

# SN54AC10, SN74AC10 TRIPLE 3-INPUT POSITIVE-NAND GATES

SCAS529B – AUGUST 1995 – REVISED SEPTEMBER 1996

- **EPIC™ (Enhanced-Performance Implanted CMOS) 1-μm Process**
- **Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK) and Flatpacks (W), and Standard Plastic (N) and Ceramic (J) DIPS**

## description

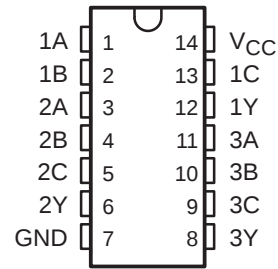
The 'AC10 contain three independent 3-input NAND gates. The devices perform the Boolean function  $Y = \overline{A \cdot B \cdot C}$  or  $Y = \overline{A} + \overline{B} + \overline{C}$  in positive logic.

The SN54AC10 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74AC10 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

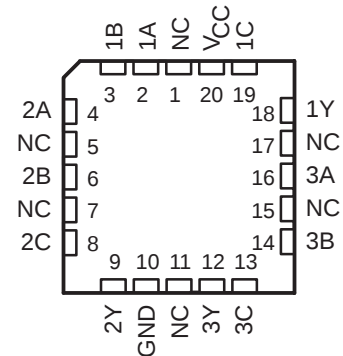
FUNCTION TABLE  
(each gate)

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| A      | B | C |             |
| H      | H | H | L           |
| L      | X | X | H           |
| X      | L | X | H           |
| X      | X | L | H           |

SN54AC10 ... J OR W PACKAGE  
SN74AC10 ... D, DB, N, OR PW PACKAGE  
(TOP VIEW)

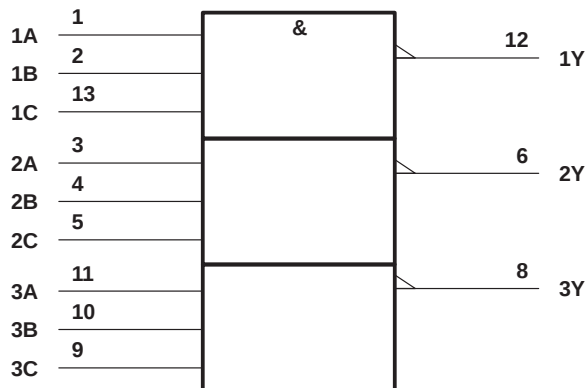


SN54AC10 ... FK PACKAGE  
(TOP VIEW)

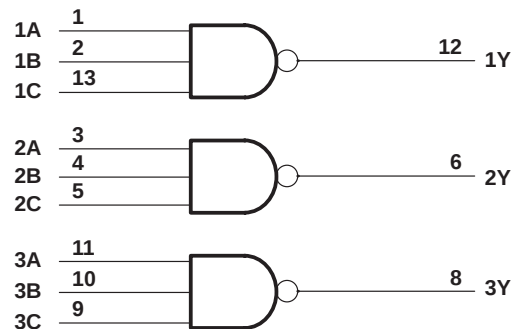


NC – No internal connection

## logic symbol†



## logic diagram, each gate (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the D, DB, J, N, PW, and W packages.



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**TEXAS  
INSTRUMENTS**

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# SN54AC10, SN74AC10

## TRIPLE 3-INPUT POSITIVE-NAND GATES

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### 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 $V_{CC} + 0.5$ V |
| Output voltage range, $V_O$ (see Note 1)                                           | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )                      | ±20 mA                     |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )                     | ±20 mA                     |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )                         | ±50 mA                     |
| Continuous current through $V_{CC}$ or GND                                         | ±200 mA                    |
| Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): |                            |
| D package                                                                          | 1.25 W                     |
| DB package                                                                         | 0.5 W                      |
| N package                                                                          | 1.1 W                      |
| PW package                                                                         | 0.5 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 voltage ratings may be exceeded if the input and output 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 N package, which has a trace length of zero.

