

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

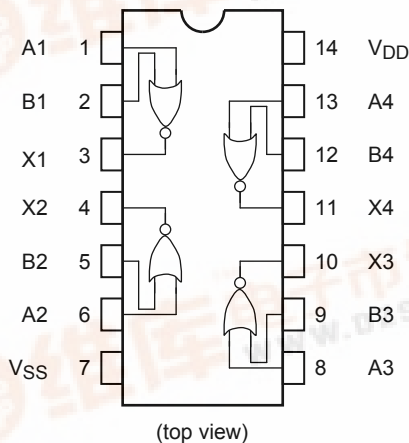
# TC4001BP, TC4001BF, TC4001BFN, TC4001BFT

## TC4001B Quad 2 Input NOR Gate

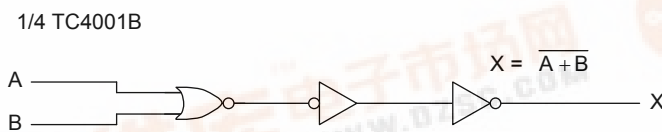
The TC4001B is 2-input positive NOR gate, respectively.

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.

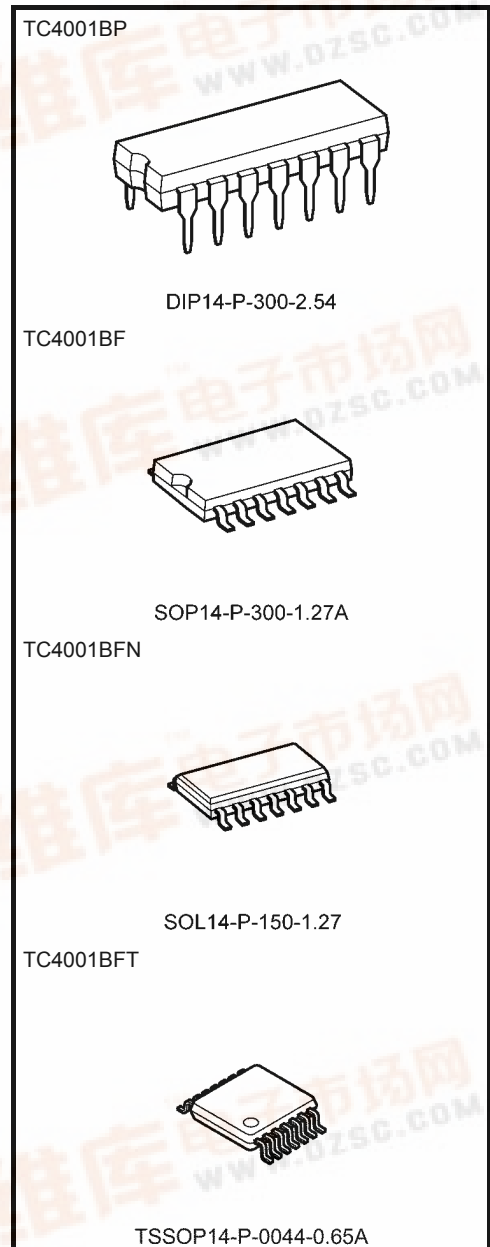
### Pin Assignment



### Logic Diagram



Note: xxxFN (JEDEC SOP) is not available in Japan.



#### Weight

|                      |                 |
|----------------------|-----------------|
| DIP14-P-300-2.54     | : 0.96 g (typ.) |
| SOP14-P-300-1.27A    | : 0.18 g (typ.) |
| SOL14-P-150-1.27     | : 0.12 g (typ.) |
| TSSOP14-P-0044-0.65A | : 0.06 g (typ.) |

