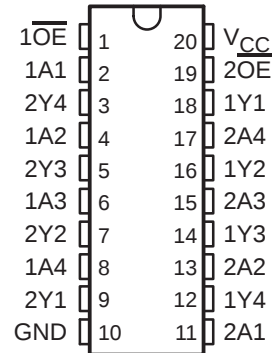


# SN54ABT244, SN74ABT244 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS099E – JANUARY 1991 – REVISED JULY 1994

- State-of-the-Art *EPIC-II<sup>B</sup>*™ BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Typical  $V_{OLP}$  (Output Ground Bounce) < 1 V at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$
- High-Drive Outputs (–32-mA  $I_{OH}$ , 64-mA  $I_{OL}$ )
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), and Plastic (N) and Ceramic (J) DIPs

SN54ABT244 . . . J PACKAGE  
SN74ABT244 . . . DB, DW, N, OR PW PACKAGE  
(TOP VIEW)



## description

These octal buffers and line drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. Taken together with the 'ABT240 and 'ABT241, these devices provide the choice of selected combinations of inverting and noninverting outputs, symmetrical active-low output-enable ( $\overline{OE}$ ) inputs, and complementary OE and  $\overline{OE}$  inputs.

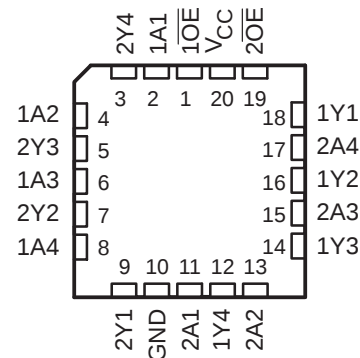
The 'ABT244 is organized as two 4-bit buffers/line drivers with separate  $\overline{OE}$  inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

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 SN74ABT244 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 SN54ABT244 is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74ABT244 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54ABT244 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE  
(each buffer)

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

EPIC-II<sup>B</sup> is a trademark of Texas Instruments Incorporated.

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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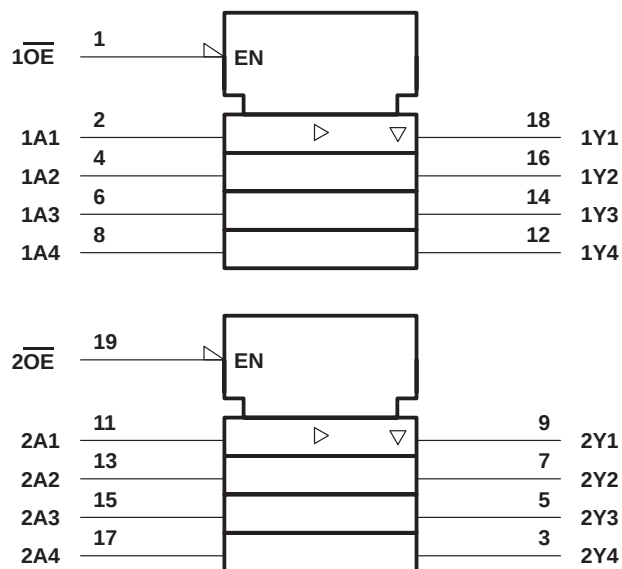
# SN54ABT244, SN74ABT244

