

DUAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR

- HIGH SPEED: f_{MAX} = 170 MHz (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION: $I_{CC} = 2 \mu A \text{ (MAX.)}$ at $T_A = 25 ^{\circ}\text{C}$
- HIGH NOISE IMMUNITY: V_{NIH} = V_{NIL} = 28% V_{CC} (MIN.)
- POWER DOWN PROTECTION ON INPUTS
- SYMMETRICAL OUTPUT IMPEDANCE: |I_{OH}| = I_{OL} = 8 mA (MIN)
- BALANCED PROPAGATION DELAYS:
 t_{PI H} ≅ t_{PHI}
- OPERATING VOLTAGE RANGE: V_{CC}(OPR) = 2V to 5.5V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 74
- IMPROVED LATCH-UP IMMUNITY

DESCRIPTION

The 74VHC74 is an advanced high-speed CMOS DUAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. A signal on the D INPUT is transferred to the Q OUTPUTS during the positive going transition of the clock pulse.

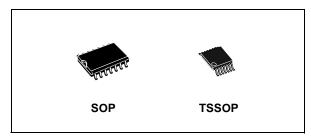


Table 1: Order Codes

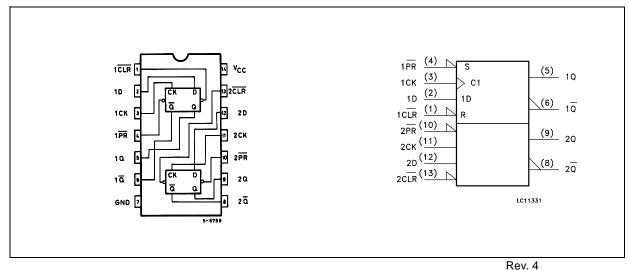
PACKAGE	T & R
SOP	74VHC74MTR
TSSOP	74VHC74TTR

CLR and PR are independent of the clock and accomplished by a low setting on the appropriate input.

Power down protection is provided on all inputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V.

All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

Figure 1: Pin Connection And IEC Logic Symbols



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Figure 2: Input Equivalent Circuit

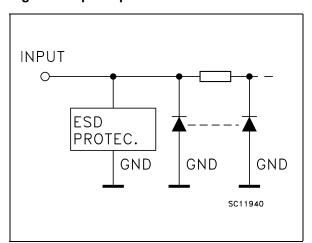


Table 2: Pin Description

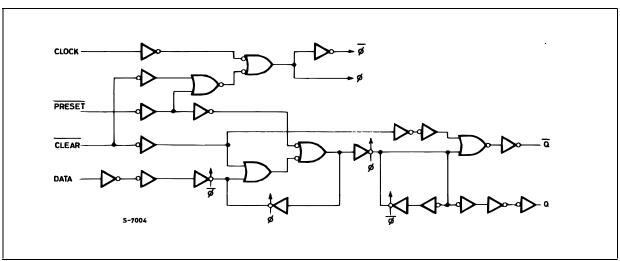
PIN N°	SYMBOL	NAME AND FUNCTION
1, 13	1CLR, 2CLR	Asynchronous Reset - Direct Input
2, 12	1D, 2D	Data Inputs
3, 11	1CK, 2CK	Clock Input (LOW to HIGH, Edge Triggered)
4, 10	1PR, 2PR	Asynchronous Set - Direct Input
5, 9	1Q, 2Q	True Flip-Flop Outputs
6, 8	1Q, 2Q	Complement Flip-Flop Outputs
7	GND	Ground (0V)
14	V _{CC}	Positive Supply Voltage

Table 3: Truth Table

	INP	UTS		ОИТІ	PUTS	FUNCTION
CLR	PR	D	СК	Q	Q	FUNCTION
L	Н	Х	Х	L	Н	CLEAR
Н	L	Х	Х	Н	L	PRESET
L	L	X	X	Н	Н	
Н	Н	L		L	Н	
Н	Н	Н		Н	L	
Н	Н	Х		Q _n	\overline{Q}_n	NO CHANGE

