

# SN54LVTZ244, SN74LVTZ244 3.3-V ABT OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS302C – SEPTEMBER 1993 – REVISED JULY 1995

- State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low-Static Power Dissipation
- 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,  $T_A = 25^\circ\text{C}$
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Bus-Hold Data Inputs Eliminate the Need for External Pullup Resistors
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), and Ceramic (J) DIPs

## description

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

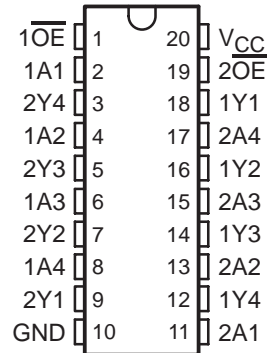
These devices are organized as two 4-bit line drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

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

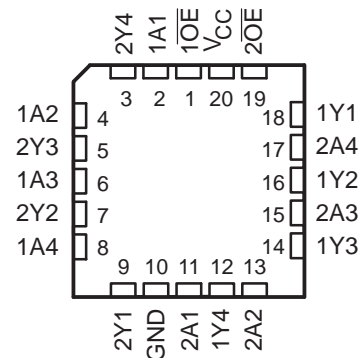
The SN74LVTZ244 is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

The SN54LVTZ244 is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74LVTZ244 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54LVTZ244 . . . J PACKAGE  
SN74LVTZ244 . . . DB, DW, OR PW PACKAGE  
(TOP VIEW)



SN54LVTZ244 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE  
(each buffer)

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



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**TEXAS  
INSTRUMENTS**

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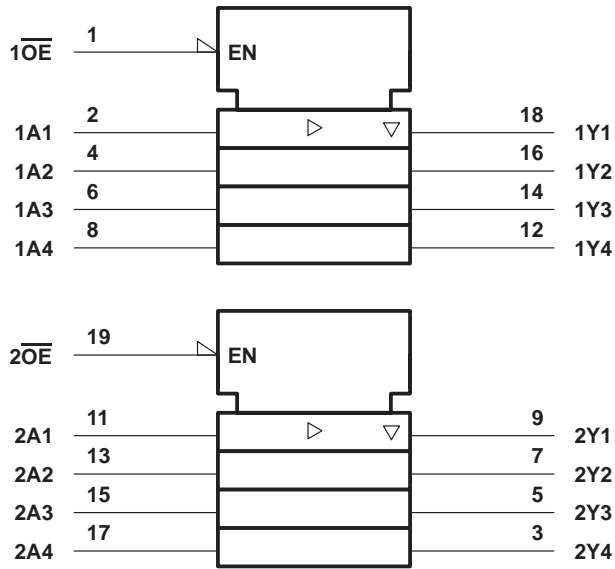
# SN54LVTZ244, SN74LVTZ244

## 3.3-V ABT OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

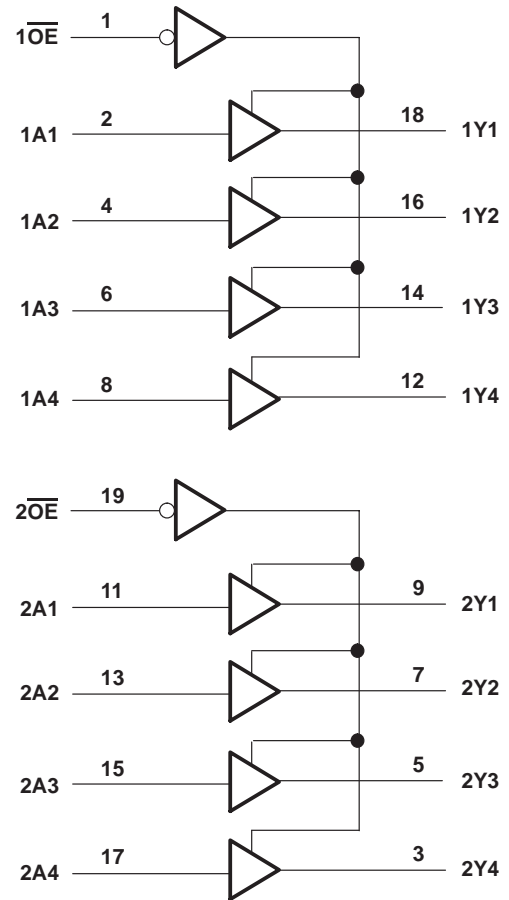
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#### logic symbol†



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

#### logic diagram (positive logic)



# SN54LVTZ244, SN74LVTZ244 3.3-V ABT OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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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 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, $I_O$ : SN54LVTZ244 .....	96 mA
SN74LVTZ244 .....	128 mA
Current into any output in the high state, $I_O$ (see Note 2): SN54LVTZ244 .....	48 mA
SN74LVTZ244 .....	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
Operating free-air temperature range, $T_A$ : SN54LVTZ244 .....	–55°C to 125°C
SN74LVTZ244 .....	–40°C to 85°C
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 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)

		SN54LVTZ244		SN74LVTZ244		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	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate	200		200		$\mu\text{s}/\text{V}$
$T_A$	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.

