

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

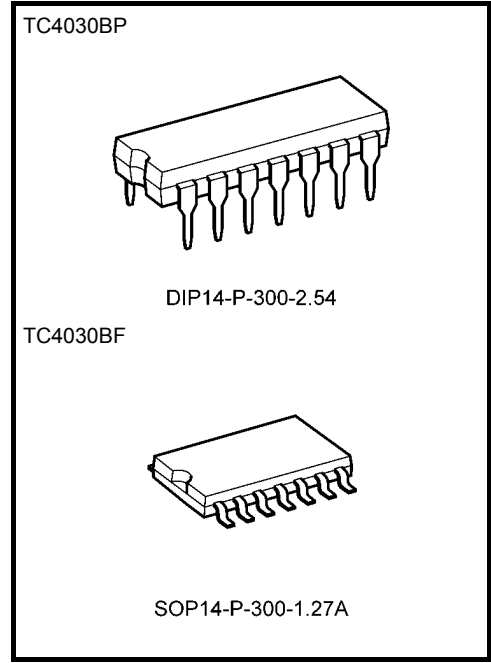
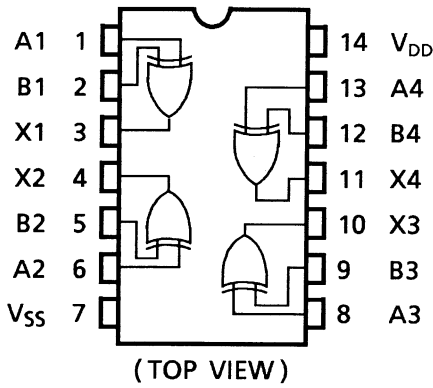
# TC4030BP, TC4030BF

## TC4030B Quad Exclusive-OR Gate

TC4030B contains four circuits of exclusive OR gates. Since the buffers of two stage inverters are provided for all the outputs, the input/output voltage characteristic has been improved and the noise immunity has been also improved. And increase of transmission time due to load capacity increase is kept minimum.

Wide variety of applicaitons are offered, such as digital comparators and parity circuits.

### Pin Assignment



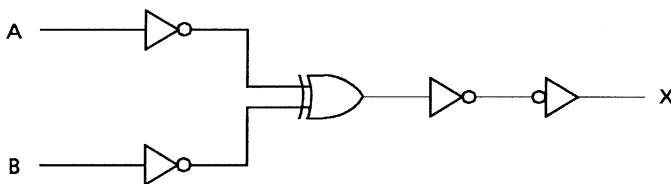
Weight  
 DIP14-P-300-2.54 : 0.96 g (typ.)  
 SOP14-P-300-1.27A : 0.18 g (typ.)

### Truth Table

| Inputs |   | Output |
|--------|---|--------|
| A      | B | X      |
| L      | L | L      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

### Circuit Diagram

1/4 TC4030B



Start of commercial production  
 1978-04

**Absolute Maximum Ratings (Note)**

| Characteristics             | Symbol    | Rating                           | Unit |
|-----------------------------|-----------|----------------------------------|------|
| DC supply voltage           | $V_{DD}$  | $V_{SS} - 0.5$ to $V_{SS} + 20$  | V    |
| Input voltage               | $V_{IN}$  | $V_{SS} - 0.5$ to $V_{DD} + 0.5$ | V    |
| Output voltage              | $V_{OUT}$ | $V_{SS} - 0.5$ to $V_{DD} + 0.5$ | V    |
| DC input current            | $I_{IN}$  | $\pm 10$                         | mA   |
| Power dissipation           | $P_D$     | 300 (DIP)/180 (SOIC)             | mW   |
| Operating temperature range | $T_{opr}$ | -40 to 85                        | °C   |
| Storage temperature range   | $T_{stg}$ | -65 to 150                       | °C   |

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

**Operating Ranges ( $V_{SS} = 0$  V) (Note)**

| Characteristics   | Symbol   | Test Condition | Min | Typ. | Max      | Unit |
|-------------------|----------|----------------|-----|------|----------|------|
| DC supply voltage | $V_{DD}$ | —              | 3   | —    | 18       | V    |
| Input voltage     | $V_{IN}$ | —              | 0   | —    | $V_{DD}$ | V    |

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either  $V_{DD}$  or  $V_{SS}$ .

