

**TC74HC109AP, TC74HC109AF, TC74HC109AFN**

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

**DUAL J -  $\bar{K}$  FLIP - FLOP WITH PRESET AND CLEAR**

The TC74HC109A is a high speed CMOS J -  $\bar{K}$  FLIP FLOP fabricated with silicon gate C<sup>2</sup>MOS technology.

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

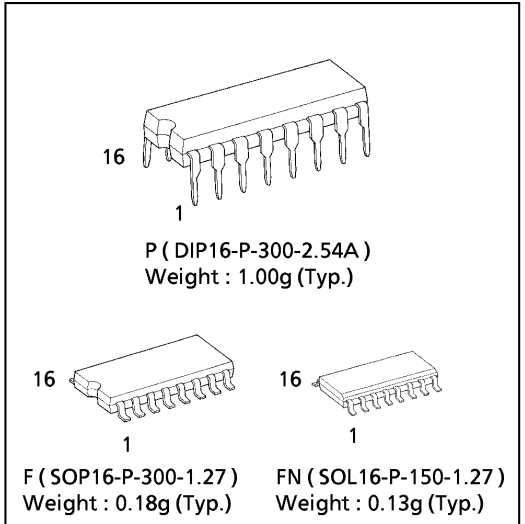
In accordance with the logic levels applied to the J and  $\bar{K}$  inputs, the outputs change state on the positive going transition of the clock pulse.

$\overline{CLR}$  and  $\overline{PR}$  are independent of the clock and are accomplished by a low logic level on the corresponding input.

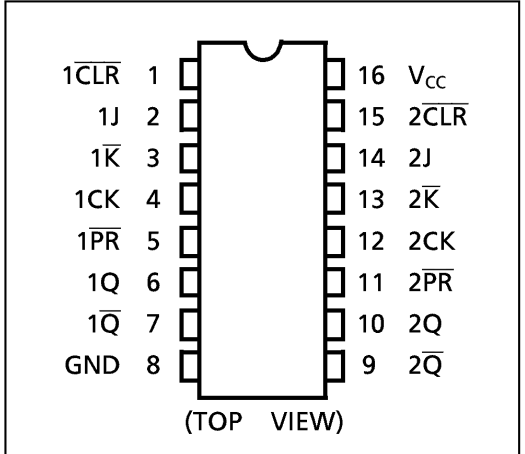
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

**FEATURES :**

- High Speed..... $f_{MAX} = 63\text{MHz}$  (typ.)  
at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 2\mu\text{A}$ (Max.) at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Output Drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 4\text{mA}$ (Min.)
- Balanced Propagation Delays.....  $t_{PLH} \approx t_{PHL}$
- Wide Operating Voltage Range...  $V_{CC}$  (opr.) =  $2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS109



