

## 74AC174 • 74ACT174

### Hex D-Type Flip-Flop with Master Reset

#### General Description

The AC/ACT174 is a high-speed hex D-type flip-flop. The device is used primarily as a 6-bit edge-triggered storage register. The information on the D inputs is transferred to storage during the LOW-to-HIGH clock transition. The device has a Master Reset to simultaneously clear all flip-flops.

#### Features

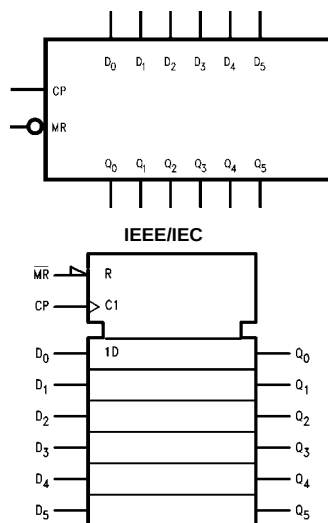
- $I_{CC}$  reduced by 50%
- Outputs source/sink 24 mA
- ACT174 has TTL-compatible inputs

#### Ordering Code:

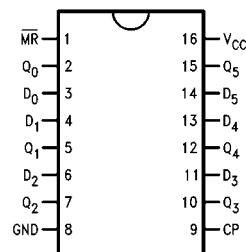
| Order Number | Package Number | Package Description                                                         |
|--------------|----------------|-----------------------------------------------------------------------------|
| 74AC174SC    | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow |
| 74AC174SJ    | M16D           | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| 74AC174MTC   | MTC16          | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74AC174PC    | N16E           | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide       |
| 74ACT174SC   | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow |
| 74ACT174SJ   | M16D           | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| 74ACT174MTC  | MTC16          | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74ACT174PC   | N16E           | 16-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.

#### Logic Symbols



#### Connection Diagram



#### Pin Descriptions

| Pin Names       | Description        |
|-----------------|--------------------|
| $D_0$ – $D_5$   | Data Inputs        |
| CP              | Clock Pulse Input  |
| $\overline{MR}$ | Master Reset Input |
| $Q_0$ – $Q_5$   | Outputs            |

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### Functional Description

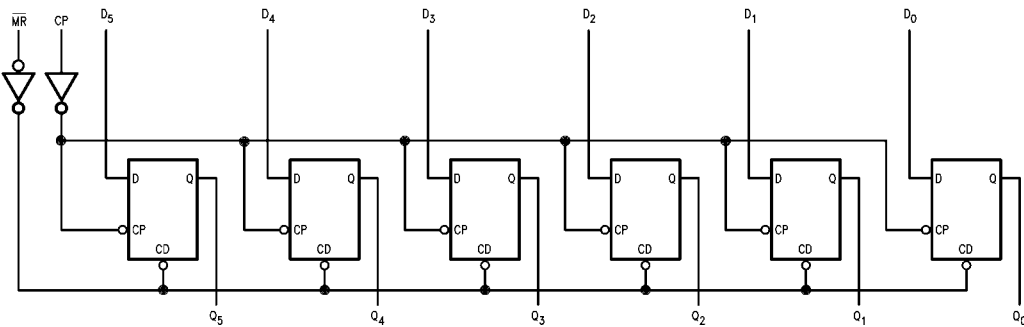
The AC/ACT174 consists of six edge-triggered D-type flip-flops with individual D inputs and Q outputs. The Clock (CP) and Master Reset (MR) are common to all flip-flops. Each D input's state is transferred to the corresponding flip-flop's output following the LOW-to-HIGH Clock (CP) transition. A LOW input to the Master Reset ( $\overline{\text{MR}}$ ) will force all outputs LOW independent of Clock or Data inputs. The AC/ACT174 is useful for applications where the true output only is required and the Clock and Master Reset are common to all storage elements.

