

QUAD D-TYPE FLIP FLOP WITH CLEAR

The TC74ACT175 is an advanced high speed CMOS QUAD D-TYPE FLIP FLOP fabricated with silicon gate and double-layer metal wiring C²MOS 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.

These four flip-flops are controlled by a clock input (CK) and a clear input (CLR).

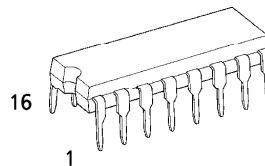
The information data applied to the D inputs (D1 thru D4) are transferred to the outputs (Q1 thru Q4 and $\overline{Q1}$ thru $\overline{Q4}$) on the positive-going edge of the clock pulse.

Reset function is accomplished when the clear input is taken low, and all Q outputs are kept in low level regardless of other input conditions.

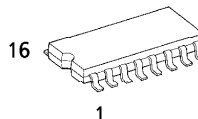
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES :

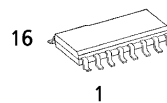
- High Speed..... $f_{\text{MAX}} = 160\text{MHz}(\text{typ.})$
at $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation..... $I_{\text{CC}} = 8\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs $V_{\text{IL}} = 0.8\text{V}(\text{Max.})$
 $V_{\text{IH}} = 2.0\text{V}(\text{Min.})$
- Symmetrical Output Impedance... $|I_{\text{OH}}| = |I_{\text{OL}}| = 24\text{mA}(\text{Min.})$
Capability of driving 50Ω
transmission lines.
- Balanced Propagation Delays..... $t_{\text{pLH}} \simeq t_{\text{pHL}}$
- Pin and Function Compatible with 74F175



P (DIP16—P— 300A)
Weight : 1.00g (TYP.)

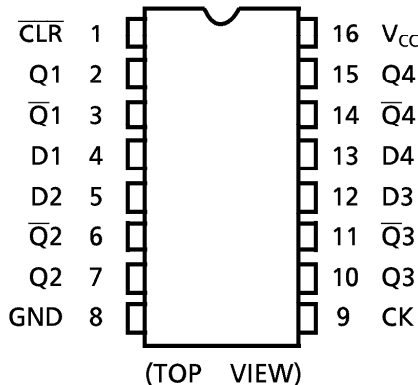


F (SOP16—P— 300)
Weight : 0.18g (TYP.)



FN (SOL16—P—150)
Weight : 0.13g (TYP.)

PIN ASSIGNMENT

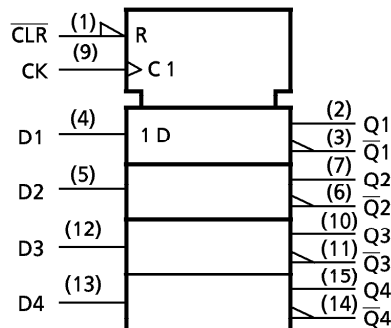


TRUTH TABLE

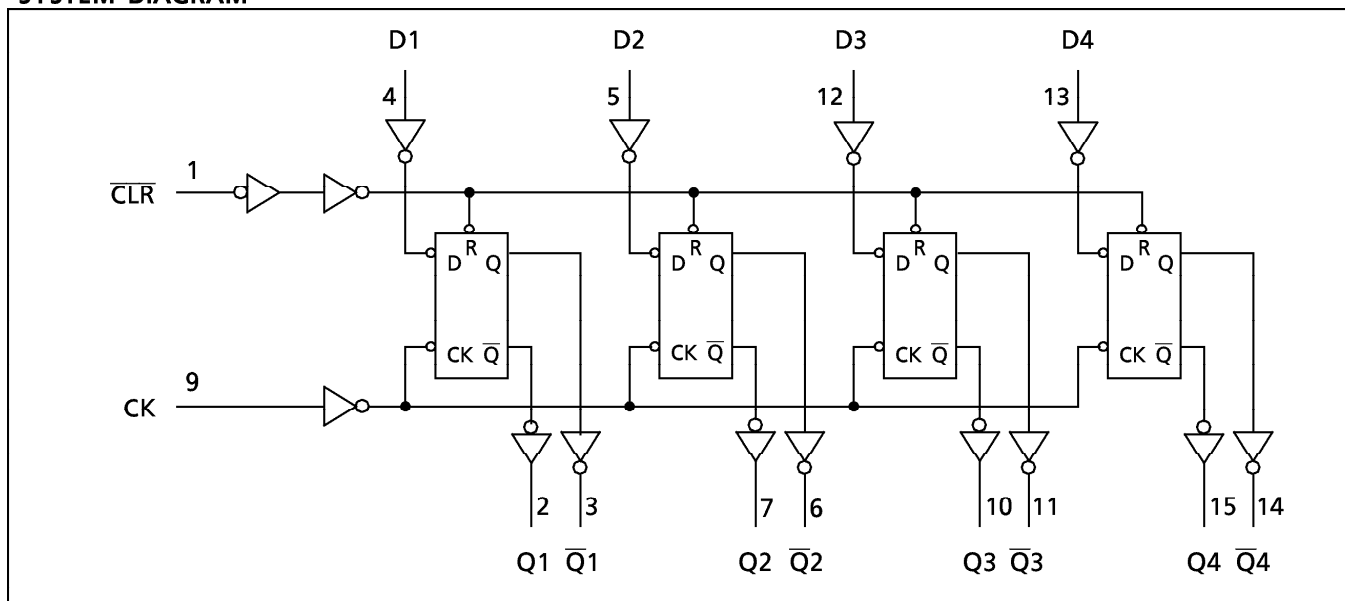
INPUTS			OUTPUTS		FUNCTION
$\overline{\text{CLR}}$	D	CK	Q	$\overline{\text{Q}}$	
L	X	X	L	H	CLEAR
H	L		L	H	—
H	H		H	L	—
H	X		Q_n	$\overline{Q}_n$	NO CHANGE

