

## MM74HCT04 Hex Inverter

### General Description

The MM74HCT04 is a logic function fabricated by using advanced silicon-gate CMOS technology which provides the inherent benefits of CMOS - low quiescent power and wide power supply range. This device is input and output characteristic as well as pin-out compatible with standard 74LS logic families. The MM74HCT04, triple buffered, hex inverters, features low power dissipation and fast switching times. All inputs are protected from static discharge by internal diodes to  $V_{CC}$  and ground.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices.

These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

### Features

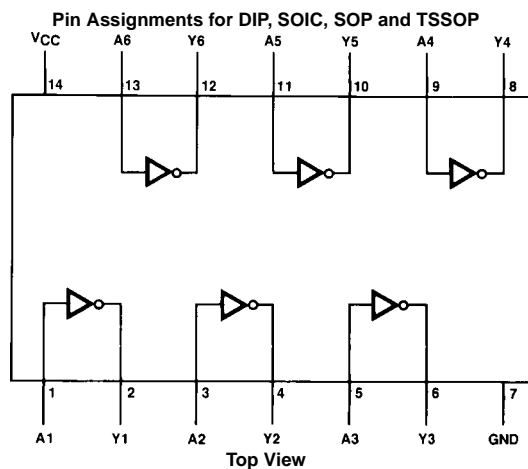
- TTL, LS pin-out and threshold compatible
- Fast switching:  $t_{PLH}$ ,  $t_{PHL}$  = 12 ns (typ)
- Low power: 10  $\mu$ W at DC, 3.7 mW at 5 MHz
- High fanout:  $\geq 10$  LS loads
- Inverting, triple buffered

### Ordering Code:

| Order Number | Package Number | Package Description  |
|--------------|----------------|--|
| MM74HCT04M   | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow |
| MM74HCT04SJ  | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                |
| MM74HCT04MTC | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  |
| MM74HCT04N   | 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



**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 ( $V_{CC}$ )                         | 4.5 | 5.5      | V     |
| DC Input or Output Voltage<br>( $V_{IN}, V_{OUT}$ ) | 0   | $V_{CC}$ | V     |
| Operating Temperature Range ( $T_A$ )               | −40 | +85      | °C    |
| Input Rise or Fall Times<br>( $t_r, t_f$ )          |     | 500      | ns    |

**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** $V_{CC} = 5V \pm 10\%$  (unless otherwise specified)

| Symbol          | Parameter                         | Conditions   | 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  |  |                       | 2.0                   | 2.0                          | 2.0                           | V     |
| V <sub>IL</sub> | Maximum LOW Level Input Voltage   |  |                       | 0.8                   | 0.8                          | 0.8                           | V     |
| V <sub>OH</sub> | Minimum HIGH Level Output Voltage | V <sub>IN</sub> = V <sub>IL</sub>  |                       |                       |                              |                               |       |
|                 |                                   | I <sub>OUT</sub>   = 20 μA   | V <sub>CC</sub>       | V <sub>CC</sub> − 0.1 | V <sub>CC</sub> − 0.1        | V <sub>CC</sub> − 0.1         | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.0 mA, V <sub>CC</sub> = 4.5V                          | 4.2                   | 3.98                  | 3.84                         | 3.7                           | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.8 mA, V <sub>CC</sub> = 5.5V                          | 5.2                   | 4.98                  | 4.84                         | 4.7                           | V     |
| V <sub>OL</sub> | Maximum LOW Level Voltage         | V <sub>IN</sub> = V <sub>IH</sub>  |                       |                       |                              |                               |       |
|                 |                                   | I <sub>OUT</sub>   = 20 μA   | 0                     | 0.1                   | 0.1                          | 0.1                           | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.0 mA, V <sub>CC</sub> = 4.5V                          | 0.2                   | 0.26                  | 0.33                         | 0.4                           | V     |
|                 |                                   | I <sub>OUT</sub>   = 4.8 mA, V <sub>CC</sub> = 5.5V                          | 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, V <sub>IH</sub> or V <sub>IL</sub> |                       | ±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          |                       | 2.0                   | 20                           | 40                            | μA    |
|                 |                                   | V <sub>IN</sub> = 2.4V or 0.5V (Note 4)                                      |                       | 0.3                   | 0.4                          | 0.5                           | mA    |

