

74AC253, 74ACT253

Dual 4-Input Multiplexer with 3-STATE Outputs

Features

- I_{CC} and I_{OZ} reduced by 50%
- Multifunction capability
- Non inverting 3-STATE outputs
- Outputs source/sink 24mA
- ACT253 has TTL-compatible inputs

General Description

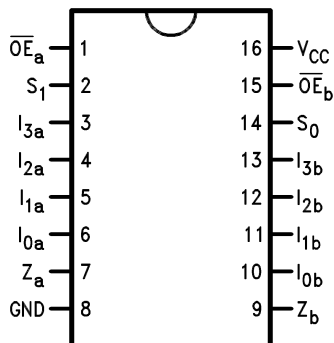
The AC/ACT253 is a dual 4-input multiplexer with 3-STATE outputs. It can select two bits of data from four sources using common select inputs. The outputs may be individually switched to a high impedance state with a HIGH on the respective Output Enable (\overline{OE}) inputs, allowing the outputs to interface directly with bus oriented systems.

Ordering Information

| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| 74AC253SC | M16A | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74AC253SJ | M16D | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74AC253PC | N16E | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |
| 74ACT253SC | M16A | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74ACT253SJ | M16D | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74ACT253MTC | MTC16 | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Device also available Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

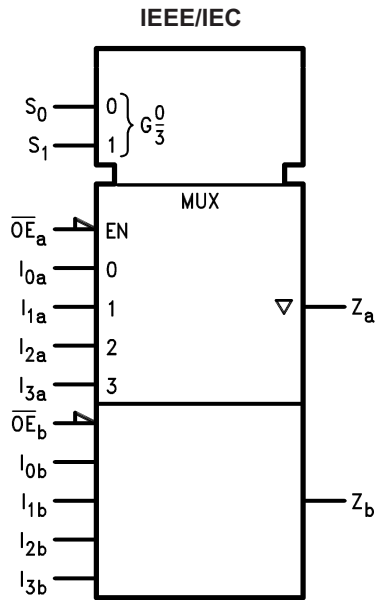
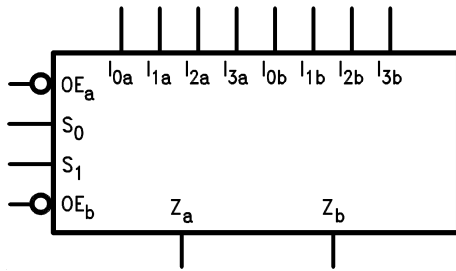
Connection Diagram



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 |
| \overline{OE}_a | Side A Output Enable Input |
| \overline{OE}_b | Side B Output Enable Input |
| Z_a, Z_b | 3-STATE Outputs |

Logic Diagram



Functional Description

The AC/ACT253 contains two identical 4-input multiplexers with 3-STATE outputs. They select two bits from four sources selected by common Select inputs (S_0, S_1). The 4-input multiplexers have individual Output Enable ($\overline{OE}_a, \overline{OE}_b$) inputs which, when HIGH, force the outputs to a high impedance (High Z) state. This device 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 two select inputs. The logic equations for the outputs are shown:

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

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

If the outputs of 3-STATE devices are tied together, all but one device must be in the high impedance state to avoid high currents that would exceed the maximum ratings. Designers should ensure that Output Enable signals to 3-STATE devices whose outputs are tied together are designed so that there is no overlap.

Truth Table

| Select Inputs | | Data Inputs | | | | Output Enable | Outputs |
|---------------|-------|-------------|-------|-------|-------|-----------------|---------|
| S_0 | S_1 | I_0 | I_1 | I_2 | I_3 | \overline{OE} | Z |
| X | X | X | X | X | X | H | Z |
| L | L | L | X | X | X | L | L |
| L | L | H | X | X | X | L | H |
| H | L | X | L | X | X | L | L |
| H | L | X | H | X | X | L | H |
| L | H | X | X | L | X | L | L |
| L | H | X | X | H | X | L | H |
| H | H | X | X | X | L | L | L |
| H | H | X | X | X | H | L | H |

Address Inputs S_0 and S_1 are common to both sections.

