



T-43-21

MM54HCU04/MM74HCU04

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.

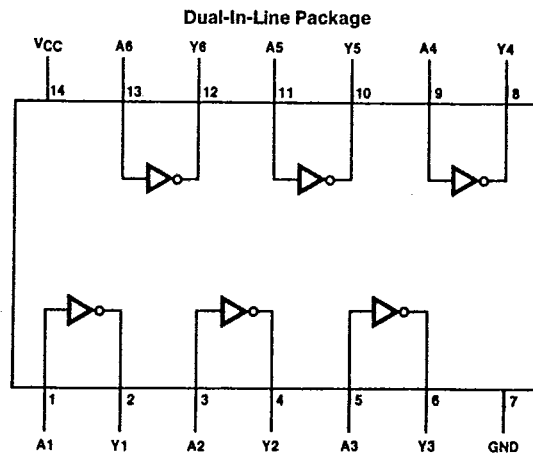
The MM54HCU04/MM74HCU04 is an unbuffered inverter. It has high noise immunity and the ability to drive 15 LS-TTL loads. The 54HCU/74HCU logic family is functionally as well as pin-out compatible with the standard 54LS/74LS

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

Features

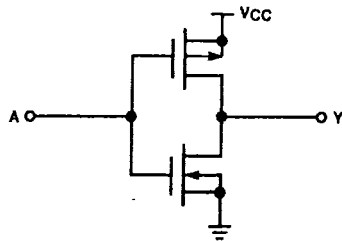
- Typical propagation delay: 7 ns
- Fanout of 15 LS-TTL loads
- Quiescent power consumption: 10 μ A maximum at room temperature
- Low input current: 1 μ A maximum

Connection and Schematic Diagrams



Order Number MM54HCU04* or MM74HCU04*

*Please look into Section 8, Appendix D for availability of various package types.



3

MM54HCU04/MM74HCU04

T-43-21

Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, 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}	$T_A = 25^\circ C$		74HCU	54HCU	Units
				Typ	Guaranteed Limits		$T_A = -40$ to $85^\circ C$	
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 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
		$V_{IN} = GND$ $ I_{OUT} \leq 4.0$ mA $ I_{OUT} \leq 5.2$ 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 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$ mA $ I_{OUT} \leq 7.8$ 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 $I_{OUT} = 0 \mu A$	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.

T-43-21

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

Symbol	Parameter	Conditions	V_{CC}	$T_A=25^{\circ}C$		74HCU $T_A=-40\text{ to }85^{\circ}C$		54HCU $T_A=-55\text{ to }125^{\circ}C$		Units
				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

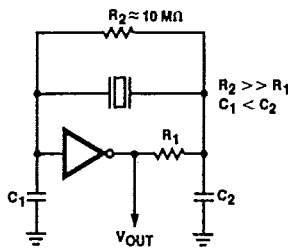


FIGURE 1. Crystal Oscillator

TL/F/5296-3

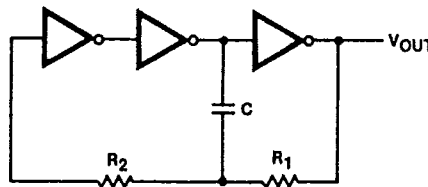


FIGURE 2. Stable RC Oscillator

TL/F/5296-4

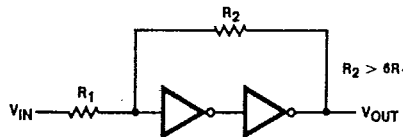


FIGURE 3. Schmitt Trigger

TL/F/5296-5