

July 1997 Revised April 1999

74VHCT74A Dual D-Type Flip-Flop with Preset and Clear

General Description

The VHCT74A is an advanced high speed CMOS Dual D-Type Flip-Flop fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The signal level applied to the D INPUT is transferred to the Q OUTPUT during the positive going transition of the CK pulse. CLR and PR are independent of the CK and are accomplished by setting the appropriate input LOW.

Protection circuits ensure that 0V to 7V can be applied to the input pins without regard to the supply voltage and to the output pins with $V_{CC}=0V$. These circuits prevent device destruction due to mismatched supply and input/

output voltages. This device can be used to interface 3V to 5V systems and two supply systems such as battery backup.

Features

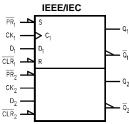
- High speed: f_{MAX} = 160 MHz (typ) at T_A = 25°C
- \blacksquare High noise immunity: $V_{IH} = 2.0V$, $V_{IL} = 0.8V$
- Power down protection is provided on all inputs and outputs
- Low power dissipation: $I_{CC} = 2 \mu A \text{ (max) at } T_A = 25^{\circ} C$
- Pin and function compatible with 74HCT74

Ordering Code:

Order Number	Package Number	Package Description
74VHCT74AM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
74VHCT74ASJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHCT74AMTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHCT74AN	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

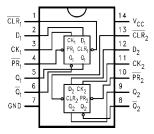
Logic Symbol



Pin Descriptions

Pin Names	Description
D ₁ , D ₂	Data Inputs
CK ₁ , CK ₂	Clock Pulse Inputs
$\overline{\text{CLR}}_1$, $\overline{\text{CLR}}_2$	Direct Clear Inputs
\overline{PR}_1 , \overline{PR}_2	Direct Preset Inputs
$Q_1, \overline{Q}_1, Q_2, \overline{Q}_2$	Outputs

Connection Diagram



Truth Table

	Inp	uts	Out	outs	Function	
CLR	PR	D	СК	Q	ď	Function
L	Н	Х	Х	L	Н	Clear
Н	L	Χ	Χ	Н	L	Preset
L	L	Χ	Χ	Н	Н	
Н	Н	L		L	Н	
Н	Н	Н	~	Н	L	
Н	Н	Х	~	Q _n	Q _n	No Change

Absolute Maximum Ratings(Note 1)

Recommended Operating Conditions (Note 5)

 -65° C to $+150^{\circ}$ C

-0.5V to +7.0V Supply Voltage (V_{CC}) DC Input Voltage (V_{IN}) -0.5V to +7.0V

DC Output Voltage (V_{OUT})

(Note 2) -0.5V to $V_{CC} + 0.5V$ (Note 3) -0.5V to 7.0VInput Diode Current (I_{IK}) -20 mA

Output Diode Current (I_{OK})

±20 mA (Note 4) DC Output Current (I_{OUT}) ±25 mA DC V_{CC} /GND Current (I_{CC}) ±50 mA Storage Temperature (T_{STG})

Lead Temperature (T_L)

260°C Soldering (10 seconds)

Supply Voltage (V_{CC})

4.5V to 5.5V 0V to +5.5V Input Voltage (V_{IN})

Output Voltage (V_{OUT})

(Note 2) 0V to V_{CC} 0V to 5.5V (Note 3) -40°C to +85°C

Operating Temperature (T_{OPR}) Input Rise and Fall Time (t_r, t_f)

 $0 \text{ ns/V} \sim 20 \text{ ns/V}$ $V_{CC} = 5.0V \pm 0.5V$

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading varaibles. Fairchild does not recommend operation outside databook specifica-

Note 2: HIGH or LOW state. $\mathbf{I}_{\mathrm{OUT}}$ absolute maximum rating must be observed.

Note 3: $V_{CC} = 0V$.

Note 4: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$.(Outputs Active)

Note 5: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V _{cc}	T _A = 25°C			$T_A = -40^{\circ}C$ to $+85^{\circ}C$		Units	Conditions	
Syllibol	Farameter	(V)	Min	Тур	Max	Min	Max	Units	Conditions	
V _{IH}	HIGH Level	4.5	2.0			2.0		V		
	Input Voltage	5.5	2.0			2.0		ľ		
V _{IL}	LOW Level	4.5			0.8		0.8	V		
	Input Voltage	5.5			0.8		0.8	V		
V _{OH}	HIGH Level	4.5	4.40	4.50		4.40		V	$V_{IN} = V_{IH}$ $I_{OH} = -50 \mu A$	
	Output Voltage	4.5	3.94			3.80		ľ	or V_{IL} $I_{OH} = -8 \text{ mA}$	
V _{OL}	LOW Level	4.5		0.0	0.1		0.1	V	$V_{IN} = V_{IH}$ $I_{OL} = 50 \mu A$	
	Output Voltage	4.5			0.36		0.44	\ \	or V _{IL} I _{OL} = 8 mA	
I _{IN}	Input Leakage Current	0-5.5			±0.1		±1.0	μΑ	V _{IN} = 5.5V or GND	
Icc	Quiescent Supply Current	5.5			2.0		20.0	μΑ	$V_{IN} = V_{CC}$ or GND	
I _{CCT}	Maximum I _{CC} /Input	5.5			1.35		1.50	mA	$V_{IN} = 3.4V$	
		3.3		1.55		1.50		IIIA	Other Inputs = V _{CC} or GND	
I _{OFF}	Output Leakage Current	0.0			+0.5		+5.0	μΑ	V _{OUT} = 5.5V	
	(Power Down State)									
	•					•			•	