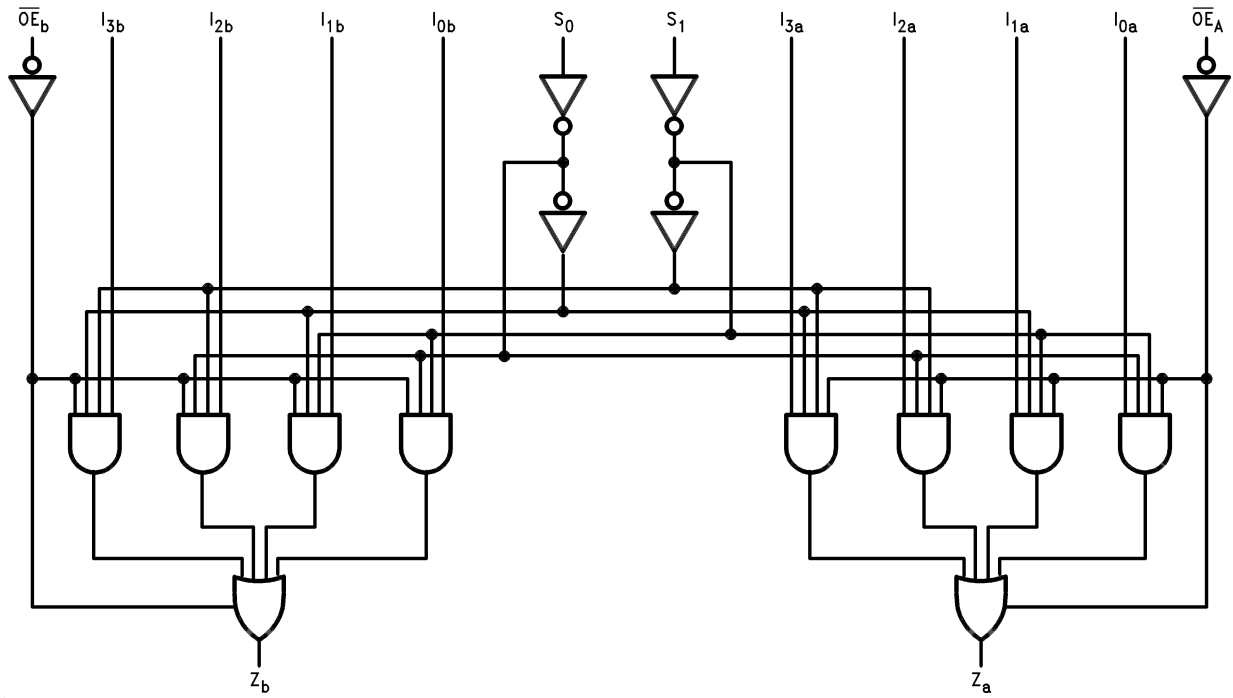
H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

Z = High Impedance

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.

