

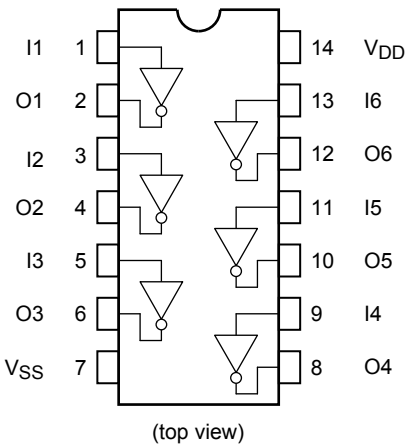
TC4069UBP, TC4069UBF, TC4069UBFT

TC4069UB Hex Inverter

TC4069UB contains six circuits of inverters. Since the internal circuit is composed of a single stage inverter, this is suitable for the applications of CR oscillator circuits, crystal oscillator circuits and linear amplifiers in addition to its application as inverters.

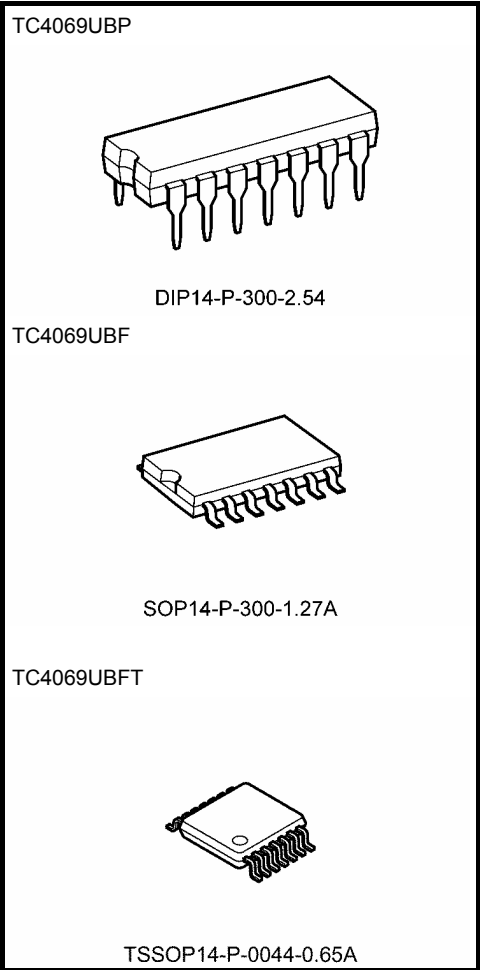
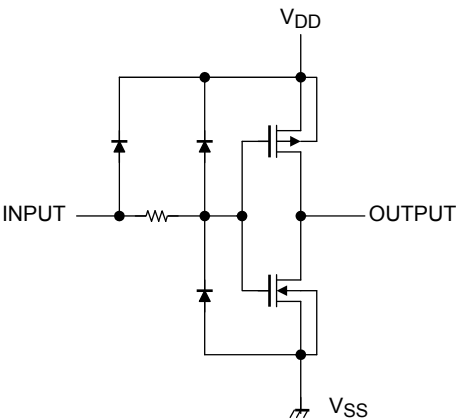
Because of one stage gate configuration, the propagation time has been reduced.

Pin Assignment



Circuit Diagram

1/6 TC4069UB



|                      |                 |
|----------------------|-----------------|
| Weight               |                 |
| DIP14-P-300-2.54     | : 0.96 g (typ.) |
| SOP14-P-300-1.27A    | : 0.18 g (typ.) |
| TSSOP14-P-0044-0.65A | : 0.06 g (typ.) |

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 (SOP)              | 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 ( $V_{SS} = 0\text{ V}$ )