## 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           | Symbol          | 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 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 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  | 5                      | -0.61 | —    | -0.51 | -1.0  | —                 | -0.42 | —    | mA   |    |
|                           |                 | V <sub>OH</sub> = 2.5 V  | 5                      | -2.50 | —    | -2.10 | -4.0  | —                 | -1.70 | —    |      |    |
|                           |                 | V <sub>OH</sub> = 9.5 V  | 10                     | -1.50 | —    | -1.30 | -2.2  | —                 | -1.10 | —    |      |    |
|                           |                 | V <sub>OH</sub> = 13.5 V   | 15                     | -4.00 | —    | -3.40 | -9.0  | —                 | -2.80 | —    |      |    |
|                           |                 | V <sub>IN</sub> = V <sub>SS</sub>  |                        |       |      |       |       |                   |       |      |      |    |
| Output low current        | I <sub>OL</sub> | V <sub>OL</sub> = 0.4 V  | 5                      | 0.61  | —    | 0.51  | 1.2   | —                 | 0.42  | —    | mA   |    |
|                           |                 | V <sub>OL</sub> = 0.5 V  | 10                     | 1.50  | —    | 1.30  | 3.2   | —                 | 1.10  | —    |      |    |
|                           |                 | V <sub>OL</sub> = 1.5 V  | 15                     | 4.00  | —    | 3.40  | 12.0  | —                 | 2.80  | —    |      |    |
|                           |                 | V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub>                              |                        |       |      |       |       |                   |       |      |      |    |
| Input high voltage        | V <sub>IH</sub> | V <sub>OUT</sub> = 0.5 V   | 5                      | 3.5   | —    | 3.5   | 2.75  | —                 | 3.5   | —    | V    |    |
|                           |                 | V <sub>OUT</sub> = 1.0 V   | 10                     | 7.0   | —    | 7.0   | 5.50  | —                 | 7.0   | —    |      |    |
|                           |                 | V <sub>OUT</sub> = 1.5 V   | 15                     | 11.0  | —    | 11.0  | 8.25  | —                 | 11.0  | —    |      |    |
|                           |                 | I <sub>OUT</sub>   < 1 μA  |                        |       |      |       |       |                   |       |      |      |    |
| Input low voltage         | V <sub>IL</sub> | V <sub>OUT</sub> = 4.5 V   | 5                      | —     | 1.5  | —     | 2.25  | 1.5               | —     | 1.5  | V    |    |
|                           |                 | V <sub>OUT</sub> = 9.0 V   | 10                     | —     | 3.0  | —     | 4.50  | 3.0               | —     | 3.0  |      |    |
|                           |                 | V <sub>OUT</sub> = 13.5 V  | 15                     | —     | 4.0  | —     | 6.75  | 4.0               | —     | 4.0  |      |    |
|                           |                 | I <sub>OUT</sub>   < 1 μA  |                        |       |      |       |       |                   |       |      |      |    |
| Input 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 current  | I <sub>DD</sub> | V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub><br>(Note)                    | 5                      | —     | 0.25 | —     | 0.001 | 0.25              | —     | 7.5  | μA   |    |
|                           |                 |  | 10                     | —     | 0.50 | —     | 0.001 | 0.50              | —     | 15.0 |      |    |
|                           |                 |  | 15                     | —     | 1.00 | —     | 0.002 | 1.00              | —     | 30.0 |      |    |

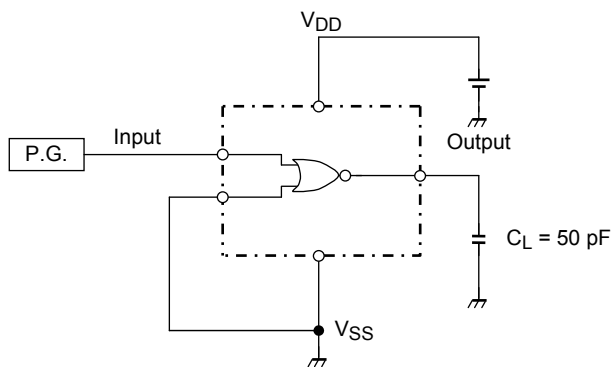
Note: All valid input combinations.

