# 54F151A

***54F151A 8-Input Multiplexer***

Literature Number: SNOS154

National Semiconductor

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# 54F/74F151A
# 8-Input Multiplexer

## General Description

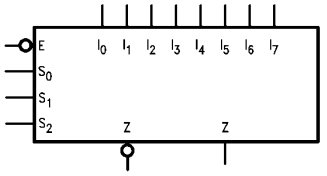
The 'F151A is a high-speed 8-input digital multiplexer. It provides in one package the ability to select one line of data from up to eight sources. The 'F151A can be used as a universal function generator to generate any logic function of four variables. Both assertion and negation outputs are provided.

| Commercial | Military | Package Number | Package Description |
|---|---|---|---|
| 74F151APC | | N16E | 16-Lead (0.300″ Wide) Molded Dual-In-Line |
| | 54F151ADM (Note 2) | J16A | 16-Lead Ceramic Dual-In-Line |
| 74F151ASC (Note 1) | | M16A | 16-Lead (0.150″ Wide) Molded Small Outline, JEDEC |
| 74F151ASJ (Note 1) | | M16D | 16-Lead (0.300″ Wide) Molded Small Outline, EIAJ |
| | 54F151AFM (Note 2) | W16A | 16-Lead Cerpack |
| | 54F151ALM (Note 2) | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |

**Note 1:** Devices also available in 13″ reel. Use suffix = SCX and SJX.

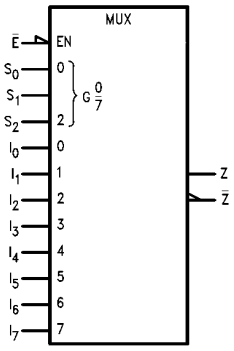
**Note 2:** Military grade device with environmental and burn-in processing. Use suffix = DQMB, FMQB and LMQB.

## Logic Symbols




TL/F/9481–3

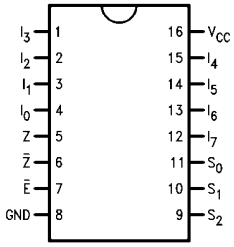
**IEEE/IEC**




TL/F/9481–5

## Connection Diagrams

**Pin Assignment for DIP, SOIC and Flatpak**

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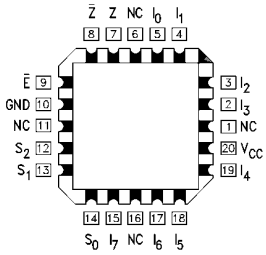
**Pin Assignment for LCC**




TL/F/9481–2

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## Unit Loading/Fan Out

| Pin Names | Description | 54F/74F | |
|---|---|---|---|
| | | U.L. HIGH/LOW | Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$ |
| $I_0-I_7$ | Data Inputs | 1.0/1.0 | 20 $\mu$A/$-$0.6 mA |
| $S_0-S_2$ | Select Inputs | 1.0/1.0 | 20 $\mu$A/$-$0.6 mA |
| $\overline{E}$ | Enable Input (Active LOW) | 1.0/1.0 | 20 $\mu$A/$-$0.6 mA |
| Z | Data Output | 50/33.3 | $-$1 mA/20 mA |
| $\overline{Z}$ | Inverted Data Output | 50/33.3 | $-$1 mA/20 mA |

## Functional Description

The 'F151A 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 assertion and negation outputs are provided. The Enable input ($\overline{E}$) is active LOW. When it is not activated, the negation output is HIGH and the assertion output is LOW regardless of all other inputs. The logic function provided at the output is:

