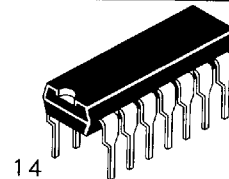


Dual D Flip-Flop with Set and Reset

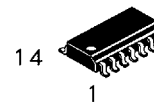
This device consists of two D flip-flops with individual Set, Reset, and Clock inputs. Information at a D-input is transferred to the corresponding Q output on the next positive going edge of the clock input. Both Q and $\bar{Q}$ outputs are available from each flip-flop. The Set and Reset inputs are asynchronous.

- **Output Drive Capability:** 10 LSTTL Loads
- **Outputs Directly Interface to CMOS, NMOS, and TTL**
- **Operating Voltage Range:** 2 to 6 V for HC devices
- **Low Input Current:** 1 μ A
- **DC, AC parameters guaranteed from -55°C to 125°C**

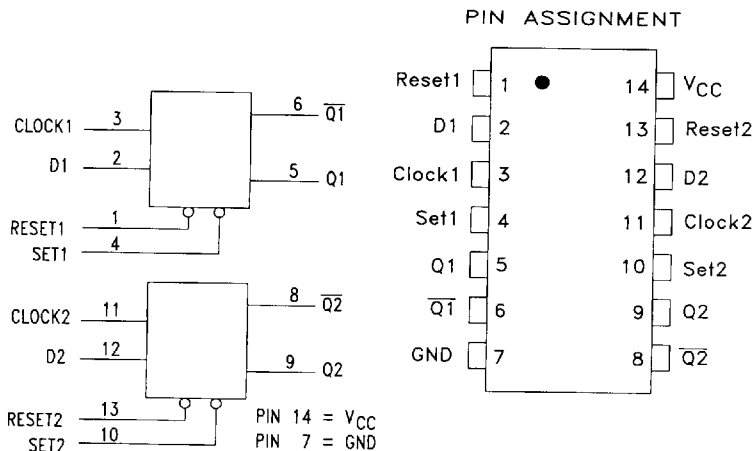
DV74HC74A DV74HCT74A



N Suffix
Plastic DIP
AVG-001 Case



D Suffix
Plastic SOP
AVG-002 Case



TRUTH TABLE

Inputs				Outputs	
Set	Reset	Clock	Data	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	No Change	No Change
H	H	H	X	No Change	No Change
H	H	↓	X	No Change	No Change

*Both outputs will remain high as long as Set and Reset are low, but the output states are unpredictable if Set and Reset go high simultaneously

H = High Logic Level

L = Low Logic Level

X = Don't Care

↑ = Low to High Transition

↓ = High to Low Transition

ABSOLUTE MAXIMUM RATINGS

Maximum ratings are those values beyond which damage to the device may occur.

Symbol	Parameter	Value	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V _{IN}	DC Input Voltage (Referenced to GND)	-1.5 to V _{CC} + 1.5	V
V _{OUT}	DC Output Voltage (Referenced to GND)	-0.5 to V _{CC} + 0.5	V
I _{IN}	DC Input Current, per Pin	± 20	mA
I _{OUT}	DC Output Current, per Pin	± 25	mA
I _{CC}	DC Supply Current, V _{CC} and GND Pins	± 50	mA
P _D	Power Dissipation in Still Air, Plastic DIP SOP Package	750 500	mW
T _{STG}	Storage Temperature Range	-65 to +150	°C
TL	Lead Temperature, 1mm from Case for 10 Seconds (Plastic DIP or SOP Package)	260	°C

GUARANTEED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	DC Supply Voltage, HC (HCT), Referenced to GND	2.0 (4.5)	6.0 (5.5)	V
V _{IN} , V _{OUT}	DC Input Voltage, Output Voltage, Referenced to GND	0	V _{CC}	V
T _A	Ambient Temperature	-55	+125	°C
t _r , t _f	Input Rise and Fall Time: HC: V _{CC} =2.0V HCT: V _{CC} =5.5V / HC: V _{CC} =4.5V HC: V _{CC} =6.0V	0 0 0	1000 500 400	ns

