

## MM74HCU04 Hex Inverter

### Features

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

### 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.

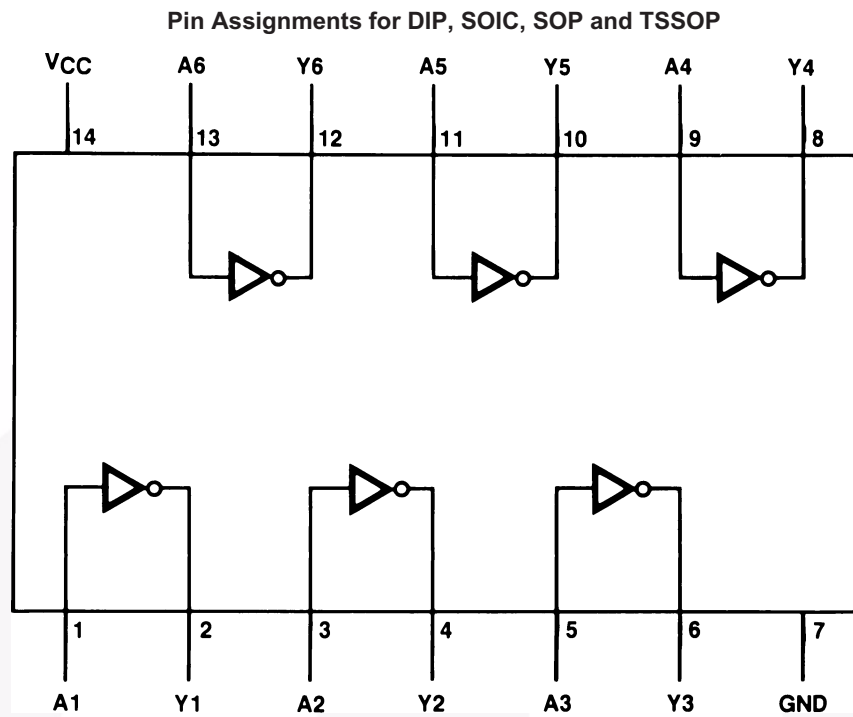
### Ordering Information

Order Number	Package Number	Package Description
MM74HCU04M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HCU04SJ	M14D	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

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

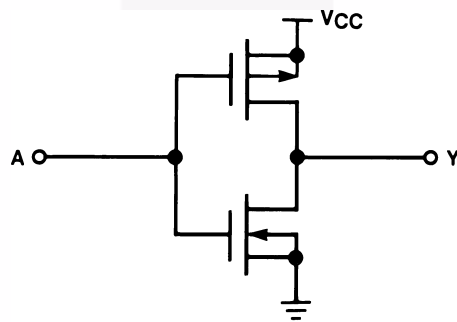
 All packages are lead free per JEDEC: J-STD-020B standard.

### Connection Diagram



Top View

### Schematic Diagram



## Absolute Maximum Ratings<sup>(1)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	-0.5 to +7.0V
$V_{IN}$	DC Input Voltage	-1.5 to $V_{CC}+1.5V$
$V_{OUT}$	DC Output Voltage	-0.5 to $V_{CC}+0.5V$
$I_{IK}, I_{OK}$	Clamp Diode Current	$\pm 20mA$
$I_{OUT}$	DC Output Current, per pin	$\pm 25mA$
$I_{CC}$	DC $V_{CC}$ or GND Current, per pin	$\pm 50mA$
$T_{STG}$	Storage Temperature Range	-65°C to +150°C
$P_D$	Power Dissipation Note 2	600mW
	S.O. Package only	500mW
$T_L$	Lead Temperature (Soldering 10 seconds)	260°C

### Notes:

1. Unless otherwise specified all voltages are referenced to ground.
2. Power Dissipation temperature derating — plastic "N" package: -12mW/°C from 65°C to 85°C.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Units
$V_{CC}$	Supply Voltage	2	6	V
$V_{IN}, V_{OUT}$	DC Input or Output Voltage	0	$V_{CC}$	V
$T_A$	Operating Temperature Range	-40	+85	°C

## DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40°C	T <sub>A</sub> = -55°C	Units
				Typ.	Guaranteed Limits			
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	2.0			1.7	1.7	1.7	V
		4.5			3.6	3.6	3.6	
		6.0			4.8	4.8	4.8	
V <sub>IL</sub>	Maximum LOW Level Input Voltage	2.0			0.3	0.3	0.3	V
		4.5			0.8	0.8	0.8	
		6.0			1.1	1.1	1.1	
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	2.0	V <sub>IN</sub> = V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 20μA	2.0	1.8	1.8	1.8	V
		4.5		4.5	4.0	4.0	4.0	
		6.0		6.0	5.5	5.5	5.5	
		4.5	V <sub>IN</sub> = GND,  I <sub>OUT</sub>   ≤ 4.0mA	4.2	3.98	3.84	3.7	
		6.0		5.7	5.48	5.34	5.2	
V <sub>OL</sub>	Maximum LOW Level Output Voltage	2.0	V <sub>IN</sub> = V <sub>IH</sub> ,  I <sub>OUT</sub>   ≤ 20μA	0	0.2	0.2	0.2	V
		4.5		0	0.5	0.5	0.5	
		6.0		0	0.5	0.5	0.5	
		4.5	V <sub>IN</sub> = V <sub>CC</sub> ,  I <sub>OUT</sub>   ≤ 6.0mA	0.2	0.26	0.33	0.4	
		6.0		0.2	0.26	0.33	0.4	
I <sub>IN</sub>	Maximum Input Current	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND		±0.1	±1.0	±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0μA		2.0	20	40	μA

**Note:**

3. For a power supply of 5V ±10% the worst case output voltages (V<sub>OH</sub>, and V<sub>OL</sub>) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5V and 4.5V respectively. (The V<sub>IH</sub> value at 5.5V is 3.85V.) The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occur for CMOS at the higher voltage and so the 6.0V values should be used.

## AC Electrical Characteristics

V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C, C<sub>L</sub> = 15pF, t<sub>r</sub> = t<sub>f</sub> = 6ns

Symbol	Parameter	Conditions	Typ.	Guaranteed Limit	Units
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay		7	13	ns

### AC Electrical Characteristics

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

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = 25^\circ C$		$T_A = -40^\circ C$ to $85^\circ C$	$T_A = -55^\circ C$ to $125^\circ C$	Units
				Typ.	Guaranteed Limits			
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay		2.0	49	82	103	120	ns
			4.5	9.9	16	21	24	
			6.0	8.4	14	18	20	
$t_{TLH}, t_{THL}$	Maximum Output Rise and Fall Time		2.0	30	75	95	110	ns
			4.5	8	15	19	22	
			6.0	7	13	16	19	
$C_{PD}$	Power Dissipation Capacitance <sup>(4)</sup>	(per gate)		90				pF
$C_{IN}$	Maximum Input Capacitance			8	15	15	15	pF