## OCTAL BUFFERS/DRIVERS

### WITH 3-STATE OUTPUTS

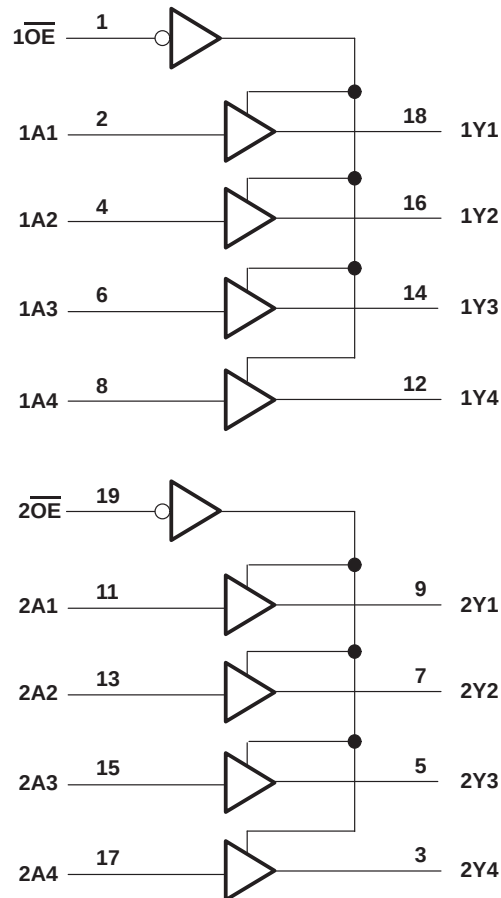
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#### logic symbol†



† 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 7 V   |
| Input voltage range, $V_I$ (see Note 1)                                                       | –0.5 V to 7 V   |
| Voltage applied to any output in the high state or power-off state, $V_O$                     | –0.5 V to 5.5 V |
| Current into any output in the low state, $I_O$ : SN54ABT244                                  | 96 mA           |
| SN74ABT244                                                                                    | 128 mA          |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                                                   | –18 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 2): DB package | 0.6 W           |
| DW package                                                                                    | 1.6 W           |
| N package                                                                                     | 1.3 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. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils, except for the N package, which has a trace length of zero. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

# SN54ABT244, SN74ABT244 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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## recommended operating conditions (see Note 3)

|                     |                                    | SN54ABT244 |          | SN74ABT244 |          | UNIT |
|---------------------|------------------------------------|------------|----------|------------|----------|------|
|                     |                                    | MIN        | MAX      | MIN        | MAX      |      |
| $V_{CC}$            | Supply voltage                     | 4.5        | 5.5      | 4.5        | 5.5      | 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                      | 0          | $V_{CC}$ | 0          | $V_{CC}$ | 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 |            | 5        |            | 5        | ns/V |
| $T_A$               | Operating free-air temperature     | –55        | 125      | –40        | 85       | °C   |

NOTE 3: Unused or floating inputs must be held high or low.

