TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

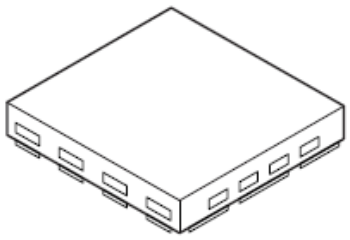
# TC7WG17FC

Triple Schmitt Buffer

## Features

- High output current : ±8 mA (min) at $V_{CC}$ = 3 V
- Super high speed operation: $t_{pd}$ = 4.0 ns (typ.) at $V_{CC}$ = 3.3 V, 15pF
- Operating voltage range : $V_{CC}$ = 0.9 to 3.6 V
- 5.5-V tolerant inputs
- 3.6-V power down protection outputs

TC7WG17FC



CSON8-P-0.4

(CST8)

Weight: 0.002 g (typ.)

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

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | −0.5 to 4.6 | V |
| DC input voltage | $V_{IN}$ | −0.5 to 7.0 | V |
| DC output voltage | $V_{OUT}$ | −0.5 to 4.6 (Note1) | V |
| | | −0.5 to $V_{CC}$+0.5 (Note2) | |
| Input diode current | $I_{IK}$ | −20 | mA |
| Output diode current | $I_{OK}$ | −20 (Note3) | mA |
| DC output current | $I_{OUT}$ | ±25 | mA |
| DC $V_{CC}$/GND current | $I_{CC}$ | ±50 | mA |
| Power dissipation | $P_D$ | 150 (Note4) | mW |
| Storage temperature | $T_{stg}$ | −65 to 150 | °C |

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).

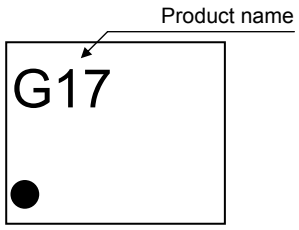
Note 1: $V_{CC}$ = 0 V

Note 2: High or Low State.
Do not exceed $I_{OUT}$ of absolute maximum ratings.

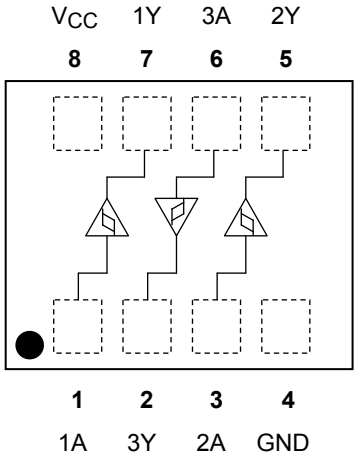
Note 3: $V_{OUT}$ < GND

Note 4: Mounted on an FR4 board.
(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 11.56 $mm^2$)

## Marking

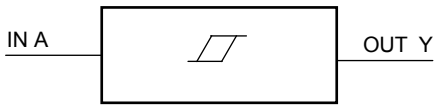



## Pin Assignment (top view)




Start of commercial production
2006-04

## IEC Logic Symbol




## Truth Table

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

## Operating Ranges

| Characteristics | Symbol | Rating | | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 0.9 to 3.6 | | V |
| Input voltage | $V_{IN}$ | 0 to 5.5 | | V |
| Output voltage | $V_{OUT}$ | 0 to 3.6 | (Note 5) | V |
| | | 0 to $V_{CC}$ | (Note 6) | |
| Output current | $I_{OH}/I_{OL}$ | ± 8.0 | (Note 7) | mA |
| | | ± 4.0 | (Note 8) | |
| | | ± 3.0 | (Note 9) | |
| | | ± 1.7 | (Note 10) | |
| | | ± 0.3 | (Note 11) | |
| | | ± 0.02 | (Note 12) | |
| Operating temperature | $T_{opr}$ | −40 to 85 | | °C |

Note 5: $V_{CC}$ = 0V

Note 6: High or Low state.

