

# TC4001BP/BF, TC4002BP/BF, TC4025BP/BF

C<sup>2</sup>MOS DIGITAL INTEGRATED CIRCUIT  
SILICON MONOLITHIC

TC4001BP/TC4001BF QUAD 2 INPUT NOR GATE  
TC4002BP/TC4002BF DUAL 4 INPUT NOR GATE  
TC4025BP/TC4025BF TRIPLE 3 INPUT NOR GATE

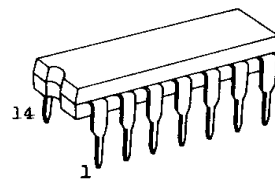
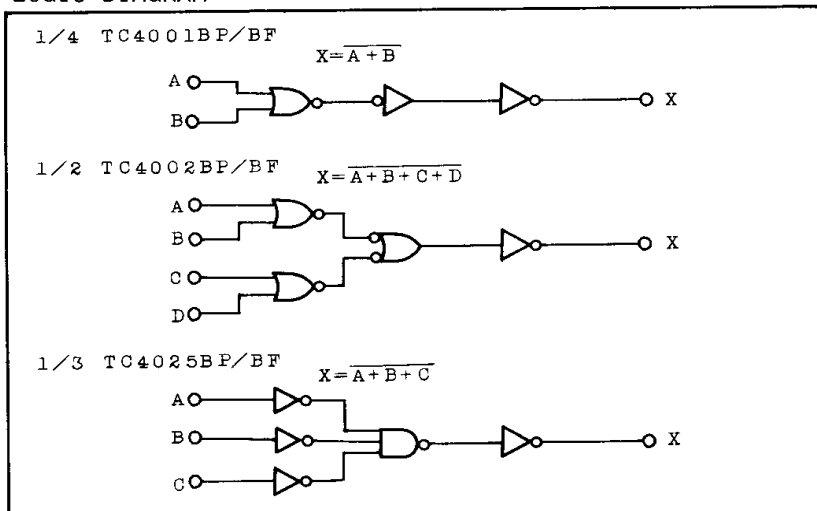
The TC4001BP/BF, the TC4025BP/BF and TC4002BP/BF are 2-input, 3-input, 4-input positive NOR gate, respectively.

Since the outputs of these gates are equipped with the buffers, the input/output transmission characteristics have been improved and the variation of transmission time due to an increase in the load capacity is kept minimum.

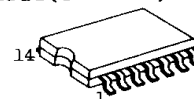
## ABSOLUTE MAXIMUM RATINGS

| CHARACTERISTIC              | SYMBOL           | RATING                                      | UNIT |
|-----------------------------|------------------|---|------|
| DC Supply Voltage           | V <sub>DD</sub>  | V <sub>SS</sub> -0.5 ~ V <sub>SS</sub> +20  | V    |
| Input Voltage               | V <sub>IN</sub>  | V <sub>SS</sub> -0.5 ~ V <sub>DD</sub> +0.5 | V    |
| Output Voltage              | V <sub>OUT</sub> | V <sub>SS</sub> -0.5 ~ V <sub>DD</sub> +0.5 | V    |
| DC Input Current            | I <sub>IN</sub>  | ±10   | mA   |
| Power Dissipation           | P <sub>D</sub>   | 300(DIP)/180(MFP)                           | mW   |
| Operating Temperature Range | T <sub>A</sub>   | -40 ~ 85                                    | °C   |
| Storage Temperature Range   | T <sub>stg</sub> | -65 ~ 150                                   | °C   |
| Lead Temp./Time             | T <sub>sol</sub> | 260°C · 10 sec                              |      |

## LOGIC DIAGRAM



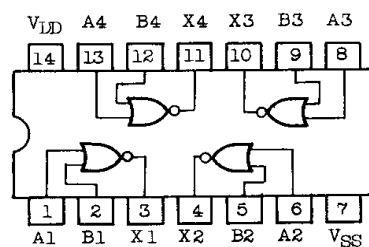
DIP14(3D14A-P)



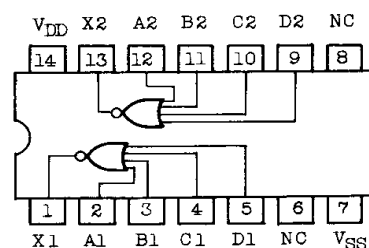
MFP14(F14GB-P)