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

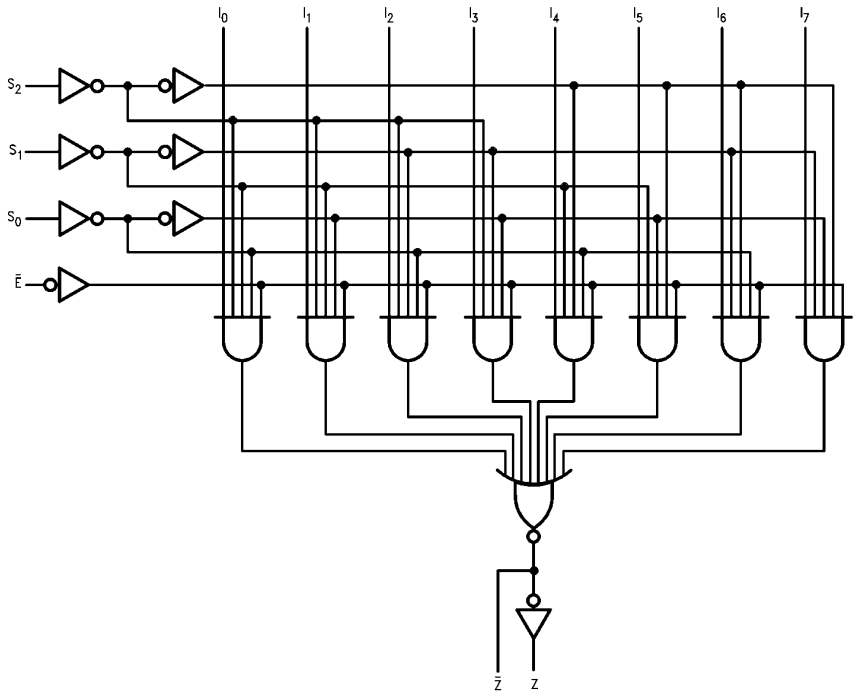
The 'F151A provides the ability, in one package, to select from eight sources of data or control information. By proper manipulation of the inputs, the 'F151A can provide any logic function of four variables and its negation.

## Truth Table

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

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

## Logic Diagram




TL/F/9481–4

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)

**If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.**

| | |
|---|---|
| Storage Temperature | −65°C to +150°C |
| Ambient Temperature under Bias | −55°C to +125°C |
| Junction Temperature under Bias | −55°C to +175°C |
| Plastic | −55°C to +150°C |
| $V_{CC}$ Pin Potential to Ground Pin | −0.5V to +7.0V |
| Input Voltage (Note 2) | −0.5V to +7.0V |
| Input Current (Note 2) | −30 mA to +5.0 mA |
| Voltage Applied to Output in HIGH State (with $V_{CC}$ = 0V) | |
| Standard Output | −0.5V to $V_{CC}$ |
| TRI-STATE® Output | −0.5V to +5.5V |
| Current Applied to Output in LOW State (Max) | twice the rated $I_{OL}$ (mA) |

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

## Recommended Operating Conditions

| | |
|---|---|
| Free Air Ambient Temperature | |
| Military | −55°C to +125°C |
| Commercial | 0°C to +70°C |
| Supply Voltage | |
| Military | +4.5V to +5.5V |
| Commercial | +4.5V to +5.5V |

## DC Electrical Characteristics

| Symbol | Parameter | | 54F/74F Min | 54F/74F Typ | 54F/74F Max | Units | $V_{CC}$ | Conditions |
|---|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Voltage | | 2.0 | | | V | | Recognized as a HIGH Signal |
| $V_{IL}$ | Input LOW Voltage | | | | 0.8 | V | | Recognized as a LOW Signal |
| $V_{CD}$ | Input Clamp Diode Voltage | | | | −1.2 | V | Min | $I_{IN}$ = −18 mA |
| $V_{OH}$ | Output HIGH Voltage | 54F 10% $V_{CC}$ | 2.5 | | | V | Min | $I_{OH}$ = −1 mA |
| | | 74F 10% $V_{CC}$ | 2.5 | | | | | $I_{OH}$ = −1 mA |
| | | 74F 5% $V_{CC}$ | 2.7 | | | | | $I_{OH}$ = −1 mA |
| $V_{OL}$ | Output LOW Voltage | 54F 10% $V_{CC}$ | | | 0.5 | V | Min | $I_{OL}$ = 20 mA |
| | | 74F 10% $V_{CC}$ | | | 0.5 | | | $I_{OL}$ = 20 mA |
| $I_{IH}$ | Input HIGH Current | 54F | | | 20.0 | μA | Max | $V_{IN}$ = 2.7V |
| | | 74F | | | 5.0 | | | |
| $I_{BVI}$ | Input HIGH Current Breakdown Test | 54F | | | 100 | μA | Max | $V_{IN}$ = 7.0V |
| | | 74F | | | 7.0 | | | |
| $I_{CEX}$ | Output HIGH Leakage Current | 54F | | | 250 | μA | Max | $V_{OUT}$ = $V_{CC}$ |
| | | 74F | | | 50 | | | |
| $V_{ID}$ | Input Leakage Test | 74F | 4.75 | | | V | 0.0 | $I_{ID}$ = 1.9 μA All Other Pins Grounded |
| $I_{OD}$ | Output Leakage Circuit Current | 74F | | | 3.75 | μA | 0.0 | $V_{IOD}$ = 150 mV All Other Pins Grounded |
| $I_{IL}$ | Input LOW Current | | | | −0.6 | mA | Max | $V_{IN}$ = 0.5V |
| $I_{OS}$ | Output Short-Circuit Current | | −60 | | −150 | mA | Max | $V_{OUT}$ = 0V |
| $I_{CC}$ | Power Supply Current | | | 13.5 | 21.0 | mA | Max | $V_O$ = HIGH |

