INTEGRATED CIRCUIT

TOSHIBA

TECHNICAL DATA

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT

TC74ACT175P/F/FN

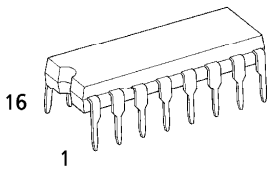
SILICON MONOLITHIC

QUAD D-TYPE FLIP FLOP WITH CLEAR

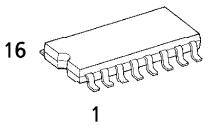
The TC74ACT175 is an advanced high speed CMOS QUAD D-TYPE FLIP FLOP fabricated with silicon gate and double-layer metal wiring C²MOS technology.
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.
This device may be used as 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 ($\overline{CLR}$).
The information data applied to the D inputs (D1 thru D4) are transferred to the outputs (Q1 thru Q4 and $\overline{Q}$1 thru $\overline{Q}$4) 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:

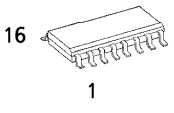
- High Speed ····· f_{MAX} = 160MHz(typ.) at V_{CC} = 5V
- Low Power Dissipation ····· I_{CC} = 8μA(Max.) at Ta = 25°C
- Compatible with TTL outputs ···· V_{IL} = 0.8V(Max.), V_{IH} = 2.0V(Min.)
- Symmetrical Output Impedance ··· $|I_{OH}| = I_{OL}$ = 24mA(Min.) Capability of driving 50Ω tansmission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



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

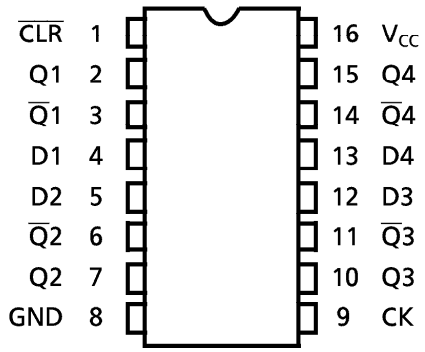


F (SOP16-P-300)
Weight : 0.18g (TYP.)



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

PIN ASSIGNMENT



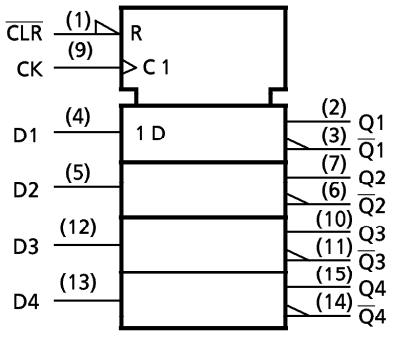
(TOP VIEW)