## PIN ASSIGNMENT (TOP VIEW)

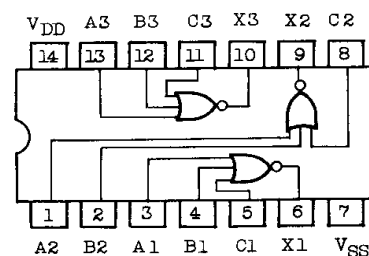
TC4001BP/BF



TC4002BP/BF



TC4025BP/BF



# TC4001BP/BF, TC4002BP/BF, TC4025BP/BF

## RECOMMENDED OPERATING CONDITIONS (V<sub>SS</sub>=0V)

| CHARACTERISTICS   | SYMBOL          | MIN. | TYP. | MAX.            | UNITS |
|-------------------|-----------------|------|------|-----------------|-------|
| DC Supply Voltage | V <sub>DD</sub> | 3    | -    | 18              | V     |
| Input Voltage     | V <sub>IN</sub> | 0    | -    | V <sub>DD</sub> | V     |

## STATIC ELECTRICAL CHARACTERISTICS (V<sub>SS</sub>=0V)

| CHARACTERISTIC            | SYMBOL          | TEST CONDITIONS   | V <sub>DD</sub><br>(V) | -40°C |      | 25°C  |       |                   | 85°C  |      | UNITS |    |
|---------------------------|-----------------|---|------------------------|-------|------|-------|-------|-------------------|-------|------|-------|----|
|                           |                 |   |                        | MIN.  | MAX. | MIN.  | TYP.  | MAX.              | MIN.  | MAX. |       |    |
| High-Level Output Voltage | V <sub>OH</sub> | I <sub>OUT</sub>   < 1μA<br>V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub>  | 5                      | 4.95  | -    | 4.95  | 5.00  | -                 | 4.95  | -    | V     |    |
|                           |                 |   | 10                     | 9.95  | -    | 9.95  | 10.00 | -                 | 9.95  | -    |       |    |
|                           |                 |   | 15                     | 14.95 | -    | 14.95 | 15.00 | -                 | 14.95 | -    |       |    |
| Low-Level Output Voltage  | V <sub>OL</sub> | I <sub>OUT</sub>   < 1μA<br>V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub>  | 5                      | -     | 0.05 | -     | 0.00  | 0.05              | -     | 0.05 | V     |    |
|                           |                 |   | 10                     | -     | 0.05 | -     | 0.00  | 0.05              | -     | 0.05 |       |    |
|                           |                 |   | 15                     | -     | 0.05 | -     | 0.00  | 0.05              | -     | 0.05 |       |    |
| Output High Current       | I <sub>OH</sub> | V <sub>OH</sub> =4.6V<br>V <sub>OH</sub> =2.5V<br>V <sub>OH</sub> =9.5V<br>V <sub>OH</sub> =13.5V<br>V <sub>IN</sub> =V <sub>SS</sub> | 5                      | -0.61 | -    | -0.51 | -1.0  | -                 | -0.42 | -    | mA    |    |
|                           |                 |   | 5                      | -2.5  | -    | -2.1  | -4.0  | -                 | -1.7  | -    |       |    |
|                           |                 |   | 10                     | -1.5  | -    | -1.3  | -2.2  | -                 | -1.1  | -    |       |    |
|                           |                 |   | 15                     | -4.0  | -    | -3.4  | -9.0  | -                 | -2.8  | -    |       |    |
|                           |                 |   |                        |       |      |       |       |                   |       |      |       |    |
| Output Low Current        | I <sub>OL</sub> | V <sub>OL</sub> =0.4V<br>V <sub>OL</sub> =0.5V<br>V <sub>OL</sub> =1.5V<br>V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub>         | 5                      | 0.61  | -    | 0.51  | 1.2   | -                 | 0.42  | -    | mA    |    |
|                           |                 |   | 10                     | 1.5   | -    | 1.3   | 3.2   | -                 | 1.1   | -    |       |    |
|                           |                 |   | 15                     | 4.0   | -    | 3.4   | 12.0  | -                 | 2.8   | -    |       |    |
|                           |                 |   |                        |       |      |       |       |                   |       |      |       |    |
| Input High Voltage        | V <sub>IH</sub> | V <sub>OUT</sub> =0.5V<br>V <sub>OUT</sub> =1.0V<br>V <sub>OUT</sub> =1.5V, 13.5V<br> I <sub>OUT</sub>   < 1μA                        | 5                      | 3.5   | -    | 3.5   | 2.75  | -                 | 3.5   | -    | V     |    |
|                           |                 |   | 10                     | 7.0   | -    | 7.0   | 5.5   | -                 | 7.0   | -    |       |    |
|                           |                 |   | 15                     | 11.0  | -    | 11.0  | 8.25  | -                 | 11.0  | -    |       |    |
|                           |                 |   |                        |       |      |       |       |                   |       |      |       |    |
| Input Low Voltage         | V <sub>IL</sub> | V <sub>OUT</sub> =0.5V, 4.5V<br>V <sub>OUT</sub> =1.0V, 9.0V<br>V <sub>OUT</sub> =1.5V, 13.5V<br> I <sub>OUT</sub>   < 1μA            | 5                      | -     | 1.5  | -     | 2.25  | 1.5               | -     | 1.5  | V     |    |
|                           |                 |   | 10                     | -     | 3.0  | -     | 4.5   | 3.0               | -     | 3.0  |       |    |
|                           |                 |   | 15                     | -     | 4.0  | -     | 6.75  | 4.0               | -     | 4.0  |       |    |
|                           |                 |   |                        |       |      |       |       |                   |       |      |       |    |
| Input Current             | "H" Level       | I <sub>IH</sub>   | V <sub>IH</sub> =18V   | 18    | -    | 0.1   | -     | 10 <sup>-5</sup>  | 0.1   | -    | 1.0   | μA |
|                           | "L" Level       | I <sub>IL</sub>   | V <sub>IL</sub> =0V    | 18    | -    | -0.1  | -     | -10 <sup>-5</sup> | -0.1  | -    | -1.0  |    |
| Quiescent Device Current  | I <sub>DD</sub> | V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub><br>*   | 5                      | -     | 0.25 | -     | 0.001 | 0.25              | -     | 7.5  | μA    |    |
|                           |                 |   | 10                     | -     | 0.5  | -     | 0.001 | 0.5               | -     | 15   |       |    |
|                           |                 |   | 15                     | -     | 1.0  | -     | 0.002 | 1.0               | -     | 30   |       |    |

