



November 1988  
Revised November 1999

## 74AC04 • 74ACT04 Hex Inverter

### General Description

The AC/ACT04 contains six inverters.

### Features

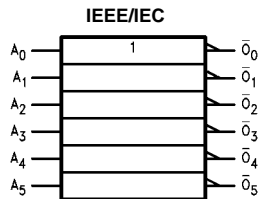
- $I_{CC}$  reduced by 50% on 74AC only
- Outputs source/sink 24 mA
- ACT04 has TTL-compatible inputs

### Ordering Code:

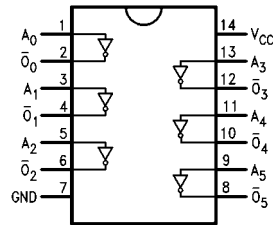
| Order Number | Package Number | Package Description   |
|--------------|----------------|---|
| 74AC04SC     | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Body |
| 74AC04SJ     | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm 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 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) | $T_A = +25^\circ C$ |                   | $T_A = -40^\circ C$ to $+85^\circ C$ |         | 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       | $I_{OUT} = -50 \mu A$   |            |
|                      |                                      | 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>$I_{OH} = -12$ mA<br>$I_{OH} = -24$ mA<br>$I_{OH} = -24$ 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       | $I_{OUT} = 50 \mu A$  |            |
|                      |                                      | 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>$I_{OL} = 12$ mA<br>$I_{OL} = 24$ mA<br>$I_{OL} = 24$ 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             |                     | $\pm 0.1$         | $\pm 1.0$                            | $\mu A$ | $V_I = V_{CC}, GND$   |            |
| $I_{OLD}$            | Minimum Dynamic Output Current       | 5.5             |                     |                   | 75                                   | mA      | $V_{OLD} = 1.65V$ Max   |            |
| $I_{OHD}$            | (Note 3)                             | 5.5             |                     |                   | -75                                  | mA      | $V_{OHD} = 3.85V$ Min   |            |
| $I_{CC}$<br>(Note 4) | Maximum Quiescent<br>Supply Current  | 5.5             |                     | 2.0               | 20.0                                 | $\mu A$ | $V_{IN} = V_{CC}$<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  $V_{CC}$ .

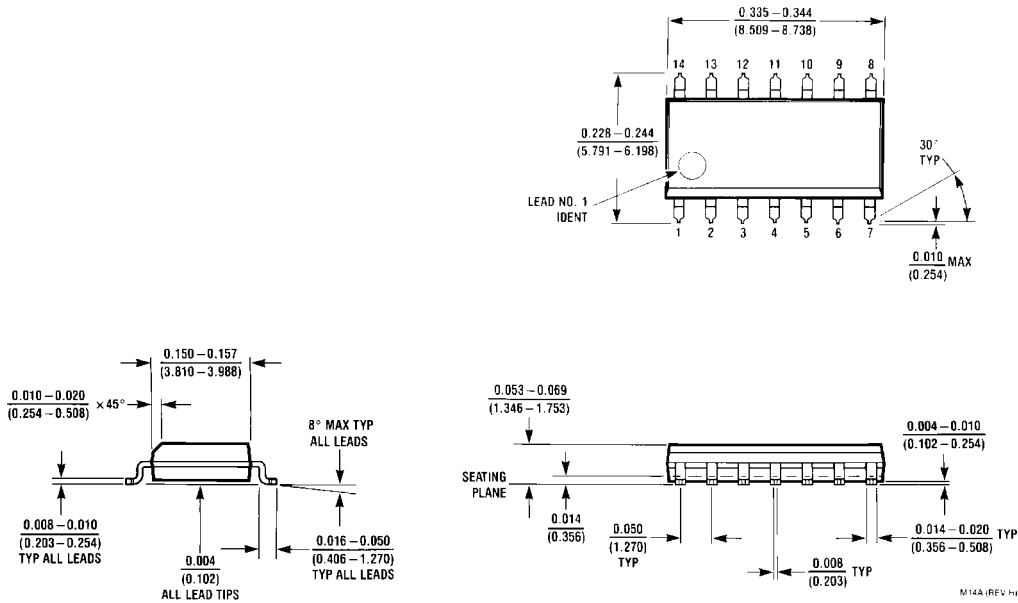
| DC Electrical Characteristics for ACT |                                      |                        |                        |                   |                                 |  |       |   |
|---------------------------------------|--------------------------------------|------------------------|------------------------|-------------------|---------------------------------|--|-------|---|
| 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>CCT</sub>                      | 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.

