

74VHC112

Dual J-K Flip-Flops with Preset and Clear

General Description

The VHC112 is an advanced high speed CMOS device 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 VHC112 contains two independent, high-speed JK flip-flops with Direct Set and Clear inputs. Synchronous state changes are initiated by the falling edge of the clock. Triggering occurs at a voltage level of the clock and is not directly related to transition time. The J and K inputs can change when the clock is in either state without affecting the flip-flop, provided that they are in the desired state during the recommended setup and hold times relative to the falling edge of the clock. The LOW signal on PR or CLR prevents clocking and forces Q and \bar{Q} HIGH, respectively. Simultaneous LOW signals on PR and CLR force both Q and \bar{Q} HIGH.

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.

Features

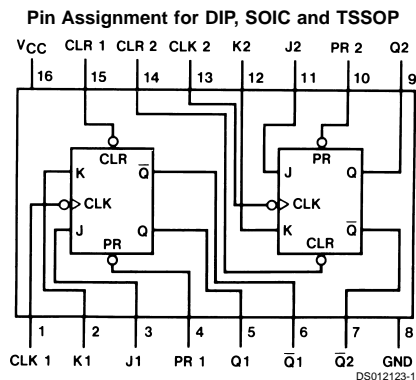
- High speed: $F_{MAX} = 200$ MHz (typ) at $V_{CC} = 5.0V$
- Low power dissipation: $I_{CC} = 2$ μA (max) at $T_A = 25^\circ C$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC} (min)
- Power down protection is provided on all inputs
- Pin and function compatible with 74HC112

Ordering Code:

Commercial	Package Number	Package Description
74VHC112M	M16A	16-Lead Molded JEDEC SOIC
74VHC112SJ	M16D	16-Lead Molded EIAJ SOIC
74VHC112MTC	MTC16	16-Lead Molded JEDEC Type 1 TSSOP
74VHC112N	N16E	16-Lead Molded DIP

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

Connection Diagram



Pin Descriptions

Pin Names	Description
J_1, J_2, K_1, K_2	Data Inputs
CLK_1, CLK_2	Clock Pulse Inputs (Active Falling edge)
CLR_1, CLR_2	Direct Clear Inputs (Active Low)
PR_1, PR_2	Direct Preset Inputs (Active Low)
$Q_1, Q_2, \bar{Q}_1, \bar{Q}_2$	

Truth Table

Inputs					Outputs	
PR	CLR	CP	J	K	Q	\bar{Q}
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H	H
H	H	~	h	h	\bar{Q}_0	Q_0
H	H	~	l	h	L	H
H	H	~	h	l	H	L
H	H	~	l	l	Q_0	\bar{Q}_0

H (h) = HIGH Voltage Level

L (l) = LOW Voltage Level

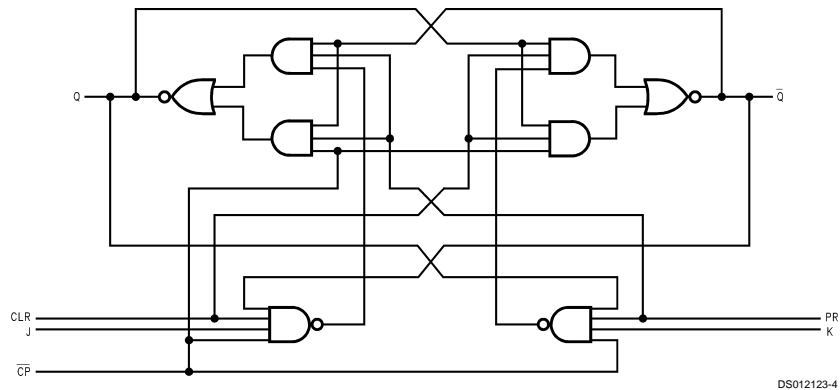
X = Immaterial

~ = HIGH-to-LOW Clock Transition

Q_0 (\bar{Q}_0) = Before HIGH-to-LOW Transition of Clock

Lower case letters indicate the state of the referenced input or output one setup time prior to the HIGH-to-LOW clock transition.

