

February 2008

74VHC74 Dual D-Type Flip-Flop with Preset and Clear

Features

- High Speed: f_{MAX} = 170MHz (typ.) at T_A = 25°C
- High noise immunity: V_{NIH} = V_{NIL} = 28% V_{CC} (min.)
- Power down protection is provided on all inputs
- Low power dissipation: $I_{CC} = 2\mu A$ (max.) at $T_A = 25$ °C
- Pin and function compatible with 74HC74

General Description

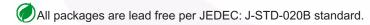
The VHC74 is an advanced high speed CMOS Dual D-Type Flip-Flop fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The signal level applied to the D input is transferred to the Q output during the positive going transition of the CK pulse. $\overline{\text{CLR}}$ and $\overline{\text{PR}}$ are independent of the CK and are accomplished by setting the appropriate input LOW.

An input protection circuit ensures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

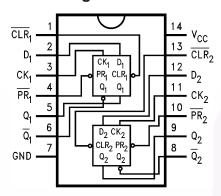
Ordering Information

Order Number	Package Number	Package Description
74VHC74M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHC74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHC74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHC74N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.



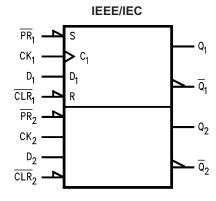
Connection Diagram



Pin Description

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

Logic Symbol



Truth Table

	Inpu	ts		Out	puts	
CLR	PR	D	СК	Q	Q	Function
L	Н	Х	Х	L	Н	Clear
Н	L	Х	Х	Н	L	Preset
L	L	Х	Х	H ⁽¹⁾	H ⁽¹⁾	
Н	Н	L	~	L	Н	
Н	Н	Н	~	Н	L	
Н	Н	Х	~	Q _n	Q _n	No Change

Note:

 This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (HIGH) state.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
V _{CC}	Supply Voltage	-0.5V to +7.0V
V _{IN}	DC Input Voltage	-0.5V to +7.0V
V _{OUT}	DC Output Voltage	-0.5V to V _{CC} + 0.5V
I _{IK}	Input Diode Current	–20mA
I _{OK}	Output Diode Current	±20mA
I _{OUT}	DC Output Current	±25mA
I _{CC}	DC V _{CC} /GND Current	±50mA
T _{STG}	Storage Temperature	−65°C to +150°C
T _L	Lead Temperature (Soldering, 10 seconds)	260°C

Recommended Operating Conditions⁽²⁾

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
V _{CC}	Supply Voltage	2.0V to +5.5V
V _{IN}	Input Voltage	0V to +5.5V
V _{OUT}	Output Voltage	0V to V _{CC}
T _{OPR}	Operating Temperature	–40°C to +85°C
t _r , t _f	Input Rise and Fall Time, $V_{CC} = 3.3V \pm 0.3V$ $V_{CC} = 5.0V \pm 0.5V$	0ns/V ~ 100ns/V 0ns/V ~ 20ns/V

Note:

2. Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

					Т	- A = 25°	С		40°C to 5°C	
Symbol	Parameter	V _{CC} (V)	Con	Conditions		Тур.	Max.	Min.	Max.	Units
V _{IH}	HIGH Level Input	2.0			1.50			1.50		V
	Voltage	3.0-5.5			0.7 x V _{CC}			0.7 x V _{CC}		
V _{IL}	LOW Level Input	2.0		/			0.50		0.50	V
	Voltage	3.0-5.5					0.3 x V _{CC}		0.3 x V _{CC}	
V _{OH}	HIGH Level	2.0	$V_{IN} = V_{IH}$	$I_{OH} = -50\mu A$	1.9	2.0		1.9		V
	Output Voltage	3.0	or V _{IL}	2.9	3.0		2.9			
		4.5			4.4	4.5		4.4		
		3.0		$I_{OH} = -4mA$	2.58			2.48		
		4.5		$I_{OH} = -8mA$	3.94			3.80		
V _{OL}	LOW Level	2.0	$V_{IN} = V_{IH}$	$I_{OL} = 50\mu A$		0.0	0.1		0.1	V
	Output Voltage	3.0	or V _{IL}			0.0	0.1		0.1	
		4.5				0.0	0.1		0.1	
		3.0		I _{OL} = 4mA			0.36		0.44	
		4.5		$I_{OL} = 8mA$			0.36		0.44	
I _{IN}	Input Leakage Current	0–5.5	V _{IN} = 5.5V	or GND			±0.1		±1.0	μA
I _{CC}	Quiescent Supply Current	5.5	$V_{IN} = V_{CC}$	or GND			2.0		20.0	μA

