

MM74HCU04 Hex Inverter

General Description

The MM74HCU04 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 MM74HCU04 is an unbuffered inverter. It has high noise immunity and the ability to drive 15 LS-TTL loads. The 74HCU logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

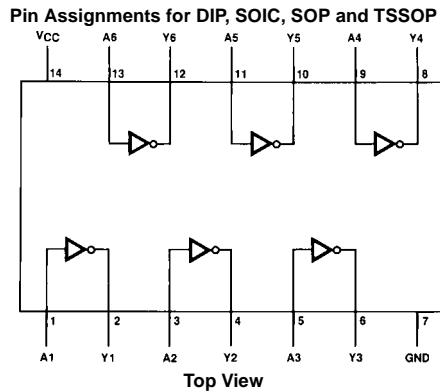
- Typical propagation delay: 7 ns
- Fanout of 15 LS-TTL loads
- Quiescent power consumption: 10 μ A maximum at room temperature
- Low input current: 1 μ A maximum

Ordering Code:

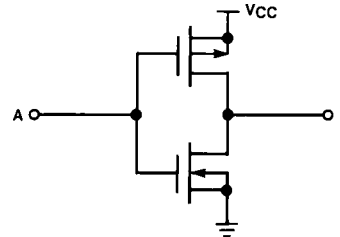
Order Number	Package Number	Package Description
MM74HCU04M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HCU04MX_NL	M14A	Pb-Free 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HCU04SJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCU04MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCU04N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74HCU04N_NL	N14A	Pb-Free 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.
Pb-Free package per JEDEC J-STD-020B.

Connection Diagram



Schematic Diagram



Absolute Maximum Ratings (Note 1)

(Note 2)

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 Temperature (T_L)	
(Soldering 10 seconds)	260°C

Recommended 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 Temperature Range (T_A)	-40	+85	°C

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.**DC Electrical Characteristics** (Note 4)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^\circ\text{C}$			Units	
				Typ	Guaranteed Limits			
V_{IH}	Minimum HIGH Level Input Voltage		2.0V		1.7	1.7	V	
			4.5V		3.6	3.6	V	
			6.0V		4.8	4.8	V	
V_{IL}	Maximum LOW Level Input Voltage		2.0V		0.3	0.3	V	
			4.5V		0.8	0.8	V	
			6.0V		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	V	
			4.5V	4.5	4.0	4.0	V	
			6.0V	6.0	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	V	
			4.5V	0	0.5	0.5	V	
			6.0V	0	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 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

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

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 $6.0V, C_L = 50 pF, t_r = t_f = 6 ns$ (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^\circ C$		$T_A = -40$ to $85^\circ C$	$T_A = -55$ 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