# SN54LVTZ244, SN74LVTZ244

## 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		SN54LVTZ244		SN74LVTZ244		UNIT	
			MIN	TYP†	MAX	MIN		TYP†
$V_{IK}$	$V_{CC} = 2.7\text{ V}$ , $I_I = -18\text{ mA}$		-1.2		-1.2		V	
$V_{OH}$	$V_{CC} = \text{MIN to MAX}^\ddagger$ , $I_{OH} = -100\text{ }\mu\text{A}$		$V_{CC} - 0.2$		$V_{CC} - 0.2$		V	
	$V_{CC} = 2.7\text{ V}$ , $I_{OH} = -8\text{ mA}$		2.4		2.4			
	$V_{CC} = 3\text{ V}$	$I_{OH} = -24\text{ mA}$	2		2			
$V_{OL}$	$V_{CC} = 2.7\text{ V}$	$I_{OL} = 100\text{ }\mu\text{A}$	0.2		0.2		V	
		$I_{OL} = 24\text{ mA}$	0.5		0.5			
	$V_{CC} = 3\text{ V}$	$I_{OL} = 16\text{ mA}$	0.4		0.4			
		$I_{OL} = 32\text{ mA}$	0.5		0.5			
		$I_{OL} = 48\text{ mA}$	0.55		0.55			
		$I_{OL} = 64\text{ mA}$			0.55			
$I_I$	$V_{CC} = 0\text{ or MAX}^\ddagger$ , $V_I = 5.5\text{ V}$		10		10		$\mu\text{A}$	
	$V_{CC} = 0\text{ to }3.6\text{ V}$	$V_I = V_{CC}\text{ or GND}$ Control inputs	$\pm 1$		$\pm 1$			
		$V_I = V_{CC}$ Data inputs	1		1			
		$V_I = 0$	-5		-5			
$I_{off}$	$V_{CC} = 0\text{ V}$ , $V_I\text{ or }V_O = 0\text{ to }4.5\text{ V}$				$\pm 100$		$\mu\text{A}$	
$I_{OZPU}^\S$	$V_{CC} = 0\text{ V to }1.5\text{ V}$ , $V_O = 0.5\text{ V to }3\text{ V}$ , $\overline{OE} = X$				$\pm 50$		$\mu\text{A}$	
$I_{OZPD}^\S$	$V_{CC} = 1.5\text{ V to }0$ , $V_O = 0.5\text{ V to }3\text{ V}$ , $\overline{OE} = X$				$\pm 50$		$\mu\text{A}$	
$I_{I(\text{hold})}$	$V_{CC} = 3\text{ V}$	$V_I = 0.8\text{ V}$	75		75		$\mu\text{A}$	
		$V_I = 2\text{ V}$	-75		-75			
$I_{OZH}$	$V_{CC} = 3.6\text{ V}$ , $V_O = 3\text{ V}$		5		5		$\mu\text{A}$	
$I_{OZL}$	$V_{CC} = 3.6\text{ V}$ , $V_O = 0.5\text{ V}$		-5		-5		$\mu\text{A}$	
$I_{CC}$	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}\text{ or GND}$	$I_O = 0$	Outputs high	0.12	0.5	0.12	0.225	mA
			Outputs low	8.6	15	8.6	15	
			Outputs disabled	0.12	0.5	0.12	0.225	
$\Delta I_{CC}^\parallel$	$V_{CC} = 3\text{ V to }3.6\text{ V}$ , One input at $V_{CC} - 0.6\text{ V}$ , Other inputs at $V_{CC}\text{ or GND}$		0.3		0.2		mA	
$C_i$	$V_I = 3\text{ V or }0$		4		4		pF	
$C_o$	$V_O = 3\text{ V or }0$		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 parameter is specified by characterization.

