CMOS Digital Integrated Circuits Silicon Monolithic

# TC74ACT14F

## 1. Functional Description

- Hex Schmitt Inverter

## 2. General

The TC74ACT14F is an advanced high speed CMOS SCHMITT INVERTER fabricated with silicon gate and double-layer metal wiring $C^2MOS$ technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

Pin configuration and function are the same as the TC74ACT04F but the inputs have hysteresis and with its schmitt trigger function, the TC74ACT14F can be used as a line receivers which will receive slow input signals.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

## 3. Features

(1) High speed: $t_{pd}$ = 6.5 ns (typ.) at $V_{CC}$ = 5.0 V

(2) Low power dissipation: $I_{CC}$ = 4.0 μA (max) at $T_a$ = 25 °C

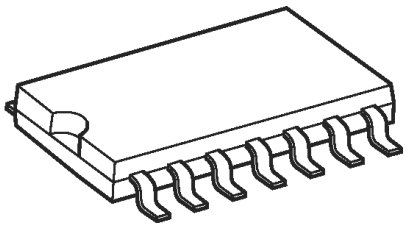
(3) Compatible with TTL inputs : $V_{IL}$ = 0.8 V (max)
: $V_{IH}$ = 2.0 V (min)

(4) Output current: $|I_{OH}|/I_{OL}$ = 24 mA (min) ($V_{CC}$ = 4.5 V)

(5) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$

(6) Pin and function compatible with 74F14.

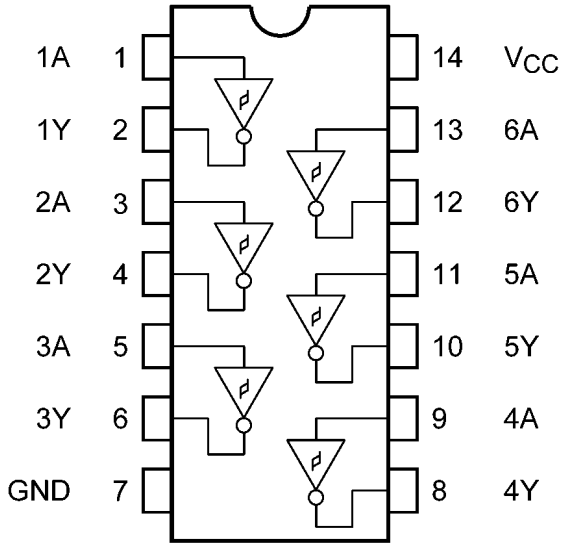
## 4. Packaging



SOP14

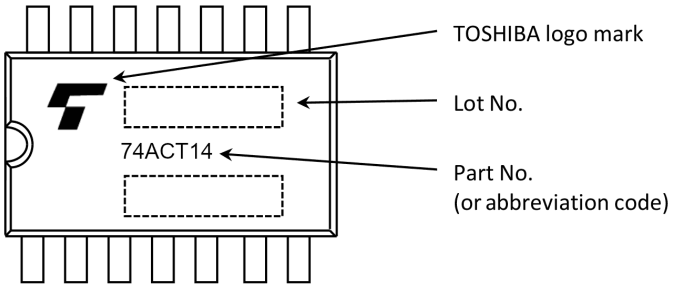
Start of commercial production
1989-11

## 5. Pin Assignment

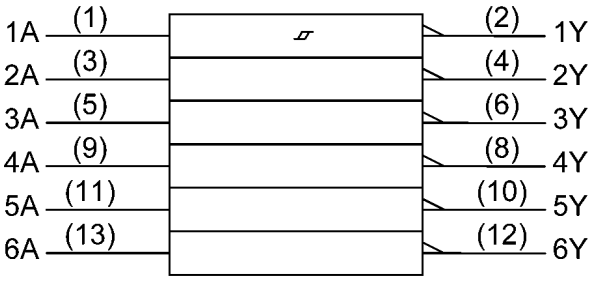



(top view)

