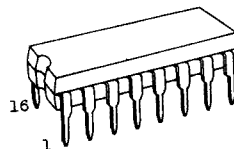


TC4501BP TRIPLE GATE (Dual 4-Input NAND Gate and 2-Input NOR/OR Gate or 8-Input AND/NAND Gate)

The TC4501BP is a combined gate which contains dual 4-input NAND gate and 2-input NOR/OR gate in one package.

Since all the outputs of these gates are provided with the buffers of inverters, the input/output transmission characteristics have been improved and the noise immunity has been elevated. Further, an increase in propagation delay time caused by an increase in load capacity is kept to a minimum.

The TC4501BP can be used as 8-input positive AND/NAND gate by externally connecting the output of NAND gate to the input of NOR/OR gate.



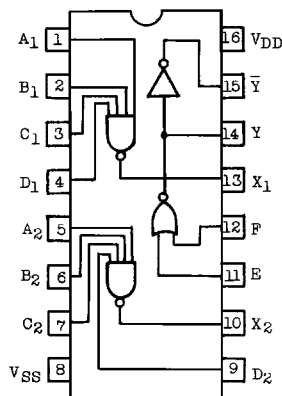
P(DIP16-P-300A)

Weight : 1.0g(Typ.)

## 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                                           | 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                                |      |

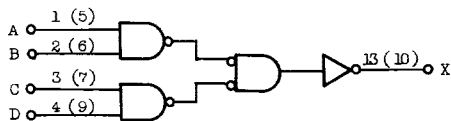
## PIN ASSIGNMENT



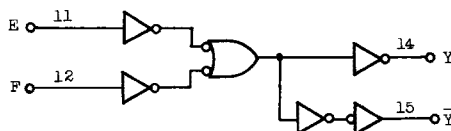
(TOP VIEW)

## LOGIC DIAGRAM

### NAND



### NOR/OR



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

| CHARACTERISTIC    | 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                                                          | 5                      | -0.61 | -    | -0.51 | -1.0              | -    | -0.42 | -    | mA    |
|                           |           |                 | V <sub>OH</sub> =2.5V                                                          | 5                      | -2.5  | -    | -2.1  | -4.0              | -    | -1.7  | -    |       |
|                           |           |                 | V <sub>OH</sub> =9.5V                                                          | 10                     | -1.5  | -    | -1.3  | -2.2              | -    | -1.1  | -    |       |
|                           |           |                 | V <sub>OH</sub> =13.5V                                                         | 15                     | -4.0  | -    | -3.4  | -9.0              | -    | -2.8  | -    |       |
|                           |           |                 | V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub>                             |                        |       |      |       |                   |      |       |      |       |
| Output Low Current        |           | I <sub>OL</sub> | V <sub>OL</sub> =0.4V                                                          | 5                      | 0.61  | -    | 0.51  | 1.5               | -    | 0.42  | -    | mA    |
|                           |           |                 | V <sub>OL</sub> =0.5V                                                          | 10                     | 1.5   | -    | 1.3   | 3.8               | -    | 1.1   | -    |       |
|                           |           |                 | V <sub>OL</sub> =1.5V                                                          | 15                     | 4.0   | -    | 3.4   | 15.0              | -    | 2.8   | -    |       |
|                           |           |                 | V <sub>IN</sub> =V <sub>SS</sub> , V <sub>DD</sub>                             |                        |       |      |       |                   |      |       |      |       |
| Input High Voltage        |           | V <sub>IH</sub> | V <sub>OUT</sub> =0.5V, 4.5V                                                   | 5                      | 3.5   | -    | 3.5   | 2.75              | -    | 3.5   | -    | V     |
|                           |           |                 | V <sub>OUT</sub> =1.0V, 9.0V                                                   | 10                     | 7.0   | -    | 7.0   | 5.5               | -    | 7.0   | -    |       |
|                           |           |                 | V <sub>OUT</sub> =1.5V, 13.5V                                                  | 15                     | 11.0  | -    | 11.0  | 8.25              | -    | 11.0  | -    |       |
|                           |           |                 | I <sub>OUT</sub>   < 1μA                                                       |                        |       |      |       |                   |      |       |      |       |
| Input Low Voltage         |           | V <sub>IL</sub> | V <sub>OUT</sub> =0.5V, 4.5V                                                   | 5                      | -     | 1.5  | -     | 2.25              | 1.5  | -     | 1.5  | V     |
|                           |           |                 | V <sub>OUT</sub> =1.0V, 9.0V                                                   | 10                     | -     | 3.0  | -     | 4.5               | 3.0  | -     | 3.0  |       |
|                           |           |                 | V <sub>OUT</sub> =1.5V, 13.5V                                                  | 15                     | -     | 4.0  | -     | 6.75              | 4.0  | -     | 4.0  |       |
|                           |           |                 | I <sub>OUT</sub>   < 1μA                                                       |                        |       |      |       |                   |      |       |      |       |
| 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 | -     | 3.8  | μA    |
|                           |           |                 |                                                                                | 10                     | -     | 0.5  | -     | 0.001             | 0.5  | -     | 7.5  |       |
|                           |           |                 |                                                                                | 15                     | -     | 1.0  | -     | 0.002             | 1.0  | -     | 15   |       |