TRUTH TABLE

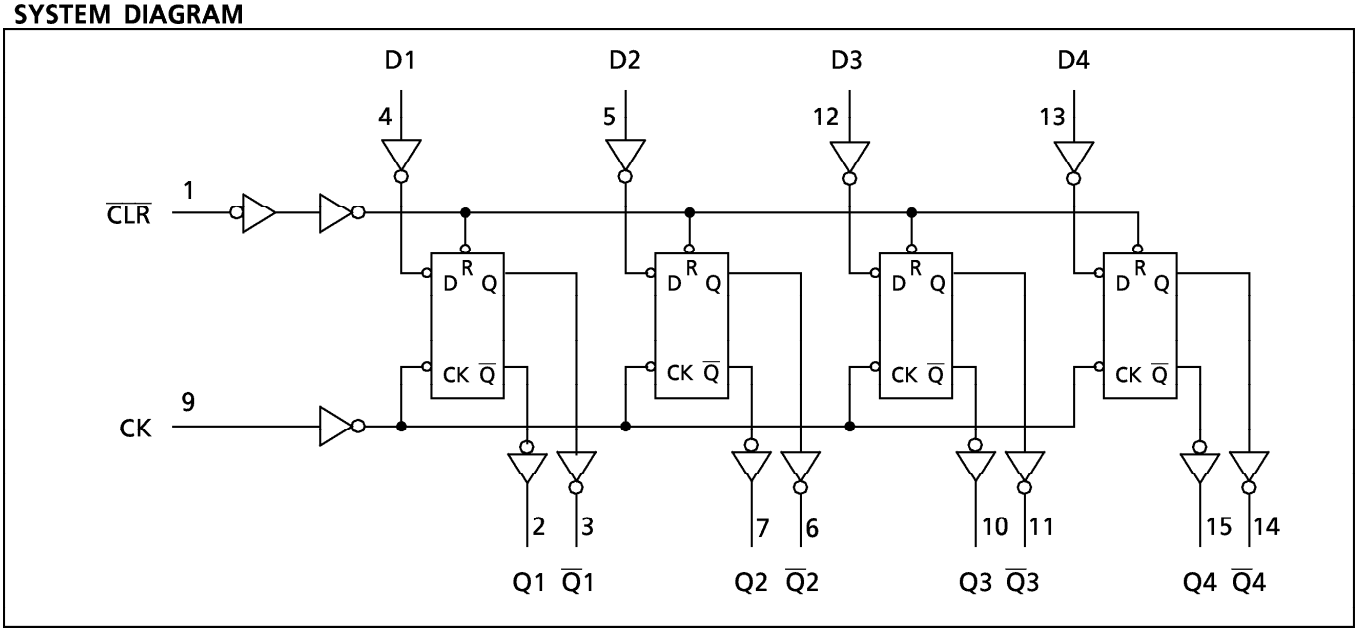
INPUTS			OUTPUTS		FUNCTION
$\overline{CLR}$	D	CK	Q	$\overline{Q}$	
L	X	X	L	H	CLEAR
H	L	↑	L	H	—
H	H	↑	H	L	—
H	X	↓	Q_n	$\overline{Q}_n$	NO CHANGE

X : Don't Care

IEC LOGIC SYMBOL



SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	−0.5~7.0	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}	±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}	−65~150	°C

*500mW in the range of Ta = −40°C~65°C. From Ta = 65°C to 85°C a derating factor of −10mW/°C 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~V_{CC}	V
Output Voltage	V_{OUT}	0~V_{CC}	V
Operating Temperature	T_{opr}	−40~85	°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 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}			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	μA
	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	V_{CC} (V)	Ta = 25°C LIMIT	Ta = −40~85°C LIMIT	UNIT
Minimum Pulse Width (CK)	$t_{W(L)}$ $t_{W(H)}$		5.0 ± 0.5	5.0	5.0	ns
Minimum Pulse Width ($\overline{CLR}$)	$t_{W(L)}$		5.0 ± 0.5	5.0	5.0	
Minimum Set - up Time	t_s		5.0 ± 0.5	4.0	4.0	
Minimum Hold Time	t_h		5.0 ± 0.5	1.0	1.0	
Minimum Removal Time ($\overline{CLR}$)	t_{rem}		5.0 ± 0.5	4.0	4.0	

AC ELECTRICAL CHARACTERISTICS (C_L = 50pF, R_L = 500Ω, Input $t_r = t_f$ = 3ns)

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 , $\overline{Q}$)	t_{pLH} t_{pHL}		5.0 ± 0.5	−	6.9	11.0	1.0	12.5	ns
Propagation Delay Time ($\overline{CLR}$−Q , $\overline{Q}$)	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	−	MHz
Input Capacitance	C_{IN}			−	5	10	−	10	pF
Power Dissipation Capacitance	C_{PD} (1)			−	46	−	−	−	