## AC Electrical Characteristics

| Symbol | Parameter | 74F $T_A = +25°C$ $V_{CC} = +5.0V$ $C_L = 50$ pF | | | 54F $T_A, V_{CC} =$ Mil $C_L = 50$ pF | | 74F $T_A, V_{CC} =$ Com $C_L = 50$ pF | | Units |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Max | Min | Max | |
| $t_{PLH}$ | Propagation Delay | 4.0 | 6.2 | 9.0 | 3.5 | 11.5 | 3.5 | 9.5 | ns |
| $t_{PHL}$ | $S_n$ to $\overline{Z}$ | 3.2 | 5.2 | 7.5 | 3.0 | 8.0 | 3.2 | 7.5 | |
| $t_{PLH}$ | Propagation Delay | 4.5 | 7.5 | 10.5 | 4.5 | 13.5 | 4.5 | 12.0 | ns |
| $t_{PHL}$ | $S_n$ to Z | 4.0 | 6.2 | 9.0 | 4.0 | 9.5 | 4.0 | 9.0 | |
| $t_{PLH}$ | Propagation Delay | 3.0 | 4.7 | 6.1 | 3.0 | 7.5 | 3.0 | 7.0 | ns |
| $t_{PHL}$ | $\overline{E}$ to $\overline{Z}$ | 3.0 | 4.4 | 6.0 | 2.5 | 6.5 | 2.5 | 6.0 | |
| $t_{PLH}$ | Propagation Delay | 5.0 | 7.0 | 9.5 | 4.0 | 12.0 | 4.0 | 10.5 | ns |
| $t_{PHL}$ | $\overline{E}$ to Z | 3.5 | 5.3 | 7.0 | 3.0 | 8.0 | 3.0 | 7.5 | |
| $t_{PLH}$ | Propagation Delay | 3.0 | 4.8 | 6.5 | 2.5 | 7.5 | 3.0 | 7.0 | ns |
| $t_{PHL}$ | $I_n$ to $\overline{Z}$ | 1.5 | 2.5 | 4.0 | 1.5 | 6.0 | 1.5 | 5.0 | |
| $t_{PLH}$ | Propagation Delay | 3.0 | 4.8 | 6.5 | 2.5 | 8.5 | 2.5 | 7.5 | ns |
| $t_{PHL}$ | $I_n$ to Z | 3.7 | 5.5 | 7.0 | 3.5 | 9.0 | 3.7 | 7.5 | |

