FAIRCHILD SEMICONDUCTOR®

December 1998
Revised February 2005

74VHCT14A
Hex Schmitt Inverter

General Description

The VHCT14A is an advanced high speed CMOS Hex Schmitt Inverter fabricated with silicon gate CMOS technology. The VHCT14A contains six independent inverters which are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

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: t_{PD} = 5.0 ns (typ) at T_A = 25°C
- High noise immunity: V_{IH} = 2.0V, V_{IL} = 0.8V
- Power down protection is provided on all inputs and outputs
- Low noise: V_{OLP} = 1.0V (max)
- Low power dissipation:
  I_{CC} = 2 μA (max) @ T_A = 25°C
- Pin and function compatible with 74HCT14

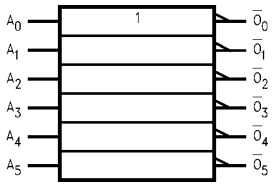
Ordering Code:

Order Number	Package Number	Package Description
74VHCT14AM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHCT14ASJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHCT14AMTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHCT14AMTCX_NL (Note 1)	MTC14	Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHCT14AN	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

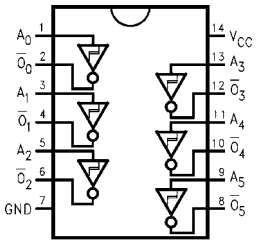
Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.
Pb-Free package per JEDEC J-STD-020B.

Note 1: "_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

Logic Symbol



Connection Diagram



Pin Descriptions

Pin Names	Description
A_n	Inputs
$\overline{O}_n$	Outputs

Truth Table

A	$\overline{O}$
L	H
H	L

Absolute Maximum Ratings (Note 2)

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Voltage (V_{IN})	−0.5V to +7.0V
DC Output Voltage (V_{OUT})	
(Note 3)	−0.5V to V_{CC} + 0.5V
(Note 4)	−0.5V to 7.0V
Input Diode Current (I_{IK})	−20 mA
Output Diode Current (I_{OK}) (Note 5)	±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 6)

Supply Voltage (V_{CC})	4.5V to +5.5V
Input Voltage (V_{IN})	0V to +5.5V
Output Voltage (V_{OUT})	
(Note 3)	0V to V_{CC}
(Note 4)	0V to 5.5V
Operating Temperature (T_{OPR})	−40°C to +85°C

Note 2: 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 3: HIGH or LOW state. I_{OUT} absolute maximum rating must be observed.

Note 4: V_{CC} = 0V.

Note 5: V_{OUT} < GND, V_{OUT} > V_{CC} (Outputs Active)

Note 6: Unused inputs must be held HIGH or LOW. They may not float.

DC 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			
V_P	Positive Threshold Voltage	4.5			1.9		1.9	V		
		5.5			2.1		2.1			
V_N	Negative Threshold Voltage	4.5	0.5			0.5		V		
		5.5	0.6			0.6				
V_H	Hysteresis Voltage	4.5	0.4		1.4	0.4	1.4	V		
		5.5	0.4		1.5	0.4	1.5			
V_{OH}	HIGH Level Output Voltage	4.5	4.40	4.50		4.40		V	V_{IN} = V_{IL}	I_{OH} = −50 μA
			3.94			3.80		V		I_{OH} = −8 mA
V_{OL}	LOW Level Output Voltage	4.5		0.0	0.1		0.1	V	V_{IN} = V_{IH}	I_{OL} = 50 μA
					0.36		0.44	V		I_{OL} = 8 mA
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	
I_{CCT}	Maximum I_{CC}/Input	5.5			1.35		1.50	mA	V_{IN} = 3.4V Other Inputs = V_{CC} or GND	
I_{OFF}	Output Leakage Current (Power Down State)	0.0			0.5		5.0	μA	V_{OUT} = 5.5V	

Noise Characteristics

Symbol	Parameter	V_{CC} (V)	T_A = 25°C		Units	Conditions
			Typ	Limits		
V_{OLP} (Note 7)	Quiet Output Maximum Dynamic V_{OL}	5.0	0.8	1.0	V	C_L = 50 pF
V_{OLV} (Note 7)	Quiet Output Minimum Dynamic V_{OL}	5.0	−0.8	1.0	V	C_L = 50 pF
V_{IHD} (Note 7)	Minimum HIGH Level Dynamic Input Voltage	5.0		2.0	V	C_L = 50 pF
V_{ILD} (Note 7)	Maximum LOW Level Dynamic Input Voltage	5.0		0.8	V	C_L = 50 pF