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

| PARAMETER                   | TEST CONDITIONS                                                                        | $T_A = 25^\circ\text{C}$    |                  |                   | SN54ABT244 |                | SN74ABT244 |                | UNIT          |
|-----------------------------|----------------------------------------------------------------------------------------|-----------------------------|------------------|-------------------|------------|----------------|------------|----------------|---------------|
|                             |                                                                                        |                             |                  |                   | MIN        | MAX            | MIN        | MAX            |               |
| $V_{IK}$                    | $V_{CC} = 4.5\text{ V}$ ,<br>$I_I = -18\text{ mA}$                                     |                             |                  | –1.2              |            | –1.2           |            | –1.2           | V             |
| $V_{OH}$                    | $V_{CC} = 4.5\text{ V}$ ,<br>$I_{OH} = -3\text{ mA}$                                   |                             |                  | 2.5               |            | 2.5            |            | 2.5            | V             |
|                             | $V_{CC} = 5\text{ V}$ ,<br>$I_{OH} = -3\text{ mA}$                                     |                             |                  | 3                 |            | 3              |            | 3              |               |
|                             | $V_{CC} = 4.5\text{ V}$                                                                | $I_{OH} = -24\text{ mA}$    |                  | 2                 |            | 2              |            |                |               |
|                             |                                                                                        | $I_{OH} = -32\text{ mA}$    |                  | 2*                |            |                |            | 2              |               |
| $V_{OL}$                    | $V_{CC} = 4.5\text{ V}$                                                                | $I_{OL} = 48\text{ mA}$     |                  |                   |            | 0.55           |            |                | V             |
|                             |                                                                                        | $I_{OL} = 64\text{ mA}$     |                  |                   |            | 0.55*          |            | 0.55           |               |
| $I_I$                       | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = V_{CC}$ or GND                                     |                             |                  | $\pm 1$           |            | $\pm 1$        |            | $\pm 1$        | $\mu\text{A}$ |
| $I_{OZH}$                   | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 2.7\text{ V}$                                      |                             |                  | $10^\ddagger$     |            | $10^\ddagger$  |            | $10^\ddagger$  | $\mu\text{A}$ |
| $I_{OZL}$                   | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 0.5\text{ V}$                                      |                             |                  | $-10^\ddagger$    |            | $-10^\ddagger$ |            | $-10^\ddagger$ | $\mu\text{A}$ |
| $I_{off}$                   | $V_{CC} = 0$ ,<br>$V_I$ or $V_O \leq 4.5\text{ V}$                                     |                             |                  | $\pm 100$         |            |                |            | $\pm 100$      | $\mu\text{A}$ |
| $I_{CEX}$                   | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 5.5\text{ V}$                                      | Outputs high                |                  | 50                |            | 50             |            | 50             | $\mu\text{A}$ |
| $I_O^{\S}$                  | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 2.5\text{ V}$                                      |                             |                  | –50   –100   –180 | –50        | –180           | –50        | –180           | mA            |
| $I_{CC}$                    | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = V_{CC}$ or GND                                     | $I_O = 0$ ,<br>Outputs high |                  | 1   250           |            | 250            |            | 250            | $\mu\text{A}$ |
|                             |                                                                                        | Outputs low                 |                  | 24   30           |            | 30             |            | 30             | mA            |
|                             |                                                                                        | Outputs disabled            |                  | 0.5   250         |            | 250            |            | 250            | $\mu\text{A}$ |
| $\Delta I_{CC}^{\parallel}$ | $V_{CC} = 5.5\text{ V}$ ,<br>One input at 3.4 V,<br>Other inputs at<br>$V_{CC}$ or GND | Data inputs                 | Outputs enabled  | 1.5               |            | 1.5            |            | 1.5            | mA            |
|                             |                                                                                        |                             | Outputs disabled | 0.05              |            | 0.05           |            | 0.05           |               |
|                             |                                                                                        | Control inputs              |                  | 1.5               |            | 1.5            |            | 1.5            |               |
| $C_i$                       | $V_I = 2.5\text{ V}$ or $0.5\text{ V}$                                                 |                             |                  | 3                 |            |                |            |                | pF            |
| $C_O$                       | $V_O = 2.5\text{ V}$ or $0.5\text{ V}$                                                 |                             |                  | 8                 |            |                |            |                | pF            |

\* On products compliant to MIL-STD-883, Class B, this parameter does not apply.

$^\ddagger$  All typical values are at  $V_{CC} = 5\text{ V}$ .

$^\S$  This data sheet limit may vary among suppliers.

$^\parallel$  Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

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



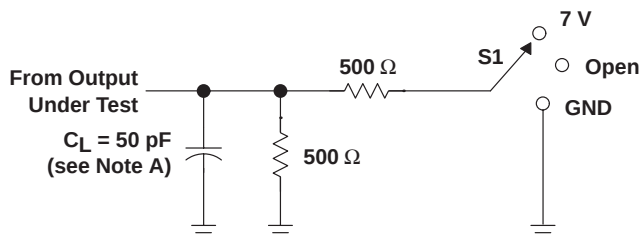
**SN54ABT244, SN74ABT244**  
**OCTAL BUFFERS/DRIVERS**  
**WITH 3-STATE OUTPUTS**

