

## 54LS157/DM54LS157/DM74LS157, 54LS158/DM54LS158/DM74LS158 Quad 2-Line to 1-Line Data Selectors/Multiplexers

### General Description

These data selectors/multiplexers contain inverters and drivers to supply full on-chip data selection to the four output gates. A separate strobe input is provided. A 4-bit word is selected from one of two sources and is routed to the four outputs. The LS157 presents true data whereas the LS158 presents inverted data to minimize propagation delay time.

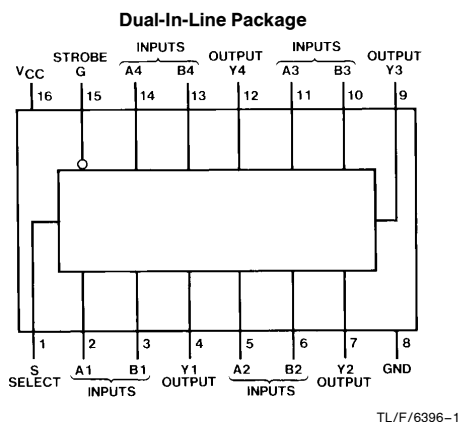
### Applications

- Expand any data input point
- Multiplex dual data buses
- Generate four functions of two variables (one variable is common)
- Source programmable counters

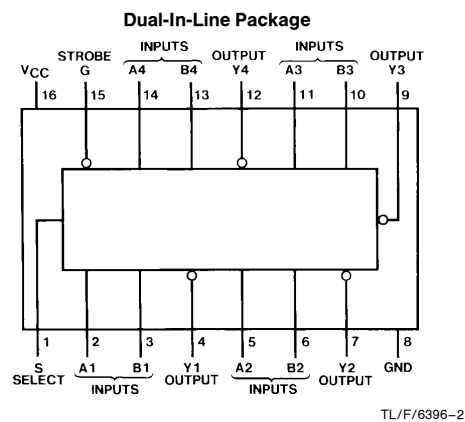
### Features

- Buffered inputs and outputs
- Typical Propagation Time
  - LS157 9 ns
  - LS158 7 ns
- Typical Power Dissipation
  - LS157 49 mW
  - LS158 24 mW
- Alternate Military/Aerospace device (54LS157, 54LS158) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

### Connection Diagrams



Order Number 54LS157DMQB, 54LS157FMBQ,  
54LS157LMQB, DM54LS157J, DM54LS157W,  
DM74LS157M or DM74LS157N  
See NS Package Number E20A, J16A,  
M16A, N16E or W16A



Order Number 54LS158DMQB, 54LS158FMBQ,  
54LS158LMQB, DM54LS158J, DM54LS158W,  
DM74LS158M or DM74LS158N  
See NS Package Number E20A, J16A,  
M16A, N16E or W16A

### Function Table

| Inputs |        |   |   | Output Y |       |
|--------|--------|---|---|----------|-------|
| Strobe | Select | A | B | LS157    | LS158 |
| H      | X      | X | X | L        | H     |
| L      | L      | L | X | L        | H     |
| L      | L      | H | X | H        | L     |
| L      | H      | X | L | L        | H     |
| L      | H      | X | H | H        | L     |

H = High Level, L = Low Level, X = Don't Care

54LS157/DM54LS157/DM74LS157, 54LS158/DM54LS158/DM74LS158  
Quad 2-Line to 1-Line Data Selectors/Multiplexers

## Absolute Maximum Ratings (Note)

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

|                                      |                 |
|--------------------------------------|-----------------|
| Supply Voltage                       | 7V              |
| Input Voltage                        | 7V              |
| Operating Free Air Temperature Range |                 |
| DM54LS and 54LS                      | −55°C to +125°C |
| DM74LS                               | 0°C to +70°C    |
| Storage Temperature Range            | −65°C to +150°C |

