

## 74AC04 • 74ACT04 Hex Inverter

### General Description

The AC/ACT04 contains six inverters.

### Features

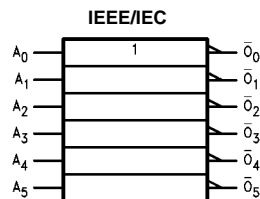
- $I_{CC}$  reduced by 50% on 74AC only
- Outputs source/sink 24 mA
- ACT04 has TTL-compatible inputs

### Ordering Code:

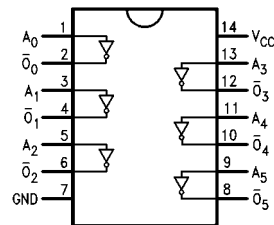
| Order Number | Package Number | Package Description   |
|--------------|----------------|---|
| 74AC04SC     | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Body |
| 74AC04SJ     | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                     |
| 74AC04MTC    | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide       |
| 74AC04PC     | N14A           | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide            |
| 74ACT04SC    | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Body |
| 74ACT04MTC   | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide       |
| 74ACT04PC    | 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 code. (PC not available in Tape and Reel.)

### Logic Symbol



### Connection Diagram



### Pin Descriptions

| Pin Names   | Description |
|-------------|-------------|
| $A_n$       | Inputs      |
| $\bar{O}_n$ | Outputs     |

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**Absolute Maximum Ratings**(Note 1)

|   |                          |
|---|--------------------------|
| Supply Voltage ( $V_{CC}$ )   | -0.5V to +7.0V           |
| DC Input Diode Current ( $I_{IK}$ )                                       |                          |
| $V_I = -0.5V$   | -20 mA                   |
| $V_I = V_{CC} + 0.5V$   | +20 mA                   |
| DC Input Voltage ( $V_I$ )  | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Diode Current ( $I_{OK}$ )                                      |                          |
| $V_O = -0.5V$   | -20 mA                   |
| $V_O = V_{CC} + 0.5V$   | +20 mA                   |
| DC Output Voltage ( $V_O$ )   | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Source or Sink Current ( $I_O$ )                                | $\pm 50$ mA              |
| DC $V_{CC}$ or Ground Current<br>per Output Pin ( $I_{CC}$ or $I_{GND}$ ) | $\pm 50$ mA              |
| Storage Temperature ( $T_{STG}$ )   | -65°C to +150°C          |
| Junction Temperature ( $T_J$ )  |                          |
| PDIP  | 140°C                    |

**Recommended Operating Conditions**

|   |                |
|---|----------------|
| Supply Voltage ( $V_{CC}$ )                     |                |
| AC  | 2.0V to 6.0V   |
| ACT   | 4.5V to 5.5V   |
| Input Voltage ( $V_I$ )                         | 0V to $V_{CC}$ |
| Output Voltage ( $V_O$ )                        | 0V to $V_{CC}$ |
| Operating Temperature ( $T_A$ )                 | -40°C to +85°C |
| Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) |                |
| AC Devices                                      |                |
| $V_{IN}$ from 30% to 70% of $V_{CC}$            |                |
| $V_{CC}$ @ 3.3V, 4.5V, 5.5V                     | 125 mV/ns      |
| Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) |                |
| ACT Devices                                     |                |
| $V_{IN}$ from 0.8V to 2.0V                      |                |
| $V_{CC}$ @ 4.5V, 5.5V                           | 125 mV/ns      |

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, with-  
out exception, to ensure that the system design is reliable over its power  
supply, temperature, and output/input loading variables. Fairchild does not  
recommend operation of FACT™ circuits outside databook specifications.

