INTEGRATED CIRCUIT

TOSHIBA

TECHNICAL DATA

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT

TC74ACT112P/F/FN

SILICON MONOLITHIC

DUAL J-K FLIP FLOP WITH PRESET AND CLEAR

The TC74ACT112 is an advanced high speed CMOS DUAL J-K FLIP FLOP fabricated with silicon gate and double - layer metal wiring C^2MOS technology.

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

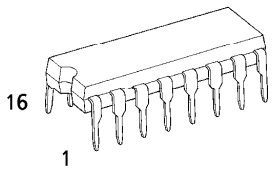
This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

In accordance with the logic level given J and K input this device changes state on negative going transition of the clock pulse. $\overline{CLEAR}$ and $\overline{PRESET}$ are independent of the clock and accomplished by a low logic level on the corresponding input.

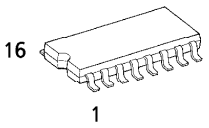
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

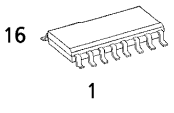
- High Speed ····· f_{MAX} = 175MHz (typ.) at V_{CC} = 5V
- Low Power Dissipation ····· I_{CC} = 4μA(Max.) at Ta = 25°C
- Compatible with TTL outputs ··· V_{IL} = 0.8V (Max.), V_{IH} = 2.0V (Min.)
- Symmetrical Output Impedance ··· $|I_{OH}| = I_{OL}$ = 24mA(Min.) Capability of driving 50Ω transmission lines.
- Balanced Propagation Delays ····· $t_{pLH} \simeq t_{pHL}$
- Pin and Function Compatible with 74F112



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

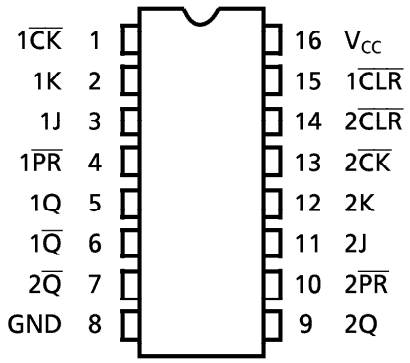


F (SOP16−P−300)
Weight : 0.18g (TYP.)



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

PIN ASSIGNMENT



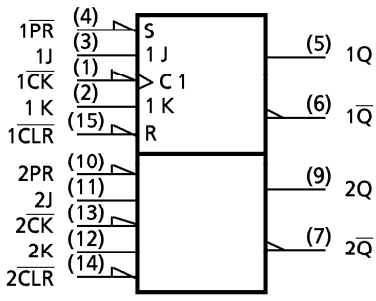
(TOP VIEW)

TRUTH TABLE

INPUTS					OUTPUTS		FUNCTION
$\overline{CLR}$	$\overline{PR}$	J	K	$\overline{CK}$	Q	$\overline{Q}$	
L	H	X	X	X	L	H	CLEAR
H	L	X	X	X	H	L	PRESET
L	L	X	X	X	H	H	
H	H	L	L	↓	Q_n	$\overline{Q}_n$	NO CHANGE
H	H	L	H	↓	L	H	
H	H	H	L	↓	H	L	
H	H	H	H	↓	$\overline{Q}_n$	Q_n	TOGGLE
H	H	X	X	↑	Q_n	$\overline{Q}_n$	NO CHANGE

