

# TC74ACT174P, TC74ACT174F, TC74ACT174FN

## Hex D-Type Flip Flop with Clear

The TC74ACT174 is an advanced high speed CMOS HEX D-TYPE FLIP FLOP fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS 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.

Information signals applied to D inputs are transferred to the Q outputs on the positive going edge of the clock pulse.

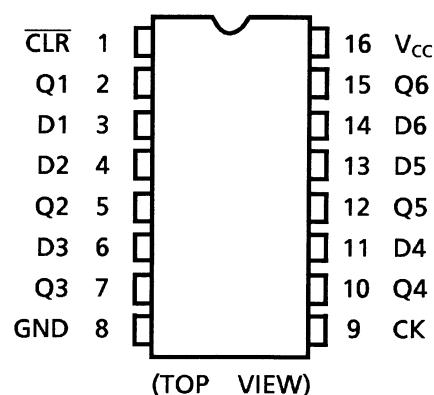
When the CLR input is held low, the Q output are in the low logic level independent of the other inputs.

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

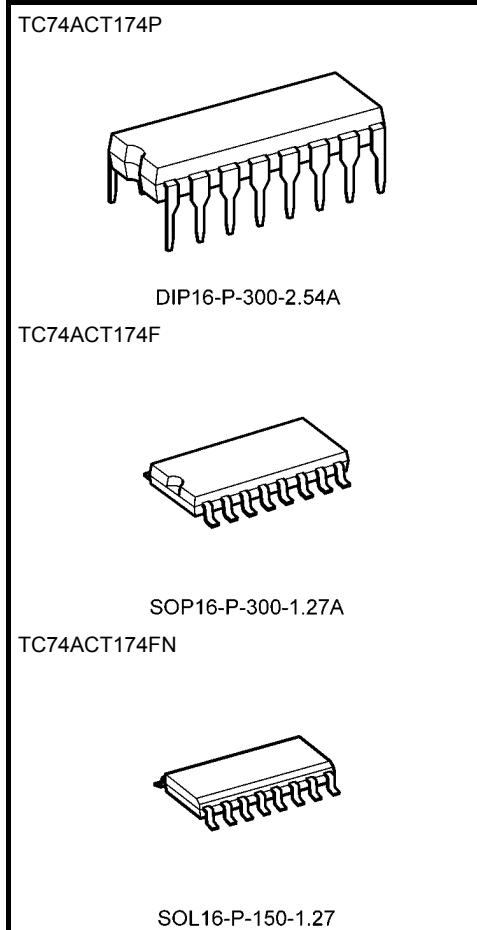
## Features

- High speed:  $f_{max} = 155$  MHz (typ.) at  $V_{CC} = 5$  V
- Low power dissipation:  $I_{CC} = 8 \mu A$  (max) at  $T_a = 25^\circ C$
- Compatible with TTL outputs:  $V_{IL} = 0.8$  V (max)  
 $V_{IH} = 2.0$  V (min)
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 24$  mA (min)  
 Capability of driving 50  $\Omega$  transmission lines.
- Balanced propagation delays:  $t_{PLH} \approx t_{PHL}$
- Pin and function compatible with 74F174

## Pin Assignment



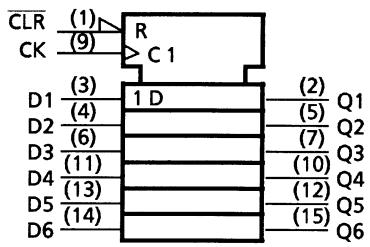
Note: xxxFN (JEDEC SOP) is not available in Japan.



### Weight

DIP16-P-300-2.54A	: 1.00 g (typ.)
SOP16-P-300-1.27A	: 0.18 g (typ.)
SOL16-P-150-1.27	: 0.13 g (typ.)

