

MM54HCU04/MM74HCU04 Hex Inverter

General Description

These inverters utilize advanced silicon-gate CMOS technology to achieve operating speeds similar to LS-TTL gates with the low power consumption of standard CMOS integrated circuits.

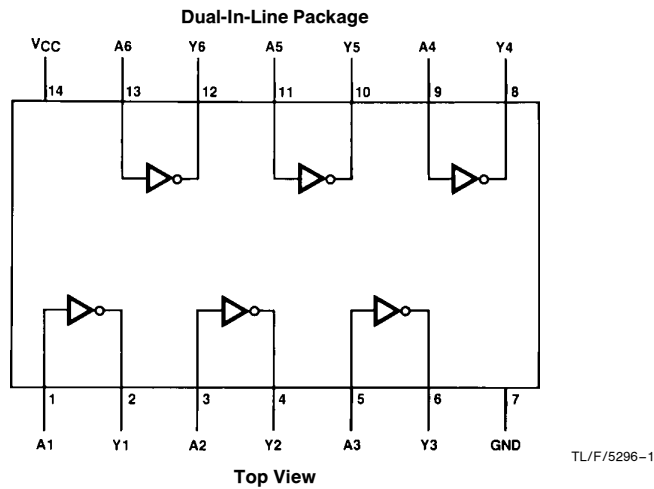
The MM54HCU04/MM74HCU04 is an unbuffered inverter. It has high noise immunity and the ability to drive 15 LS-TTL loads. The 54HCU/74HCU logic family is functionally as well as pin-out compatible with the standard 54LS/74LS

logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

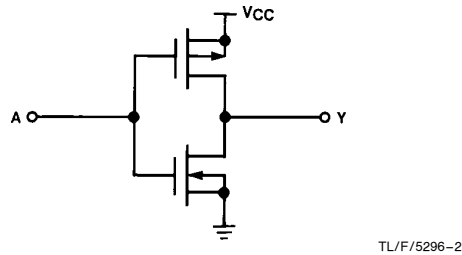
Features

- Typical propagation delay: 7 ns
- Fanout of 15 LS-TTL loads
- Quiescent power consumption: 10 μA maximum at room temperature
- Low input current: 1 μA maximum

Connection and Schematic Diagrams



Order Number MM54HCU04 or MM74HCU04



Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	-0.5 to +7.0V
DC Input Voltage (V_{IN})	-1.5 to $V_{CC} + 1.5V$
DC Output Voltage (V_{OUT})	-0.5 to $V_{CC} + 0.5V$
Clamp Diode Current (I_{IK}, I_{OK})	± 20 mA
DC Output Current, per pin (I_{OUT})	± 25 mA
DC V_{CC} or GND Current, per pin (I_{CC})	± 50 mA
Storage Temperature Range (T_{STG})	-65°C to +150°C
Power Dissipation (P_D) (Note 3)	600 mW
S.O. Package only	500 mW
Lead Temp. (T_L) (Soldering 10 seconds)	260°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage (V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temp. Range (T_A)			
MM74HCU	-40	+85	°C
MM54HCU	-55	+125	°C

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^\circ\text{C}$		74HCU $T_A = -40$ to 85°C		54HCU $T_A = -55$ to 125°C		Units	
				Typ	Guaranteed Limits						
V_{IH}	Minimum High Level Input Voltage		2.0V		1.7	1.7	1.7		V		
			4.5V		3.6	3.6	3.6		V		
			6.0V		4.8	4.8	4.8		V		
V_{IL}	Maximum Low Level Input Voltage		2.0V		0.3	0.3	0.3		V		
			4.5V		0.8	0.8	0.8		V		
			6.0V		1.1	1.1	1.1		V		
V_{OH}	Minimum High Level Output Voltage	$V_{IN} = V_{IL}$ $ I_{OUT} \leq 20 \mu\text{A}$	2.0V	2.0	1.8	1.8	1.8		V		
			4.5V	4.5	4.0	4.0	4.0		V		
			6.0V	6.0	5.5	5.5	5.5		V		
		$V_{IN} = \text{GND}$ $ I_{OUT} \leq 4.0 \text{ mA}$ $ I_{OUT} \leq 5.2 \text{ mA}$	4.5V	4.2	3.98	3.84	3.7		V		
			6.0V	5.7	5.48	5.34	5.2		V		
V_{OL}	Maximum Low Level Output Voltage	$V_{IN} = V_{IH}$ $ I_{OUT} \leq 20 \mu\text{A}$	2.0V	0	0.2	0.2	0.2		V		
			4.5V	0	0.5	0.5	0.5		V		
			6.0V	0	0.5	0.5	0.5		V		
		$V_{IN} = V_{CC}$ $ I_{OUT} \leq 6.0 \text{ mA}$ $ I_{OUT} \leq 7.8 \text{ mA}$	4.5V	0.2	0.26	0.33	0.4		V		
			6.0V	0.2	0.26	0.33	0.4		V		
I_{IN}	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		± 0.1	± 1.0	± 1.0	μA			
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu\text{A}$	6.0V		2.0	20	40	μA			

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C; ceramic "J" package: -12 mW/°C from 100°C to 125°C.

