

**TOSHIBA**

**TC4SU69F**

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

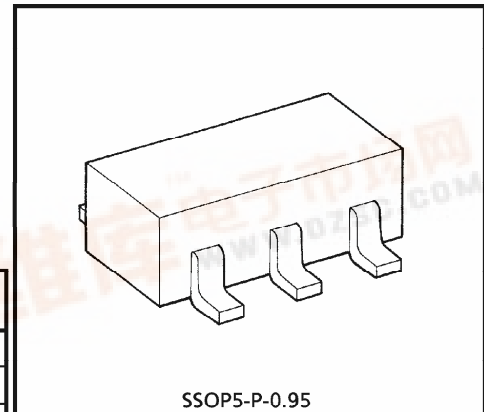
# TC4SU69F

## INVERTER GATE

The TC4SU69F is single inverter. Therefore, this is suitable for the applications of C, R oscillator circuits, crystal oscillator circuits and linear amplifiers in addition to its application as inverters.

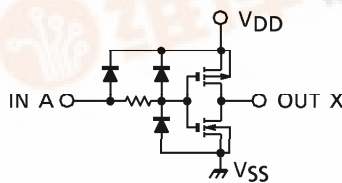
### MAXIMUM RATINGS (Ta = 25°C)

| 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>   | 200                                           | mW   |
| Operating Temperature Range | T <sub>opr</sub> | - 40 ~ 85                                     | °C   |
| Storage Temperature Range   | T <sub>stg</sub> | - 65 ~ 150                                    | °C   |
| Lead Temperature (10s)      | T <sub>L</sub>   | 260                                           | °C   |

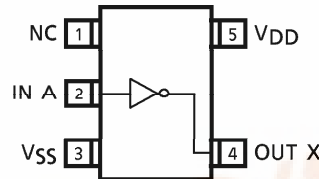


Weight : 0.016g (Typ.)

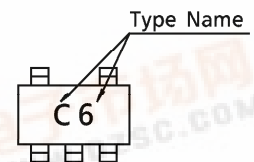
### LOGIC DIAGRAM



### PIN CONFIGURATION (TOP VIEW)



### Marking



961001EBA2

TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

RECOMMENDED OPERATING CONDITIONS ( $V_{SS} = 0V$ )

| CHARACTERISTIC    | SYMBOL   |   | MIN. | TYP. | MAX.     | UNIT |
|-------------------|----------|---|------|------|----------|------|
| DC Supply Voltage | $V_{DD}$ | — | 3    | —    | 18       | V    |
| Input Voltage     | $V_{IN}$ | — | 0    | —    | $V_{DD}$ | V    |

STATIC ELECTRICAL CHARACTERISTICS ( $V_{SS} = 0V$ )