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| 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<br>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 |     |   |      |       |

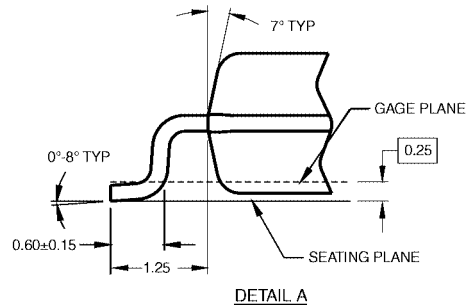
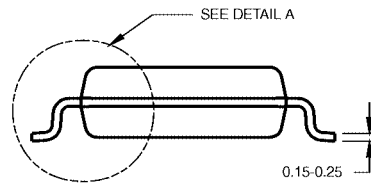
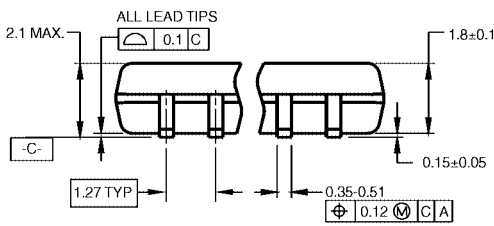
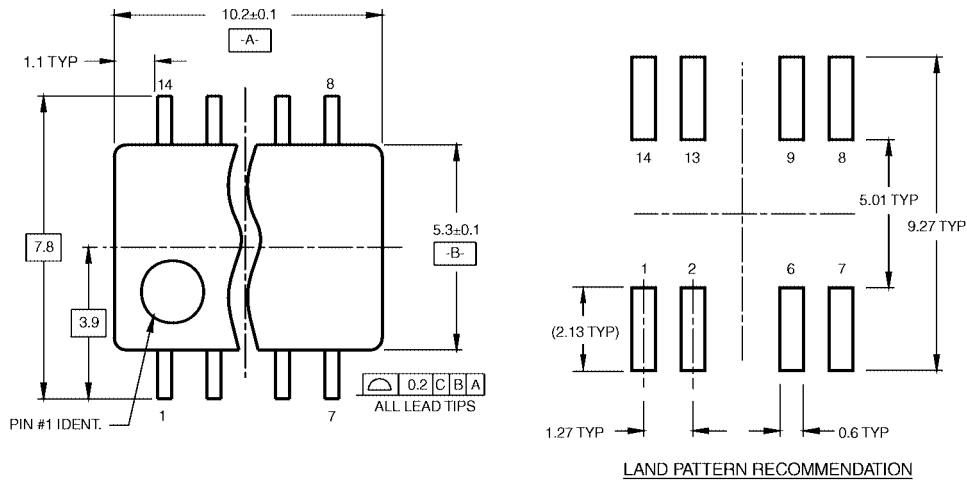
**Physical Dimensions** inches (millimeters) unless otherwise noted



