

## 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  $\mu A$  maximum at room temperature
- Low input current: 1  $\mu A$  maximum

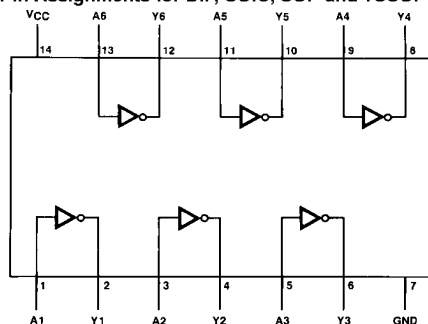
### Ordering Code:

| Order Number | Package Number | Package Description                                                          |
|--------------|----------------|------------------------------------------------------------------------------|
| MM74HCU04M   | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 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       |

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

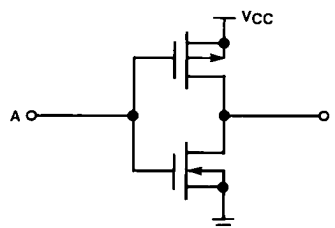
### Connection Diagram

Pin Assignments for DIP, SOIC, SOP and TSSOP



Top View

### 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 ( $I_{IK}, I_{OK}$ )         | $\pm 20$ mA             |
| DC Output Current, per pin ( $I_{OUT}$ )         | $\pm 25$ mA             |
| DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ ) | $\pm 50$ 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 <sub>CC</sub> | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = -40 to 85°C | T <sub>A</sub> = -55 to 125°C | Units |
|-----------------|-----------------------------------|---------------------------------------------------------------------------------------------------|-----------------|-----------------------|-------------------|------------------------------|-------------------------------|-------|
|                 |                                   |                                                                                                   |                 | Typ                   | Guaranteed Limits |                              |                               |       |
| V <sub>IH</sub> | 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 <sub>IL</sub> | 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 <sub>OH</sub> | Minimum HIGH Level Output Voltage | V <sub>IN</sub> = V <sub>IL</sub><br> I <sub>OUT</sub>   ≤ 20 μA                                  | 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 <sub>IN</sub> = GND<br> I <sub>OUT</sub>   ≤ 4.0 mA<br> I <sub>OUT</sub>   ≤ 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 <sub>OL</sub> | Maximum LOW Level Output Voltage  | V <sub>IN</sub> = V <sub>IH</sub><br> I <sub>OUT</sub>   ≤ 20 μA                                  | 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 <sub>IN</sub> = V <sub>CC</sub><br> I <sub>OUT</sub>   ≤ 6.0 mA<br> I <sub>OUT</sub>   ≤ 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 <sub>IN</sub> | Maximum Input Current             | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                          | 6.0V            |                       | ±0.1              | ±1.0                         | ±1.0                          | μA    |
| I <sub>CC</sub> | Maximum Quiescent Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA                               | 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

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

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

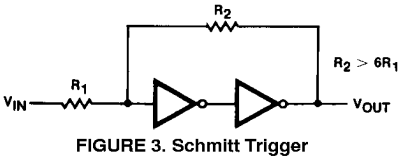
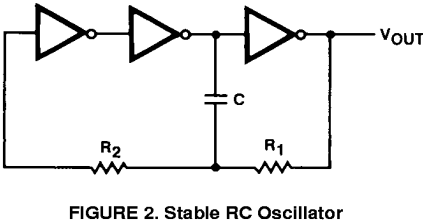
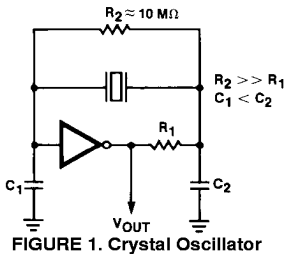
AC Electrical Characteristics