**DC Electrical Characteristics for AC**

| Symbol               | Parameter                            | $V_{CC}$<br>(V) | $T_A = +25^\circ\text{C}$ |                   | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |               | Units   | Conditions |
|----------------------|--------------------------------------|-----------------|---------------------------|-------------------|---|---------------|---|------------|
|                      |                                      |                 | Typ                       | Guaranteed Limits |   |               |   |            |
| $V_{IH}$             | Minimum HIGH Level<br>Input Voltage  | 3.0             | 1.5                       | 2.1               | 2.1   | V             | $V_{OUT} = 0.1V$<br>or $V_{CC} - 0.1V$  |            |
|                      |                                      | 4.5             | 2.25                      | 3.15              | 3.15  |               |   |            |
|                      |                                      | 5.5             | 2.75                      | 3.85              | 3.85  |               |   |            |
| $V_{IL}$             | Maximum LOW Level<br>Input Voltage   | 3.0             | 1.5                       | 0.9               | 0.9   | V             | $V_{OUT} = 0.1V$<br>or $V_{CC} - 0.1V$  |            |
|                      |                                      | 4.5             | 2.25                      | 1.35              | 1.35  |               |   |            |
|                      |                                      | 5.5             | 2.75                      | 1.65              | 1.65  |               |   |            |
| $V_{OH}$             | Minimum HIGH Level<br>Output Voltage | 3.0             | 2.99                      | 2.9               | 2.9   | V             | $I_{OUT} = -50 \mu\text{A}$   |            |
|                      |                                      | 4.5             | 4.49                      | 4.4               | 4.4   |               |   |            |
|                      |                                      | 5.5             | 5.49                      | 5.4               | 5.4   |               |   |            |
|                      |                                      | 3.0             |                           | 2.56              | 2.46  | V             | $V_{IN} = V_{IL}$ or $V_{IH}$<br>$I_{OH} = -12 \text{ mA}$<br>$I_{OH} = -24 \text{ mA}$<br>$I_{OH} = -24 \text{ mA (Note 2)}$ |            |
|                      |                                      | 4.5             |                           | 3.86              | 3.76  |               |   |            |
|                      |                                      | 5.5             |                           | 4.86              | 4.76  |               |   |            |
| $V_{OL}$             | Maximum LOW Level<br>Output Voltage  | 3.0             | 0.002                     | 0.1               | 0.1   | V             | $I_{OUT} = 50 \mu\text{A}$  |            |
|                      |                                      | 4.5             | 0.001                     | 0.1               | 0.1   |               |   |            |
|                      |                                      | 5.5             | 0.001                     | 0.1               | 0.1   |               |   |            |
|                      |                                      | 3.0             |                           | 0.36              | 0.44  | V             | $V_{IN} = V_{IL}$ or $V_{IH}$<br>$I_{OL} = 12 \text{ mA}$<br>$I_{OL} = 24 \text{ mA}$<br>$I_{OL} = 24 \text{ mA (Note 2)}$    |            |
|                      |                                      | 4.5             |                           | 0.36              | 0.44  |               |   |            |
|                      |                                      | 5.5             |                           | 0.36              | 0.44  |               |   |            |
| $I_{IN}$<br>(Note 4) | Maximum Input<br>Leakage Current     | 5.5             |                           | $\pm 0.1$         | $\pm 1.0$                                       | $\mu\text{A}$ | $V_I = V_{CC}, \text{ GND}$   |            |
| $I_{OLD}$            | Minimum Dynamic Output Current       | 5.5             |                           |                   | 75  | mA            | $V_{OLD} = 1.65V \text{ Max}$   |            |
| $I_{OHD}$            | (Note 3)                             | 5.5             |                           |                   | -75   | mA            | $V_{OHD} = 3.85V \text{ Min}$   |            |
| $I_{CC}$<br>(Note 4) | Maximum Quiescent<br>Supply Current  | 5.5             |                           | 2.0               | 20.0  | $\mu\text{A}$ | $V_{IN} = V_{CC}$<br>or GND   |            |

**Note 2:** All outputs loaded; thresholds on input associated with output under test.

**Note 3:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 4:**  $I_{IN}$  and  $I_{CC}$  @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V  $V_{CC}$ .