**Note 4:** This is measured per input with all other inputs held at  $V_{CC}$  or ground.

**AC Electrical Characteristics**
 $V_{CC} = 5.0V$ ,  $t_r = t_f = 6\text{ ns}$ ,  $C_L = 15\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

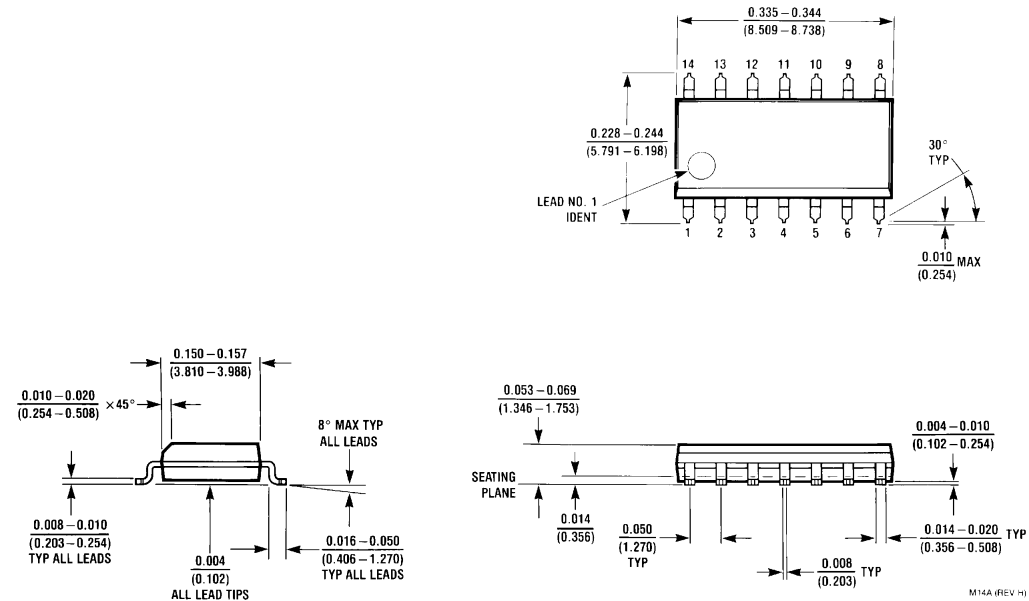
| Symbol                | Parameter                 | Conditions | Typ | Guaranteed Limit | Units |
|-----------------------|---------------------------|------------|-----|------------------|-------|
| $t_{PLH}$ , $t_{PHL}$ | Maximum Propagation Delay |            | 10  | 18               | ns    |

**AC Electrical Characteristics**
 $V_{CC} = 5.0V \pm 10\%$ ,  $t_r = t_f = 6\text{ ns}$ ,  $C_L = 50\text{ pF}$  (unless otherwise noted)