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

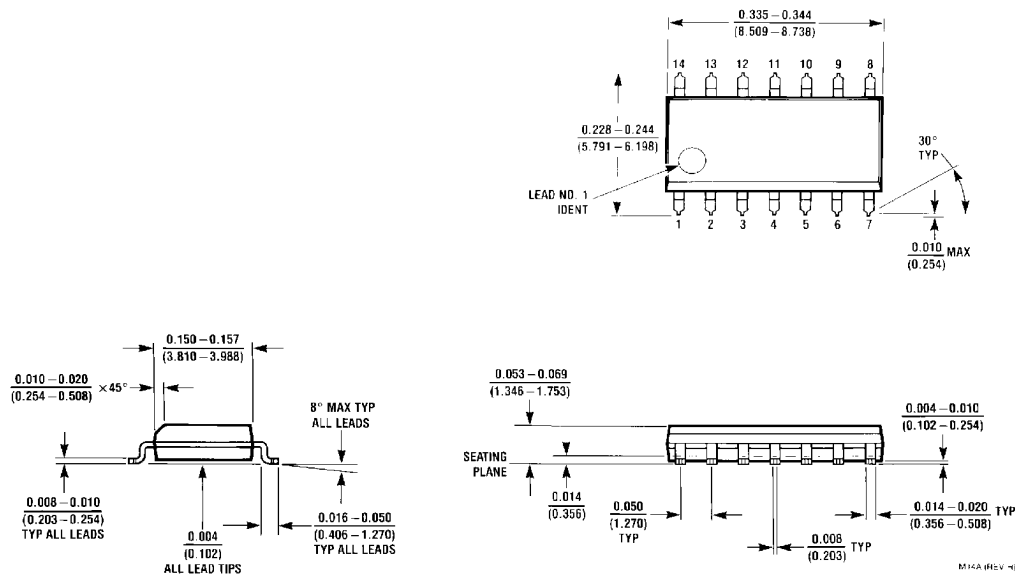
| Symbol                              | Parameter                              | Conditions | V <sub>CC</sub> | T <sub>A</sub> =25°C |                   | T <sub>A</sub> =−40 to 85°C | T <sub>A</sub> =−55 to 125°C | Units |
|-------------------------------------|----------------------------------------|------------|-----------------|----------------------|-------------------|-----------------------------|------------------------------|-------|
|                                     |                                        |            |                 | Typ                  | Guaranteed Limits |                             |                              |       |
| t <sub>PHL</sub> , t <sub>PLH</sub> | 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 <sub>TLH</sub> , t <sub>THL</sub> | 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 <sub>PD</sub>                     | Power Dissipation Capacitance (Note 5) | (per gate) |                 | 90                   |                   |                             |                              | pF    |
| C <sub>IN</sub>                     | 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,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