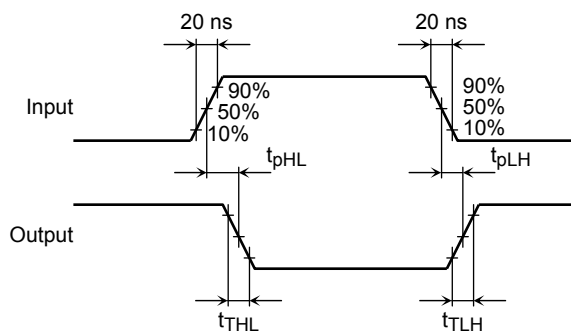
| Characteristics           |           | Symbol   | Test Condition                                                  | $V_{DD}$<br>(V) | -40°C |      | 25°C  |            |      | 85°C  |      | Unit          |
|---------------------------|-----------|----------|-----------------------------------------------------------------|-----------------|-------|------|-------|------------|------|-------|------|---------------|
|                           |           |          |                                                                 |                 | Min   | Max  | Min   | Typ.       | Max  | Min   | Max  |               |
| High-level output voltage |           | $V_{OH}$ | $ I_{OUT}  < 1\text{ }\mu\text{A}$<br>$V_{IN} = V_{SS}, V_{DD}$ | 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  |           | $V_{OL}$ | $ I_{OUT}  < 1\text{ }\mu\text{A}$<br>$V_{IN} = V_{SS}, V_{DD}$ | 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       |           | $I_{OH}$ | $V_{OH} = 4.6\text{ V}$                                         | 5               | -0.61 | —    | -0.51 | -1.0       | —    | -0.42 | —    | mA            |
|                           |           |          | $V_{OH} = 2.5\text{ V}$                                         | 5               | -2.50 | —    | -2.10 | -4.0       | —    | -1.70 | —    |               |
|                           |           |          | $V_{OH} = 9.5\text{ V}$                                         | 10              | -1.50 | —    | -1.30 | -2.2       | —    | -1.10 | —    |               |
|                           |           |          | $V_{OH} = 13.5\text{ V}$                                        | 15              | -4.00 | —    | -3.40 | -9.0       | —    | -2.80 | —    |               |
|                           |           |          | $V_{IN} = V_{SS}$                                               |                 |       |      |       |            |      |       |      |               |
| Output low current        |           | $I_{OL}$ | $V_{OL} = 0.4\text{ V}$                                         | 5               | 0.61  | —    | 0.51  | 1.2        | —    | 0.42  | —    | mA            |
|                           |           |          | $V_{OL} = 0.5\text{ V}$                                         | 10              | 1.50  | —    | 1.30  | 3.2        | —    | 1.10  | —    |               |
|                           |           |          | $V_{OL} = 1.5\text{ V}$                                         | 15              | 4.00  | —    | 3.40  | 12.0       | —    | 2.80  | —    |               |
|                           |           |          | $V_{IN} = V_{DD}$                                               |                 |       |      |       |            |      |       |      |               |
| Input high voltage        |           | $V_{IH}$ | $V_{OUT} = 0.5\text{ V}, 4.5\text{ V}$                          | 5               | 4.0   | —    | 4.0   | —          | —    | 4.0   | —    | V             |
|                           |           |          | $V_{OUT} = 1.0\text{ V}, 9.0\text{ V}$                          | 10              | 8.0   | —    | 8.0   | —          | —    | 8.0   | —    |               |
|                           |           |          | $V_{OUT} = 1.5\text{ V}, 13.5\text{ V}$                         | 15              | 12.0  | —    | 12.0  | —          | —    | 12.0  | —    |               |
|                           |           |          | $ I_{OUT}  < 1\text{ }\mu\text{A}$                              |                 |       |      |       |            |      |       |      |               |
| Input low voltage         |           | $V_{IL}$ | $V_{OUT} = 0.5\text{ V}, 4.5\text{ V}$                          | 5               | —     | 1.0  | —     | —          | 1.0  | —     | 1.0  | V             |
|                           |           |          | $V_{OUT} = 1.0\text{ V}, 9.0\text{ V}$                          | 10              | —     | 2.0  | —     | —          | 2.0  | —     | 2.0  |               |
|                           |           |          | $V_{OUT} = 1.5\text{ V}, 13.5\text{ V}$                         | 15              | —     | 3.0  | —     | —          | 3.0  | —     | 3.0  |               |
|                           |           |          | $ I_{OUT}  < 1\text{ }\mu\text{A}$                              |                 |       |      |       |            |      |       |      |               |
| Input current             | "H" level | $I_{IH}$ | $V_{IL} = 18\text{ V}$                                          | 18              | —     | 0.1  | —     | $10^{-5}$  | 0.1  | —     | 1.0  | $\mu\text{A}$ |
|                           | "L" level | $I_{IL}$ | $V_{IL} = 0\text{ V}$                                           | 18              | —     | -0.1 | —     | $-10^{-5}$ | -0.1 | —     | -1.0 |               |
| Quiescent supply current  |           | $I_{DD}$ | $V_{IN} = V_{SS}, V_{DD}$<br>(Note)                             | 5               | —     | 0.25 | —     | 0.001      | 0.25 | —     | 7.5  | $\mu\text{A}$ |
|                           |           |          |                                                                 | 10              | —     | 0.50 | —     | 0.001      | 0.50 | —     | 15.0 |               |
|                           |           |          |                                                                 | 15              | —     | 1.00 | —     | 0.002      | 1.00 | —     | 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 |
|-----------------------------------------|-----------|----------------|---------|-----|------|-----|------|
|                                         |           |                |         |     |      |     |      |
| Output transition time<br>(low to high) | $t_{TLH}$ | —              | 5       | —   | 70   | 200 | ns   |
|                                         |           |                | 10      | —   | 35   | 100 |      |
|                                         |           |                | 15      | —   | 30   | 80  |      |
| Output transition time<br>(high to low) | $t_{THL}$ | —              | 5       | —   | 70   | 200 | ns   |
|                                         |           |                | 10      | —   | 35   | 100 |      |
|                                         |           |                | 15      | —   | 30   | 80  |      |
| Propagation delay time<br>(low to high) | $t_{pLH}$ | —              | 5       | —   | 55   | 110 | ns   |
|                                         |           |                | 10      | —   | 30   | 60  |      |
|                                         |           |                | 15      | —   | 25   | 50  |      |
| Propagation delay time<br>(high to low) | $t_{pHL}$ | —              | 5       | —   | 55   | 110 | ns   |
|                                         |           |                | 10      | —   | 30   | 60  |      |
|                                         |           |                | 15      | —   | 25   | 50  |      |
| Input capacitance                       | $C_{IN}$  | —              | —       | —   | 7.5  | 15  | pF   |