## Ordering Information

74F 151A S C X

Temperature Range Family
74F = Commercial
54F = Military

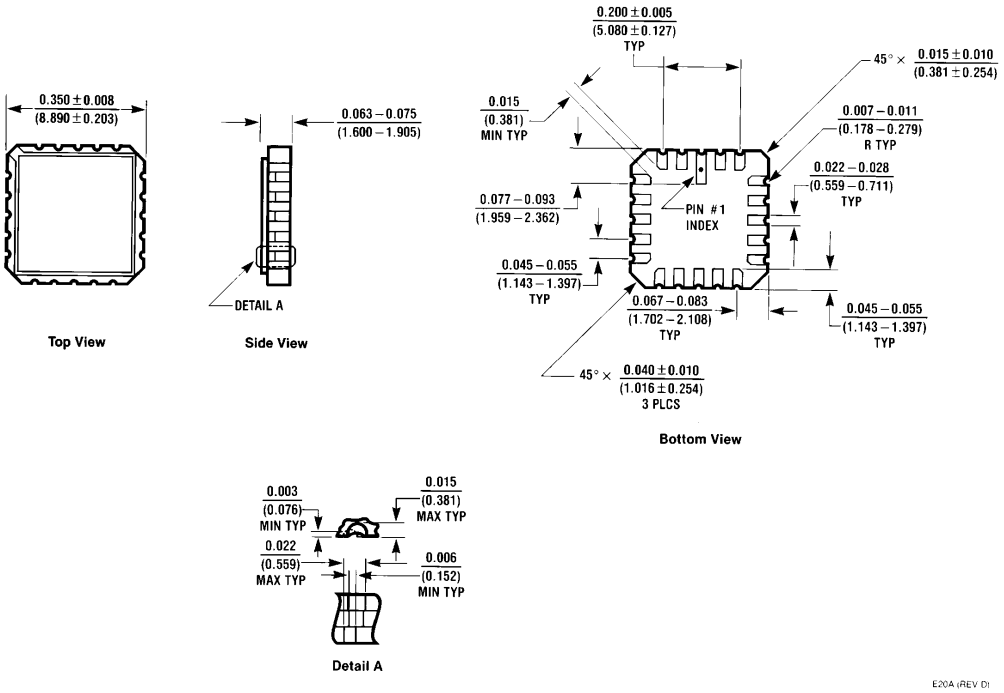
Device Type

Package Code
P = Plastic DIP
D = Ceramic DIP
F = Flatpak
L = Leadless Chip Carrier (LCC)
S = Small Outline SOIC JEDEC
SJ = Small Outline SOIC EIAJ

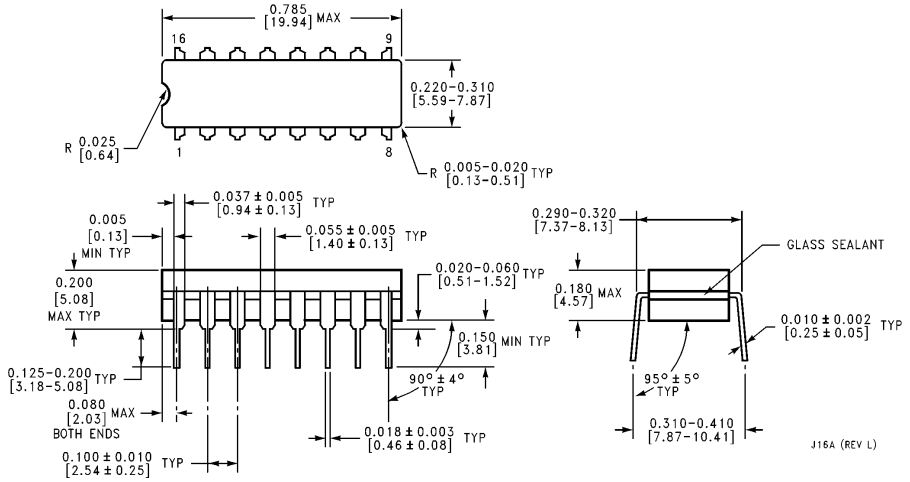
Temperature Range
C = Commercial (0°C to +70°C)
M = Military (−55°C to +125°C)

Special Variations
QB = Military grade device with environmental and burn-in processing
X = Devices shipped in 13″ reel