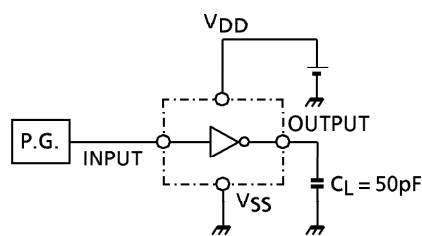
| CHARACTERISTIC            | SYM-BOL  | TEST CONDITION                            | $V_{DD}$<br>(V) | - 40°C |      | 25°C  |       |            | 85°C  |      | UNIT    |
|---------------------------|----------|-------------------------------------------|-----------------|--------|------|-------|-------|------------|-------|------|---------|
|                           |          |                                           |                 | MIN.   | MAX. | MIN.  | TYP.  | MAX.       | MIN.  | MAX. |         |
| High-Level Output Voltage | $V_{OH}$ | $ I_{OUT}  < 1\mu A$<br>$V_{IN} = V_{SS}$ | 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\mu A$<br>$V_{IN} = 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       | $I_{OH}$ | $V_{OH} = 4.6V$                           | 5               | -0.61  | —    | -0.51 | -1.0  | —          | -0.42 | —    | mA      |
|                           |          | $V_{OH} = 2.5V$                           | 5               | -2.5   | —    | -2.1  | -4.0  | —          | -1.7  | —    |         |
|                           |          | $V_{OH} = 9.5V$                           | 10              | -1.5   | —    | -1.3  | -2.2  | —          | -1.1  | —    |         |
|                           |          | $V_{OH} = 13.5V$                          | 15              | -4.0   | —    | -3.4  | -9.0  | —          | -2.8  | —    |         |
|                           |          | $V_{IN} = V_{SS}$                         |                 |        |      |       |       |            |       |      |         |
| Output Low Current        | $I_{OL}$ | $V_{OL} = 0.4V$                           | 5               | 0.61   | —    | 0.51  | 1.2   | —          | 0.42  | —    | mA      |
|                           |          | $V_{OL} = 0.5V$                           | 10              | 1.5    | —    | 1.3   | 3.2   | —          | 1.1   | —    |         |
|                           |          | $V_{OL} = 1.5V$                           | 15              | 4.0    | —    | 3.4   | 12.0  | —          | 2.8   | —    |         |
|                           |          | $V_{IN} = V_{DD}$                         |                 |        |      |       |       |            |       |      |         |
|                           |          |                                           |                 |        |      |       |       |            |       |      |         |
| Input High Voltage        | $V_{IH}$ | $V_{OUT} = 0.5V$                          | 5               | 4.0    | —    | 4.0   | —     | —          | 4.0   | —    | V       |
|                           |          | $V_{OUT} = 1.0V$                          | 10              | 8.0    | —    | 8.0   | —     | —          | 8.0   | —    |         |
|                           |          | $V_{OUT} = 1.5V$                          | 15              | 12.0   | —    | 12.0  | —     | —          | 12.0  | —    |         |
|                           |          | $ I_{OUT}  < 1\mu A$                      |                 |        |      |       |       |            |       |      |         |
| Input Low Voltage         | $V_{IL}$ | $V_{OUT} = 4.5V$                          | 5               | —      | 1.0  | —     | —     | 1.0        | —     | 1.0  | V       |
|                           |          | $V_{OUT} = 9.0V$                          | 10              | —      | 2.0  | —     | —     | 2.0        | —     | 2.0  |         |
|                           |          | $V_{OUT} = 13.5V$                         | 15              | —      | 3.0  | —     | —     | 3.0        | —     | 3.0  |         |
|                           |          | $ I_{OUT}  < 1\mu A$                      |                 |        |      |       |       |            |       |      |         |
| Input Current             | H Level  | $I_{IH}$                                  | $V_{IH} = 18V$  | 18     | —    | 0.1   | —     | $10^{-5}$  | 0.1   | —    | $\mu A$ |
|                           | L Level  | $I_{IL}$                                  | $V_{IL} = 0V$   | 18     | —    | -0.1  | —     | $-10^{-5}$ | -0.1  | —    |         |
| Quiescent Device Current  | $I_{DD}$ | $V_{IN} = V_{SS}, V_{DD}$                 | 5               | —      | 0.25 | —     | 0.001 | 0.25       | —     | 7.5  | $\mu A$ |
|                           |          |                                           | 10              | —      | 0.5  | —     | 0.001 | 0.5        | —     | 15   |         |
|                           |          |                                           | 15              | —      | 1.0  | —     | 0.002 | 1.0        | —     | 30   |         |