Figure 1.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

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

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

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

DC Electrical Characteristics for AC

| Symbol | Parameter | V _{CC} (V) | Conditions | T _A = +25°C | | T _A = -40°C to +85°C | | Units | |
|--------------------------------|---|------------------------|--|------------------------|-------------------|---------------------------------|------|-------|--|
| | | | | Typ. | Guaranteed Limits | | | | |
| V _{IH} | Minimum HIGH Level Input Voltage | 3.0 | V _{OUT} = 0.1V or V _{CC} - 0.1V | 1.5 | 2.1 | 2.1 | | V | |
| | | 4.5 | | 2.25 | 3.15 | 3.15 | | | |
| | | 5.5 | | 2.75 | 3.85 | 3.85 | | | |
| V _{IL} | Maximum LOW Level Input Voltage | 3.0 | V _{OUT} = 0.1V or V _{CC} - 0.1V | 1.5 | 0.9 | 0.9 | | V | |
| | | 4.5 | | 2.25 | 1.35 | 1.35 | | | |
| | | 5.5 | | 2.75 | 1.65 | 1.65 | | | |
| V _{OH} | Minimum HIGH Level Output Voltage | 3.0 | I _{OUT} = -50μA | 2.99 | 2.9 | 2.9 | | V | |
| | | 4.5 | | 4.49 | 4.4 | 4.4 | | | |
| | | 5.5 | | 5.49 | 5.4 | 5.4 | | | |
| | | 3.0 | V _{IN} = V _{IL} or V _{IH} ; I _{OH} = -12mA | | | 2.56 | 2.46 | | |
| | | 4.5 | I _{OH} = -24mA | | | 3.86 | 3.76 | | |
| | | 5.5 | I _{OH} = -24mA ⁽¹⁾ | | | 4.86 | 4.76 | | |
| V _{OL} | Maximum LOW Level Output Voltage | 3.0 | I _{OUT} = 50μA | 0.002 | 0.1 | 0.1 | | V | |
| | | 4.5 | | 0.001 | 0.1 | 0.1 | | | |
| | | 5.5 | | 0.001 | 0.1 | 0.1 | | | |
| | | 3.0 | V _{IN} = V _{IL} or V _{IH} ; I _{OL} = 12mA | | | 0.36 | 0.44 | | |
| | | 4.5 | I _{OL} = 24mA | | | 0.36 | 0.44 | | |
| | | 5.5 | I _{OL} = 24mA ⁽¹⁾ | | | 0.36 | 0.44 | | |
| I _{IN} ⁽³⁾ | Maximum Input Leakage Current | 5.5 | V _I = V _{CC} , GND | | ±0.1 | ±1.0 | | μA | |
| I _{OZ} | Maximum 3-STATE Current | 5.5 | V _I (OE) = V _{IL} , V _{IH} ; V _I = V _{CC} , GND; V _O = V _{CC} , GND | | ±0.25 | ±2.5 | | μA | |
| I _{OLD} | Minimum Dynamic Output Current ⁽²⁾ | 5.5 | V _{OLD} = 1.65V Max. | | | 75 | | mA | |
| I _{OHD} | | 5.5 | V _{OHD} = 3.85V Min. | | | -75 | | mA | |
| I _{CC} ⁽³⁾ | Maximum Quiescent Supply Current | 5.5 | V _{IN} = V _{CC} or GND | | 4.0 | 40.0 | | μA | |

Notes:

1. All outputs loaded; thresholds on input associated with output under test.
2. Maximum test duration 2.0ms, one output loaded at a time.
3. 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 _{CC} (V) | Conditions | T _A = +25°C | | T _A = -40°C to +85°C | | Units | |
|------------------|---|------------------------|--|------------------------|-------------------|---------------------------------|------|-------|--|
| | | | | Typ. | Guaranteed Limits | | | | |
| V _{IH} | Minimum HIGH Level Input Voltage | 4.5 | V _{OUT} = 0.1V or V _{CC} - 0.1V | 1.5 | 2.0 | 2.0 | | V | |
| | | 5.5 | | 1.5 | 2.0 | 2.0 | | | |
| V _{IL} | Maximum LOW Level Input Voltage | 4.5 | V _{OUT} = 0.1V or V _{CC} - 0.1V | 1.5 | 0.8 | 0.8 | | V | |
| | | 5.5 | | 1.5 | 0.8 | 0.8 | | | |
| V _{OH} | Minimum HIGH Level Output Voltage | 4.5 | I _{OUT} = -50μA | 4.49 | 4.4 | 4.4 | | V | |
| | | 5.5 | | 5.49 | 5.4 | 5.4 | | | |
| | | 4.5 | V _{IN} = V _{IL} or V _{IH} ; I _{OH} = -24mA | | | 3.86 | 3.76 | | |
| | | 5.5 | I _{OH} = -24mA ⁽⁴⁾ | | | 4.86 | 4.76 | | |
| V _{OL} | Maximum LOW Level Output Voltage | 4.5 | I _{OUT} = 50μA | 0.001 | 0.1 | 0.1 | | V | |
| | | 5.5 | | 0.001 | 0.1 | 0.1 | | | |
| | | 4.5 | V _{IN} = V _{IL} or V _{IH} ; I _{OL} = 24mA | | | 0.36 | 0.44 | | |
| | | 5.5 | I _{OL} = 24mA ⁽⁴⁾ | | | 0.36 | 0.44 | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | V _I = V _{CC} , GND | | ±0.1 | ±1.0 | | μA | |
| I _{OZ} | Maximum 3-STATE Current | 5.5 | V _I = V _{IL} , V _{IH} ; V _O = V _{CC} , GND | | ±0.25 | ±2.5 | | μA | |
| I _{CCT} | Maximum I _{CC} /Input | 5.5 | V _I = V _{CC} - 2.1V | 0.6 | | 1.5 | | mA | |
| I _{OLD} | Minimum Dynamic Output Current ⁽⁵⁾ | 5.5 | V _{OLD} = 1.65V Max. | | | 75 | | mA | |
| I _{OHD} | | 5.5 | V _{OHD} = 3.85V Min. | | | -75 | | mA | |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | V _{IN} = V _{CC} or GND | | 4.0 | 40.0 | | μA | |

