

74AC157 • 74ACT157 Quad 2-Input Multiplexer

General Description

The AC/ACT157 is a high-speed quad 2-input multiplexer. Four bits of data from two sources can be selected using the common Select and Enable inputs. The four outputs present the selected data in the true (noninverted) form. The AC/ACT157 can also be used as a function generator.

Features

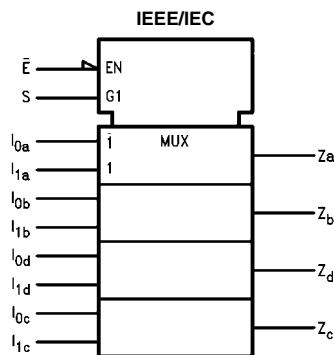
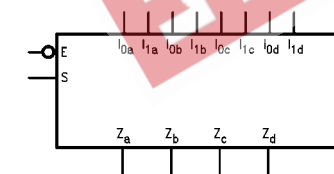
- I_{CC} and I_{OZ} reduced by 50%
- Outputs source/sink 24 mA
- ACT157 has TTL-compatible inputs

Ordering Code:

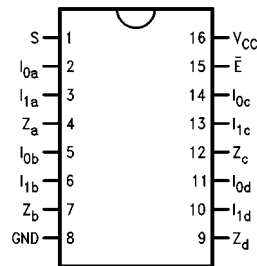
| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| 74AC157SC | M16A | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body |
| 74AC157SJ | M16D | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74AC157MTC | MTC16 | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74AC157PC | N16E | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |
| 74ACT157SC | M16A | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Body |
| 74ACT157SJ | M16D | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74ACT157MTC | MTC16 | 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| 74ACT157PC | 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_{0a} – I_{0d} | Source 0 Data Inputs |
| I_{1a} – I_{1d} | Source 1 Data Inputs |
| \bar{E} | Enable Input |
| S | Select Input |
| Z_a – Z_d | Outputs |

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Functional Description

The AC/ACT157 is a quad 2-input multiplexer. It selects four bits of data from two sources under the control of a common Select input (S). The Enable input (\bar{E}) is active-LOW. When \bar{E} is HIGH, all of the outputs (Z) are forced LOW regardless of all other inputs. The AC/ACT157 is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the Select input. The logic equations for the outputs are shown below:

$$Z_a = \bar{E} \cdot (I_{1a} \cdot S + I_{0a} \cdot \bar{S})$$

$$Z_b = \bar{E} \cdot (I_{1b} \cdot S + I_{0b} \cdot \bar{S})$$

$$Z_c = \bar{E} \cdot (I_{1c} \cdot S + I_{0c} \cdot \bar{S})$$

$$Z_d = \bar{E} \cdot (I_{1d} \cdot S + I_{0d} \cdot \bar{S})$$

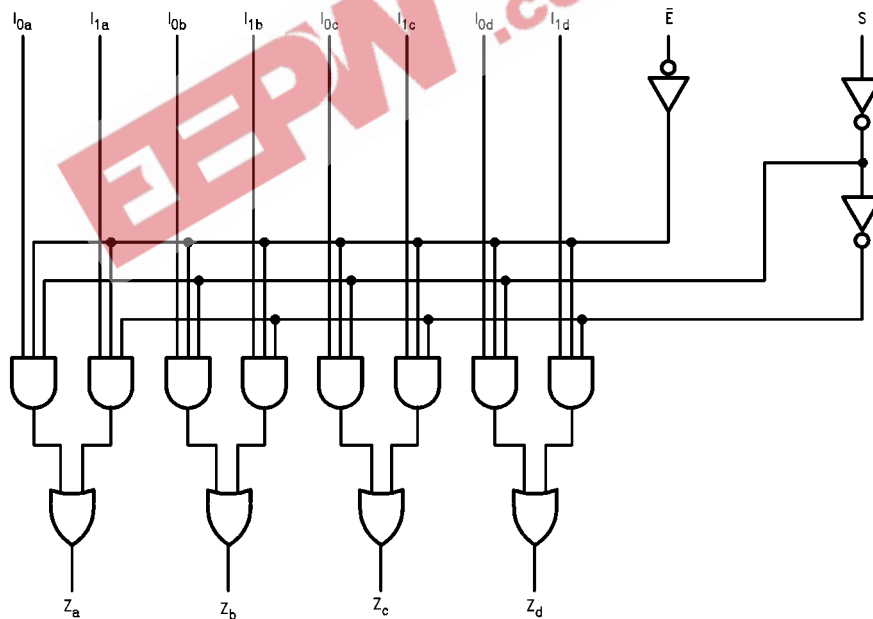
A common use of the AC/ACT157 is the moving of data from two groups of registers to four common output buses. The particular register from which the data comes is determined by the state of the Select input. A less obvious use is as a function generator. The AC/ACT157 can generate any four of the sixteen different functions of two variables with one variable common. This is useful for implementing gating functions.