### recommended operating conditions (see Note 3)

|                     |                                    |                  | SN54AC10 |          | SN74AC10 |          | UNIT |
|---------------------|------------------------------------|------------------|----------|----------|----------|----------|------|
|                     |                                    |                  | MIN      | MAX      | MIN      | MAX      |      |
| $V_{CC}$            | Supply voltage                     |                  | 2        | 6        | 2        | 6        | V    |
| $V_{IH}$            | High-level input voltage           | $V_{CC} = 3$ V   | 2.1      |          | 2.1      |          | V    |
|                     |                                    | $V_{CC} = 4.5$ V | 3.15     |          | 3.15     |          |      |
|                     |                                    | $V_{CC} = 5.5$ V | 3.85     |          | 3.85     |          |      |
| $V_{IL}$            | Low-level input voltage            | $V_{CC} = 3$ V   |          | 0.9      |          | 0.9      | V    |
|                     |                                    | $V_{CC} = 4.5$ V |          | 1.35     |          | 1.35     |      |
|                     |                                    | $V_{CC} = 5.5$ V |          | 1.65     |          | 1.65     |      |
| $V_I$               | Input voltage                      |                  | 0        | $V_{CC}$ | 0        | $V_{CC}$ | V    |
| $V_O$               | Output voltage                     |                  | 0        | $V_{CC}$ | 0        | $V_{CC}$ | V    |
| $I_{OH}$            | High-level output current          | $V_{CC} = 3$ V   |          | –12      |          | –12      | mA   |
|                     |                                    | $V_{CC} = 4.5$ V |          | –24      |          | –24      |      |
|                     |                                    | $V_{CC} = 5.5$ V |          | –24      |          | –24      |      |
| $I_{OL}$            | Low-level output current           | $V_{CC} = 3$ V   |          | 12       |          | 12       | mA   |
|                     |                                    | $V_{CC} = 4.5$ V |          | 24       |          | 24       |      |
|                     |                                    | $V_{CC} = 5.5$ V |          | 24       |          | 24       |      |
| $\Delta t/\Delta v$ | Input transition rise or fall rate |                  | 0        | 8        | 0        | 8        | 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.



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

| PARAMETER       | TEST CONDITIONS                                             | V <sub>CC</sub> | T <sub>A</sub> = 25°C |       |      | SN54AC10 |     | SN74AC10 |      | UNIT |
|-----------------|-------------------------------------------------------------|-----------------|-----------------------|-------|------|----------|-----|----------|------|------|
|                 |                                                             |                 | MIN                   | TYP   | MAX  | MIN      | MAX | MIN      | MAX  |      |
| V <sub>OH</sub> | I <sub>OH</sub> = – 50 µA                                   | 3 V             | 2.9                   | 2.99  |      | 2.9      |     | 2.9      |      | V    |
|                 |                                                             | 4.5 V           | 4.4                   | 4.99  |      | 4.4      |     | 4.4      |      |      |
|                 |                                                             | 5.5 V           | 5.4                   | 5.49  |      | 5.4      |     | 5.4      |      |      |
|                 | I <sub>OH</sub> = – 12 mA                                   | 3 V             | 2.56                  |       |      | 2.4      |     | 2.46     |      |      |
|                 |                                                             | 4.5 V           | 3.86                  |       |      | 3.7      |     | 3.76     |      |      |
|                 | I <sub>OH</sub> = – 24 mA                                   | 4.5 V           | 3.86                  |       |      | 3.7      |     | 3.76     |      |      |
|                 |                                                             | 5.5 V           | 4.86                  |       |      | 4.7      |     | 4.76     |      |      |
| V <sub>OL</sub> | I <sub>OL</sub> = 50 µA                                     | 3 V             |                       | 0.002 | 0.1  |          | 0.1 |          | 0.1  | V    |
|                 |                                                             | 4.5 V           |                       | 0.001 | 0.1  |          | 0.1 |          | 0.1  |      |
|                 |                                                             | 5.5 V           |                       | 0.001 | 0.1  |          | 0.1 |          | 0.1  |      |
|                 | I <sub>OL</sub> = 12 mA                                     | 3 V             |                       |       | 0.36 |          | 0.5 |          | 0.44 |      |
|                 |                                                             | 4.5 V           |                       |       | 0.36 |          | 0.5 |          | 0.44 |      |
|                 | I <sub>OL</sub> = 24 mA                                     | 4.5 V           |                       |       | 0.36 |          | 0.5 |          | 0.44 |      |
|                 |                                                             | 5.5 V           |                       |       | 0.36 |          | 0.5 |          | 0.44 |      |
| I <sub>I</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 5.5 V           |                       |       | ±0.1 |          | ±1  |          | ±1   | µA   |
|                 |                                                             | 5.5 V           |                       |       | 2    |          | 80  |          | 20   | µA   |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 | 5.5 V           |                       |       | 2    |          | 80  |          | 20   | µA   |
| C <sub>i</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 5 V             |                       | 2.6   |      |          |     |          |      | pF   |

