

# TC7W74F, TC7W74FU, TC7W74FK

## D-TYPE FLIP FLOP WITH PRESET AND CLEAR

The TC7W74 is a high speed C<sup>2</sup>MOS D 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 C<sup>2</sup>MOS low power dissipation.

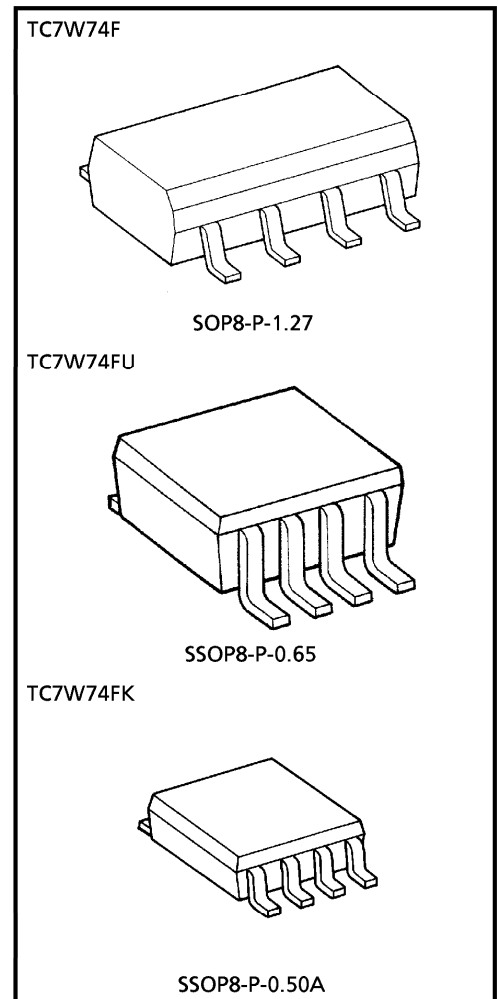
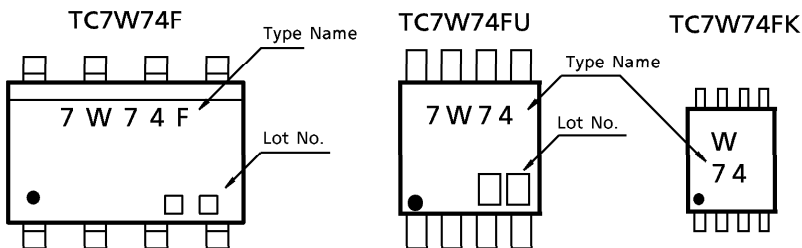
The signal level applied to the D INPUT is transferred to Q OUTPUT during the positive going transition of the CLOCK pulse CLEAR and PRESET are independent of the CLOCK and are accomplished by setting the appropriate input to an "L" level Input is equipped with protection circuits against static discharge or transient excess voltage.

Weight SOP8-P-1.27 : 0.05g (Typ.)  
 SSOP8-P-0.65 : 0.02g (Typ.)

**FEATURES**

- High Speed .....  $f_{MAX} = 77\text{MHz}$  (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 ...  $V_{CC}(\text{opr}) = 2\sim 6\text{V}$

**MARKING**

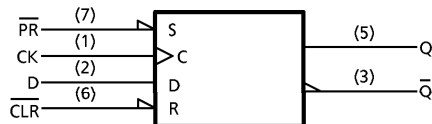


Weight  
 SOP8-P-1.27 : 0.05g (Typ.)  
 SSOP8-P-0.65 : 0.02g (Typ.)  
 SSOP8-P-0.50A : 0.01g (Typ.)