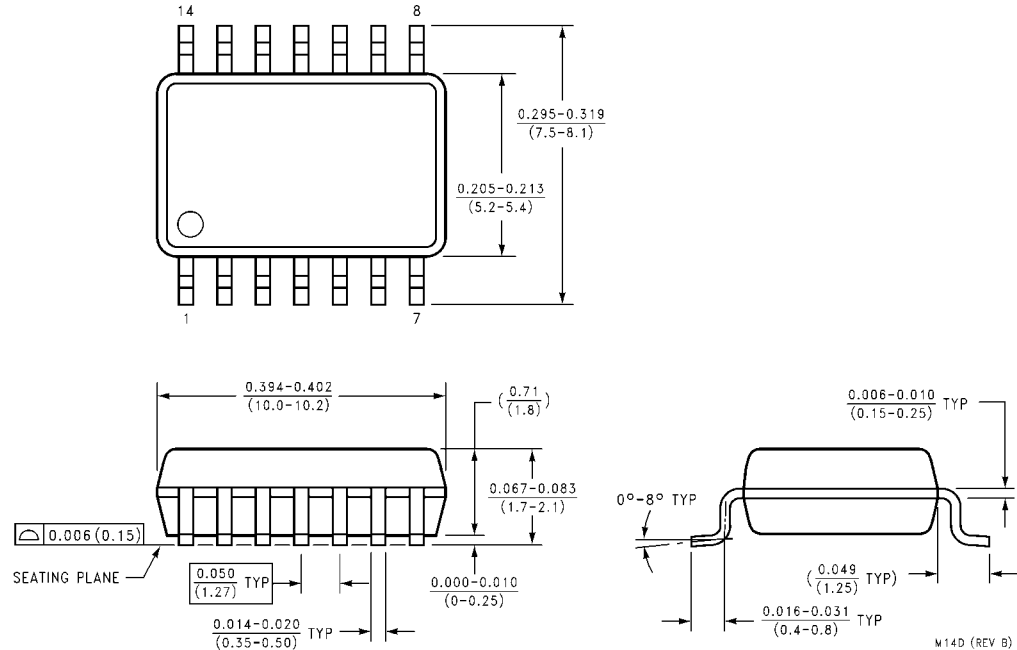
| Symbol                              | Parameter                       | Conditions | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = −40 to 85°C | T <sub>A</sub> = −55 to 125°C | Units |
|-------------------------------------|---------------------------------|------------|-----------------------|-------------------|------------------------------|-------------------------------|-------|
|                                     |                                 |            | Typ                   | Guaranteed Limits |                              |                               |       |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Maximum Propagation Delay       |            | 14                    | 20                | 25                           | 30                            | ns    |
| t <sub>THL</sub> , t <sub>TLH</sub> | Maximum Output Rise & Fall Time |            | 8                     | 15                | 19                           | 22                            | ns    |
| C <sub>PD</sub>                     | Power Dissipation Capacitance   | (Note 5)   | 20                    |                   |                              |                               | pF    |
| C <sub>IN</sub>                     | Input Capacitance               |            | 5                     | 10                | 10                           | 10                            | 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,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