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

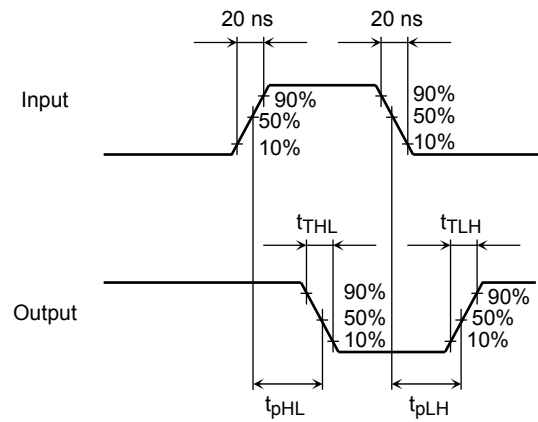
| Characteristics        | Symbol           | Test Condition | VDD (V) | Min | Typ. | Max | Unit |
|------------------------|------------------|----------------|---------|-----|------|-----|------|
|                        |                  |                |         |     |      |     |      |
| Output transition time | t <sub>TLH</sub> | —              | 5       | —   | 70   | 200 | ns   |
|                        |                  |                | 10      | —   | 35   | 100 |      |
|                        |                  |                | 15      | —   | 30   | 80  |      |
| Output transition time | t <sub>THL</sub> | —              | 5       | —   | 70   | 200 | ns   |
|                        |                  |                | 10      | —   | 35   | 100 |      |
|                        |                  |                | 15      | —   | 30   | 80  |      |
| Propagation delay time | t <sub>pLH</sub> | —              | 5       | —   | 65   | 200 | ns   |
|                        |                  |                | 10      | —   | 30   | 100 |      |
|                        |                  |                | 15      | —   | 25   | 80  |      |
| Propagation delay time | t <sub>pHL</sub> | —              | 5       | —   | 65   | 200 | ns   |
|                        |                  |                | 10      | —   | 30   | 100 |      |
|                        |                  |                | 15      | —   | 25   | 80  |      |
| Input capacitance      | C <sub>IN</sub>  | —              | —       | 5   | 7.5  | pF  |      |

