

# SN54F21, SN74F21 DUAL 4-INPUT POSITIVE-AND GATES

SDFS006A – MARCH 1987 – REVISED OCTOBER 1993

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

## description

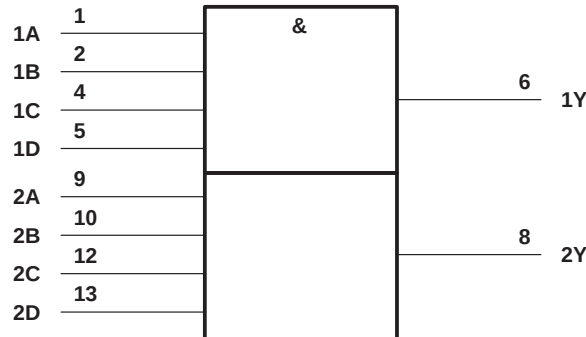
These devices contain two independent 4-input AND gates. They perform the Boolean functions  $Y = A \cdot B \cdot C \cdot D$  or  $Y = \overline{A} + \overline{B} + \overline{C} + \overline{D}$  in positive logic.

The SN54F21 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74F21 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE  
(each gate)

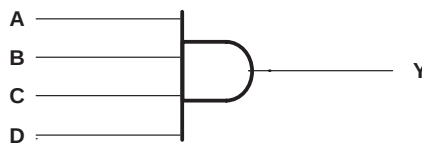
| INPUTS |   |   |   | OUTPUT<br>Y |
|--------|---|---|---|-------------|
| A      | B | C | D |             |
| H      | H | H | H | H           |
| L      | X | X | X | L           |
| X      | L | X | X | L           |
| X      | X | L | X | L           |
| X      | X | X | L | L           |

## logic symbol†

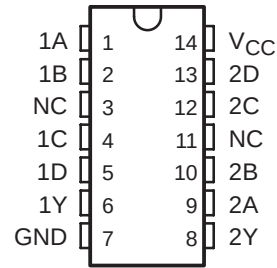


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, J, and N packages.

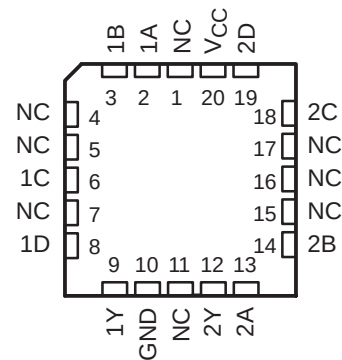
## logic diagram, each gate (positive logic)



SN54F21 . . . J PACKAGE  
SN74F21 . . . D OR N PACKAGE  
(TOP VIEW)



SN54F21 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

# SN54F21, SN74F21

## DUAL 4-INPUT POSITIVE-AND 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)               | –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: SN54F21         | –55°C to 125°C     |
| SN74F21                                               | 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

|          |                                | SN54F21 |     |     | SN74F21 |     |     | 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    |                  | SN54F21 |                  |      | SN74F21 |                  |      | 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,  | $V_I = 4.5$ V    |         | 2.8              | 4.3  |         | 2.8              | 4.3  | mA   |
| $I_{CCL}$     | $V_{CC} = 5.5$ V,  | $V_I = 0$        |         | 4.7              | 7.3  |         | 4.7              | 7.3  | 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.

# SN54F21, SN74F21 DUAL 4-INPUT POSITIVE-AND GATES

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## 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 |
|------------------|-----------------|----------------|-------------------------------------------------------------------------------------------------------|-----|-----|-------------------------------------------------------------------------------------------------------------------------|-----|---------|-----|------|
|                  |                 |                | ‘F21                                                                                                  |     |     | SN54F21                                                                                                                 |     | SN74F21 |     |      |
|                  |                 |                | MIN                                                                                                   | TYP | MAX | MIN                                                                                                                     | MAX | MIN     | MAX |      |
| t <sub>PLH</sub> | A, B, C, or D   | Y              | 1                                                                                                     | 3.2 | 4.7 | 1                                                                                                                       | 5.6 | 1       | 5.3 | ns   |
| t <sub>PHL</sub> |                 |                | 1.5                                                                                                   | 3.4 | 5.1 | 1.5                                                                                                                     | 5.9 | 1.5     | 5.5 |      |