Notes:

- All outputs loaded; thresholds on input associated with output under test.
- Maximum test duration 2.0ms, one output loaded at a time.

AC Electrical Characteristics for AC

| Symbol | Parameter | V _{CC} (V) ⁽⁶⁾ | T _A = +25°C C _L = 50pF | | | T _A = -40°C to +85°C, C _L = 50pF | | Units |
|------------------|--|------------------------------------|---|------|------|---|------|-------|
| | | | Min. | Typ. | Max. | Min | Max | |
| t _{PLH} | Propagation Delay, S _n to Z _n | 3.3 | 2.0 | 8.5 | 15.5 | 2.0 | 17.5 | ns |
| | | 5.0 | 2.0 | 6.5 | 11.0 | 1.5 | 12.5 | |
| t _{PHL} | Propagation Delay, S _n to Z _n | 3.3 | 2.5 | 9.5 | 16.0 | 2.0 | 18.0 | ns |
| | | 5.0 | 2.0 | 7.0 | 11.5 | 1.5 | 13.0 | |
| t _{PLH} | Propagation Delay, I _n to Z _n | 3.3 | 1.5 | 7.0 | 14.5 | 1.5 | 17.0 | ns |
| | | 5.0 | 1.5 | 5.5 | 10.0 | 1.5 | 11.5 | |
| t _{PHL} | Propagation Delay, I _n to Z _n | 3.3 | 2.0 | 7.5 | 13.0 | 1.5 | 15.0 | ns |
| | | 5.0 | 1.5 | 5.5 | 9.5 | 1.5 | 11.0 | |
| t _{PZH} | Output Enable Time | 3.3 | 1.5 | 4.5 | 8.0 | 1.0 | 8.5 | ns |
| | | 5.0 | 1.5 | 3.5 | 6.0 | 1.0 | 6.5 | |
| t _{PZL} | Output Enable Time | 3.3 | 1.5 | 5.0 | 8.0 | 1.0 | 9.0 | ns |
| | | 5.0 | 1.5 | 3.5 | 6.0 | 1.0 | 7.0 | |
| t _{PHZ} | Output Disable Time | 3.3 | 2.0 | 5.5 | 9.5 | 1.5 | 10.0 | ns |
| | | 5.0 | 2.0 | 5.0 | 8.0 | 1.5 | 8.5 | |
| t _{PLZ} | Output Disable Time | 3.3 | 1.5 | 5.0 | 8.0 | 1.0 | 9.0 | ns |
| | | 5.0 | 1.5 | 4.0 | 7.0 | 1.0 | 7.5 | |

Note:

6. 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 _{CC} (V) ⁽⁷⁾ | T _A = +25°C, C _L = 50pF | | | T _A = -40°C to +85°C, C _L = 50pF | | Units |
|------------------|---|------------------------------------|--|------|------|---|------|-------|
| | | | Min. | Typ. | Max. | Min. | Max. | |
| t _{PLH} | Propagation Delay, S _n to Z _n | 5.0 | 2.0 | 7.0 | 11.5 | 2.0 | 13.0 | ns |
| t _{PHL} | Propagation Delay, S _n to Z _n | 5.0 | 3.0 | 7.5 | 13.0 | 2.5 | 14.5 | ns |
| t _{PLH} | Propagation Delay, I _n to Z _n | 5.0 | 2.5 | 5.5 | 10.0 | 2.0 | 11.0 | ns |
| t _{PHL} | Propagation Delay, I _n to Z _n | 5.0 | 3.5 | 6.5 | 11.0 | 3.0 | 12.5 | ns |
| t _{PZH} | Output Enable Time | 5.0 | 2.0 | 4.5 | 7.5 | 1.5 | 8.5 | ns |
| t _{PZL} | Output Enable Time | 5.0 | 2.0 | 5.0 | 8.0 | 1.5 | 9.0 | ns |
| t _{PHZ} | Output Disable Time | 5.0 | 3.0 | 6.0 | 9.5 | 2.5 | 10.0 | ns |
| t _{PLZ} | Output Disable Time | 5.0 | 2.5 | 4.5 | 7.5 | 2.0 | 8.5 | ns |

Note:

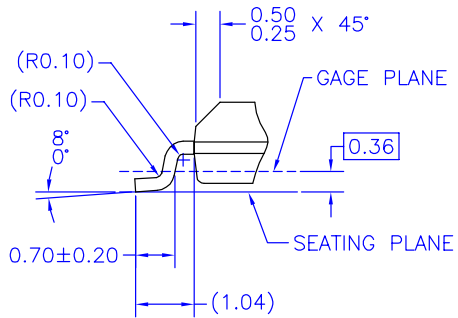
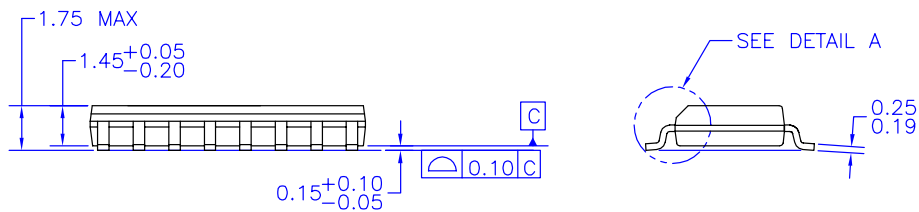
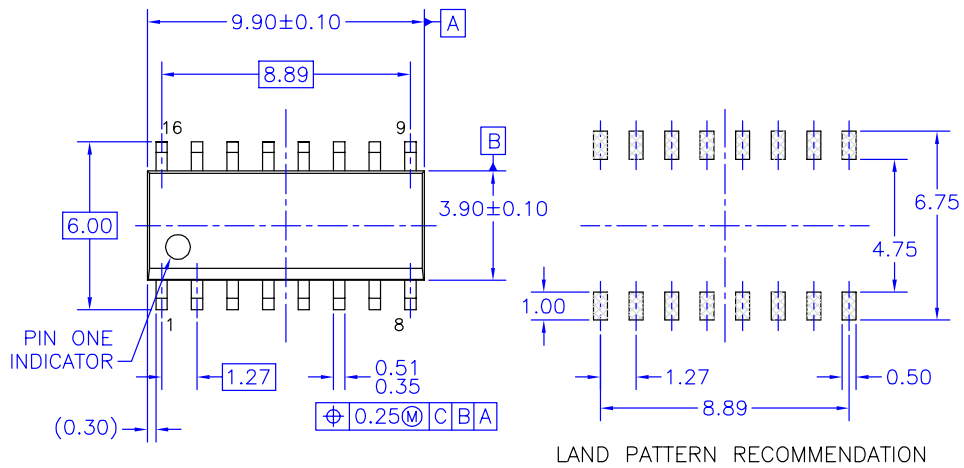
7. Voltage range 5.0 is 5.0V ± 0.5V.