X : Don't Care

Figure 3: Logic Diagram



This logic diagram has not be used to estimate propagation delays

Table 4: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	-0.5 to +7.0	V
V _I	DC Input Voltage	-0.5 to +7.0	V
Vo	DC Output Voltage	-0.5 to V _{CC} + 0.5	V
I _{IK}	DC Input Diode Current	- 20	mA
I _{OK}	DC Output Diode Current	± 20	mA
Ι _Ο	DC Output Current	± 25	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 50	mA
T _{stg}	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

Table 5: Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	2 to 5.5	V
V _I	Input Voltage	0 to 5.5	V
Vo	Output Voltage	0 to V _{CC}	V
T _{op}	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time (note 1) (V_{CC} = 3.3 \pm 0.3V) (V_{CC} = 5.0 \pm 0.5V)	0 to 100 0 to 20	ns/V

¹⁾ $V_{\mbox{\footnotesize{IN}}}$ from 30% to 70% of $V_{\mbox{\footnotesize{CC}}}$

Table 6: DC Specifications

		1	est Condition	Value							
Symbol	Parameter	V _{CC}		T _A = 25°C			-40 to 85°C		-55 to 125°C		Unit
		(V)		Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
V _{IH}	High Level Input	2.0		1.5			1.5		1.5		
	Voltage	3.0 to 5.5		0.7V _{CC}			0.7V _{CC}		0.7V _{CC}		V
V _{IL}	Low Level Input	2.0				0.5		0.5		0.5	
	Voltage	3.0 to 5.5				0.3V _{CC}		0.3V _{CC}		0.3V _{CC}	V
V _{OH} High Level Output	2.0	I _O =-50 μA	1.9	2.0		1.9		1.9			
	Voltage	3.0	I _O =-50 μA	2.9	3.0		2.9		2.9		
		4.5	I _O =-50 μA	4.4	4.5		4.4		4.4		V
		3.0	I _O =-4 mA	2.58			2.48		2.4		
		4.5	I _O =-8 mA	3.94			3.8		3.7		
V _{OL}	Low Level Output	2.0	I _O =50 μA		0.0	0.1		0.1		0.1	
	Voltage	3.0	I _O =50 μA		0.0	0.1		0.1		0.1	
		4.5	I _O =50 μA		0.0	0.1		0.1		0.1	V
		3.0	I _O =4 mA			0.36		0.44		0.55	
		4.5	I _O =8 mA			0.36		0.44		0.55	
I _I	Input Leakage Current	0 to 5.5	V _I = 5.5V or GND			± 0.1		± 1		± 1	μΑ
I _{CC}	Quiescent Supply Current	5.5	$V_I = V_{CC}$ or GND			2		20		20	μΑ

Table 7: AC Electrical Characteristics (Input $t_r = t_f = 3ns$)

		7	Test Co	ondition				Value				
Symbol	Parameter	V _{CC}	CL		Т	A = 25°	С	-40 to	85°C	-55 to	125°C	Unit
		(V)	(p F)		Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
t _{PLH}	Propagation Delay Time CK to Q or Q	3.3 ^(*)	15			6.7	11.9	1.0	14.0	1.0	14.0	
t _{PHL}		3.3 ^(*)	50			9.2	15.4	1.0	17.5	1.0	17.5	ns
		5.0 ^(**)	15			4.6	7.3	1.0	8.5	1.0	8.5	115
		5.0 ^(**)	50			6.1	9.3	1.0	10.5	1.0	10.5	
t _{PLH}	Propagation Delay	3.3 ^(*)	15			7.6	12.3	1.0	14.5	1.0	14.5	
t _{PHL}	Time PR or CLR to Q or Q	3.3 ^(*)	50			10.1	15.8	1.0	18.0	1.0	18.0	ns
		5.0 ^(**)	15			4.8	7.7	1.0	9.0	1.0	9.0	115
		5.0 ^(**)	50			6.3	9.7	1.0	11.0	1.0	11.0	
t _W	CK Pulse Width	3.3 ^(*)					6.0		7.0		7.0	- ns
	HIGH or LOW	5.0 ^(**)					5.0		5.0		5.0	
t _W	PR or CLR Pulse	3.3 ^(*)					6.0		7.0		7.0	ns
	Width LOW	5.0 ^(**)					5.0		5.0		5.0	10
t _s	Setup Time D to CK	3.3 ^(*)					6.0		7.0		7.0	ns
	HIGH or LOW	5.0 ^(**)					5.0		5.0		5.0	115
t _h	Hold Time D to CK	3.3 ^(*)					0.5		0.5		0.5	nc
	HIGH or LOW	5.0 ^(**)					0.5		0.5		0.5	ns
t _{REM}	Removal Time	3.3 ^(*)					5.0		5.0		5.0	ns
	PR or CLR to CK	5.0 ^(**)					3.0		3.0		3.0	110
f _{MAX}	Maximum Clock Frequency	3.3 ^(*)	15		80	125		70		70		
		3.3 ^(*)	50		50	75		45		45		MHz
		5.0 ^(**)	15		130	170		110		110		IVITIZ
		5.0 ^(**)	50		90	115		75		75		