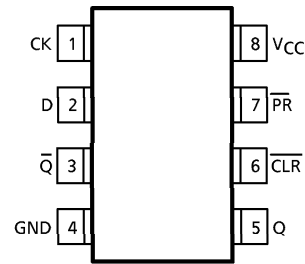
**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V <sub>CC</sub>	-0.5~7	V
DC Input Voltage	V <sub>IN</sub>	-0.5~V <sub>CC</sub> +0.5	V
DC Output Voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> +0.5	V
Input Diode Current	I <sub>IK</sub>	±20	mA
Output Diode Current	I <sub>OK</sub>	±20	mA
DC Output Current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /Ground Current	I <sub>CC</sub>	±25	mA
Power Dissipation	P <sub>D</sub>	300	mW
Storage Temperature	T <sub>stg</sub>	-65~150	°C
Lead Temperature (10s)	T <sub>L</sub>	260	°C

**LOGIC DIAGRAM**



**PIN ASSIGNMENT (TOP VIEW)**



**TRUTH TABLE**

INPUTS				OUTPUTS		FUNCTION
CLR	PR	D	CK	Q	Q̄	
L	H	x	x	L	H	CLEAR
H	L	x	x	H	L	PRESET
L	L	x	x	H	H	—
H	H	L	↑	L	H	—
H	H	H	↑	H	L	—
H	H	x	↓	Q <sub>n</sub>	Q̄ <sub>n</sub>	NO CHANGE

x : Don't care

**RECOMMENDED OPERATING CONDITIONS**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	2~6	V
Input Voltage	V <sub>IN</sub>	0~V <sub>CC</sub>	V
Output Voltage	V <sub>OUT</sub>	0~V <sub>CC</sub>	V
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Input Rise and Fall Time	t <sub>r</sub> , t <sub>f</sub>	0~1000 (V <sub>CC</sub> = 2.0V) 0~500 (V <sub>CC</sub> = 4.5V) 0~400 (V <sub>CC</sub> = 6.0V)	ns

**DC ELECTRICAL CHARACTERISTICS**

CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C						Ta = -40~85°C		UNIT
			V <sub>CC</sub>	MIN.	TYP.	MAX.	MIN.	MAX.			
High-Level Input Voltage	V <sub>IH</sub>	—	2.0	1.5	—	—	1.5	—	V		
			4.5	3.15	—	—	3.15	—			
			6.0	4.2	—	—	4.2	—			
Low-Level Input Voltage	V <sub>IL</sub>	—	2.0	—	—	0.5	—	0.5	V		
			4.5	—	—	1.35	—	1.35			
			6.0	—	—	1.8	—	1.8			
High-Level Output Voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2.0	1.9	2.0	—	1.9	—	V	
				4.5	4.4	4.5	—	4.4	—		
			I <sub>OH</sub> = -4mA I <sub>OH</sub> = -5.2mA	4.5	4.18	4.31	—	4.13	—		
				6.0	5.68	5.80	—	5.63	—		
Low-Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	2.0	—	0.0	0.1	—	0.1	V	
				4.5	—	0.0	0.1	—	0.1		
			I <sub>OL</sub> = 4mA I <sub>OL</sub> = 5.2mA	4.5	—	0.17	0.26	—	0.33		
				6.0	—	0.18	0.26	—	0.33		
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	6.0	—	—	±0.1	—	±1.0	μA		
Quiescent Supply Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	6.0	—	—	2.0	—	20.0	μA		

**TIMING REQUIREMENTS (Input t<sub>r</sub> = t<sub>f</sub> = 6ns)**

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C				Ta = -40~85°C		UNIT
			V <sub>CC</sub>	TYP.	LIMIT	LIMIT			
Minimum Pulse Width (CLOCK)	t <sub>W</sub> (L) t <sub>W</sub> (H)	—	2.0	—	75	95	ns		
			4.5	—	15	19			
			6.0	—	13	16			
Minimum Pulse Width (CLR, PR)	t <sub>W</sub> (L)	—	2.0	—	75	95	ns		
			4.5	—	15	19			
			6.0	—	13	16			
Minimum Set-up Time	t <sub>s</sub>	—	2.0	—	75	95	ns		
			4.5	—	15	19			
			6.0	—	13	16			
Minimum Hold Time	t <sub>h</sub>	—	2.0	—	0	0	ns		
			4.5	—	0	0			
			6.0	—	0	0			
Minimum Removal Time (CLR, PR)	t <sub>rem</sub>	—	2.0	—	25	30	ns		
			4.5	—	5	6			
			6.0	—	4	5			
Clock Frequency	f	—	2.0	—	6	5	MHz		
			4.5	—	31	25			
			6.0	—	36	29			

