

# SN54BCT541, SN74BCT541A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS011D – JULY 1988 – REVISED SEPTEMBER 1994

- State-of-the-Art BiCMOS Design Significantly Reduces  $I_{CCZ}$
- 3-State Outputs Drive Bus Lines or Buffer Memory-Address Registers
- P-N-P Inputs Reduce DC Loading
- Data Flow-Through Pinout (All Inputs on Opposite Side From Outputs)
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK) and Flatpacs (W), and Plastic (N) and Ceramic (J) 300-mil DIPs

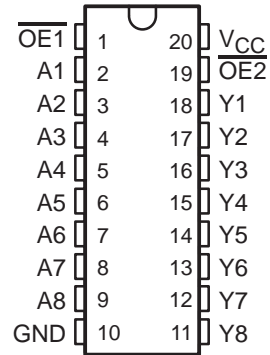
## description

The SN54BCT541 and SN74BCT541A octal buffers and line drivers are ideal for driving bus lines or buffering memory-address registers. The devices feature inputs and outputs on opposite sides of the package to facilitate printed-circuit-board layout.

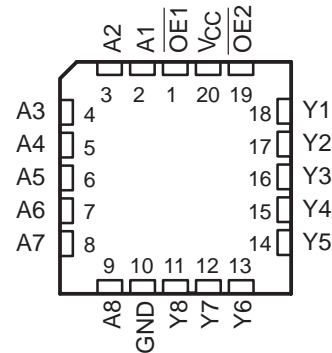
The 3-state control gate is a 2-input AND gate with active-low inputs so that if either output-enable ( $\overline{OE1}$  or  $\overline{OE2}$ ) input is high, all eight outputs are in the high-impedance state.

The SN54BCT541 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74BCT541A is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54BCT541 . . . J OR W PACKAGE  
SN74BCT541A . . . DW OR N PACKAGE  
(TOP VIEW)



SN54BCT541 . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE

| INPUTS           |                  |   | OUTPUT |
|------------------|------------------|---|--------|
| $\overline{OE1}$ | $\overline{OE2}$ | A | Y      |
| L                | L                | L | L      |
| L                | L                | H | H      |
| H                | X                | X | Z      |
| X                | H                | X | Z      |

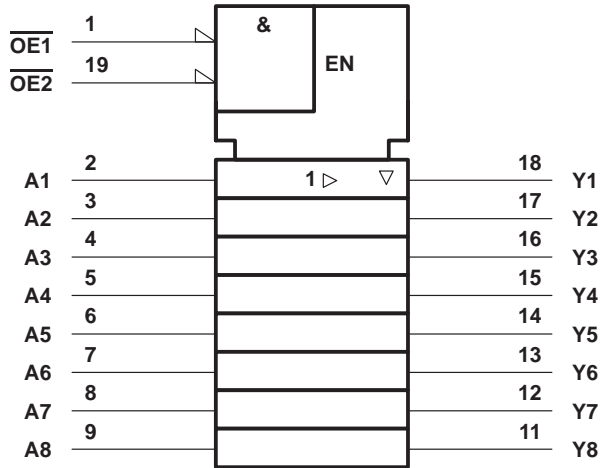
# SN54BCT541, SN74BCT541A

## OCTAL BUFFERS/DRIVERS

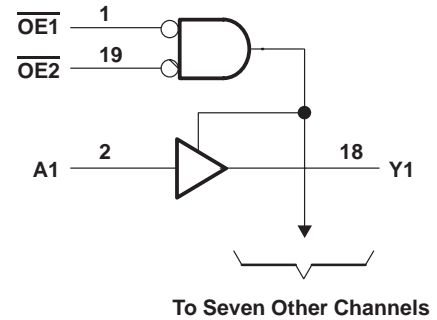
### WITH 3-STATE OUTPUTS

SCBS011D – JULY 1988 – REVISED SEPTEMBER 1994

#### logic symbol†



#### logic diagram (positive logic)



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

#### 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 disabled or power-off state, $V_O$ ..... | - 0.5 V to 5.5 V    |
| Voltage range applied to any output in the high state, $V_{OH}$ .....               | - 0.5 V to $V_{CC}$ |
| Current into any output in the low state: SN54BCT541 .....                          | 96 mA               |
| SN74BCT541A .....   | 128 mA              |
| Operating free-air temperature range, $T_A$ : SN54BCT541 .....                      | - 55°C to 125°C     |
| SN74BCT541A .....   | 0°C to 70°C         |
| 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 voltage ratings may be exceeded if the input and output current ratings are observed.

