

TC74HC175AP, TC74HC175AF, TC74HC175AFN

QUAD D - TYPE FLIP FLOP WITH CLEAR

The TC74HC175A is a high speed CMOS D-TYPE FLIP FLOP fabricated with silicon gate C²MOS technology.

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

Information signals applied to D inputs are transferred to the Q and $\bar{Q}$ outputs on the positive going edge of the clock pulse.

When the $\overline{\text{CLR}}$ input is held low, the Q outputs are at the low logic level and the $\bar{Q}$ outputs are at the high logic level independent of the other inputs.

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

FEATURES :

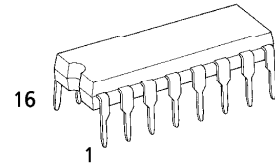
- High Speed..... $f_{\text{MAX}} = 63\text{MHz}(\text{typ.})$
at $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation..... $I_{\text{CC}} = 4\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{\text{NIH}} = V_{\text{NIL}} = 28\% V_{\text{CC}} (\text{Min.})$
- Symmetrical Output Impedance... $|I_{\text{OH}}| = I_{\text{OL}} = 4\text{mA}(\text{Min.})$
- Balanced Propagation Delays..... $t_{\text{PLH}} \approx t_{\text{PHL}}$
- Wide Operating Voltage Range.... $V_{\text{CC}} (\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS175

TRUTH TABLE

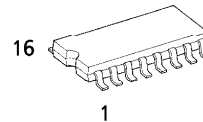
INPUTS			OUTPUTS		FUNCTION
$\overline{\text{CLR}}$	D	CK	Q	$\bar{Q}$	
L	X	X	L	H	Clear
H	L		L	H	—
H	H		H	L	—
H	X		Q_n	$\bar{Q}_n$	No change

X : Don't Care

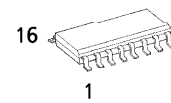
(Note) The JEDEC SOP (FN) is not available in Japan.



P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)

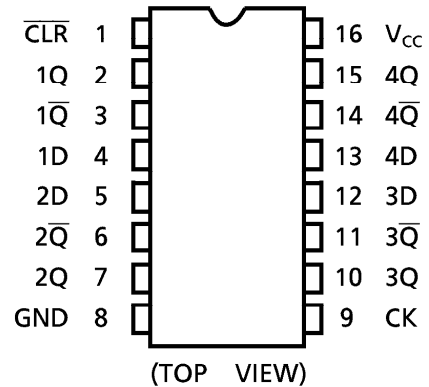


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

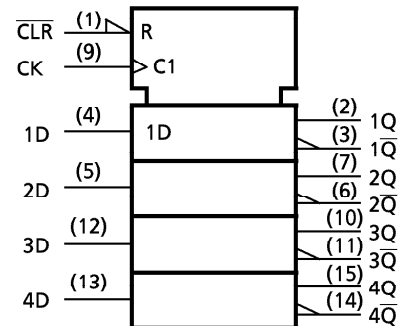


FN (SOL16-P-150-1.27)
Weight : 0.13g (Typ.)