Logic Diagram (One Half Shown)



Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	-0.5V to +7.0V
DC Input Voltage (V_{IN})	-0.5V to +7.0V
DC Output Voltage (V_{OUT})	-0.5V to $V_{CC} + 0.5V$
Input Diode Current (I_{IK})	-20 mA
Output Diode Current (I_{OK})	±20 mA
DC Output Current (I_{OUT})	±25 mA
DC V_{CC}/GND Current (I_{CC})	±50 mA
Storage Temperature (T_{STG})	-65°C to +150°C
Lead Temperature (T_L) (Soldering, 10 seconds)	260°C

Recommended Operating Conditions

(Note 2)

Supply Voltage (V_{CC})	2.0V to +5.5V
Input Voltage (V_{IN})	0V to +5.5V
Output Voltage (V_{OUT})	0V to V_{CC}
Operating Temperature (T_{OPR})	-40°C to +85°C
Input Rise and Fall Time (t_r, t_f)	
$V_{CC} = 3.3V \pm 0.3V$	0 ~ 100 ns/V
$V_{CC} = 5.0V \pm 0.5V$	0 ~ 20 ns/V

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 variables. Fairchild does not recommend operation outside databook specifications.

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

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = 25^\circ C$			$T_A = -40^\circ C$ to $+85^\circ C$		Units	Conditions	
			Min	Typ	Max	Min	Max			
V_{IH}	High Level Input Voltage	2.0 3.0-5.5	1.50			1.50	0.7 V_{CC}	V		
V_{IL}	Low Level Input Voltage	2.0 3.0-5.5			0.50 0.3 V_{CC}		0.50 0.3 V_{CC}	V		
V_{OH}	High Level Output Voltage	2.0	1.9	2.0		1.9		V	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50 \mu A$
		3.0	2.9	3.0		2.9				
		4.5	4.4	4.5		4.4		V	$I_{OH} = -4 \text{ mA}$ $I_{OH} = -8 \text{ mA}$	
		3.0	2.58			2.48				
4.5	3.94			3.80						
V_{OL}	Low Level Output Voltage	2.0		0.0	0.1		0.1	V	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50 \mu A$
		3.0		0.0	0.1		0.1			
		4.5		0.0	0.1		0.1	V	$I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$	
		3.0			0.36		0.44			
4.5			0.36		0.44					
I_{IN}	Input Leakage Current	0-5.5			±0.1		±1.0	μA	$V_{IN} = 5.5V$ or GND	
I_{CC}	Quiescent Supply Current	5.5			2.0		20.0	μA	$V_{IN} = V_{CC}$ or GND	