Capacitance

| Symbol | Parameter | Conditions | Typ. | Units |
|-----------------|-------------------------------|------------------------|------|-------|
| C _{IN} | Input Capacitance | V _{CC} = OPEN | 4.5 | pF |
| C _{PD} | Power Dissipation Capacitance | V _{CC} = 5.0V | 50.0 | pF |

Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



DETAIL A
SCALE: 2:1

NOTES: UNLESS OTHERWISE SPECIFIED

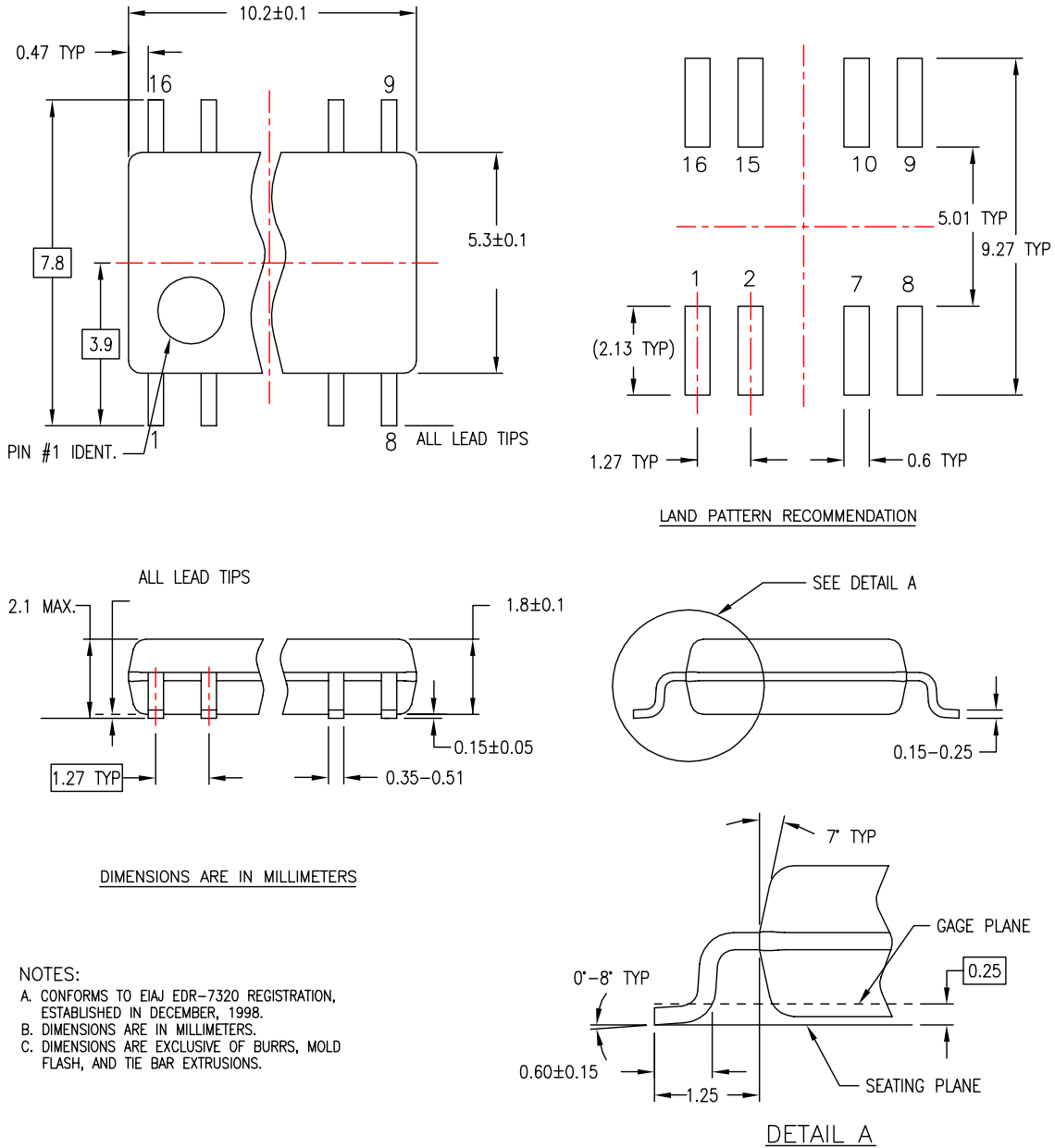
- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AC, ISSUE C, DATED MAY 1990.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) STANDARD LEAD FINISH:
200 MICRONS / 5.08 MICRONS MIN.
LEAD/TIN (SOLDER) ON COPPER.