\* All valid input combinations.

**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_a=25^{\circ}\text{C}$ ,  $V_{SS}=0\text{V}$ ,  $C_L=50\text{pF}$ )

| CHARACTERISTIC                          |                                         | SYMBOL           | TEST CONDITION | V <sub>DD</sub> (V) | MIN. | TYP. | MAX. | UNITS |
|-----------------------------------------|-----------------------------------------|------------------|----------------|---------------------|------|------|------|-------|
| Output Transition Time<br>(Low to High) |                                         | t <sub>TLH</sub> |                | 5                   | -    | 80   | 200  | ns    |
|                                         |                                         |                  |                | 10                  | -    | 50   | 100  |       |
|                                         |                                         |                  |                | 15                  | -    | 40   | 80   |       |
| Output Transition Time<br>(High to Low) |                                         | t <sub>THL</sub> |                | 5                   | -    | 80   | 200  |       |
|                                         |                                         |                  |                | 10                  | -    | 50   | 100  |       |
|                                         |                                         |                  |                | 15                  | -    | 40   | 80   |       |
| NAND                                    | Propagation Delay Time<br>(Low to High) | t <sub>pLH</sub> |                | 5                   | -    | 80   | 260  |       |
|                                         |                                         |                  |                | 10                  | -    | 50   | 140  |       |
|                                         |                                         |                  |                | 15                  | -    | 40   | 100  |       |
|                                         | Propagation Delay Time<br>(High to Low) | t <sub>pHL</sub> |                | 5                   | -    | 80   | 260  |       |
|                                         |                                         |                  |                | 10                  | -    | 50   | 140  |       |
|                                         |                                         |                  |                | 15                  | -    | 40   | 100  |       |
| NOR                                     | Propagation Delay Time<br>(Low to High) | t <sub>pLH</sub> |                | 5                   | -    | 100  | 230  |       |
|                                         |                                         |                  |                | 10                  | -    | 50   | 130  |       |
|                                         |                                         |                  |                | 15                  | -    | 40   | 90   |       |
|                                         | Propagation Delay Time<br>(High to Low) | t <sub>pHL</sub> |                | 5                   | -    | 100  | 230  |       |
|                                         |                                         |                  |                | 10                  | -    | 50   | 130  |       |
|                                         |                                         |                  |                | 15                  | -    | 40   | 90   |       |
| NOR-Inverter                            | Propagation Delay Time<br>(Low to High) | t <sub>pLH</sub> |                | 5                   | -    | 130  | 260  |       |
|                                         |                                         |                  |                | 10                  | -    | 70   | 140  |       |
|                                         |                                         |                  |                | 15                  | -    | 50   | 100  |       |
|                                         | Propagation Delay Time<br>(High to Low) | t <sub>pHL</sub> |                | 5                   | -    | 130  | 260  |       |
|                                         |                                         |                  |                | 10                  | -    | 70   | 140  |       |
|                                         |                                         |                  |                | 15                  | -    | 50   | 100  |       |
| Input Capacitance                       |                                         | C <sub>IN</sub>  |                |                     | -    | 5    | 7.5  | pF    |

### CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