AC Electrical Characteristics

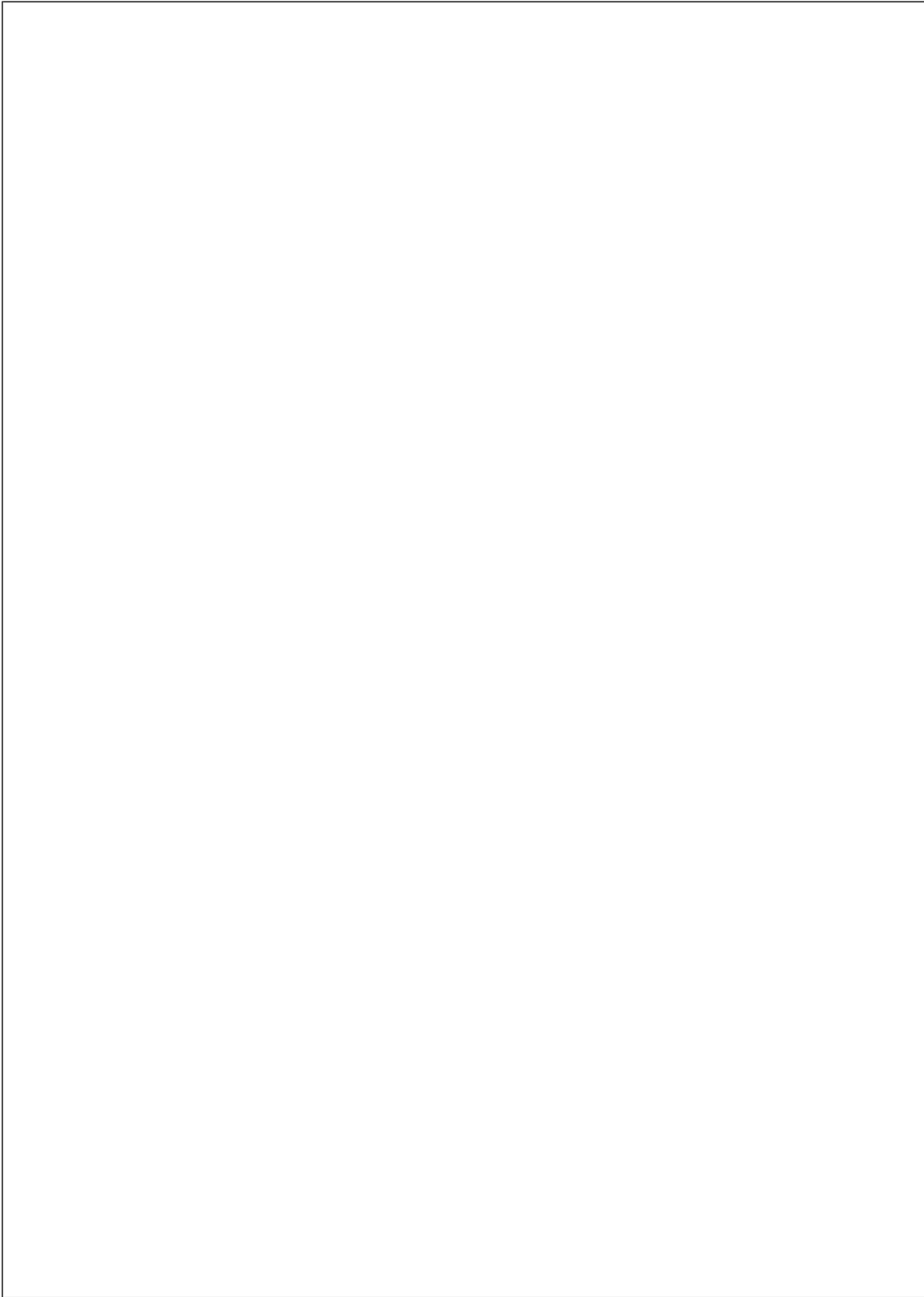
Symbol	Parameter	V _{CC} (V)	T _A = 25°C			T _A = -40°C to +85°C		Units	Conditions
			Min	Typ	Max	Min	Max		
f _{MAX}	Maximum Clock Frequency	3.3 ± 0.3	110	150		100		MHz	C _L = 15 pF
			90	120		80			C _L = 50 pF
		5.0 ± 0.5	150	200		135		MHz	C _L = 15 pF
			120	185		110			C _L = 50 pF
t _{PLH} t _{PHL}	Propagation Delay Time (CP to Q _n or \bar{Q}_n)	3.3 ± 0.3	8.5	11.0		1.0	13.4	ns	C _L = 15 pF
			10.0	15.0		1.0	16.5		C _L = 50 pF
		5.0 ± 0.5	5.1	7.3		1.0	8.8	ns	C _L = 15 pF
			6.3	10.5		1.0	12.0		C _L = 50 pF
t _{PLH} t _{PHL}	Propagation Delay Time (PR or CLR to Q _n or \bar{Q}_n)	3.3 ± 0.3	6.7	10.2		1.0	11.7	ns	C _L = 15 pF
			9.7	13.5		1.0	15.0		C _L = 50 pF
		5.0 ± 0.5	4.6	6.7		1.0	8.0	ns	C _L = 15 pF
			6.4	9.5		1.0	11.0		C _L = 50 pF
C _{IN}	Input Capacitance		4	10		10	pF	V _{CC} = Open	
C _{PD}	Power Dissipation Capacitance		18				pF	(Note 3)	

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}/4 (per F/F), and the total C_{PD} when n pcs of the Flip Flop operate can be calculated by the following equation: C_{PD (total)} = 30 + 14 * n