**Note:**

4.  $C_{PD}$  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

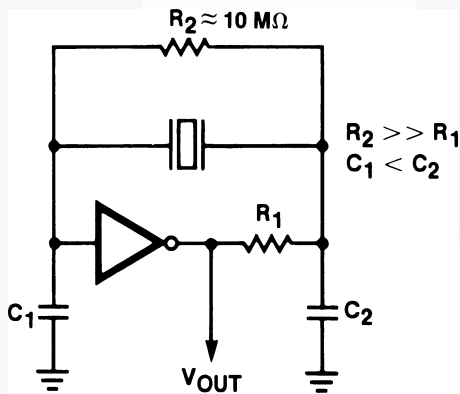


Figure 1. Crystal Oscillator

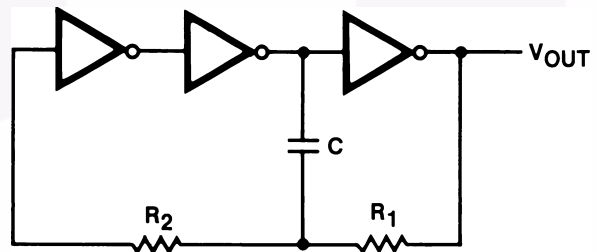


Figure 2. Stable RC Oscillator

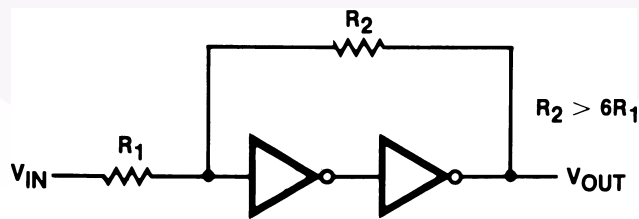
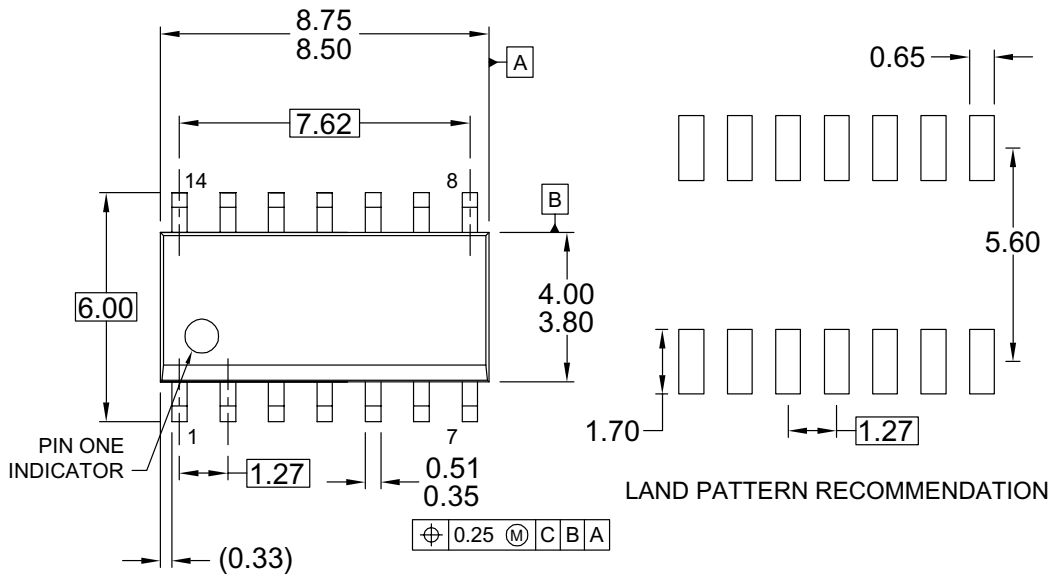
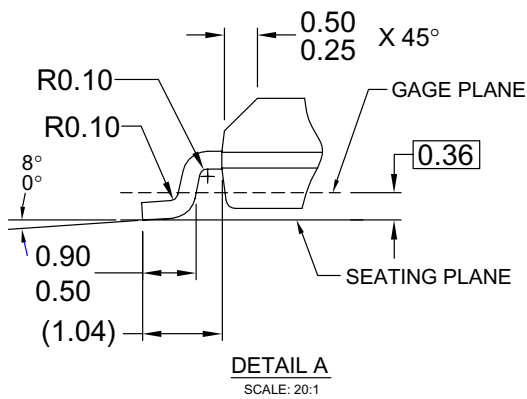


Figure 3. Schmitt Trigger

Physical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED



- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C,
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X145-14M
- E) DRAWING CONFORMS TO ASME Y14.5M-1994
- F) DRAWING FILE NAME: M14AREV13

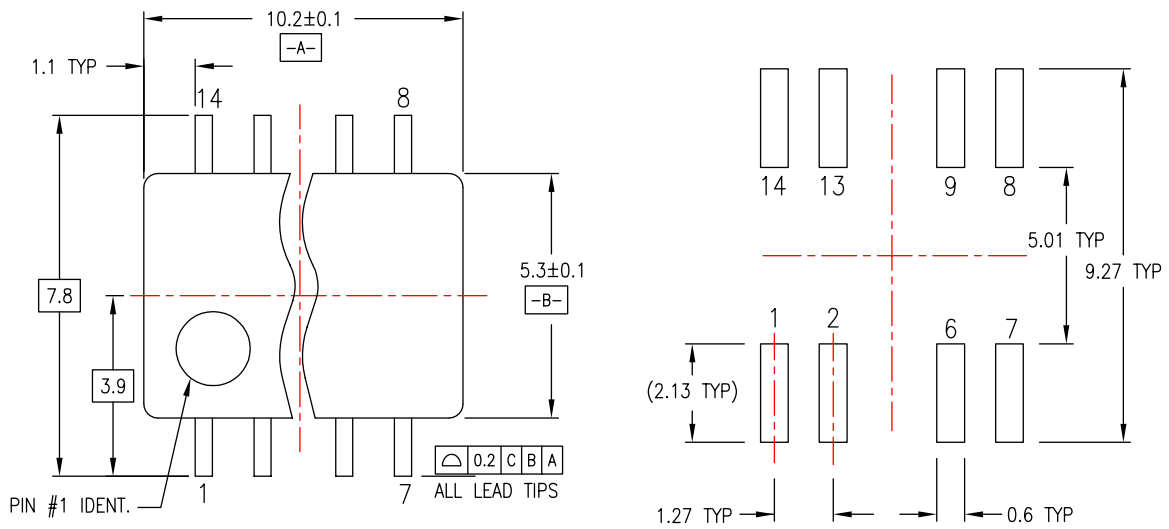
Figure 4. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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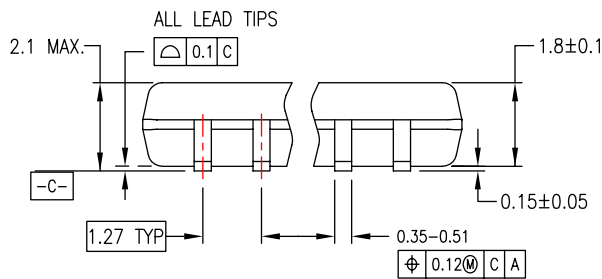
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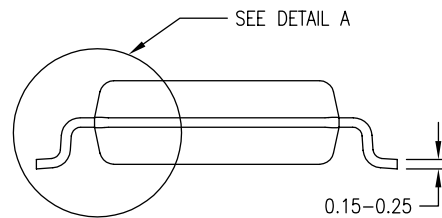
**Physical Dimensions (Continued)**