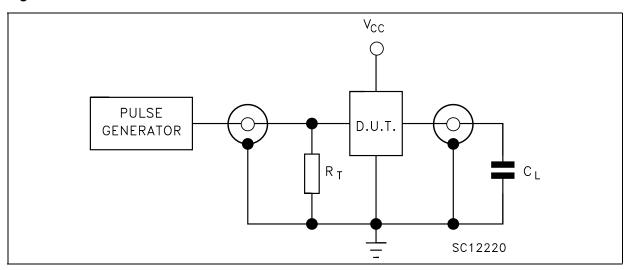
Table 8: Capacitive Characteristics

			Test Condition		Value						
Symbol	Parameter	V _{CC}		T _A = 25°C			-40 to 85°C		-55 to 125°C		Unit
		(V)		Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
C _{IN}	Input Capacitance	5.0			7	10		10		10	pF
C _{PD}	Power Dissipation Capacitance (note 1)	5.0	f _{IN} = 10MHz		25						pF

¹⁾ C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2$ (per flip-flop)

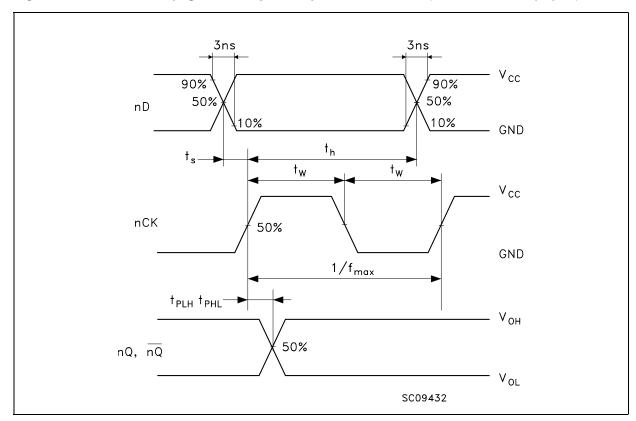
^(*) Voltage range is $3.3 \text{V} \pm 0.3 \text{V}$ (**) Voltage range is $5.0 \text{V} \pm 0.5 \text{V}$

Figure 4: Test Circuit



 C_L =15/50pF or equivalent (includes jig and probe capacitance) R_T = Z_{OUT} of pulse generator (typically $50\Omega)$

Figure 5: Waveform - Propagation Delays, Setup And Hold Times (f=1MHz; 50% duty cycle)



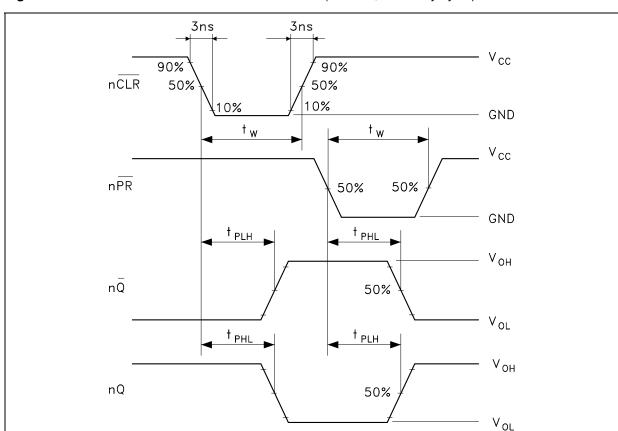
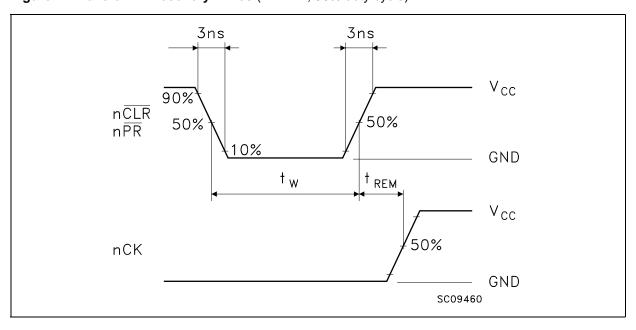