AC Electrical Characteristics

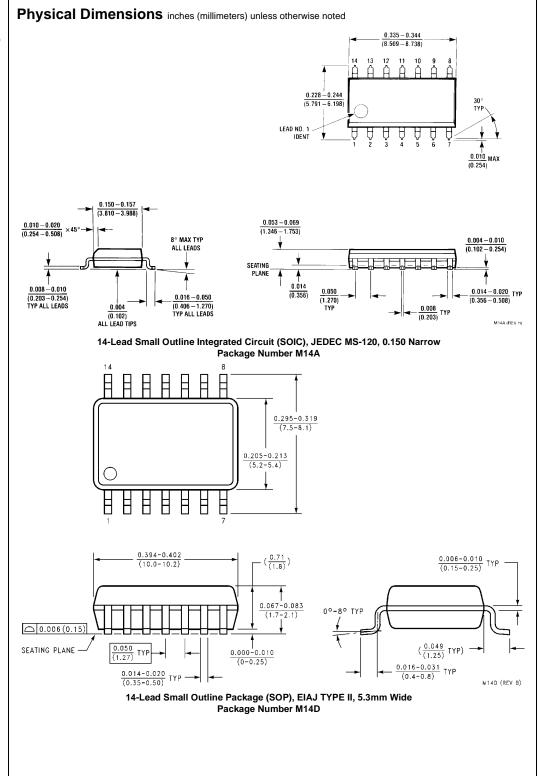
	Parameter	V _{CC}	T _A = 25°C			$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			
Symbol		(V) (Note 6)	Min	Тур	Max	Min	Max	Units	Conditions
f _{MAX}	Maximum Clock	5.0	100	160		80		MHz	C _L = 15 pF
	Frequency	5.0	80	140		65		IVII IZ	C _L = 50 pF
t _{PLH}	Propagation Delay Time	5.0		5.8	7.8	1.0	9.0		C _L = 15 pF
t_{PHL}	$(CK-Q, \overline{Q})$	5.0		6.3	8.8	1.0	10.0	ns	C _L = 50 pF
t _{PLH}	Propagation Delay time	5.0		7.6	10.4	1.0	12.0		C _L = 15 pF
t_{PHL}	$(\overline{CLR}, \overline{PR} - Q, \overline{Q})$	5.0		8.1	11.4	1.0	13.0	ns	C _L = 50 pF
C _{IN}	Input Capacitance			4	10		10	pF	V _{CC} = Open
C _{PD}	Power Dissipation Capacitance			24				pF	(Note 7)

Note 6: V_{CC} is $5.0 \pm 0.5 V$

Note 7: 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} (opr) = $C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2$ (per flip-flop).

AC Operating Requirements

Symbol	Parameter	V _{CC} (V)	$T_A = 25^{\circ}C$		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	Units
	i arameter		Тур	Guarai		
t _W (L) t _W (H)	Minimum Pulse Width (CK)	5.0 ± 0.5		5.0	5.0	ns
t _W (L)	Minimum Pulse Width (CLR, PR)	5.0 ± 0.5		5.0	5.0	ns
t _S	Minimum Setup Time	5.0 ± 0.5		5.0	5.0	ns
t _H	Minimum Hold Time	5.0 ± 0.5		0	0	ns
t _{REM}	Minimum Removal Time (CLR, PR)	5.0 ± 0.5		3.5	3.5	ns



Physical Dimensions inches (millimeters) unless otherwise noted (Continued) 5.0±0.1 0.43 TYP -A-7.72 4.16 6.4 4.4±0.1 -B-3.2 ALL LEAD TIPS LAND PATTERN RECOMMENDATION PIN #1 IDENT. SEE DETAIL A ALL LEAD TIPS 0.90+0.15 1.2 MAX [0.09-0.20 -C-L_{0.10±0.05} 0.65 412.00°ТОР & ВОТТОМ R0.16 R0.31-GAGE PLANE NDTES: 0.25 A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION ABJREF NOTE 6, DATED 7/930°-8° B. DIMENSIONS ARE IN MILLIMETERS C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS 0.6±0.1 SEATING PLANE -1.00-DETAIL A 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC14

Physical Dimensions inches (millimeters) unless otherwise noted (Continued) 0.740 - 0.770 (18.80 - 19.56)0.090 (2.286) 14 13 12 11 10 9 8 14 13 12 INDEX AREA 0.250 ± 0.010 (6.350 ± 0.254) PIN NO. 1 IDENT PIN NO. 1 IDENT 1 2 3 4 5 6 7 1 2 3 $\frac{0.092}{(2.337)}$ DIA $\frac{0.030}{(0.762)}$ MAX DEPTH OPTION 1 OPTION 02 $\frac{0.135 \pm 0.005}{(3.429 \pm 0.127)}$ 0.300 - 0.320 $\frac{0.630 - 8.128}{(7.620 - 8.128)}$ $\frac{0.145 - 0.200}{(3.683 - 5.080)}$ 0.060 (1.524) 4° TYP Optional (1.651) $\frac{0.008 - 0.016}{(0.203 - 0.406)}$ TYP 0.020 (0.508) 0.125 - 0.150 0.075 ± 0.015 $\overline{(3.175 - 3.810)}$ (1.905 ± 0.381) (7.112) MIN 0.014 - 0.0230.100 ± 0.010 (2.540 ± 0.254) (0.356 - 0.584) $\frac{0.050 \pm 0.010}{(1.270 - 0.254)}$ TYP 0.325 ^{+0.040} -0.015 8.255 + 1.016 N14A (REV F)

14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N14A

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