

## DUAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR

The TC74LVQ74 is a high speed CMOS D-FLIP FLOP fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

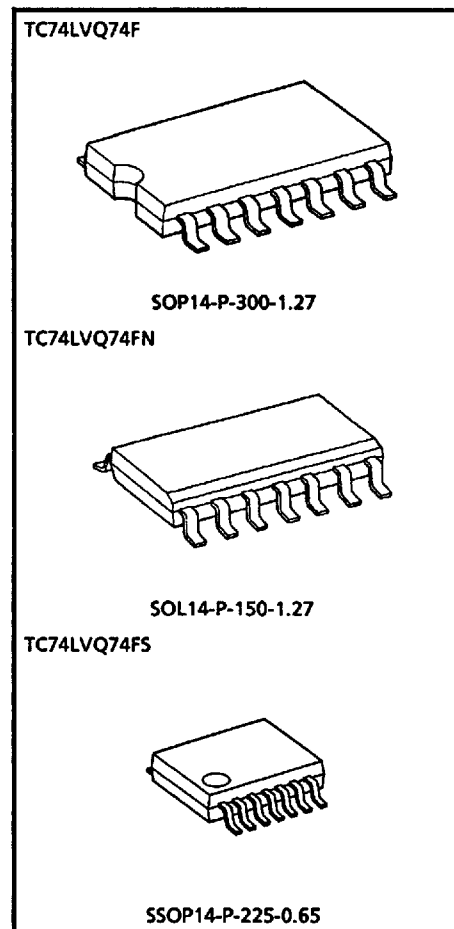
The signal level applied to the D INPUT is transferred to Q OUTPUT during the positive going transition of the CK pulse.

$\overline{\text{CLR}}$  and  $\overline{\text{PR}}$  are independent of the CK and are accomplished by setting the appropriate input to an "L" level.

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

### FEATURES

- High speed :  $f_{\text{MAX}} = 147\text{MHz}$  (Typ.) ( $V_{\text{CC}} = 3.3\text{V}$ )
- Low power dissipation :  $I_{\text{CC}} = 2.5\mu\text{A}$  (Max.) ( $T_a = 25^\circ\text{C}$ )
- Input voltage level :  $V_{\text{IL}} = 0.8\text{V}$  (Max.) ( $V_{\text{CC}} = 3\text{V}$ )  
 $V_{\text{IH}} = 2.0\text{V}$  (Min.) ( $V_{\text{CC}} = 3\text{V}$ )
- Symmetrical output impedance :  $|I_{\text{OH}}| = I_{\text{OL}} = 12\text{mA}$  (Min.)
- Balanced propagation delays :  $t_{\text{PLH}} \approx t_{\text{PHL}}$
- Pin and function compatible with 74HC74



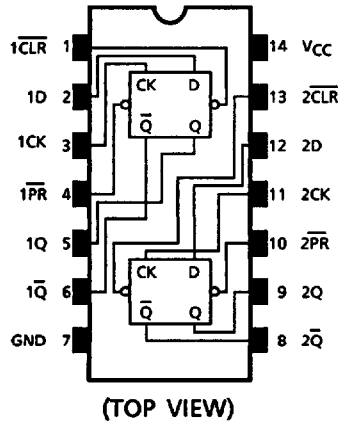
Weight  
 SOP14-P-300-1.27 : 0.18g (Typ.)  
 SOL14-P-150-1.27 : 0.12g (Typ.)  
 SSOP14-P-225-0.65 : 0.07g (Typ.)

● 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.

● TOSHIBA is continually working to improve the quality and the 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 observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product 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 products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