Note 7: $V_{CC}$ = 3.0 to 3.6 V

Note 8: $V_{CC}$ = 2.3 to 2.7 V

Note 9: $V_{CC}$ = 1.65 to 1.95 V

Note 10: $V_{CC}$ = 1.4 to 1.6 V

Note 11: $V_{CC}$ = 1.1 to 1.3 V

Note 12: $V_{CC}$ = 0.9 V

## Electrical Characteristics

## DC Characteristics

| Characteristics | | Symbol | Test Condition | | Ta = 25°C | | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $V_{CC}$ (V) | Min | Typ. | Max | Min | Max | |
| Threshold Voltage | Positive threshold voltage | $V_P$ | — | | 0.9 | — | — | 0.73 | — | 0.80 | V |
| | | | | | 1.1 | — | — | 0.86 | — | 0.93 | |
| | | | | | 1.4 | — | — | 1.07 | — | 1.12 | |
| | | | | | 1.65 | — | — | 1.23 | — | 1.25 | |
| | | | | | 2.3 | — | — | 1.66 | — | 1.68 | |
| | | | | | 3.0 | — | — | 2.14 | — | 2.15 | |
| | Negative threshold voltage | $V_N$ | — | | 0.9 | 0.18 | — | — | 0.07 | — | |
| | | | | | 1.1 | 0.26 | — | — | 0.18 | — | |
| | | | | | 1.4 | 0.36 | — | — | 0.31 | — | |
| | | | | | 1.65 | 0.45 | — | — | 0.41 | — | |
| | | | | | 2.3 | 0.69 | — | — | 0.64 | — | |
| | | | | | 3.0 | 0.96 | — | — | 0.91 | — | |
| Hysteresis Voltage | | $V_H$ | — | | 0.9 | 0.20 | — | 0.38 | 0.15 | 0.53 | V |
| | | | | | 1.1 | 0.25 | — | 0.41 | 0.21 | 0.53 | |
| | | | | | 1.4 | 0.35 | — | 0.48 | 0.34 | 0.57 | |
| | | | | | 1.65 | 0.42 | — | 0.56 | 0.40 | 0.60 | |
| | | | | | 2.3 | 0.60 | — | 0.74 | 0.61 | 0.76 | |
| | | | | | 3.0 | 0.79 | — | 0.93 | 0.80 | 0.94 | |
| Output voltage | High level | $V_{OH}$ | $V_{IN} = V_{IH}$ | $I_{OH}$ =−0.02 mA | 0.9 | 0.75 | — | — | 0.75 | — | V |
| | | | | $I_{OH}$ = −0.3 mA | 1.1 to 1.3 | $V_{CC}$ × 0.75 | — | — | $V_{CC}$ × 0.75 | — | |
| | | | | $I_{OH}$ = −1.7 mA | 1.4 to 1.6 | $V_{CC}$ × 0.75 | — | — | $V_{CC}$ × 0.75 | — | |
| | | | | $I_{OH}$ = −3.0 mA | 1.65 to 1.95 | $V_{CC}$ -0.45 | — | — | $V_{CC}$ -0.45 | — | |
| | | | | $I_{OH}$ = −4.0 mA | 2.3 to 2.7 | 2.0 | — | — | 2.0 | — | |
| | | | | $I_{OH}$ = −8.0 mA | 3.0 to 3.6 | 2.48 | — | — | 2.48 | — | |
| | Low level | $V_{OL}$ | $V_{IN} = V_{IL}$ | $I_{OL}$ = 0.02 mA | 0.9 | — | — | 0.1 | — | 0.1 | |
| | | | | $I_{OL}$ = 0.3 mA | 1.1 to 1.3 | — | — | $V_{CC}$ × 0.25 | — | $V_{CC}$ × 0.25 | |
| | | | | $I_{OL}$ = 1.7 mA | 1.4 to 1.6 | — | — | $V_{CC}$ × 0.25 | — | $V_{CC}$ × 0.25 | |
| | | | | $I_{OL}$ = 3.0 mA | 1.65 to 1.95 | — | — | 0.45 | — | 0.45 | |
| | | | | $I_{OL}$ = 4.0 mA | 2.3 to 2.7 | — | — | 0.4 | — | 0.4 | |
| | | | | $I_{OL}$ = 8.0 mA | 3.0 to 3.6 | — | — | 0.4 | — | 0.4 | |
| Input leakage current | | $I_{IN}$ | $V_{IN}$ = 0 to 5.5 V | | 0 to 3.6 | — | — | ±0.1 | — | ±1.0 | μA |
| Power off leakage current | | $I_{OFF}$ | $V_{IN}$ = 5.5 V or $V_{OUT}$ = 3.6 V | | 0 | — | — | 1.0 | — | 10.0 | μA |
| Quiescent supply current | | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND | | 3.6 | — | — | 1.0 | — | 10.0 | μA |