HC-74A

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} V	Guaranteed Limits			Unit
				25°C to -55°C	≤85°C	≤125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{OUT} = 0.1 V, I _{OUT} = 20 μA or V _{OUT} = V _{CC} - 0.1 V	2.0 4.5 6.0	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
V _{IL}	Maximum Low-Level Input Voltage	V _{OUT} = 0.1 V, I _{OUT} ≤ 20 μA or V _{OUT} = V _{CC} - 0.1 V	2.0 4.5 6.0	0.5 1.35 1.8	0.5 1.35 1.8	0.5 1.35 1.8	V
V _{OH}	Minimum High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA	4.5 6.0	3.98 5.48	3.84 5.34	3.7 5.2	
V _{OL}	Maximum Low Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA	4.5 6.0	0.26 0.26	0.33 0.33	0.40 0.40	
I _{IN}	Maximum Input Leakage Current	V _{IN} = V _{CC} or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND, I _{OUT} ≤ 0 μA	6.0	2.0	20	80	μA

AC ELECTRICAL CHARACTERISTICS over full operating conditions (C_L = 50 pF, Input t_f = t_r = 6 ns)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
f _{max}	Maximum Clock Frequency (50% Duty Cycle)	2.0 4.5 6.0	6.0 30 35	4.8 24 28	4.0 20 24	MHz
t _{PLH} , t _{PHL}	Maximum Propagation Delay Time, Clock to Q or Q̄	2.0 4.5 6.0	100 20 17	125 25 21	150 30 26	ns
t _{PLH} , t _{PHL}	Maximum Propagation Delay Time, Set or Reset to Q or Q̄	2.0 4.5 6.0	105 21 18	130 26 22	160 32 27	ns
t _{TLH} , t _{THL}	Maximum Output Transition Time Any Output	2.0 4.5 6.0	75 15 13	95 19 16	110 22 19	ns
C _{IN}	Maximum Input Capacitance	—	10	10	10	pF

C _{PD}	Power Dissipation Capacitance (Per Flip-Flop) Used to determine the no-load dynamic power consumption, P _D = C _{PD} V _{CC} ² f + I _{CC} V _{CC}	Typical @ 25°C, V _{CC} = 5 V	pF
		39	

TIMING REQUIREMENTS (Input $t_r = t_f = 6.0$ ns)

Symbol	Parameter	V _{CC}	Guaranteed Limit			Unit
			25°C to -55°C	≤85 °C	≤125°C	
t _{su}	Minimum Setup Time, Data to Clock	2.0	80	100	120	ns
		4.5	16	20	24	
		6.0	14	17	20	
t _h	Minimum Hold Time, Clock to Data	2.0	3.0	3.0	3.0	ns
		4.5	3.0	3.0	3.0	
		6.0	3.0	3.0	3.0	
t _{rec}	Minimum Recovery Time, Set or Reset Inactive to Clock	2.0	8.0	8.0	8.0	ns
		4.5	8.0	8.0	8.0	
		6.0	8.0	8.0	8.0	
t _w	Minimum Pulse Width, Clock	2.0	60	75	90	ns
		4.5	12	15	18	
		6.0	10	13	15	
t _w	Minimum Pulse Width, Set or Reset	2.0	60	75	90	ns
		4.5	12	15	18	
		6.0	10	13	15	
t _r , t _f	Maximum Input Rise and Fall Times	2.0	1000	1000	1000	ns
		4.5	500	500	500	
		6.0	400	400	400	

HCT-74A
DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} V	Guaranteed Limits			Unit
				25°C to -55°C	≤85°C	≤125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{OUT} =0.1 V, I _{OUT} ≤20μA or V _{OUT} = V _{CC} -0.1V	4.5 5.5	2.0 2.0	2.0 2.0	2.0 2.0	V
V _{IL}	Maximum Low- Level Input Voltage	V _{OUT} =0.1 V, I _{OUT} ≤20μA or V _{OUT} = V _{CC} -0.1V	4.5 5.5	0.8 0.8	0.8 0.8	0.8 0.8	V
V _{OH}	Minimum High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 20 μA	4.5 5.5	4.4 5.4	4.4 5.4	4.4 5.4	V
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0mA	4.5	3.98	3.84	3.7	
V _{OL}	Maximum Low Level Output Voltage	V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 20 μA	4.5 5.5	0.1 0.1	0.1 0.1	0.1 0.1	V
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0mA	4.5	0.26	0.33	0.40	V
I _{IN}	Maximum Input Leakage Current	V _{IN} = V _{CC} or GND	5.5	± 0.1	± 1.0	± 1.0	μA
I _{CC}	Maximum Quiescent Supply Current (Per Package)	V _{IN} = V _{CC} or GND I _{OUT} ≤ 0 μA	5.5	1.0	10	40	μA
ΔI _{CC}	Additional Quiescent Supply Current	V _{IN} = 2.4 V, Any One Input V _{IN} = V _{CC} or GND, Other Inputs I _{OUT} = 0 μA	5.5	≥-55°C 2.9	25°C to 125°C 2.4		mA

