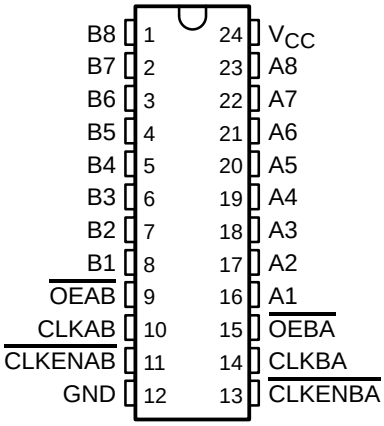
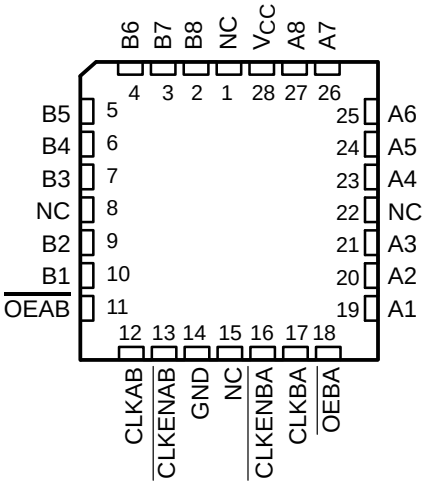
- **State-of-the-Art *EPIC*-II*B*™ BiCMOS Design Significantly Reduces Power Dissipation**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17**
- **Two 8-Bit, Back-to-Back Registers Store Data Flowing in Both Directions**
- **Inverting Outputs**
- **Typical $V_{OLP}$ (Output Ground Bounce) < 1 V at $V_{CC}$ = 5 V, $T_A$ = 25°C**
- **Package Options Include Plastic Small-Outline (DW) and Shrink Small-Outline (DB) Packages, Ceramic Chip Carriers (FK), and Standard Plastic and Ceramic 300-mil DIPs (JT, NT)**

**SN54ABT2953 . . . JT PACKAGE**
**SN74ABT2953 . . . DB, DW, OR NT PACKAGE**
**(TOP VIEW)**




**SN54ABT2953 . . . FK PACKAGE**
**(TOP VIEW)**




NC – No internal connection

## description

The ′ABT2953 consists 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 ($\overline{\text{CLKENAB}}$ or $\overline{\text{CLKENBA}}$) input is low. Taking the output-enable ($\overline{\text{OEAB}}$ or $\overline{\text{OEBA}}$) input low accesses the data on either port.

To ensure the high-impedance state during power up or power down, $\overline{\text{OE}}$ 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 SN74ABT2953 is packaged 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 SN54ABT2953 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74ABT2953 is characterized for operation from –40°C to 85°C.

PRODUCT PREVIEW

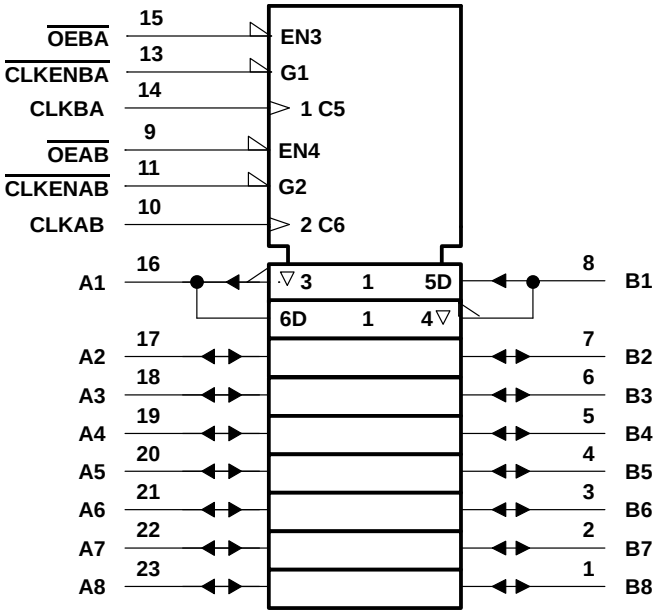
EPIC-IIB is a trademark of Texas Instruments Incorporated.

**FUNCTION TABLE†**

| INPUTS | | | | OUTPUT |
|---|---|---|---|---|
| $\overline{\text{CLKENAB}}$ | CLKAB | $\overline{\text{OEAB}}$ | A | B |
| H | X | L | X | $B_0$‡ |
| X | H or L | L | X | $B_0$‡ |
| L | ↑ | L | L | H |
| L | ↑ | L | H | L |
| X | X | H | X | Z |

† A-to-B data flow is shown; B-to-A data flow is similar but uses $\overline{\text{CLKENBA}}$, CLKBA, and $\overline{\text{OEBA}}$.
‡ Level of B before the indicated steady-state input conditions were established.

