

- **Output Ports Have Equivalent 25- $\Omega$  Series Resistors, So No External Resistors Are Required**
- **State-of-the-Art *EPIC-II B*<sup>™</sup> BiCMOS Design Significantly Reduces Power Dissipation**
- **Typical  $V_{OLP}$  (Output Ground Bounce) < 1 V at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$**
- **Latch-Up Performance Exceeds 500 mA Per JESD 17**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ( $C = 200$  pF,  $R = 0$ )**
- **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 'ABT2241 and 'ABT2244A, these devices provide combinations of inverting and noninverting outputs, symmetrical active-low output-enable ( $\overline{OE}$ ) inputs, and complementary OE and  $\overline{OE}$  inputs. These devices feature high fan-out and improved fan-in.

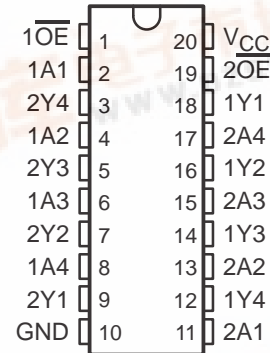
These devices are organized as two 4-bit line drivers with separate  $\overline{OE}$  inputs. When  $\overline{OE}$  is low, the devices pass inverted data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

The outputs, which are designed to sink up to 12 mA, include equivalent 25- $\Omega$  series resistors to reduce overshoot and undershoot.

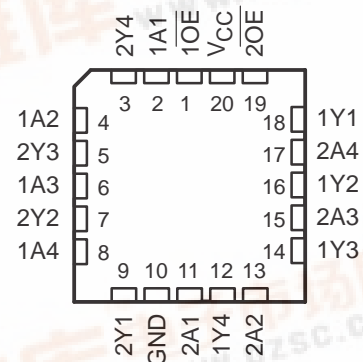
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN54ABT2240A is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74ABT2240A is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54ABT2240A . . . J OR W PACKAGE  
 SN74ABT2240A . . . DB, DW, N, OR PW PACKAGE  
 (TOP VIEW)



SN54ABT2240A . . . FK PACKAGE  
 (TOP VIEW)



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 On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

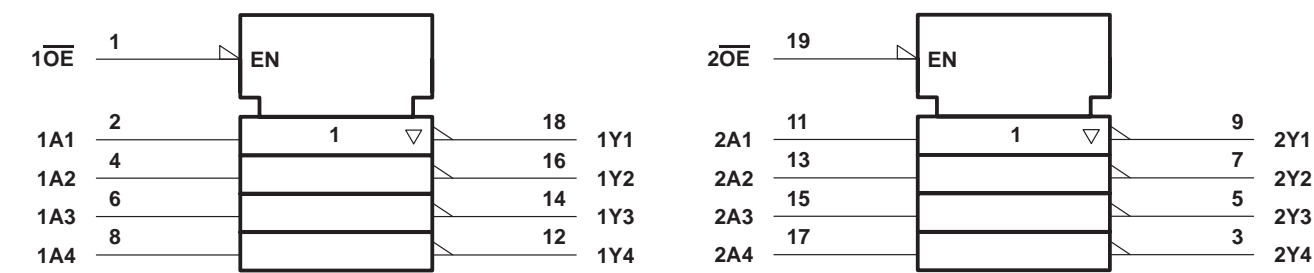
# SN54ABT2240A, SN74ABT2240A OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

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FUNCTION TABLE  
(each buffer)

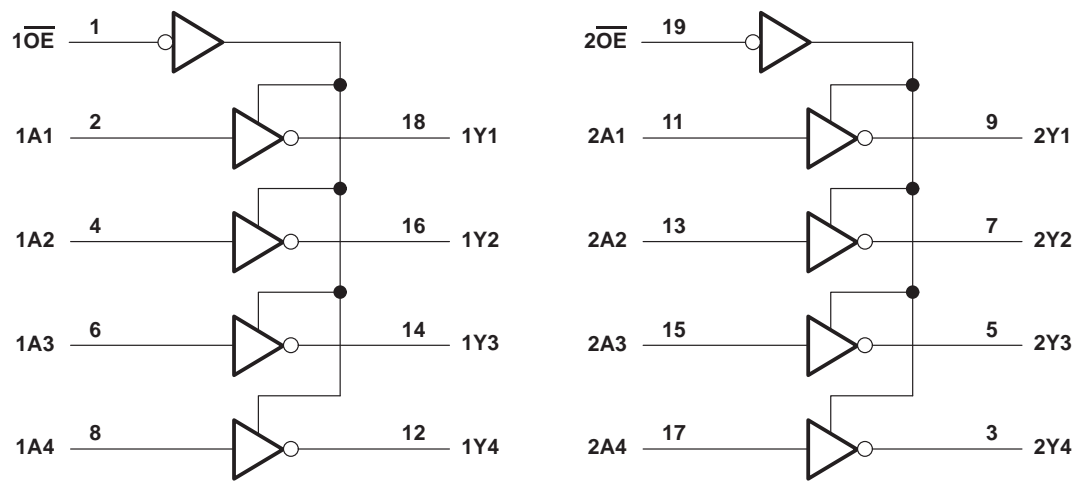
| INPUTS          |   | OUTPUT<br>Y |
|-----------------|---|-------------|
| $\overline{OE}$ | A |             |
| L               | H | L           |
| L               | L | H           |
| H               | X | Z           |

