

## 74AC151 • 74ACT151 8-Input Multiplexer

### General Description

The AC/ACT151 is a high-speed 8-input digital multiplexer. It provides, in one package, the ability to select one line of data from up to eight sources. The AC/ACT151 can be used as a universal function generator to generate any logic function of four variables. Both true and complementary outputs are provided.

### Features

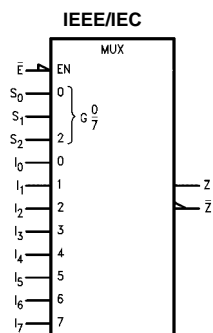
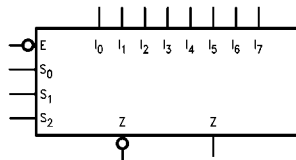
- $I_{CC}$  reduced by 50%
- Outputs source/sink 24 mA
- ACT151 has TTL-compatible inputs

### Ordering Code:

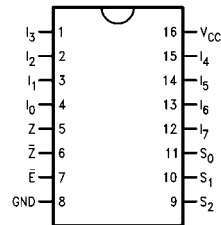
| Order Number | Package Number | Package Description   |
|--------------|----------------|---|
| 74AC151SC    | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body |
| 74AC151SJ    | M16D           | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                     |
| 74AC151MTC   | MTC16          | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide       |
| 74AC151PC    | N16E           | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide            |
| 74ACT151SC   | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body |
| 74ACT151SJ   | M16D           | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                     |
| 74ACT151PC   | 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          |
|---------------|----------------------|
| $I_0$ - $I_7$ | Data Inputs          |
| $S_0$ - $S_2$ | Select Inputs        |
| $\bar{E}$     | Enable Input         |
| Z             | Data Output          |
| $\bar{Z}$     | Inverted Data Output |

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**Truth Table**

| Inputs    |       |       |       | Outputs     |       |
|-----------|-------|-------|-------|-------------|-------|
| $\bar{E}$ | $S_2$ | $S_1$ | $S_0$ | $\bar{Z}$   | Z     |
| H         | X     | X     | X     | H           | L     |
| L         | L     | L     | L     | $\bar{I}_0$ | $I_0$ |
| L         | L     | L     | H     | $\bar{I}_1$ | $I_1$ |
| L         | L     | H     | L     | $\bar{I}_2$ | $I_2$ |
| L         | L     | H     | H     | $\bar{I}_3$ | $I_3$ |
| L         | H     | L     | L     | $\bar{I}_4$ | $I_4$ |
| L         | H     | L     | H     | $\bar{I}_5$ | $I_5$ |
| L         | H     | H     | L     | $\bar{I}_6$ | $I_6$ |
| L         | H     | H     | H     | $\bar{I}_7$ | $I_7$ |