### Truth Table

| Inputs                 |    |   | Output |
|------------------------|----|---|--------|
| $\overline{\text{MR}}$ | CP | D | Q      |
| L                      | X  | X | L      |
| H                      | ↗  | H | H      |
| H                      | ↗  | L | L      |
| H                      | L  | X | Q      |

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 ↗ = LOW-to-HIGH Transition  
 X = Immaterial

### Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

**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                   |
| $V = V_{CC} + 0.5V$                      | +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, without 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 <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  | 3.0                    | 1.5                    | 2.1               | 2.1                             | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> − 0.1V                                                                                              |
|                             |                                      | 4.5                    | 2.25                   | 3.15              | 3.15                            |       |                                                                                                                                                   |
|                             |                                      | 5.5                    | 2.75                   | 3.85              | 3.85                            |       |                                                                                                                                                   |
| V <sub>IL</sub>             | Maximum LOW Level<br>Input Voltage   | 3.0                    | 1.5                    | 0.9               | 0.9                             | V     | V <sub>OUT</sub> = 0.1V<br>or V <sub>CC</sub> − 0.1V                                                                                              |
|                             |                                      | 4.5                    | 2.25                   | 1.35              | 1.35                            |       |                                                                                                                                                   |
|                             |                                      | 5.5                    | 2.75                   | 1.65              | 1.65                            |       |                                                                                                                                                   |
| V <sub>OH</sub>             | Minimum HIGH Level<br>Output Voltage | 3.0                    | 2.99                   | 2.9               | 2.9                             | V     | I <sub>OUT</sub> = −50 μA                                                                                                                         |
|                             |                                      | 4.5                    | 4.49                   | 4.4               | 4.4                             |       |                                                                                                                                                   |
|                             |                                      | 5.5                    | 5.49                   | 5.4               | 5.4                             |       |                                                                                                                                                   |
|                             |                                      | 3.0                    |                        | 2.56              | 2.46                            | V     | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OH</sub> = −12 mA<br>I <sub>OH</sub> = −24 mA<br>I <sub>OH</sub> = −24 mA (Note 2) |
|                             |                                      | 4.5                    |                        | 3.86              | 3.76                            |       |                                                                                                                                                   |
|                             |                                      | 5.5                    |                        | 4.86              | 4.76                            |       |                                                                                                                                                   |
| V <sub>OL</sub>             | Maximum LOW Level<br>Output Voltage  | 3.0                    | 0.002                  | 0.1               | 0.1                             | V     | I <sub>OUT</sub> = 50 μA                                                                                                                          |
|                             |                                      | 4.5                    | 0.001                  | 0.1               | 0.1                             |       |                                                                                                                                                   |
|                             |                                      | 5.5                    | 0.001                  | 0.1               | 0.1                             |       |                                                                                                                                                   |
|                             |                                      | 3.0                    |                        | 0.36              | 0.44                            | V     | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OL</sub> = 12 mA<br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 24 mA (Note 2)    |
|                             |                                      | 4.5                    |                        | 0.36              | 0.44                            |       |                                                                                                                                                   |
|                             |                                      | 5.5                    |                        | 0.36              | 0.44                            |       |                                                                                                                                                   |
| I <sub>IN</sub><br>(Note 4) | Maximum Input<br>Leakage Current     | 5.5                    |                        | ±0.1              | ±1.0                            | μA    | V <sub>I</sub> = V <sub>CC</sub><br>or GND                                                                                                        |
| I <sub>OLD</sub>            | Minimum Dynamic                      | 5.5                    |                        |                   | 75                              | mA    | V <sub>OLD</sub> = 1.65V Max                                                                                                                      |
| I <sub>OHD</sub>            | Output Current (Note 3)              | 5.5                    |                        |                   | −75                             | mA    | V <sub>OHD</sub> = 3.85V Min                                                                                                                      |
| I <sub>CC</sub><br>(Note 4) | Maximum Quiescent<br>Supply Current  | 5.5                    |                        | 4.0               | 40.0                            | μA    | V <sub>IN</sub> = V <sub>CC</sub><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                      | 5.5                    |                        |                   | 75                              |  | mA    | V <sub>OLD</sub> = 1.65V Max                                                                                          |
| I <sub>OHD</sub> | Output Current (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  |       |
| f <sub>MAX</sub> | Maximum Clock<br>Frequency                | 3.3<br>5.0                         | 90<br>100                                        | 100<br>125 |      | 70<br>100                                                 |      | MHz   |
| t <sub>PLH</sub> | Propagation Delay<br>CP to Q <sub>n</sub> | 3.3                                | 2.0                                              | 9.0        | 11.5 | 1.5                                                       | 12.5 | ns    |
|                  |                                           | 5.0                                | 1.5                                              | 6.0        | 8.5  | 1.0                                                       | 9.5  |       |
| t <sub>PHL</sub> | Propagation Delay<br>CP to Q <sub>n</sub> | 3.3                                | 2.0                                              | 8.5        | 11.0 | 1.5                                                       | 12.0 | ns    |
|                  |                                           | 5.0                                | 1.5                                              | 6.0        | 8.0  | 1.0                                                       | 9.0  |       |
| t <sub>PHL</sub> | Propagation Delay<br>MR to Q <sub>n</sub> | 3.3                                | 2.5                                              | 9.0        | 11.5 | 2.0                                                       | 12.5 | ns    |
|                  |                                           | 5.0                                | 1.5                                              | 7.0        | 9.0  | 1.5                                                       | 10.5 |       |

