

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

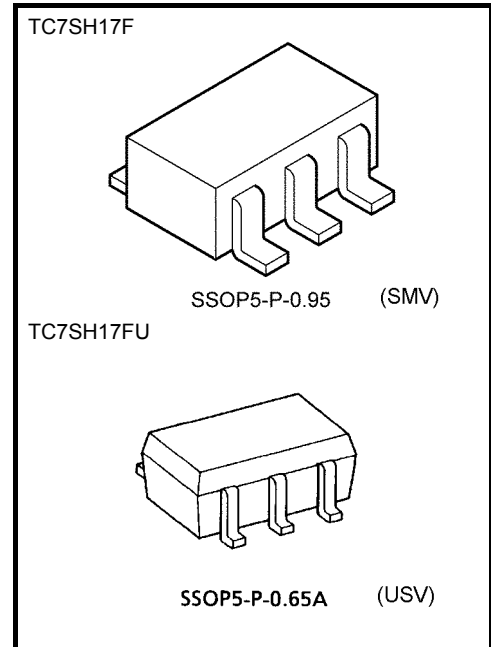
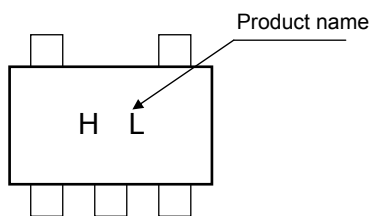
## TC7SH17F, TC7SH17FU

### Schmitt Buffer

#### Features

- High speed operation :  $t_{pd} = 5.5 \text{ ns (typ.)}$   
at  $V_{CC} = 5 \text{ V}$ ,  $C_L = 15 \text{ pF}$
- Low power dissipation :  $I_{CC} = 2 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- Wide operating voltage range:  $V_{CC} = 2 \text{ to } 5.5 \text{ V}$
- High noise immunity :  $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- 5.5-V tolerant input

#### Marking



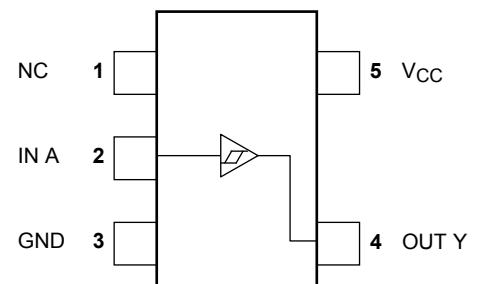
#### Weight

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

#### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

| 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        | $I_{OK}$  | $\pm 20$ (Note 1)      | mA               |
| DC output current           | $I_{OUT}$ | $\pm 25$               | mA               |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 50$               | mA               |
| Power dissipation           | $P_D$     | 200                    | mW               |
| Storage temperature         | $T_{stg}$ | -65 to 150             | $^\circ\text{C}$ |
| Lead temperature (10 s)     | $T_L$     | 260                    | $^\circ\text{C}$ |

#### Pin Assignment (top view)



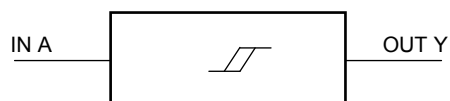
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

Start of commercial production  
2007-02

## IEC Logic Symbol



## Truth Table

| A | Y |
|---|---|
| L | L |
| 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   |