X : Don't Care

IEC LOGIC SYMBOL



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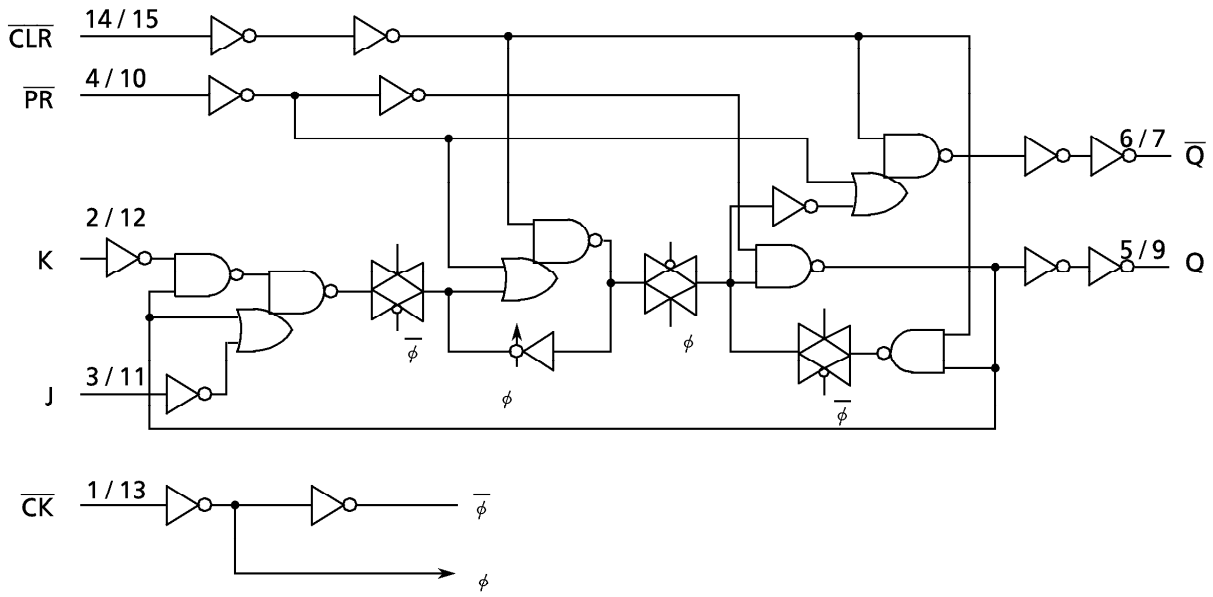
SYSTEM DIAGRAM



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}	± 100	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			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	—	—	4.0	—	40.0	
	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	V_{CC} (V)	Ta = 25°C	Ta = −40~85°C	UNIT
				LIMIT	LIMIT	
Minimum Pulse Width ($\overline{CK}$)	$t_{W(L)}$ $t_{W(H)}$		5.0 ± 0.5	5.0	5.0	ns
Minimum Pulse Width ($\overline{CLR}$, $\overline{PR}$)	$t_{W(L)}$		5.0 ± 0.5	5.0	5.0	
Minimum Set - up Time	t_s		5.0 ± 0.5	5.0	5.0	
Minimum Hold Time	t_h		5.0 ± 0.5	1.0	1.0	
Minimum Removal Time ($\overline{CLR}$, $\overline{PR}$)	t_{rem}		5.0 ± 0.5	3.0	3.0	

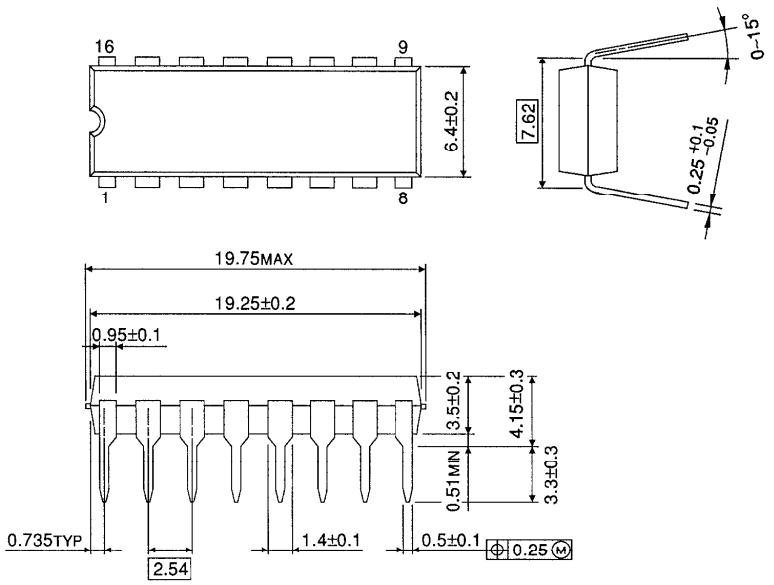
AC ELECTRICAL CHARACTERISTICS (C_L = 50pF , R_L = 500 Ω , Input $t_r = t_f$ = 3ns)