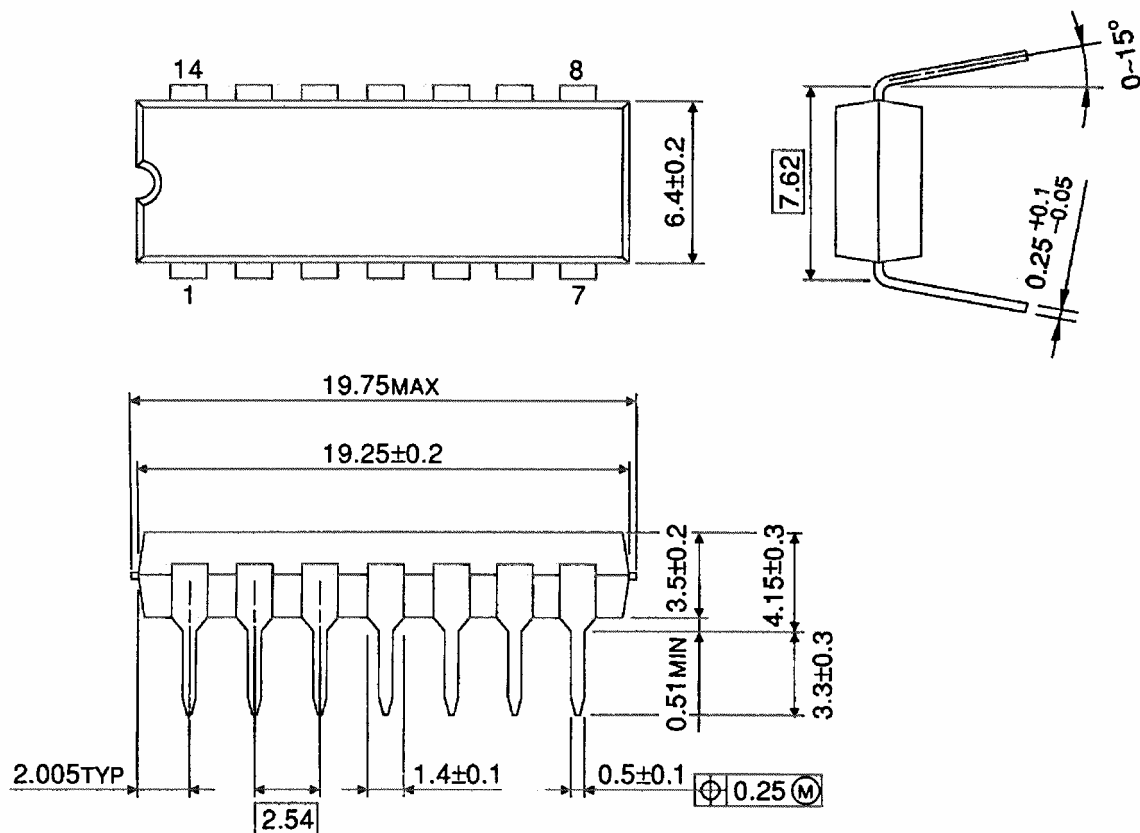
## Waveform for Measurement of Dynamic Characteristics