**PIN ASSIGNMENT**

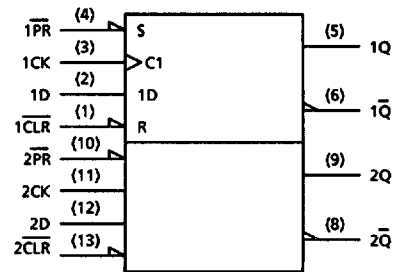


**TRUTH TABLE**

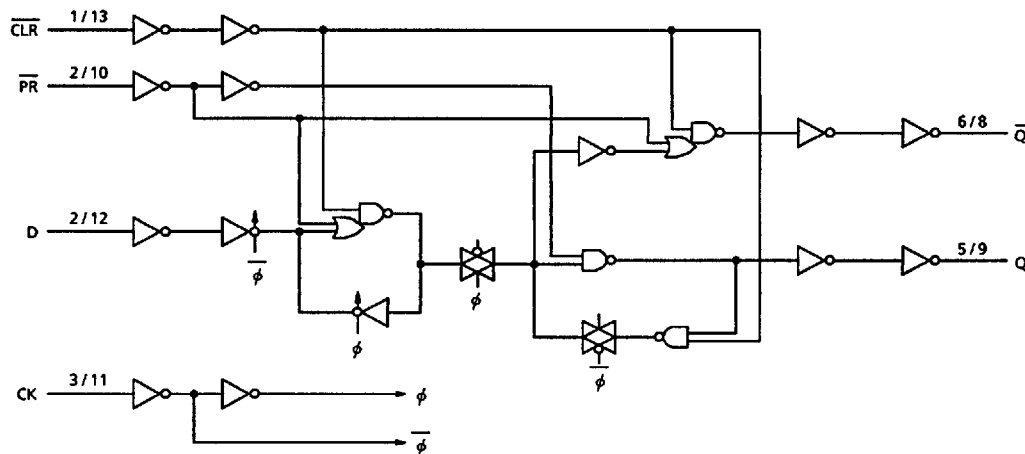
INPUT				OUTPUT		FUNCTION
CLR	PR	D	CK	Q	Q̄	
L	H	X	X	L	H	CLEAR
H	L	X	X	H	L	PRESET
L	L	X	X	H	H	—
H	H	L	↑	L	H	—
H	H	H	↑	H	L	—
H	H	X	⊘	Q <sub>n</sub>	Q̄ <sub>n</sub>	NO CHANGE

X : Don't care

**IEC LOGIC SYMBOL**



**SYSTEM DIAGRAM**



TC74LVQ74F - 2  
1996-09-09  
TOSHIBA CORPORATION

**MAXIMUM RATINGS**

PARAMETER	SYMBOL	RATING	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	$P_D$	180	mW
Storage Temperature	$T_{stg}$	-65~150	°C

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	2.0~3.6	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	dt/dv	0~100	ns/v

**ELECTRICAL CHARACTERISTICS**

DC characteristics

PARAMETER	SYM-BOL	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.			
Input Voltage	"H" Level	$V_{IH}$	3.0	2.0	—	—	2.0	—	V		
	"L" Level	$V_{IL}$	3.0	—	—	0.8	—	0.8			
Output Voltage	"H" Level	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50\mu\text{A}$	3.0	2.9	3.0	—	2.9	—	V
				$I_{OH} = -12\text{mA}$	3.0	2.58	—	—	2.48	—	
	"L" Level	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50\mu\text{A}$	3.0	—	0.0	0.1	—	0.1	
				$I_{OL} = 12\text{mA}$	3.0	—	—	0.36	—	0.44	
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	3.6	—	—	±0.1	—	±1.0	μA		
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	3.6	—	—	2.5	—	25.0	μA		

TC74LVQ74F - 3  
1996-09-09  
TOSHIBA CORPORATION

**TIMING REQUIREMENTS** (Input  $t_r = t_f = 3ns$ )

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C		Ta = -40~85°C		UNIT
			V <sub>CC</sub> (V)	LIMIT	LIMIT	LIMIT	
Minimum Pulse Width (CK)	t <sub>w</sub> (L)		2.7	9.0	10.0		ns
	t <sub>w</sub> (H)		3.3 ± 0.3	7.0	7.0		
Minimum Pulse Width (CLR, PR)	t <sub>w</sub> (L)		2.7	9.0	10.0		
			3.3 ± 0.3	7.0	7.0		
Minimum Set-up Time	t <sub>s</sub>		2.7	7.5	8.5		
			3.3 ± 0.3	6.0	6.0		
Minimum Hold Time	t <sub>h</sub>		2.7	1.0	1.0		
			3.3 ± 0.3	1.0	1.0		
Minimum Removal Time (CLR, PR)	t <sub>rem</sub>		2.7	6.0	6.0		
			3.3 ± 0.3	4.0	4.0		

**AC characteristics** (Input  $t_r = t_f = 3ns$ , C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			V <sub>CC</sub> (V)	MIN.	TYP.	MAX.	MIN.		MAX.
Propagation Delay Time (CK-Q, Q̄)	t <sub>pLH</sub> t <sub>pHL</sub>		2.7	—	9.0	19.7	1.0	23.0	ns
			3.3 ± 0.3	—	7.5	14.0	1.0	16.0	
Propagation Delay Time (CLR, PR-Q, Q̄)	t <sub>pLH</sub> t <sub>pHL</sub>		2.7	—	8.4	16.9	1.0	19.0	ns
			3.3 ± 0.3	—	7.0	12.0	1.0	13.5	
Maximum Clock Frequency	f <sub>MAX</sub>		2.7	55	110	—	45	—	MHz
			3.3 ± 0.3	70	130	—	65	—	
Output To Output Skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 1)	2.7	—	—	1.5	—	1.5	ns
			3.3 ± 0.3	—	—	1.5	—	1.5	
Input Capacitance	C <sub>IN</sub>	(Note 2)		—	5	10	—	10	pF
Power Dissipation Capacitance	C <sub>PD</sub>	(Note 3)		—	39	—	—	—	pF

(Note 1) Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

(Note 2) Parameter guaranteed by design.