X : Don't Care

IEC LOGIC SYMBOL



SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7.0$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC} + 0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 50	mA
DC Output Current	I_{OUT}	± 50	mA
DC V_{CC} /Ground Current	I_{CC}	± 200	mA
Power Dissipation	P_D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	$^{\circ}\text{C}$

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

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	4.5~5.5	V
Input Voltage	V_{IN}	$0 \sim V_{CC}$	V
Output Voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating Temperature	T_{opr}	$-40 \sim 85$	$^{\circ}\text{C}$
Input Rise and Fall Time	dt/dV	0~10	ns/V

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		V _{CC} (V)	Ta = 25°C			Ta = -40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
High - Level Input Voltage	V _{IH}			4.5 5.5	2.0	—	—	2.0	—	V
Low - Level Input Voltage	V _{IL}			4.5 5.5	—	—	0.8	—	0.8	V
High - Level Output Voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50μA	4.5	4.4	4.5	—	4.4	—	V
			I _{OH} = -24mA	4.5	3.94	—	—	3.80	—	
			I _{OH} = -75mA*	5.5	—	—	—	3.85	—	
Low - Level Output Voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50μA	4.5	—	0.0	0.1	—	0.1	V
			I _{OL} = 24mA	4.5	—	—	0.36	—	0.44	
			I _{OL} = 75mA*	5.5	—	—	—	—	1.65	
Input Leakage Current	I _{IN}	V _{IN} = V _{CC} or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	8.0	—	80.0	
	I _C	PER INPUT : V _{IN} = 3.4V OTHER INPUT : V _{CC} or GND		5.5	—	—	1.35	—	1.5	mA

* : This spec indicates the capability of driving 50Ω transmission lines.
One output should be tested at a time for a 10ms maximum duration.

TIMING REQUIREMENTS (Input t_r = t_f = 3ns)

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C	Ta = -40~85°C	UNIT
				V _{CC} (V)	LIMIT	
Minimum Pulse Width (CK)	t _W (L) t _W (H)			5.0 ± 0.5	5.0	ns
Minimum Pulse Width (CLR)	t _W (L)			5.0 ± 0.5	5.0	
Minimum Set - up Time	t _s			5.0 ± 0.5	4.0	
Minimum Hold Time	t _h			5.0 ± 0.5	1.0	
Minimum Removal Time (CLR)	t _{rem}			5.0 ± 0.5	4.0	

AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, $R_L = 500\Omega$, Input $t_r = t_f = 3\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT
			V _{CC} (V)	MIN.	TYP.	MAX.	MIN.	MAX.
Propagation Delay Time (CK-Q, $\bar{Q}$)	t_{PLH} t_{PHL}		5.0 ± 0.5	—	6.9	11.0	1.0	12.5
Propagation Delay Time ($\bar{\text{CLR}}$ -Q, $\bar{Q}$)	t_{PLH} t_{PHL}		5.0 ± 0.5	—	6.5	10.4	1.0	11.8
Maximum Clock Frequency	f _{MAX}		5.0 ± 0.5	80	145	—	80	—
Input Capacitance	C _{IN}			—	5	10	—	10
Power Dissipation Capacitance	C _{PD} (1)			—	46	—	—	—

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 :