# Physical Dimensions inches (millimeters) unless otherwise noted



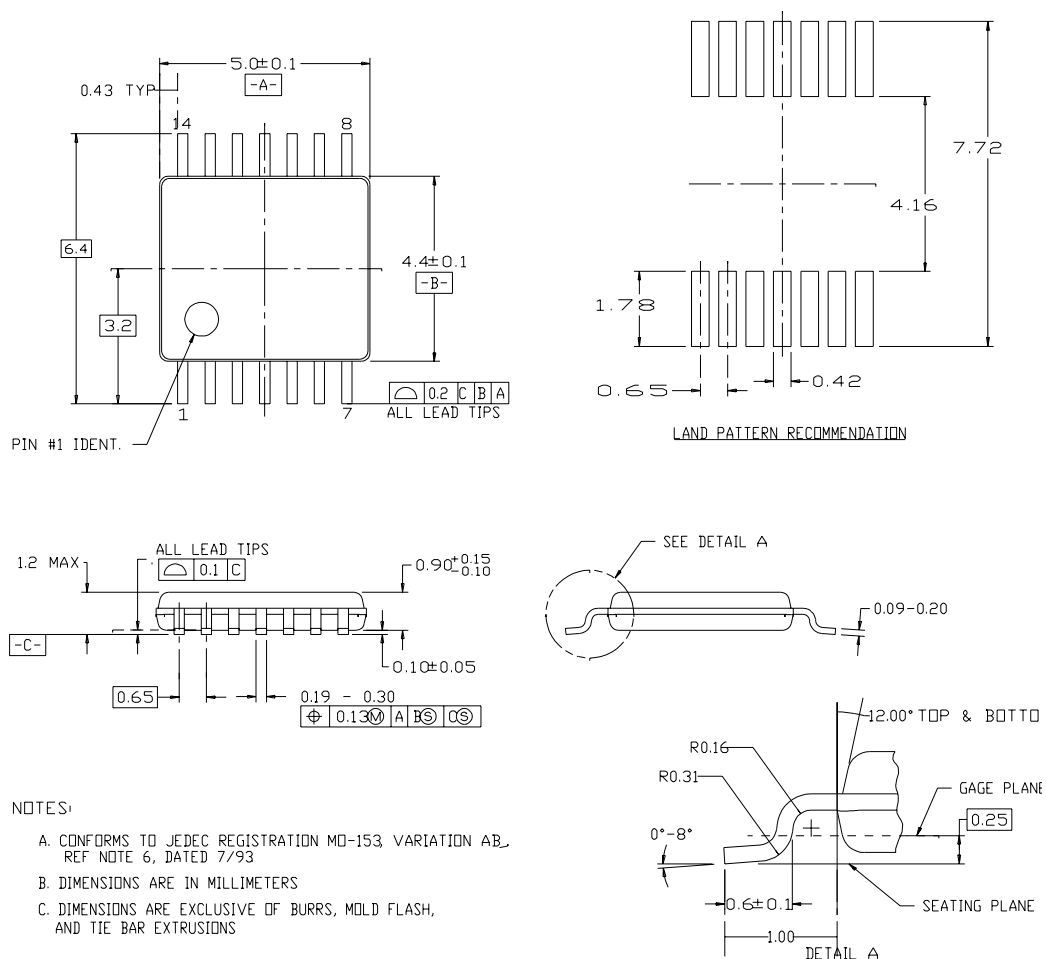
**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Package Number M14A**



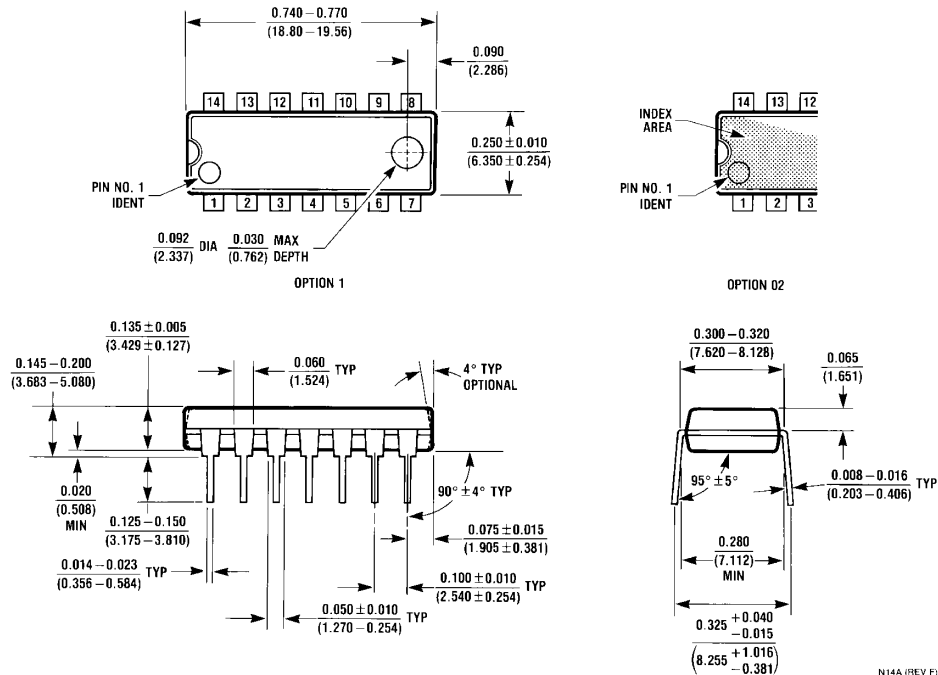
**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M14D**

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

14LD, TSSOP, JEDEC MO-153, 4.4MM WIDE



## 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

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