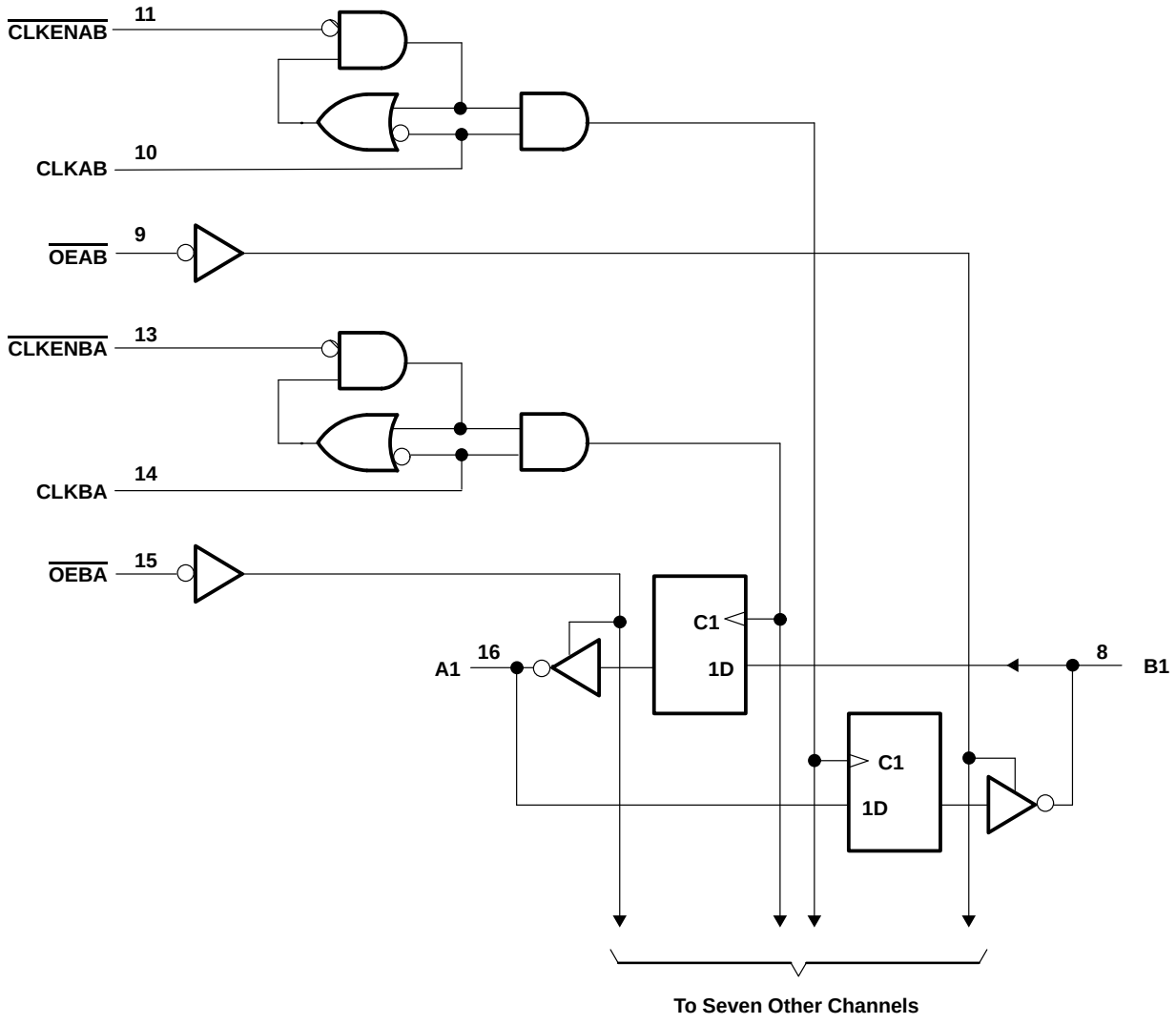
## logic symbol§




§ 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.

PRODUCT PREVIEW

## logic diagram (positive logic)




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

### 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, $I_O$: SN54ABT2953 . . . . . 96 mA
SN74ABT2953 . . . . . 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°C (in still air): DB package . . . . . 0.7 W
DW package . . . . . 1 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.

NOTE 1: The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

### recommended operating conditions (see Note 2)

| | | | SN54ABT2953 | | SN74ABT2953 | | 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 | | 10 | | 10 | ns/V |
| $T_A$ | Operating free-air temperature | | –55 | 125 | –40 | 85 | °C |

NOTE 2: Unused or floating pins (input or I/O) must be held high or low.