## 6. Marking



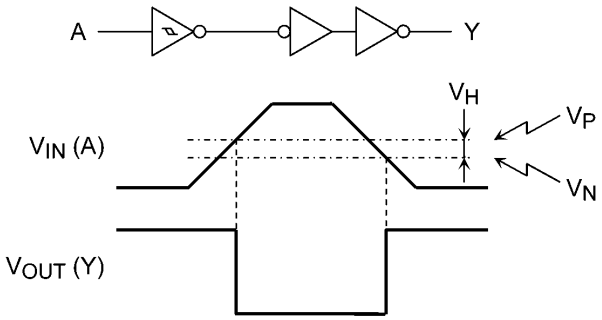

## 7. IEC Logic Symbol



## 8. Truth Table

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

## 9. System Diagram, Waveform




## 10. Absolute Maximum Ratings (Note)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | -0.5 to 7.0 | V |
| Input voltage | $V_{IN}$ | -0.5 to $V_{CC}$ + 0.5 | V |
| Output voltage | $V_{OUT}$ | -0.5 to $V_{CC}$ + 0.5 | V |
| Input diode current | $I_{IK}$ | ±20 | mA |
| Output diode current | $I_{OK}$ | ±50 | mA |
| Output current | $I_{OUT}$ | ±50 | mA |
| $V_{CC}$/ground current | $I_{CC}$ | ±150 | mA |
| Power dissipation | $P_D$ | 180 | mW |
| Storage temperature | $T_{stg}$ | -65 to 150 | °C |

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.
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).

## 11. Operating Ranges (Note)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 4.5 to 5.5 | V |
| Input voltage | $V_{IN}$ | 0 to $V_{CC}$ | V |
| Output voltage | $V_{OUT}$ | 0 to $V_{CC}$ | V |
| Operating temperature | $T_{opr}$ | -40 to 85 | °C |

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either $V_{CC}$ or GND.

## 12. Electrical Characteristics

### 12.1. DC Characteristics (Unless otherwise specified, $T_a$ = 25 °C)

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Positive threshold voltage | $V_P$ | — | | 4.5 | — | — | 2.0 | V |
| Negative threshold voltage | $V_N$ | — | | 4.5 | 0.8 | — | — | V |
| Hysteresis voltage | $V_H$ | — | | 4.5 | 0.4 | — | 1.2 | V |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IL}$ | $I_{OH}$ = -50 μA | 4.5 | 4.4 | 4.5 | — | V |
| | | | $I_{OH}$ = -24 mA | 4.5 | 3.94 | — | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ | $I_{OL}$ = 50 μA | 4.5 | — | 0.0 | 0.1 | V |
| | | | $I_{OL}$ = 24 mA | 4.5 | — | — | 0.36 | |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | — | ±0.1 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | — | 4.0 | μA |
| | $I_{CCT}$ | Per input: $V_{IN}$ = 3.4 V<br>Other input: $V_{CC}$ or GND | | 5.5 | — | — | 1.35 | mA |

### 12.2. DC Characteristics (Unless otherwise specified, $T_a$ = -40 to 85 °C)

| Characteristics | Symbol | Test Condition | | Note | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Positive threshold voltage | $V_P$ | — | | | 4.5 | — | 2.0 | V |
| Negative threshold voltage | $V_N$ | — | | | 4.5 | 0.8 | — | V |
| Hysteresis voltage | $V_H$ | — | | | 4.5 | 0.4 | 1.2 | V |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IL}$ | $I_{OH}$ = -50 μA | | 4.5 | 4.4 | — | V |
| | | | $I_{OH}$ = -24 mA | | 4.5 | 3.80 | — | |
| | | | $I_{OH}$ = -75 mA | (Note 1) | 5.5 | 3.85 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ | $I_{OL}$ = 50 μA | | 4.5 | — | 0.1 | V |
| | | | $I_{OL}$ = 24 mA | | 4.5 | — | 0.44 | |
| | | | $I_{OL}$ = 75 mA | (Note 1) | 5.5 | — | 1.65 | |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = $V_{CC}$ or GND | | | 5.5 | — | ±1.0 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | | 5.5 | — | 40.0 | μA |
| | $I_{CCT}$ | Per input: $V_{IN}$ = 3.4 V<br>Other input: $V_{CC}$ or GND | | | 5.5 | — | 1.5 | mA |

Note 1: This spec indicates the capability of driving 50 Ω transmission lines.
One output should be tested within a 10 ms maximum duration.