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | T <sub>A</sub> = 25°C |     |     | SN54AC10 |     | SN74AC10 |      | UNIT |
|------------------|--------------|-------------|-----------------------|-----|-----|----------|-----|----------|------|------|
|                  |              |             | MIN                   | TYP | MAX | MIN      | MAX | MIN      | MAX  |      |
| t <sub>PLH</sub> | Any          | Y           | 1.5                   | 6   | 9.5 | 1        | 11  | 1        | 10.5 | ns   |
| t <sub>PHL</sub> |              |             | 1.5                   | 5.5 | 8.5 | 1        | 10  | 1        | 10   |      |

switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | T <sub>A</sub> = 25°C |     |     | SN54AC10 |     | SN74AC10 |     | UNIT |
|------------------|--------------|-------------|-----------------------|-----|-----|----------|-----|----------|-----|------|
|                  |              |             | MIN                   | TYP | MAX | MIN      | MAX | MIN      | MAX |      |
| t <sub>PLH</sub> | Any          | Y           | 1.5                   | 4.5 | 7   | 1        | 8.5 | 1        | 8   | ns   |
| t <sub>PHL</sub> |              |             | 1.5                   | 4   | 6   | 1        | 7   | 1        | 6.5 |      |

operating characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

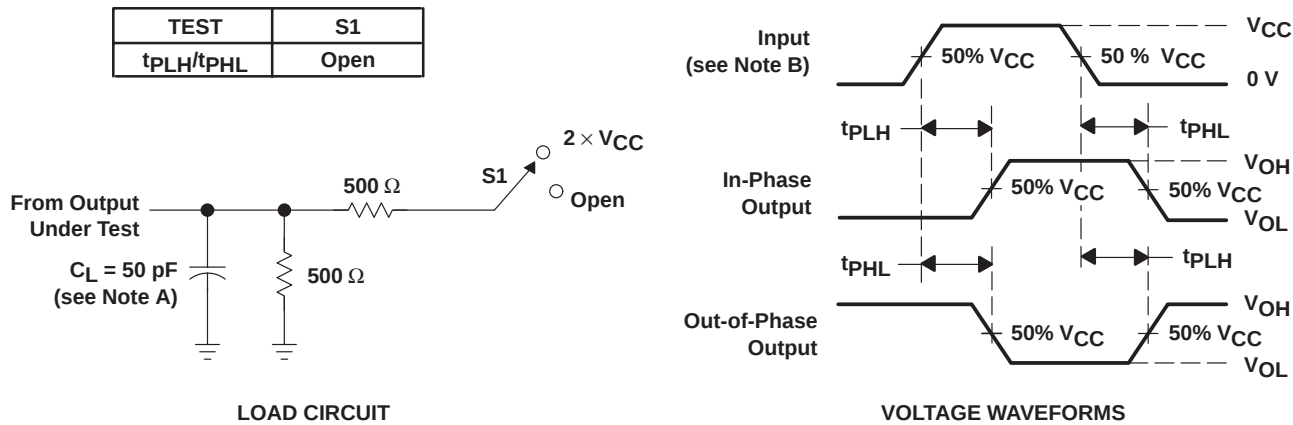
| PARAMETER                                     | TEST CONDITIONS                   | TYP | UNIT |
|-----------------------------------------------|-----------------------------------|-----|------|
| C <sub>pd</sub> Power dissipation capacitance | C <sub>L</sub> = 50 pF, f = 1 MHz | 25  | pF   |



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PARAMETER MEASUREMENT INFORMATION



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ ,  $t_r \leq 2.5\text{ ns}$ ,  $t_f \leq 2.5\text{ ns}$ .  
C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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