TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74HC175AP, TC74HC175AF, TC74HC175AFN

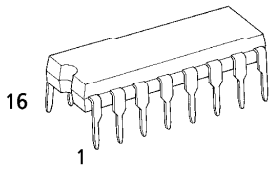
QUAD D-TYPE FLIP FLOP WITH CLEAR

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

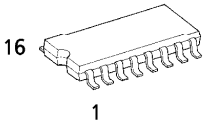
The TC74HC175A is a high speed CMOS D-TYPE FLIP FLOP fabricated with silicon gate C^2MOS technology.
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.
Information signals applied to D inputs are transferred to the Q and $\overline{Q}$ outputs on the positive going edge of the clock pulse.
When the $\overline{CLR}$ input is held low, the Q outputs are at the low logic level and the $\overline{Q}$ 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:

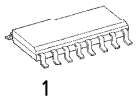
- High Speed ····· f_{MAX} = 63MHz(typ.) at V_{CC} = 5V
- Low Power Dissipation ····· I_{CC} = 4μA(Max.) at Ta = 25°C
- High Noise Immunity ····· $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Symmetrical Output Impedance ··· $|I_{OH}| = I_{OL}$ = 4mA(Min.)
- Balanced Propagation Delays ····· $t_{pLH} \simeq t_{pHL}$
- Wide Operating Voltage Range ···· V_{CC} (opr.) = 2V~6V
- Pin and Function Compatible with 74LS175



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

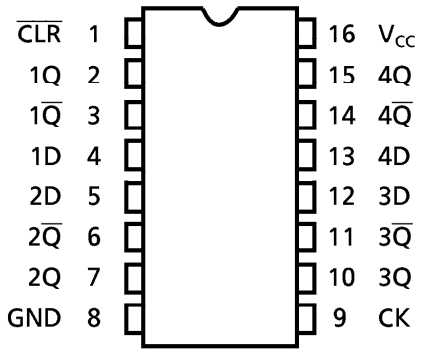


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)



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

PIN ASSIGNMENT



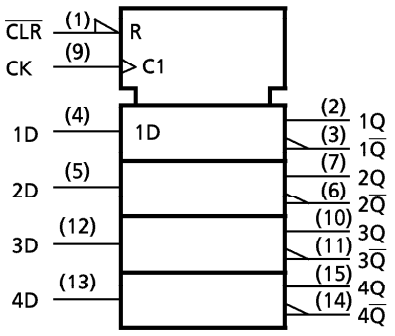
(TOP VIEW)

TRUTH TABLE

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

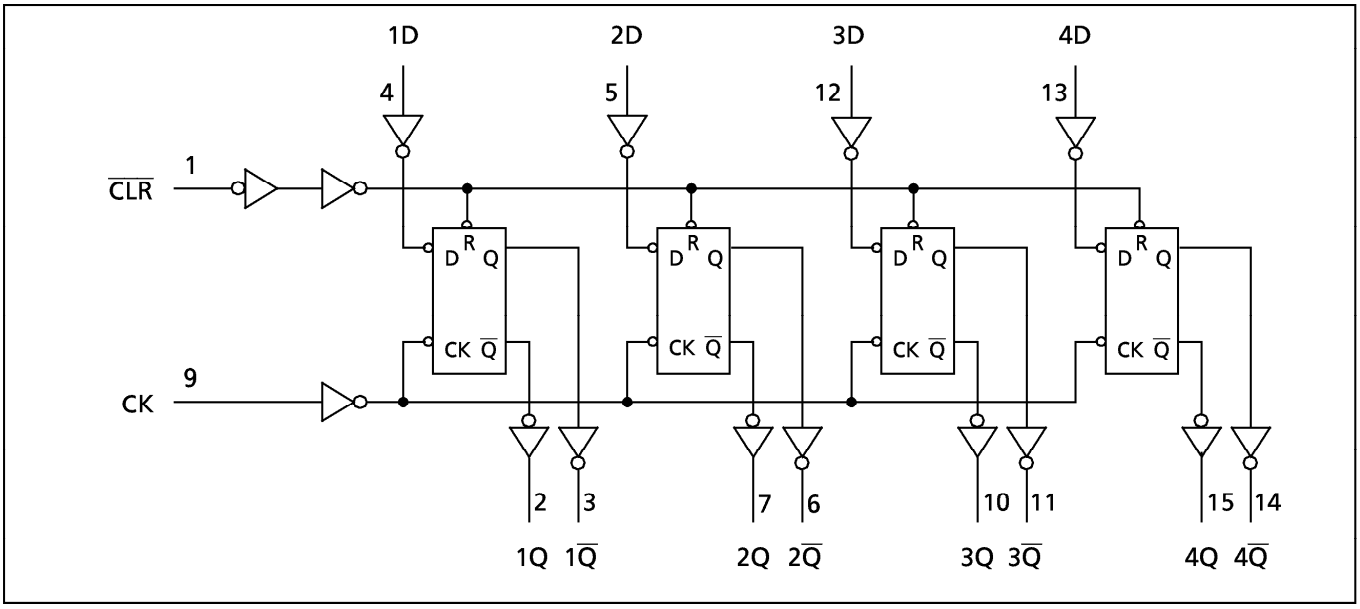
X : Don't Care

IEC LOGIC SYMBOL



961001EBA2

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}	±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}	−65~150	°C

*500mW in the range of Ta= −40°C~65°C. From Ta=65°C to 85 °C a derating factor of −10mW/°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}	−40~85	°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