M16AREVK

Figure 2. 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M16A

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.

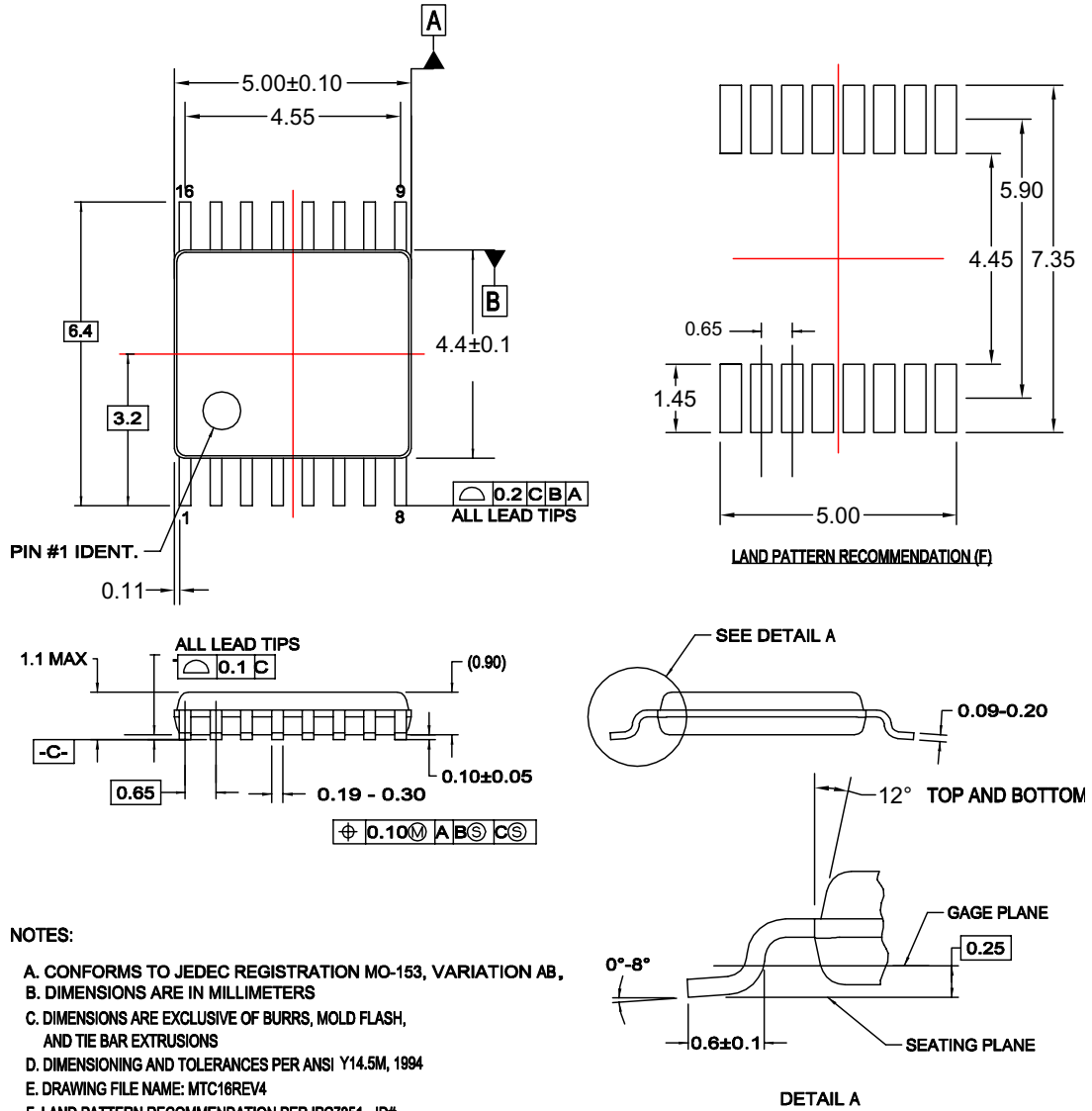


M16DREVC

Figure 3. 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M16D

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB,
- B. DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1994
- E. DRAWING FILE NAME: MTC16REV4
- F. LAND PATTERN RECOMMENDATION PER IPC7351 - ID# TSOP65P640X110-16N

MTC16rev4