## Static Electrical Characteristics (V<sub>SS</sub> = 0 V)

| Characteristics              | Sym-<br>bol     | Test Condition   | V <sub>DD</sub><br>(V) | -40°C |      | 25°C  |       |                   | 85°C  |      | Unit |    |
|------------------------------|-----------------|--|------------------------|-------|------|-------|-------|-------------------|-------|------|------|----|
|                              |                 |  |                        | Min   | Max  | Min   | Typ.  | Max               | Min   | Max  |      |    |
| High-level output<br>voltage | V <sub>OH</sub> | I <sub>OUT</sub>   < 1 μA<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<br>voltage  | V <sub>OL</sub> | I <sub>OUT</sub>   < 1 μA<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> = 4.6 V<br>V <sub>OH</sub> = 2.5 V<br>V <sub>OH</sub> = 9.5 V<br>V <sub>OH</sub> = 13.5 V<br>V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub> | 5                      | -0.61 | —    | -0.51 | -1.0  | —                 | -0.42 | —    | mA   |    |
|                              |                 |  | 5                      | -2.50 | —    | -2.10 | -4.0  | —                 | -1.70 | —    |      |    |
|                              |                 |  | 10                     | -1.50 | —    | -1.30 | -2.2  | —                 | -1.10 | —    |      |    |
|                              |                 |  | 15                     | -4.00 | —    | -3.40 | -9.0  | —                 | -2.80 | —    |      |    |
| Output low current           | I <sub>OL</sub> | V <sub>OL</sub> = 0.4 V<br>V <sub>OL</sub> = 0.5 V<br>V <sub>OL</sub> = 1.5 V<br>V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub>                             | 5                      | 0.61  | —    | 0.51  | 1.2   | —                 | 0.42  | —    | mA   |    |
|                              |                 |  | 10                     | 1.50  | —    | 1.30  | 3.2   | —                 | 1.10  | —    |      |    |
|                              |                 |  | 15                     | 4.00  | —    | 3.40  | 12.0  | —                 | 2.80  | —    |      |    |
|                              |                 |  | —                      | —     | —    | —     | —     | —                 | —     | —    |      |    |
| Input high voltage           | V <sub>IH</sub> | V <sub>OUT</sub> = 0.5 V, 4.5 V<br>V <sub>OUT</sub> = 1.0 V, 9.0 V<br>V <sub>OUT</sub> = 1.5 V, 13.5 V<br> I <sub>OUT</sub>   < 1 μA                             | 5                      | 3.5   | —    | 3.5   | 2.75  | —                 | 3.5   | —    | V    |    |
|                              |                 |  | 10                     | 7.0   | —    | 7.0   | 5.50  | —                 | 7.0   | —    |      |    |
|                              |                 |  | 15                     | 11.0  | —    | 11.0  | 8.25  | —                 | 11.0  | —    |      |    |
|                              |                 |  | —                      | —     | —    | —     | —     | —                 | —     | —    |      |    |
| Input low voltage            | V <sub>IL</sub> | V <sub>OUT</sub> = 0.5 V, 4.5 V<br>V <sub>OUT</sub> = 1.0 V, 9.0 V<br>V <sub>OUT</sub> = 1.5 V, 13.5 V<br> I <sub>OUT</sub>   < 1 μA                             | 5                      | —     | 1.5  | —     | 2.25  | 1.5               | —     | 1.5  | V    |    |
|                              |                 |  | 10                     | —     | 3.0  | —     | 4.50  | 3.0               | —     | 3.0  |      |    |
|                              |                 |  | 15                     | —     | 4.0  | —     | 6.75  | 4.0               | —     | 4.0  |      |    |
|                              |                 |  | —                      | —     | —    | —     | —     | —                 | —     | —    |      |    |
| Input<br>current             | "H" level       | I <sub>IH</sub>  | V <sub>IH</sub> = 18 V | 18    | —    | 0.1   | —     | 10 <sup>-5</sup>  | 0.1   | —    | 1.0  | μA |
|                              | "L" level       | I <sub>IL</sub>  | V <sub>IL</sub> = 0 V  | 18    | —    | -0.1  | —     | -10 <sup>-5</sup> | -0.1  | —    | -1.0 |    |
| Quiescent supply<br>current  | I <sub>DD</sub> | V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub><br>(Note)  | 5                      | —     | 1    | —     | 0.001 | 1                 | —     | 7.5  | μA   |    |
|                              |                 |  | 10                     | —     | 2    | —     | 0.001 | 2                 | —     | 15.0 |      |    |
|                              |                 |  | 15                     | —     | 4    | —     | 0.002 | 4                 | —     | 30.0 |      |    |

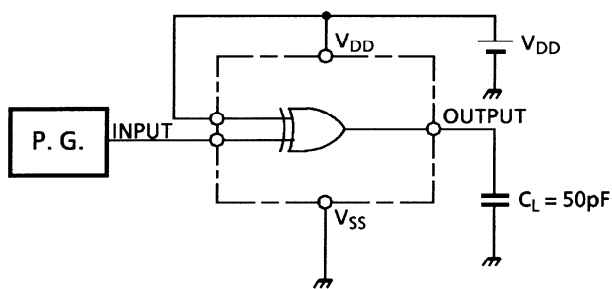
Note: All valid input combinations.

