

# SN54ABT2952A, SN74ABT2952A OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

SCBS203A - AUGUST 1992 - REVISED JULY 1994

- State-of-the-Art *EPIC-II*<sup>™</sup> BICMOS Design Significantly Reduces Power Dissipation
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Two 8-Bit Back-to-Back Registers Store Data Flowing in Both Directions
- Noninverting Outputs
- Typical  $V_{OLP}$  (Output Ground Bounce) < 1 V at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$
- Package Options Include Plastic Small-Outline (DW) and Shrink Small-Outline (DB) Packages, Ceramic Chip Carriers (FK), and Plastic (NT) and Ceramic (JT) DIPs

## description

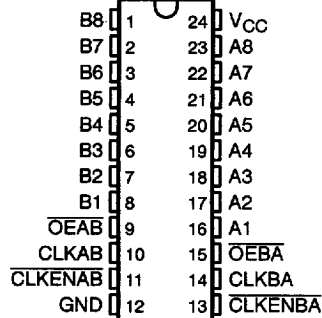
The 'ABT2952A transceivers consist of two 8-bit back-to-back registers that store data flowing in both directions between two bidirectional buses. Data on the A or B bus is stored in the registers on the low-to-high transition of the clock (CLKAB or CLKBA) input provided that the clock-enable (CLKENAB or CLKENBA) input is low. Taking the output-enable (OEAB or OEBA) input low accesses the data on either port.

To ensure the high-impedance state during power up or power down, 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.

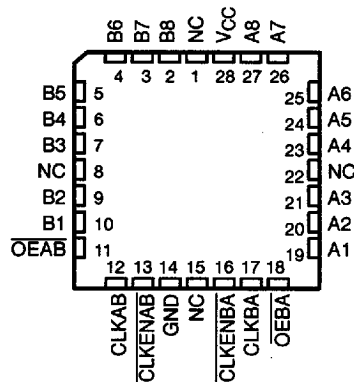
The SN74ABT2952A is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

The SN54ABT2952A is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74ABT2952A is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54ABT2952A ... JT PACKAGE  
SN74ABT2952A ... DB, DW, OR NT PACKAGE  
(TOP VIEW)



SN54ABT2952A ... FK PACKAGE  
(TOP VIEW)



NC - No internal connection

EPIC-II is a trademark of Texas Instruments Incorporated.

UNLESS OTHERWISE NOTED this document contains PRODUCTION DATA information 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.

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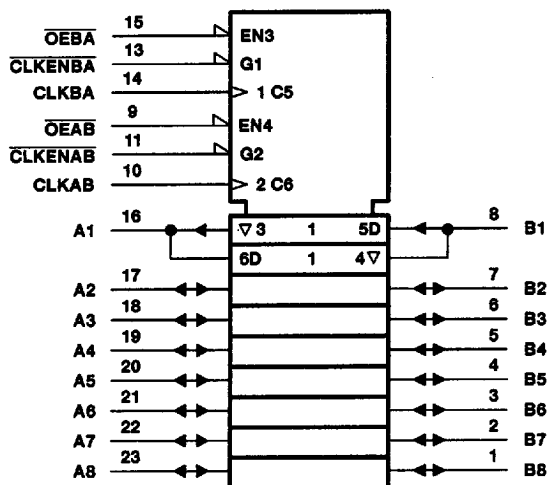
FUNCTION TABLE†

| INPUTS  |        |      |   | OUTPUT           |
|---------|--------|------|---|------------------|
| CLKENAB | CLKAB  | OEAB | A | B                |
| H       | X      | L    | X | B <sub>0</sub> ‡ |
| X       | H or L | L    | X | B <sub>0</sub> ‡ |
| L       | ↑      | L    | L | L                |
| L       | ↑      | L    | H | H                |
| X       | X      | H    | X | Z                |

† A-to-B data flow is shown; B-to-A data flow is similar but uses  $\overline{\text{CLKENBA}}$ ,  $\text{CLKBA}$ , and  $\overline{\text{OEBA}}$ .

