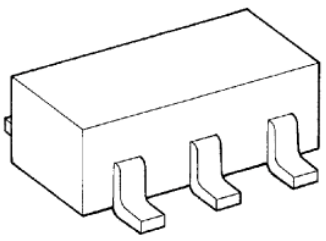
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC7S00F, TC7S00FU

## 2-INPUT NAND GATE

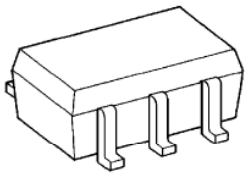
The TC7S00 is a high speed $C^2MOS$ 2-INPUT NAND GATE fabricated with silicon gate $C^2MOS$ technology.
It achieves high speed operation similar to equivalent LSTTL while maintaining the $C^2MOS$ low power dissipation.
The internal circuit is composed of 3 stages including buffer output, which enables high noise immunity and stable output.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.
Output currents are 1/2 compared to TC74HC series models.

TC7S00F



SSOP5-P-0.95

TC7S00FU



SSOP5-P-0.65A

Weight SSOP5-P-0.95 : 0.016g (Typ.)
SSOP5-P-0.65A : 0.006g (Typ.)

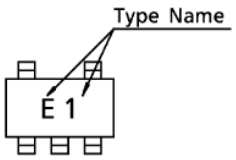
### FEATURES

- High Speed ..... $t_{pd}$ = 7ns (Typ.) at $V_{CC}$ = 5V
- Low Power Dissipation ..... $I_{CC}$ = 1$\mu$A (Max.) at Ta = 25°C
- High Noise Immunity ..... $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (Min.)
- Output Drive Capability ..... 5 LSTTL Loads
- Symmetrical Output Impedance ... $|I_{OH}| = I_{OL}$ = 2mA (Min.)
- Balanced Propagation Delays ..... $t_{pLH} \fallingdotseq t_{pHL}$
- Wide Operating Voltage Range ... $V_{CC\,(opr)}$ = 2~6V

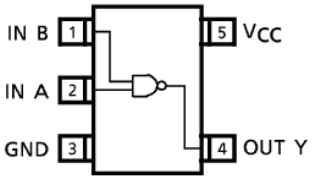
### MAXIMUM RATINGS

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage Range | $V_{CC}$ | −0.5~7 | V |
| DC Input Voltage | $V_{IN}$ | −0.5~$V_{CC}$+0.5 | V |
| DC Output Voltage | $V_{OUT}$ | −0.5~$V_{CC}$+0.5 | V |
| Input Diode Current | $I_{IK}$ | ±20 | mA |
| Output Diode Current | $I_{OK}$ | ±20 | mA |
| DC Output Current | $I_{OUT}$ | ±12.5 | mA |
| DC $V_{CC}$/Ground Current | $I_{CC}$ | ±25 | mA |
| Power Dissipation | $P_D$ | 200 | mW |
| Storage Temperature | $T_{stg}$ | −65~150 | °C |
| Lead Temperature (10s) | $T_L$ | 260 | °C |

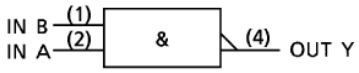
### MARKING




### PIN ASSIGNMENT (TOP VIEW)



**LOGIC DIAGRAM**




**RECOMMENDED OPERATING CONDITIONS**

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 2~6 | V |
| Input Voltage | $V_{IN}$ | 0~$V_{CC}$ | V |
| Output Voltage | $V_{OUT}$ | 0~$V_{CC}$ | V |
| Operating Temperature | $T_{opr}$ | −40~85 | °C |
| Input Rise and Fall Time | $t_r$, $t_f$ | 0~1000 ($V_{CC}$ = 2.0V)<br>0~ 500 ($V_{CC}$ = 4.5V)<br>0~ 400 ($V_{CC}$ = 6.0V) | ns |