## IEC Logic Symbol

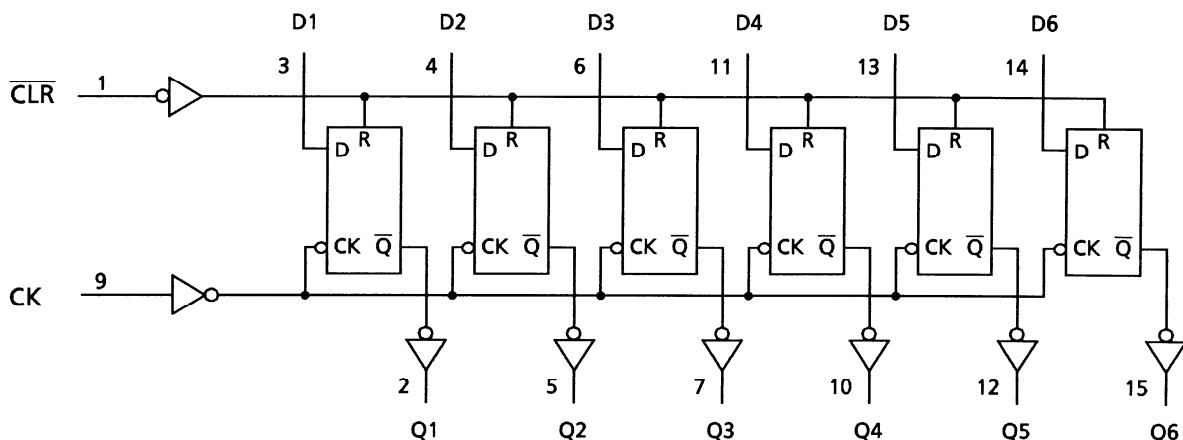


## Truth Table

Inputs			Output	Function
$\overline{\text{CLR}}$	D	CK	Q	
L	X	X	L	Clear
H	L	↑	L	—
H	H	↑	H	—
H	X	↓	$Q_n$	No Change

X: Don't care

## System Diagram



**Absolute Maximum Ratings (Note 1)**

Characteristics	Symbol	Rating	Unit
Supply voltage range	V <sub>CC</sub>	−0.5 to 7.0	V
DC input voltage	V <sub>IN</sub>	−0.5 to V <sub>CC</sub> + 0.5	V
DC output voltage	V <sub>OUT</sub>	−0.5 to V <sub>CC</sub> + 0.5	V
Input diode current	I <sub>IK</sub>	±20	mA
Output diode current	I <sub>OK</sub>	±50	mA
DC output current	I <sub>OUT</sub>	±50	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±150	mA
Power dissipation	P <sub>D</sub>	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T <sub>stg</sub>	−65 to 150	°C

Note 1: 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.).

Note 2: 500 mW in the range of Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°C should be applied up to 300 mW.

**Operating Ranges (Note)**

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	4.5 to 5.5	V
Input voltage	V <sub>IN</sub>	0 to V <sub>CC</sub>	V
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	−40 to 85	°C
Input rise and fall time	dt/dV	0 to 10	ns/V

Note: The operating ranges must be maintained to ensure the normal operation of the device.  
Unused inputs must be tied to either VCC or GND.

## Electrical Characteristics

## DC Characteristics

Characteristics	Symbol	Test Condition		V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to 85°C		Unit
					Min	Typ.	Max	Min	Max	
High-level input voltage	V <sub>IH</sub>	—		4.5 to 5.5	2.0	—	—	2.0	—	V
Low-level input voltage	V <sub>IL</sub>	—		4.5 to 5.5	—	—	0.8	—	0.8	V
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50 µA I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -75 mA (Note)	4.5 4.5 5.5	4.4 3.94 —	4.5 — —	— — —	4.4 3.80 3.85	— — —	V
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50 µA I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 75 mA (Note)	4.5 4.5 5.5	— — —	0.0 0.36 —	0.1 — —	— — —	0.1 0.44 1.65	V
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		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	—	—	8.0	—	80.0	µA
	I <sub>C</sub>	Per input: V <sub>IN</sub> = 3.4 V Other input: V <sub>CC</sub> or GND		5.5	—	—	1.35	—	1.5	mA