Truth Table

| Inputs | | | | Outputs |
|-----------|---|-------|-------|---------|
| \bar{E} | S | I_0 | I_1 | Z |
| H | X | X | X | L |
| L | H | X | L | L |
| L | H | X | H | H |
| L | L | L | X | L |
| L | L | H | X | 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) | ± 50 mA |
| DC V_{CC} or Ground Current | |
| per Output Pin (I_{CC} or I_{GND}) | ± 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} (V) | $T_A = +25^\circ\text{C}$ | | | Units | Conditions |
|----------------------|--------------------------------------|-----------------|---------------------------|-------------------|-----------|---------|---|
| | | | Typ | Guaranteed Limits | | | |
| V_{IH} | Minimum HIGH Level Input Voltage | 3.0 | 1.5 | 2.1 | 2.1 | V | $V_{OUT} = 0.1V$ 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 Input Voltage | 3.0 | 1.5 | 0.9 | 0.9 | V | $V_{OUT} = 0.1V$ 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 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} $I_{OH} = -12$ mA $I_{OH} = -24$ mA $I_{OH} = -24$ mA (Note 2) |
| | | 4.5 | | 3.86 | 3.76 | | |
| | | 5.5 | | 4.86 | 4.76 | | |
| V_{OL} | Maximum LOW Level 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} $I_{OL} = 12$ mA $I_{OL} = 24$ mA $I_{OL} = 24$ mA (Note 2) |
| | | 4.5 | | 0.36 | 0.44 | | |
| | | 5.5 | | 0.36 | 0.44 | | |
| I_{IN} (Note 4) | Maximum Input Leakage Current | 5.5 | | ± 0.1 | ± 1.0 | μA | $V_I = V_{CC}, GND$ |
| 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} (Note 4) | Maximum Quiescent Supply Current | 5.5 | | 4.0 | 40.0 | μA | $V_{IN} = V_{CC}$ 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 Characteristics for ACT