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

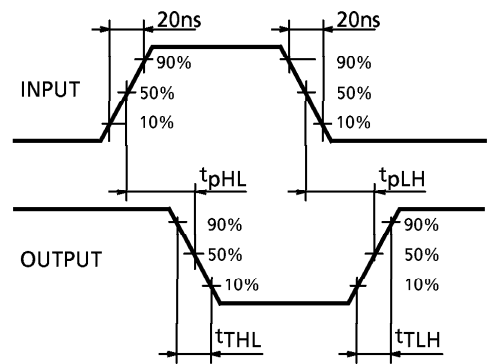
| CHARACTERISTIC                          | SYMBOL | TEST CONDITION | VDD (V) | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------------|--------|----------------|---------|------|------|------|------|
|                                         |        |                |         |      |      |      |      |
| Output Transition Time<br>(Low to High) | tTLH   | —              | 5       | —    | 70   | 200  | ns   |
|                                         |        |                | 10      | —    | 35   | 100  |      |
|                                         |        |                | 15      | —    | 30   | 80   |      |
| Output Transition Time<br>(High to Low) | tTHL   | —              | 5       | —    | 70   | 200  | ns   |
|                                         |        |                | 10      | —    | 35   | 100  |      |
|                                         |        |                | 15      | —    | 30   | 80   |      |
| Propagation Delay Time                  | tpLH   | —              | 5       | —    | 55   | 110  | ns   |
|                                         |        |                | 10      | —    | 30   | 60   |      |
|                                         |        |                | 15      | —    | 25   | 50   |      |
| Propagation Delay Time                  | tpHL   | —              | 5       | —    | 55   | 110  | ns   |
|                                         |        |                | 10      | —    | 30   | 60   |      |
|                                         |        |                | 15      | —    | 25   | 50   |      |
| Input Capacitance                       | CIN    | —              |         | —    | 7.5  | 15   | pF   |

CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

TEST CIRCUIT

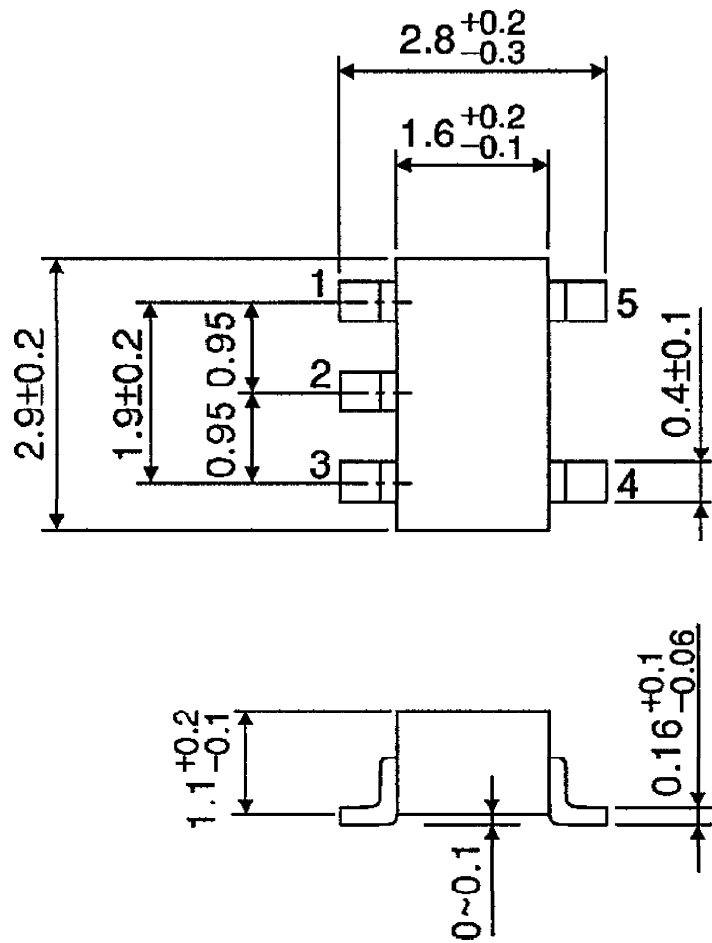


WAVEFORM



OUTLINE DRAWING  
SSOP5-P-0.95

Unit : mm



Weight : 0.016g (Typ.)