

## 74AC153 • 74ACT153 Dual 4-Input Multiplexer

### General Description

The AC/ACT153 is a high-speed dual 4-input multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present data in the true (non-inverted) form. In addition to multiplexer operation, the AC/ACT153 can act as a function generator and generate any two functions of three variables.

### Features

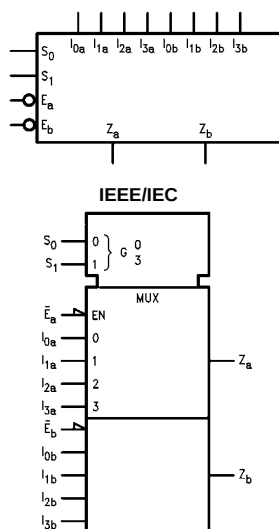
- $I_{CC}$  reduced by 50%
- Outputs source/sink 24 mA
- ACT153 has TTL-compatible inputs

### Ordering Code:

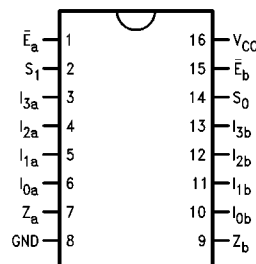
| Order Number | Package Number | Package Description                                                               |
|--------------|----------------|-----------------------------------------------------------------------------------|
| 74AC153SC    | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body |
| 74AC153SJ    | M16D           | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                     |
| 74AC153MTC   | MTC16          | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide       |
| 74AC153PC    | N16E           | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide            |
| 74ACT153SC   | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body |
| 74ACT153MTC  | MTC16          | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm 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          |
|---------------------|----------------------|
| $I_{0a}$ – $I_{3a}$ | Side A Data Inputs   |
| $I_{0b}$ – $I_{3b}$ | Side B Data Inputs   |
| $S_0, S_1$          | Common Select Inputs |
| $\bar{E}_a$         | Side A Enable Input  |
| $\bar{E}_b$         | Side B Enable Input  |
| $Z_a$               | Side A Output        |
| $Z_b$               | Side B Output        |

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## Functional Description

The AC/ACT153 is a dual 4-input multiplexer. It can select two bits of data from up to four sources under the control of the common Select inputs ( $S_0$ ,  $S_1$ ). The two 4-input multiplexer circuits have individual active-LOW Enables ( $\bar{E}_a$ ,  $\bar{E}_b$ ) which can be used to strobe the outputs independently. When the Enables ( $\bar{E}_a$ ,  $\bar{E}_b$ ) are HIGH, the corresponding outputs  $Z_a$ ,  $Z_b$  are forced LOW. The AC/ACT153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the Select inputs. The logic equations for the outputs are shown below.

$$Z_a = \bar{E}_a \cdot (I_{0a} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1a} \cdot \bar{S}_1 \cdot S_0 + I_{2a} \cdot S_1 \cdot \bar{S}_0 + I_{3a} \cdot S_1 \cdot S_0)$$

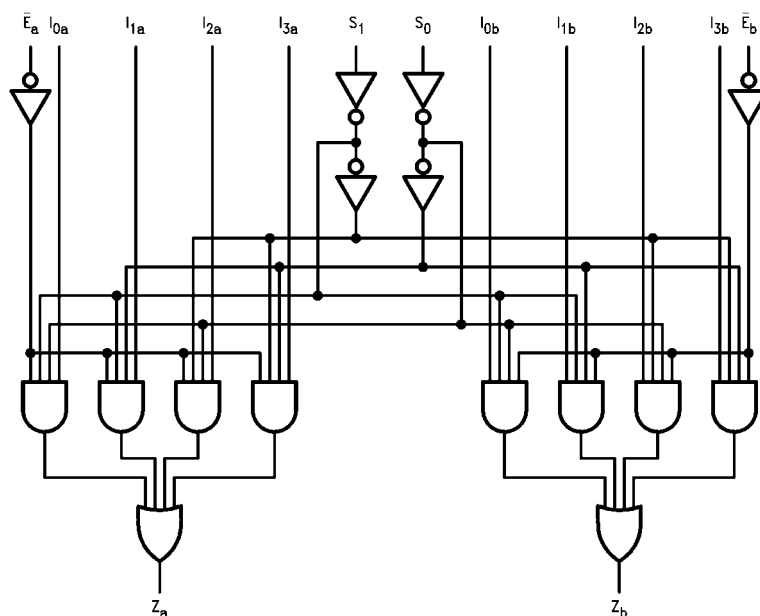
$$Z_b = \bar{E}_b \cdot (I_{0b} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1b} \cdot \bar{S}_1 \cdot S_0 + I_{2b} \cdot S_1 \cdot \bar{S}_0 + I_{3b} \cdot S_1 \cdot S_0)$$

## Truth Table

| Select Inputs  |                | Inputs (a or b) |                |                |                |                | Output |
|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|--------|
| S <sub>0</sub> | S <sub>1</sub> | $\bar{E}$       | I <sub>0</sub> | I <sub>1</sub> | I <sub>2</sub> | I <sub>3</sub> | Z      |
| X              | X              | H               | X              | X              | X              | X              | L      |
| L              | L              | L               | L              | X              | X              | X              | L      |
| L              | L              | L               | H              | X              | X              | X              | H      |
| H              | L              | L               | X              | L              | X              | X              | L      |
| H              | L              | L               | X              | H              | X              | X              | H      |
| L              | H              | L               | X              | X              | L              | X              | L      |
| L              | H              | L               | X              | X              | H              | X              | H      |
| H              | H              | L               | X              | X              | X              | L              | L      |
| H              | H              | L               | X              | X              | X              | H              | H      |