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

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

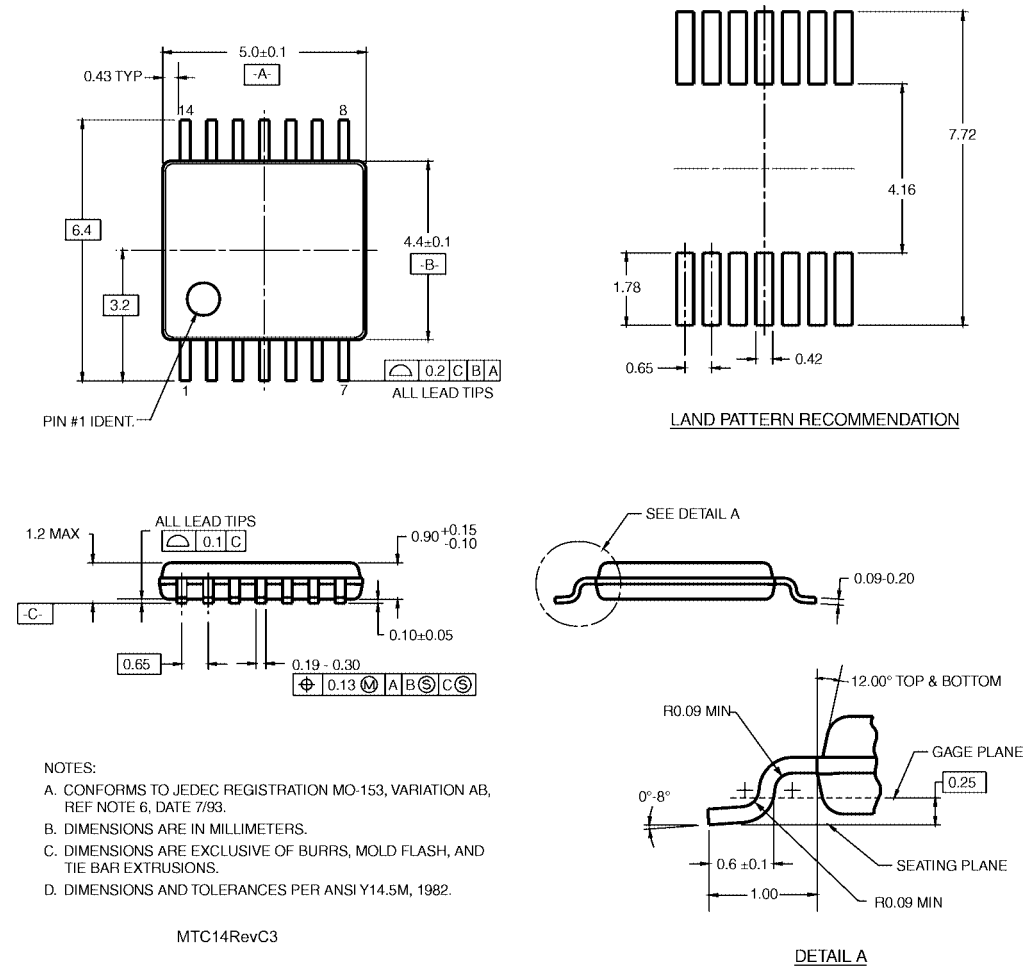


- NOTES:
- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
  - B. DIMENSIONS ARE IN MILLIMETERS.
  - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1

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

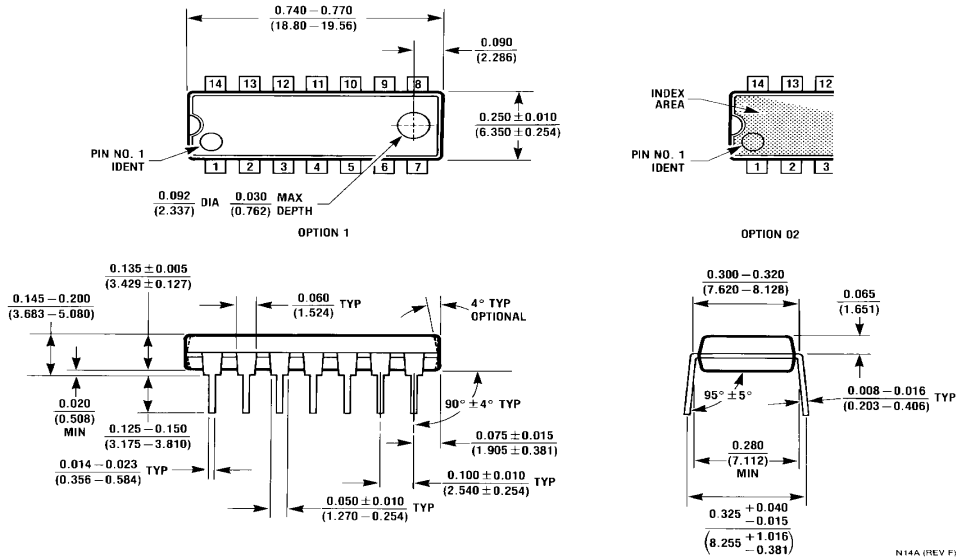
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC14**

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**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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