**PIN ASSIGNMENT**

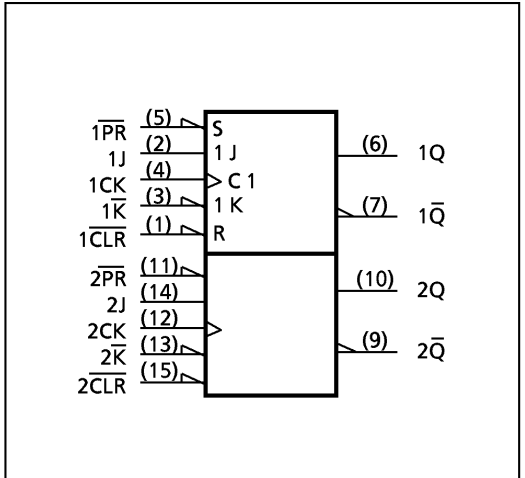


**TRUTH TABLE**

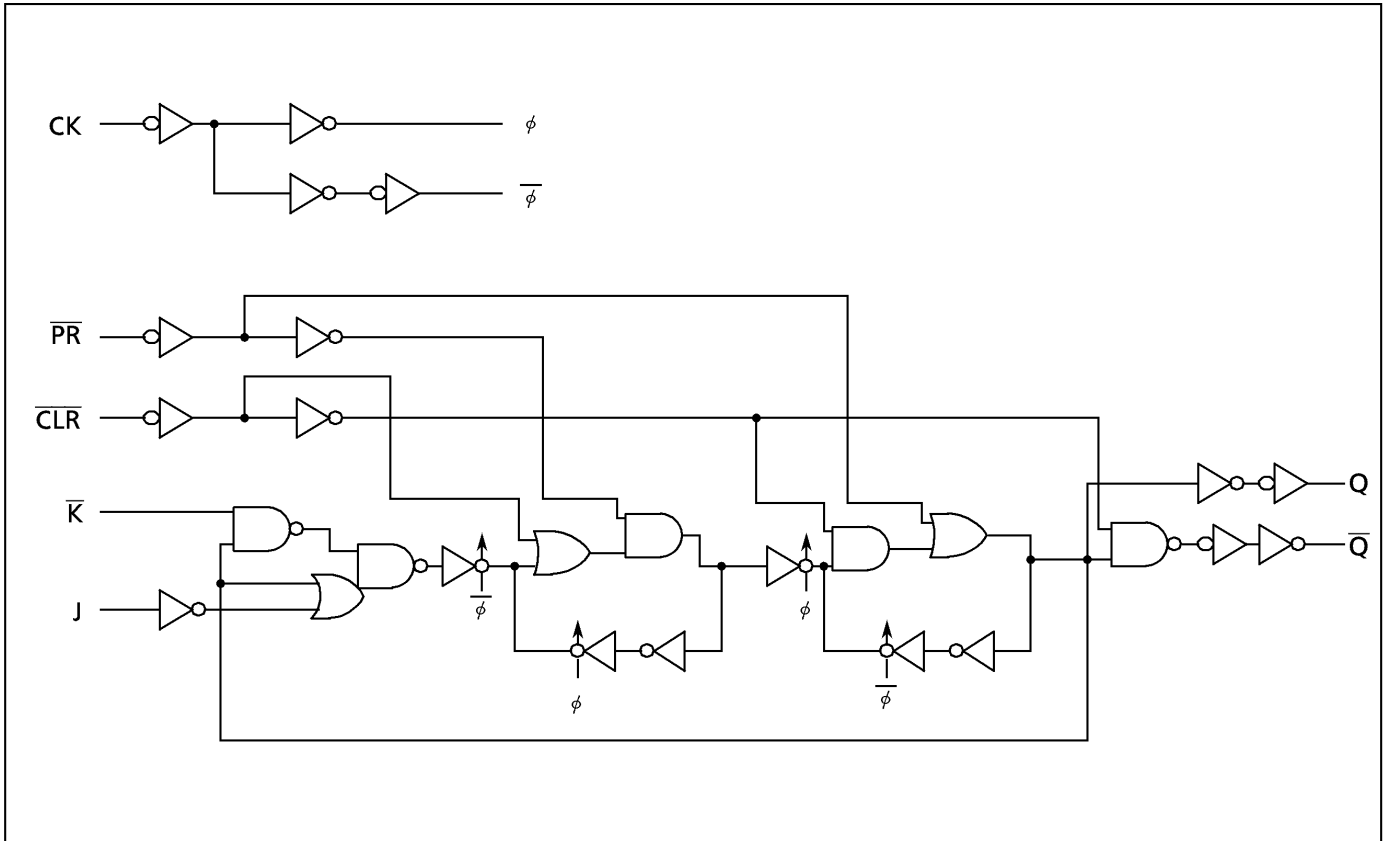
INPUTS					OUTPUTS		FUNCTION
$\overline{CLR}$	$\overline{PR}$	J	$\bar{K}$	CK	Q	$\bar{Q}$	
L	H	X	X	X	L	H	CLEAR
H	L	X	X	X	H	L	PRESET
L	L	X	X	X	H	H	
H	H	L	H	$\downarrow$	$Q_n$	$\bar{Q}_n$	NO CHANGE
H	H	L	L	$\downarrow$	L	H	
H	H	H	H	$\downarrow$	H	L	
H	H	H	L	$\downarrow$	$\bar{Q}_n$	$Q_n$	TOGGLE
H	H	X	X	$\downarrow$	$Q_n$	$\bar{Q}_n$	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	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	$I_{IK}$	$\pm 20$	mA
Output Diode Current	$I_{OK}$	$\pm 20$	mA
DC Output Current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ / Ground Current	$I_{CC}$	$\pm 50$	mA
Power Dissipation	$P_D$	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	$T_{stg}$	-65~150	°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  $85^{\circ}\text{C}$  a derating factor of  $-10\text{mW}/^{\circ}\text{C}$  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 ( $V_{CC} = 2.0\text{V}$ ) 0~500 ( $V_{CC} = 4.5\text{V}$ ) 0~400 ( $V_{CC} = 6.0\text{V}$ )	ns

## DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	$T_a = 25^{\circ}\text{C}$			$T_a = -40 \sim 85^{\circ}\text{C}$		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.		
High - Level Input Voltage	$V_{IH}$		2.0	1.50	—	—	1.50	—	V	
			4.5	3.15	—	—	3.15	—		
			6.0	4.20	—	—	4.20	—		
Low - Level Input Voltage	$V_{IL}$		2.0	—	—	0.50	—	0.50	V	
			4.5	—	—	1.35	—	1.35		
			6.0	—	—	1.80	—	1.80		
High - Level Output Voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -20\mu\text{A}$	2.0	1.9	2.0	—	1.9	—	V
			$I_{OH} = -4\text{ mA}$	4.5	4.4	4.5	—	4.4	—	
			$I_{OH} = -5.2\text{ mA}$	6.0	5.9	6.0	—	5.9	—	
Low - Level Output Voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 20\mu\text{A}$	2.0	—	0.0	0.1	—	0.1	V
			$I_{OL} = 4\text{ mA}$	4.5	—	0.0	0.1	—	0.1	
			$I_{OL} = 5.2\text{ mA}$	6.0	—	0.0	0.1	—	0.1	
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	2.0	—	20.0		

TIMING REQUIREMENTS (Input  $t_r = t_f = 6\text{ns}$ )

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	Ta = 25°C		Ta = -40~85°C	UNIT
				TYP.	LIMIT	LIMIT	
Minimum Pulse Width (CK)	$t_{W(L)}$ $t_{W(H)}$		2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Pulse Width (PR, CLR)	$t_{W(L)}$		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Set-up Time	$t_s$		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Hold Time	$t_h$		2.0	—	0	0	
			4.5	—	0	0	
			6.0	—	0	0	
Minimum Removal Time (PR, CLR)	$t_{rem}$		2.0	—	50	65	
			4.5	—	10	13	
			6.0	—	9	11	
Clock Frequency	f		2.0	—	6	5	MHz
			4.5	—	31	25	
			6.0	—	36	29	

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	$t_{TLH}$		—	6	12	ns
	$t_{THL}$					
Propagation Delay Time (CK-Q, $\bar{Q}$ )	$t_{PLH}$		—	13	26	
	$t_{PHL}$					
Propagation Delay Time (PR, CLR-Q, $\bar{Q}$ )	$t_{PLH}$		—	13	26	
	$t_{PHL}$					
Maximum Clock Frequency	$f_{MAX}$		33	63	—	

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

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	Ta = 25°C			Ta = -40~85°C		UNIT
				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, $\bar{Q}$ )	$t_{PLH}$ $t_{PHL}$		2.0	—	50	150	—	190	
			4.5	—	16	30	—	38	
			6.0	—	13	26	—	32	
Propagation Delay Time (PR, CLR-Q, $\bar{Q}$ )	$t_{PLH}$ $t_{PHL}$		2.0	—	50	150	—	190	
			4.5	—	16	30	—	38	
			6.0	—	13	26	—	32	
Maximum Clock Frequency	$f_{MAX}$		2.0	6	17	—	5	—	MHz
			4.5	31	59	—	25	—	
			6.0	36	67	—	29	—	
Input Capacitance	$C_{IN}$		—	5	10	—	10	pF	
Power Dissipation Capacitance	$C_{PD}(1)$		—	41	—	—	—		