AC Electrical Characteristics

				т	A = 25°	С		-40°C 85°C	
Symbol	Parameter	V _{CC} (V)	Conditions	Min.	Тур.	Max.	Min.	Max.	Units
f _{MAX}	Maximum Clock	3.3 ± 0.3	C _L = 15pF	80	125		70		MHz
	Frequency		C _L = 50pF	50	75		45		
		5.0 ± 0.5	C _L = 15pF	130	170		110		
			C _L = 50pF	90	115		75		
t _{PLH} , t _{PHL}	Propagation Delay	3.3 ± 0.3	C _L = 15pF		6.7	11.9	1.0	14.0	ns
	Time (CK-Q, Q)		C _L = 50pF		9.2	15.4	1.0	17.5	
		5.0 ± 0.5	C _L = 15pF		4.6	7.3	1.0	8.5	
			C _L = 50pF		6.1	9.3	1.0	10.5	
t _{PLH} , t _{PHL}	Propagation Delay	3.3 ± 0.3	C _L = 15pF		7.6	12.3	1.0	14.5	ns
	Time (\overline{CLR} , \overline{PR} -Q, \overline{Q})	ime (CLR, PR -Q, Q)	C _L = 50pF		10.1	15.8	1.0	18.0	
		5.0 ± 0.5	C _L = 15pF		4.8	7.7	1.0	9.0	
			C _L = 50pF		6.3	9.7	1.0	11.0	
C _{IN}	Input Capacitance		V _{CC} = Open		4	10		10	pF
C _{PD}	Power Dissipation Capacitance		(3)		25				pF

Note:

3. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained from the equation: I_{CC} (opr.) = C_{PD} • V_{CC} • f_{IN} + I_{CC} / 2 (per F/F).

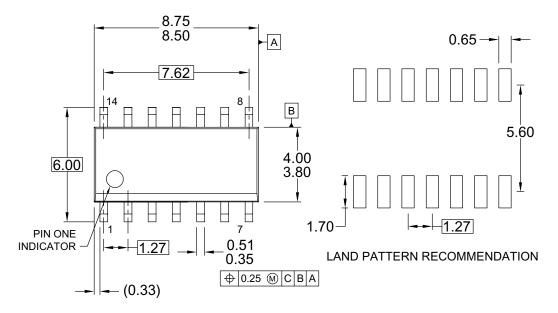
AC Operating Requirements

			T _A =	25°C	T _A = -40°C to +85°C	
Symbol	Parameter	V _{CC} (V) ⁽⁴⁾	Тур.		aranteed inimum	Units
$t_W(L), t_W(H)$	Minimum Pulse Width (CK)	3.3		6.0	7.0	ns
		5.0		5.0	5.0	
t _W (L)	Minimum Pulse Width (CLR, PR)	3.3		6.0	7.0	ns
		5.0		5.0	5.0	
t _S	Minimum Setup Time	3.3		6.0	7.0	ns
		5.0		5.0	5.0	
t _H	Minimum Hold Time	3.3		0.5	0.5	ns
		5.0		0.5	0.5	
t _{REC}	Minimum Recovery Time (CLR, PR)	3.3		5.0	5.0	ns
		5.0		3.0	3.0	1