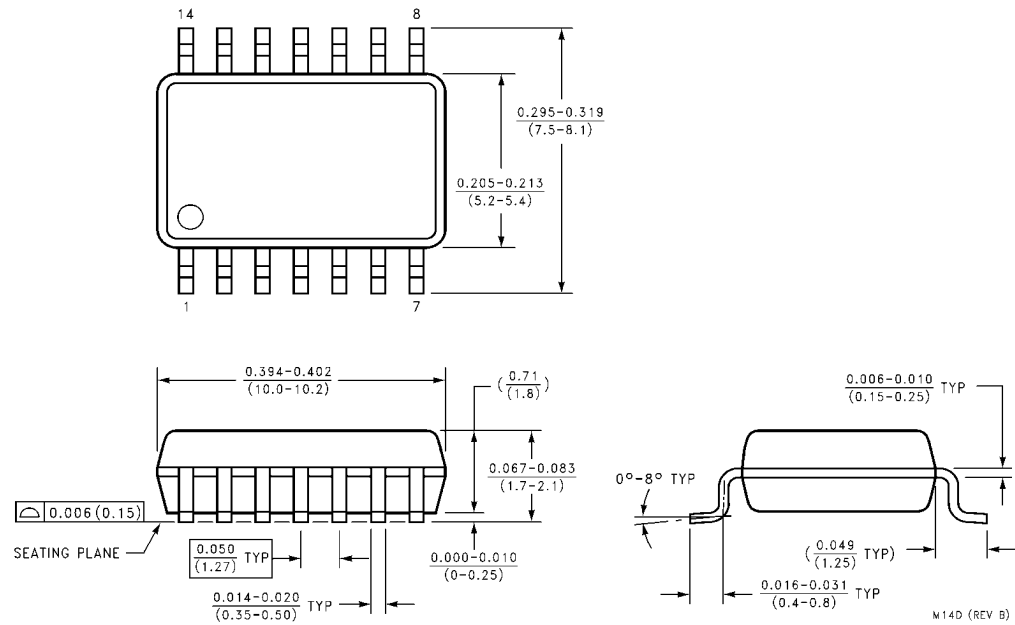
Typical Applications



# Physical Dimensions inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow  
Package Number M14A**



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

5.0 ± 0.1  
-A-

0.43 TYP

14

8

6.4

4.4 ± 0.1  
-B-

3.2

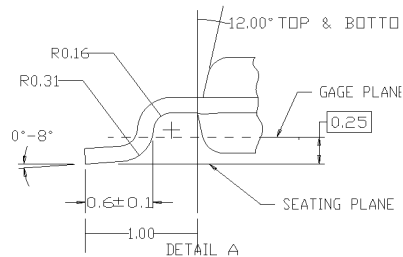
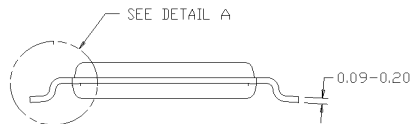
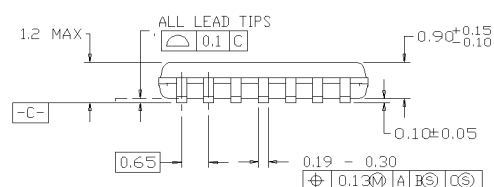
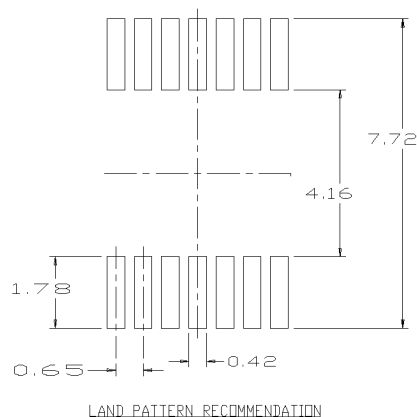
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0.2 C B A

ALL LEAD TIPS

PIN #1 IDENT.



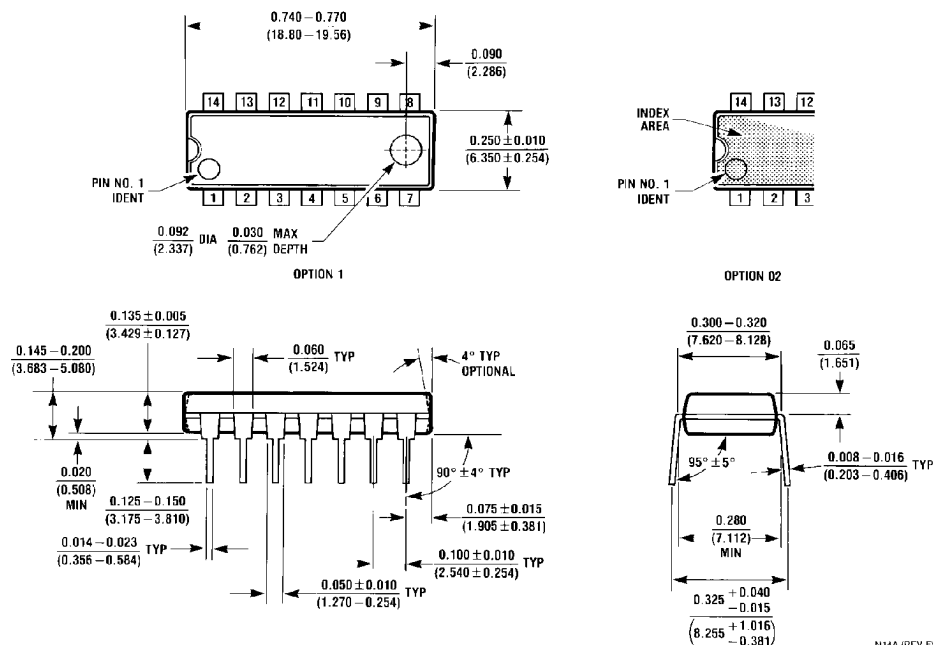
A. CONFORMS TO JEDEC REGISTRATION MO-153 VARIATION AB,  
REF NOTE 6, DATED 7/93

B. DIMENSIONS ARE IN MILLIMETERS

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH,  
AND TIE BAR EXTRUSIONS

**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)



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

N14A (REV F)

### LIFE SUPPORT POLICY

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2. A critical component in 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.

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