#### recommended operating conditions

|          |                                | SN54BCT541 |     |     | SN74BCT541A |     |     | UNIT |
|----------|--------------------------------|------------|-----|-----|-------------|-----|-----|------|
|          |                                | MIN        | NOM | MAX | MIN         | NOM | MAX |      |
| $V_{CC}$ | Supply voltage                 | 4.5        | 5   | 5.5 | 4.5         | 5   | 5.5 | V    |
| $V_{IH}$ | High-level input voltage       | 2          |     |     | 2           |     |     | V    |
| $V_{IL}$ | Low-level input voltage        |            |     | 0.8 |             |     | 0.8 | V    |
| $I_{IK}$ | Input clamp current            |            |     | -18 |             |     | -18 | mA   |
| $I_{OH}$ | High-level output current      |            |     | -12 |             |     | -15 | mA   |
| $I_{OL}$ | Low-level output current       |            |     | 48  |             |     | 64  | mA   |
| $T_A$    | Operating free-air temperature | -55        |     | 125 | 0           |     | 70  | °C   |

# SN54BCT541, SN74BCT541A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS011D – JULY 1988 – REVISED SEPTEMBER 1994

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

| PARAMETER | TEST CONDITIONS    |                          | SN54BCT541 |      |      | SN74BCT541A |      |      | UNIT    |
|-----------|--------------------|--------------------------|------------|------|------|-------------|------|------|---------|
|           |                    |                          | MIN        | TYP† | MAX  | MIN         | TYP† | MAX  |         |
| $V_{IK}$  | $V_{CC} = 4.5 V$ , | $I_I = -18 mA$           |            |      | -1.2 |             |      | -1.2 | V       |
| $V_{OH}$  | $V_{CC} = 4.5 V$   | $I_{OH} = -3 mA$         | 2.4        | 3.3  |      | 2.4         | 3.3  |      | V       |
|           |                    | $I_{OH} = -12 mA$        | 2          | 3.2  |      |             |      |      |         |
|           |                    | $I_{OH} = -15 mA$        |            |      |      | 2           | 3.1  |      |         |
| $V_{OL}$  | $V_{CC} = 4.5 V$   | $I_{OL} = 48 mA$         |            | 0.38 | 0.55 |             |      |      | V       |
|           |                    | $I_{OL} = 64 mA$         |            |      |      | 0.42        | 0.55 |      |         |
| $I_I$     | $V_{CC} = 5.5 V$ , | $V_I = 7 V$              |            |      | 0.1  |             |      | 0.1  | mA      |
| $I_{IH}$  | $V_{CC} = 5.5 V$ , | $V_I = 2.7 V$            |            |      | 20   |             |      | 20   | $\mu A$ |
| $I_{IL}$  | $V_{CC} = 5.5 V$ , | $V_I = 0.5 V$            |            |      | -0.6 |             |      | -0.6 | mA      |
| $I_{OZH}$ | $V_{CC} = 5.5 V$ , | $V_O = 2.7 V$            |            |      | 50   |             |      | 50   | $\mu A$ |
| $I_{OZL}$ | $V_{CC} = 5.5 V$ , | $V_O = 0.5 V$            |            |      | -50  |             |      | -50  | $\mu A$ |
| $I_{OS}‡$ | $V_{CC} = 5.5 V$ , | $V_O = 0$                | -100       |      | -225 | -100        |      | -225 | mA      |
| $I_{CCH}$ | $V_{CC} = 5.5 V$   |                          |            | 27   | 40   |             | 27   | 40   | mA      |
| $I_{CCL}$ | $V_{CC} = 5.5 V$   |                          |            | 47   | 72   |             | 47   | 72   | mA      |
| $I_{CCZ}$ | $V_{CC} = 5.5 V$   |                          |            | 5    | 7    |             | 5    | 7    | mA      |
| $C_i$     | $V_{CC} = 5 V$ ,   | $V_I = 2.5 V$ or $0.5 V$ |            | 5    |      |             | 5    |      | pF      |
| $C_o$     | $V_{CC} = 5 V$ ,   | $V_O = 2.5 V$ or $0.5 V$ |            | 10   |      |             | 10   |      | pF      |

† All typical values are at  $V_{CC} = 5 V$ ,  $T_A = 25^\circ C$ .

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

## switching characteristics (see Figure 1)

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | $V_{CC} = 5 V$ ,<br>$C_L = 50 pF$ ,<br>$R_1 = 500 \Omega$ ,<br>$R_2 = 500 \Omega$ ,<br>$T_A = 25^\circ C$ |     |      | $V_{CC} = 4.5 V$ to $5.5 V$ ,<br>$C_L = 50 pF$ ,<br>$R_1 = 500 \Omega$ ,<br>$R_2 = 500 \Omega$ ,<br>$T_A = MIN$ to $MAX$ § |      |             |      | UNIT |
|-----------|-----------------|-------------|---|-----|------|--|------|-------------|------|------|
|           |                 |             | 'BCT541   |     |      | SN54BCT541   |      | SN74BCT541A |      |      |
|           |                 |             | MIN   | TYP | MAX  | MIN  | MAX  | MIN         | MAX  |      |
| $t_{PLH}$ | A               | Y           | 2.1   | 3.7 | 5.3  | 1.7  | 6.3  | 1.7         | 6    | ns   |
| $t_{PHL}$ |                 |             | 3.7   | 5.5 | 7.5  | 3.2  | 8.7  | 3.4         | 8.2  |      |
| $t_{PZH}$ | $\overline{OE}$ | Y           | 4.5   | 7.2 | 9.3  | 4.4  | 11   | 3.9         | 10.7 | ns   |
| $t_{PZL}$ |                 |             | 5   | 8   | 10.4 | 5.4  | 12.4 | 4.4         | 11.5 |      |
| $t_{PHZ}$ | OE              | Y           | 3.5   | 5.6 | 7.6  | 3  | 9.1  | 3           | 8.6  | ns   |
| $t_{PLZ}$ |                 |             | 3.4   | 5.2 | 7.2  | 3  | 9.4  | 3           | 8.6  |      |

