

# SN54ABT241, SN74ABT241A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS184D – JANUARY 1991 – REVISED JANUARY 1997

- State-of-the-Art *EPIC-IIB™* BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- 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), Plastic (N) and Ceramic (J) DIPs, and Ceramic Flat (W) Package

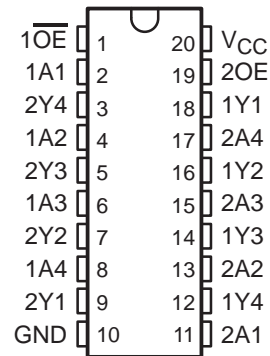
## description

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. Together with the SN54ABT240, SN74ABT240A, and 'ABT244A, 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.

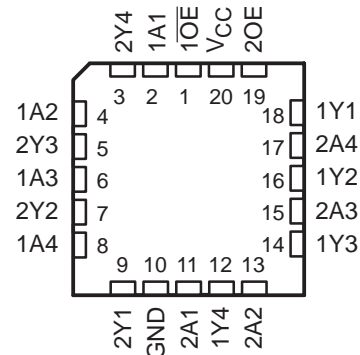
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver. OE should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

The SN54ABT241 is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74ABT241A is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54ABT241 . . . J OR W PACKAGE  
SN74ABT241A . . . DB, DW, N, OR PW PACKAGE  
(TOP VIEW)



SN54ABT241 . . . FK PACKAGE  
(TOP VIEW)



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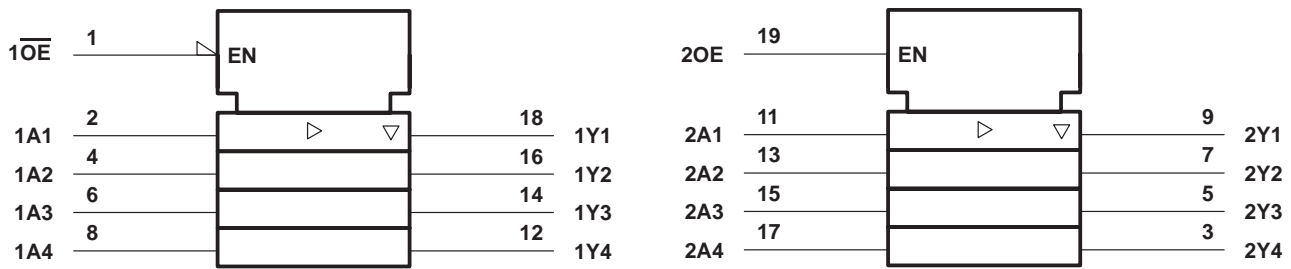
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## FUNCTION TABLES

| INPUTS |    | OUTPUT |
|--------|----|--------|
| 1OE    | 1A | 1Y     |
| L      | H  | H      |
| L      | L  | L      |
| H      | X  | Z      |

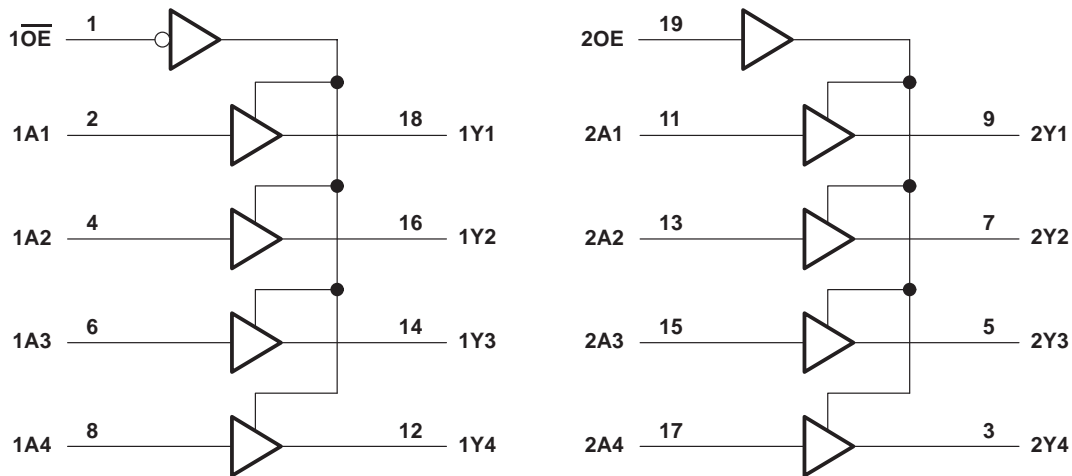
| INPUTS |    | OUTPUT |
|--------|----|--------|
| 2OE    | 2A | 2Y     |
| H      | H  | H      |
| H      | L  | L      |
| L      | X  | Z      |