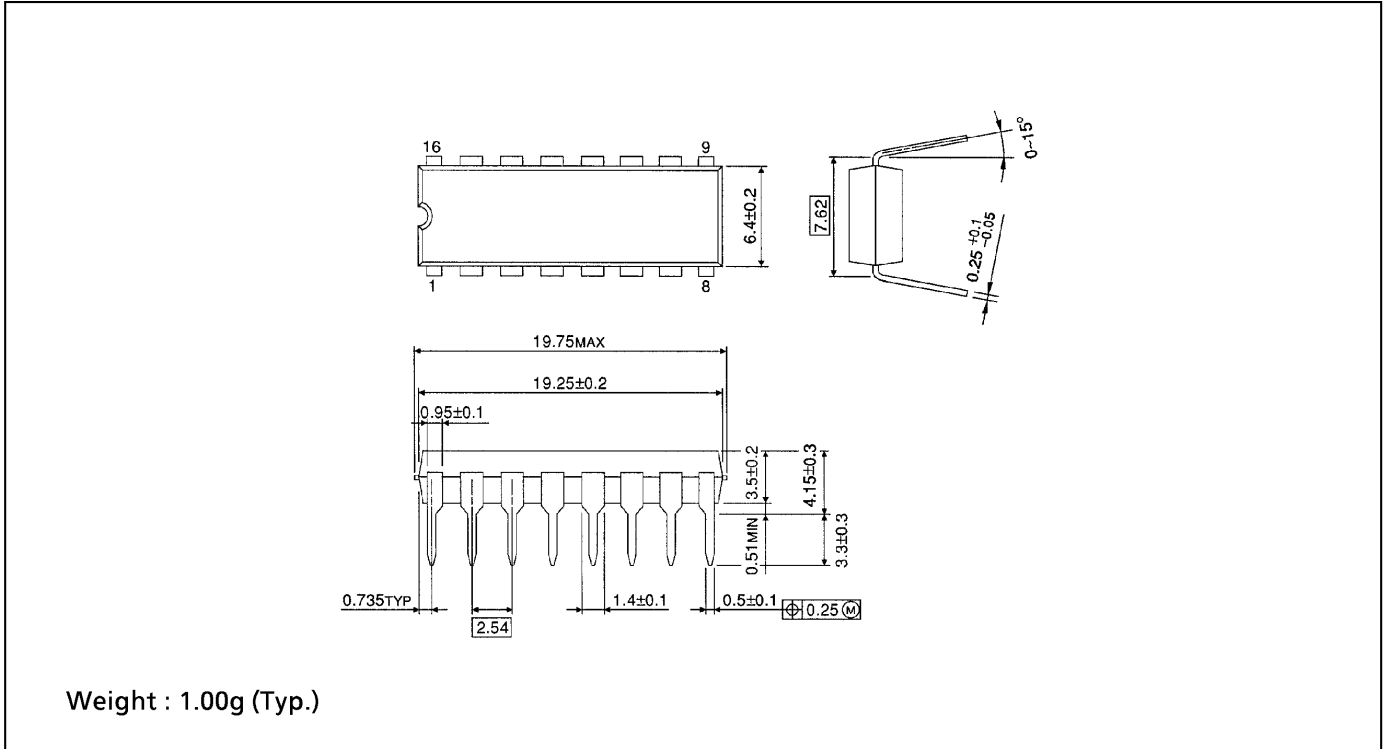
Note(1)  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