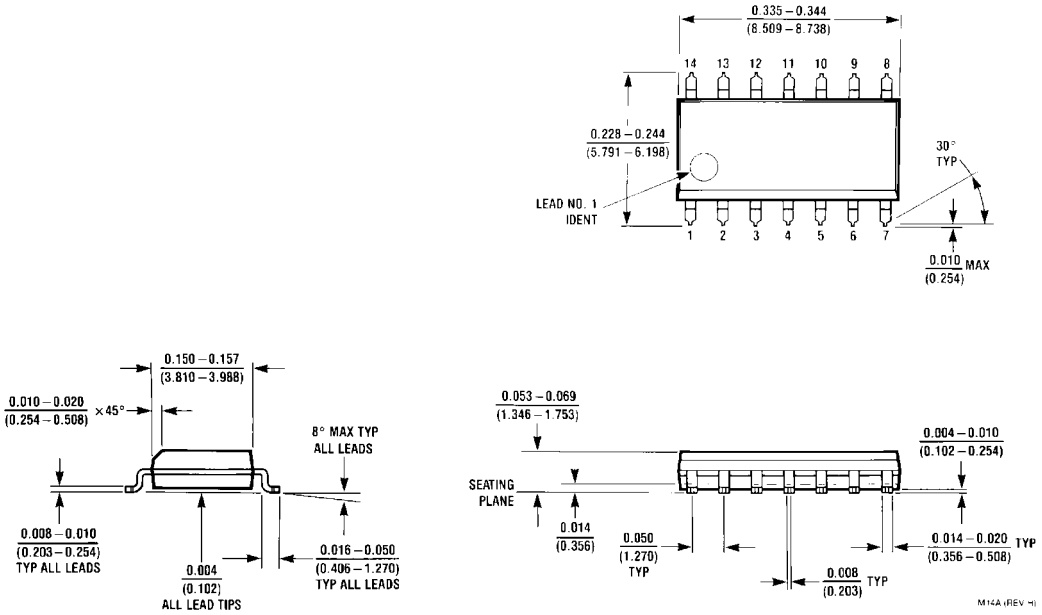
Note 7: Parameter guaranteed by design.

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		
t_{PHL}	Propagation Delay	5.0 ± 0.5		5.0	7.6	1.0	9.0	ns	$C_L = 15$ pF
t_{PLH}				6.5	9.6	1.0	11.0	ns	$C_L = 50$ pF
C_{IN}	Input Capacitance			2	10		10	pF	V_{CC} = OPEN
C_{PD}	Power Dissipation Capacitance			11				pF	(Note 8)

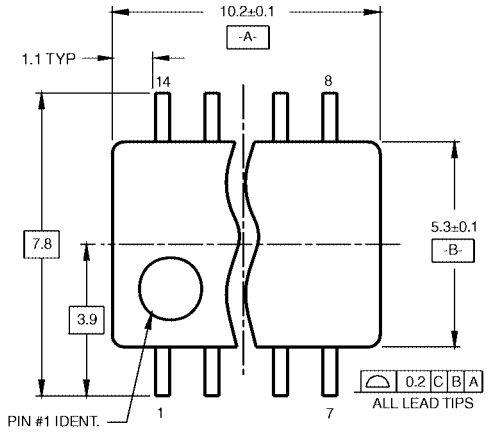
Note 8: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC} (opr.) = $C_{PD} * V_{CC} * f_{IN} + I_{CC}/6$ (per gate).

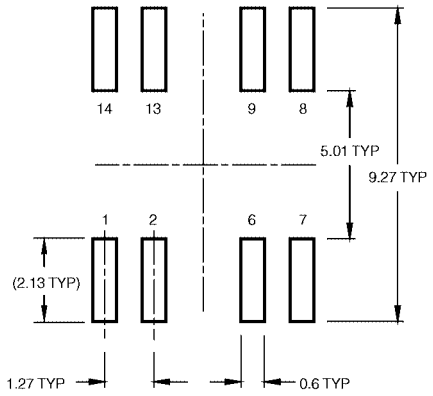
Physical Dimensions inches (millimeters) unless otherwise noted



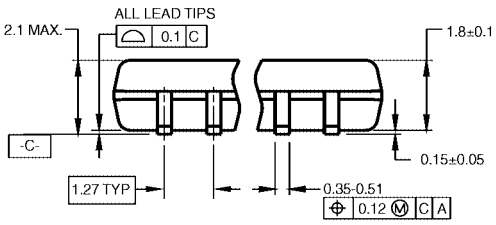
14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M14A

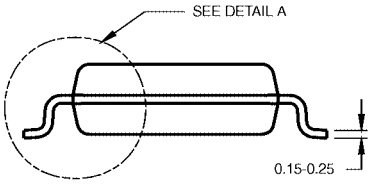
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)





LAND PATTERN RECOMMENDATION





DIMENSIONS ARE IN MILLIMETERS

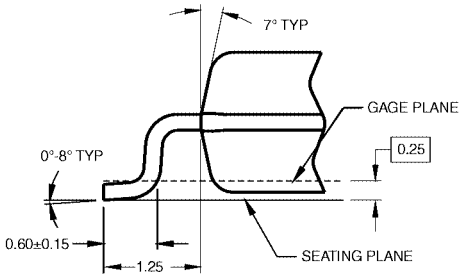
NOTES:

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.