## Electrical Characteristics

## DC Characteristics

| Characteristics          |                            | Symbol          | Test Condition                           |                          | Ta = 25°C           |      |      | Ta = -40 to 85°C |      | Unit |     |
|--------------------------|----------------------------|-----------------|------------------------------------------|--------------------------|---------------------|------|------|------------------|------|------|-----|
|                          |                            |                 |                                          |                          | V <sub>CC</sub> (V) | Min  | Typ. | Max              | Min  |      | Max |
| Input voltage            | Positive threshold voltage | V <sub>P</sub>  | —                                        | 3.0                      | —                   | —    | 2.20 | —                | 2.20 | V    |     |
|                          |                            |                 |                                          | 4.5                      | —                   | —    | 3.15 | —                | 3.15 |      |     |
|                          |                            |                 |                                          | 5.5                      | —                   | —    | 3.85 | —                | 3.85 |      |     |
|                          | Negative threshold voltage | V <sub>N</sub>  | —                                        | 3.0                      | 0.90                | —    | —    | 0.90             | —    |      |     |
|                          |                            |                 |                                          | 4.5                      | 1.35                | —    | —    | 1.35             | —    |      |     |
|                          |                            |                 |                                          | 5.5                      | 1.65                | —    | —    | 1.65             | —    |      |     |
| Hysteresis Voltage       |                            | V <sub>H</sub>  | —                                        | 3.0                      | 0.30                | —    | 1.20 | 0.30             | 1.20 | V    |     |
|                          |                            |                 |                                          | 4.5                      | 0.40                | —    | 1.40 | 0.40             | 1.40 |      |     |
|                          |                            |                 |                                          | 5.5                      | 0.50                | —    | 1.60 | 0.50             | 1.60 |      |     |
| Output voltage           | High level                 | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IH</sub>        | I <sub>OH</sub> = -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 <sub>OH</sub> = -4 mA  | 3.0                 | 2.58 | —    | —                | 2.48 | —    |     |
|                          |                            |                 |                                          |                          | 4.5                 | 3.94 | —    | —                | 3.80 | —    |     |
|                          | Low level                  | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IL</sub>        | I <sub>OL</sub> = 50 μA  | 2.0                 | —    | 0.0  | 0.1              | —    | 0.1  |     |
|                          |                            |                 |                                          |                          | 3.0                 | —    | 0.0  | 0.1              | —    | 0.1  |     |
|                          |                            |                 |                                          |                          | 4.5                 | —    | 0.0  | 0.1              | —    | 0.1  |     |
|                          |                            |                 |                                          | I <sub>OL</sub> = 4 mA   | 3.0                 | —    | —    | 0.36             | —    | 0.44 |     |
|                          |                            |                 |                                          |                          | 4.5                 | —    | —    | 0.36             | —    | 0.44 |     |
| Input leakage current    |                            | I <sub>IN</sub> | V <sub>IN</sub> = 5.5 V or GND           | 0 to 5.5                 | —                   | —    | ±0.1 | —                | ±1.0 | μA   |     |
| Quiescent supply current |                            | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND | 5.5                      | —                   | —    | 2.0  | —                | 20.0 | μA   |     |

**AC Characteristics (unless otherwise specified, Input:  $t_r = t_f = 3 \text{ ns}$ )**

| Characteristics               | Symbol | Test Condition |           |         | Ta = 25°C |      |      | Ta = −40 to 85°C |      | Unit |
|-------------------------------|--------|----------------|-----------|---------|-----------|------|------|------------------|------|------|
|                               |        |                | VCC (V)   | CL (pF) | Min       | Typ. | Max  | Min              | Max  |      |
| Propagation delay time        | tPLH   |                | 3.3 ± 0.3 | 15      | —         | 8.3  | 12.8 | 1.0              | 15.0 | ns   |
|                               |        |                |           | 50      | —         | 10.8 | 16.3 | 1.0              | 18.5 |      |
|                               | tPHL   |                | 5.0 ± 0.5 | 15      | —         | 5.5  | 8.6  | 1.0              | 10.0 |      |
|                               |        |                |           | 50      | —         | 7.0  | 10.6 | 1.0              | 12.0 |      |
| Input capacitance             | CIN    | —              |           |         | —         | 4    | 10   | —                | 10   | pF   |
| Power dissipation capacitance | CPD    | (Note 2)       |           |         | —         | 14   | —    | —                | —    | pF   |