## Circuit and Waveform for Measurement of Dynamic Characteristics

### Circuit



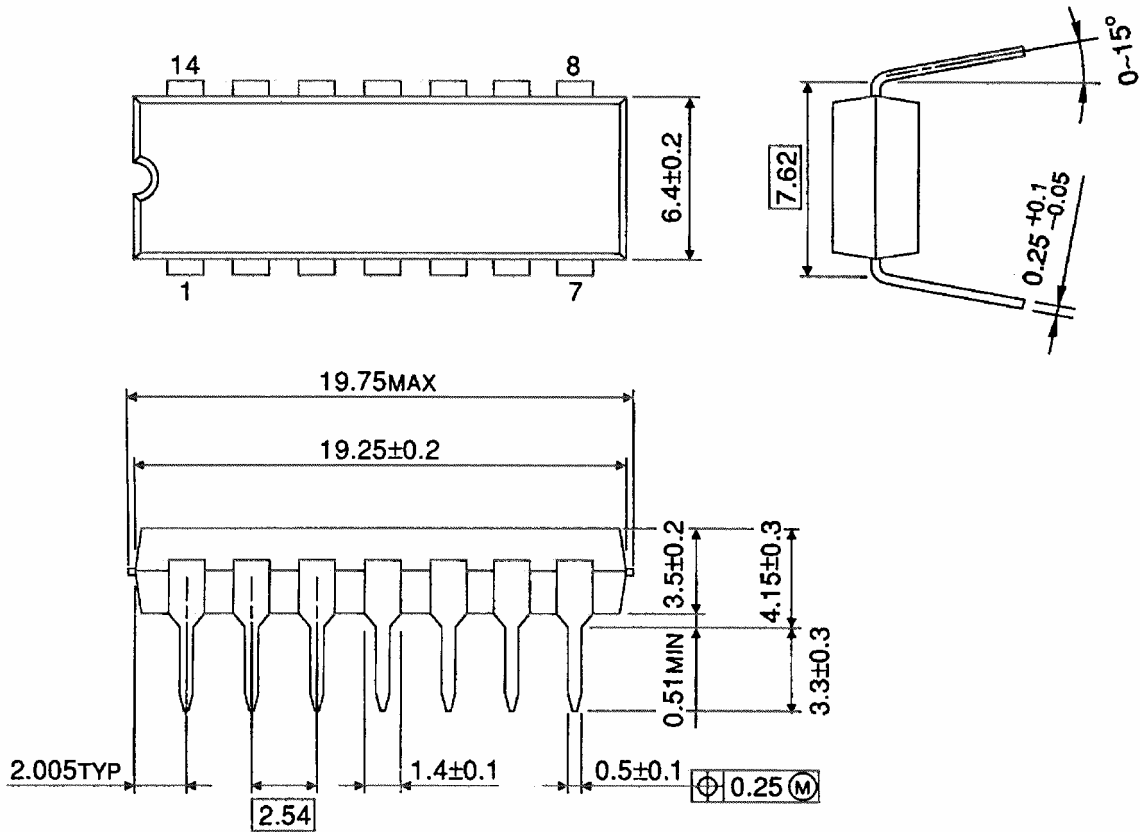
### Waveform



**Package Dimensions**

DIP14-P-300-2.54

Unit : mm

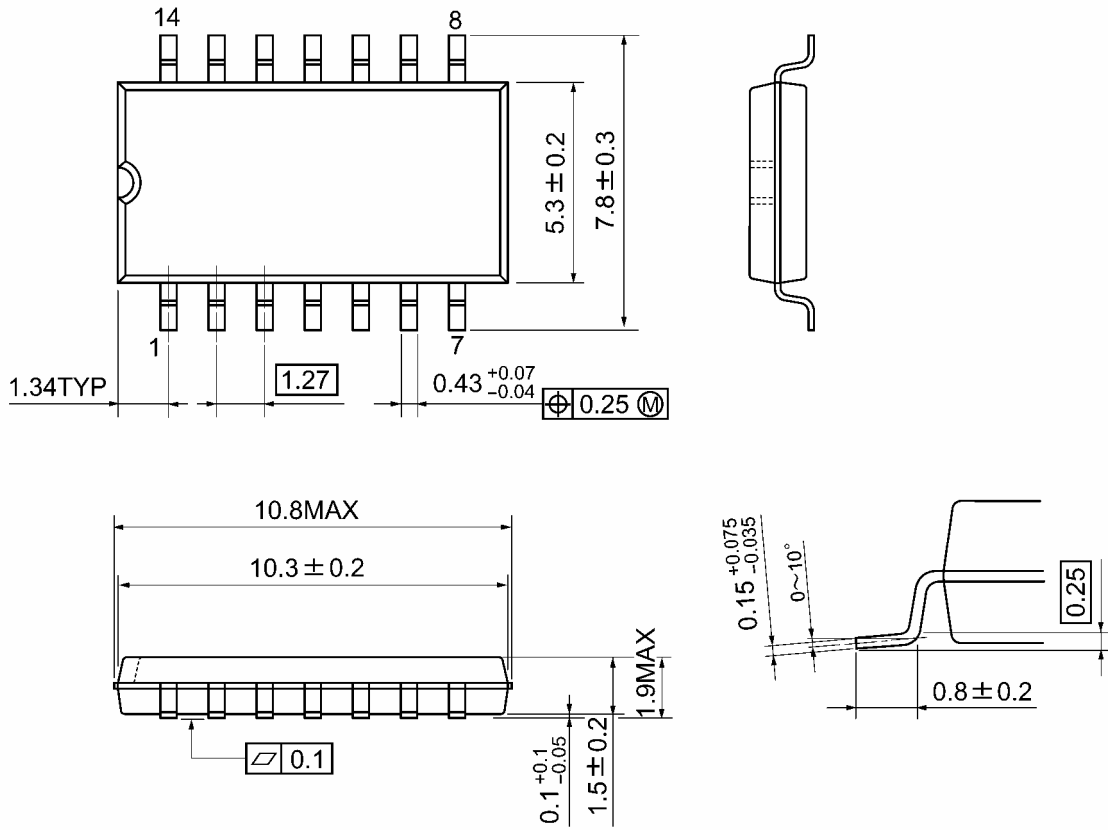


Weight: 0.96 g (typ.)

