

# SN54F38, SN74F38 QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

SDFS013A – 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 four independent 2-input NAND buffer gates with open-collector outputs. They perform the Boolean functions  $Y = \overline{A \cdot B}$  or  $Y = A + \overline{B}$  in positive logic.

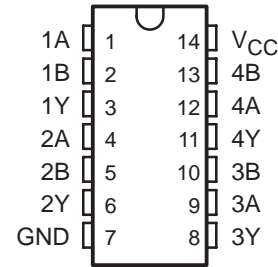
The open-collector outputs require pullup resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher  $V_{OH}$  levels.

The SN54F38 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74F38 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

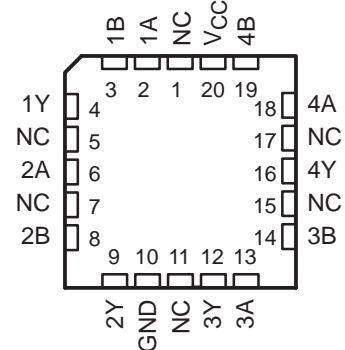
FUNCTION TABLE  
(each gate)

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

SN54F38 . . . J PACKAGE  
SN74F38 . . . D OR N PACKAGE  
(TOP VIEW)

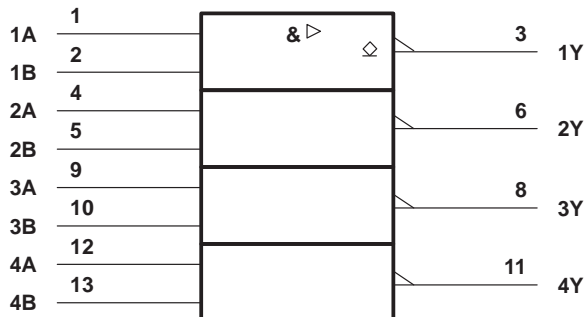


SN54F38 . . . FK PACKAGE  
(TOP VIEW)

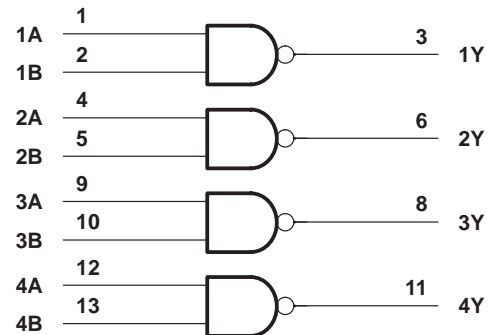


NC – No internal connection

## logic symbol†



## logic diagram (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, J, and N packages.

# SN54F38, SN74F38

## QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS

### WITH OPEN-COLLECTOR OUTPUTS

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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 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              | 128 mA             |
| Operating free-air temperature range: SN54F38         | –55°C to 125°C     |
| SN74F38   | 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

|          |                                | SN54F38 |     |     | SN74F38 |     |     | 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   |
| $V_{OH}$ | High-level output voltage      |         |     | 4.5 |         |     | 4.5 | V    |
| $I_{OL}$ | Low-level output current       |         |     | 48  |         |     | 64  | 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          |                          | SN54F38 |      |       | SN74F38 |       |     | UNIT |
|------------------|--------------------------|--------------------------|---------|------|-------|---------|-------|-----|------|
|                  |                          |                          | MIN     | TYP‡ | MAX   | MIN     | TYP‡  | MAX |      |
| V <sub>IK</sub>  | V <sub>CC</sub> = 4.5 V, | I <sub>I</sub> = – 18 mA | –0.73   | –1.2 |       |         | –1.2  | V   |      |
| V <sub>OL</sub>  | V <sub>CC</sub> = 4.5 V, | I <sub>OL</sub> = 48 mA  | 0.3     | 0.5  |       | 0.3     | 0.5   | V   |      |
|                  | V <sub>CC</sub> = 4.5 V, | I <sub>OL</sub> = 64 mA  | 0.3     | 0.5  |       | 0.3     | 0.5   |     |      |
| I <sub>I</sub>   | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 7 V     |         |      | 0.1   |         | 0.1   | mA  |      |
| I <sub>IH</sub>  | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 2.7 V   |         |      | 20    |         | 20    | μA  |      |
| I <sub>IL</sub>  | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 0.5 V   |         |      | – 0.6 |         | – 0.6 | mA  |      |
| I <sub>OH</sub>  | V <sub>CC</sub> = 4.5 V  |                          |         |      | 250   |         | 250   | μA  |      |
| I <sub>CCH</sub> | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 0       | 4       | 7    |       | 4       | 7     | mA  |      |
| I <sub>CCL</sub> | V <sub>CC</sub> = 5.5 V, | V <sub>I</sub> = 4.5 V   | 22      | 30   |       | 22      | 30    | mA  |      |

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

**SN54F38, SN74F38**  
**QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS**  
**WITH OPEN-COLLECTOR OUTPUTS**

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**switching characteristics (see Note 2)**

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | VCC = 5 V,<br>CL = 50 pF,<br>RL = 500 Ω,<br>TA = 25°C |     |      | VCC = 4.5 V to 5.5 V,<br>CL = 50 pF,<br>RL = 500 Ω,<br>TA = MIN to MAX† |     |         |     | UNIT |
|-----------|-----------------|----------------|---|-----|------|---|-----|---------|-----|------|
|           |                 |                | 'F38  |     |      | SN54F38   |     | SN74F38 |     |      |
|           |                 |                | MIN   | TYP | MAX  | MIN   | MAX | MIN     | MAX |      |
| tPLH      | A or B          | Y              | 6.7   | 9.6 | 12.5 | 6.2   | 14  | 6.7     | 13  | ns   |
| tPHL      |                 |                | 1   | 2.6 | 5    | 1   | 6.5 | 1       | 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.