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial

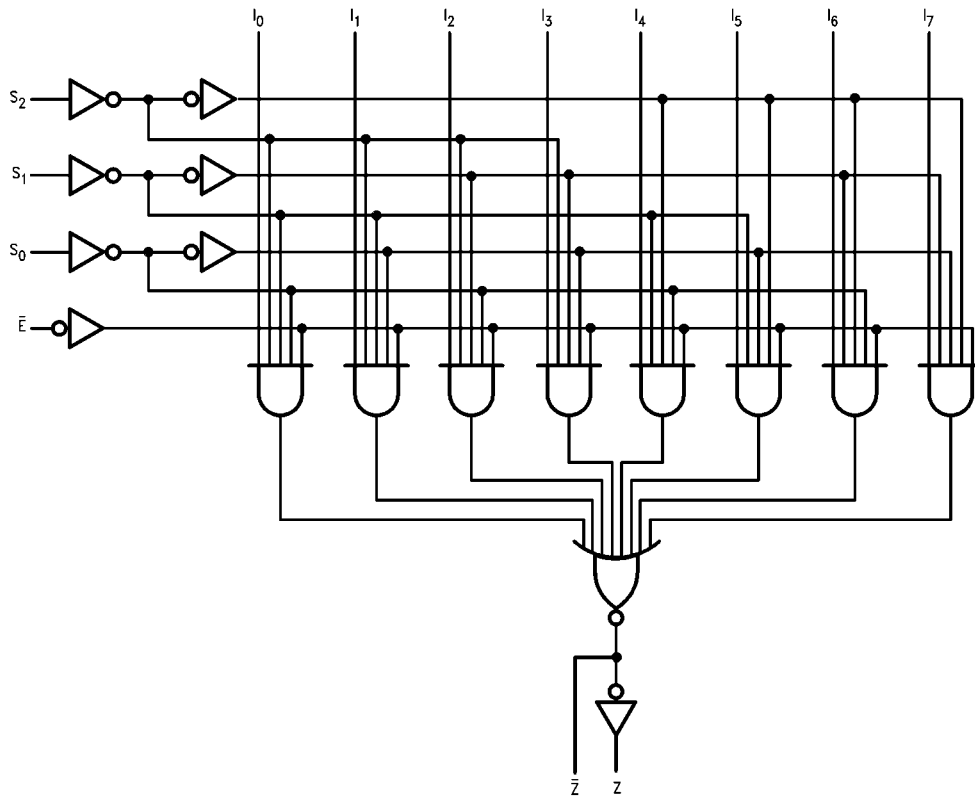
**Functional Description**

The AC/ACT151 is a logic implementation of a single pole, 8-position switch with the switch position controlled by the state of three Select inputs,  $S_0, S_1, S_2$ . Both true and complementary outputs are provided. The Enable input ( $\bar{E}$ ) is active LOW. When it is not activated, the complementary output is HIGH and the true output is LOW regardless of all other inputs. The logic function provided at the output is:

$$Z = \bar{E} \cdot (I_0 \cdot \bar{S}_0 \cdot \bar{S}_1 \cdot \bar{S}_2 + I_1 \cdot S_0 \cdot \bar{S}_1 \cdot \bar{S}_2 + I_2 \cdot \bar{S}_0 \cdot S_1 \cdot \bar{S}_2 + I_3 \cdot S_0 \cdot S_1 \cdot \bar{S}_2 + I_4 \cdot \bar{S}_0 \cdot \bar{S}_1 \cdot S_2 + I_5 \cdot S_0 \cdot \bar{S}_1 \cdot S_2 + I_6 \cdot \bar{S}_0 \cdot S_1 \cdot S_2 + I_7 \cdot S_0 \cdot S_1 \cdot S_2)$$

The AC/ACT151 provides the ability, in one package, to select from eight sources of data or control information. By proper manipulation of the inputs, the AC/ACT151 can provide any logic function of four variables and its complement.

**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                   |
| $V_O = V_{CC} + 0.5V$   | +20 mA                   |
| DC Output Voltage ( $V_O$ )   | -0.5V to $V_{CC} + 0.5V$ |
| DC Output Source<br>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, 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                            | $V_{CC}$<br>(V) | $T_A = +25^\circ\text{C}$ |                   | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |                   | Units   | Conditions |
|----------------------|--------------------------------------|-----------------|---------------------------|-------------------|---|-------------------|---|------------|
|                      |                                      |                 | Typ                       | Guaranteed Limits | 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                      | 5.5             |                           |                   | 75  | mA                | $V_{OLD} = 1.65V$ Max   |            |
| $I_{OHD}$            | Output Current (Note 3)              | 5.5             |                           |                   | -75   | mA                | $V_{OHD} = 3.85V$ Min   |            |
| $I_{CC}$<br>(Note 4) | Maximum Quiescent<br>Supply Current  | 5.5             |                           | 4.0               | 40.0  | $\mu A$           | $V_{IN} = V_{CC}$ 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>  | 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<br>Output Current (Note 6) | 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  |       |
| t <sub>PLH</sub> | Propagation Delay<br>S <sub>n</sub> to Z or $\bar{Z}$ | 3.3                                | 3.0  | 11.5 | 18.0 | 3.0   | 20.0 | ns    |
|                  |   | 5.0                                | 2.5  | 8.5  | 13.0 | 2.0   | 15.0 |       |
| t <sub>PHL</sub> | Propagation Delay<br>S <sub>n</sub> to Z or $\bar{Z}$ | 3.3                                | 2.5  | 12.0 | 18.0 | 2.5   | 20.0 | ns    |
|                  |   | 5.0                                | 2.0  | 8.5  | 13.0 | 1.5   | 15.0 |       |
| t <sub>PLH</sub> | Propagation Delay<br>$\bar{E}$ to Z or $\bar{Z}$      | 3.3                                | 2.5  | 8.0  | 13.0 | 2.0   | 14.0 | ns    |
|                  |   | 5.0                                | 2.0  | 6.0  | 10.0 | 1.5   | 11.0 |       |
| t <sub>PHL</sub> | Propagation Delay<br>$\bar{E}$ to Z or $\bar{Z}$      | 3.3                                | 1.5  | 8.5  | 13.0 | 1.5   | 14.0 | ns    |
|                  |   | 5.0                                | 1.5  | 6.5  | 10.0 | 1.5   | 11.0 |       |
| t <sub>PLH</sub> | Propagation Delay<br>I <sub>n</sub> to Z or $\bar{Z}$ | 3.3                                | 2.5  | 9.5  | 14.0 | 2.0   | 15.5 | ns    |
|                  |   | 5.0                                | 1.5  | 7.0  | 10.5 | 1.5   | 11.0 |       |
| t <sub>PHL</sub> | Propagation Delay<br>I <sub>n</sub> to Z or $\bar{Z}$ | 3.3                                | 2.5  | 9.5  | 15.0 | 2.0   | 16.0 | ns    |
|                  |   | 5.0                                | 1.5  | 7.0  | 11.0 | 1.5   | 12.0 |       |

