

# SN54F20, SN74F20

## DUAL 4-INPUT POSITIVE-NAND GATES

SDFS041A – MARCH 1987 – REVISED OCTOBER 1993

- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

### description

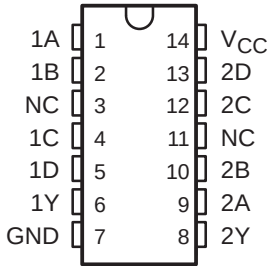
These devices contain two independent 4-input NAND gates. They perform the Boolean functions  $Y = A \bullet B \bullet C \bullet D$  or  $Y = \overline{A + B + C + D}$  in positive logic.

The SN54F20 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74F20 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

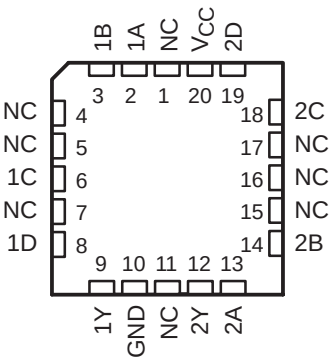
FUNCTION TABLE  
(each gate)

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

SN54F20 . . . J PACKAGE  
SN74F20 . . . D OR N PACKAGE  
(TOP VIEW)

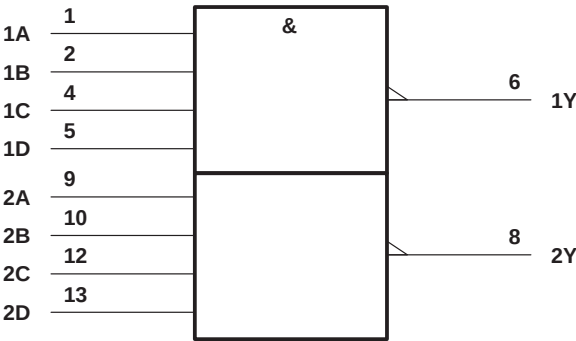


SN54F20 . . . FK PACKAGE  
(TOP VIEW)



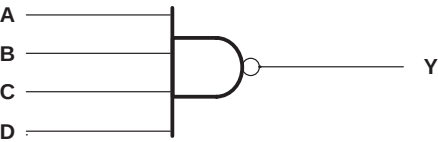
NC – No internal connection

### logic symbol†



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

### logic diagram, each gate (positive logic)



# SN54F20, SN74F20

## DUAL 4-INPUT POSITIVE-NAND GATES

SDFS041A – MARCH 1987 – REVISED OCTOBER 1993

### 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)               | –1.2 V to 7 V      |
| Input current range                                   | –30 mA to 5 mA     |
| Voltage range applied to any output in the high state | –0.5 V to $V_{CC}$ |
| Current into any output in the low state              | 40 mA              |
| Operating free-air temperature range: SN54F20         | –55°C to 125°C     |
| SN74F20                                               | 0°C to 70°C        |
| Storage temperature range                             | –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.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

### recommended operating conditions

|          |                                | SN54F20 |     |     | SN74F20 |     |     | 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      |         |     | –1  |         |     | –1  | mA   |
| $I_{OL}$ | Low-level output current       |         |     | 20  |         |     | 20  | mA   |
| $T_A$    | Operating free-air temperature | –55     |     | 125 | 0       |     | 70  | °C   |

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

| PARAMETER     | TEST CONDITIONS    |                  | SN54F20 |                  |      | SN74F20 |                  |      | UNIT |
|---------------|--------------------|------------------|---------|------------------|------|---------|------------------|------|------|
|               |                    |                  | MIN     | TYP <sup>‡</sup> | MAX  | MIN     | TYP <sup>‡</sup> | MAX  |      |
| $V_{IK}$      | $V_{CC} = 4.5$ V,  | $I_I = -18$ mA   |         |                  | –1.2 |         |                  | –1.2 | V    |
| $V_{OH}$      | $V_{CC} = 4.5$ V,  | $I_{OH} = -1$ mA | 2.5     | 3.4              |      | 2.5     | 3.4              |      | V    |
|               | $V_{CC} = 4.75$ V, | $I_{OH} = -1$ mA |         |                  |      | 2.7     |                  |      |      |
| $V_{OL}$      | $V_{CC} = 4.5$ V,  | $I_{OL} = 20$ mA |         | 0.3              | 0.5  |         | 0.3              | 0.5  | V    |
| $I_I$         | $V_{CC} = 5.5$ V,  | $V_I = 7$ V      |         |                  | 0.1  |         |                  | 0.1  | mA   |
| $I_{IH}$      | $V_{CC} = 5.5$ V,  | $V_I = 2.7$ V    |         |                  | 20   |         |                  | 20   | μA   |
| $I_{IL}$      | $V_{CC} = 5.5$ V,  | $V_I = 0.5$ V    |         |                  | –0.6 |         |                  | –0.6 | mA   |
| $I_{OS}^{\S}$ | $V_{CC} = 5.5$ V,  | $V_O = 0$        | –60     |                  | –150 | –60     |                  | –150 | mA   |
| $I_{CCH}$     | $V_{CC} = 5.5$ V,  | $V_I = 0$        |         | 0.9              | 1.4  |         | 0.9              | 1.4  | mA   |
| $I_{CCL}$     | $V_{CC} = 5.5$ V,  | $V_I = 4.5$ V    |         | 3.4              | 5.1  |         | 3.4              | 5.1  | mA   |

<sup>‡</sup> All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$ .

<sup>\S</sup> Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.



# SN54F20, SN74F20

## DUAL 4-INPUT POSITIVE-NAND GATES

SDFS041A – MARCH 1987 – REVISED OCTOBER 1993

### switching characteristics (see Note 2)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> = 5 V,<br>C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω,<br>T <sub>A</sub> = 25°C |     |     | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω,<br>T <sub>A</sub> = MIN to MAX† |     |         |     | UNIT |
|------------------|-----------------|----------------|-------------------------------------------------------------------------------------------------------|-----|-----|-------------------------------------------------------------------------------------------------------------------------|-----|---------|-----|------|
|                  |                 |                | ‘F20                                                                                                  |     |     | SN54F20                                                                                                                 |     | SN74F20 |     |      |
|                  |                 |                | MIN                                                                                                   | TYP | MAX | MIN                                                                                                                     | MAX | MIN     | MAX |      |
| t <sub>PLH</sub> | A, B, C, or D   | Y              | 1.6                                                                                                   | 3.3 | 5   | 1.2                                                                                                                     | 7   | 1.6     | 6   | ns   |
| t <sub>PHL</sub> |                 |                | 1                                                                                                     | 2.8 | 4.3 | 1                                                                                                                       | 6.5 | 1       | 5.3 |      |

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

NOTE 2: Load circuits and waveforms are shown in Section 1.





## **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.