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | T _A = -40°C to +85°C | | Units | Conditions |
|------------------|--|------------------------|------------------------|-------------------|---------------------------------|----|---|------------|
| | | | Typ | Guaranteed Limits | | | | |
| V _{IH} | Minimum HIGH Level Input Voltage | 4.5 | 1.5 | 2.0 | 2.0 | V | V _{OUT} = 0.1V or V _{CC} - 0.1V | |
| | | 5.5 | 1.5 | 2.0 | 2.0 | | | |
| V _{IL} | Maximum LOW Level Input Voltage | 4.5 | 1.5 | 0.8 | 0.8 | V | V _{OUT} = 0.1V or V _{CC} - 0.1V | |
| | | 5.5 | 1.5 | 0.8 | 0.8 | | | |
| V _{OH} | Minimum HIGH Level Output Voltage | 4.5 | 4.49 | 4.4 | 4.4 | V | I _{OUT} = -50 μA | |
| | | 5.5 | 5.49 | 5.4 | 5.4 | | | |
| | | 4.5 | | 3.86 | 3.76 | V | V _{IN} = V _{IL} or V _{IH} I _{OH} = -24 mA I _{OH} = -24 mA (Note 5) | |
| | | 5.5 | | 4.86 | 4.76 | | | |
| V _{OL} | Maximum LOW Level Output Voltage | 4.5 | 0.001 | 0.1 | 0.1 | V | I _{OUT} = 50 μA | |
| | | 5.5 | 0.001 | 0.1 | 0.1 | | | |
| | | 4.5 | | 0.36 | 0.44 | V | V _{IN} = V _{IL} or V _{IH} I _{OL} = 24 mA I _{OL} = 24 mA (Note 5) | |
| | | 5.5 | | 0.36 | 0.44 | | | |
| I _{IN} | Maximum Input Leakage Current | 5.5 | | ±0.1 | ±1.0 | μA | V _I = V _{CC} , GND | |
| I _{CC} | Maximum I _{CC} /Input | 5.5 | 0.6 | | 1.5 | mA | V _I = V _{CC} - 2.1V | |
| I _{OLD} | Minimum Dynamic Output Current (Note 6) | 5.5 | | | 75 | mA | V _{OLD} = 1.65V Max | |
| I _{OHD} | Output Current (Note 6) | 5.5 | | | -75 | mA | V _{OHD} = 3.85V Min | |
| I _{CC} | Maximum Quiescent Supply Current | 5.5 | | 4.0 | 40.0 | μA | V _{IN} = V _{CC} 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 _{CC} (V) (Note 7) | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | Units |
|------------------|---|------------------------------------|--|-----|------|---|------|-------|
| | | | Min | Typ | Max | Min | Max | |
| t _{PLH} | Propagation Delay S to Z _n | 3.3 | 1.5 | 7.0 | 11.5 | 1.5 | 13.0 | ns |
| | | 5.0 | 1.5 | 5.5 | 9.0 | 1.5 | 10.0 | |
| t _{PHL} | Propagation Delay S to Z _n | 3.3 | 1.5 | 6.5 | 11.0 | 1.5 | 12.0 | ns |
| | | 5.0 | 1.5 | 5.0 | 8.5 | 1.0 | 9.5 | |
| t _{PLH} | Propagation Delay \bar{E} to Z _n | 3.3 | 1.5 | 7.0 | 11.5 | 1.5 | 13.0 | ns |
| | | 5.0 | 1.5 | 5.5 | 9.0 | 1.5 | 10.0 | |
| t _{PHL} | Propagation Delay \bar{E} to Z _n | 3.3 | 1.5 | 6.5 | 11.0 | 1.5 | 12.0 | ns |
| | | 5.0 | 1.5 | 5.5 | 9.0 | 1.0 | 9.5 | |
| t _{PLH} | Propagation Delay I _n to Z _n | 3.3 | 1.5 | 5.0 | 8.5 | 1.0 | 9.0 | ns |
| | | 5.0 | 1.5 | 4.0 | 6.5 | 1.0 | 7.0 | |
| t _{PHL} | Propagation Delay I _n to Z _n | 3.3 | 1.5 | 5.0 | 8.0 | 1.0 | 9.0 | ns |
| | | 5.0 | 1.5 | 4.0 | 6.5 | 1.0 | 7.0 | |

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

Voltage Range 5.0 is 5.0V ± 0.5V

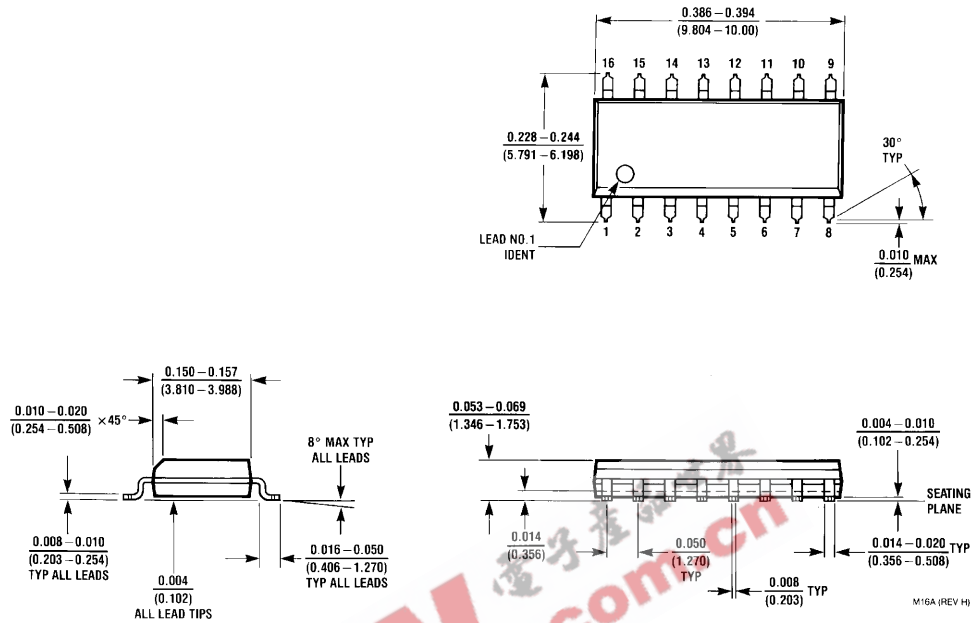
| AC Electrical Characteristics for ACT | | | | | | | | |
|---------------------------------------|---|------------------------------------|--|-----|------|---|------|-------|
| Symbol | Parameter | V _{CC} (V) (Note 8) | T _A = +25°C C _L = 50 pF | | | T _A = -40°C to +85°C C _L = 50 pF | | Units |
| | | | Min | Typ | Max | Min | Max | |
| t _{PLH} | Propagation Delay S to Z _n | 5.0 | 2.0 | 5.5 | 9.0 | 1.5 | 10.0 | ns |
| t _{PHL} | Propagation Delay S to Z _n | 5.0 | 2.0 | 5.5 | 9.5 | 2.0 | 10.5 | ns |
| t _{PLH} | Propagation Delay \bar{E} to Z _n | 5.0 | 1.5 | 6.0 | 10.0 | 1.5 | 11.5 | ns |
| t _{PHL} | Propagation Delay \bar{E} to Z _n | 5.0 | 1.5 | 5.0 | 8.5 | 1.0 | 9.0 | ns |
| t _{PLH} | Propagation Delay I _n to Z _n | 5.0 | 1.5 | 4.0 | 7.0 | 1.0 | 8.5 | ns |
| t _{PHL} | Propagation Delay I _n to Z _n | 5.0 | 1.5 | 4.5 | 7.5 | 1.0 | 8.5 | ns |