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

Voltage Range 5.0 is 5.0V ± 0.5V

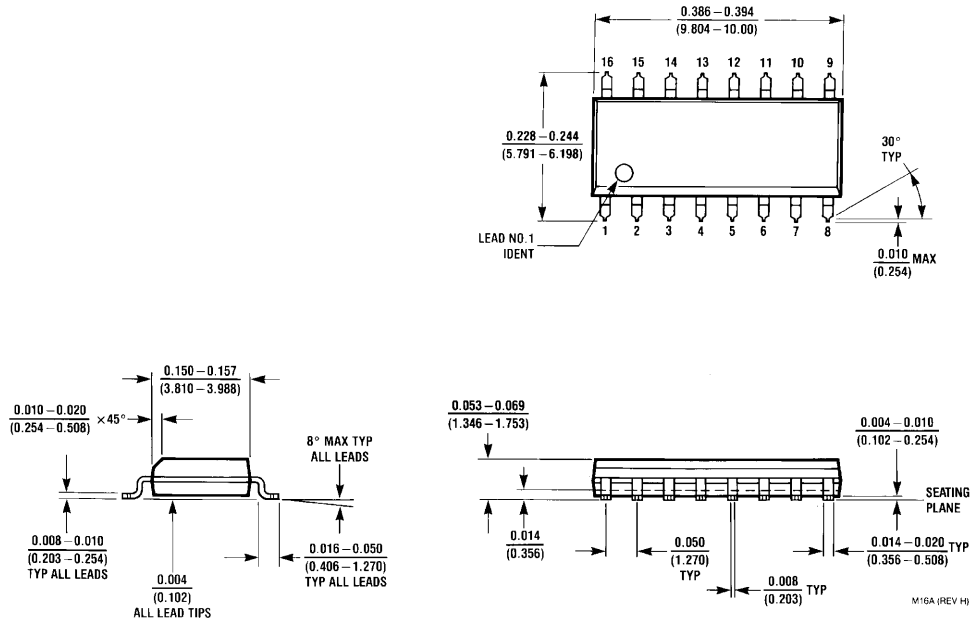
| AC Electrical Characteristics for ACT |  |                                    |  |      |      |   |      |       |
|---------------------------------------|--|------------------------------------|--|------|------|---|------|-------|
| Symbol                                | Parameter  | V <sub>CC</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<br>S <sub>n</sub> to Z         | 5.0                                | 3.5  | 12.5 | 15.5 | 3.0   | 17.0 | ns    |
| t <sub>PHL</sub>                      | Propagation Delay<br>S <sub>n</sub> to Z         | 5.0                                | 3.5  | 12.5 | 15.5 | 3.0   | 16.5 | ns    |
| t <sub>PLH</sub>                      | Propagation Delay<br>S <sub>n</sub> to $\bar{Z}$ | 5.0                                | 3.5  | 12.5 | 15.0 | 3.0   | 16.5 | ns    |
| t <sub>PHL</sub>                      | Propagation Delay<br>S <sub>n</sub> to $\bar{Z}$ | 5.0                                | 4.0  | 12.5 | 16.5 | 3.5   | 18.5 | ns    |
| t <sub>PLH</sub>                      | Propagation Delay<br>$\bar{E}$ to Z              | 5.0                                | 2.5  | 6.0  | 9.5  | 2.5   | 10.0 | ns    |
| t <sub>PHL</sub>                      | Propagation Delay<br>$\bar{E}$ to Z              | 5.0                                | 2.5  | 6.0  | 9.0  | 2.5   | 10.0 | ns    |
| t <sub>PLH</sub>                      | Propagation Delay<br>$\bar{E}$ to $\bar{Z}$      | 5.0                                | 2.5  | 6.0  | 8.5  | 2.5   | 9.5  | ns    |
| t <sub>PHL</sub>                      | Propagation Delay<br>$\bar{E}$ to $\bar{Z}$      | 5.0                                | 3.0  | 6.5  | 10.0 | 2.5   | 10.5 | ns    |
| t <sub>PLH</sub>                      | Propagation Delay<br>I <sub>n</sub> to Z         | 5.0                                | 3.5  | 7.5  | 11.5 | 3.0   | 12.5 | ns    |
| t <sub>PHL</sub>                      | Propagation Delay<br>I <sub>n</sub> to Z         | 5.0                                | 3.5  | 8.0  | 12.0 | 3.0   | 13.5 | ns    |
| t <sub>PLH</sub>                      | Propagation Delay<br>I <sub>n</sub> to $\bar{Z}$ | 5.0                                | 3.5  | 8.0  | 12.0 | 3.0   | 13.0 | ns    |
| t <sub>PHL</sub>                      | Propagation Delay<br>I <sub>n</sub> to $\bar{Z}$ | 5.0                                | 4.0  | 8.0  | 12.5 | 3.0   | 14.0 | ns    |