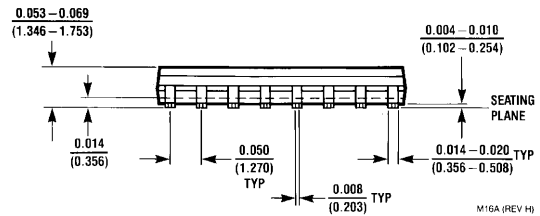
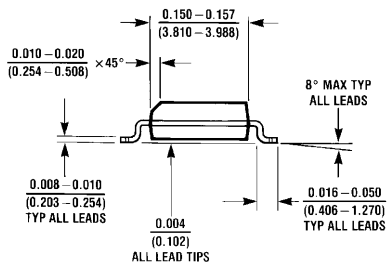
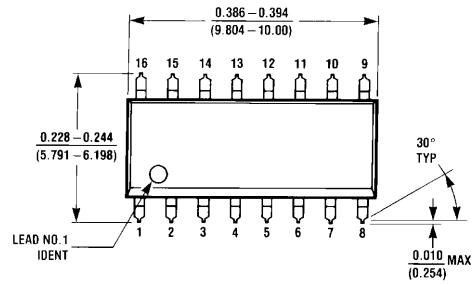
AC Operating Requirements

Symbol	Parameter	V _{CC} (Note 4) (V)	T _A = 25°C		T _A = -40°C to +85°C		Units
			Typ	Guaranteed Minimum			
t _w	Minimum Pulse Width (CP or CLR or PR)	3.3		5.0	5.0	ns	
		5.0		5.0	5.0		
t _s	Minimum Setup Time (J _n or K _n to CP _n)	3.3		5.0	5.0	ns	
		5.0		4.0	4.0		
t _h	Minimum Hold Time (J _n or K _n to CP _n)	3.3		1.0	1.0	ns	
		5.0		1.0	1.0		
t _{rec}	Minimum Recovery Time (CLR or PR to CP)	3.3		6.0	6.0	ns	
		5.0		5.0	5.0		

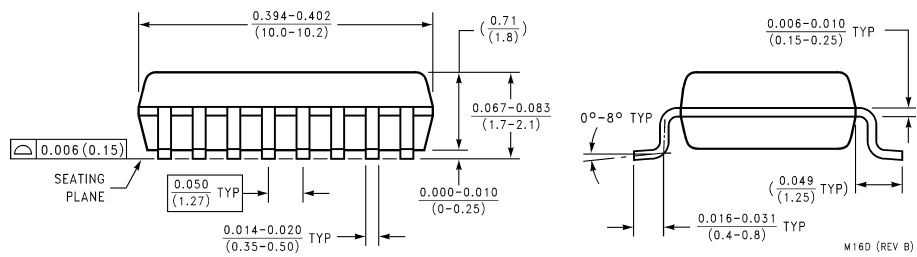
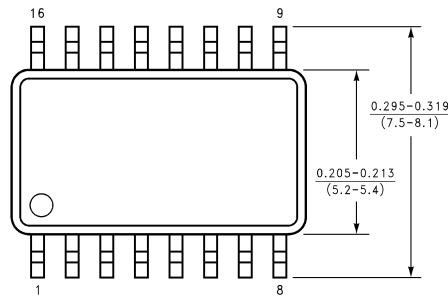
Note 4: V_{CC} is 3.3 ± 0.3V or 5.0 ± 0.5V