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

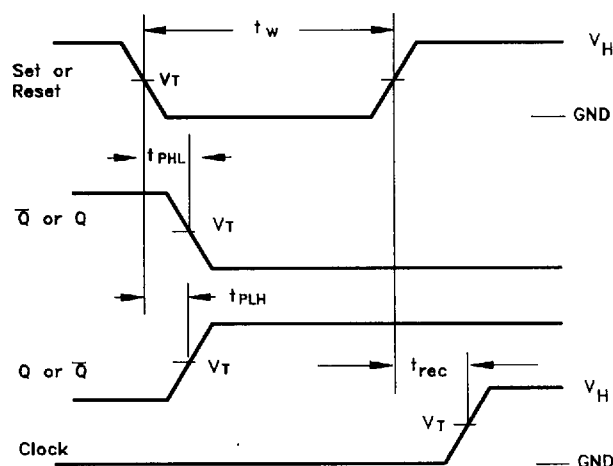
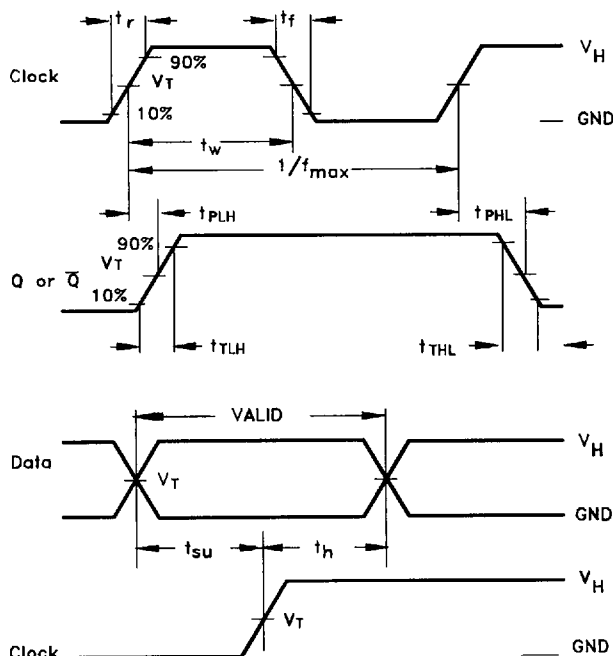
Symbol	Parameter	Vcc V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
$f_{\max}$	Maximum Clock Frequency (50% Duty Cycle)	5.0V ± 10%	30	24	20	MHz
t_{PLH} , t_{PHL}	Maximum Propagation Delay Time, Clock to Q or $\bar{Q}$		24	30	36	ns
t_{PLH} , t_{PHL}	Maximum Propagation Delay Time, Set or Reset to Q or $\bar{Q}$		24	30	36	ns
t_{TLH} , t_{THL}	Maximum Output Transition Time Any Output		15	19	22	ns
C_{IN}	Maximum Input Capacitance	—	10	10	10	pF

CPD	Power Dissipation Capacitance (Per Flip-Flop) Used to determine the no-load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$	Typical @ 25°C, $V_{CC} = 5\text{ V}$	pF
		130	

TIMING REQUIREMENTS ($C_L=50\text{pF}$, Input $t_f=t_r=6.0\text{ ns}$)

TIMING REQUIREMENTS (C _L =50pF, Input t _r =t _f =0.6 ns)									
Symbol	Parameter	V _{CC}	Guaranteed Limit						Unit
			25°C to -55°C		≤ 85°C		<125°C		
			Min	Max	Min	Max	Min	Max	
t _{su}	Minimum Setup Time, Data to Clock	5.0V ±10%	15		19		22		ns
t _h	Minimum Hold Time, Clock to Data		3		3		3		ns
t _{rec}	Minimum Recovery Time, Set or Reset Inactive to Clock		6		8		9		ns
t _w	Minimum Pulse Width, Clock		15		19		22		ns
t _w	Minimum Pulse Width, Set or Reset		15		19		22		ns
t _r , t _f	Maximum Input Rise and Fall Times			500		500		500	ns

SWITCHING WAVEFORMS



Input and Output threshold voltage, $V_T=50\% V_{CC}$ for HC; 1.3V for HCT, $V_H=V_{CC}$ for HC, 3V for HCT