H = HIGH Voltage Level  
L = LOW Voltage Level  
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                   |
| $V_O = V_{CC} + 0.5V$                    | +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, 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> , 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 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 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 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 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 Leakage Current     | 5.5                    |                        | ±0.1              | ±1.0                            | μA | V <sub>I</sub> = V <sub>CC</sub> , GND                                                                                  |            |
| I <sub>CCT</sub> | Maximum 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 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 <sub>n</sub> | 3.3                                | 2.5                                              | 9.5 | 15.0 | 2.5                                                       | 17.5 | ns    |
|                  |                                                       | 5.0                                | 2.0                                              | 6.5 | 11.0 | 2.0                                                       | 12.5 |       |
| t <sub>PHL</sub> | Propagation Delay<br>S <sub>n</sub> to Z <sub>n</sub> | 3.3                                | 3.0                                              | 8.5 | 14.5 | 2.5                                                       | 16.5 | ns    |
|                  |                                                       | 5.0                                | 2.5                                              | 6.5 | 11.0 | 2.0                                                       | 12.0 |       |
| t <sub>PLH</sub> | Propagation Delay<br>$\bar{E}$ to Z <sub>n</sub>      | 3.3                                | 2.5                                              | 8.0 | 13.5 | 2.0                                                       | 16.0 | ns    |
|                  |                                                       | 5.0                                | 1.5                                              | 5.5 | 9.5  | 1.5                                                       | 11.0 |       |
| t <sub>PHL</sub> | Propagation Delay<br>$\bar{E}$ to Z <sub>n</sub>      | 3.3                                | 2.5                                              | 7.0 | 11.0 | 2.0                                                       | 12.5 | ns    |
|                  |                                                       | 5.0                                | 2.0                                              | 5.0 | 8.0  | 1.5                                                       | 9.0  |       |
| t <sub>PLH</sub> | Propagation Delay<br>I <sub>n</sub> to Z <sub>n</sub> | 3.3                                | 2.5                                              | 7.5 | 12.5 | 2.0                                                       | 14.5 | ns    |
|                  |                                                       | 5.0                                | 1.5                                              | 5.5 | 9.0  | 1.5                                                       | 10.5 |       |
| t <sub>PHL</sub> | Propagation Delay<br>I <sub>n</sub> to Z <sub>n</sub> | 3.3                                | 1.5                                              | 7.0 | 11.5 | 1.5                                                       | 13.0 | ns    |
|                  |                                                       | 5.0                                | 1.5                                              | 5.0 | 8.5  | 1.5                                                       | 10.0 |       |

**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 <sub>n</sub>   | 5.0                                | 3.0                                              | 7.0 | 11.5 | 2.0                                                       | 13.5 | ns    |
| t <sub>PHL</sub> | Propagation Delay<br>S <sub>n</sub> to Z <sub>n</sub>   | 5.0                                | 3.0                                              | 7.0 | 11.5 | 2.5                                                       | 13.5 | ns    |
| t <sub>PLH</sub> | Propagation Delay<br>$\overline{E}_n$ to Z <sub>n</sub> | 5.0                                | 2.0                                              | 6.5 | 10.5 | 2.0                                                       | 12.5 | ns    |
| t <sub>PHL</sub> | Propagation Delay<br>$\overline{E}_n$ to Z <sub>n</sub> | 5.0                                | 3.0                                              | 6.0 | 9.5  | 2.5                                                       | 11.0 | ns    |
| t <sub>PLH</sub> | Propagation Delay<br>I <sub>n</sub> to Z <sub>n</sub>   | 5.0                                | 2.5                                              | 5.5 | 9.5  | 2.0                                                       | 11.0 | ns    |
| t <sub>PHL</sub> | Propagation Delay<br>I <sub>n</sub> to Z <sub>n</sub>   | 5.0                                | 2.0                                              | 5.5 | 9.5  | 2.0                                                       | 11.0 | 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 | 65.0 | 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)

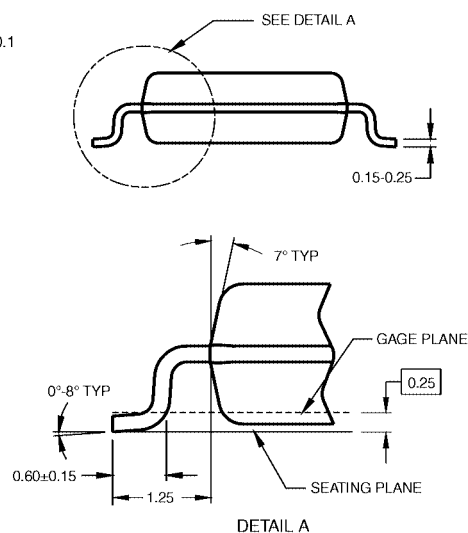


DIMENSIONS ARE IN MILLIMETERS

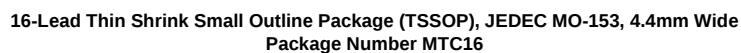
## NOTES:

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

M16DRevB1



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



# 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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