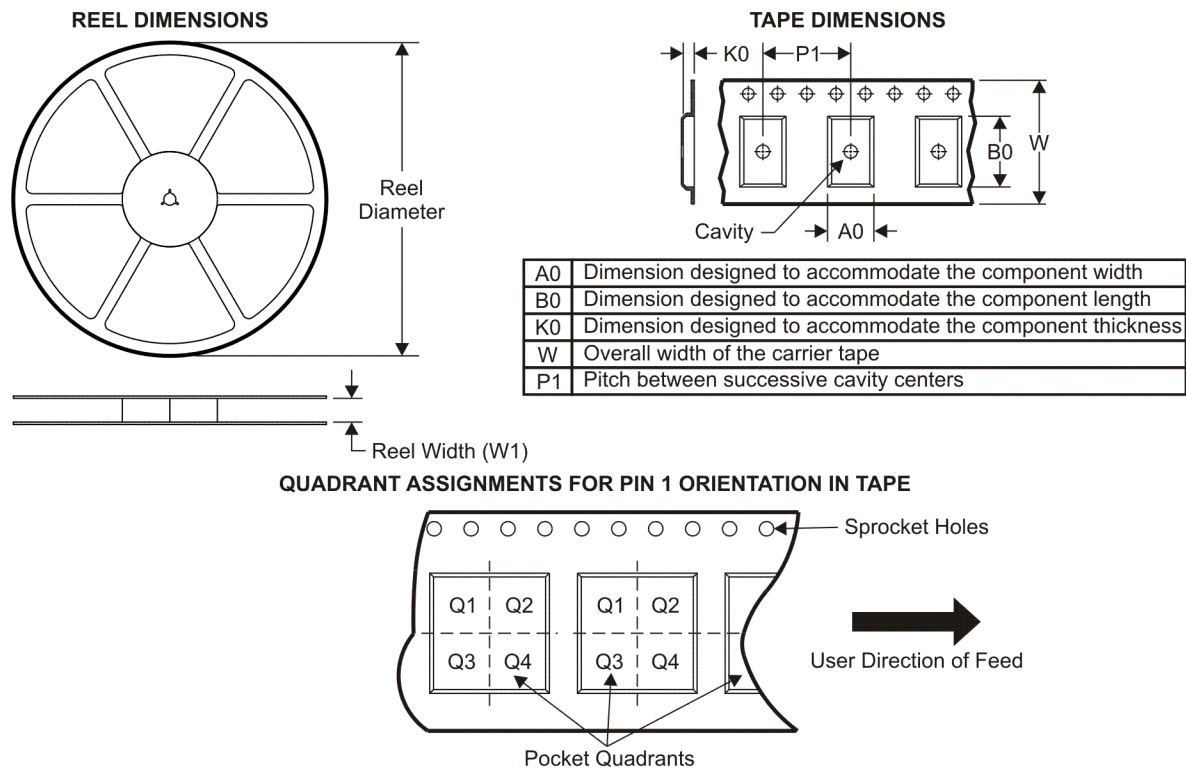
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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





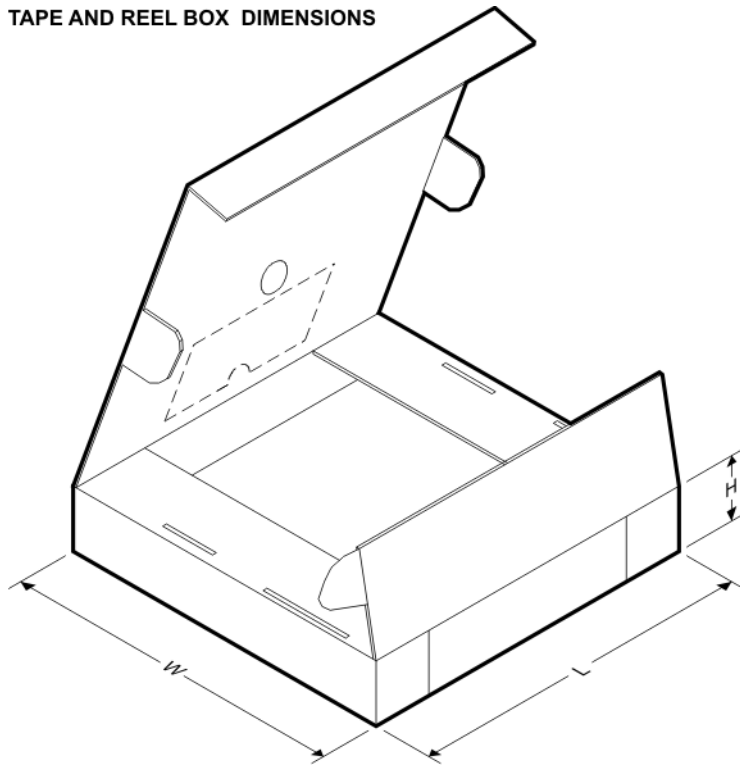
**TAPE AND REEL INFORMATION**



\*All dimensions are nominal

| Device    | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74F21DR | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device    | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74F21DR | SOIC         | D               | 14   | 2500 | 346.0       | 346.0      | 33.0        |

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