

74VHCU04 Hex Inverter

General Description

The 74VHCU04 is an advanced high speed CMOS 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.

Since the internal circuit is composed of a single stage inverter, it can be used in analog applications such as crystal oscillators. An input protection circuit ensures that 0V–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

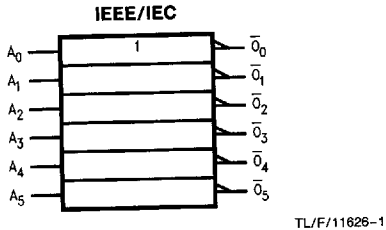
- Low Power Dissipation:
 $I_{CC} = 2 \mu\text{A (Max)} @ T_a = 25^\circ\text{C}$
- High Noise Immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (Min)}$
- All inputs are equipped with a Power Down Protection Function
- Balanced Propagation Delays: $t_{pLH} \approx t_{pHL}$
- Low Noise: $V_{OLP} = 0.8\text{V (Max)}$
- Pin and Function Compatible with 74HCU04

Ordering Code: See Section 6

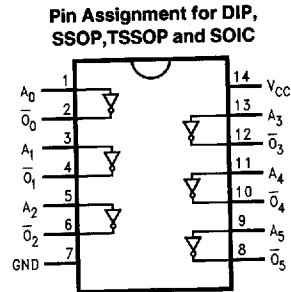
Commercial	Package Number	Package Description
74VHCU04M	M14A	14-Lead Molded JEDEC SOIC
74VHCU04SJ	M14D	14-Lead Molded EIAJ SOIC
74VHCU04MSC	MSC14	14-Lead Molded EIAJ Type I SSOP
74VHCU04MTC	MTC14	14-Lead Molded JEDEC Type I TSSOP
74VHCU04N	N14A	14-Lead Molded DIP

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

Logic Symbol



Connection Diagram



Truth Table

Pin Names	Description
A_n	Inputs
\bar{O}_n	Outputs

A	O
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 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. 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} (V)	74VHC			74VHC		Units	Conditions	
			$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C}$ to +85°C				
			Min	Typ	Max	Min	Max			
V_{IH}	High Level Input Voltage	2.0 3.0-5.5	1.70 0.8 V_{CC}			1.70 0.8 V_{CC}		V		
V_{IL}	Low Level Input Voltage	2.0 3.0-5.5	0.30 0.20 V_{CC}			0.30 0.20 V_{CC}		V		
V_{OH}	High Level Output Voltage	2.0	1.8 2.0			1.8		V	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50 \mu\text{A}$
		3.0	2.7 3.0			2.7				
		4.5	4.0 4.5			4.0		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 0.2			0.2		V	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50 \mu\text{A}$
		3.0	0.0 0.3			0.3				
		4.5	0.0 0.5			0.5		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	

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

Symbol	Parameter	V _{CC} (V)	74VHC		Units	Conditions	Fig. No.
			T _A = 25°C				
			Typ	Limits			
**V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	5.0	0.5	0.8	V	C _L = 50 pF	2-11, 12
**V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	5.0	-0.5	-0.8	V	C _L = 50 pF	2-11, 12
**V _{IHD}	Minimum High Level Dynamic Input Voltage	5.0		4.0	V	C _L = 50 pF	2-11, 12
**V _{ILD}	Maximum Low Level Dynamic Input Voltage	5.0		1.0	V	C _L = 50 pF	2-11, 12

**Parameter guaranteed by design.

AC Electrical Characteristics for 'VHC Family Devices: See Section 2 for Waveforms

Symbol	Parameter	V _{CC} (V)	74VHC			74VHC		Units	Conditions	Fig. No.
			T _A = 25°C			T _A = -40°C to +85°C				
			Min	Typ	Max	Min	Max			
t _{PHL} , t _{PLH}	Propagation Delay	3.3 ± 0.3	5.0	8.9	1.0	10.5	ns	C _L = 15 pF	2-5	
			7.5	11.4	1.0	13.0		C _L = 50 pF		
		5.0 ± 0.5	3.5	5.5	1.0	6.5	ns	C _L = 15 pF	2-5	
			5.0	7.0	1.0	8.0		C _L = 50 pF		
C _{IN}	Input Capacitance		5	10		10	pF	V _{CC} = Open		
C _{PD}	Power Dissipation Capacitance		9				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).