

**TC74HCT174AP, TC74HCT174AF, TC74HCT174AFN**

**HEX D - TYPE FLIP FLOP WITH CLEAR**

The TC74HCT174A is a high speed CMOS D - TYPE FLIP FLOP fabricated with silicon gate C<sup>2</sup>MOS technology. It achieves the high speed operation similar to equivalent LSTTL 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 the D inputs are transferred to the Q outputs on the positive going edge of the clock pulse. When the  $\overline{\text{CLR}}$  input is held low , the Q outputs 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 :**

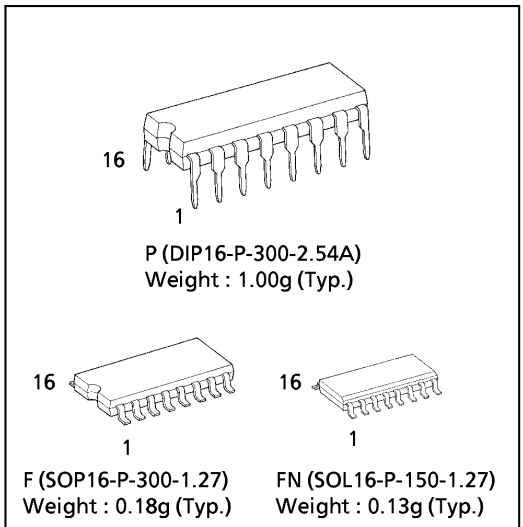
- High Speed..... $f_{\text{MAX}} = 56\text{MHz}(\text{typ.})$   
at  $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation..... $I_{\text{CC}} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs..... $V_{\text{IH}} = 2.0\text{V}(\text{Min.})$   
 $V_{\text{IL}} = 0.8\text{V}(\text{Max.})$
- Wide Interfacing ability.....LSTTL , NMOS , CMOS
- Output Drive Capability.....10 LSTTL Loads
- Symmetrical Output Impedance..... $|I_{\text{OH}}| = I_{\text{OL}} = 4\text{mA}(\text{Min.})$
- Balanced Propagation Delays..... $t_{\text{pLH}} \approx t_{\text{pHL}}$
- Pin and Function Compatible with 74LS174

**TRUTH TABLE**

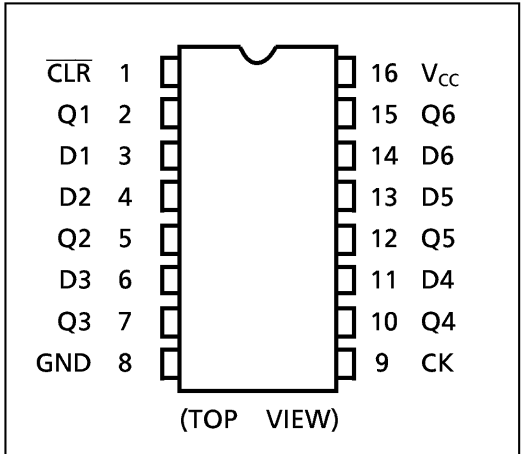
INPUTS			OUTPUT	FUNCTION
$\overline{\text{CLR}}$	D	CK	Q	
L	X	X	L	CLEAR
H	L		L	—
H	H		H	—
H	X		Q <sub>n</sub>	NO CHANGE

X : Don't Care

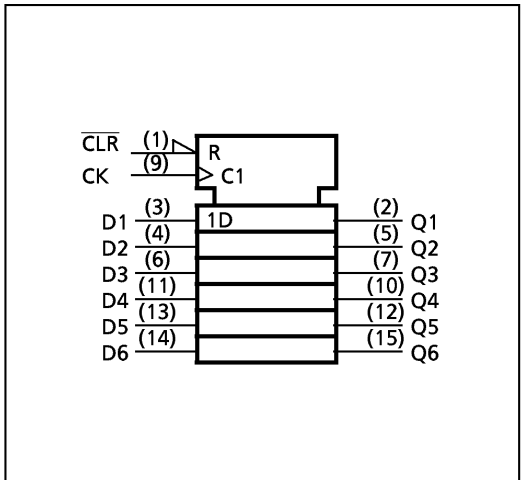
(Note) The JEDEC SOP (FN) is not available in Japan.