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

### Capacitance

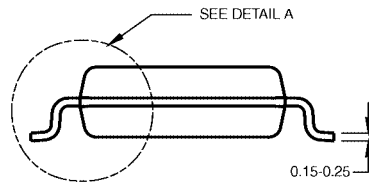
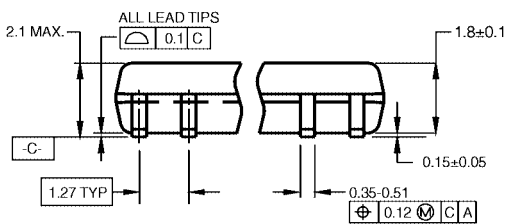
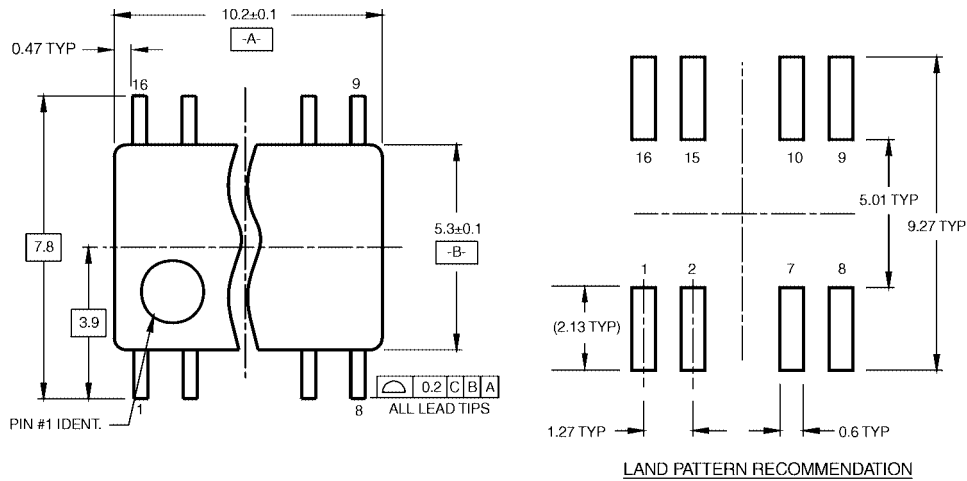
| Symbol          | Parameter                     | Typ  | Units | Conditions             |
|-----------------|-------------------------------|------|-------|------------------------|
| C <sub>IN</sub> | Input Capacitance             | 4.5  | pF    | V <sub>CC</sub> = OPEN |
| C <sub>PD</sub> | Power Dissipation Capacitance | 70.0 | 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 Body  
Package Number M16A**

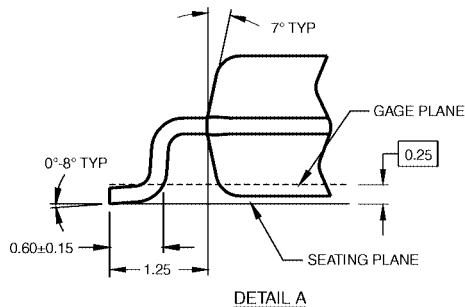
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