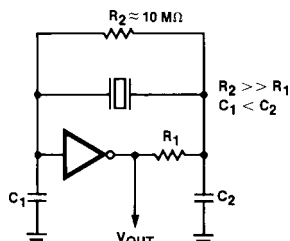


FIGURE 1. Crystal Oscillator

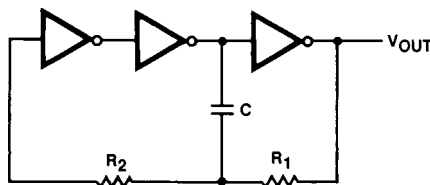


FIGURE 2. Stable RC Oscillator

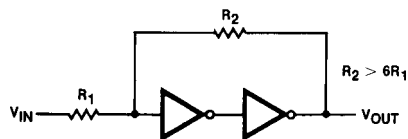
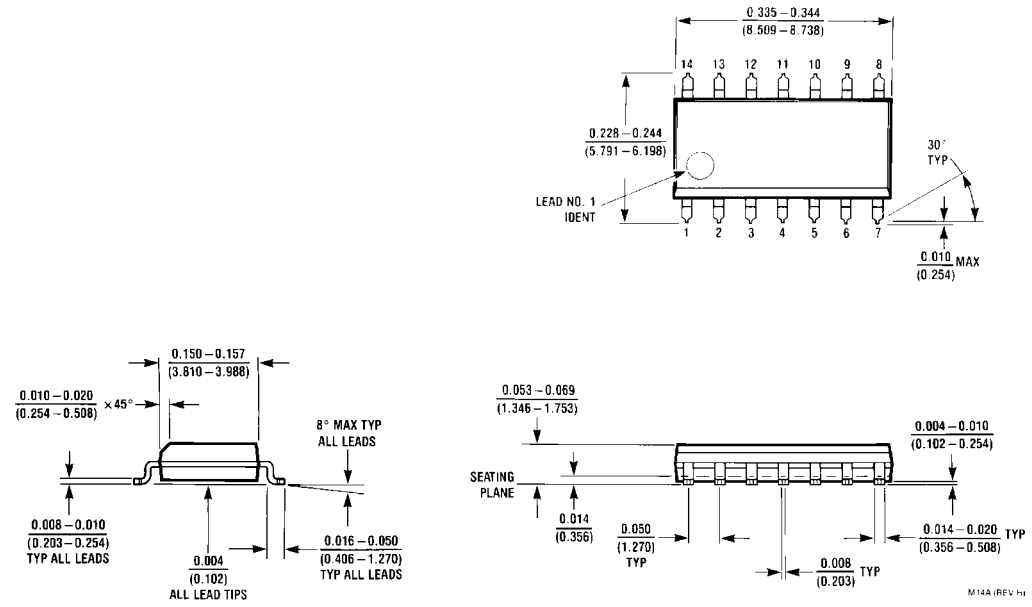


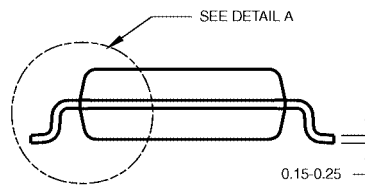
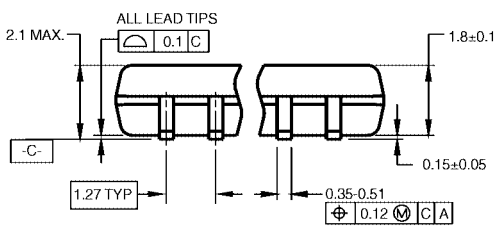
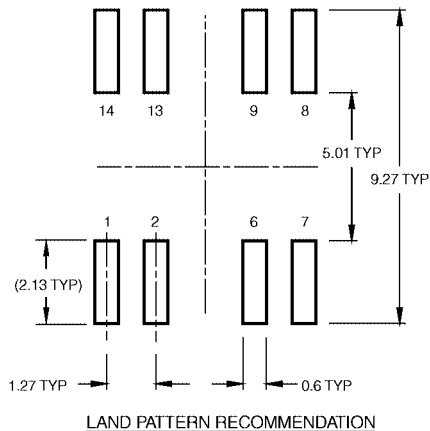
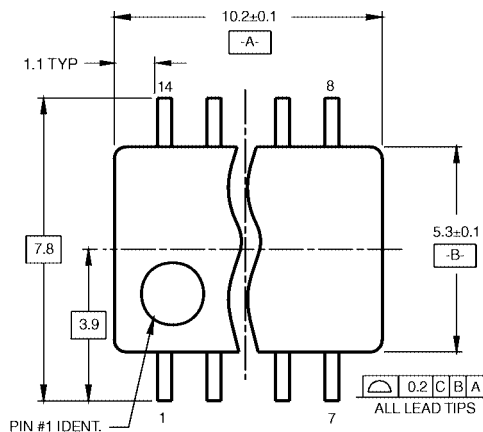
FIGURE 3. Schmitt Trigger

Physical Dimensions inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M14A**