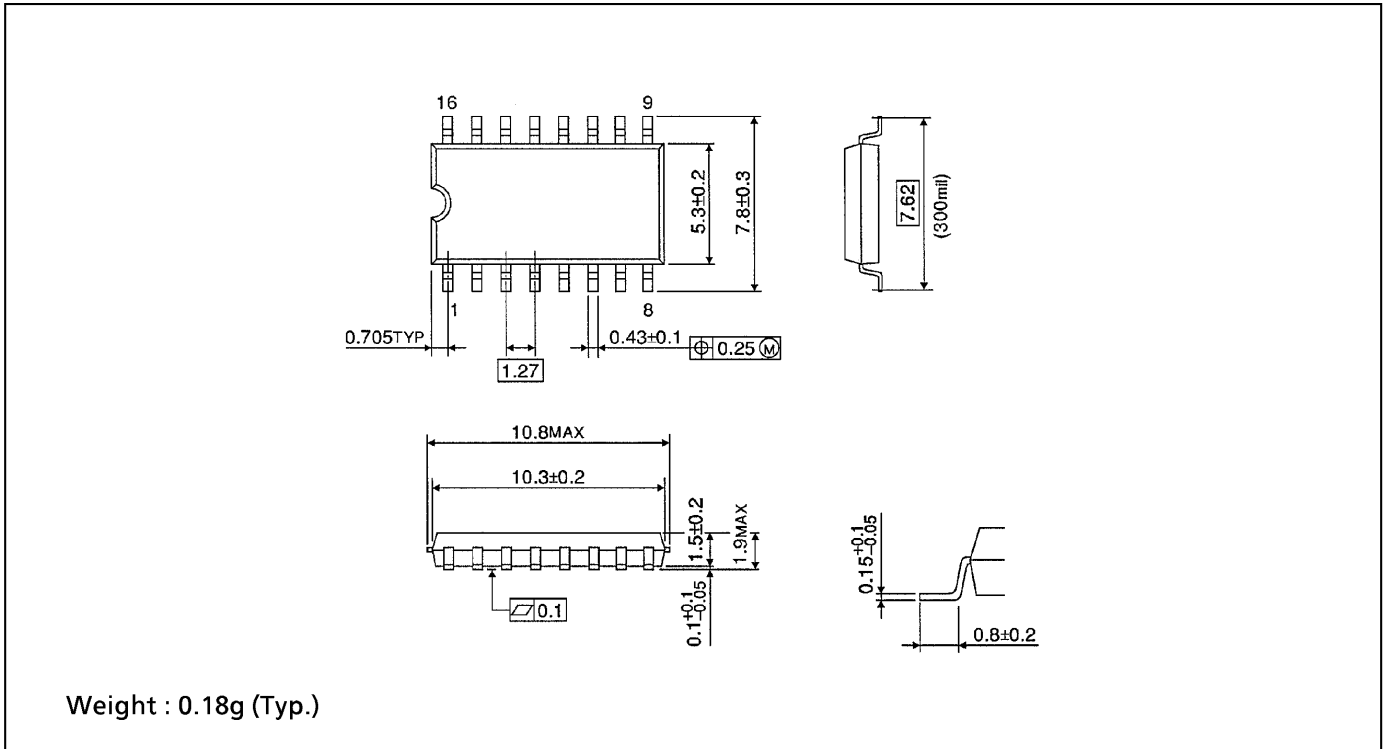
**DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A )**

Unit in mm



**SOP 16PIN ( 200mil BODY ) PACKAGE DIMENSIONS ( SOP16-P-300-1.27 )**

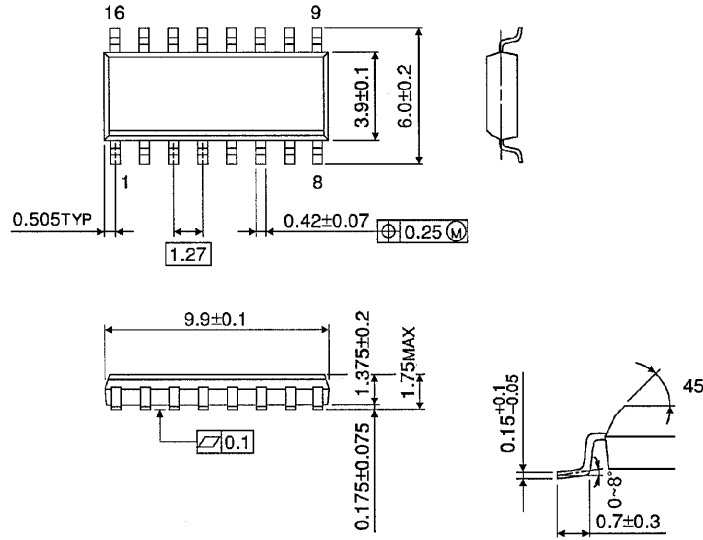
Unit in mm



**SOP 16PIN ( 150mil BODY ) PACKAGE DIMENSIONS ( SOL16-P-150 -1.27)**

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

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000707EBA

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