## Package Dimensions

DIP14-P-300-2.54

Unit : mm

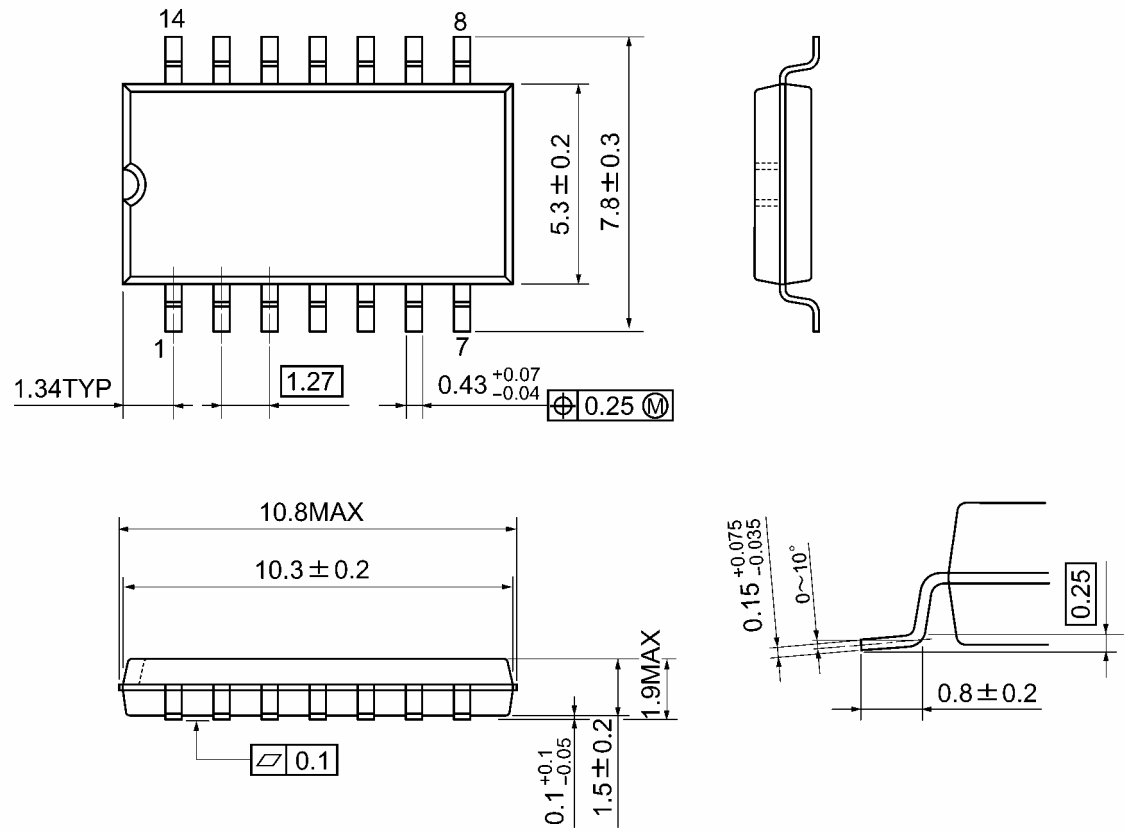


Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

## Unit: mm

Weight: 0.06 g (typ.)

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