## logic symbol†



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

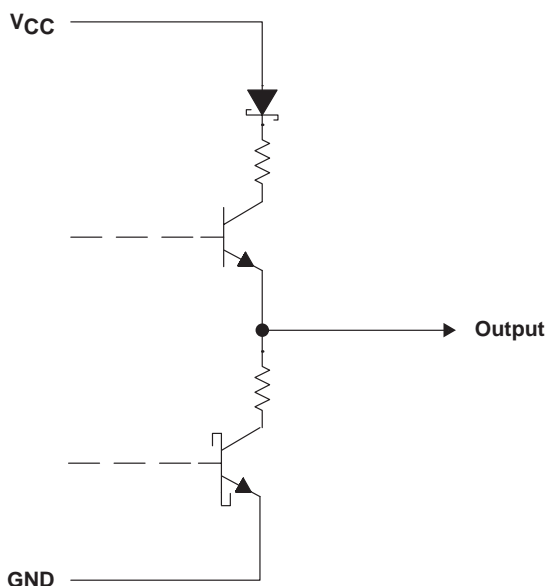
## logic diagram (positive logic)



# SN54ABT2240A, SN74ABT2240A OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

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## schematic of Y outputs



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|   |                 |
|---|-----------------|
| 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, $I_O$                           | 30 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  |

<sup>†</sup> 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 JESD 51, except for through-hole packages, which use a trace length of zero.

# SN54ABT2240A, SN74ABT2240A

## OCTAL BUFFERS AND LINE/MOS DRIVERS

### WITH 3-STATE OUTPUTS

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#### recommended operating conditions (see Note 3)

|                 |                                    |                 | SN54ABT2240A |                 | SN74ABT2240A |                 | UNIT |
|-----------------|------------------------------------|-----------------|--------------|-----------------|--------------|-----------------|------|
|                 |                                    |                 | MIN          | MAX             | MIN          | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     |                 | 4.5          | 5.5             | 4.5          | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage           |                 | 2            |                 | 2            |                 | V    |
| V <sub>IL</sub> | Low-level input voltage            |                 |              | 0.8             |              | 0.8             | V    |
| V <sub>I</sub>  | Input voltage                      |                 | 0            | V <sub>CC</sub> | 0            | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-level output current          |                 |              | –24             |              | –32             | mA   |
| I <sub>OL</sub> | Low-level output current           |                 |              | 12              |              | 12              | mA   |
| Δt/Δv           | Input transition rise or fall rate | Outputs enabled |              | 5               |              | 5               | ns/V |
| T <sub>A</sub>  | Operating free-air temperature     |                 | –55          | 125             | –40          | 85              | °C   |

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER          |                | TEST CONDITIONS  | T <sub>A</sub> = 25°C |      |         | SN54ABT2240A |      | SN74ABT2240A |      | 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  | 2                     |      |         | 2            |      |              |      |      |
|                    |                |  | 2*                    |      |         |              |      | 2            |      |      |
| V <sub>OL</sub>    |                | V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 12 mA                                     |                       |      | 0.8     |              | 0.8  |              | 0.8  | V    |
| 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                                      |                       |      | 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, V <sub>I</sub> = V <sub>CC</sub> or GND |                       |      |         |              |      |              |      | μA   |
|                    |                |  |                       |      | 1 250   |              | 250  |              | 250  | μA   |
|                    |                |  |                       |      | 24 30   |              | 30   |              | 30   | mA   |
| ΔI <sub>CC</sub> § | Data inputs    | V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND  |                       |      |         |              |      |              |      | mA   |
|                    |                |  |                       |      | 0.5 250 |              | 250  |              | 250  |      |
|                    | Control inputs | V <sub>CC</sub> = 5.5 V, One input at 3.4 V, 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  |                       |      | 7       |              |      |              |      | 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.

**SN54ABT2240A, SN74ABT2240A**  
**OCTAL BUFFERS AND LINE/MOS 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) | SN54ABT2240A                                    |     |     |     | UNIT |     |
|------------------|-----------------|----------------|---|-----|-----|-----|------|-----|
|                  |                 |                | V <sub>CC</sub> = 5 V,<br>T <sub>A</sub> = 25°C |     |     | MIN |      | MAX |
|                  |                 |                | MIN   | TYP | MAX |     |      |     |
| t <sub>PLH</sub> | A               | Y              | 1   | 3   | 4   | 1   | 5    | ns  |
| t <sub>PHL</sub> |                 |                | 2.1   | 4.8 | 5.8 | 2.1 | 6.3  |     |
| t <sub>PZH</sub> | $\overline{OE}$ | Y              | 1.5   | 3.7 | 4.7 | 1.5 | 6.1  | ns  |
| t <sub>PZL</sub> |                 |                | 1.7   | 6.5 | 7.6 | 1.7 | 8.8  |     |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y              | 1.8   | 3.8 | 6.4 | 1.5 | 6.8  | ns  |
| t <sub>PLZ</sub> |                 |                | 1   | 4.7 | 5.8 | 1   | 6.9  |     |