| DC Electrical Characteristics for ACT |                                      |                        |                        |                   |                                 |  |       |   |
|---------------------------------------|--------------------------------------|------------------------|------------------------|-------------------|---------------------------------|--|-------|---|
| Symbol                                | Parameter                            | V <sub>CC</sub><br>(V) | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> = -40°C to +85°C |  | Units | Conditions  |
|                                       |                                      |                        | Typ                    | Guaranteed Limits |                                 |  |       |   |
| V <sub>IH</sub>                       | Minimum HIGH Level<br>Input Voltage  | 4.5                    | 1.5                    | 2.0               | 2.0                             |  | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V  |
|                                       |                                      | 5.5                    | 1.5                    | 2.0               | 2.0                             |  |       |   |
| V <sub>IL</sub>                       | Maximum LOW Level<br>Input Voltage   | 4.5                    | 1.5                    | 0.8               | 0.8                             |  | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> - 0.1V  |
|                                       |                                      | 5.5                    | 1.5                    | 0.8               | 0.8                             |  |       |   |
| V <sub>OH</sub>                       | Minimum HIGH Level<br>Output Voltage | 4.5                    | 4.49                   | 4.4               | 4.4                             |  | V     | I <sub>OUT</sub> = -50 μA   |
|                                       |                                      | 5.5                    | 5.49                   | 5.4               | 5.4                             |  |       |   |
|                                       |                                      | 4.5                    |                        | 3.86              | 3.76                            |  | V     | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OH</sub> = -24 mA<br>I <sub>OH</sub> = -24 mA (Note 5) |
|                                       |                                      | 5.5                    |                        | 4.86              | 4.76                            |  |       |   |
| V <sub>OL</sub>                       | Maximum LOW Level<br>Output Voltage  | 4.5                    | 0.001                  | 0.1               | 0.1                             |  | V     | I <sub>OUT</sub> = 50 μA  |
|                                       |                                      | 5.5                    | 0.001                  | 0.1               | 0.1                             |  |       |   |
|                                       |                                      | 4.5                    |                        | 0.36              | 0.44                            |  | V     | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 24 mA (Note 5)   |
|                                       |                                      | 5.5                    |                        | 0.36              | 0.44                            |  |       |   |
| I <sub>IN</sub>                       | Maximum Input<br>Leakage Current     | 5.5                    |                        | ±0.1              | ±1.0                            |  | μA    | V <sub>I</sub> = V <sub>CC</sub> , GND  |
| I <sub>CC</sub> T                     | Maximum<br>I <sub>CC</sub> /Input    | 5.5                    | 0.6                    |                   | 1.5                             |  | mA    | V <sub>I</sub> = V <sub>CC</sub> - 2.1V   |
| I <sub>OLD</sub>                      | Minimum Dynamic Output Current       | 5.5                    |                        |                   | 75                              |  | mA    | V <sub>OLD</sub> = 1.65V Max  |
| I <sub>OHD</sub>                      | (Note 6)                             | 5.5                    |                        |                   | -75                             |  | mA    | V <sub>OHD</sub> = 3.85V Min  |
| I <sub>CC</sub>                       | Maximum Quiescent<br>Supply Current  | 5.5                    |                        | 4.0               | 40.0                            |  | μA    | V <sub>IN</sub> = V <sub>CC</sub><br>or GND   |

**Note 5:** All outputs loaded; thresholds on input associated with output under test.  
**Note 6:** Maximum test duration 2.0 ms, one output loaded at a time.

### AC Electrical Characteristics for AC

| Symbol           | Parameter         | V <sub>CC</sub><br>(V)<br>(Note 7) | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |     |     | T <sub>A</sub> = -40°C to +85°C<br>C <sub>L</sub> = 50 pF |      | Units |
|------------------|-------------------|------------------------------------|--|-----|-----|---|------|-------|
|                  |                   |                                    | Min  | Typ | Max | Min   | Max  |       |
| t <sub>PLH</sub> | Propagation Delay | 3.3                                | 1.5  | 4.5 | 9.0 | 1.0   | 10.0 | ns    |
|                  |                   | 5.0                                | 1.5  | 4.0 | 7.0 | 1.0   | 7.5  |       |
| t <sub>PHL</sub> | Propagation Delay | 3.3                                | 1.5  | 4.5 | 8.5 | 1.0   | 9.5  | ns    |
|                  |                   | 5.0                                | 1.5  | 3.5 | 6.5 | 1.0   | 7.0  |       |