Physical Dimensions inches (millimeters) unless otherwise noted

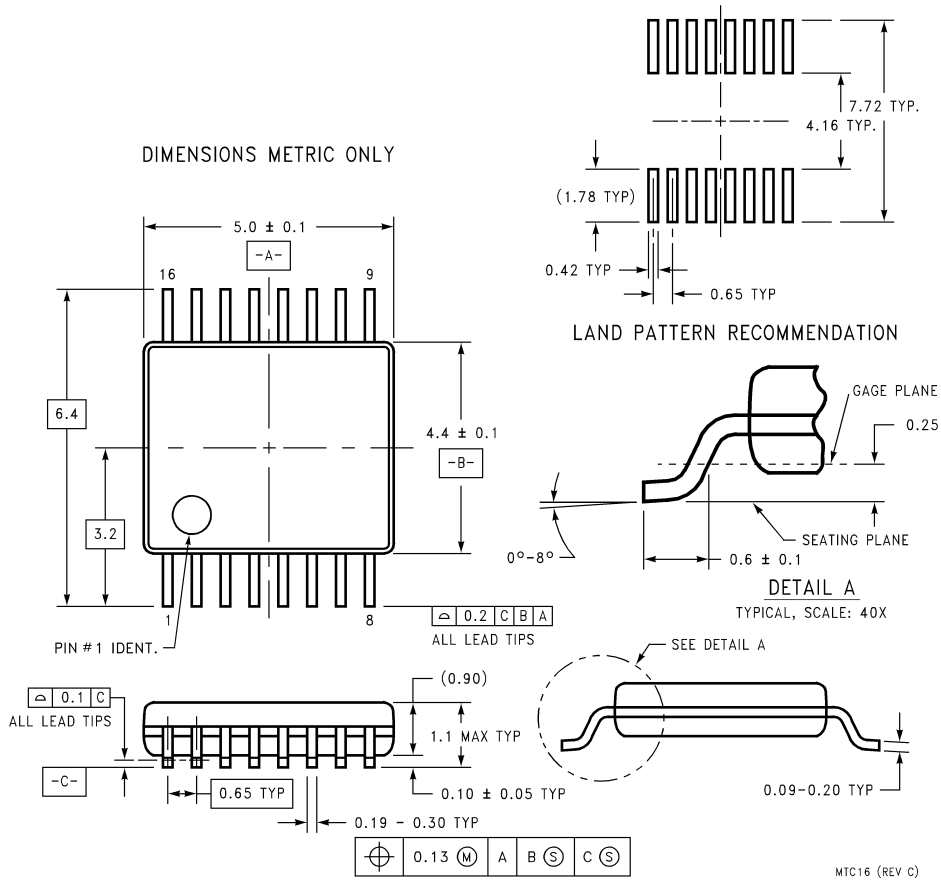


16-Lead Molded JEDEC SOIC
Package Number M16A



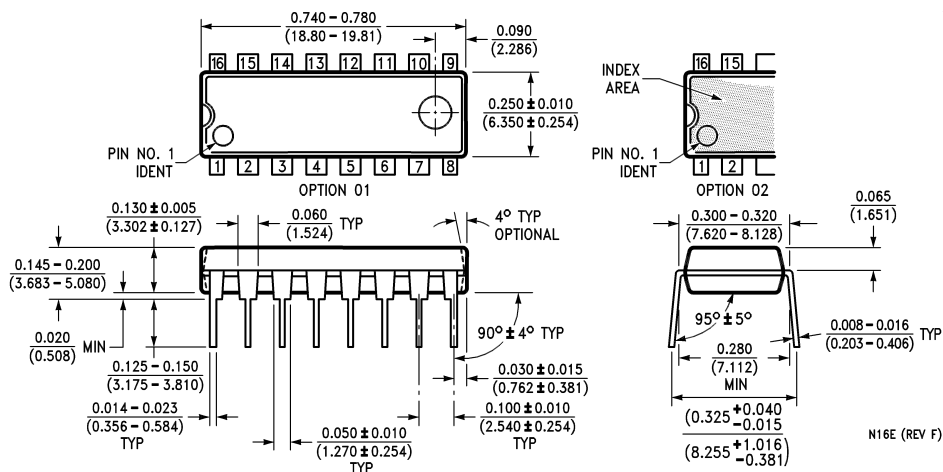
16-Lead Molded EIAJ SOIC
Package Number M16D

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Molded JEDEC Type 1 TSSOP
Package Number MTC16

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



**16-Lead (0.300") Molded Dual-In-Line Package
Package Number N16E**

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Fairchild Semiconductor Corporation Americas
Customer Response Center
Tel: 1-888-522-5372

Fairchild Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 8 141-35-0
English Tel: +44 (0) 1 793-85-68-56
Italy Tel: +39 (0) 2 57 5631

Fairchild Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: +862 2737-7200
Fax: +852 2314-0061

National Semiconductor Japan Ltd.
Tel: 81-3-5620-6175
Fax: 81-3-5620-6179

www.fairchildsemi.com