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Recommended Operating Conditions

| Symbol          | Parameter                      | DM54LS157 |     |      | DM74LS157 |     |      | Units |
|-----------------|--------------------------------|-----------|-----|------|-----------|-----|------|-------|
|                 |                                | Min       | Nom | Max  | Min       | Nom | Max  |       |
| V <sub>CC</sub> | Supply Voltage                 | 4.5       | 5   | 5.5  | 4.75      | 5   | 5.25 | V     |
| V <sub>IH</sub> | High Level Input Voltage       | 2         |     |      | 2         |     |      | V     |
| V <sub>IL</sub> | Low Level Input Voltage        |           |     | 0.7  |           |     | 0.8  | V     |
| I <sub>OH</sub> | High Level Output Current      |           |     | −0.4 |           |     | −0.4 | mA    |
| I <sub>OL</sub> | Low Level Output Current       |           |     | 4    |           |     | 8    | mA    |
| T <sub>A</sub>  | Free Air Operating Temperature | −55       |     | 125  | 0         |     | 70   | °C    |

## 'LS157 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

| Symbol          | Parameter                         | Conditions                                                                                   | Min    | Typ<br>(Note 1) | Max  | Units |
|-----------------|-----------------------------------|----------------------------------------------------------------------------------------------|--------|-----------------|------|-------|
| V <sub>I</sub>  | Input Clamp Voltage               | V <sub>CC</sub> = Min, I <sub>I</sub> = −18 mA                                               |        |                 | −1.5 | V     |
| V <sub>OH</sub> | High Level Output Voltage         | V <sub>CC</sub> = Min, I <sub>OH</sub> = Max<br>V <sub>IL</sub> = Max, V <sub>IH</sub> = Min | DM54   | 2.5             | 3.4  | V     |
|                 |                                   |                                                                                              | DM74   | 2.7             | 3.4  |       |
| V <sub>OL</sub> | Low Level Output Voltage          | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max<br>V <sub>IL</sub> = Max, V <sub>IH</sub> = Min | DM54   |                 | 0.25 | V     |
|                 |                                   |                                                                                              | DM74   |                 | 0.35 |       |
|                 |                                   | I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min                                                | DM74   |                 | 0.25 |       |
| I <sub>I</sub>  | Input Current @ Max Input Voltage | V <sub>CC</sub> = Max<br>V <sub>I</sub> = 7V                                                 | S or G |                 | 0.2  | mA    |
|                 |                                   |                                                                                              | A or B |                 | 0.1  |       |
| I <sub>IH</sub> | High Level Input Current          | V <sub>CC</sub> = Max<br>V <sub>I</sub> = 2.7V                                               | S or G |                 | 40   | μA    |
|                 |                                   |                                                                                              | A or B |                 | 20   |       |
| I <sub>IL</sub> | Low Level Input Current           | V <sub>CC</sub> = Max<br>V <sub>I</sub> = 0.4V                                               | S or G |                 | −0.8 | mA    |
|                 |                                   |                                                                                              | A or B |                 | −0.4 |       |
| I <sub>OS</sub> | Short Circuit Output Current      | V <sub>CC</sub> = Max<br>(Note 2)                                                            | DM54   | −20             | −100 | mA    |
|                 |                                   |                                                                                              | DM74   | −20             | −100 |       |
| I <sub>CC</sub> | Supply Current                    | V <sub>CC</sub> = Max (Note 3)                                                               |        | 9.7             | 16   | mA    |

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 3: I<sub>CC</sub> is measured with 4.5V applied to all inputs and all outputs open.

## 'LS157 Switching Characteristics

at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$  (See Section 1 for Test Waveforms and Output Load)

| Symbol    | Parameter                                          | From (Input)<br>To (Output) | $R_L = 2\text{ k}\Omega$ |     |                      |     | Units |
|-----------|----------------------------------------------------|-----------------------------|--------------------------|-----|----------------------|-----|-------|
|           |                                                    |                             | $C_L = 15\text{ pF}$     |     | $C_L = 50\text{ pF}$ |     |       |
|           |                                                    |                             | Min                      | Max | Min                  | Max |       |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | Data<br>to Y                |                          | 14  |                      | 18  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | Data<br>to Y                |                          | 14  |                      | 23  | ns    |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | Strobe<br>to Y              |                          | 20  |                      | 24  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | Strobe<br>to Y              |                          | 21  |                      | 30  | ns    |
| $t_{PLH}$ | Propagation Delay Time<br>Low to High Level Output | Select<br>to Y              |                          | 23  |                      | 28  | ns    |
| $t_{PHL}$ | Propagation Delay Time<br>High to Low Level Output | Select<br>to Y              |                          | 27  |                      | 32  | ns    |