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

Timing Requirements (input: t<sub>r</sub> = t<sub>f</sub> = 3 ns)

Characteristics	Symbol	Test Condition			Ta = 25°C	Ta = -40 to 85°C	Unit	
					V <sub>CC</sub> (V)	Limit		
Minimum pulse width (CK)	t <sub>W</sub> (L) t <sub>W</sub> (H)	—			5.0 ± 0.5	5.0	5.0	ns
Minimum pulse width (CLR)	t <sub>W</sub> (L)	—			5.0 ± 0.5	5.0	5.0	ns
Minimum set-up time	t <sub>s</sub>	—			5.0 ± 0.5	3.5	3.5	ns
Minimum hold time	t <sub>h</sub>	—			5.0 ± 0.5	2.0	2.0	ns
Minimum removal time (CLR)	t <sub>rem</sub>	—			5.0 ± 0.5	3.0	3.0	ns

AC Characteristics ( $C_L = 50 \text{ pF}$ ,  $R_L = 500 \Omega$ , input:  $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		
Propagation delay time (CK-Q)	$t_{PLH}$ $t_{PHL}$	—	5.0 ± 0.5	—	7.1	10.1	1.0	11.5	ns
Propagation delay time ( $\overline{CLR}$ -Q)	$t_{PHL}$	—	5.0 ± 0.5	—	7.4	11.8	1.0	13.5	ns
Maximum clock frequency	$f_{max}$	—	5.0 ± 0.5	85	140	—	85	—	MHz
Input capacitance	$C_{IN}$	—	—	—	5	10	—	10	pF
Power dissipation capacitance	$C_{PD}$ (Note)	—	—	—	32	—	—	—	pF

Note:  $C_{PD}$  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:

$$I_{CC} (\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6 \text{ (per F/F)}$$

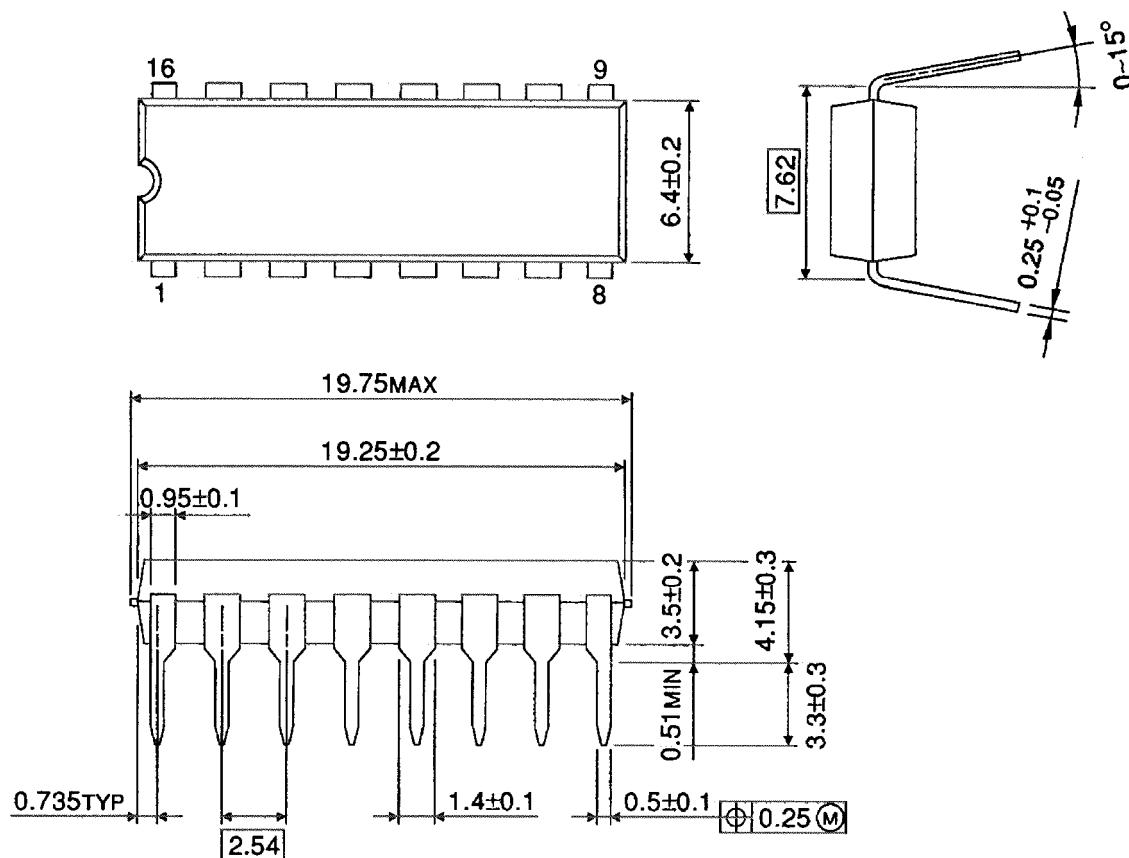
And the total  $C_{PD}$  when  $n$  pcs of Flip Flop operate can be gained by the following equation.