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

| PARAMETER | TEST CONDITIONS | | | $T_A$ = 25°C | | | SN54ABT2953 | | SN74ABT2953 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP† | MAX | MIN | MAX | MIN | MAX | |
| $V_{IK}$ | $V_{CC}$ = 4.5 V, | $I_I$ = –18 mA | | | | –1.2 | | –1.2 | | –1.2 | V |
| $V_{OH}$ | $V_{CC}$ = 4.5 V, | $I_{OH}$ = – 3 mA | | 2.5 | | | 2.5 | | 2.5 | | V |
| | $V_{CC}$ = 5 V, | $I_{OH}$ = – 3 mA | | 3 | | | 3 | | 3 | | |
| | $V_{CC}$ = 4.5 V | $I_{OH}$ = –24 mA | | 2 | | | 2 | | | | |
| | | $I_{OH}$ = – 32 mA | | 2‡ | | | | | 2 | | |
| $V_{OL}$ | $V_{CC}$ = 4.5 V | $I_{OL}$ = 48 mA | | | | 0.55 | | 0.55 | | | V |
| | | $I_{OL}$ = 64 mA | | | | 0.55‡ | | | | 0.55 | |
| $I_I$ | $V_{CC}$ = 5.5 V, $V_I$ = $V_{CC}$ or GND | | Control inputs | | | ±1 | | ±1 | | ±1 | µA |
| | | | A or B ports | | | ±100 | | ±100 | | ±100 | |
| $I_{OZH}$§ | $V_{CC}$ = 5.5 V, | $V_O$ = 2.7 V | | | | 50 | | 50 | | 50 | µA |
| $I_{OZL}$§ | $V_{CC}$ = 5.5 V, | $V_O$ = 0.5 V | | | | –50 | | –50 | | –50 | µA |
| $I_{off}$ | $V_{CC}$ = 0, | $V_I$ or $V_O$ ≤ 4.5 V | | | | ±100 | | | | ±100 | µA |
| $I_{CEX}$ | $V_{CC}$ = 5.5 V, | $V_O$ = 5.5 V | Outputs high | | | 50 | | 50 | | 50 | µA |
| $I_O$¶ | $V_{CC}$ = 5.5 V, | $V_O$ = 2.5 V | | –50 | –100 | –180 | –50 | –180 | –50 | –180 | mA |
| $I_{CC}$ | $V_{CC}$ = 5.5 V, $I_O$ = 0, $V_I$ = $V_{CC}$ or GND | A or B ports | Outputs high | | 1 | 250 | | 250 | | 250 | µA |
| | | | Outputs low | | 24 | 35 | | 35 | | 35 | mA |
| | | | Outputs disabled | | 0.5 | 250 | | 250 | | 250 | µA |
| $\Delta I_{CC}$# | $V_{CC}$ = 5.5 V, One input at 3.4 V, Other inputs at $V_{CC}$ or GND | | | | | 1.5 | | 1.5 | | 1.5 | mA |
| $C_i$ | $V_I$ = 2.5 V or 0.5 V | | Control inputs | | 4 | | | | | | pF |
| $C_{io}$ | $V_O$ = 2.5 V or 0.5 V | | A or B ports | | 7 | | | | | | pF |

† All typical values are at $V_{CC}$ = 5 V.
‡ On products compliant to MIL-STD-883, Class B, this parameter does not apply.
§ The parameters $I_{OZH}$ and $I_{OZL}$ 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 $V_{CC}$ or GND.

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

| | | | | $V_{CC}$ = 5 V, $T_A$ = 25°C | | SN54ABT2953 | | SN74ABT2953 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{clock}$ | Clock frequency | | | 0 | 150 | 0 | 150 | 0 | 150 | MHz |
| $t_w$ | Pulse duration | | CLK high | 3 | | 3 | | 3 | | ns |
| | | | CLK low | 3.5 | | 3.5 | | 3.5 | | |
| $t_{su}$ | Setup time before CLK↑ | A or B | High | 4 | | 4 | | 4 | | ns |
| | | | Low | 3 | | 3 | | 3 | | |
| | | $\overline{\text{CLKEN}}$ | High | 3.5 | | 3.5 | | 3.5 | | |
| | | | Low | 2.5 | | 2.5 | | 2.5 | | |
| $t_h$ | Hold time after CLK↑ | A or B | | 0 | | 0 | | 0 | | ns |
| | | $\overline{\text{CLKEN}}$ | | 0 | | 0 | | 0 | | |