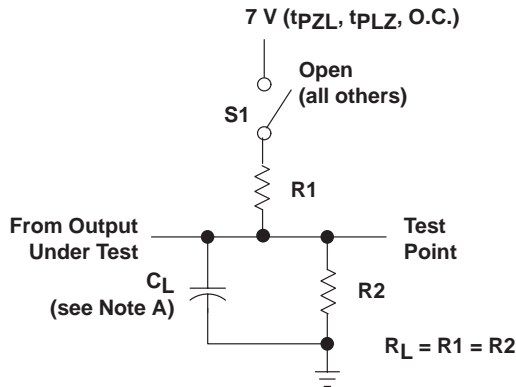
§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.



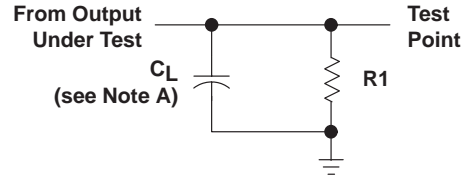
# SN54BCT541, SN74BCT541A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS011D – JULY 1988 – REVISED SEPTEMBER 1994

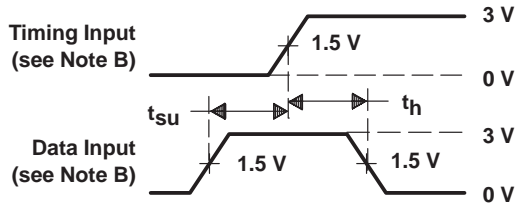
## PARAMETER MEASUREMENT INFORMATION



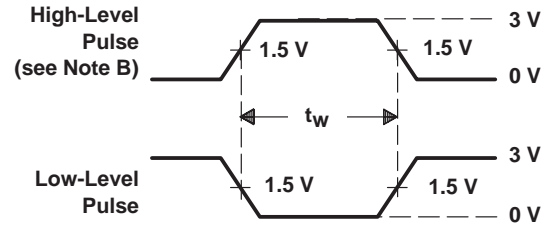
LOAD CIRCUIT FOR  
3-STATE AND OPEN-COLLECTOR OUTPUTS



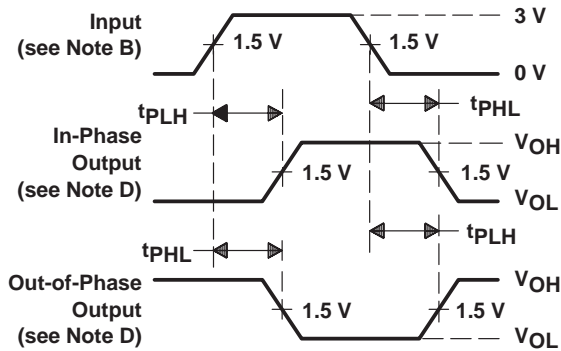
LOAD CIRCUIT FOR  
TOTEM-POLE OUTPUTS



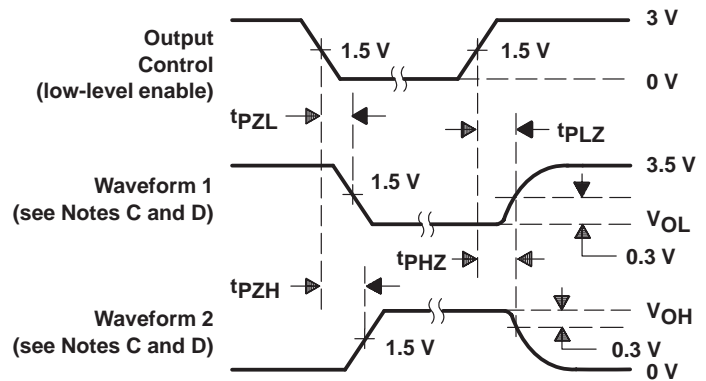
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (see Note D)



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

- 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,  $t_r = t_f \leq$  2.5 ns, duty cycle = 50%.
- 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.
- E. When measuring propagation delay times of 3-state outputs, switch S1 is open.

Figure 1. Load Circuits and Voltage Waveforms

## **IMPORTANT NOTICE**

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

**CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.**

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.