TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

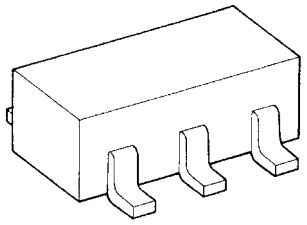
# TC7SH08F, TC7SH08FU

2-Input AND Gate

## Features

- High speed operation : $t_{pd}$ = 4.3ns (typ.) at $V_{CC}$ = 5V, 15pF
- Low power dissipation : $I_{CC}$ = 2 μA (max) at Ta = 25°C
- High noise immunity : $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (min)
- 5.5-V tolerant inputs
- Wide operating voltage range : $V_{CC}$ = 2 to 5.5 V

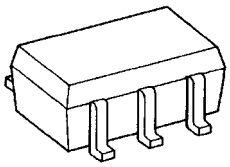
TC7SH08F



SSOP5-P-0.95

(SMV)

TC7SH08FU

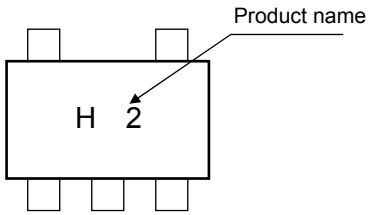


SSOP5-P-0.65A

(USV)

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

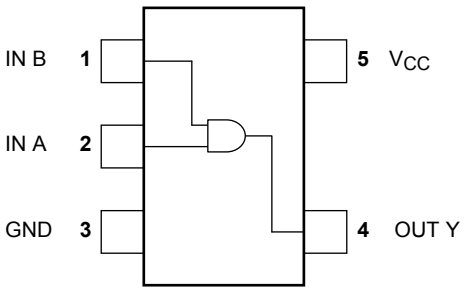
## Marking




## Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | − 0.5 to 7 | V |
| DC input voltage | $V_{IN}$ | − 0.5 to 7 | V |
| DC output voltage | $V_{OUT}$ | − 0.5 to $V_{CC}$ + 0.5 | V |
| Input diode current | $I_{IK}$ | − 20 | mA |
| Output diode current | $I_{OK}$ | ± 20 (Note1) | mA |
| DC output current | $I_{OUT}$ | ± 25 | mA |
| DC $V_{CC}$/ground current | $I_{CC}$ | ± 50 | mA |
| Power dissipation | $P_D$ | 200 | mW |
| Storage temperature | $T_{stg}$ | − 65 to 150 | °C |
| Lead temperature (10 s) | $T_L$ | 260 | °C |

## Pin Assignment (top view)




Note: 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).

Note1: $V_{OUT}$ < GND, $V_{OUT}$ > $V_{CC}$

## IEC Logic Symbol




## Truth Table

| A | B | Y |
|---|---|---|
| L | L | L |
| L | H | L |
| H | L | L |
| H | H | H |

## Operating Ranges

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2.0 to 5.5 | V |
| Input voltage | $V_{IN}$ | 0 to 5.5 | V |
| Output voltage | $V_{OUT}$ | 0 to $V_{CC}$ | V |
| Operating temperature | $T_{opr}$ | −40 to 85 | °C |
| Input rise and fall time | dt/dv | 0 to 100 ($V_{CC}$ = 3.3±0.3V) | ns/V |
| | | 0 to 20 ($V_{CC}$ = 5.0±0.5V) | |

## Electrical Characteristics

## DC Characteristics

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Min | Typ. | Max | Min | Max | |
| High-level input voltage | $V_{IH}$ | — | | 2.0 | 1.5 | — | — | 1.5 | — | V |
| | | | | 3.0 to 5.5 | $V_{CC}$ × 0.7 | — | — | $V_{CC}$ × 0.7 | — | |
| Low-level input voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.5 | — | 0.5 | |
| | | | | 3.0 to 5.5 | — | — | $V_{CC}$ × 0.3 | — | $V_{CC}$ × 0.3 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ | $I_{OH}$ = −50 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | $I_{OH}$ = −4 mA | 3.0 | 2.58 | — | — | 2.48 | — | |
| | | | $I_{OH}$ = −8 mA | 4.5 | 3.94 | — | — | 3.80 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 50 μA | 2.0 | — | 0 | 0.10 | — | 0.10 | |
| | | | | 3.0 | — | 0 | 0.10 | — | 0.10 | |
| | | | | 4.5 | — | 0 | 0.10 | — | 0.10 | |
| | | | $I_{OL}$ = 4mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | $I_{OL}$ = 8 mA | 4.5 | — | — | 0.36 | — | 0.44 | |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = 5.5 V or GND | | 0 to 5.5 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | — | 2.0 | — | 20.0 | μA |

## AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

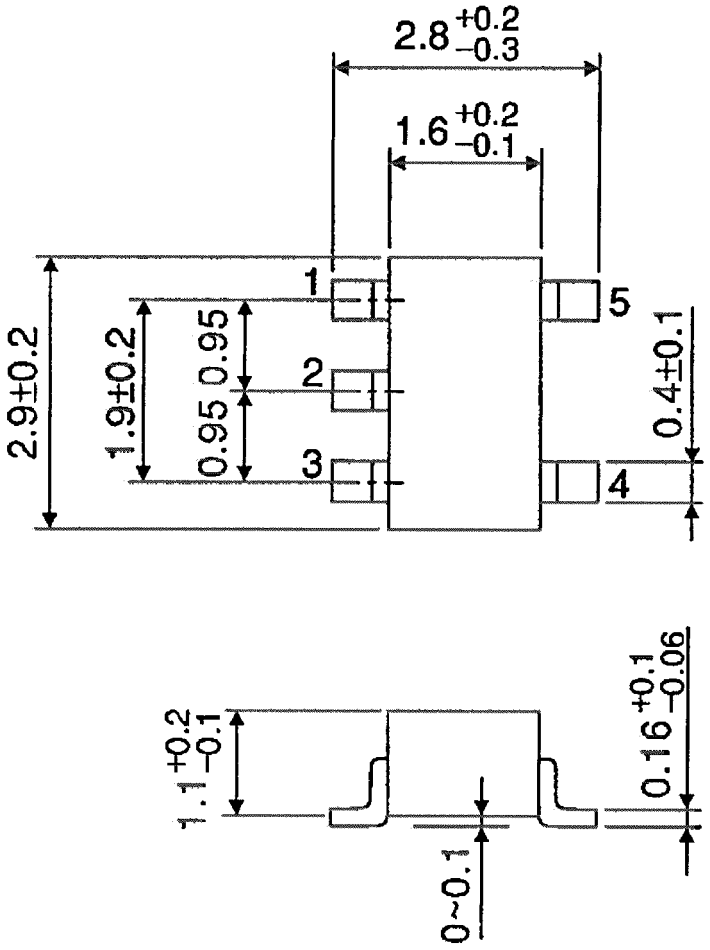
| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | $C_L$ (pF) | Min | Typ. | Max | Min | Max | |
| Propagation delay time | $t_{PLH}$ $t_{PHL}$ | | 3.3 ± 0.3 | 15 | — | 6.2 | 8.8 | 1.0 | 10.5 | ns |
| | | | | 50 | — | 8.7 | 12.3 | 1.0 | 14.0 | |
| | | | 5.0 ± 0.5 | 15 | — | 4.3 | 5.9 | 1.0 | 7.0 | |
| | | | | 50 | — | 5.8 | 7.9 | 1.0 | 9.0 | |
| Input capacitance | $C_{IN}$ | — | | | — | 4 | 10 | — | 10 | pF |
| Power dissipation capacitance | $C_{PD}$ | (Note 2) | | | — | 14 | — | — | — | pF |

Note 2: $C_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.
Average operating current can be obtained by the equation:

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

**Package Dimensions**

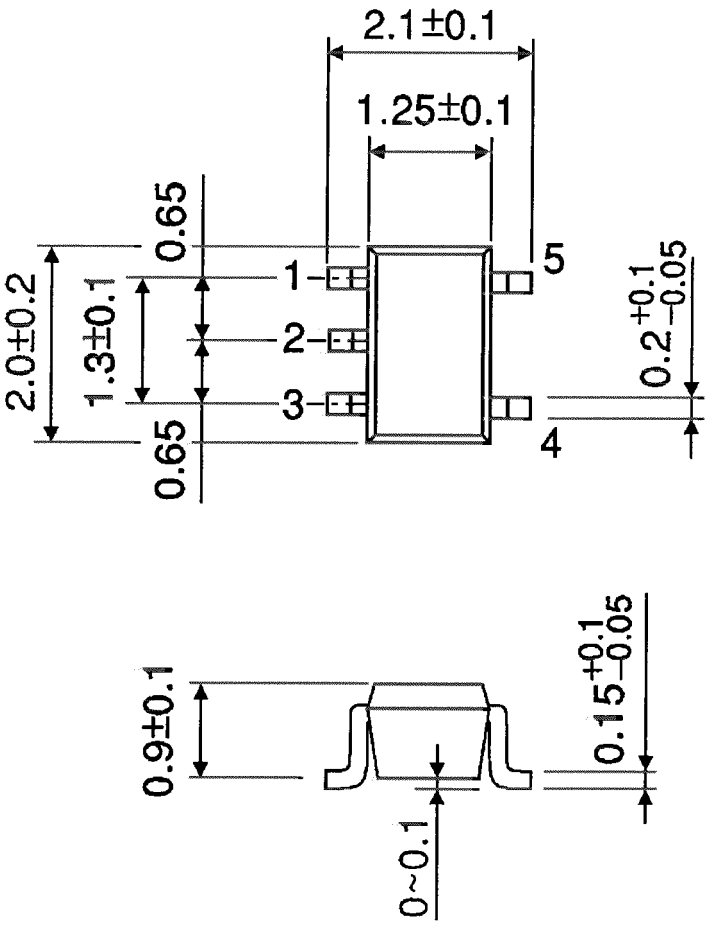
SSOP5-P-0.95 Unit : mm




Weight: 0.016 g (typ.)

**Package Dimensions**

SSOP5-P-0.65A Unit : mm




Weight: 0.006 g (typ.)

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