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

Capacitance

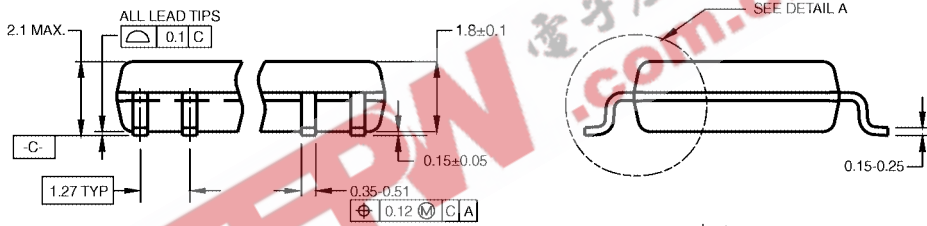
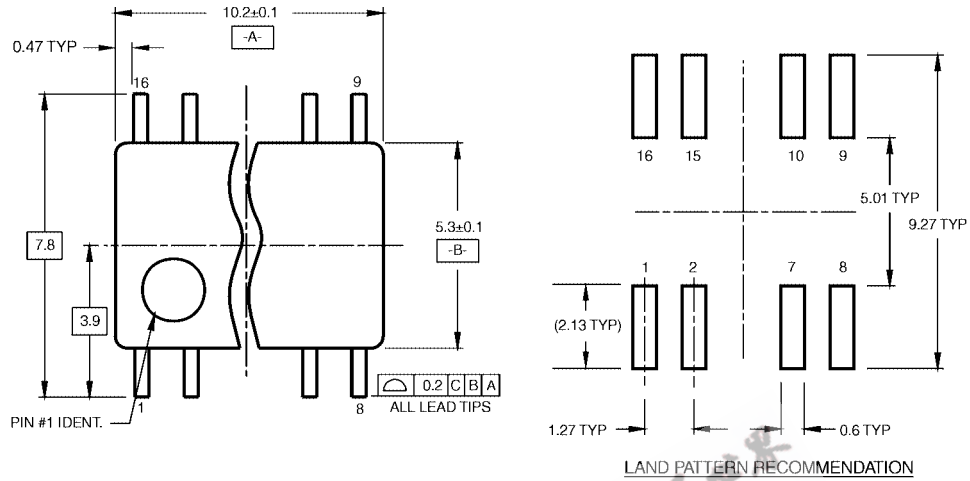
| Symbol | Parameter | Typ | Units | Conditions |
|-----------------|-------------------------------|------|-------|------------------------|
| C _{IN} | Input Capacitance | 4.5 | pF | V _{CC} = OPEN |
| C _{PD} | Power Dissipation Capacitance | 50.0 | pF | V _{CC} = 5.0V |

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)