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 15\text{pF}$ ,  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	$t_{TLH}$ $t_{THL}$	—	—	6	12	ns
Propagation Delay Time (CLOCK-Q, Q)	$t_{pLH}$ $t_{pHL}$	—	—	13	26	
Propagation Delay Time (CLR, PR-Q, Q)	$t_{pLH}$ $t_{pHL}$	—	—	14	26	
Maximum Clock Frequency	$f_{MAX}$	—	36	77	—	MHz

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

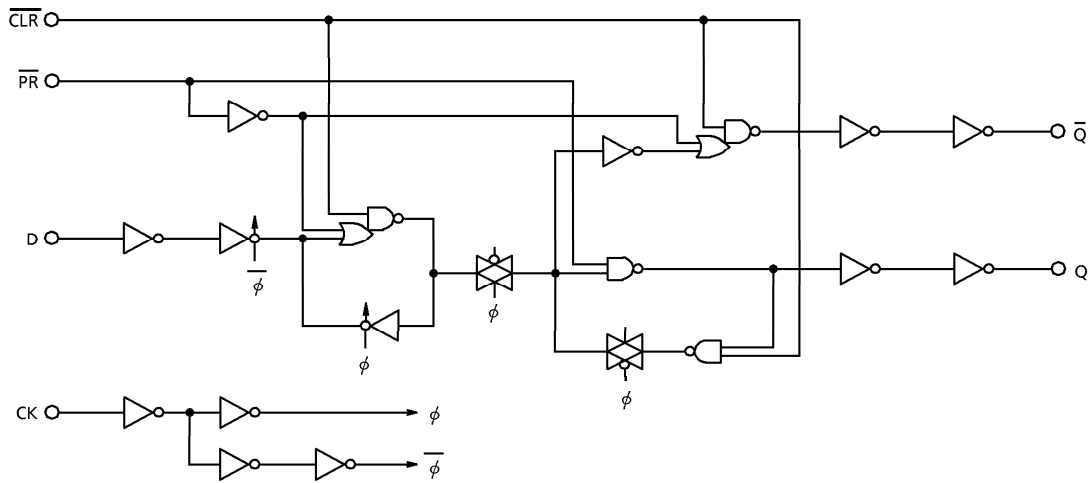
PARAMETER	SYMBOL	TEST CONDITION	$T_a = 25^\circ\text{C}$			$T_a = -40 \sim 85^\circ\text{C}$		UNIT	
			$V_{CC}$	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	$t_{TLH}$ $t_{THL}$	—	2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation Delay Time (CLOCK-Q, $\bar{Q}$ )	$t_{pLH}$ $t_{pHL}$	—	2.0	—	48	150	—	190	
			4.5	—	16	30	—	38	
			6.0	—	13	26	—	32	
Propagation Delay Time (CLR, PR-Q, Q)	$t_{pLH}$ $t_{pHL}$	—	2.0	—	51	150	—	190	
			4.5	—	17	30	—	38	
			6.0	—	15	26	—	32	
Maximum Clock Frequency	$f_{MAX}$	—	2.0	6	21	—	5	—	MHz
			4.5	31	63	—	25	—	
			6.0	36	67	—	29	—	
Input Capacitance	$C_{IN}$	—	—	5	10	—	10	pF	
Power Dissipation Capacitance	$C_{PD}$	(Note 1)	—	34	—	—	—		

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

Average operating current can be obtained by the equation.

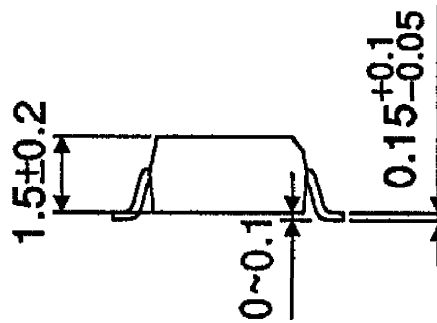
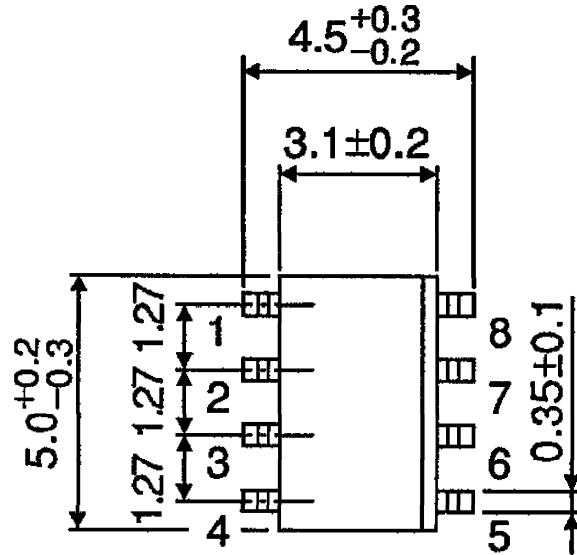
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