**Note 7:** Voltage Range 3.3 is 3.3V ± 0.3V

Voltage Range 5.0 is 5.0V ± 0.5V

### AC Operating Requirements for AC

| 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 |
|------------------|-------------------------|------------------------------------|--------------------------------------------------|--------------------|-----------------------------------------------------------|-------|
|                  |                         |                                    | Typ                                              | Guaranteed Minimum |                                                           |       |
| t <sub>S</sub>   | Setup Time, HIGH or LOW | 3.3                                | 2.5                                              | 6.5                | 7.0                                                       | ns    |
|                  | D <sub>n</sub> to CP    | 5.0                                | 2.0                                              | 5.0                | 5.5                                                       |       |
| t <sub>H</sub>   | Hold Time, HIGH or LOW  | 3.3                                | 1.0                                              | 3.0                | 3.0                                                       | ns    |
|                  | D <sub>n</sub> to CP    | 5.0                                | 0.5                                              | 3.0                | 3.0                                                       |       |
| t <sub>W</sub>   | MR Pulse Width, LOW     | 3.3                                | 1.0                                              | 5.5                | 7.0                                                       | ns    |
|                  |                         | 5.0                                | 1.0                                              | 5.0                | 5.0                                                       |       |
| t <sub>W</sub>   | CP Pulse Width          | 3.3                                | 1.0                                              | 5.5                | 7.0                                                       | ns    |
|                  |                         | 5.0                                | 1.0                                              | 5.0                | 5.0                                                       |       |
| t <sub>REC</sub> | Recovery Time           | 3.3                                | 0                                                | 2.5                | 2.5                                                       | ns    |
|                  | MR to CP                | 5.0                                | 0                                                | 2.0                | 2.0                                                       |       |

**Note 8:** 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 9) | 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  |       |
| f <sub>MAX</sub> | Maximum Clock<br>Frequency                | 5.0                                | 165                                              | 200 |      | 140                                                       |      | MHz   |
| t <sub>PLH</sub> | Propagation Delay<br>CP to Q <sub>n</sub> | 5.0                                | 1.5                                              | 7.0 | 10.5 | 1.5                                                       | 11.5 | ns    |
| t <sub>PHL</sub> | Propagation Delay<br>CP to Q <sub>n</sub> | 5.0                                | 1.5                                              | 7.0 | 10.5 | 1.5                                                       | 11.5 | ns    |
| t <sub>PHL</sub> | Propagation Delay<br>MR to Q <sub>n</sub> | 5.0                                | 1.5                                              | 6.5 | 9.5  | 1.5                                                       | 11.0 | ns    |