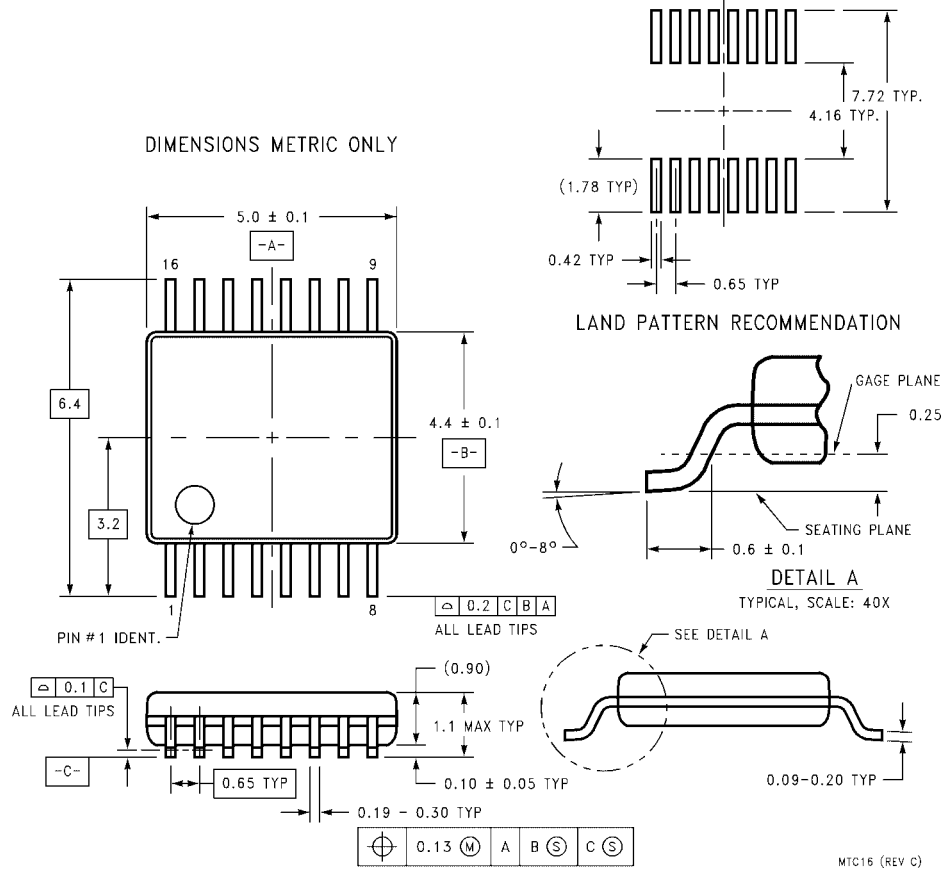
- NOTES:  
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.  
 B. DIMENSIONS ARE IN MILLIMETERS.  
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M16DRevB1



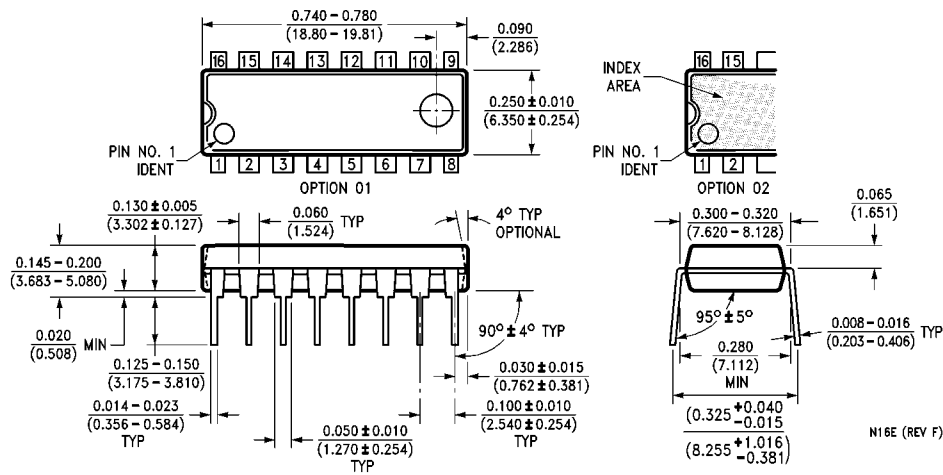
**16-Lead Small Outline Package (SOIC), EIAJ TYPE II, 5.3mm Wide  
 Package Number M16D**

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



**16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC16**

**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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