(Note 3) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

Average operating current can be obtained by the equation :

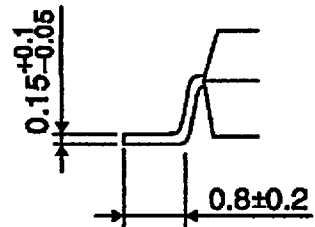
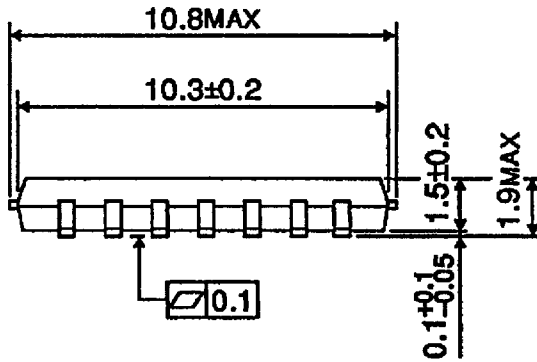
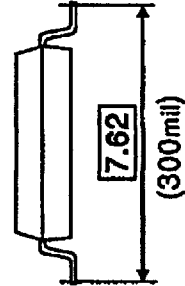
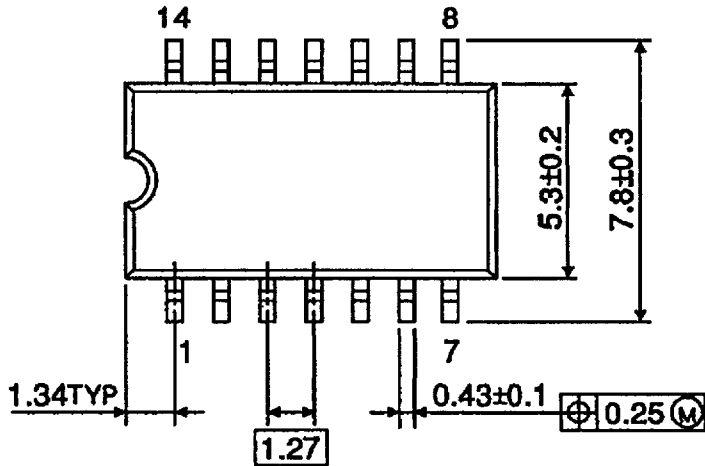
$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2 \text{ (per F/F)}$$

Noise characteristics (Ta = 25°C, Input tr = tf = 3ns, CL = 50pF, RL = 500Ω)

PARAMETER	SYMBOL	TEST CONDITION	VCC (V)	TYP.	LIMIT	UNIT
Quiet Output Maximum Dynamic VOL	VOLP		3.3	0.3	0.8	V
Quiet Output Minimum Dynamic VOL	VOLV		3.3	-0.3	-0.8	V
Minimum High Level Dynamic Input Voltage	VIHD		3.3	—	2.0	V
Maximum Low Level Dynamic Input Voltage	VILD		3.3	—	0.8	V