$$C_{PD} (\text{total}) = 20 + 12 \cdot n$$

**Package Dimensions**

DIP16-P-300-2.54A

Unit : mm

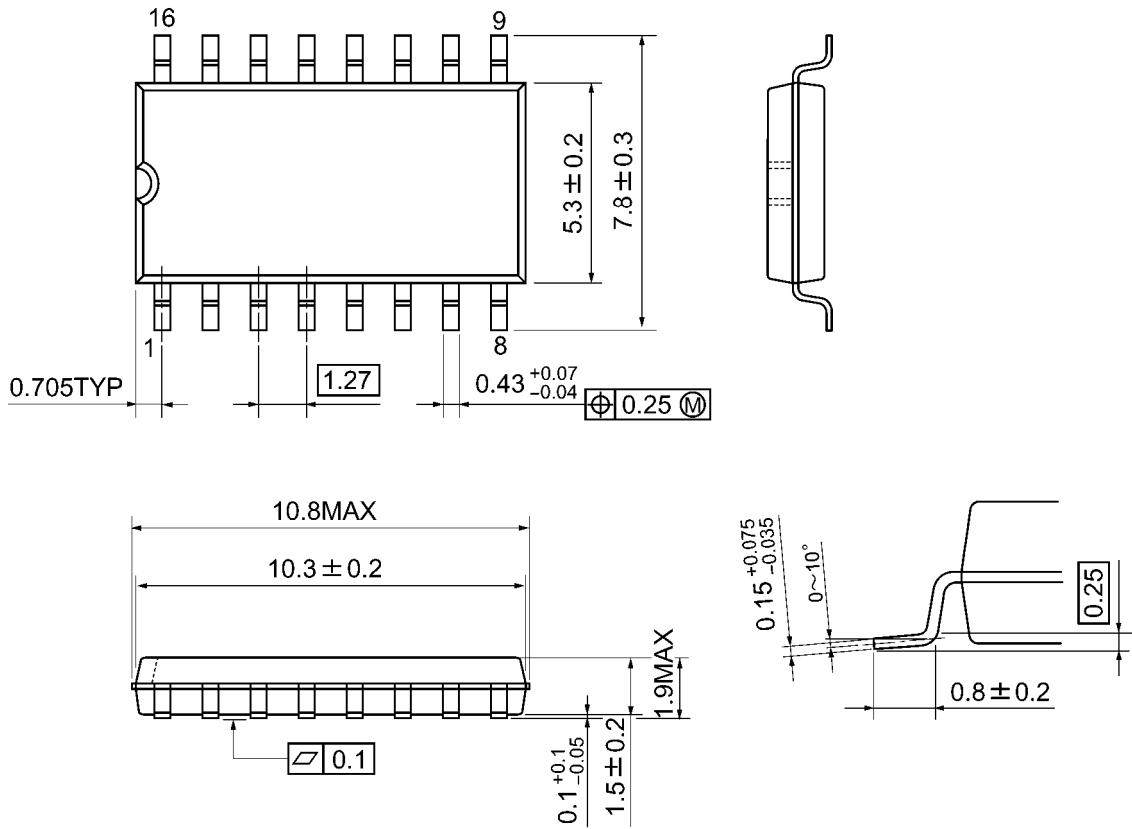


Weight: 1.00 g (typ.)

