

# SN54LVTT240, SN74LVTT240 3.3-V ABT OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCES005 – FEBRUARY 1995

- State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low-Static Power Dissipation
- Supports Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Supports Unregulated Battery Operation Down to 2.7 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $< 0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Supports Live Insertion
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), Ceramic Flat (W) Packages, and Ceramic (J) DIPs

## description

These octal buffers and line drivers are designed specifically for low-voltage (3.3-V)  $V_{CC}$  operation, but with the capability to provide a TTL interface to a 5-V system environment.

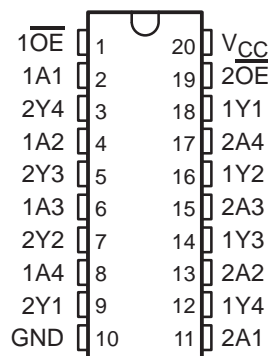
The 'LVTT240 is organized as two 4-bit buffer/line drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

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.

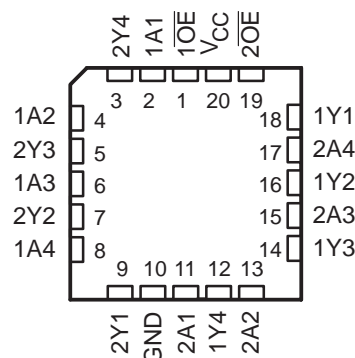
The SN74LVTT240 is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

The SN54LVTT240 is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74LVTT240 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54LVTT240 . . . J OR W PACKAGE  
SN74LVTT240 . . . DB, DW, OR PW PACKAGE  
(TOP VIEW)



SN54LVTT240 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE  
(each buffer)

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

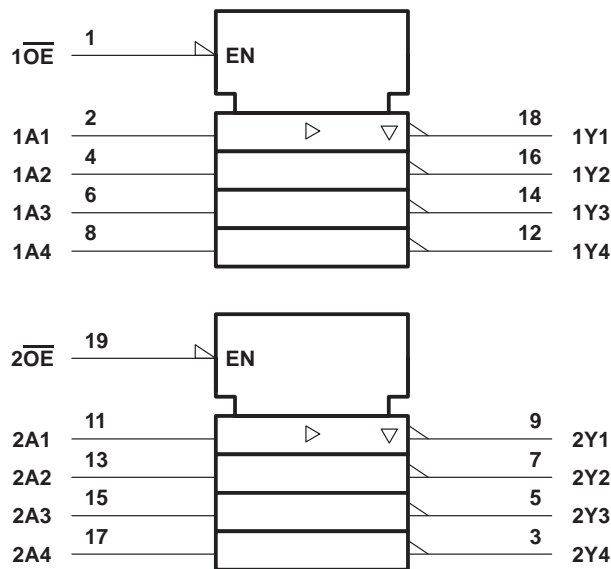
# SN54LVTT240, SN74LVTT240

## 3.3-V ABT OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

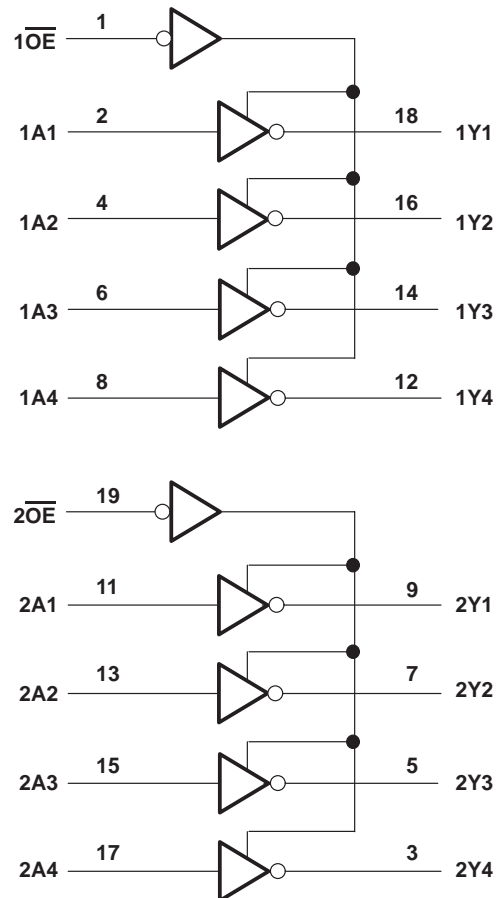
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#### logic symbol†



† 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 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, $I_O$ : SN54LVTT240	96 mA
SN74LVTT240	128 mA
Current into any output in the high state, $I_O$ (see Note 2): SN54LVTT240	48 mA
SN74LVTT240	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): DB package	0.6 W
DW package	1.6 W
PW package	0.7 W
Storage temperature range	–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 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 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

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

		SN54LVTT240		SN74LVTT240		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				ns/V
			10		10	
$T_A$	Operating free-air temperature	–55	125	–40	85	°C

NOTE 4: Unused or floating control inputs must be held high or low.

