

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  $\rm V_{CC}=0V$ . 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<sub>OLP</sub> = 1.0V (max)
- Low power dissipation:

 $I_{CC} = 2 \mu A \text{ (max) } @ T_A = 25 \text{ °C}$ 

■ Pin and function compatible with 74HCT14

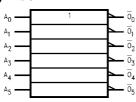
### **Ordering Code:**

Order Number	Package	Package Description						
Order Number	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						

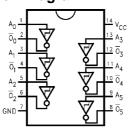
Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code. Pb-Free package per JEDEC J-STD-020B.

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 <sub>n</sub>		Inputs
O <sub>n</sub>		Outputs

### **Truth Table**

Α	ō
L	Н
Н	L

### **Absolute Maximum Ratings**(Note 2)

 $\begin{array}{ll} \mbox{(Note 3)} & -0.5\mbox{V to V}_{CC} + 0.5\mbox{V} \\ \mbox{(Note 4)} & -0.5\mbox{V to 7.0\mbox{V}} \\ \mbox{Input Diode Current (I_{IK})} & -20\mbox{ mA} \end{array}$ 

Output Diode Current (I<sub>OK</sub>)

 $\begin{array}{lll} \mbox{(Note 5)} & \pm 20 \mbox{ mA} \\ \mbox{DC Output Current ($I_{\rm OUT}$)} & \pm 25 \mbox{ mA} \\ \mbox{DC $V_{\rm CC}$/GND Current ($I_{\rm CC}$)} & \pm 50 \mbox{ mA} \\ \end{array}$ 

Storage Temperature (T<sub>STG</sub>)
Lead Temperature (T<sub>1</sub>)

(Soldering, 10 seconds)

## 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<sub>OUT</sub>)

 $\begin{array}{c} \mbox{(Note 3)} & \mbox{OV to V}_{\mbox{CC}} \\ \mbox{(Note 4)} & \mbox{OV to 5.5V} \\ \mbox{Operating Temperature ($T_{\mbox{OPR}}$)} & -40^{\circ}\mbox{C to $+85^{\circ}$C} \end{array}$ 

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 specifica-

Note 3: HIGH or LOW state. I<sub>OUT</sub> absolute maximum rating must be

Note 4:  $V_{CC} = 0V$ .

-65°C to +150°C

260°C

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 <sub>CC</sub>	T <sub>A</sub> = 25°C		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		Units	Conditions		
- Tarameter		(V)	Min	Тур	Max	Min	Max	Oiiito	Con	uitions
$V_{P}$	Positive Threshold Voltage	4.5			1.9		1.9	V		
		5.5			2.1		2.1	V		
V <sub>N</sub>	Negative Threshold Voltage	4.5	0.5			0.5		٧		
		5.5	0.6			0.6				
V <sub>H</sub>	Hysteresis Voltage	4.5	0.4		1.4	0.4	1.4	V		
		5.5	0.4		1.5	0.4	1.5	٧		
V <sub>OH</sub>	HIGH Level Output Voltage	4.5	4.40	4.50		4.40		V	$V_{IN} = V_{IL}$	I <sub>OH</sub> = -50 μA
		4.5	3.94			3.80		V		I <sub>OH</sub> = -8 mA
V <sub>OL</sub>	LOW Level Output Voltage	4.5		0.0	0.1		0.1	V	$V_{IN} = V_{IH}$	$I_{OL} = 50 \mu A$
		4.5			0.36		0.44	V		I <sub>OL</sub> = 8 mA
I <sub>IN</sub>	Input Leakage Current	0 – 5.5			±0.1		±1.0	μА	$V_{IN} = 5.5V$ or	GND
I <sub>CC</sub>	Quiescent Supply Current	5.5			2.0		20.0	μА	$V_{IN} = V_{CC}$ or	GND
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5			1.35		1.50	mA	V <sub>IN</sub> = 3.4V Other Inputs = V <sub>CC</sub> or GND	
I <sub>OFF</sub>	Output Leakage Current (Power Down State)	0.0			0.5		5.0	μА	V <sub>OUT</sub> = 5.5V	
	(					1		I	ı	

### **Noise Characteristics**

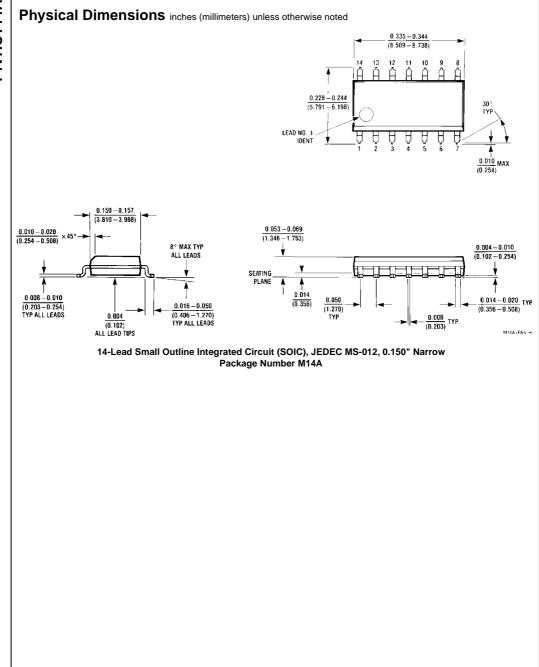
-			-	05:0		1	
Symbol	Parameter	V <sub>CC</sub>	I <sub>A</sub> =	25°C	Units	Conditions	
Symbol	r ai ailletei	(V)	Тур	Limits	Onits		
V <sub>OLP</sub> (Note 7)	Quiet Output Maximum Dynamic V <sub>OL</sub>	5.0	0.8	1.0	V	C <sub>L</sub> = 50 pF	
V <sub>OLV</sub> (Note 7)	Quiet Output Minimum Dynamic V <sub>OL</sub>	5.0	-0.8	1.0	V	C <sub>L</sub> = 50 pF	
V <sub>IHD</sub> (Note 7)	Minimum HIGH Level Dynamic Input Voltage	5.0		2.0	V	C <sub>L</sub> = 50 pF	
V <sub>ILD</sub> (Note 7)	Maximum LOW Level Dynamic Input Voltage	5.0		0.8	V	C <sub>L</sub> = 50 pF	

