TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

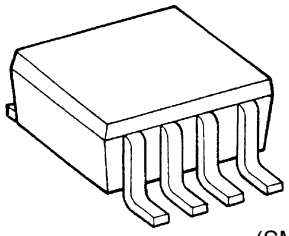
# TC7WH157FU,TC7WH157FK

2-Channel Multiplexer

## Features

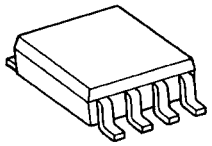
- High speed: $t_{pd}$ = 4.1ns (typ.) at $V_{CC}$ = 5V, $C_L$ = 15pF
- Low power dissipation: $I_{CC}$ = 2μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (min)
- 5.5-V Tolerant inputs.
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: $V_{CC}$ = 2 to 5.5V
- Low Noise : $V_{OLP}$ = 0.8 V (max)

TC7WH157FU



SSOP8-P-0.65 (SM8)

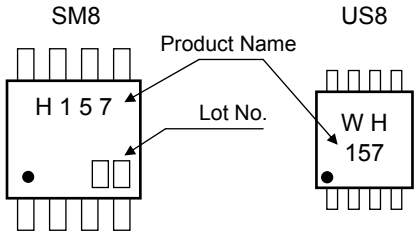
TC7WH157FK



SSOP8-P-0.50A (US8)

Weight
SSOP8-P-0.65: 0.02 g (typ.)
SSOP8-P-0.50A: 0.01 g (typ.)

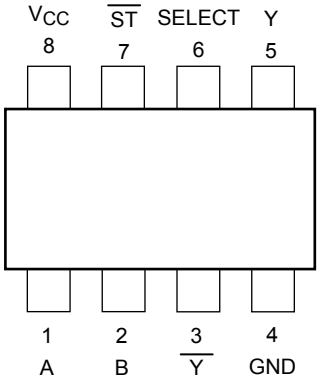
## Marking




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

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | −0.5 to 7.0 | V |
| DC input voltage | $V_{IN}$ | −0.5 to 7.0 | 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 (Note 1) | mA |
| DC output current | $I_{OUT}$ | ±25 | mA |
| DC $V_{CC}$/ground current | $I_{CC}$ | ±50 | mA |
| Power dissipation | $P_D$ | 300 (SM8) | mW |
| | | 200 (US8) | |
| Storage temperature | $T_{stg}$ | −65 to 150 | °C |
| Lead temperature (10 s) | $T_L$ | 260 | °C |

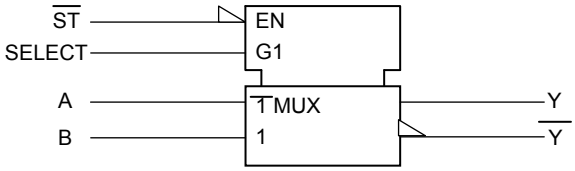
## Pin Assignment (top view)




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).

Note 1: $V_{OUT}$ < GND, $V_{OUT}$ > $V_{CC}$

## IEC Logic Symbol




## Truth Table

| INPUTS | | | | OUTPUTS | |
|---|---|---|---|---|---|
| $\overline{ST}$ | SELECT | A | B | Y | $\overline{Y}$ |
| H | X | X | X | L | H |
| L | L | L | X | L | H |
| L | L | H | X | H | L |
| L | H | X | L | L | H |
| L | H | X | H | H | L |

X: Don't Care

## 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 ± 0.3 V) | ns/V |
| | | 0 to 20 ($V_{CC}$ = 5.0 ± 0.5 V) | |

## Electrical Characteristics

### DC Characteristics

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Ta = 25°C Min | Ta = 25°C Typ. | Ta = 25°C Max | Ta = −40 to 85°C Min | Ta = −40 to 85°C Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| High-level input voltage | $V_{IH}$ | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | 3.0 to 5.5 | $V_{CC}$ × 0.7 | — | — | $V_{CC}$ × 0.7 | — | |
| Low-level input voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.50 | — | 0.50 | V |
| | | | | 3.0~5.5 | — | — | $V_{CC}$ × 0.3 | — | $V_{CC}$ × 0.3 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −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 | 0.1 | — | 0.1 | V |
| | | | | 3.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | $I_{OL}$ = 4 mA | 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)

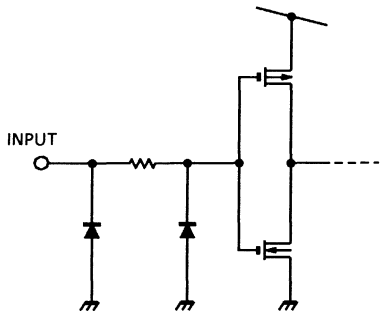
| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | $C_L$ (pF) | Min | Typ. | Max | Min | Max | |
| Propagation Delay Time (A, B – Y , $\overline{Y}$) | $t_{pLH}$ $t_{pHL}$ | | 3.3 ± 0.3 | 15 | — | 6.2 | 9.7 | 1.0 | 11.5 | ns |
| | | | | 50 | — | 8.7 | 13.2 | 1.0 | 15.0 | |
| | | | 5.0 ± 0.5 | 15 | — | 4.1 | 6.4 | 1.0 | 7.5 | |
| | | | | 50 | — | 5.6 | 8.4 | 1.0 | 9.5 | |
| Propagation Delay Time (SELECT – Y,$\overline{Y}$) | $t_{pLH}$ $t_{pHL}$ | | 3.3 ± 0.3 | 15 | — | 8.4 | 13.2 | 1.0 | 15.5 | ns |
| | | | | 50 | — | 10.9 | 16.7 | 1.0 | 19.0 | |
| | | | 5.0 ± 0.5 | 15 | — | 5.3 | 8.1 | 1.0 | 9.5 | |
| | | | | 50 | — | 6.8 | 10.1 | 1.0 | 11.5 | |
| Propagation Delay Time ($\overline{ST}$ – Y,$\overline{Y}$) | $t_{pLH}$ $t_{pHL}$ | | 3.3 ± 0.3 | 15 | — | 8.7 | 13.6 | 1.0 | 16.0 | ns |
| | | | | 50 | — | 11.2 | 17.1 | 1.0 | 19.5 | |
| | | | 5.0 ± 0.5 | 15 | — | 5.6 | 8.6 | 1.0 | 10.0 | |
| | | | | 50 | — | 7.1 | 10.6 | 1.0 | 12.0 | |
| Input Capacitance | $C_{IN}$ | | | | — | 4 | 10 | — | 10 | pF |
| Power Dissipation Capacitance | $C_{PD}$ | (Note 2) | | | — | 20 | — | — | — | 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 :
$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN}\ I_{CC}$