**Package Dimensions**

SOP14-P-300-1.27A

Unit: mm

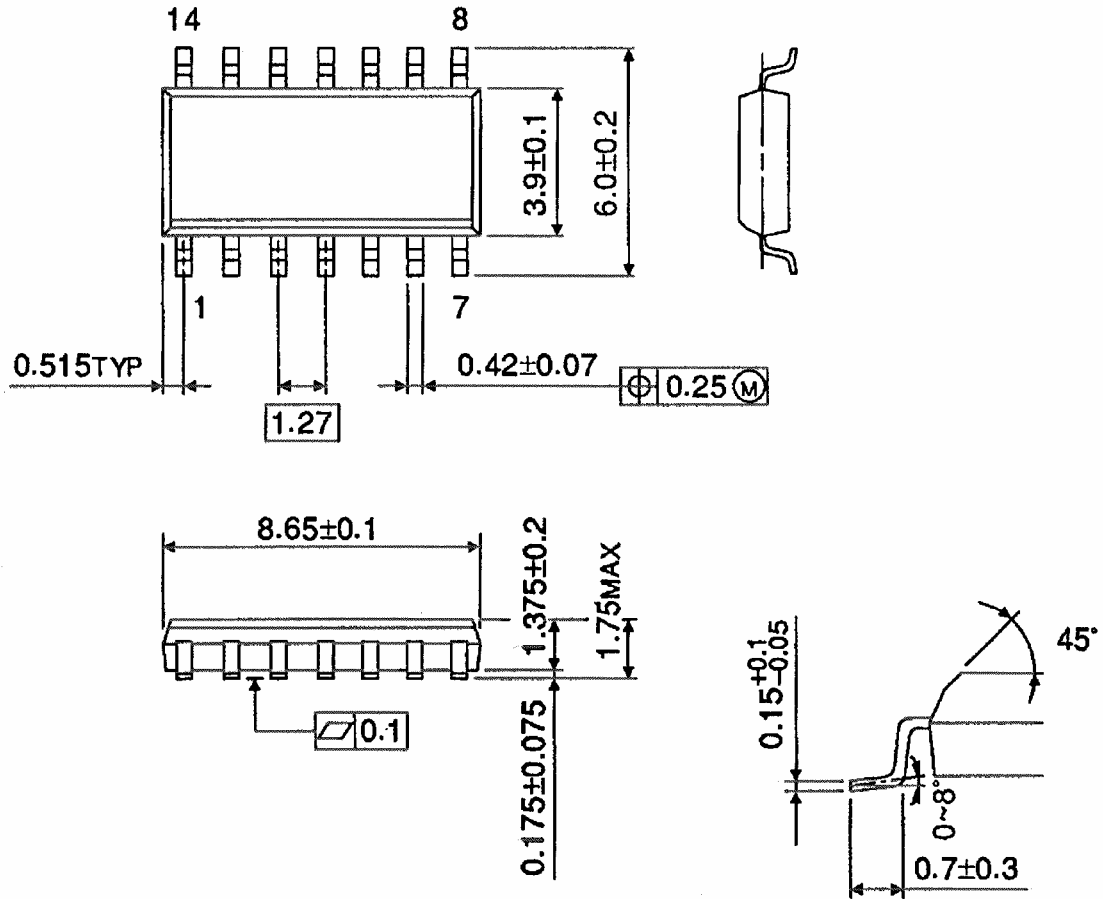


Weight: 0.18 g (typ.)