Note 2: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

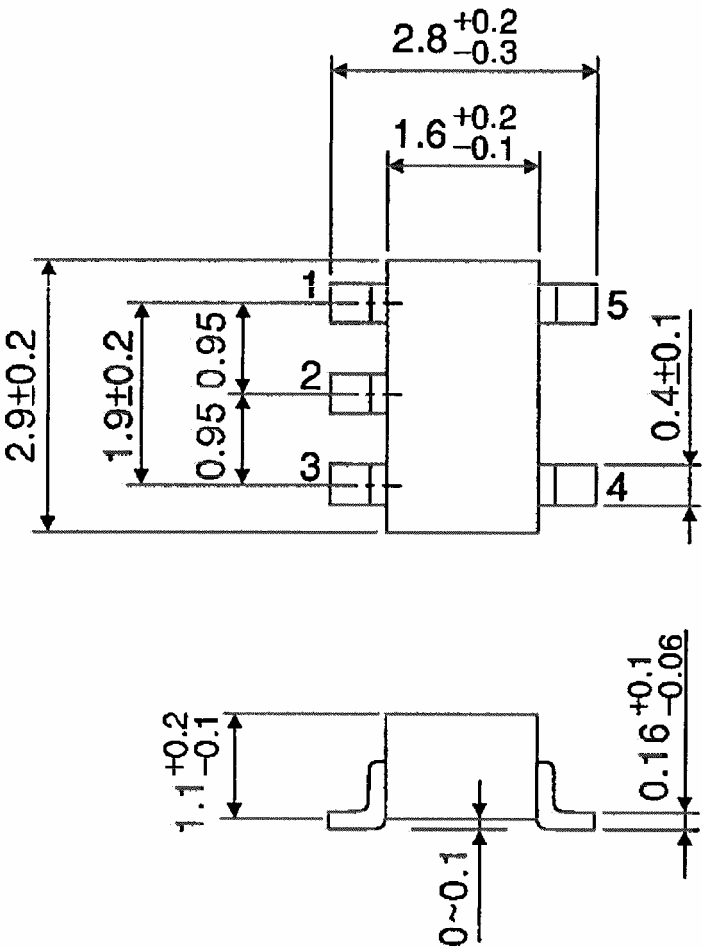
Average operating current can be obtained by the equation.

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

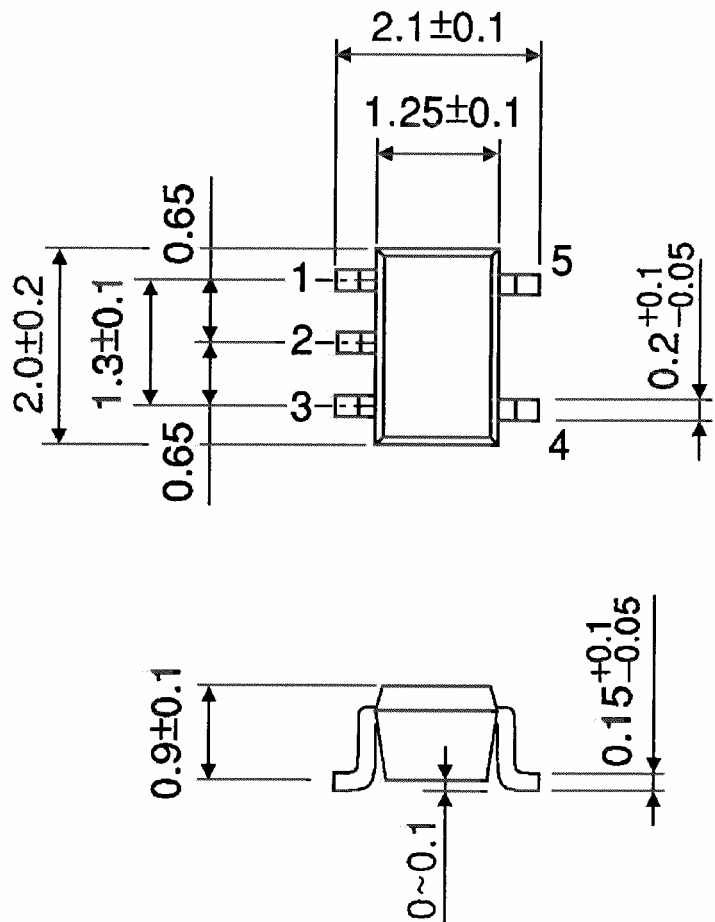


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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