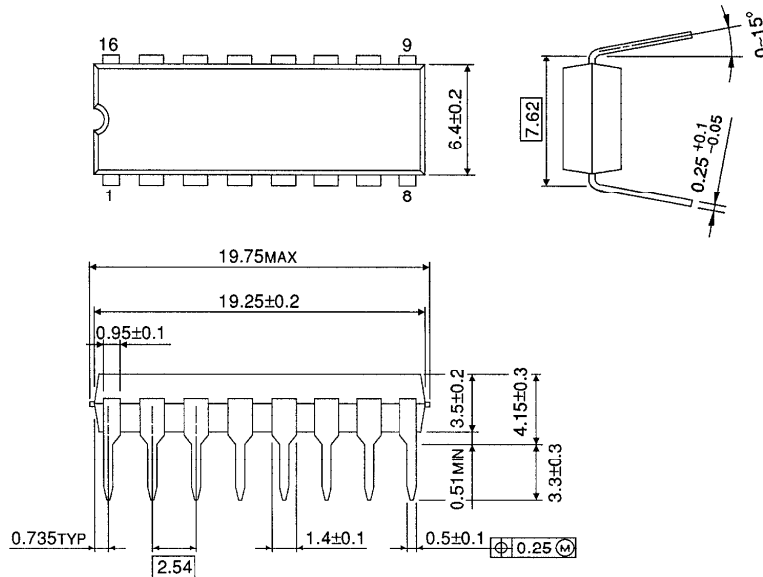
$$I_{\text{CC}}(\text{opr.}) = C_{\text{PD}} \cdot V_{\text{CC}} \cdot f_{\text{IN}} + I_{\text{CC}} / 4 \text{ (per F / F)}$$

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

$$C_{\text{PD}}(\text{total}) = 25 + 21 \cdot n$$

DIP 16PIN OUTLINE DRAWING (DIP16—P—300A)

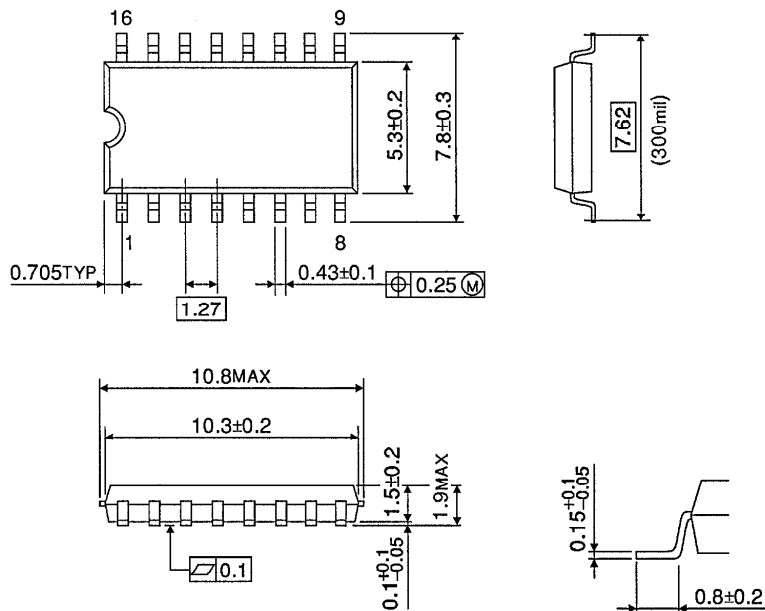
Unit in mm



Weight : 1.00g (TYP.)

SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16—P—300)

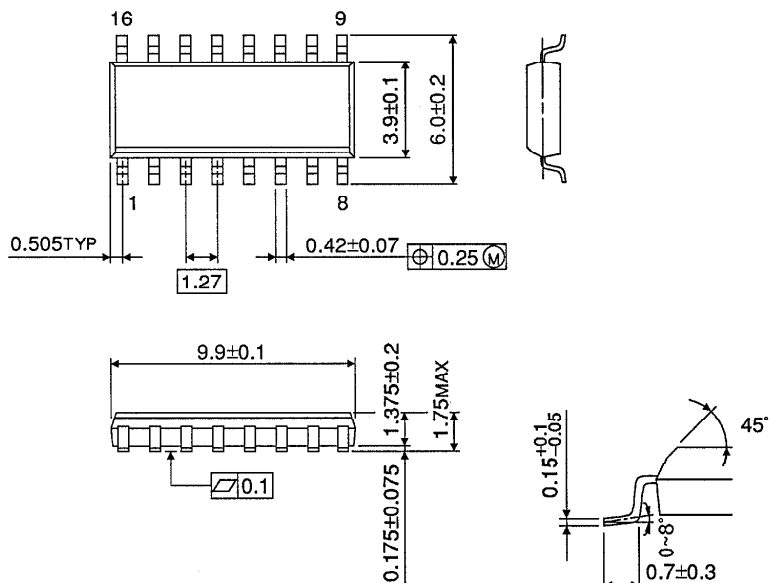
Unit in mm



Weight : 0.18g (TYP.)

SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150)

Unit in mm



Weight : 0.13g (TYP.)