# SN54LVTT240, SN74LVTT240

## 3.3-V ABT OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS		SN54LVTT240		SN74LVTT240		UNIT	
			MIN	TYP†	MAX	MIN		TYP†
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	±1		±1				
I <sub>off</sub>	V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> = 0 to 4.5 V				±100		μA	
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>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	0.12	0.19	0.12	0.19	mA
			Outputs low	8.6	12	8.6	12	
			Outputs disabled	0.12	0.19	0.12	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		8		8		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 is the increase in supply current for each input that is at the specified TTL voltage level rather than  $V_{CC}$  or GND.

**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)	SN54LVTT240				SN74LVTT240				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	4.2		5.2	1	2.9	4.1		5.2	ns
t <sub>PHL</sub>			1.3	3.7		4.1	1.3	2.5	3.5		4	
t <sub>PZH</sub>	OE	Y	1.2	4.7		5.7	1.2	3.2	4.6		5.6	ns
t <sub>PZL</sub>			1.5	4.8		5.9	1.4	3.5	4.7		5.8	
t <sub>PHZ</sub>	OE	Y	2	5.3		5.7	2	3.6	5.2		5.5	ns
t <sub>PLZ</sub>			1.9	4.6		4.6	1.9	3.2	4.4		4.4	

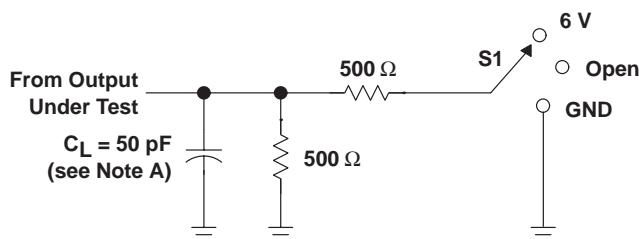
† All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

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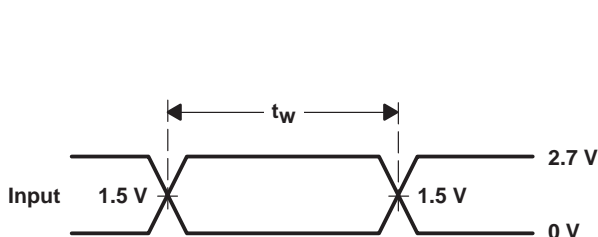
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## PARAMETER MEASUREMENT INFORMATION

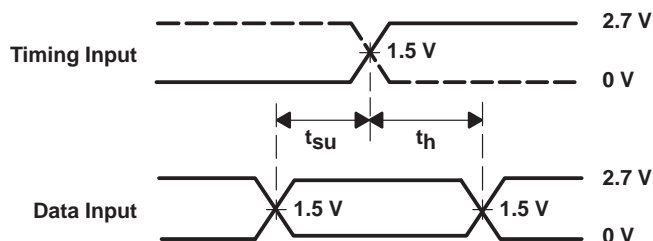


LOAD CIRCUIT FOR OUTPUTS

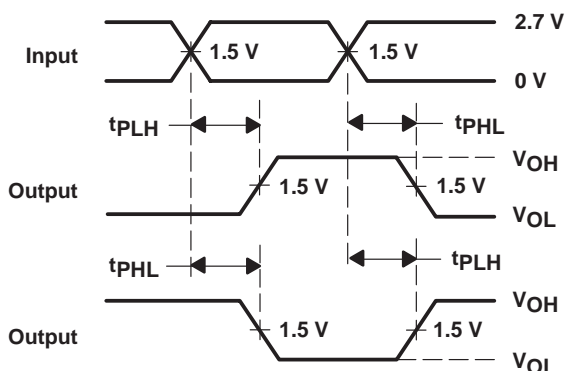
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND



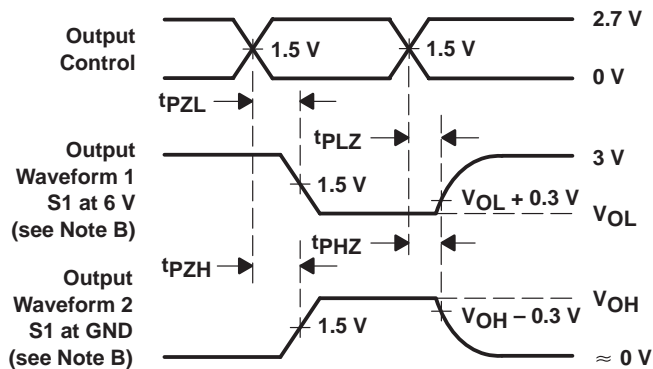
VOLTAGE WAVEFORMS  
PULSE DURATION



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