**DC ELECTRICAL CHARACTERISTICS**

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | $V_{CC}$ | Ta = 25°C MIN. | Ta = 25°C TYP. | Ta = 25°C MAX. | Ta = −40~85°C MIN. | Ta = −40~85°C MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | — | | 2.0 | 1.5 | — | — | 1.5 | — | V |
| | | | | 4.5 | 3.15 | — | — | 3.15 | — | |
| | | | | 6.0 | 4.2 | — | — | 4.2 | — | |
| Low-Level Input Voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.5 | — | 0.5 | V |
| | | | | 4.5 | — | — | 1.35 | — | 1.35 | |
| | | | | 6.0 | — | — | 1.8 | — | 1.8 | |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −20μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| | | | $I_{OH}$ = −2mA | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | $I_{OH}$ = −2.6mA | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| Low-Level Output Voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ | $I_{OL}$ = 20μA | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | $I_{OL}$ = 2mA | 4.5 | — | 0.17 | 0.26 | — | 0.33 | |
| | | | $I_{OL}$ = 2.6mA | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| Input Leakage Current | $I_{IN}$ | $V_{IN}$ = $V_{CC}$ or GND | | 6.0 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 6.0 | — | — | 1.0 | — | 10.0 | |

Output currents are 1/2 compared to TC74HC series models.

**AC ELECTRICAL CHARACTERISTICS** ($C_L$ = 15pF, Input $t_r = t_f$ = 6ns, $V_{CC}$ = 5V)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | Ta = 25°C | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN. | TYP. | MAX. | |
| Output Transition Time | $t_{TLH}$ $t_{THL}$ | — | — | 5 | 10 | ns |
| Propagation Delay Time | $t_{pLH}$ $t_{pHL}$ | — | — | 7 | 15 | ns |

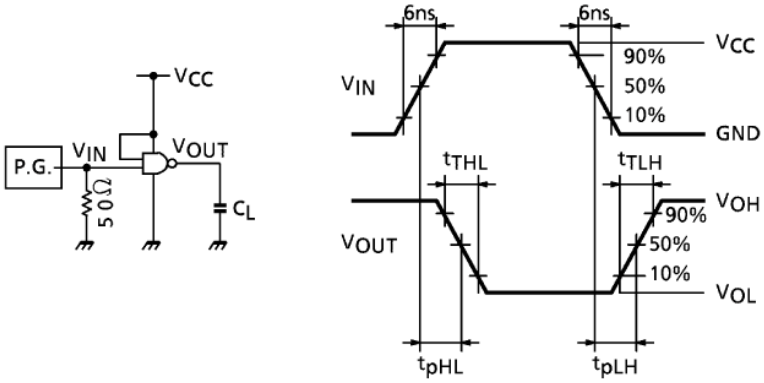
**AC ELECTRICAL CHARACTERISTICS** ($C_L$ = 50pF, Input $t_r = t_f$ = 6ns)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | Ta = 25°C | | | Ta = −40~85°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ | MIN. | TYP. | MAX. | MIN. | MAX. | |
| Output Transition Time | $t_{TLH}$ $t_{THL}$ | — | 2.0 | — | 50 | 125 | — | 155 | ns |
| | | | 4.5 | — | 14 | 25 | — | 31 | |
| | | | 6.0 | — | 12 | 21 | — | 26 | |
| Propagation Delay Time | $t_{pLH}$ $t_{pHL}$ | — | 2.0 | — | 48 | 100 | — | 125 | ns |
| | | | 4.5 | — | 12 | 20 | — | 25 | |
| | | | 6.0 | — | 9 | 17 | — | 21 | |
| Input Capacitance | $C_{IN}$ | — | | — | 5 | 10 | — | 10 | pF |
| Power Dissipation Capacitance | $C_{PD}$ | (Note 1) | | — | 10 | — | — | — | |

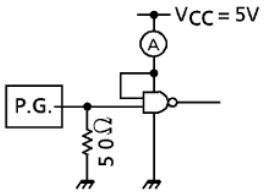
Note 1 : $C_{PD}$ defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit).
Average operating current can be obtained by the equation hereunder.