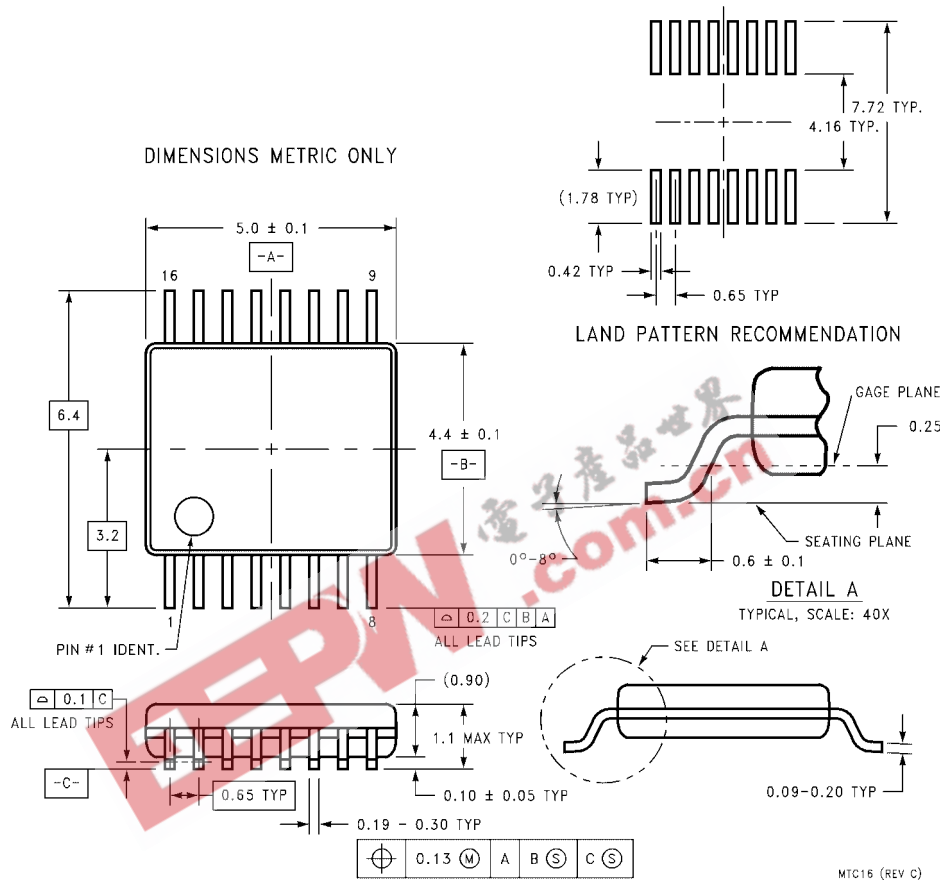


- NOTES:
- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M16DRevB1

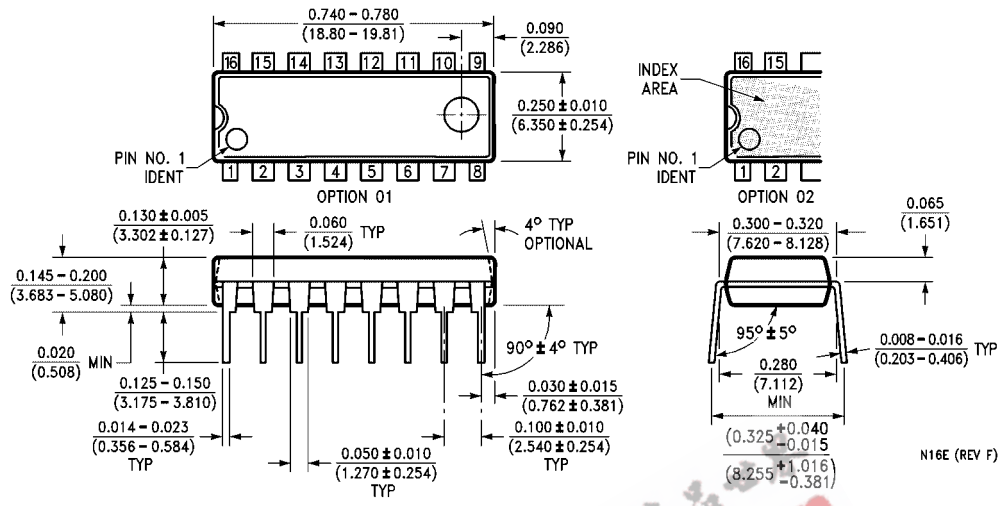
16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M16D

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

N16E (REV F)

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