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		V_{CC} (V)	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	Ta = −40~85°C MIN.	Ta = −40~85°C MAX.	UNIT
High - Level Input Voltage	V_{IH}			2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	— — —	V
Low - Level Input Voltage	V_{IL}			2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	0.50 1.35 1.80	V
High - Level Output Voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −20μA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	— — —	V
			I_{OH} = −4 mA I_{OH} = −5.2mA	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} = 20μA	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
			I_{OL} = 4 mA I_{OL} = 5.2mA	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	μA
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	V_{CC} (V)	Ta = 25°C TYP.	Ta = 25°C LIMIT	Ta = −40~85°C LIMIT	UNIT
Minimum Pulse Width (CK)	$t_{W(L)}$ $t_{W(H)}$		2.0 4.5 6.0	— — —	75 15 13	95 19 16	ns
Minimum Pulse Width ($\overline{CLR}$)	$t_{W(L)}$		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	
Minimum Hold Time	t_h		2.0 4.5 6.0	— — —	0 0 0	0 0 0	
Minimum Removal Time	t_{rem}		2.0 4.5 6.0	— — —	75 15 13	95 19 16	
Clock Frequency	f		2.0 4.5 6.0	— — —	6 31 36	5 25 29	MHz

AC ELECTRICAL CHARACTERISTICS (C_L = 15pF, V_{CC} = 5V, Ta = 25°C, Input $t_r = t_f$ = 6ns)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}		—	4	8	ns
Propagation Delay Time (CK−Q , $\overline{Q}$)	t_{pLH} t_{pHL}		—	16	24	
Propagation Delay Time ($\overline{CLR}$−Q , $\overline{Q}$)	t_{pLH} t_{pHL}		—	13	21	
Maximum Clock Frequency	f_{MAX}		36	63	—	MHz

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

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 , $\overline{Q}$)	t_{pLH} t_{pHL}		2.0	—	70	140	—	175	
			4.5	—	19	28	—	35	
			6.0	—	16	24	—	30	
Propagation Delay Time ($\overline{CLR}$−Q , $\overline{Q}$)	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.

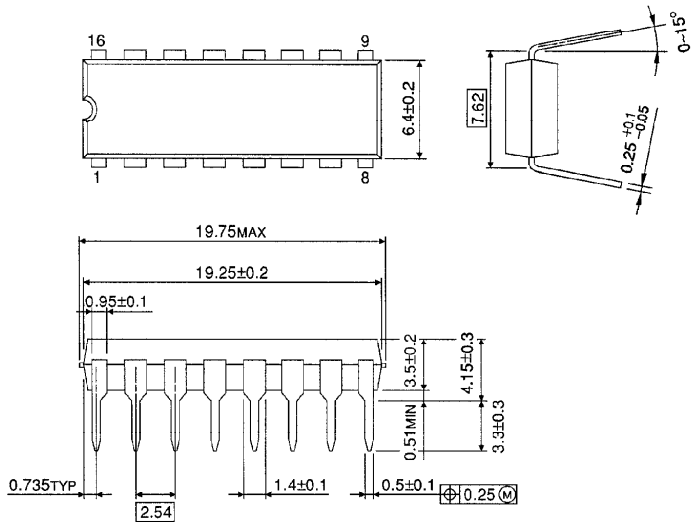
Average operating current can be obtained by the equation :

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

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

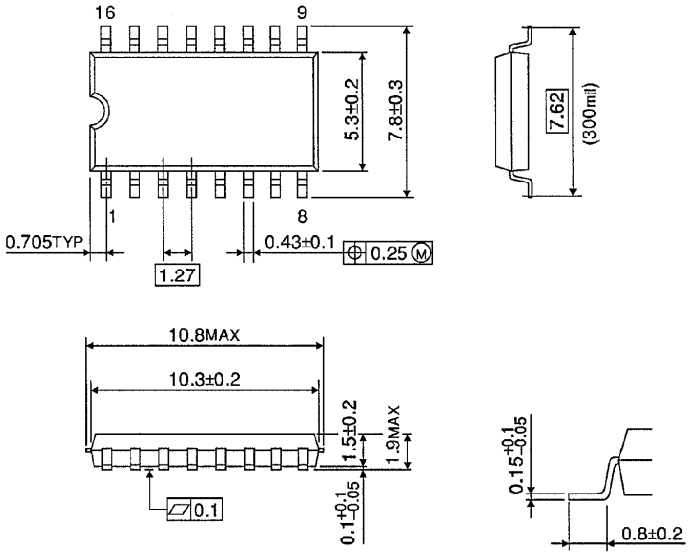
$$CPD(total) = 32 + 21 \cdot n$$

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



Weight : 1.00g (Typ.)

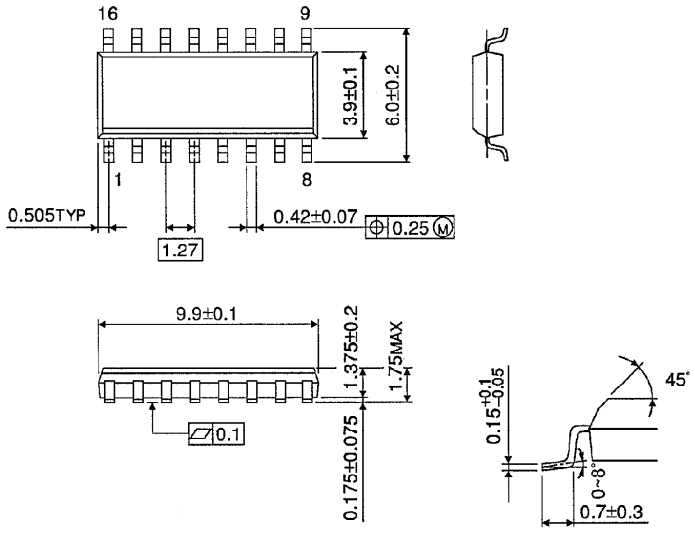
SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27) Unit in mm



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.)