‡ Level of B before the indicated steady-state input conditions were established.

## logic symbols



§ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the DB, DW, JT, and NT packages.

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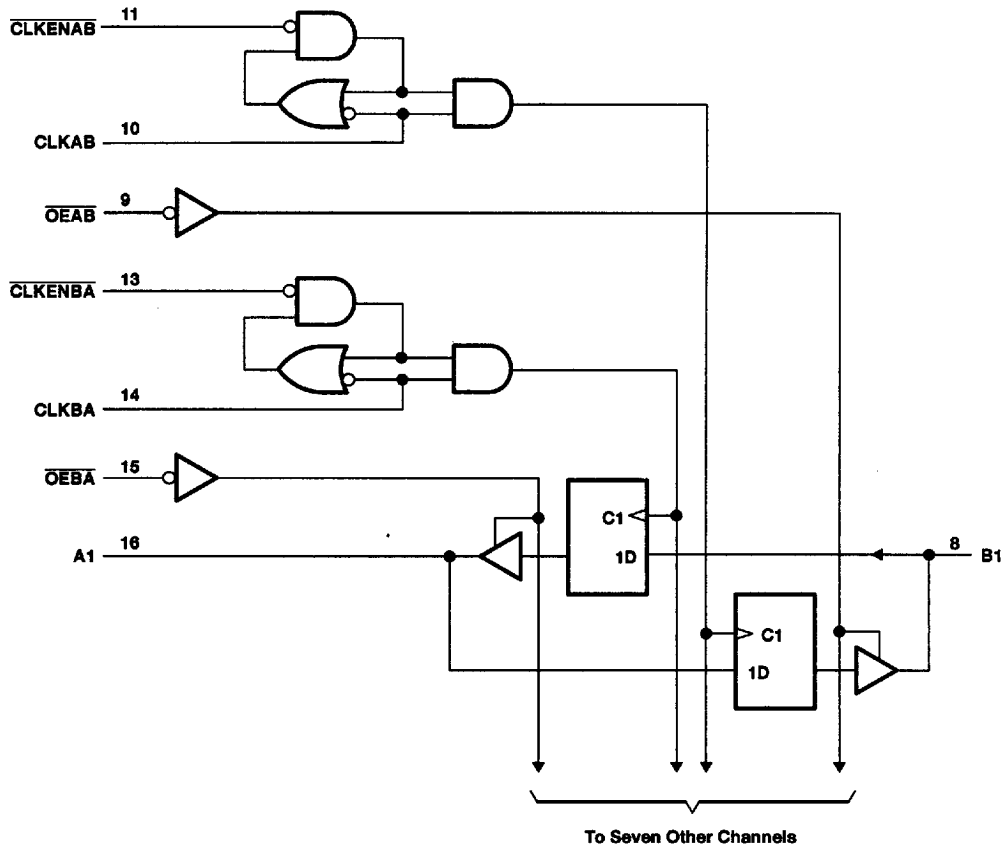
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logic diagram (positive logic)



Pin numbers shown are for the DB, DW, JT, and NT packages.



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# SN54ABT2952A, SN74ABT2952A OCTAL BUS TRANSCEIVERS AND REGISTERS 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, $V_I$ (except I/O ports) (see Note 1)                                    | -0.5 V to 7 V   |
| Voltage range applied to any output in the high state or power-off state, $V_O$               | -0.5 V to 5.5 V |
| Current into any output in the low state, $I_{OL}$ : SN54ABT2952A                             | 96 mA           |
| SN74ABT2952A                                                                                  | 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 | 0.65 W          |
| DW package                                                                                    | 1.7 W           |
| NT package                                                                                    | 1.3 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 NT 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.