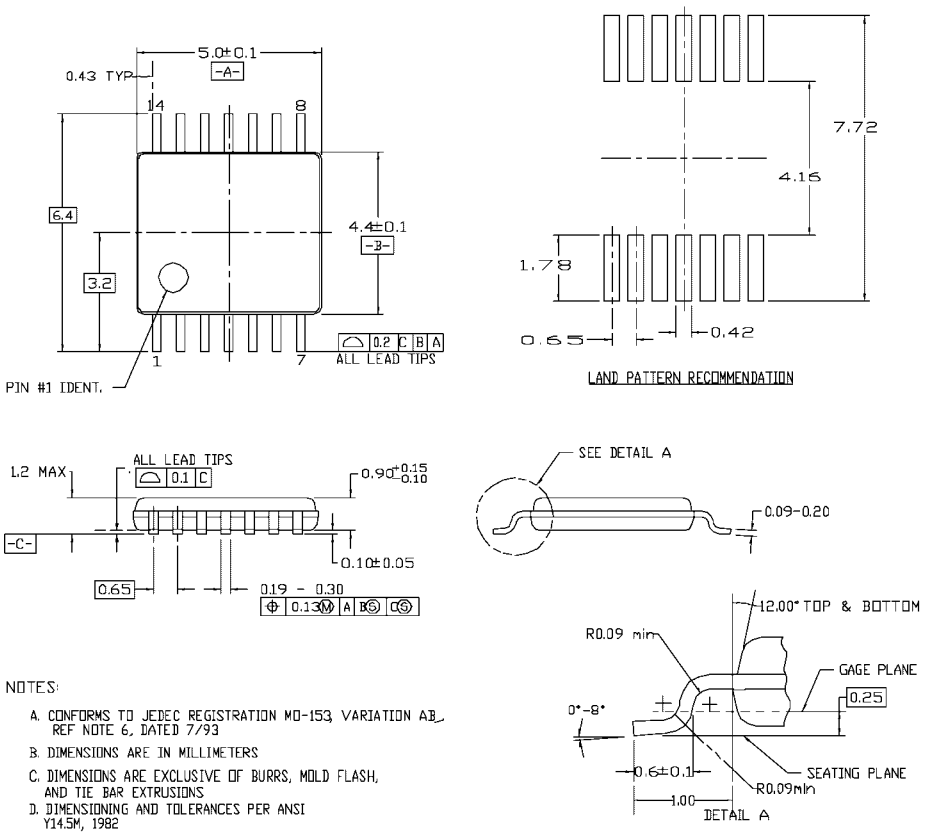
M14DRevB1



DETAIL A

Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M14D

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



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATED 7/93

B. DIMENSIONS ARE IN MILLIMETERS

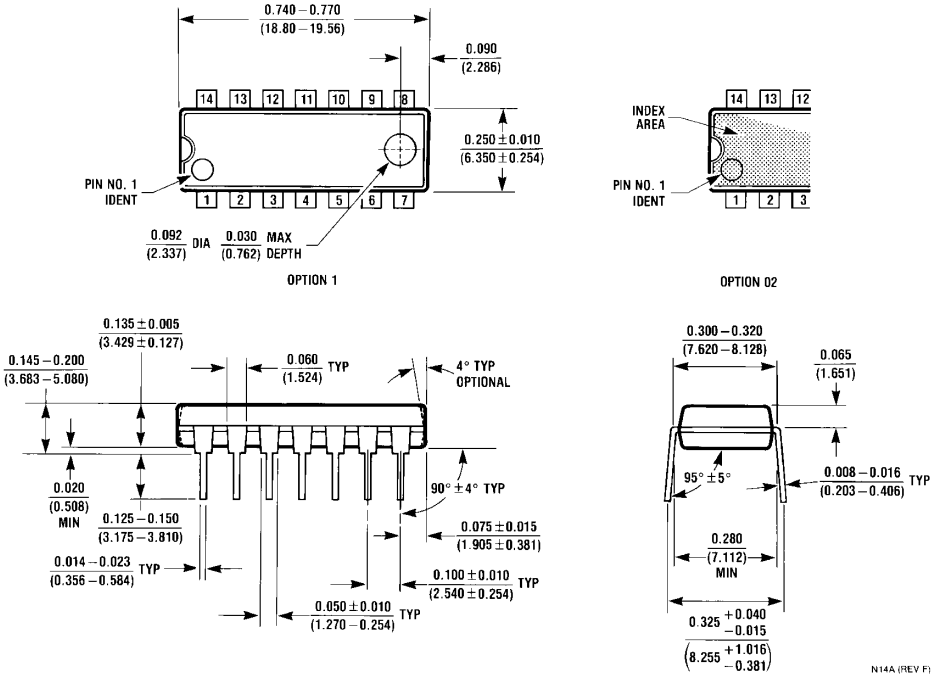
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS

D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

MTC14revD

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)



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