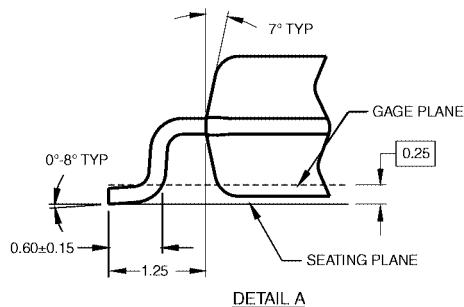
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

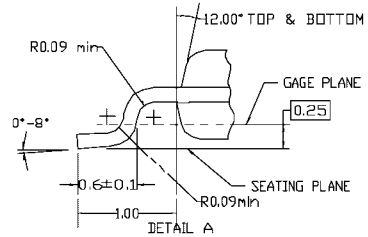
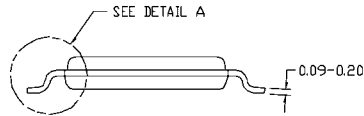
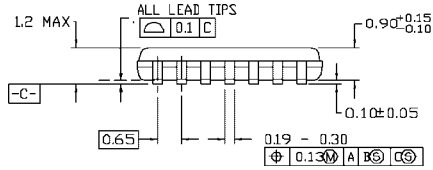
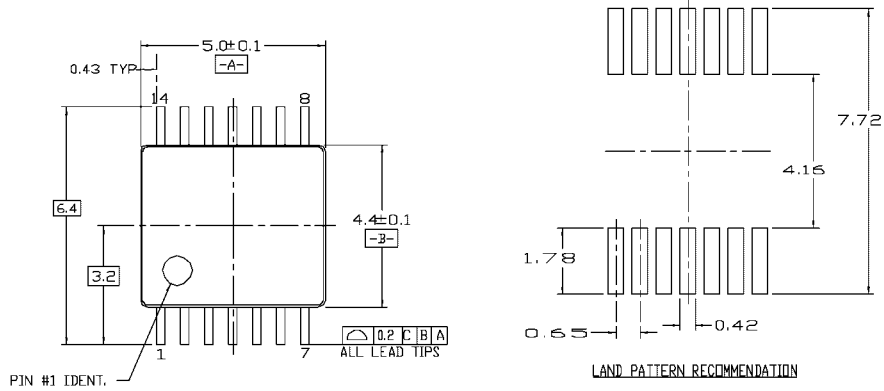
- NOTES:
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M14DRevB1



Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M14D

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



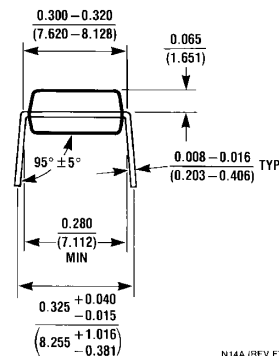
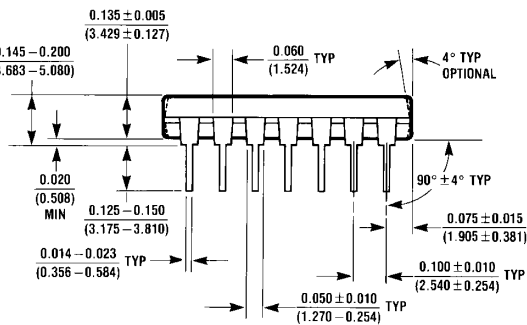
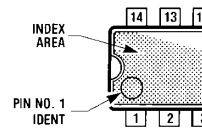
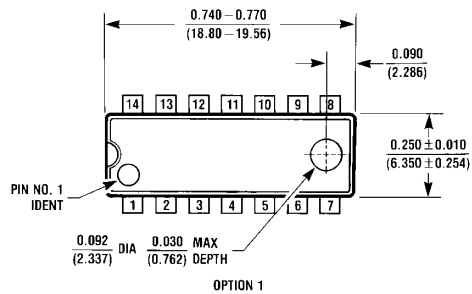
NOTES:

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- 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)



N14A (REV F)

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

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