## Physical Dimensions inches (millimeters)

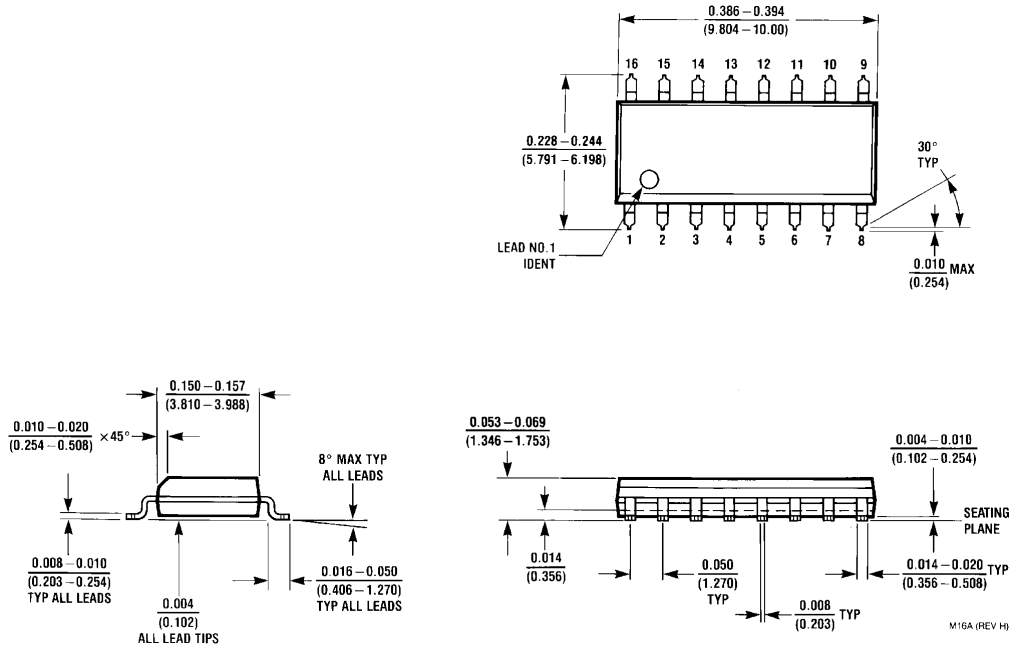



**20-Lead Ceramic Leadless Chip Carrier (L)**
**NS Package Number E20A**



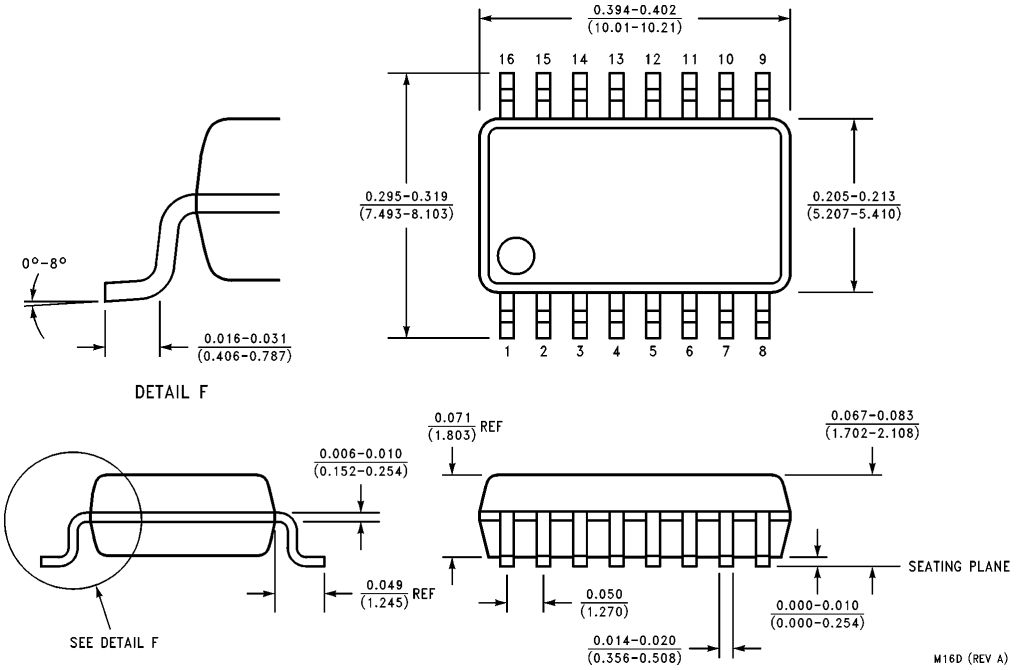

**16-Lead Ceramic Dual In-Line Package (D)**
**NS Package Number J16A**

## Physical Dimensions inches (millimeters) (Continued)

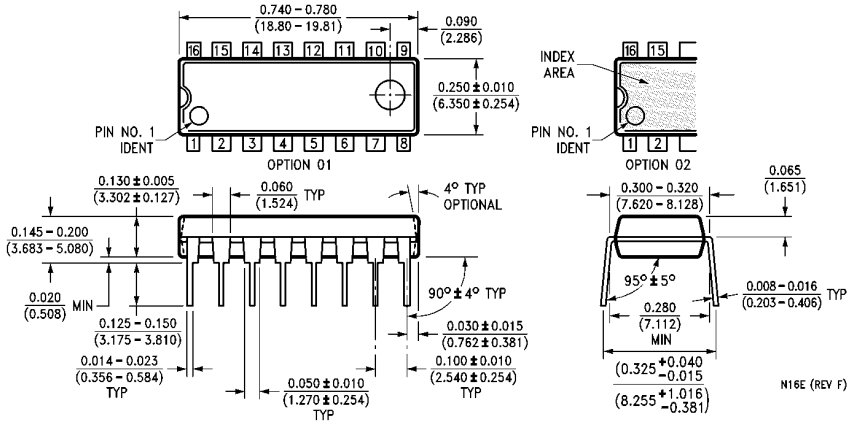



**16-Lead (0.150″ Wide) Molded Small Outline Package, JEDEC (S)**
**NS Package Number