PIN ASSIGNMENT



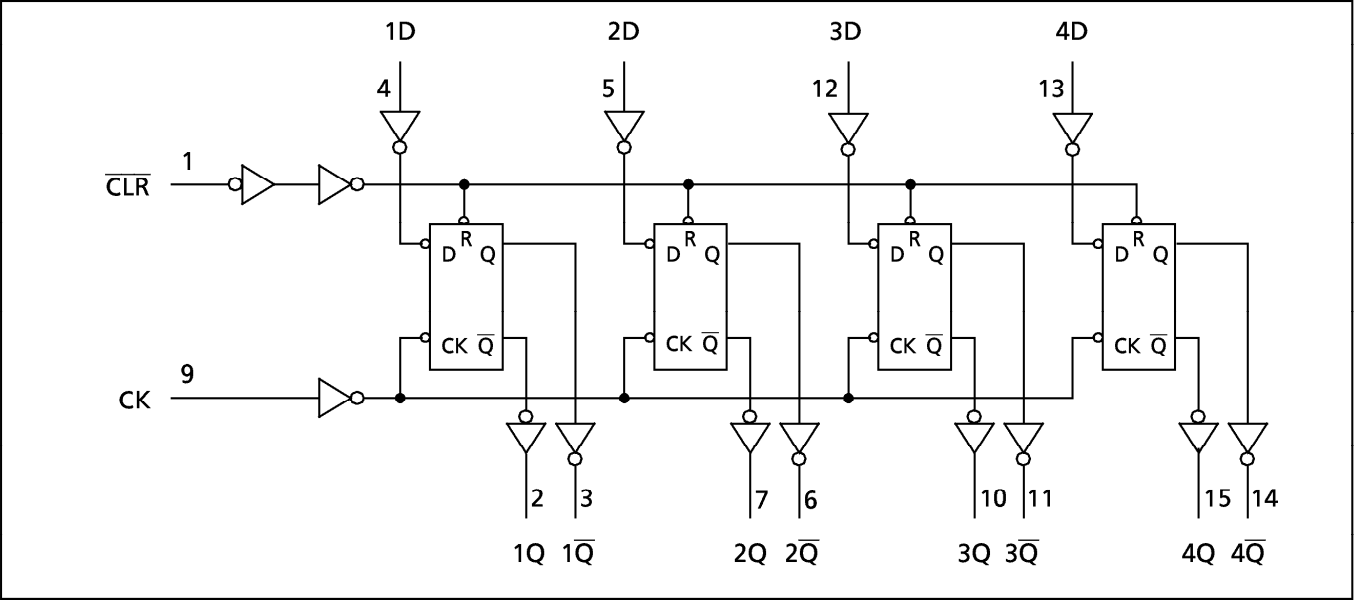
IEC LOGIC SYMBOL



961001EBA2

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

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

*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}	2~6	V
Input Voltage	V_{IN}	0~ V_{CC}	V
Output Voltage	V_{OUT}	0~ V_{CC}	V
Operating Temperature	T_{opr}	$-40 \sim 85$	$^{\circ}C$
Input Rise and Fall Time	t_r, t_f	0~1000 ($V_{CC} = 2.0V$) 0~500 ($V_{CC} = 4.5V$) 0~400 ($V_{CC} = 6.0V$)	ns

961001EBA2'

● The products described in this document are subject to foreign exchange and foreign trade control laws.
● The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
● The information contained herein is subject to change without notice.

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = -40~85°C		UNIT
				V _{CC} (V)	MIN.	TYP.	MAX.	MIN.	MAX.
High - Level Input Voltage	V _{IH}			2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	— — —
Low - Level Input Voltage	V _{IL}			2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	0.50 1.35 1.80
High - Level Output Voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -20 µA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	— — —
			I _{OH} = -4 mA	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	— —
			I _{OH} = -5.2 mA	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	— —
Low - Level Output Voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20 µA	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1
			I _{OL} = 4 mA	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33
			I _{OL} = 5.2 mA	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33
Input Leakage Current	I _{IN}	V _{IN} = V _{CC} or GND		6.0	—	—	±0.1	—	±1.0
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND		6.0	—	—	4.0	—	40.0

TIMING REQUIREMENTS (Input t_r = t_f = 6ns)

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C		Ta = -40~85°C	UNIT
				V _{CC} (V)	TYP.	LIMIT	
Minimum Pulse Width (CK)	t _{W(L)} t _{W(H)}			2.0 4.5 6.0	— — —	75 15 13	95 19 16
				2.0 4.5 6.0	— — —	75 15 13	95 19 16
				2.0 4.5 6.0	— — —	75 15 13	95 19 16
Minimum Set—up Time	t _s			2.0 4.5 6.0	— — —	75 15 13	95 19 16
				2.0 4.5 6.0	— — —	0 0 0	0 0 0
				2.0 4.5 6.0	— — —	75 15 13	95 19 16
Minimum Removal Time	t _{rem}			2.0 4.5 6.0	— — —	75 15 13	95 19 16
				2.0 4.5 6.0	— — —	6 31 36	5 25 29
				2.0 4.5 6.0	— — —	6 31 36	5 25 29
Clock Frequency	f			2.0 4.5 6.0	— — —	6 31 36	5 25 29

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}		—	4	8	ns
Propagation Delay Time ($\text{CK} - \text{Q}, \overline{\text{Q}}$)	t_{PLH} t_{PHL}		—	16	24	
Propagation Delay Time ($\overline{\text{CLR}} - \text{Q}, \overline{\text{Q}}$)	t_{PLH} t_{PHL}		—	13	21	
Maximum Clock Frequency	f_{MAX}		36	63	—	MHz