Note 7: Voltage Range 3.3 is 3.3V ± 0.3V  
Voltage Range 5.0 is 5.0V ± 0.5V

### AC Electrical Characteristics for ACT

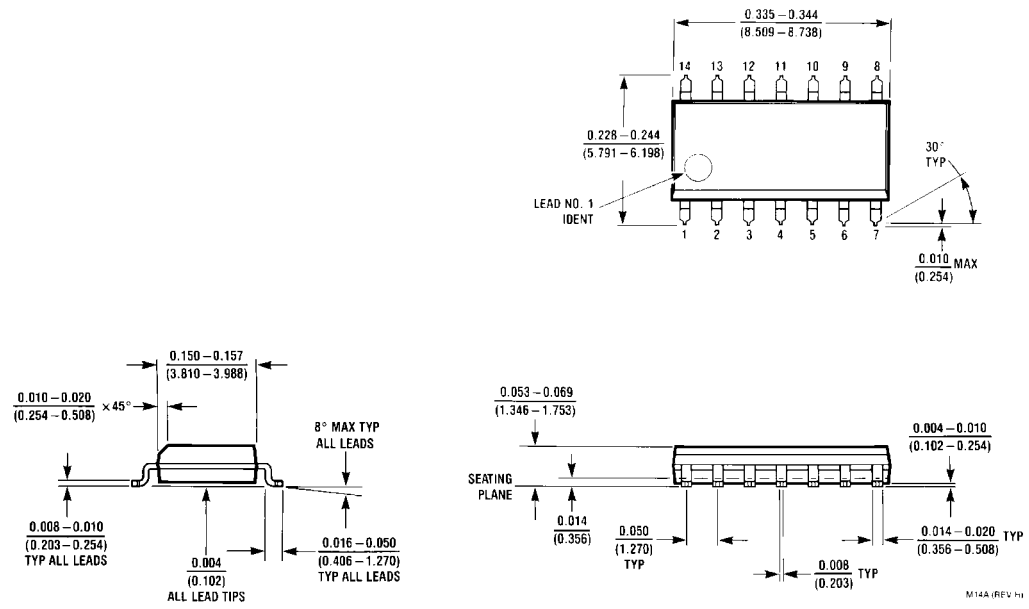
| Symbol           | Parameter         | V <sub>CC</sub><br>(V)<br>(Note 8) | T <sub>A</sub> = +25°C<br>C <sub>L</sub> = 50 pF |     |     | T <sub>A</sub> = -40°C to +85°C<br>C <sub>L</sub> = 50 pF |     | Units |
|------------------|-------------------|------------------------------------|--|-----|-----|---|-----|-------|
|                  |                   |                                    | Min  | Typ | Max | Min   | Max |       |
| t <sub>PLH</sub> | Propagation Delay | 5.0                                | 1.0  | 6.0 | 8.5 | 1.0   | 9.0 | ns    |
| t <sub>PHL</sub> | Propagation Delay | 5.0                                | 1.0  | 5.5 | 8.0 | 1.0   | 8.5 | ns    |

Note 8: Voltage Range 5.0 is 5.0V ± 0.5V

### Capacitance

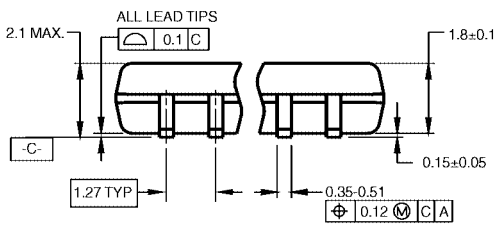
| Symbol          | Parameter                     | Typ  | Units | Conditions             |
|-----------------|-------------------------------|------|-------|------------------------|
| C <sub>IN</sub> | Input Capacitance             | 4.5  | pF    | V <sub>CC</sub> = OPEN |
| V <sub>CC</sub> | Power Dissipation Capacitance | 30.0 | pF    | V <sub>CC</sub> = 5.0V |

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



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

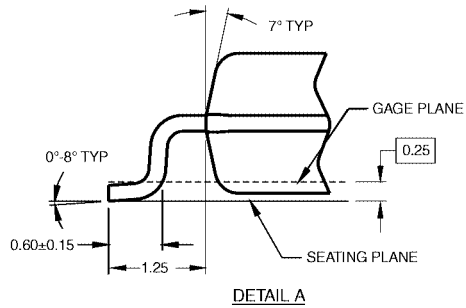
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