Note 4: For a power supply of $5V \pm 10\%$ the worst case output voltages (V_{OH} and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

AC Electrical Characteristics $V_{CC}=5V$, $T_A=25^\circ C$, $C_L=15\text{ pF}$, $t_r=t_f=6\text{ ns}$

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PHL} , t_{PLH}	Maximum Propagation Delay		7	13	ns

AC Electrical Characteristics $V_{CC}=2.0V$ to $6.0V$, $C_L=50\text{ pF}$, $t_r=t_f=6\text{ ns}$ (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A=25^\circ C$		74HCU	54HCU	Units
						$T_A=-40\text{ to }85^\circ C$	$T_A=-55\text{ to }125^\circ C$	
				Typ	Guaranteed Limits			
t_{PHL} , t_{PLH}	Maximum Propagation Delay		2.0V	49	82	103	120	ns
			4.5V	9.9	16	21	24	ns
			6.0V	8.4	14	18	20	ns
t_{TLH} , t_{THL}	Maximum Output Rise and Fall Time		2.0V	30	75	95	110	ns
			4.5V	8	15	19	22	ns
			6.0V	7	13	16	19	ns
C_{PD}	Power Dissipation Capacitance (Note 5)	(per gate)		90				pF
C_{IN}	Maximum Input Capacitance			8	15	15	15	pF

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D=C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S=C_{PD} V_{CC} f + I_{CC}$.

Typical Applications

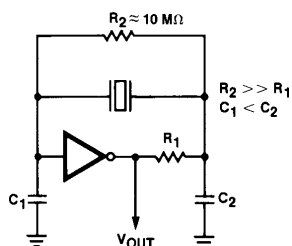


FIGURE 1. Crystal Oscillator

TL/F/5296-3

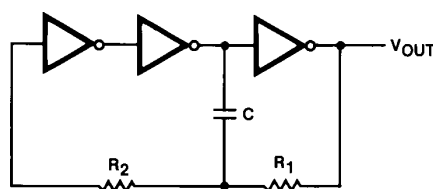


FIGURE 2. Stable RC Oscillator

TL/F/5296-4

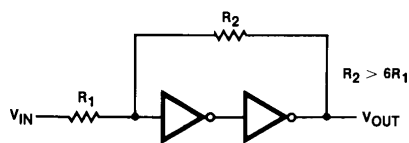
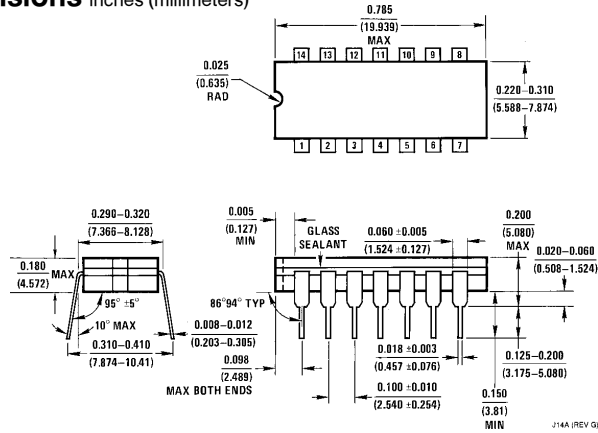


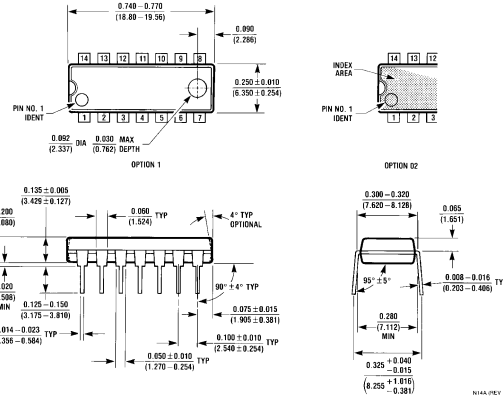
FIGURE 3. Schmitt Trigger

TL/F/5296-5

Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number MM54HCU04J or MM74HCU04J
NS Package Number J14A



Molded Dual-In-Line Package (N)
Order Number MM74HCU04N
NS Package Number N14A

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is 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.

 <p>National Semiconductor Corporation 1111 West Bardin Road Arlington, TX 76017 Tel: 1(800) 272-9959 Fax: 1(800) 737-7018</p>	<p>National Semiconductor Europe Fax: (+49) 0-180-530 85 86 Email: cnjwge@tevm2.nsc.com Deutsch Tel: (+49) 0-180-530 85 85 English Tel: (+49) 0-180-532 78 32 Français Tel: (+49) 0-180-532 93 58 Italiano Tel: (+49) 0-180-534 16 80</p>	<p>National Semiconductor Hong Kong Ltd. 19th Floor, Straight Block, Ocean Centre, 5 Canton Rd. Tsimshatsui, Kowloon Hong Kong Tel: (852) 2737-1600 Fax: (852) 2736-9960</p>	<p>National Semiconductor Japan Ltd. Tel: 81-043-299-2309 Fax: 81-043-299-2408</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

This datasheet has been download from:

www.datasheetcatalog.com

Datasheets for electronics components.