## Recommended Operating Conditions

| Symbol   | Parameter                      | DM54LS158 |     |      | DM74LS158 |     |      | Units      |
|----------|--------------------------------|-----------|-----|------|-----------|-----|------|------------|
|          |                                | Min       | Nom | Max  | Min       | Nom | Max  |            |
| $V_{CC}$ | Supply Voltage                 | 4.5       | 5   | 5.5  | 4.75      | 5   | 5.25 | V          |
| $V_{IH}$ | High Level Input Voltage       | 2         |     |      | 2         |     |      | V          |
| $V_{IL}$ | Low Level Input Voltage        |           |     | 0.7  |           |     | 0.8  | V          |
| $I_{OH}$ | High Level Output Current      |           |     | -0.4 |           |     | -0.4 | mA         |
| $I_{OL}$ | Low Level Output Current       |           |     | 4    |           |     | 8    | mA         |
| $T_A$    | Free Air Operating Temperature | -55       |     | 125  | 0         |     | 70   | $^\circ C$ |

## 'LS158 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

| Symbol   | Parameter                            | Conditions                                                                                     | Min    | Typ<br>(Note 1) | Max  | Units   |
|----------|--------------------------------------|------------------------------------------------------------------------------------------------|--------|-----------------|------|---------|
| $V_I$    | Input Clamp Voltage                  | $V_{CC} = \text{Min}$ , $I_I = -18\text{ mA}$                                                  |        |                 | -1.5 | V       |
| $V_{OH}$ | High Level Output<br>Voltage         | $V_{CC} = \text{Min}$ , $I_{OH} = \text{Max}$<br>$V_{IL} = \text{Max}$ , $V_{IH} = \text{Min}$ | DM54   | 2.5             | 3.4  | V       |
|          |                                      |                                                                                                | DM74   | 2.7             | 3.4  |         |
| $V_{OL}$ | Low Level Output<br>Voltage          | $V_{CC} = \text{Min}$ , $I_{OL} = \text{Max}$<br>$V_{IL} = \text{Max}$ , $V_{IH} = \text{Min}$ | DM54   |                 | 0.25 | V       |
|          |                                      |                                                                                                | DM74   |                 | 0.35 |         |
|          |                                      | $I_{OL} = 4\text{ mA}$ , $V_{CC} = \text{Min}$                                                 | DM74   |                 | 0.25 | 0.4     |
| $I_I$    | Input Current @ Max<br>Input Voltage | $V_{CC} = \text{Max}$<br>$V_I = 7V$                                                            | S or G |                 | 0.2  | mA      |
|          |                                      |                                                                                                | A or B |                 | 0.1  |         |
| $I_{IH}$ | High Level Input<br>Current          | $V_{CC} = \text{Max}$<br>$V_I = 2.7V$                                                          | S or G |                 | 40   | $\mu A$ |
|          |                                      |                                                                                                | A or B |                 | 20   |         |
| $I_{IL}$ | Low Level Input<br>Current           | $V_{CC} = \text{Max}$<br>$V_I = 0.4V$                                                          | S or G |                 | -0.8 | mA      |
|          |                                      |                                                                                                | A or B |                 | -0.4 |         |
| $I_{OS}$ | Short Circuit<br>Output Current      | $V_{CC} = \text{Max}$<br>(Note 2)                                                              | DM54   | -20             | -100 | mA      |
|          |                                      |                                                                                                | DM74   | -20             | -100 |         |
| $I_{CC}$ | Supply Current                       | $V_{CC} = \text{Max}$ (Note 3)                                                                 |        | 4.8             | 8    | mA      |