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

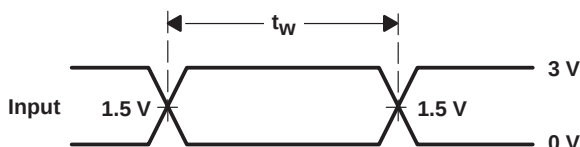
| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC} = 5$ V,<br>$T_A = 25^\circ\text{C}$ |     |     | SN54ABT244 |     | SN74ABT244 |     | UNIT |
|-----------|-----------------|----------------|---------------------------------------------|-----|-----|------------|-----|------------|-----|------|
|           |                 |                | MIN                                         | TYP | MAX | MIN        | MAX | MIN        | MAX |      |
| $t_{PLH}$ | A               | Y              | 1                                           | 2.6 | 4.1 | 1          | 5.3 | 1          | 4.6 | ns   |
| $t_{PHL}$ |                 |                | 1                                           | 2.9 | 4.2 | 1          | 5   | 1          | 4.6 |      |
| $t_{pZH}$ | $\overline{OE}$ | Y              | 1.1                                         | 3.1 | 4.6 | 0.8        | 5.7 | 1.1        | 5.1 | ns   |
| $t_{pZL}$ |                 |                | 2.1                                         | 4.1 | 5.6 | 1.2        | 7.9 | 2.1        | 6.1 |      |
| $t_{PHZ}$ | $\overline{OE}$ | Y              | 2.1                                         | 4.1 | 5.6 | 1.2        | 7.6 | 2.1        | 6.6 | ns   |
| $t_{PLZ}$ |                 |                | 1.7                                         | 3.7 | 5.2 | 1          | 7.9 | 1.7        | 5.7 |      |

## PARAMETER MEASUREMENT INFORMATION

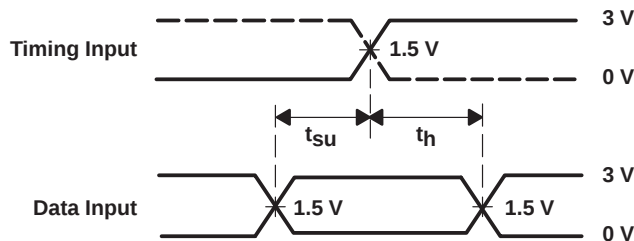


| TEST              | S1   |
|-------------------|------|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 7 V  |
| $t_{PHZ}/t_{PZH}$ | Open |

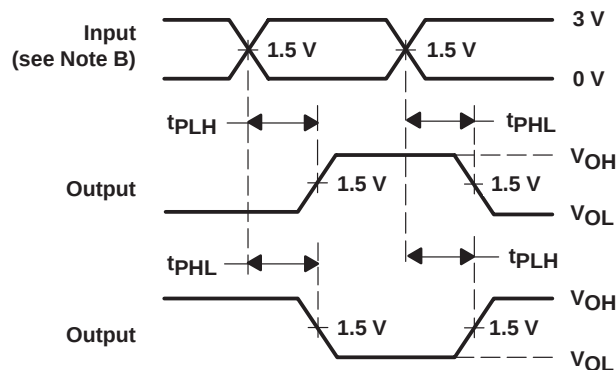
LOAD CIRCUIT FOR OUTPUTS



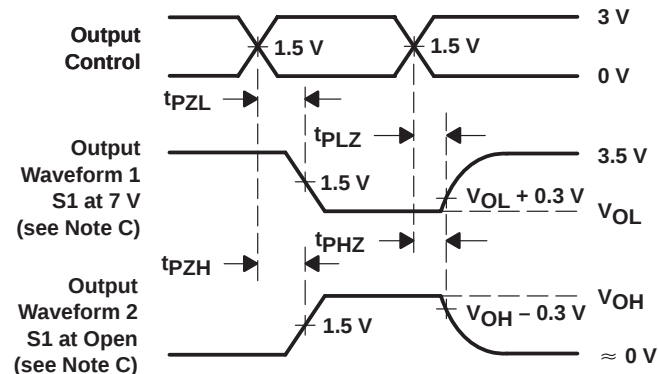
VOLTAGE WAVEFORMS  
PULSE DURATION



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. 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.  
C. 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.  
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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