## Noise Characteristics (Ta = 25°C, input: $t_r = t_f = 3$ ns)

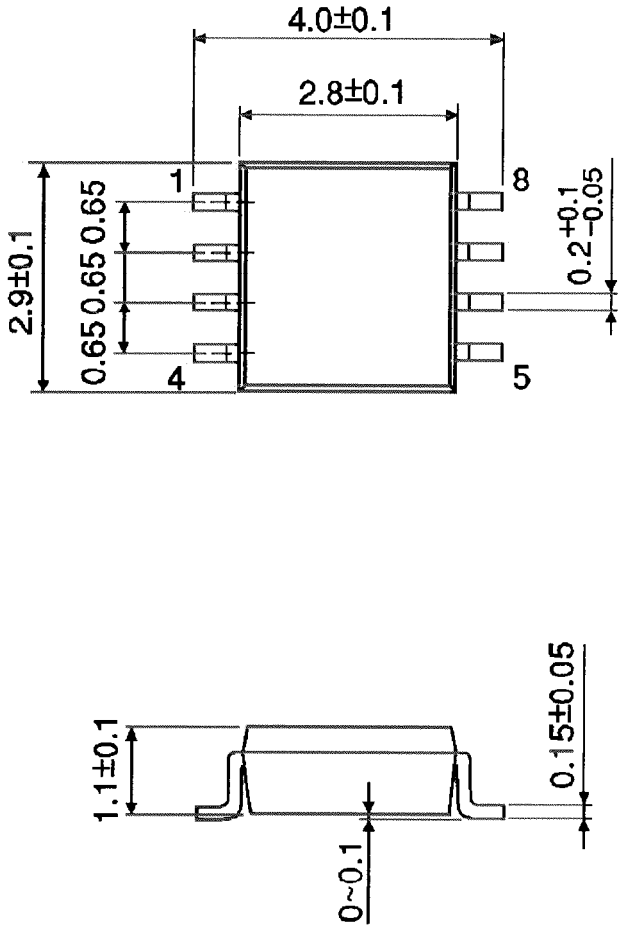
| Characteristics | Symbol | Test Condition | | Typ. | Limit | Unit |
|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | | | |
| Quiet output maximum dynamic $V_{OL}$ | $V_{OLP}$ | $C_L$ = 50 pF | 5.0 | 0.3 | 0.8 | V |
| Quiet output minimum dynamic $V_{OL}$ | $V_{OLV}$ | $C_L$ = 50 pF | 5.0 | −0.3 | −0.8 | V |
| Minimum high level dynamic input voltage | $V_{IHD}$ | $C_L$ = 50 pF | 5.0 | — | 3.5 | V |
| Maximum low level dynamic input voltage | $V_{ILD}$ | $C_L$ = 50 pF | 5.0 | — | 1.5 | V |

## Input Equivalent Circuit



## Package Dimensions

SSOP8-P-0.65 Unit : mm



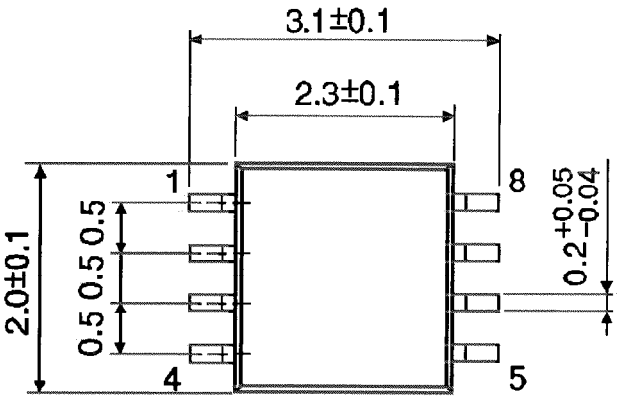


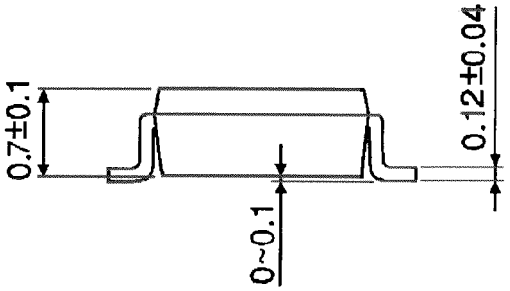


Weight: 0.02 g (typ.)

**Package Dimensions**

SSOP8-P-0.50A Unit : mm




Weight: 0.01 g (typ.)

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