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

NOTES:

- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DREVC

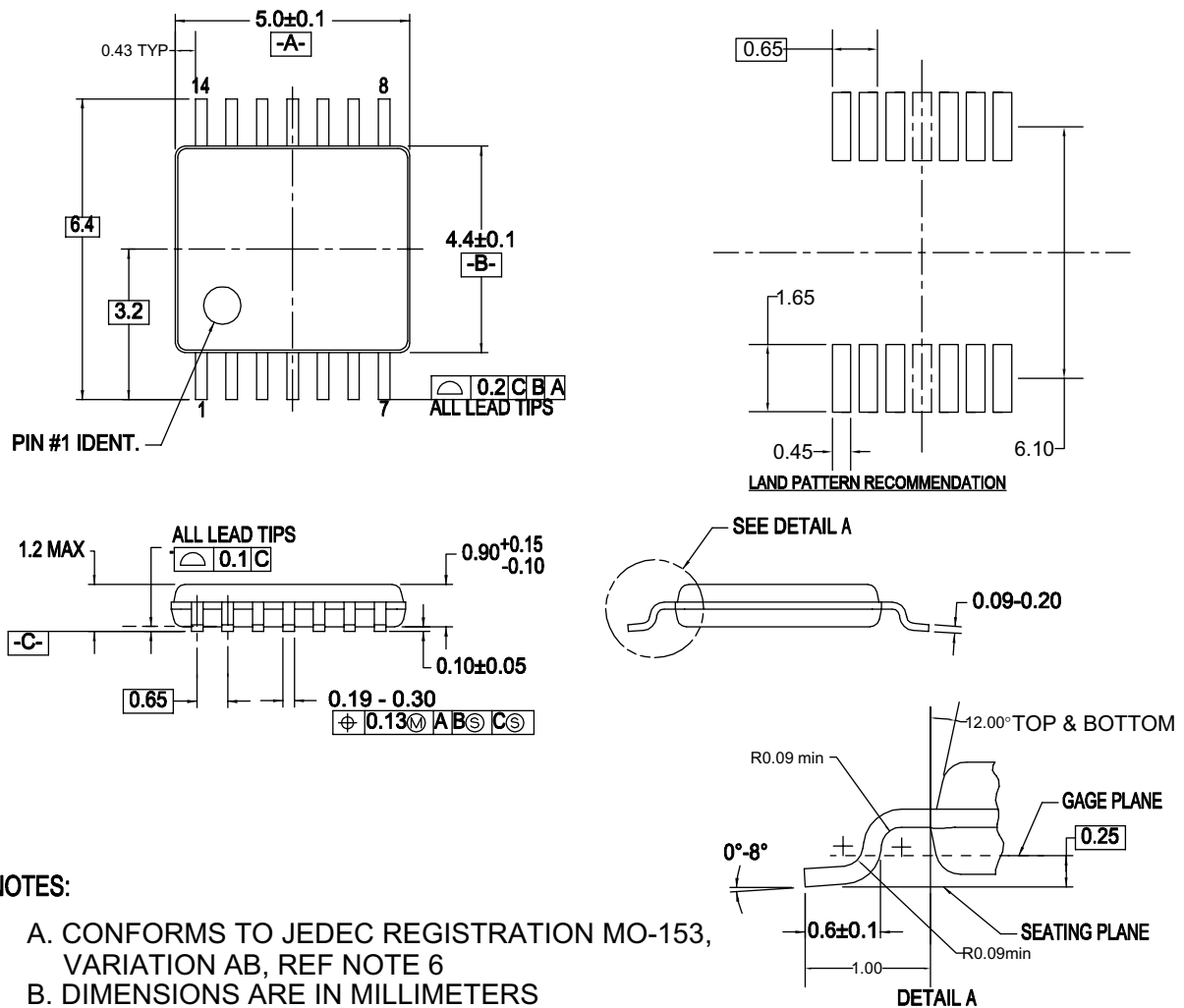
**Figure 5. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

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## Physical Dimensions (Continued)



## NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- DIMENSIONS ARE IN MILLIMETERS
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982
- LANDPATTERN STANDARD: SOP65P640X110-14M
- DRAWING FILE NAME: MTC14REV6

Figure 6. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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## Physical Dimensions (Continued)



- NOTES: UNLESS OTHERWISE SPECIFIED**
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  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - D) DIMENSIONS AND TOLERANCES PER ASME Y14.5-1994
  - E) DRAWING FILE NAME: MKT-N14AREV7

**Figure 7. 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide**

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