## recommended operating conditions (see Note 3)

|                     |                                    | SN54ABT2952A |          | SN74ABT2952A |          | 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 |              | 10       |              | 10       | ns/V |
| $T_A$               | Operating free-air temperature     | -55          | 125      | -40          | 85       | °C   |

NOTE 3: Unused or floating pins (input or I/O) must be held high or low.

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# SN54ABT2952A, SN74ABT2952A OCTAL BUS TRANSCEIVERS AND REGISTERS 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 |      |       | SN54ABT2952A |      | SN74ABT2952A |      | 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            |      |              |      |      |
|                    |                                                                                            | I <sub>OH</sub> = -32 mA | 2*                    |      |       |              |      | 2            |      |      |
| V <sub>OL</sub>    | V <sub>CC</sub> = 4.5 V                                                                    | I <sub>OL</sub> = 48 mA  |                       |      | 0.55  |              | 0.55 |              |      | V    |
|                    |                                                                                            | I <sub>OL</sub> = 64 mA  |                       |      | 0.55* |              |      |              | 0.55 |      |
| I <sub>I</sub>     | V <sub>CC</sub> = 5.5 V,<br>V <sub>I</sub> = V <sub>CC</sub> or GND                        | Control inputs           |                       |      | ±1    |              |      |              | ±1   | μA   |
|                    |                                                                                            | A or B ports             |                       |      | ±100  |              | ±100 |              | ±100 |      |
| I <sub>OZH</sub> ‡ | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V                                            |                          |                       |      | 50    |              | 50   |              | 50   | μA   |
| I <sub>OZL</sub> ‡ | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0.5 V                                            |                          |                       |      | -50   |              | -50  |              | -50  | 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,<br>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,<br>I <sub>O</sub> = 0,<br>V <sub>I</sub> = V <sub>CC</sub> or GND | A or B ports             |                       |      |       |              |      |              |      |      |
|                    |                                                                                            | Outputs high             |                       |      | 1     | 250          |      | 250          |      | μA   |
|                    |                                                                                            | Outputs low              |                       |      | 24    | 35           |      | 35           |      | mA   |
|                    |                                                                                            | Outputs disabled         |                       |      | 0.5   | 250          |      | 250          |      | μA   |
| ΔI <sub>CC</sub> ¶ | 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  | mA   |
| C <sub>i</sub>     | V <sub>I</sub> = 2.5 V or 0.5 V                                                            | Control inputs           |                       |      | 3.5   |              |      |              |      | pF   |
| C <sub>io</sub>    | V <sub>O</sub> = 2.5 V or 0.5 V                                                            | A or B ports             |                       |      | 7.5   |              |      |              |      | pF   |

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

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

‡ The parameters I<sub>OZH</sub> and I<sub>OZL</sub> include the input leakage current.

§ 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.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

|                    |                        |        |                 | V <sub>CC</sub> = 5 V,<br>T <sub>A</sub> = 25°C |     | SN54ABT2952A |     | SN74ABT2952A |     | UNIT |
|--------------------|------------------------|--------|-----------------|-------------------------------------------------|-----|--------------|-----|--------------|-----|------|
|                    |                        |        |                 | MIN                                             | MAX | MIN          | MAX | MIN          | MAX |      |
| f <sub>clock</sub> | Clock frequency        |        |                 | 0                                               | 150 | 0            | 150 | 0            | 150 | MHz  |
| t <sub>w</sub>     | Pulse duration         |        |                 | 3.3                                             |     | 3.3          |     | 3.3          |     | ns   |
| t <sub>su</sub>    | Setup time before CLK↑ | A or B | CLK high or low | 2.5                                             |     | 2.5          |     | 2.5          |     | ns   |
|                    |                        | CLKEN  | High or low     | 3                                               |     |              |     | 3            |     |      |
| t <sub>h</sub>     | Hold time after CLK↑   | A or B |                 | 1.5                                             |     | 1.5          |     | 1.5          |     | ns   |
|                    |                        | CLKEN  |                 | 2                                               |     | 2            |     | 2            |     |      |