**Note 9:** Voltage Range 5.0 is 5.0V ± 0.5V

### AC Operating Requirements for ACT

| Symbol           | Parameter                                       | V <sub>CC</sub><br>(V)<br>(Note 10) | 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 |
|------------------|-------------------------------------------------|-------------------------------------|--------------------------------------------------|--------------------|-----------------------------------------------------------|-------|
|                  |                                                 |                                     | Typ                                              | Guaranteed Minimum |                                                           |       |
| t <sub>S</sub>   | Setup Time, HIGH or LOW<br>D <sub>n</sub> to CP | 5.0                                 | 0.5                                              | 1.5                | 1.5                                                       | ns    |
| t <sub>H</sub>   | Hold Time, HIGH or LOW<br>D <sub>n</sub> to CP  | 5.0                                 | 1.0                                              | 2.0                | 2.0                                                       | ns    |
| t <sub>W</sub>   | MR Pulse Width, LOW                             | 5.0                                 | 1.5                                              | 3.0                | 3.5                                                       | ns    |
| t <sub>W</sub>   | CP Pulse Width, HIGH or LOW                     | 5.0                                 | 1.5                                              | 3.0                | 3.5                                                       | ns    |
| t <sub>rec</sub> | Recovery Time<br>MR to CP                       | 5.0                                 | −1.0                                             | 0.5                | 0.5                                                       | ns    |

**Note 10:** Voltage Range 5.0 is 5.0V ± 0.5V

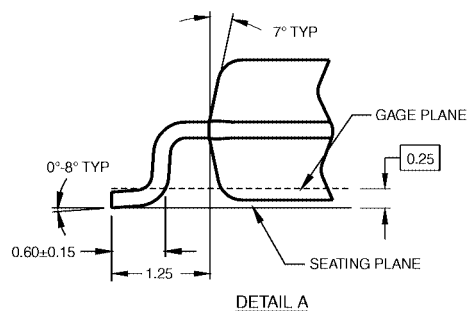
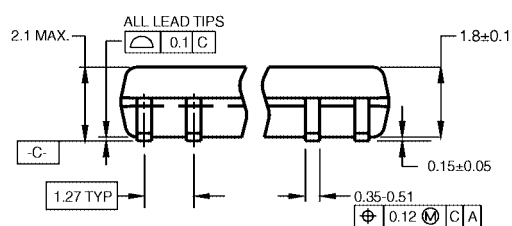
### Capacitance

| Symbol          | Parameter                     | Typ  | Units | Conditions             |
|-----------------|-------------------------------|------|-------|------------------------|
| C <sub>IN</sub> | Input Capacitance             | 4.5  | pF    | V <sub>CC</sub> = OPEN |
| C <sub>PD</sub> | Power Dissipation Capacitance | 85.0 | pF    | V <sub>CC</sub> = 5.0V |

# Physical Dimensions inches (millimeters) unless otherwise noted



16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow  
Package Number M16A



A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.

B. DIMENSIONS ARE IN MILLIMETERS.

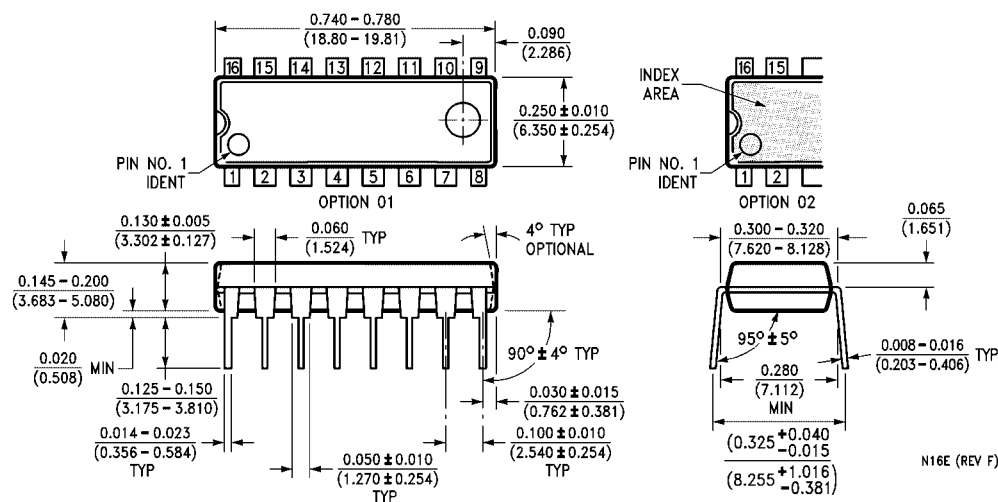
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

**16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
Package Number M16D**

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



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



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide  
Package Number N16E

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