Figure 4. 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC16

Physical Dimensions (Continued)

Dimensions are in inches (millimeters) unless otherwise noted.

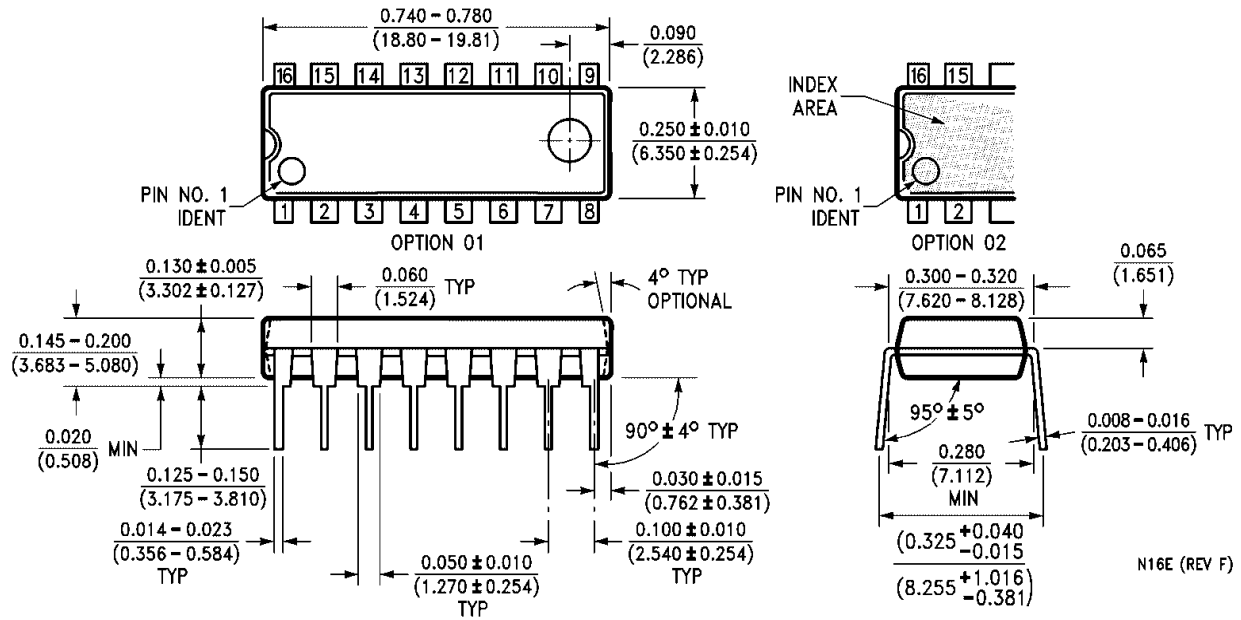



Figure 5. 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N16E

N16E (REV F)

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| No Identification Needed | Full Production | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
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