### logic symbol†



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

### logic diagram (positive logic)



# SN54ABT241, SN74ABT241A 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 7 V   |
| Input voltage range, $V_I$ (see Note 1) .....                                   | –0.5 V to 7 V   |
| Voltage range applied to any output in the high or power-off state, $V_O$ ..... | –0.5 V to 5.5 V |
| Current into any output in the low state, $I_O$ : SN54ABT241 .....              | 96 mA           |
| SN74ABT241A .....   | 128 mA          |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ ) .....                               | –18 mA          |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ ) .....                              | –50 mA          |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): DB package .....         | 115°C/W         |
| DW package .....  | 97°C/W          |
| N package .....   | 67°C/W          |
| PW package .....  | 128°C/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. The package thermal impedance is calculated in accordance with EIA/JEDEC Std JESD51, except for through-hole packages, which use a trace length of zero.

## recommended operating conditions (see Note 3)

|                     |                                    | SN54ABT241      |          | SN74ABT241A |          | 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 | Outputs enabled |          | 5           | 5        | ns/V |
| $T_A$               | Operating free-air temperature     | –55             | 125      | –40         | 85       | °C   |

NOTE 3: Unused inputs must be held high or low to prevent them from floating.



# SN54ABT241, SN74ABT241A

## 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   |  | T <sub>A</sub> = 25°C |      |      | SN54ABT241 |       | SN74ABT241A |      | UNIT |
|--------------------|---|--|-----------------------|------|------|------------|-------|-------------|------|------|
|                    |   |  | MIN                   | TYP† | MAX  | MIN        | MAX   | MIN         | MAX  |      |
| V <sub>IK</sub>    | V <sub>CC</sub> = 4.5 V,  | I <sub>I</sub> = -18 mA  |                       |      | -1.2 |            | -1.2  |             | -1.2 | V    |
| V <sub>OH</sub>    | V <sub>CC</sub> = 4.5 V,  | I <sub>OH</sub> = -3 mA  |                       |      | 2.5  |            | 2.5   |             | 2.5  | V    |
|                    | V <sub>CC</sub> = 5 V,  | I <sub>OH</sub> = -3 mA  |                       |      | 3    |            | 3     |             | 3    |      |
|                    | V <sub>CC</sub> = 4.5 V   | I <sub>OH</sub> = -24 mA   |                       |      | 2    |            | 2     |             |      |      |
| V <sub>OL</sub>    | V <sub>CC</sub> = 4.5 V   | I <sub>OL</sub> = 48 mA  |                       |      |      |            | 0.55  |             |      | V    |
|                    |   | I <sub>OL</sub> = 64 mA  |                       |      |      |            | 0.55* |             | 0.55 |      |
| V <sub>hys</sub>   |   |  |                       |      | 100  |            |       |             |      | mV   |
| I <sub>I</sub>     | V <sub>CC</sub> = 5.5 V,  | V <sub>I</sub> = V <sub>CC</sub> or GND  |                       |      | ±1   |            | ±1    |             | ±1   | µA   |
| I <sub>OZH</sub>   | V <sub>CC</sub> = 5.5 V,  | V <sub>O</sub> = 2.7 V   |                       |      | 10   |            | 10    |             | 10   | µA   |
| I <sub>OZL</sub>   | V <sub>CC</sub> = 5.5 V,  | V <sub>O</sub> = 0.5 V   |                       |      | -10  |            | -10   |             | -10  | µA   |
| I <sub>off</sub>   | V <sub>CC</sub> = 0,  | V <sub>I</sub> or V <sub>O</sub> ≤ 4.5 V   |                       |      | ±100 |            |       |             | ±100 | µA   |
| I <sub>CEX</sub>   | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 5.5 V   | Outputs high   |                       |      | 50   |            | 50    |             | 50   | µA   |
| I <sub>O‡</sub>    | V <sub>CC</sub> = 5.5 V,  | V <sub>O</sub> = 2.5 V   | -50                   | -100 | -180 | -50        | -180  | -50         | -180 | mA   |
| I <sub>CC</sub>    | V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0,<br>V <sub>I</sub> = V <sub>CC</sub> or GND | Outputs high   |                       | 1    | 250  |            | 250   |             | 250  | µA   |
|                    |   | Outputs low  |                       | 24   | 30   |            | 30    |             | 30   | mA   |
|                    |   | Outputs disabled   |                       | 0.5  | 250  |            | 250   |             | 250  | µA   |
| ΔI <sub>CC</sub> § | Data inputs   | V <sub>CC</sub> = 5.5 V,<br>One input at 3.4 V,<br>Other inputs at<br>V <sub>CC</sub> or GND | Outputs enabled       |      | 1.5  |            | 1.5   |             | 1.5  | mA   |
|                    |   |  | Outputs disabled      |      | 0.05 |            | 0.05  |             | 0.05 |      |
|                    | Control inputs  | V <sub>CC</sub> = 5.5 V, One input at 3.4 V,<br>Other inputs at V <sub>CC</sub> or GND       |                       |      | 1.5  |            | 1.5   |             | 1.5  |      |
| C <sub>i</sub>     | V <sub>I</sub> = 2.5 V or 0.5 V   |  |                       | 4    |      |            |       |             |      | pF   |
| C <sub>o</sub>     | V <sub>O</sub> = 2.5 V or 0.5 V   |  |                       | 5.5  |      |            |       |             |      | pF   |

\* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at V<sub>CC</sub> = 5 V.

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

§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V<sub>CC</sub> or GND.



**SN54ABT241, SN74ABT241A**  
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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 (INPUT)          | TO (OUTPUT) | SN54ABT241                            |     |     |     | UNIT |     |
|-----------|-----------------------|-------------|---------------------------------------|-----|-----|-----|------|-----|
|           |                       |             | $V_{CC} = 5$ V,<br>$T_A = 25^\circ$ C |     |     | MIN |      | MAX |
|           |                       |             | MIN                                   | TYP | MAX |     |      |     |
| $t_{PLH}$ | A                     | Y           | 1                                     | 2.6 | 4.1 | 0.8 | 5.3  | ns  |
| $t_{PHL}$ |                       |             | 1                                     | 2.9 | 4.2 | 0.8 | 5    |     |
| $t_{PZH}$ | $\overline{OE}$ or OE | Y           | 1.1                                   | 4.8 | 6.3 | 1   | 7    | ns  |
| $t_{PZL}$ |                       |             | 1.3                                   | 4.3 | 5.8 | 1   | 7    |     |
| $t_{PHZ}$ | $\overline{OE}$ or OE | Y           | 1.1                                   | 4.6 | 6.1 | 0.8 | 7.9  | ns  |
| $t_{PLZ}$ |                       |             | 1                                     | 3.9 | 5.4 | 0.8 | 6.2  |     |

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 (INPUT)          | TO (OUTPUT) | SN74ABT241A                           |     |     |     | UNIT |     |
|-----------|-----------------------|-------------|---------------------------------------|-----|-----|-----|------|-----|
|           |                       |             | $V_{CC} = 5$ V,<br>$T_A = 25^\circ$ C |     |     | MIN |      | MAX |
|           |                       |             | MIN                                   | TYP | MAX |     |      |     |
| $t_{PLH}$ | A                     | Y           | 1                                     | 2.6 | 4.1 | 1   | 4.6  | ns  |
| $t_{PHL}$ |                       |             | 1                                     | 2.9 | 4.4 | 1   | 4.6  |     |
| $t_{PZH}$ | $\overline{OE}$ or OE | Y           | 1.1                                   | 4.8 | 6.3 | 1.1 | 6.8  | ns  |
| $t_{PZL}$ |                       |             | 1.3                                   | 4.3 | 5.8 | 1.3 | 6.8  |     |
| $t_{PHZ}$ | $\overline{OE}$ or OE | Y           | 1.6                                   | 4.6 | 6.1 | 1.6 | 7.1  | ns  |
| $t_{PLZ}$ |                       |             | 1                                     | 3.9 | 5.4 | 1   | 5.9  |     |

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**PARAMETER MEASUREMENT INFORMATION**

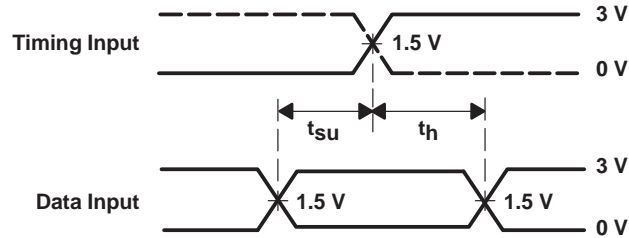


**LOAD CIRCUIT**

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



**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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