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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>$T_A = 25^\circ\text{C}$ |     |     | SN54ABT2952A |     | SN74ABT2952A |     | UNIT |
|------------|----------------------------------------|----------------|---------------------------------------------|-----|-----|--------------|-----|--------------|-----|------|
|            |                                        |                | MIN                                         | TYP | MAX | MIN          | MAX | MIN          | MAX |      |
| $f_{\max}$ |                                        |                | 150                                         |     |     | 150          |     | 150          |     | MHz  |
| $t_{PLH}$  | CLKAB or CLKBA                         | B or A         | 2                                           | 3.3 | 5.2 | 2            | 5.3 | 2            | 5.9 | ns   |
| $t_{PHL}$  |                                        |                | 2.5                                         | 4   | 6.1 | 2.5          | 6.8 | 2.5          | 6.3 |      |
| $t_{PZH}$  | $\overline{OE}BA$ or $\overline{OE}AB$ | A or B         | 1.5                                         | 3.2 | 4.7 | 1.5          | 5.7 | 1.5          | 5.6 | ns   |
| $t_{PZL}$  |                                        |                | 2                                           | 3.7 | 5.7 | 2            | 6.7 | 2            | 6.6 |      |
| $t_{PHZ}$  | $\overline{OE}BA$ or $\overline{OE}AB$ | A or B         | 1.5                                         | 3.5 | 5.1 | 1.5          | 6.5 | 1.5          | 6.4 | ns   |
| $t_{PLZ}$  |                                        |                | 1.5                                         | 3.4 | 5.9 | 1.5          | 6.7 | 1.5          | 6.2 |      |

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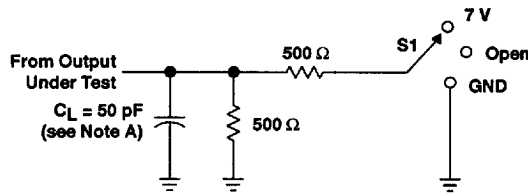
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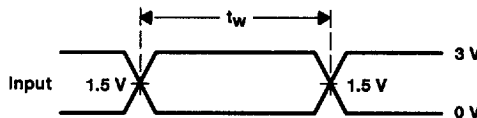
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## PARAMETER MEASUREMENT INFORMATION

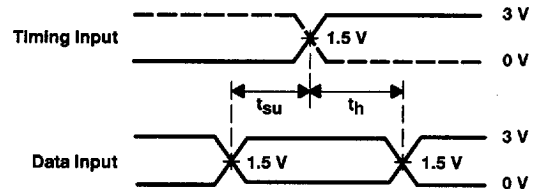


LOAD CIRCUIT FOR OUTPUTS

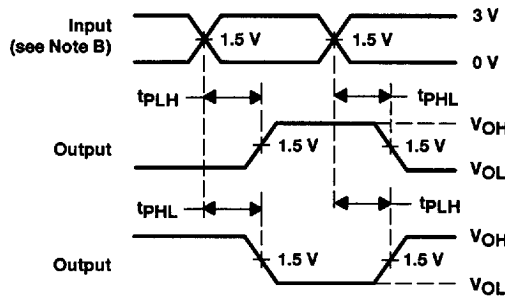
| TEST              | S1   |
|-------------------|------|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 7 V  |
| $t_{PHZ}/t_{PZH}$ | Open |



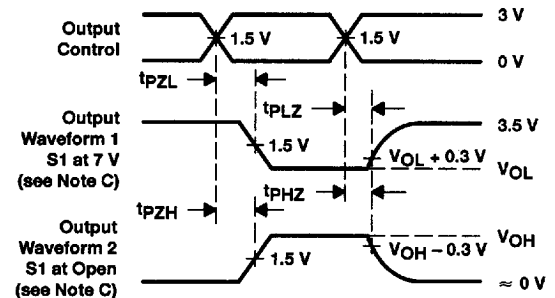
VOLTAGE WAVEFORMS  
PULSE DURATION



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. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .  
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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