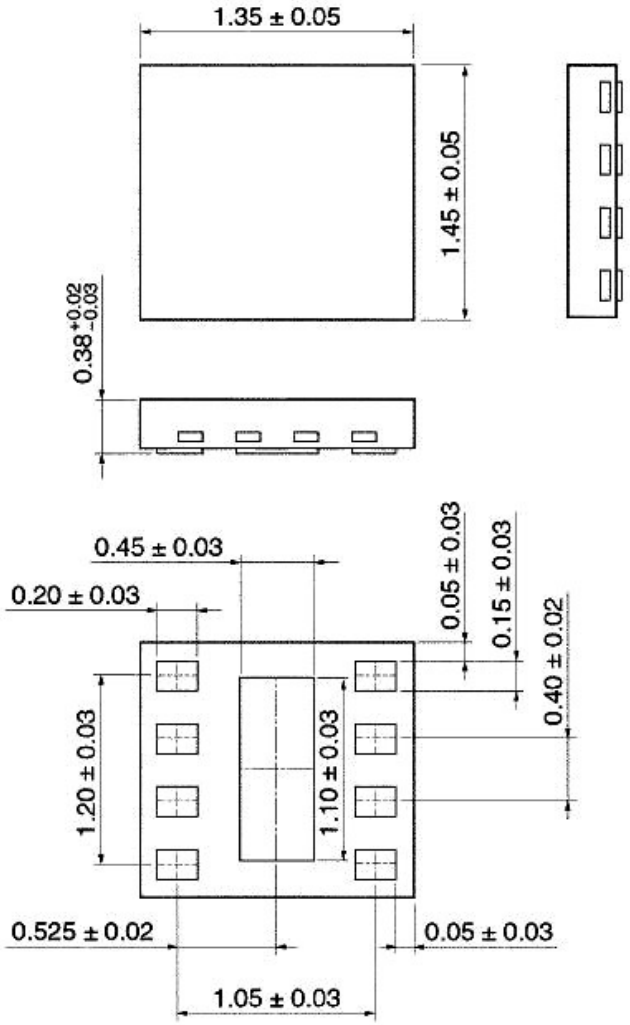
## AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | Min | Typ. | Max | Min | Max | |
| Propagation delay time | $t_{pLH}$ $t_{pHL}$ | $C_L$ = 10 pF, $R_L$ = 1 MΩ | 0.9 | — | 41.3 | — | — | — | ns |
| | | | 1.1 to 1.3 | — | 18.0 | 25.4 | 1.0 | 40.8 | |
| | | | 1.4 to 1.6 | — | 9.5 | 12.2 | 1.0 | 13.5 | |
| | | | 1.65 to 1.95 | — | 7.0 | 8.7 | 1.0 | 9.3 | |
| | | | 2.3 to 2.7 | — | 4.7 | 5.7 | 1.0 | 6.2 | |
| | | | 3.0 to 3.6 | — | 3.7 | 4.5 | 1.0 | 4.7 | |
| | | $C_L$ = 15 pF, $R_L$ = 1 MΩ | 0.9 | — | 44.4 | — | — | — | |
| | | | 1.1 to 1.3 | — | 19.3 | 27.7 | 1.0 | 46.9 | |
| | | | 1.4 to 1.6 | — | 10.2 | 13.1 | 1.0 | 14.7 | |
| | | | 1.65 to 1.95 | — | 7.5 | 9.3 | 1.0 | 9.9 | |
| | | | 2.3 to 2.7 | — | 5.0 | 5.9 | 1.0 | 6.4 | |
| | | | 3.0 to 3.6 | — | 4.0 | 4.8 | 1.0 | 5.2 | |
| | | $C_L$ = 30 pF, $R_L$ = 1 MΩ | 0.9 | — | 55.8 | — | — | — | |
| | | | 1.1 to 1.3 | — | 24.7 | 36.3 | 1.0 | 59.6 | |
| | | | 1.4 to 1.6 | — | 12.9 | 16.8 | 1.0 | 19.2 | |
| | | | 1.65 to 1.95 | — | 9.2 | 11.5 | 1.0 | 12.9 | |
| | | | 2.3 to 2.7 | — | 5.9 | 7.1 | 1.0 | 8.3 | |
| | | | 3.0 to 3.6 | — | 4.9 | 5.7 | 1.0 | 6.6 | |
| Input capacitance | $C_{IN}$ | — | 3.6 | — | 3 | — | — | — | pF |
| Power dissipation capacitance | $C_{PD}$ | (Note 13) | 0.9 to 3.6 | — | 11 | — | — | — | pF |

Note 13: $C_{PD}$ 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:
$I_{CC\ (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/3$

**Package Dimensions**

CSON8-P-0.4 Unit: mm




Weight: 0.002 g (typ.)

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