### 12.3. AC Characteristics (Unless otherwise specified, $T_a$ = 25 °C, Input: $t_r$ = $t_f$ = 3 ns)

| Characteristics | Symbol | Note | Test Condition | $V_{CC}$ (V) | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Propagation delay time | $t_{PLH}$,$t_{PHL}$ | | $C_L$ = 50 pF<br>$R_L$ = 500 Ω | 5.0 ± 0.5 | — | 7.2 | 11.4 | ns |
| Input capacitance | $C_{IN}$ | | — | | — | 5 | 10 | pF |
| Power dissipation capacitance | $C_{PD}$ | (Note 1) | — | | — | 30 | — | pF |

Note 1: $C_{PD}$ 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.

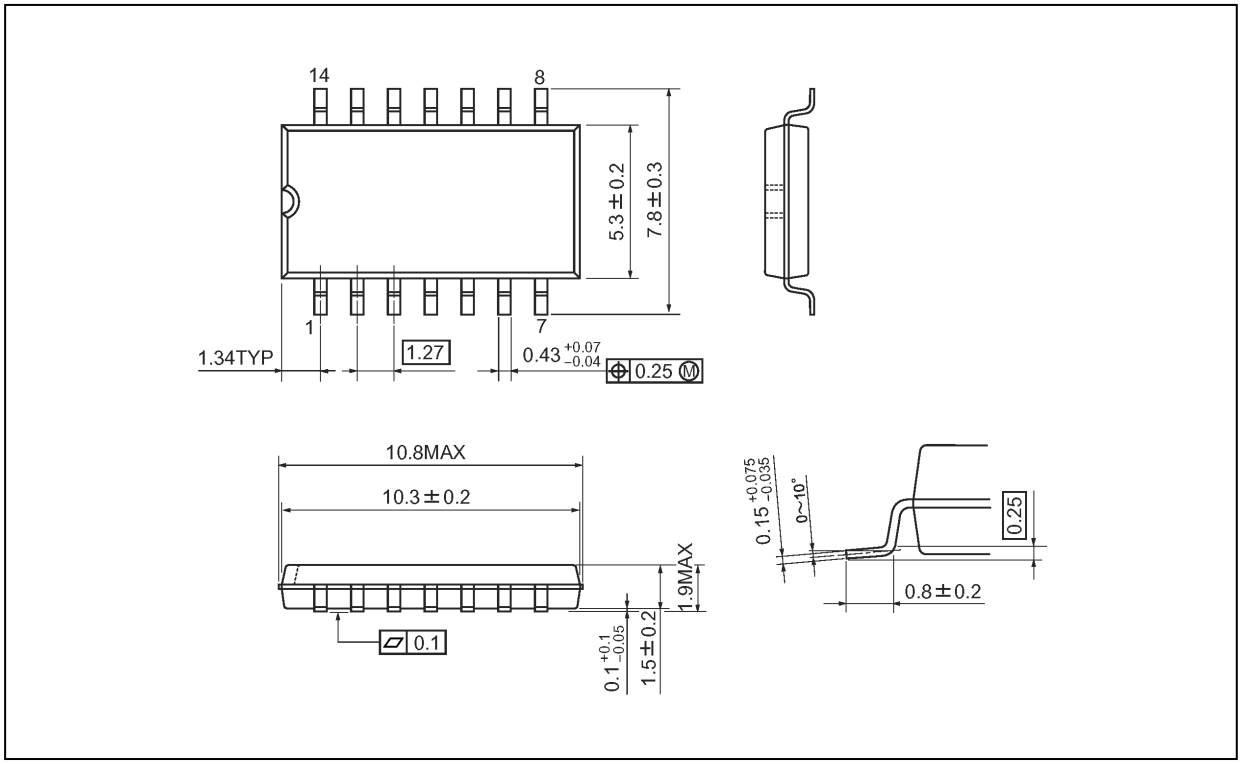
$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/6$ (per gate)

### 12.4. AC Characteristics (Unless otherwise specified, $T_a$ = -40 to 85 °C, Input: $t_r$ = $t_f$ = 3 ns)

| Characteristics | Symbol | Test Condition | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|
| Propagation delay time | $t_{PLH}$,$t_{PHL}$ | $C_L$ = 50 pF<br>$R_L$ = 500 Ω | 5.0 ± 0.5 | 1.0 | 13.0 | ns |
| Input capacitance | $C_{IN}$ | — | | — | 10 | pF |

## Package Dimensions

Unit: mm




Weight: 0.18 g (typ.)

| Package Name(s) |
| --- |
| Nickname: SOP14 |

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