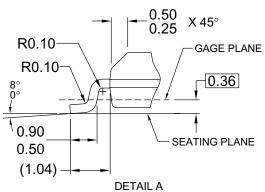
Note:

4. V_{CC} is 3.3 ± 0.3V or 5.0 ± 0.5V

Physical Dimensions







SCALE: 20:1

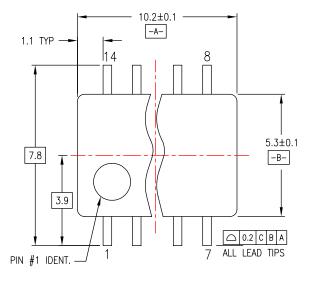
- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C,
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X145-14M
- E) DRAWING CONFORMS TO ASME Y14.5M-1994
- F) DRAWING FILE NAME: M14AREV13

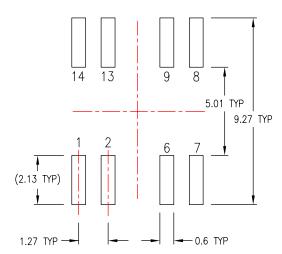
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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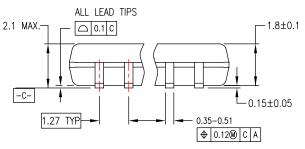
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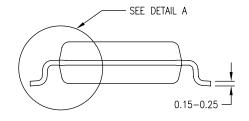
Physical Dimensions (Continued)





LAND PATTERN RECOMMENDATION

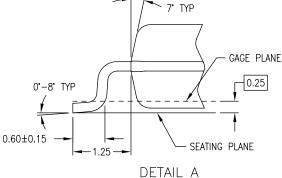




DIMENSIONS ARE IN MILLIMETERS

NOTES:

- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 B. DIMENSIONS ARE IN MILLIMETERS.
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.



M14DREVC

Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

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Physical Dimensions (Continued) 5.0±0.1 -A-0.65 0.43 TYP 6.4 4.4±0.1 -B-1.65 3.2 □ 0.2 C B A PIN #1 IDENT. 6.10 0.45LAND PATTERN RECOMMENDATION SEE DETAIL A ALL LEAD TIPS 0.90+0.15 1.2 MAX □ 0.1 C 0.09-0.20 -C-0.10±0.05 0.65 0.19 - 0.30⊕ |0.13\\(\) |A |B\(\) |C\(\) 12.00°TOP & BOTTOM R0.09 min GAGE PLANE 0.25 0°-8° NOTES: 0.6±0.1 A. CONFORMS TO JEDEC REGISTRATION MO-153, SEATING PLANE R0.09min VARIATION AB, REF NOTE 6 1 00 **DETAIL A**

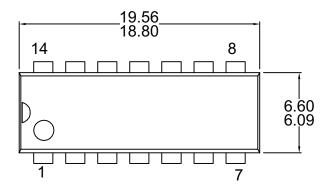
- **B. DIMENSIONS ARE IN MILLIMETERS**
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982
- E. LANDPATTERN STANDARD: SOP65P640X110-14M
- F. DRAWING FILE NAME: MTC14REV6

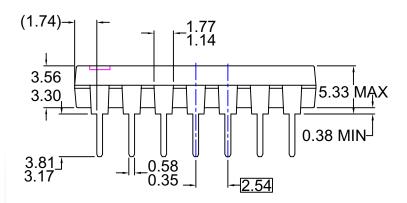
Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

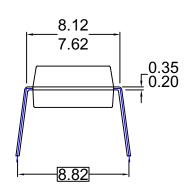
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Physical Dimensions (Continued)







NOTES: UNLESS OTHERWISE SPECIFIED THIS PACKAGE CONFORMS TO

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
 DIMENSIONS ARE EXCLUSIVE OF BURRS.
- C) MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D) DIMENSIONS AND TOLERANCES PER ASME Y14.5-1994
- E) DRAWING FILE NAME: MKT-N14AREV7

Figure 4. 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

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