**Note 1:** All typicals are at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$ .

**Note 2:** Not more than one output should be shorted at a time, and the duration should not exceed one second.

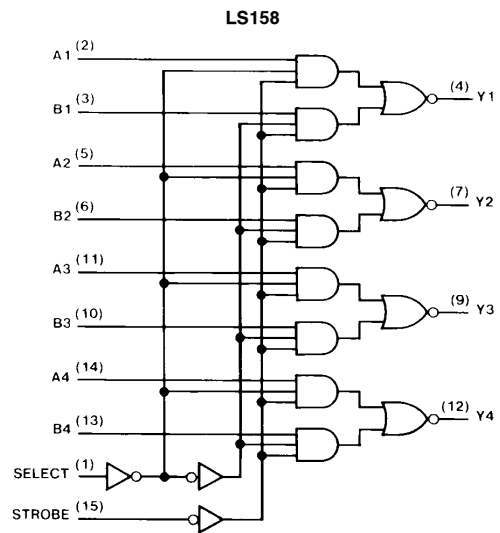
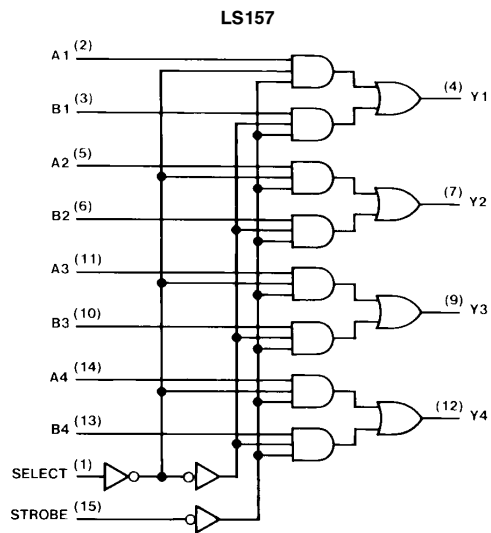
**Note 3:**  $I_{CC}$  is measured with 4.5V applied to all inputs and all outputs open.

## 'LS158 Switching Characteristics

at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$  (See Section 1 for Test Waveforms and Output Load)

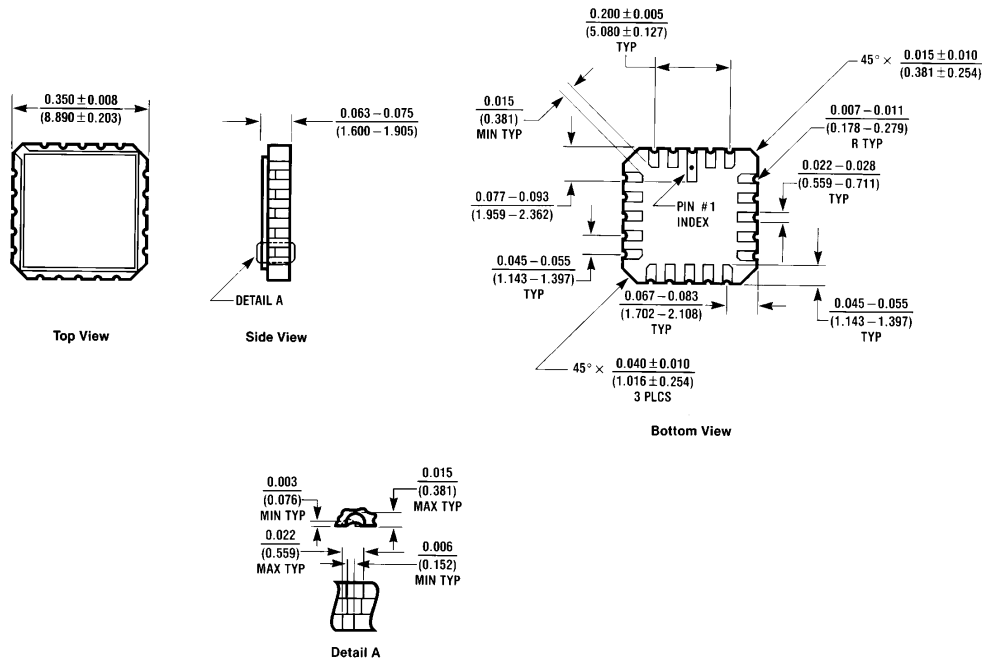
| Symbol           | Parameter                                          | From (Input)<br>To (Output) | R <sub>L</sub> = 2 kΩ  |     |                        |     | Units |
|------------------|----------------------------------------------------|-----------------------------|------------------------|-----|------------------------|-----|-------|
|                  |                                                    |                             | C <sub>L</sub> = 15 pF |     | C <sub>L</sub> = 50 pF |     |       |
|                  |                                                    |                             | Min                    | Max | Min                    | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output | Data<br>to Y                |                        | 12  |                        | 18  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output | Data<br>to Y                |                        | 12  |                        | 21  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output | Strobe<br>to Y              |                        | 17  |                        | 23  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output | Strobe<br>to Y              |                        | 18  |                        | 28  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output | Select<br>to Y              |                        | 20  |                        | 24  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output | Select<br>to Y              |                        | 24  |                        | 36  | ns    |