**SYSTEM DIAGRAM**



PACKAGE DIMENSIONS  
SOP8-P-1.27

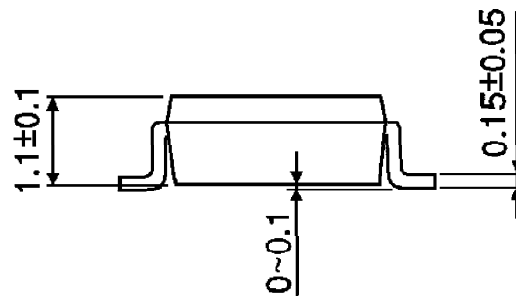
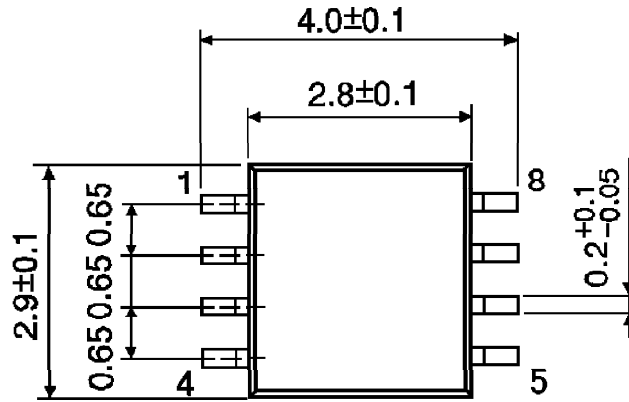
Unit : mm



Weight : 0.05g (Typ.)

PACKAGE DIMENSIONS  
SSOP8-P-0.65

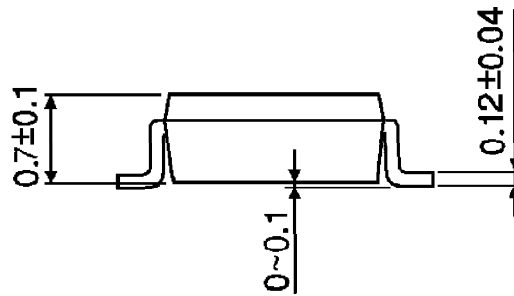
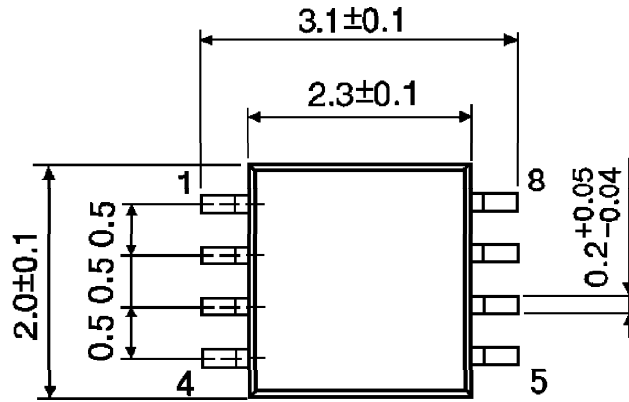
Unit : mm



Weight : 0.02g (Typ.)

PACKAGE DIMENSIONS  
SSOP8-P-0.50A

Unit : mm



Weight : 0.01g (Typ.)



**RESTRICTIONS ON PRODUCT USE**

000707EBA

- TOSHIBA is continually working to improve the quality and 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 comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products 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 TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade 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.