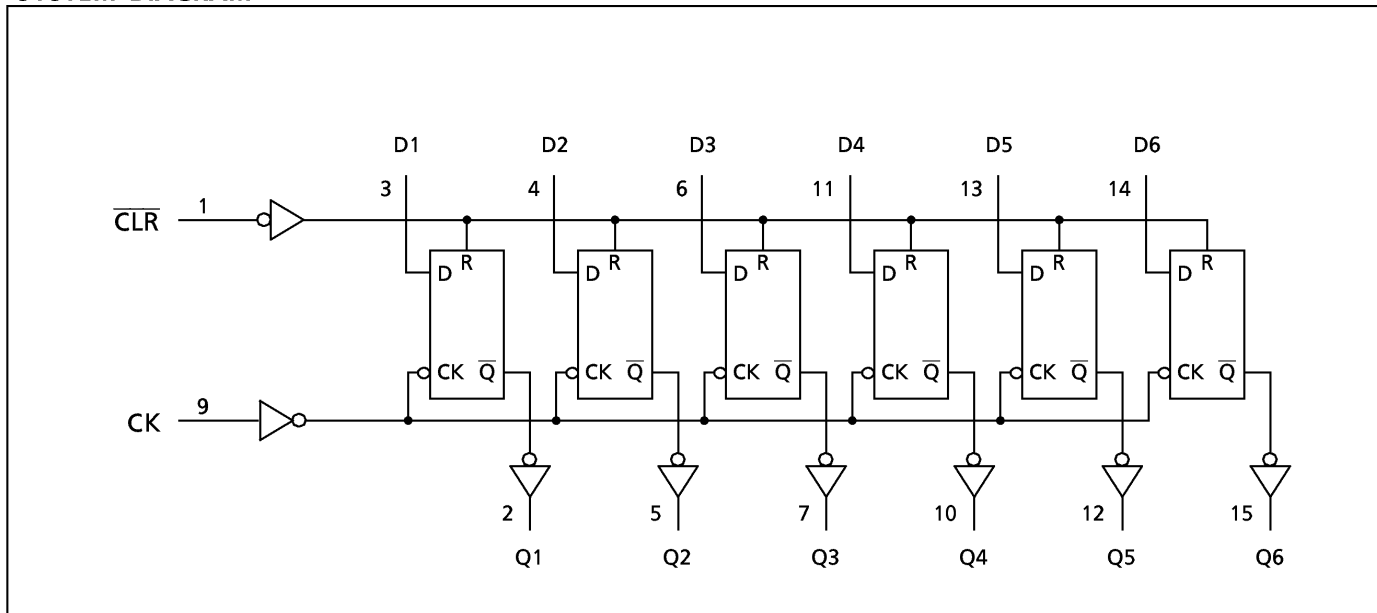
**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**



**SYSTEM DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	$V_{CC}$	-0.5~7	V
DC Input Voltage	$V_{IN}$	-0.5~ $V_{CC} + 0.5$	V
DC Output Voltage	$V_{OUT}$	-0.5~ $V_{CC} + 0.5$	V
Input Diode Current	$I_{IK}$	$\pm 20$	mA
Output Diode Current	$I_{OK}$	$\pm 20$	mA
DC Output Current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ / Ground Current	$I_{CC}$	$\pm 50$	mA
Power Dissipation	$P_D$	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	$T_{stg}$	-65~150	$^{\circ}C$

\*500mW in the range of  $T_a = -40^{\circ}C \sim 65^{\circ}C$ . From  $T_a = 65^{\circ}C$  to  $85^{\circ}C$  a derating factor of  $-10mW/^{\circ}C$  shall be applied until 300mW.

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	$V_{CC}$	4.5~5.5	V
Input Voltage	$V_{IN}$	0~ $V_{CC}$	V
Output Voltage	$V_{OUT}$	0~ $V_{CC}$	V
Operating Temperature	$T_{opr}$	-40~85	$^{\circ}C$
Input Rise and Fall Time	$t_r, t_f$	0~500	ns

## DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.		
High - Level Input Voltage	V <sub>IH</sub>		4.5 } 5.5	2.0	—	—	2.0	—	V	
Low - Level Input Voltage	V <sub>IL</sub>		4.5 } 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> = -20 μA	4.5	4.4	4.5	—	4.4	—	V
			I <sub>OH</sub> = -4 mA	4.5	4.18	4.31	—	4.13	—	
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> = 20 μA	4.5	—	0.0	0.1	—	0.1	V
			I <sub>OL</sub> = 4 mA	4.5	—	0.17	0.26	—	0.33	
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	—	—	4.0	—	40.0	mA	
	I <sub>C</sub>	PER INPUT: V <sub>IN</sub> = 0.5V or 2.4V OTHER INPUT: V <sub>CC</sub> or GND	5.5	—	—	2.0	—	2.9		