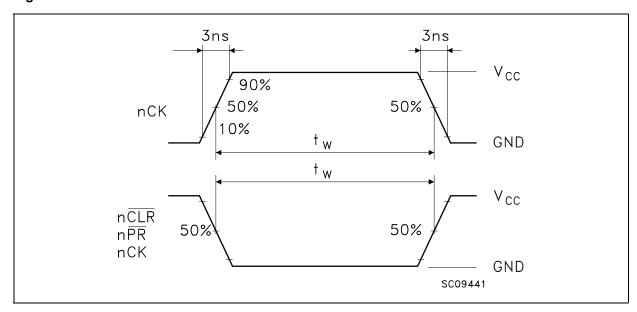
Figure 6: WAVEFORM 2: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)

Figure 7: Waveform - Recovery Times (f=1MHz; 50% duty cycle)



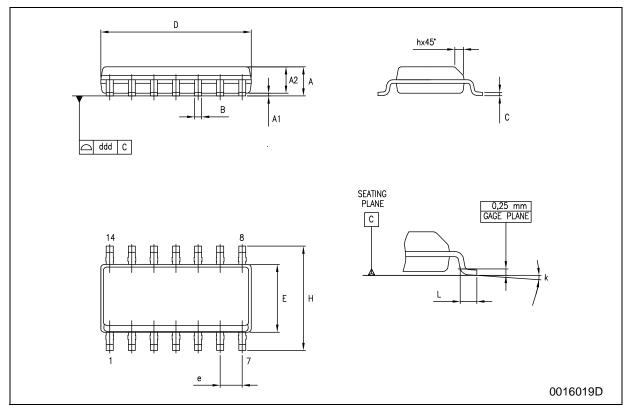
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Figure 8: Waveform - Pulse Width



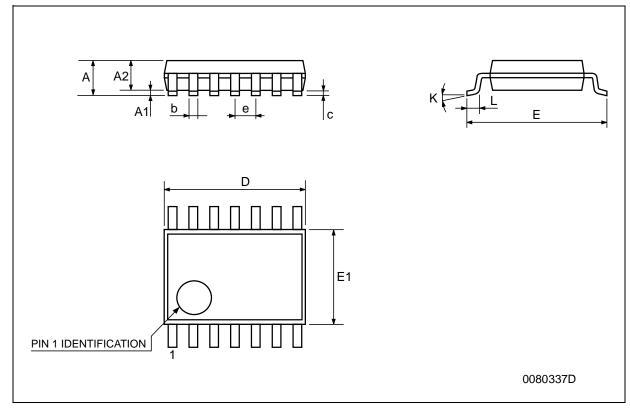
SO-14 MECHANICAL DATA

DIM		mm.			inch	
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
А	1.35		1.75	0.053		0.069
A1	0.1		0.25	0.004		0.010
A2	1.10		1.65	0.043		0.065
В	0.33		0.51	0.013		0.020
С	0.19		0.25	0.007		0.010
D	8.55		8.75	0.337		0.344
E	3.8		4.0	0.150		0.157
е		1.27			0.050	
Н	5.8		6.2	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.4		1.27	0.016		0.050
k	0°		8°	0°		8°
ddd			0.100			0.004