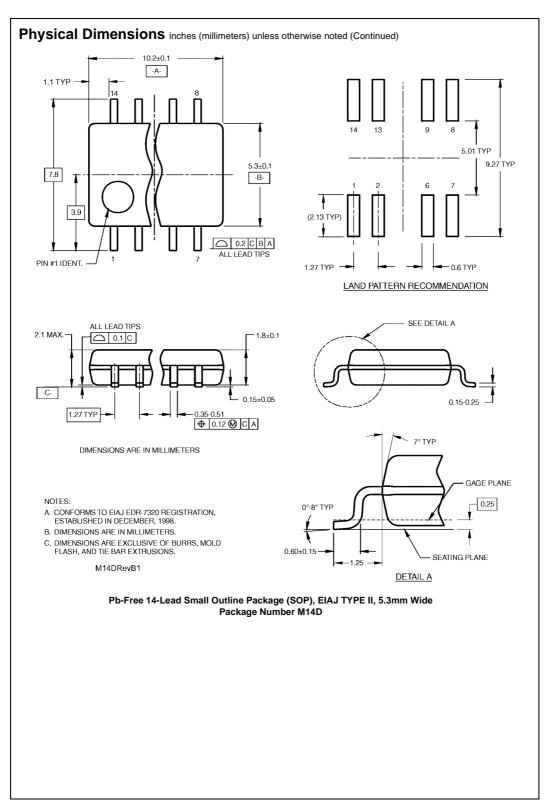
Note 7: Parameter guaranteed by design.

## **AC Electrical Characteristics**

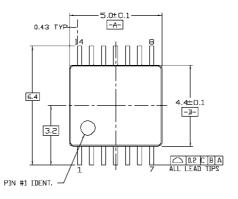
Symbol	Parameter	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°	C to +85°C	Units	Conditions
Cymbol	i didilictor	(V)	Min	Тур	Max	Min	Max	Oilles	Conditions
t <sub>PHL</sub>	Propagation Delay	5.0 ± 0.5		5.0	7.6	1.0	9.0	ns	C <sub>L</sub> = 15 pF
t <sub>PLH</sub>		3.0 ± 0.3		6.5	9.6	1.0	11.0	ns	C <sub>L</sub> = 50 pF
C <sub>IN</sub>	Input Capacitance			2	10		10	pF	V <sub>CC</sub> = OPEN
C <sub>PD</sub>	Power Dissipation Capacitance			11				pF	(Note 8)

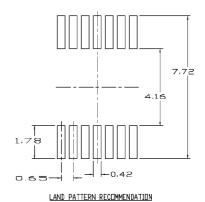
Note 8: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC</sub> (opr.) = C<sub>PD</sub> \* V<sub>CC</sub> \* f<sub>IN</sub> + I<sub>CC</sub>/6 (per gate).



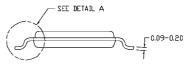


### Physical Dimensions inches (millimeters) unless otherwise noted (Continued)





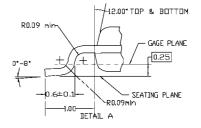
-0.90<sup>+0.15</sup> -C-L<sub>0.10±0.05</sub> 0.65 



#### 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) 0.740 - 0.7700.090 (2.286) 14 13 12 11 10 9 8 14 13 12 INDE) $(6.350 \pm 0.254)$ 1 2 3 4 5 6 7 1 2 3 $\frac{0.092}{(2.337)} \ DIA \ \ \frac{0.030}{(0.762)} \ \frac{\text{MAX}}{\text{DEPTH}}$ OPTION 1 OPTION 02 $0.135 \pm 0.005$ $(3.429 \pm 0.127)$ 0.145 - 0.2001.524) TYP 4° TYP Optional (1.651) 0.008-0.016 (0.203-0.406) TYP 0.020 $\frac{0.125 - 0.150}{(3.175 - 3.810)}$ $0.075 \pm 0.015$ $\frac{0.070\pm0.010}{(1.905\pm0.381)}$ 0.280 (7.112) MIN

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

 $\frac{0.050 \pm 0.010}{(1.270 - 0.254)} \text{ TYP}$ 

0.1<u>00±0.010</u> TYP  $(2.540 \pm 0.254)$ 

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### LIFE SUPPORT POLICY

 $\frac{0.014 - 0.023}{(0.356 - 0.584)}$  TYP

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- 2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

 $0.325 ^{\,+\,0.040}_{\,-\,0.015}$  $\left(8.255 \begin{array}{c} +1.016 \\ -0.381 \end{array}\right)$ 

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N14A (REV F)