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

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# SN54LVTZ244, SN74LVTZ244

## 3.3-V ABT OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

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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)	SN54LVTZ244				SN74LVTZ244				UNIT	
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			$V_{CC} = 2.7\text{ V}$		
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN		MAX
$t_{PLH}$	A	Y	1	4.7		5.2	1	2.5	4.1	5	ns	
$t_{PHL}$			1	4.4		5.4	1	2.5	4.1	5.2		
$t_{PZH}$	$\overline{OE}$	Y	1	5.4		6.5	1	2.7	5.2	6.3	ns	
$t_{PZL}$			1.1	5.4		7.6	1.1	3.1	5.2	6.7		
$t_{PHZ}$	$\overline{OE}$	Y	1.9	6.2		6.9	1.9	3.9	5.6	6.3	ns	
$t_{PLZ}$			1.8	5.5		6	1.8	3.2	5.1	5.6		

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

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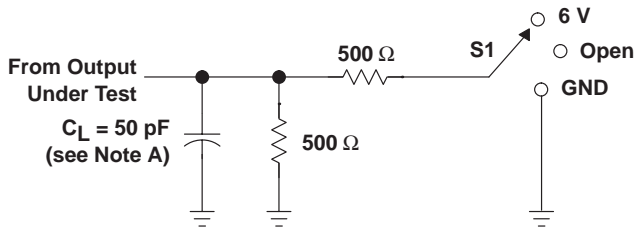
# SN54LVTZ244, SN74LVTZ244

## 3.3-V ABT OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

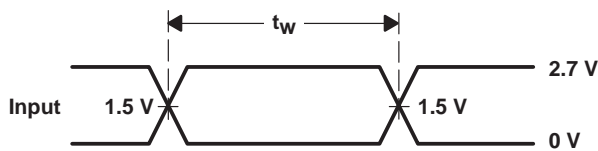
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#### PARAMETER MEASUREMENT INFORMATION

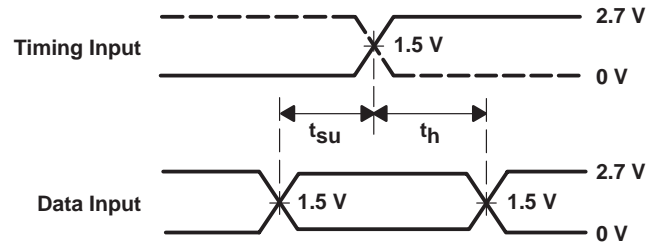


LOAD CIRCUIT FOR OUTPUTS

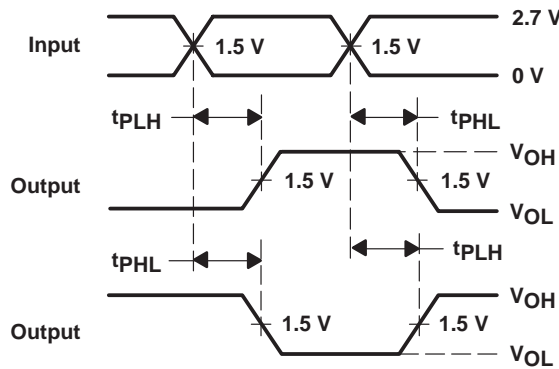
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	6 V
$t_{PHZ}/t_{PZH}$	GND



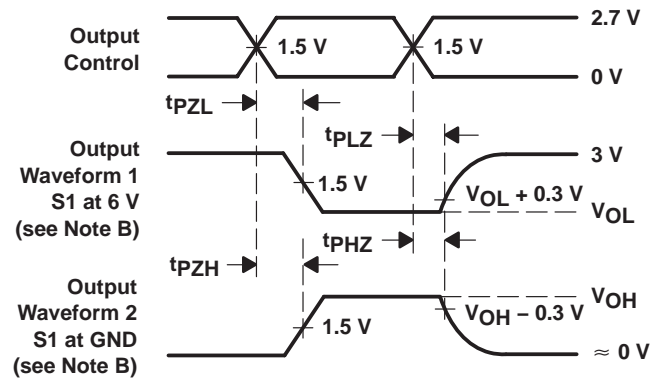
VOLTAGE WAVEFORMS  
PULSE DURATION



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:  $PRR \leq 10$  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.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74LVTZ244DBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
SN74LVTZ244DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244PWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI
SN74LVTZ244PWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244PWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVTZ244PWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVTZ244DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LVTZ244DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74LVTZ244PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVTZ244DBR	SSOP	DB	20	2000	346.0	346.0	33.0
SN74LVTZ244DWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74LVTZ244PWR	TSSOP	PW	20	2000	346.0	346.0	33.0

DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AC.

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