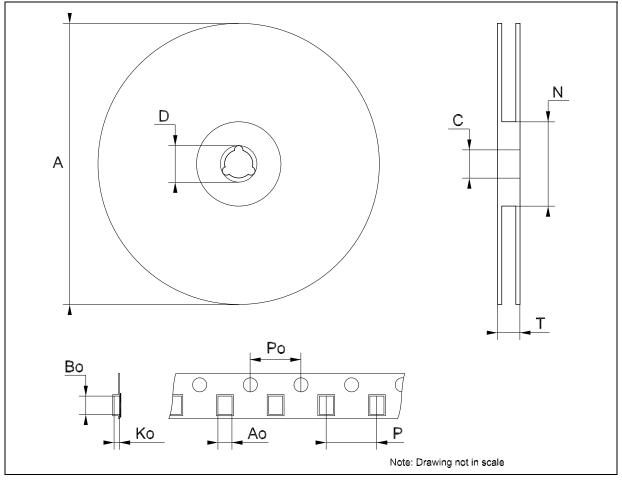
TSSOP14 MECHANICAL DATA

DIM		mm.		inch				
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.		
А			1.2			0.047		
A1	0.05		0.15	0.002	0.004	0.006		
A2	0.8	1	1.05	0.031	0.039	0.041		
b	0.19		0.30	0.007		0.012		
С	0.09		0.20	0.004		0.0089		
D	4.9	5	5.1	0.193	0.197	0.201		
Е	6.2	6.4	6.6	0.244	0.252	0.260		
E1	4.3	4.4	4.48	0.169	0.173	0.176		
е		0.65 BSC			0.0256 BSC			
К	0°		8°	0°		8°		
L	0.45	0.60	0.75	0.018	0.024	0.030		



Tape & Reel SO-14 MECHANICAL DATA

	mm.		inch				
MIN.	TYP	MAX.	MIN.	TYP.	MAX.		
		330			12.992		
12.8		13.2	0.504		0.519		
20.2			0.795				
60			2.362				
		22.4			0.882		
6.4		6.6	0.252		0.260		
9		9.2	0.354		0.362		
2.1		2.3	0.082		0.090		
3.9		4.1	0.153		0.161		
7.9		8.1	0.311		0.319		
	12.8 20.2 60 6.4 9 2.1 3.9	MIN. TYP 12.8 20.2 60 6.4 9 2.1 3.9	MIN. TYP MAX. 330 12.8 13.2 20.2 60 22.4 6.4 6.6 9 9 9.2 2.1 2.3 3.9 4.1	MIN. TYP MAX. MIN. 330 12.8 13.2 0.504 20.2 0.795 0.795 60 2.362 22.4 6.6 0.252 9 9.2 0.354 2.1 2.3 0.082 3.9 4.1 0.153	MIN. TYP MAX. MIN. TYP. 12.8 13.2 0.504 0.795		



Tape & Reel TSSOP14 MECHANICAL DATA

DIM		mm.		inch			
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.	
А			330			12.992	
С	12.8		13.2	0.504		0.519	
D	20.2			0.795			
N	60			2.362			
Т			22.4			0.882	
Ao	6.7		6.9	0.264		0.272	
Во	5.3		5.5	0.209		0.217	
Ko	1.6		1.8	0.063		0.071	
Po	3.9		4.1	0.153		0.161	
Р	7.9		8.1	0.311		0.319	

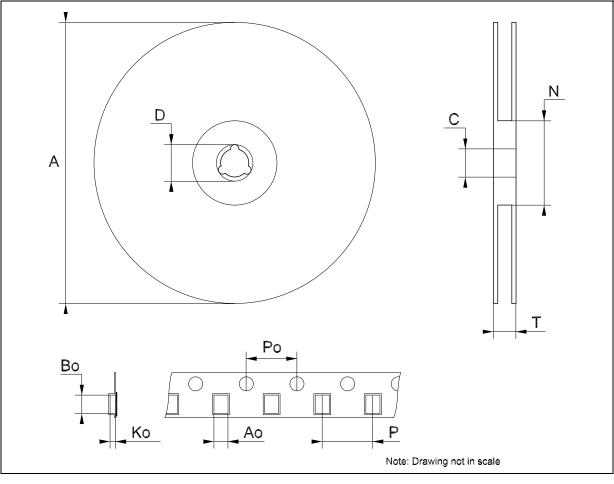


Table 9: Revision History

Date	Revision	Description of Changes
12-Nov-2004	4	Order Codes Revision - pag. 1.

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