PRODUCT PREVIEW

**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) | $V_{CC}$ = 5 V, $T_A$ = 25°C | | | SN54ABT2953 | | SN74ABT2953 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | 150 | | | 150 | | 150 | | MHz |
| $t_{PLH}$ | CLKBA or CLKAB | A or B | 2.6 | 5.1 | 6.6 | 2.6 | | 2.6 | 7.6 | ns |
| $t_{PHL}$ | | | 3.2 | 5.7 | 7.2 | 3.2 | | 3.2 | 8.2 | |
| $t_{PZH}$ | $\overline{OEBA}$ or $\overline{OEAB}$ | A or B | 1 | 3.3 | 4.8 | 1 | | 1 | 5.8 | ns |
| $t_{PZL}$ | | | 2.2 | 4.7 | 6.2 | 2.2 | | 2.2 | 7.5 | |
| $t_{PHZ}$ | $\overline{OEBA}$ or $\overline{OEAB}$ | A or B | 3.6 | 6.1 | 7.6 | 3.6 | | 3.6 | 8.1 | ns |
| $t_{PLZ}$ | | | 3.1 | 6.6 | 7.1 | 3.1 | | 3.1 | 7.6 | |

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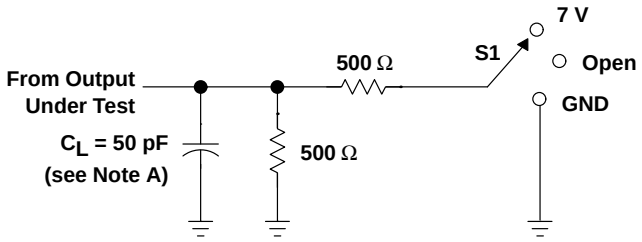
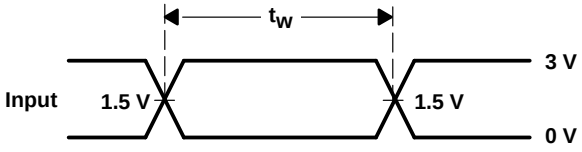
## PARAMETER MEASUREMENT INFORMATION

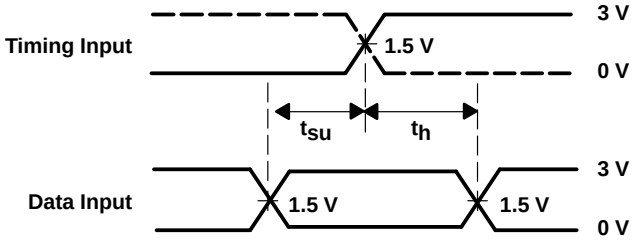



| TEST | S1 |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 7 V |
| $t_{PHZ}/t_{PZH}$ | Open |

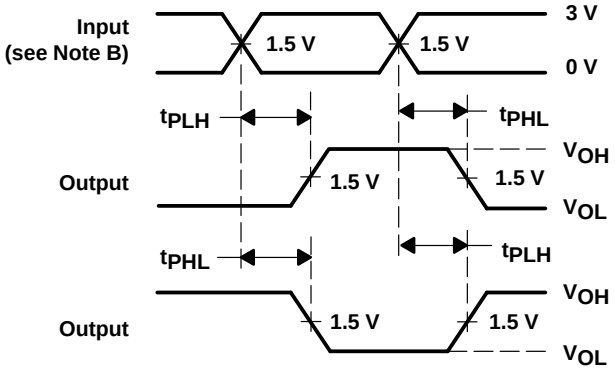
LOAD CIRCUIT FOR OUTPUTS



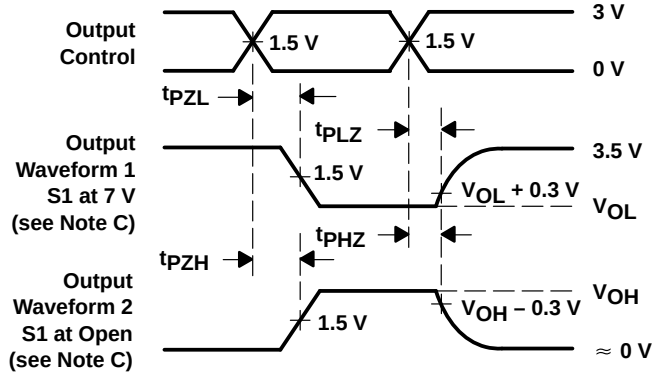

VOLTAGE WAVEFORMS
PULSE DURATION




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 ≤ 10 MHz, $Z_O$ = 50 Ω, $t_r$ ≤ 2.5 ns, $t_f$ ≤ 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**

PRODUCT PREVIEW

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