# TOSHIBA
## TC4S11F

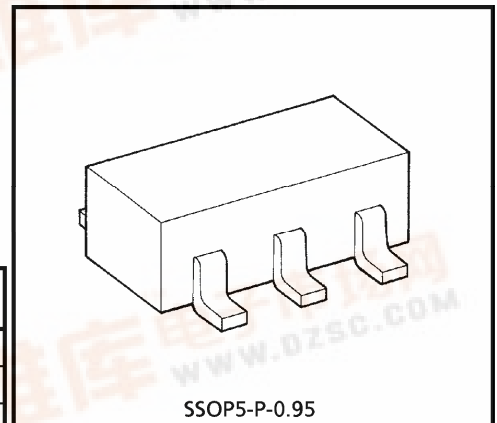TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT   SILICON MONOLITHIC

# TC4S11F

## 2 INPUT NAND GATE

The TC4S11F is 2-input positive logic NAND gates.
Gate output with inverter buffer improve the input-output characteristics and even if the load capacitance increases, it can be stopped the change of propagation time.
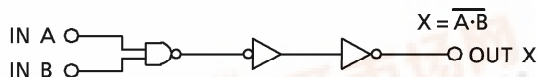
**MAXIMUM RATINGS** (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| DC Supply Voltage | $V_{DD}$ | $V_{SS} - 0.5 \sim V_{SS} + 20$ | V |
| Input Voltage | $V_{IN}$ | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| Output Voltage | $V_{OUT}$ | $V_{SS} - 0.5 \sim V_{DD} + 0.5$ | V |
| DC Input Current | $I_{IN}$ | $\pm 10$ | mA |
| Power Dissipation | $P_D$ | 200 | mW |
| Operating Temperature Range | $T_{opr}$ | $-40 \sim 85$ | °C |
| Storage Temperature Range | $T_{stg}$ | $-65 \sim 150$ | °C |
| Lead Temperature (10s) | $T_L$ | 260 | °C |

SSOP5-P-0.95

Weight : 0.016g ( Typ.)

### LOGIC DIAGRAM

$X = \overline{A \cdot B}$

IN A
IN B
OUT X

### MARKING

Type Name

C 1

### PIN CONFIGURATION (TOP VIEW)

IN B [1]     [5] $V_{DD}$

IN A [2]

$V_{SS}$ [3]    [4] OUT X

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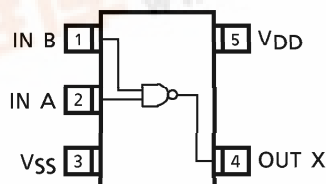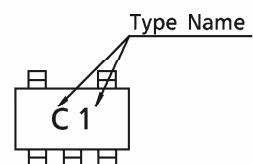
## RECOMMENDED OPERATING CONDITIONS ($V_{SS} = 0V$)

| 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 | $V_{DD}$ (V) | −40°C MIN. | −40°C MAX. | 25°C MIN. | 25°C TYP. | 25°C MAX. | 85°C MIN. | 85°C MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High-Level Output Voltage | $V_{OH}$ | $\|I_{OUT}\| < 1\mu A$ $V_{IN} = V_{SS}, V_{DD}$ | 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 | $V_{OL}$ | $\|I_{OUT}\| < 1\mu A$ $V_{IN} = V_{DD}$ | 5 | — | 0.05 | — | 0.00 | 0.05 | — | 0.05 | |
| | | | 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 | — | |
| | | $V_{IN} = V_{SS}, V_{DD}$ | | | | | | | | | |
| Output Low Current | $I_{OL}$ | $V_{OL} = 0.4V$ | 5 | 0.61 | — | 0.51 | 1.2 | — | 0.42 | — | |
| | | $V_{OL} = 0.5V$ | 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 | $V_{IH}$ | $V_{OUT} = 0.5V, 4.5V$ | 5 | 3.5 | — | 3.5 | 2.75 | — | 3.5 | — | V |
| | | $V_{OUT} = 1.0V, 9.0V$ | 10 | 7.0 | — | 7.0 | 5.5 | — | 7.0 | — | |
| | | $V_{OUT} = 1.5V, 13.5V$ | 15 | 11.0 | — | 11.0 | 8.25 | — | 11.0 | — | |
| | | $\|I_{OUT}\| < 1\mu A$ | | | | | | | | | |
| Input Low Voltage | $V_{IL}$ | $V_{OUT} = 4.5V$ | 5 | — | 1.5 | — | 2.25 | 1.5 | — | 1.5 | |
| | | $V_{OUT} = 9.0V$ | 10 | — | 3.0 | — | 4.5 | 3.0 | — | 3.0 | |
| | | $V_{OUT} = 13.5V$ | 15 | — | 4.0 | — | 6.75 | 4.0 | — | 4.0 | |
| | | $\|I_{OUT}\| < 1\mu A$ | | | | | | | | | |
| Input Current — H Level | $I_{IH}$ | $V_{IH} = 18V$ | 18 | — | 0.1 | — | $10^{-5}$ | 0.1 | — | 1.0 | $\mu A$ |
| Input Current — L Level | $I_{IL}$ | $V_{IL} = 0V$ | 18 | — | −0.1 | — | $-10^{-5}$ | −0.1 | — | −1.0 | |
| 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 | |

* All valid input combinations.

## DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, $V_{SS}$ = 0V, $C_L$ = 50pF)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | $V_{DD}$ (V) | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Output Transition Time (Low to High) | $t_{TLH}$ | — | 5 | — | 70 | 200 | ns |
| | | | 10 | — | 35 | 100 | |
| | | | 15 | — | 30 | 80 | |
| Output Transition Time (High to Low) | $t_{THL}$ | — | 5 | — | 70 | 200 | |
| | | | 10 | — | 35 | 100 | |
| | | | 15 | — | 30 | 80 | |
| Propagation Delay Time | $t_{pLH}$ | — | 5 | — | 65 | 200 | ns |
| | | | 10 | — | 30 | 100 | |
| | | | 15 | — | 25 | 80 | |
| Propagation Delay Time | $t_{pHL}$ | — | 5 | — | 65 | 200 | |
| | | | 10 | — | 30 | 100 | |
| | | | 15 | — | 25 | 80 | |
| Input Capacitance | $C_{IN}$ | — | | — | 5 | 7.5 | pF |

## CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS
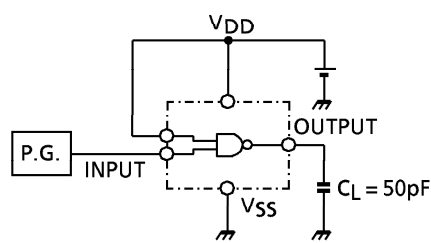
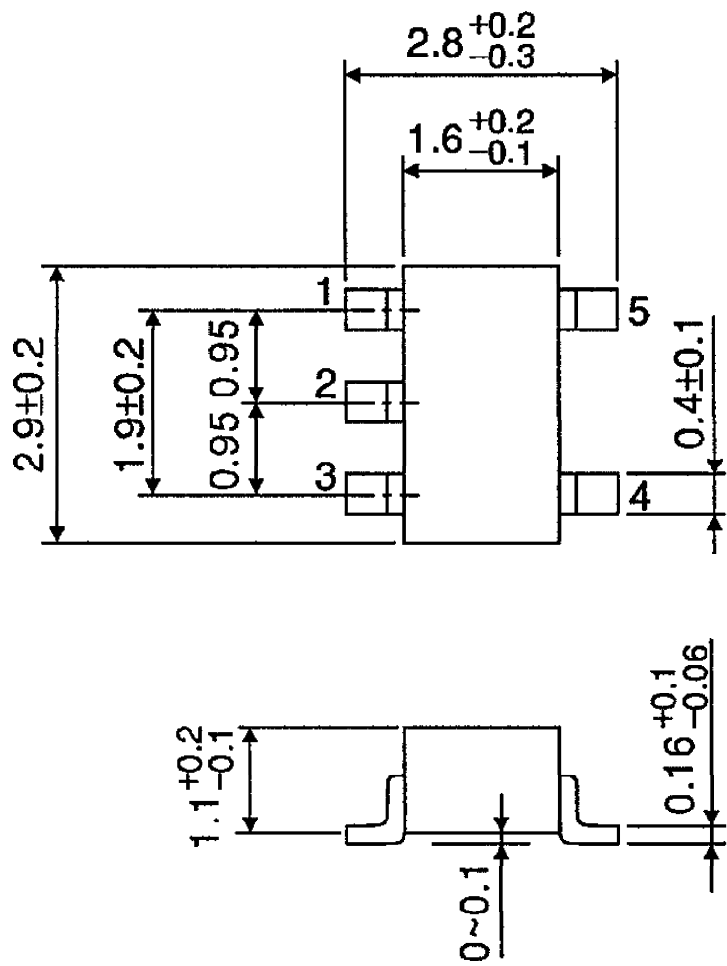TEST CIRCUIT                                    WAVEFORM
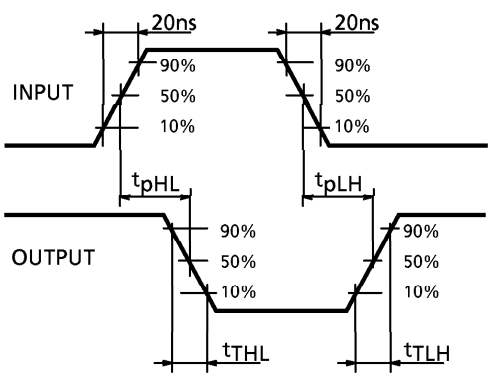
**PACKAGE DIMENSIONS**
SSOP5-P-0.95                                                            Unit : mm



Weight : 0.016g (Typ.)

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