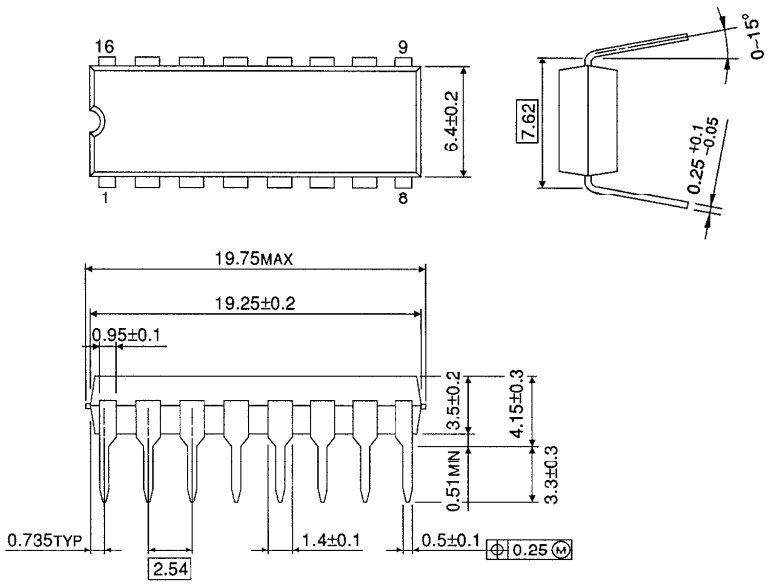
Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.
Average operating current can be obtained by the equation :

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

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

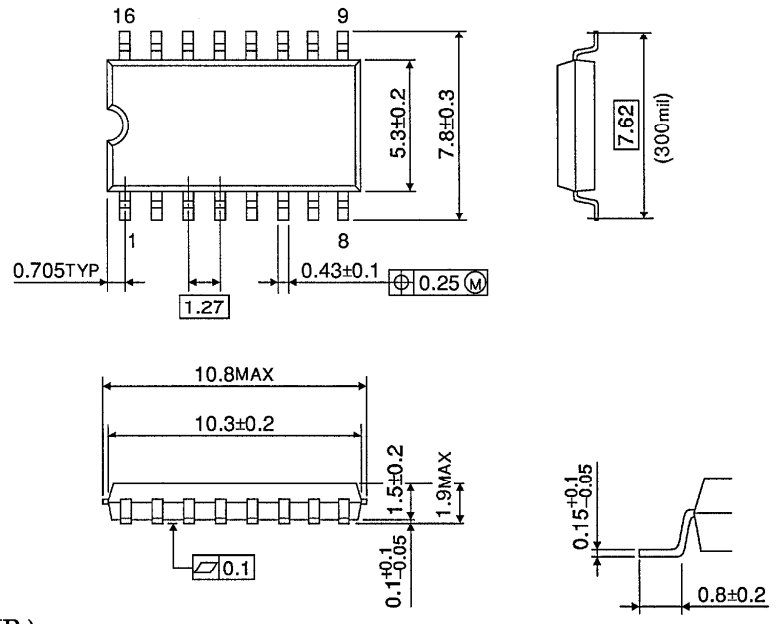
$$C_{PD} \text{ (total)} = 25 + 21 \cdot n$$

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



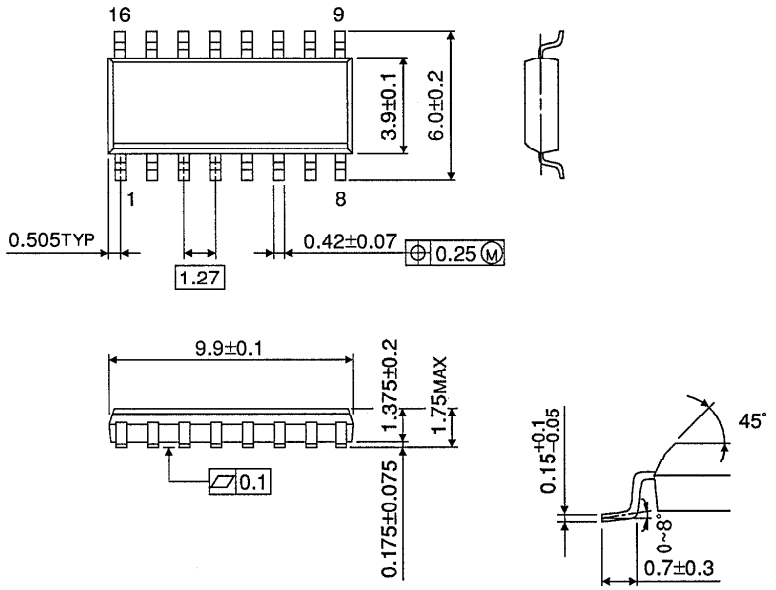
Weight : 1.00g (TYP.)

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.)