M16A**

## Physical Dimensions inches (millimeters) (Continued)

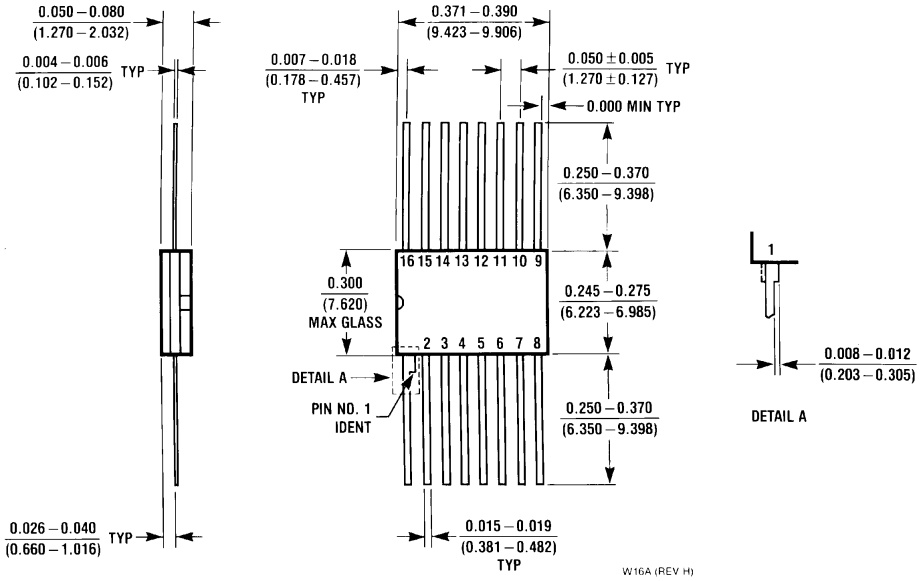



**16-Lead (0.300″ Wide) Molded Small Outline Package, EIAJ (SJ)**
**NS Package Number M16D**




**16-Lead (0.300″ Wide) Molded Dual In-Line Package (P)**
**NS Package Number N16E**

## Physical Dimensions inches (millimeters) (Continued)




**16-Lead Ceramic Flatpak (F)**
**NS Package Number W16A**

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