TIMING REQUIREMENTS (Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	Ta = 25°C		Ta = -40~85°C	UNIT	
				TYP.	LIMIT	LIMIT		
Minimum Pulse Width (CK)	t <sub>w(L)</sub> t <sub>w(H)</sub>		4.5	—	15	19	ns	
			5.5	—	14	18		
Minimum Pulse Width (CLR)	t <sub>w(L)</sub>		4.5	—	15	19		
			5.5	—	14	18		
Minimum Set-up Time	t <sub>s</sub>		4.5	—	20	25		
			5.5	—	18	23		
Minimum Hold Time	t <sub>h</sub>		4.5	—	5	5		
			5.5	—	5	5		
Minimum Removal Time (CLR)	t <sub>rem</sub>		4.5	—	10	10		
			5.5	—	10	10		
Clock Frequency	f		4.5	—	30	24		MHz
			5.5	—	33	26		

AC ELECTRICAL CHARACTERISTICS (  $C_L = 15\text{pF}$ ,  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$ , Input  $t_r = t_f = 6\text{ns}$  )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	$t_{TLH}$ $t_{THL}$		—	12	15	ns
Propagation Delay Time (CK—Q)	$t_{pLH}$ $t_{pHL}$		—	29	36	
Propagation Delay Time (CLR—Q)	$t_{pHL}$		—	29	36	
Maximum Clock Frequency	$f_{MAX}$		32	61	—	MHz

AC ELECTRICAL CHARACTERISTICS (  $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$  )

PARAMETER	SYMBOL	TEST CONDITION	$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		UNIT	
			$V_{CC}(\text{V})$	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	$t_{TLH}$ $t_{THL}$		4.5	—	8	15	—	19	ns
			5.5	—	7	14	—	18	
Propagation Delay Time (CK—Q)	$t_{pLH}$ $t_{pHL}$		4.5	—	20	34	—	43	
			5.5	—	17	31	—	39	
Propagation Delay Time (CLR—Q)	$t_{pHL}$		4.5	—	20	34	—	43	
			5.5	—	17	31	—	39	
Maximum Clock Frequency	$f_{MAX}$		4.5	30	54	—	24	—	MHz
			5.5	33	57	—	26	—	
Input Capacitance	$C_{IN}$		—	5	10	—	10	pF	
Power Dissipation Capacitance	$C_{PD}(1)$		—	30	—	—	—		

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 :

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

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

$$C_{PD}(\text{total}) = 18 + 12 \cdot n$$

**DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A)**

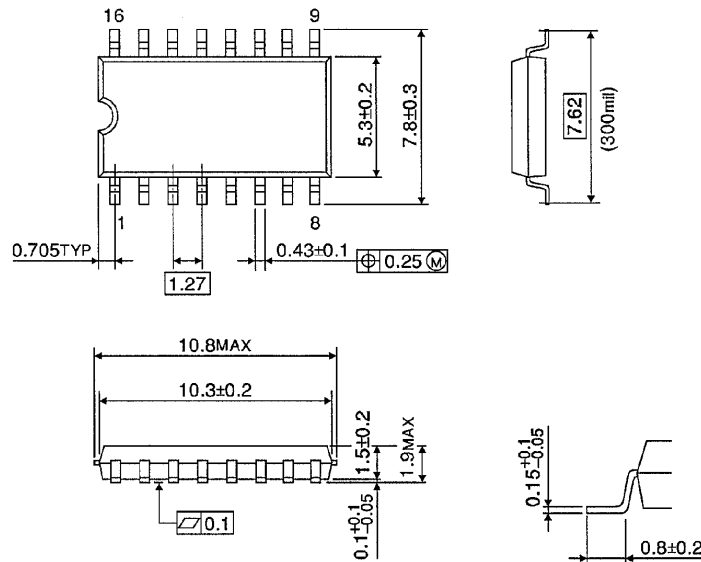
Unit in mm



Weight : 1.00g (Typ.)

**SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27)**

Unit in mm



Weight : 0.18g (Typ.)

**SOP 16PIN (150mil BODY) PACKAGE DIMENSIONS (SOL16-P-150 -1.27)**

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

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