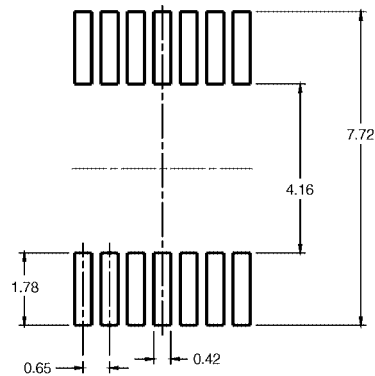
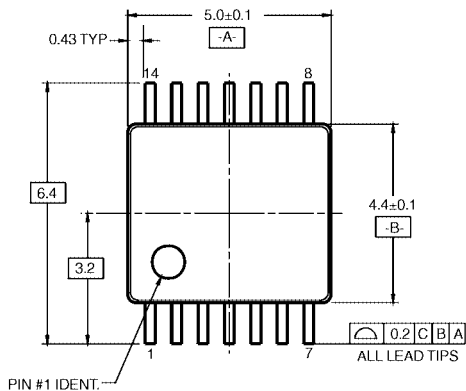
- NOTES:  
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.  
 B. DIMENSIONS ARE IN MILLIMETERS.  
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1

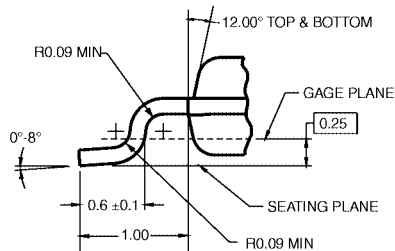
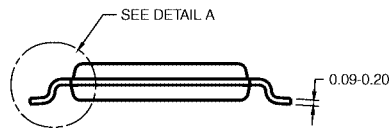
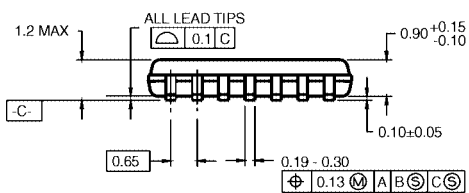


**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
 Package Number M14D**

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



LAND PATTERN RECOMMENDATION



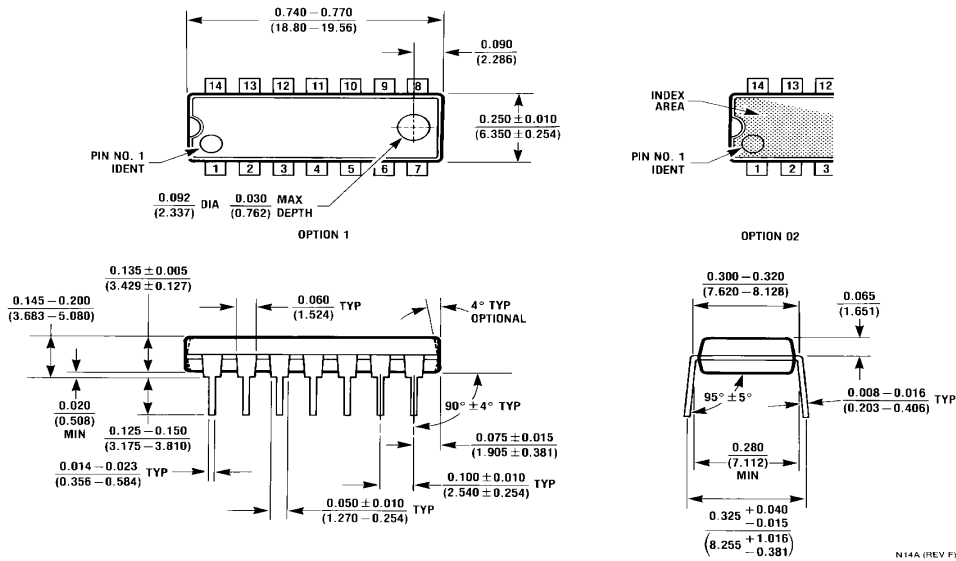
DETAIL A

- NOTES:
- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATE 7/93.
  - B. DIMENSIONS ARE IN MILLIMETERS.
  - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC14RevC3

**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

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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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