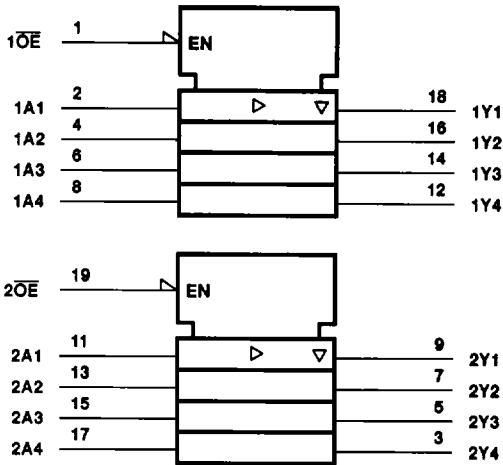
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**OCTAL BUFFER/DRIVER**  
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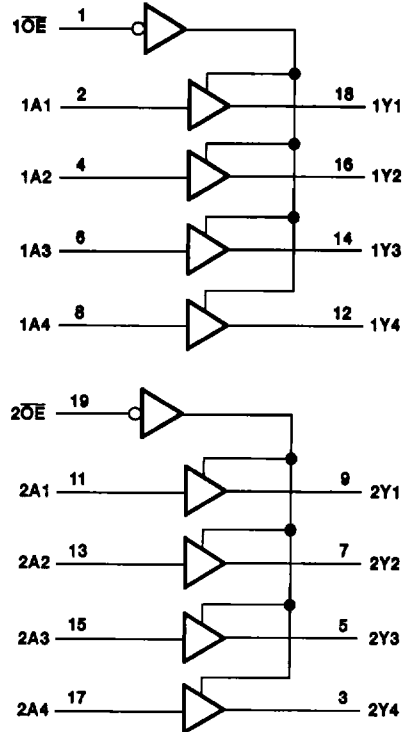
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**logic symbol†**



† 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 6.5 V	
Input voltage range, $V_I$ (see Note 1) .....	-0.5 V to 6.5 V	
Voltage range applied to any output in the high-impedance or power-off state, $V_O$ (see Note 1) .....	-0.5 V to 6.5 V	
Voltage range applied to any output in the high or low state, $V_O$ (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, $I_{OK}$ ( $V_O < 0$ ) .....	±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):	DB package .....	0.6 W
	DW package .....	1.6 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. 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	Operating	2	3.6	V
		Data retention only	1.5		
$V_{IH}$	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 data inputs	0	5.5	V	
$V_O$	Output voltage	High or low state	0	$V_{CC}$	V
		3 state	0	5.5	
$I_{OH}$	High-level output current	$V_{CC} = 2.7$ V		-12	mA
		$V_{CC} = 3$ V		-24	
$I_{OL}$	Low-level output current	$V_{CC} = 2.7$ V		12	mA
		$V_{CC} = 3$ 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 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> <sup>†</sup>	MIN	TYP <sup>‡</sup>	MAX	UNIT
V <sub>OH</sub>	I <sub>OH</sub> = -100 μA	MIN to MAX	V <sub>CC</sub> -0.2			V
	I <sub>OH</sub> = -12 mA	2.7 V	2.2			
	I <sub>OH</sub> = -24 mA	3 V	2.4			
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	MIN to MAX			0.2	V
	I <sub>OL</sub> = 12 mA	2.7 V			0.4	
	I <sub>OL</sub> = 24 mA	3 V			0.55	
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	3.6 V			±5	μA
I <sub>I</sub> (hold)	V <sub>I</sub> = 0.8 V	3 V		75		μA
	V <sub>I</sub> = 2 V	3 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	MIN to MAX			±10	μA
	V <sub>O</sub> = 3.6 V or 5.5 V				±50	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	3.6 V			10	μA
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND	2.7 V to 3.6 V			500	μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V		3.1		pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	3.3 V		5		pF

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

<sup>‡</sup> All typical values are measured at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.



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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 3.3$ V $\pm 0.3$ V		$V_{CC} = 2.7$ V		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}$	A or B	Y	1.5	6.5	7.5		ns
$t_{en}$	$\overline{OE}$	Y	1.5	8	9		ns
$t_{dis}$	$\overline{OE}$	Y	1.5	7	8		ns
$t_{sk(o)}^\dagger$				1			ns

$^\dagger$  Skew between any two outputs of the same package switching in the same direction. This parameter is warranted but not production tested.

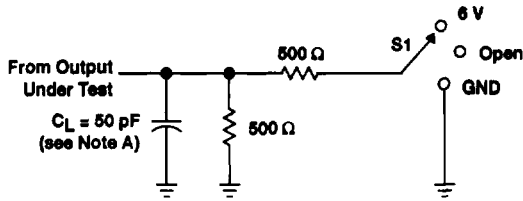
operating characteristics,  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
$C_{pd}$	Power dissipation capacitance per buffer/driver	$C_L = 50$ pF, $f = 10$ MHz	33	pF
			2	



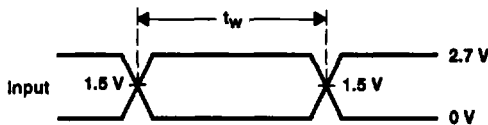
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**PARAMETER MEASUREMENT INFORMATION**

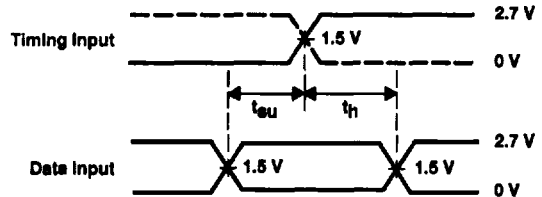


**LOAD CIRCUIT FOR OUTPUTS**

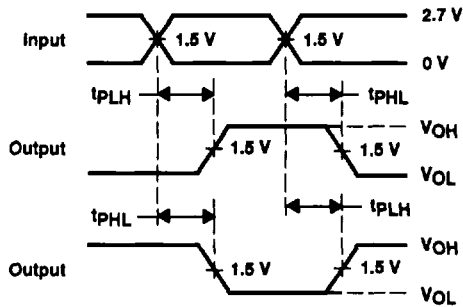
TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND



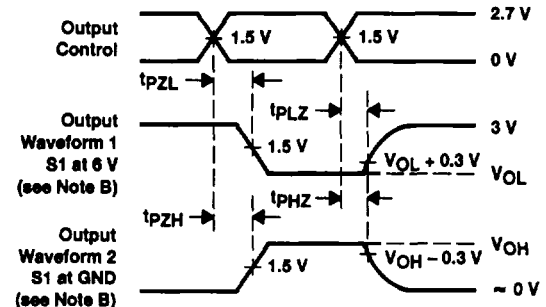
**VOLTAGE WAVEFORMS**  
**PULSE DURATION**



**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 MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.  
 D. The outputs are measured one at a time with one transition per measurement.  
 E.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .  
 F.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .  
 G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

**Figure 1. Load Circuit and Voltage Waveforms**