**OUTLINE DRAWING**  
SOP14-P-300-1.27

Unit : mm

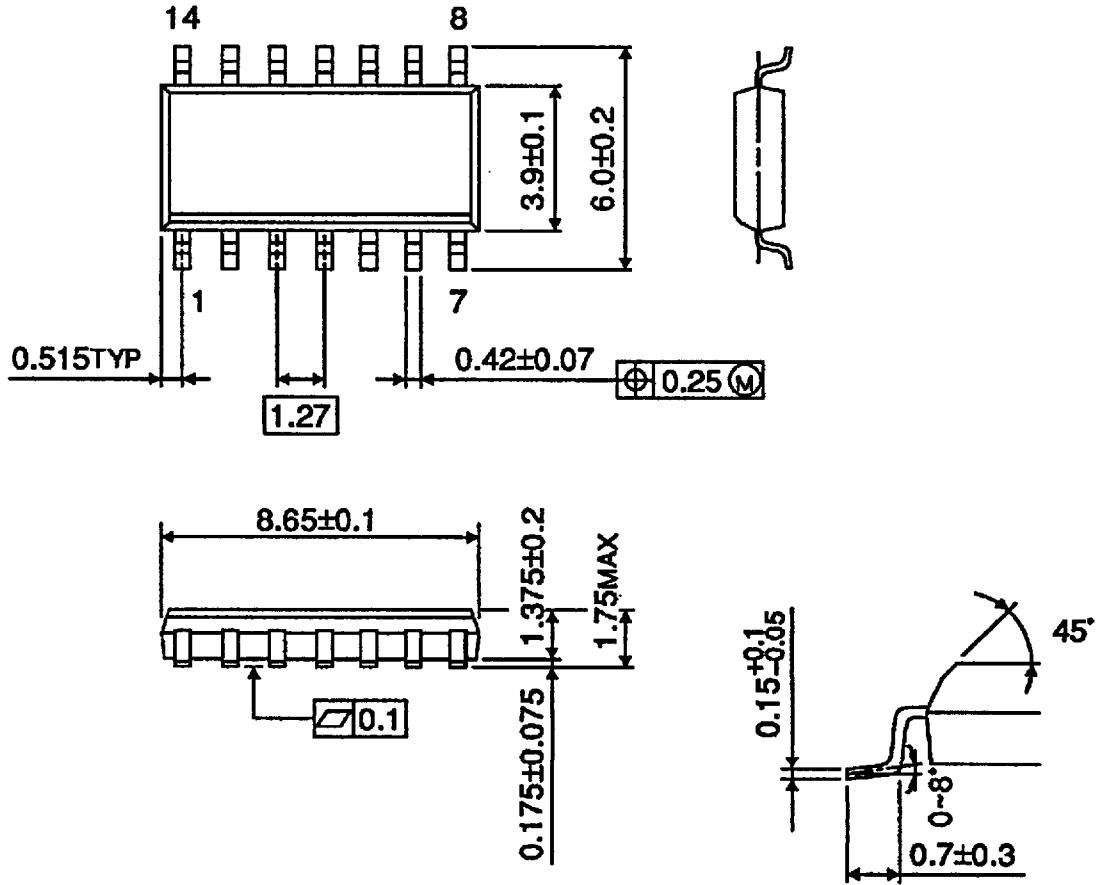


Weight : 0.18g (Typ.)

TC74LVQ74F - 6
1996-09-09
<b>TOSHIBA CORPORATION</b>

OUTLINE DRAWING  
SOL14-P-150-1.27

Unit : mm

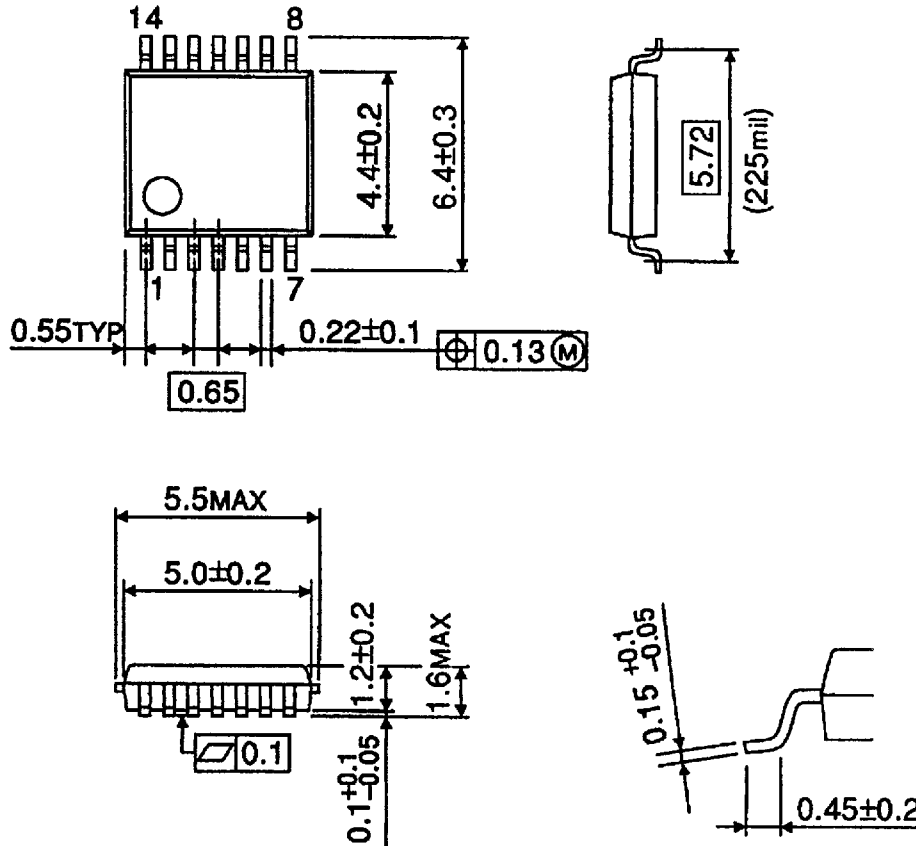


Weight : 0.12g (Typ.)

TC74LVQ74F - 7
1996-09-09
<b>TOSHIBA CORPORATION</b>

**OUTLINE DRAWING**  
SSOP14-P-225-0.65

Unit : mm



Weight : 0.07g (Typ.)

TC74LVQ74F - 8*
1996-09-09
<b>TOSHIBA CORPORATION</b>