**Package Dimensions**

SOP16-P-300-1.27A

Unit: mm

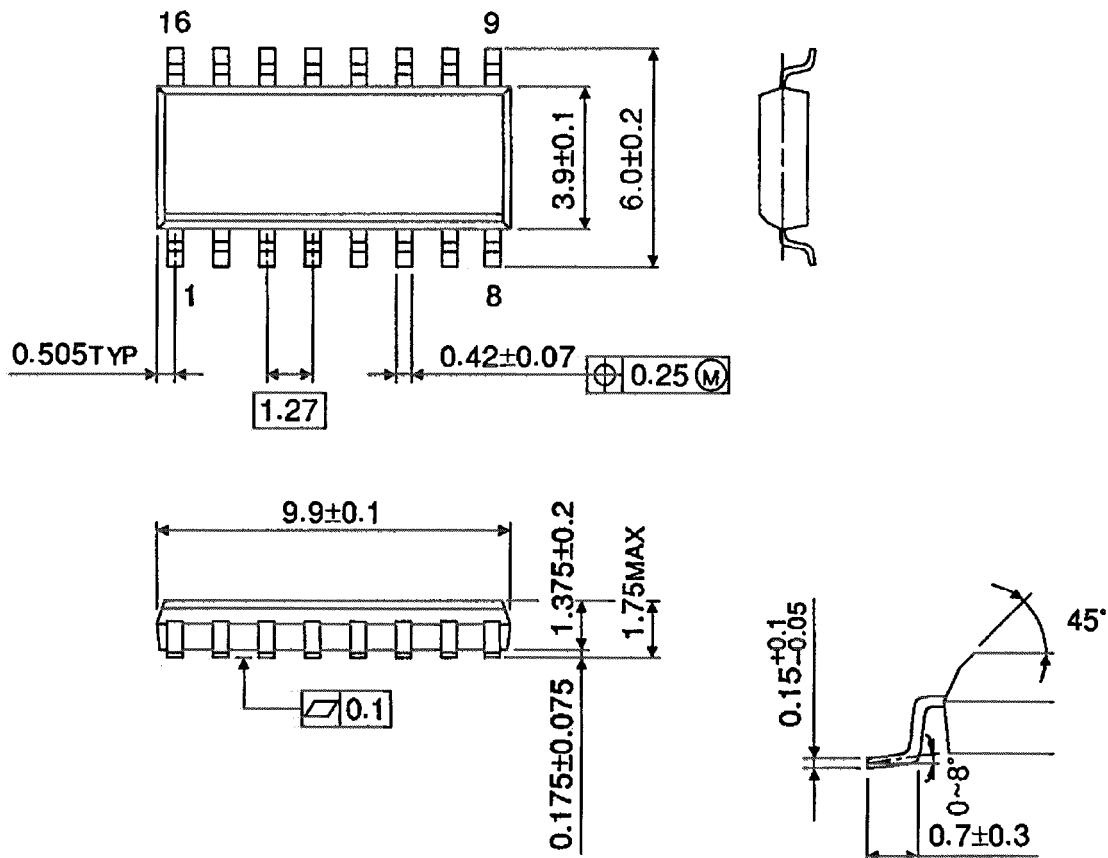


Weight: 0.18 g (typ.)

**Package Dimensions (Note)**

SOL16-P-150-1.27

Unit : mm



Note: This package is not available in Japan.

Weight: 0.13 g (typ.)

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