$$I_{CC\,(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

**SWITCHING CHARACTERISTICS TEST CIRCUIT**




**$I_{CC\,(opr)}$ TEST CIRCUIT**

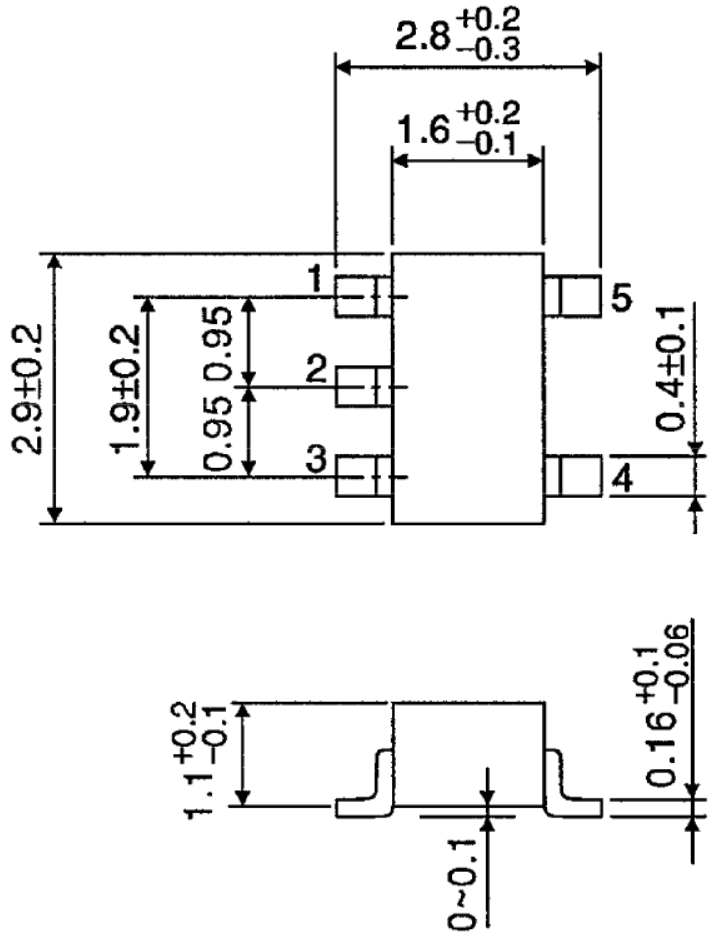



Input waveform is the same as that in case of switching characteristics test.

**PACKAGE DIMENSIONS**

SSOP5-P-0.95

Unit : mm

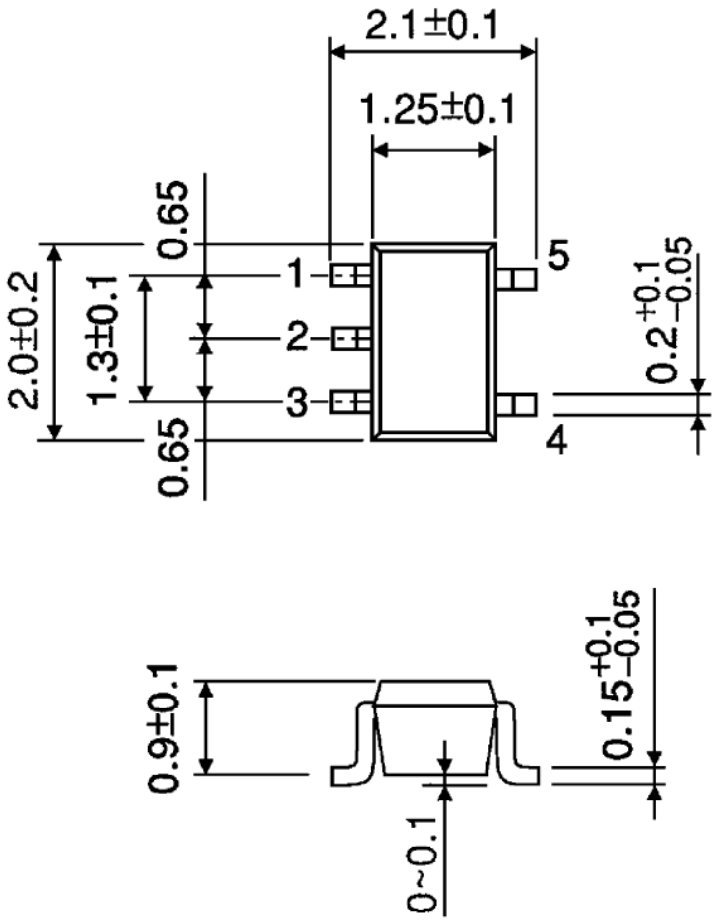



Weight : 0.016g (Typ.)

**PACKAGE DIMENSIONS**

SSOP5-P-0.65A

Unit : mm




Weight : 0.006g (Typ.)

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20070701-EN GENERAL

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