## PACKAGING INFORMATION

| Orderable part number      | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">SN74F38D</a>   | Obsolete      | Production           | SOIC (D)   14  | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | F38                 |
| <a href="#">SN74F38DR</a>  | Active        | Production           | SOIC (D)   14  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | F38                 |
| SN74F38DR.A                | Active        | Production           | SOIC (D)   14  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | F38                 |
| SN74F38DRG4                | Active        | Production           | SOIC (D)   14  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | F38                 |
| <a href="#">SN74F38N</a>   | Active        | Production           | PDIP (N)   14  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | SN74F38N            |
| SN74F38N.A                 | Active        | Production           | PDIP (N)   14  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | SN74F38N            |
| SN74F38N.B                 | Active        | Production           | PDIP (N)   14  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | SN74F38N            |
| <a href="#">SN74F38NSR</a> | Active        | Production           | SOP (NS)   14  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 74F38               |
| SN74F38NSR.A               | Active        | Production           | SOP (NS)   14  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 74F38               |
| SN74F38NSR.B               | Active        | Production           | SOP (NS)   14  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 74F38               |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## 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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74F38DR  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74F38NSR | SOP          | NS              | 14   | 2000 | 330.0              | 16.4               | 8.45    | 10.55   | 2.5     | 12.0    | 16.2   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device     | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74F38DR  | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| SN74F38NSR | SOP          | NS              | 14   | 2000 | 353.0       | 353.0      | 32.0        |



## TUBE



\*All dimensions are nominal

| Device     | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN74F38N   | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74F38N   | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74F38N.A | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74F38N.A | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74F38N.B | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74F38N.B | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |

**D0014A****PACKAGE OUTLINE****SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

**NOTES:**

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.

# EXAMPLE BOARD LAYOUT

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

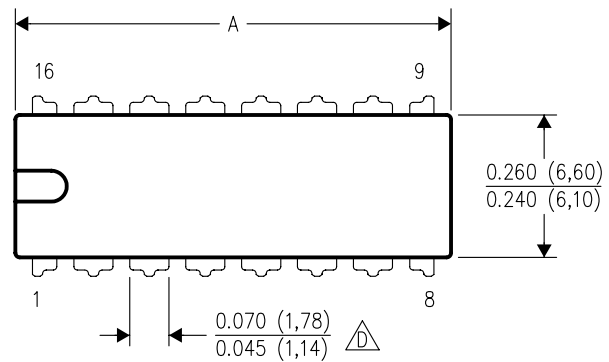


- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

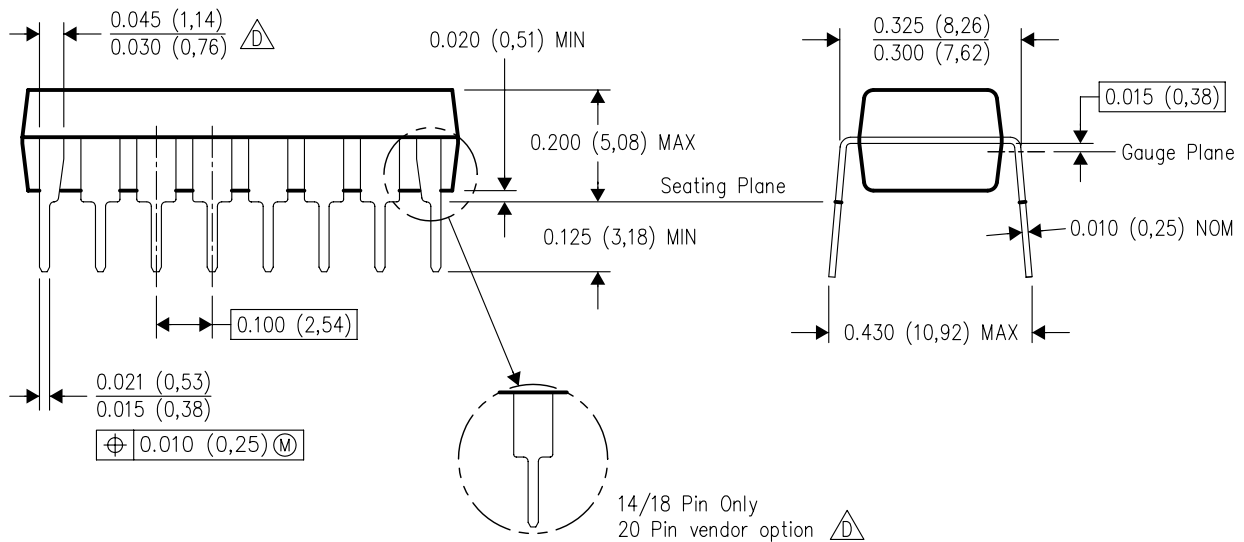
N (R-PDIP-T\*\*)

16 PINS SHOWN

# PLASTIC DUAL-IN-LINE PACKAGE



| DIM \ PINS **       | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

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