National Semiconductor

74VHC14
Hex Schmitt Inverter

General Description

The 'VHC14 is an advanced high speed CMOS Hex Schmitt Inverter 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. Pin configuration and function are the same as the VHC04 but the inputs have hysteresis between the positive-going and negative-going input thresholds, which are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals, thus providing greater noise margin than conventional inverters.

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 back up. This circuit prevents device destruction due to mismatched supply and input voltages.

Features

- Low power dissipation: $I_{CC} = 2\ \mu A$ (Max) at $T_A = 25°C$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\%\ V_{CC}$ (Min)
- All inputs are equipped with a power down protection function
- Balanced propagation delays: $T_{PLH} \cong T_{PHL}$
- Low noise: $V_{OLP} = 0.8V$ (Max)
- Pin and function compatible with 74HC14

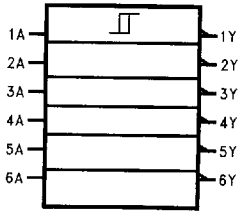
Ordering Code: See Section 6

Commercial	Package Number	Package Description
74VHC14M	M14A	14-Lead Molded JEDEC SOIC
74VHC14SJ	M14D	14-Lead Molded EIAJ SOIC
74VHC14MSC	MSC14	14-Lead Molded EIAJ Type 1 SSOP
74VHC14MTC	MTC14	14-Lead Molded JEDEC Type 1 TSSOP
74VHC14N	N14A	14-Lead Molded DIP

Note: Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code. EIAJ Type 1 SSOP available on Tape and Reel only, order MSCX.

Logic Symbol

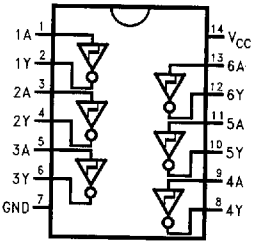
IEEE/IEC



TL/F/11617–1

Connection Diagram

Pin Assignment for DIP, SSOP, TSSOP and SOIC



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Truth Table

A-Inputs	Y-Outputs
L	H
H	L

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

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

Recommended Operating Conditions

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

DC Characteristics for 'VHC Family Devices

Symbol	Parameter	V_{CC}	74VHC T_A = 25°C			74VHC T_A = −40°C to +85°C		Units	Conditions	
			Min	Typ	Max	Min	Max			
V_P	Positive Threshold Voltage	3.0			2.20		2.20	V		
		4.5			3.15		3.15			
		5.5			3.85		3.85			
V_N	Negative Threshold Voltage	3.0	0.90			0.90		V		
		4.5	1.35			1.35				
		5.5	1.65			1.65				
V_H	Hysteresis Voltage	3.0	0.30		1.20	0.30	1.20	V		
		4.5	0.40		1.40	0.40	1.40			
		5.5	0.50		1.60	0.50	1.60			
V_{OH}	High Level Output Voltage	2.0	1.9	2.0		1.9		V	V_{IN} = V_{IL}	I_{OH} = −50 μA
		3.0	2.9	3.0		2.9				
		4.5	4.4	4.5		4.4				
		3.0	2.58			2.48		V		I_{OH} = −4 mA
		4.5	3.94			3.80				I_{OH} = −8 mA
V_{OL}	Low Level Output Voltage	2.0		0.0	0.1		0.1	V	V_{IN} = V_{IH}	I_{OL} = 50 μA
		3.0		0.0	0.1		0.1			
		4.5		0.0	0.1		0.1			
		3.0			0.36		0.44	V		I_{OL} = 4 mA
		4.5			0.36		0.44			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	

DC Characteristics for 'VHC Family Devices: See Section 2 for Waveforms

Symbol	Parameter	V_{CC}	74VHC T_A = 25°C Typ	74VHC T_A = 25°C Limits	Units	Conditions	Fig. No.
*V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	5.0	0.4	0.8	V	C_L = 50 pF	2-11, 12
*V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	5.0	−0.4	−0.8	V	C_L = 50 pF	2-11, 12
*V_{IHD}	Minimum High Level Dynamic Input Voltage	5.0		3.5	V	C_L = 50 pF	2-11, 12
*V_{ILD}	Maximum Low Level Dynamic Input Voltage	5.0		1.5	V	C_L = 50 pF	2-11, 12

*Parameter guaranteed by design.

AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	V_{CC}	74VHC T_A = 25°C Min	Typ	Max	74VHC T_A = −40°C to +85°C Min	Max	Units	Conditions	Fig. No.
t_{PLH} t_{PHL}	Propagation Delay Time	3.3 ±0.3		8.3	12.8	1.0	15.0	ns	C_L = 15 pF	2-5
				10.8	16.3	1.0	18.5		C_L = 50 pF	2-5
		5.0 ±0.5		5.5	8.6	1.0	10.0	ns	C_L = 15 pF	2-5
				7.0	10.6	1.0	12.0		C_L = 50 pF	2-5
C_{IN}	Input Capacitance			4	10		10	pF	V_{CC} = Open	
C_{PD}	Power Dissipation Capacitance			21				pF	(Note 1)	

Note 1: 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)