**Dynamic Electrical Characteristics (Ta = 25°C, VSS = 0 V, CL = 50 pF)**

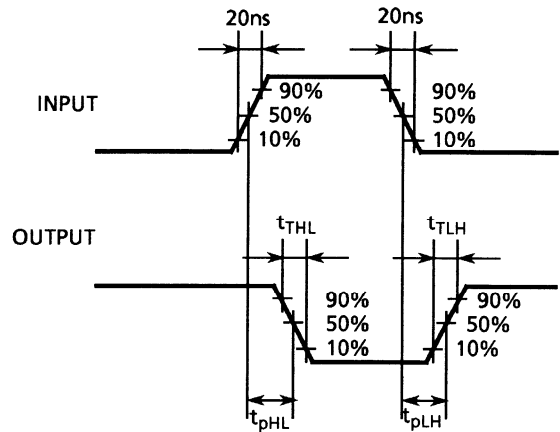
| Characteristics                         | Symbol           | Test Condition | VDD (V) | Min | Typ. | Max | Unit |
|---|------------------|----------------|---------|-----|------|-----|------|
|   |                  |                | 5       | 10  | 15   | —   | —    |
| Output transition time<br>(low to high) | t <sub>TLH</sub> | —              | 5       | —   | 70   | 200 | ns   |
|   |                  |                | 10      | —   | 35   | 100 |      |
|   |                  |                | 15      | —   | 30   | 80  |      |
| Output transition time<br>(high to low) | t <sub>THL</sub> | —              | 5       | —   | 70   | 200 | ns   |
|   |                  |                | 10      | —   | 35   | 100 |      |
|   |                  |                | 15      | —   | 30   | 80  |      |
| Propagation delay time                  | t <sub>pLH</sub> | —              | 5       | —   | 90   | 280 | ns   |
|   | t <sub>pHL</sub> |                | 10      | —   | 45   | 130 |      |
|   |                  |                | 15      | —   | 35   | 100 |      |
| Input capacitance                       | C <sub>IN</sub>  | —              | —       | 5   | 7.5  | pF  |      |

**Circuit and Waveform for Measurement of Dynamic Characteristics**

**Circuit**



**Waveform**



## Package Dimensions

DIP14-P-300-2.54

Unit : mm

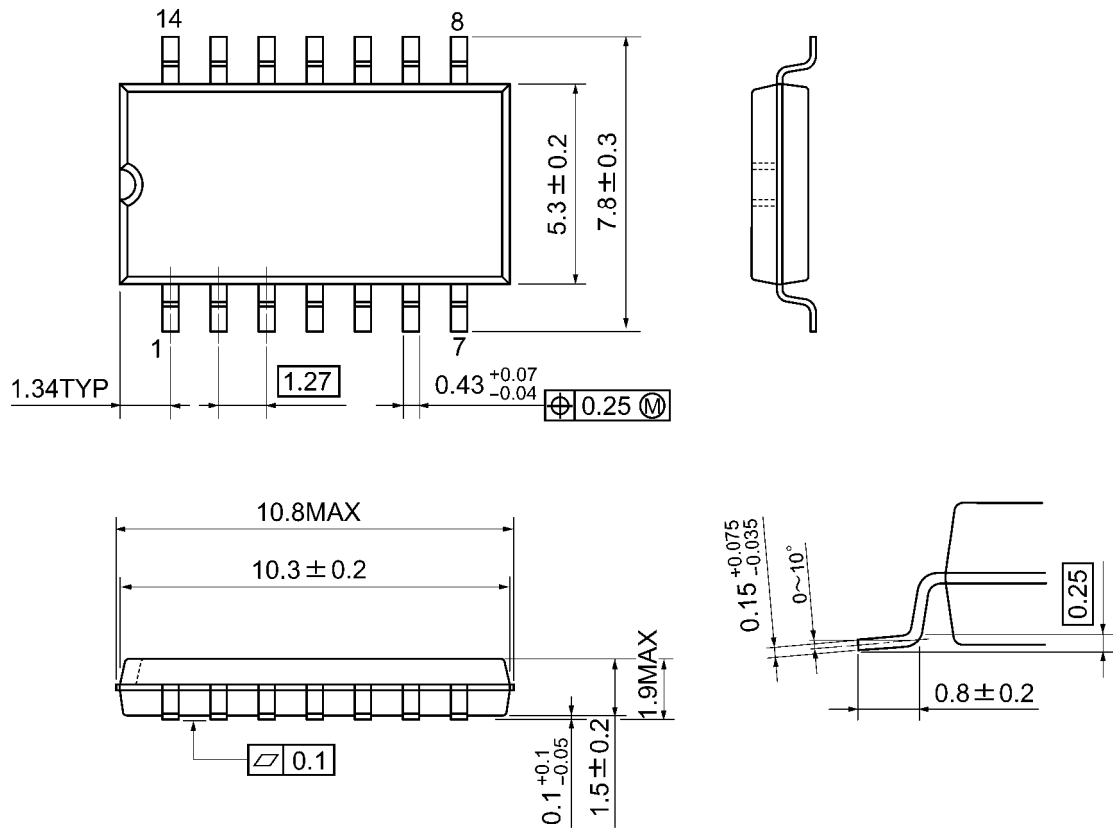


Weight: 0.96 g (typ.)

## Package Dimensions

SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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