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = −40~85°C		UNIT
			V_{CC} (V)	MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time ($\overline{CK}$ − Q , $\overline{Q}$)	t_{pLH} t_{pHL}		5.0 ± 0.5	−	6.4	10.0	1.0	11.5	ns
Propagation Delay Time ($\overline{CLR}$, $\overline{PR}$ - Q, $\overline{Q}$)	t_{pLH} t_{pHL}		5.0 ± 0.5	−	6.8	10.5	1.0	12.0	
Maximum Clock Frequency	f_{MAX}		5.0 ± 0.5	85	100	−	85	−	MHz
Input Capacitance	C_{IN}			−	5	10	−	10	pF
Power Dissipation Capacitance	C_{PD}(1)			−	32	−	−	−	

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 :

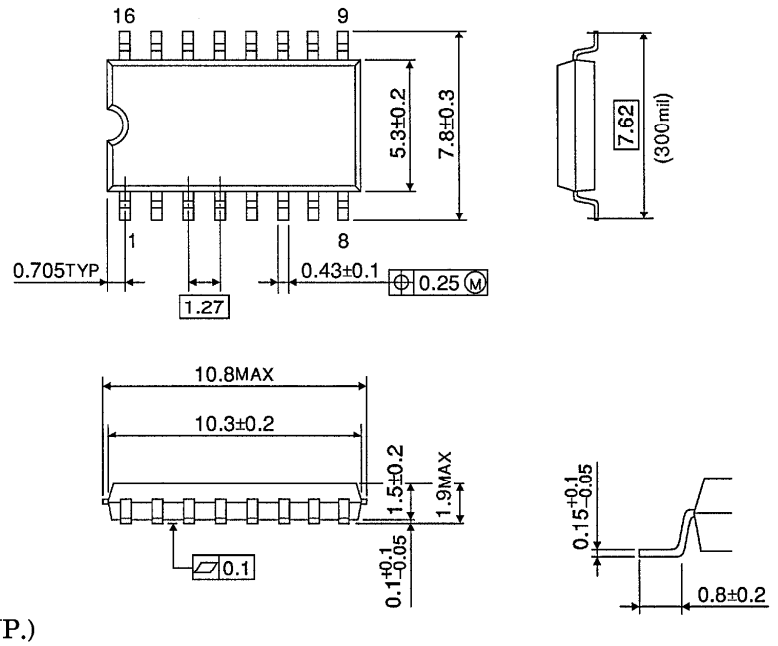
$$I_{CC}(opr.) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2 \text{ (per F / F)}$$

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



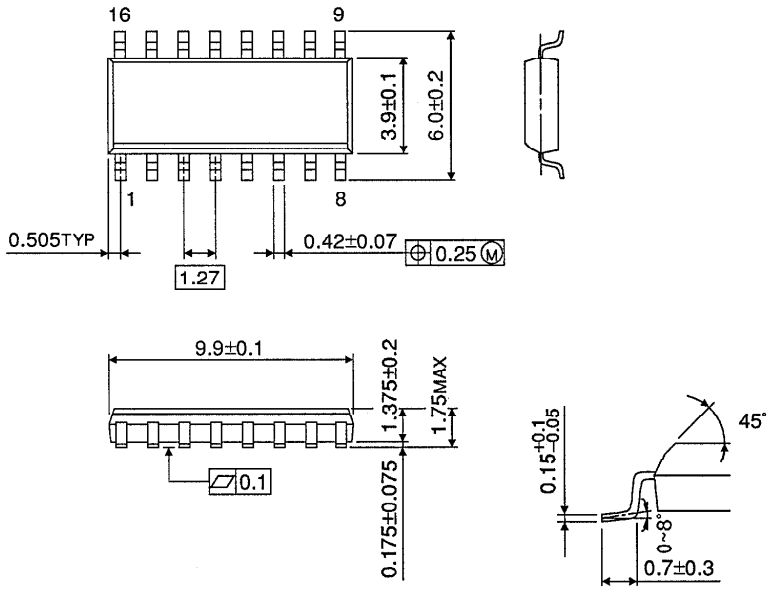
Weight : 1.00g (TYP.)

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.)