\* All valid input combinations.

# TC4001BP/BF, TC4002BP/BF, TC4025BP/BF

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta=25°C, VSS=0V, CL=50pF)

| CHARACTERISTIC  | SYMBOL           | TEST CONDITION | VDD(V) | MIN. | TYP. | MAX. | UNITS |
|---|------------------|----------------|--------|------|------|------|-------|
| Output Transition Time<br>(TC4002BP/BF)                   | t <sub>TLH</sub> |                | 5      | -    | 80   | 200  | ns    |
|   |                  |                | 10     | -    | 50   | 100  |       |
|   |                  |                | 15     | -    | 40   | 80   |       |
| Output Transition Time<br>(TC4002BP/BF)                   | t <sub>THL</sub> |                | 5      | -    | 80   | 200  |       |
|   |                  |                | 10     | -    | 50   | 100  |       |
|   |                  |                | 15     | -    | 40   | 80   |       |
| Output Transition Time<br>(TC4001BP/BF),<br>(TC4025BP/BF) | t <sub>TLH</sub> |                | 5      | -    | 70   | 200  |       |
|   |                  |                | 10     | -    | 35   | 100  |       |
|   |                  |                | 15     | -    | 30   | 80   |       |
| Output Transition Time<br>(TC4001BP/BF),<br>(TC4025BP/BF) | t <sub>THL</sub> |                | 5      | -    | 70   | 200  |       |
|   |                  |                | 10     | -    | 35   | 100  |       |
|   |                  |                | 15     | -    | 30   | 80   |       |
| Propagation Delay Time<br>(TC4001BP/BF)                   | t <sub>pLH</sub> |                | 5      | -    | 65   | 200  |       |
|   |                  |                | 10     | -    | 30   | 100  |       |
|   |                  |                | 15     | -    | 25   | 80   |       |
| Propagation Delay Time<br>(TC4001BP/BF)                   | t <sub>pHL</sub> |                | 5      | -    | 65   | 200  |       |
|   |                  |                | 10     | -    | 30   | 100  |       |
|   |                  |                | 15     | -    | 25   | 80   |       |
| Propagation Delay Time,<br>(TC4002BP/BF)                  | t <sub>pLH</sub> |                | 5      | -    | 100  | 250  |       |
|   |                  |                | 10     | -    | 40   | 120  |       |
|   |                  |                | 15     | -    | 30   | 90   |       |
| Propagation Delay Time<br>(TC4002BP/BF)                   | t <sub>pHL</sub> |                | 5      | -    | 100  | 250  |       |
|   |                  |                | 10     | -    | 40   | 120  |       |
|   |                  |                | 15     | -    | 30   | 90   |       |
| Propagation Delay Time<br>(TC4025BP/BF)                   | t <sub>pLH</sub> |                | 5      | -    | 70   | 200  |       |
|   |                  |                | 10     | -    | 35   | 100  |       |
|   |                  |                | 15     | -    | 30   | 80   |       |
| Propagation Delay Time<br>(TC4025BP/BF)                   | t <sub>pHL</sub> |                | 5      | -    | 70   | 200  |       |
|   |                  |                | 10     | -    | 35   | 100  |       |
|   |                  |                | 15     | -    | 30   | 80   |       |
| Input Capacitance   | C <sub>IN</sub>  |                |        | -    | 5    | 7.5  | pF    |

## CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