**Package Dimensions (Note)**

SOL14-P-150-1.27

Unit : mm



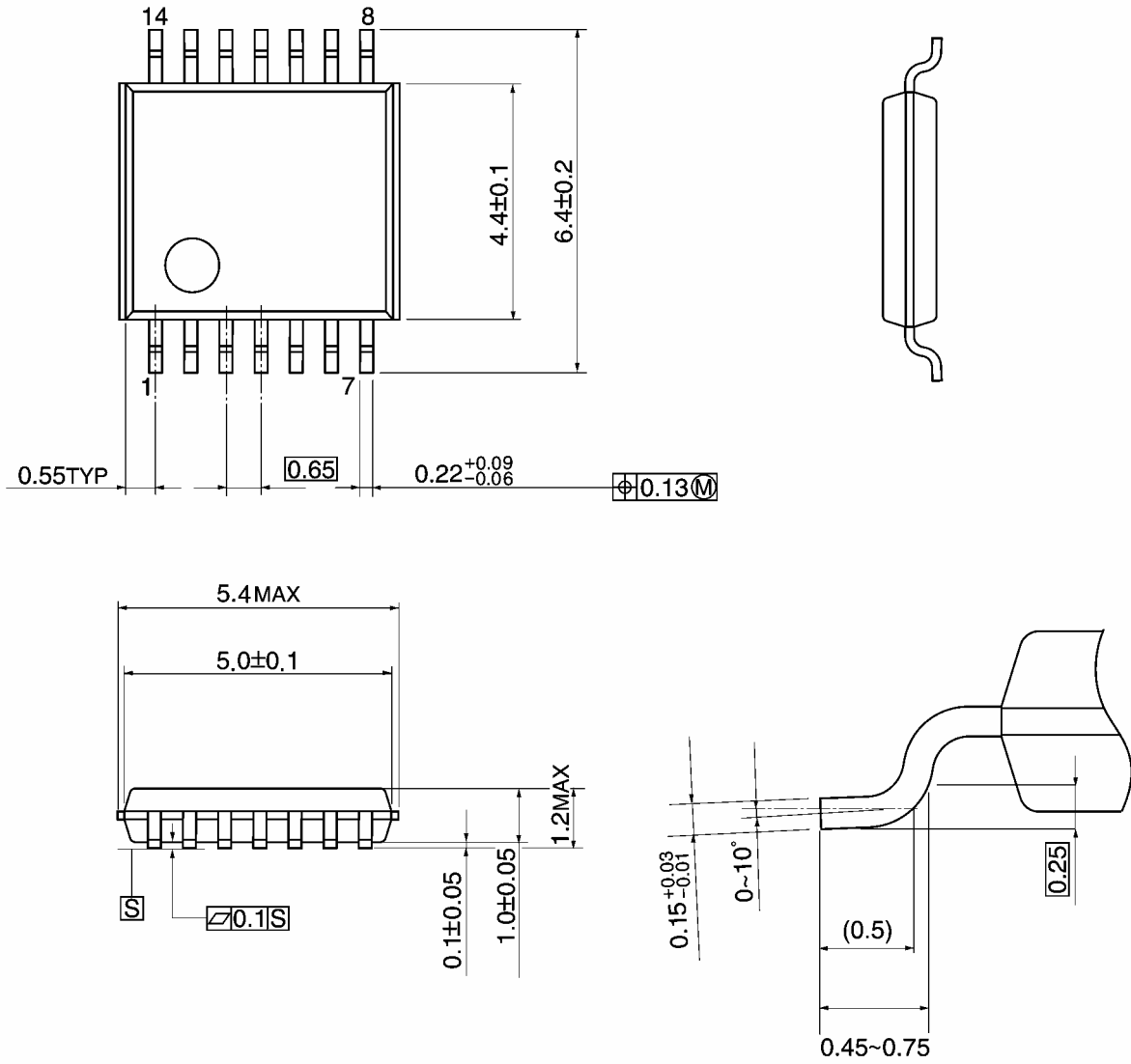
Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

**Package Dimensions**

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)



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20070701-EN GENERAL

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