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

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			V _{CC} (V)	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	t _{TLH} t _{THL}		2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation Delay Time (CK—Q , Q)	t _{pLH} t _{pHL}		2.0	—	70	140	—	175	
			4.5	—	19	28	—	35	
			6.0	—	16	24	—	30	
Propagation Delay Time (CLR—Q , Q)	t _{pLH} t _{pHL}		2.0	—	50	125	—	160	
			4.5	—	16	25	—	32	
			6.0	—	12	22	—	27	
Maximum Clock Frequency	f _{MAX}		2.0	6	14	—	5	—	MHz
			4.5	31	53	—	25	—	
			6.0	36	63	—	29	—	
Input Capacitance	C _{IN}		—	5	10	—	10	pF	
Power Dissipation Capacitance	C _{PD} (1)		—	53	—	—	—		

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 :

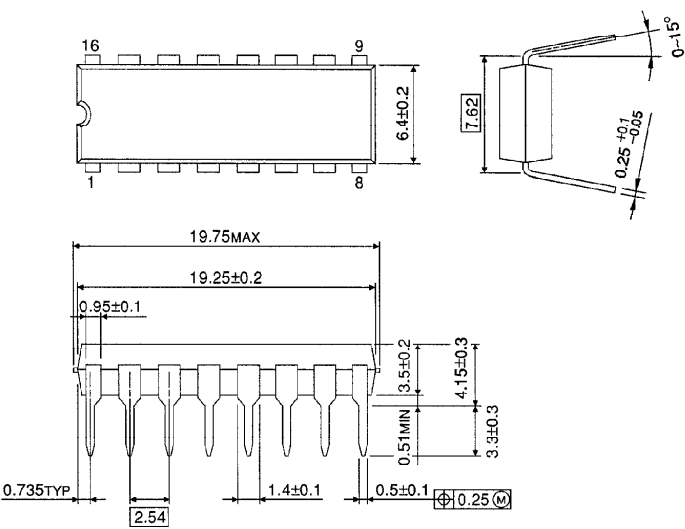
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per F/F)}$$

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

$$CPD(\text{total}) = 32 + 21 \cdot n$$

DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)

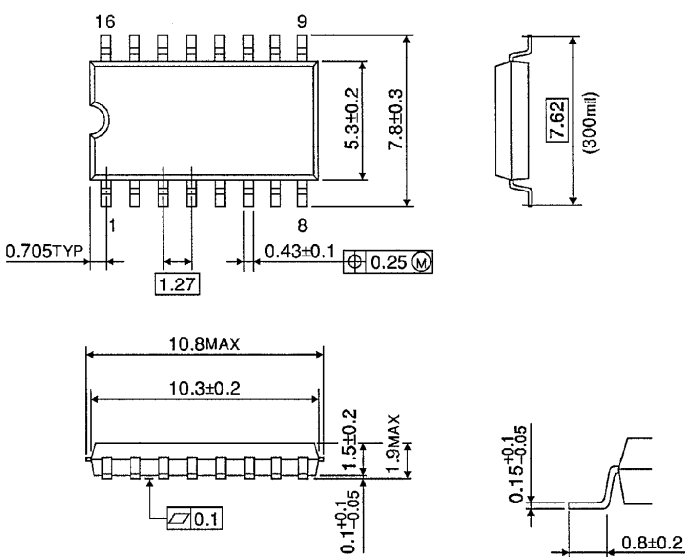
Unit in mm



Weight : 1.00g (Typ.)

SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27)

Unit in mm

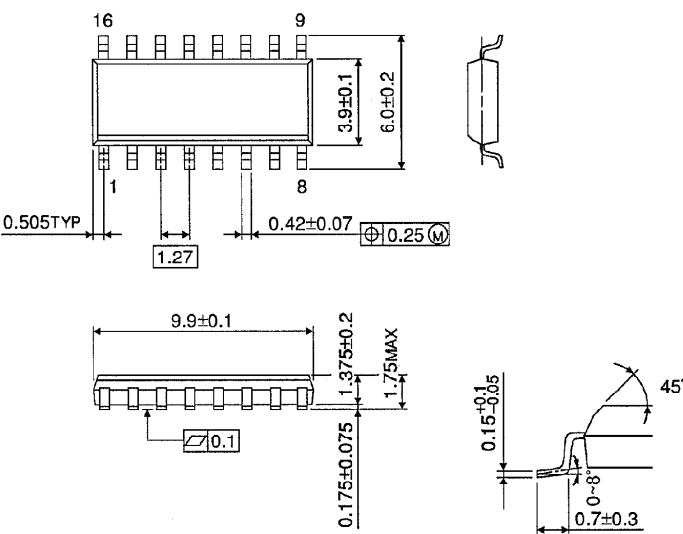


Weight : 0.18g (Typ.)

SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150 -1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)