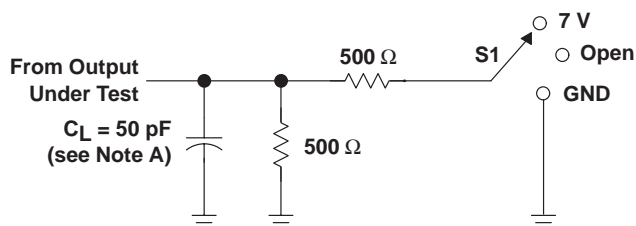
switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | SN74ABT2240A                                    |     |     |     |     | UNIT |
|------------------|-----------------|----------------|---|-----|-----|-----|-----|------|
|                  |                 |                | V <sub>CC</sub> = 5 V,<br>T <sub>A</sub> = 25°C |     |     | MIN | MAX |      |
|                  |                 |                | MIN   | TYP | MAX |     |     |      |
| t <sub>PLH</sub> | A               | Y              | 1   | 3   | 4.1 | 1   | 4.8 | ns   |
| t <sub>PHL</sub> |                 |                | 2.1   | 4.1 | 5.1 | 2.1 | 5.4 |      |
| t <sub>PZH</sub> | OE              | Y              | 1.1   | 3.1 | 4.7 | 1.1 | 5.2 | ns   |
| t <sub>PZL</sub> |                 |                | 1.7   | 4.5 | 6.4 | 1.7 | 6.8 |      |
| t <sub>PHZ</sub> | OE              | Y              | 1.8   | 3.4 | 5.7 | 1.8 | 6.4 | ns   |
| t <sub>PLZ</sub> |                 |                | 1.9   | 3.6 | 6   | 1.9 | 6.2 |      |

# SN54ABT2240A, SN74ABT2240A OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

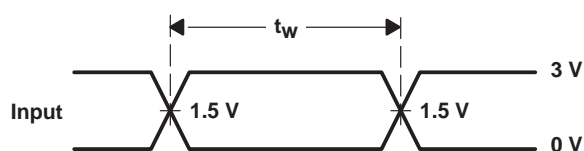
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## PARAMETER MEASUREMENT INFORMATION

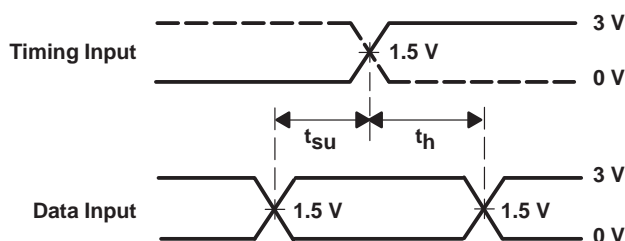


LOAD CIRCUIT

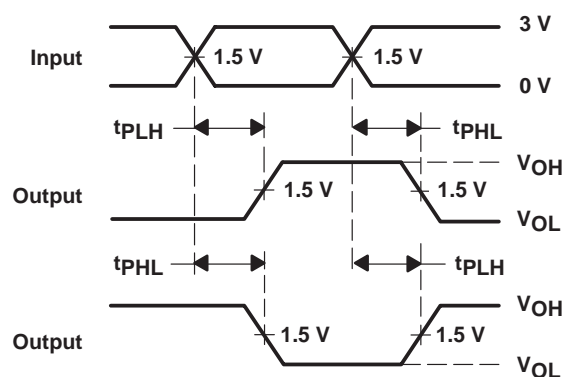
| TEST              | S1   |
|-------------------|------|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 7 V  |
| $t_{PHZ}/t_{PZH}$ | Open |



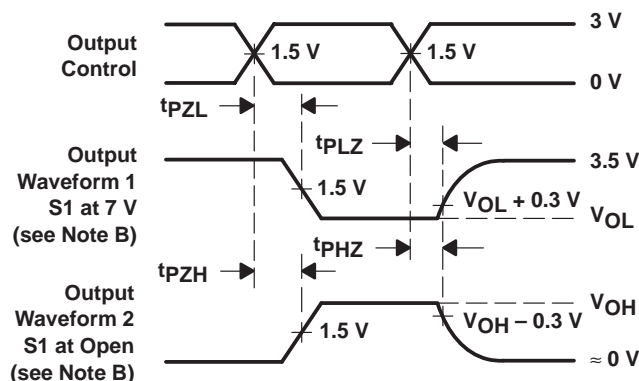
VOLTAGE WAVEFORMS  
PULSE DURATION



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:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
  - The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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