## Logic Diagrams



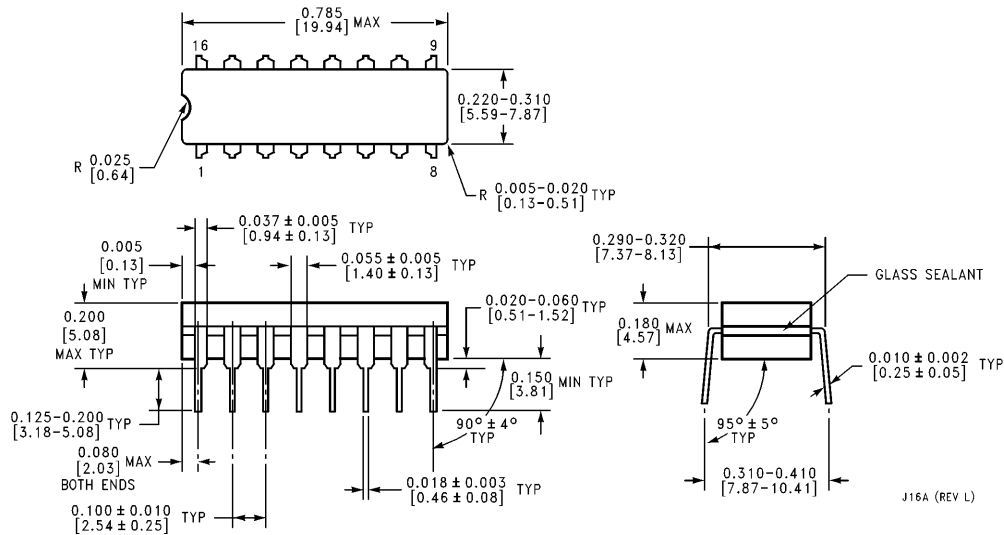


## Physical Dimensions inches (millimeters)



E20A (REV D)

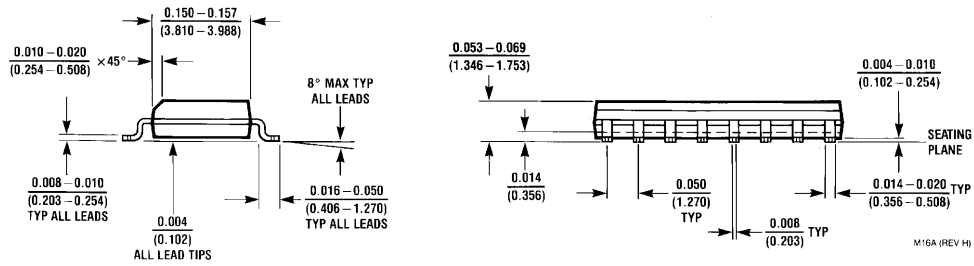
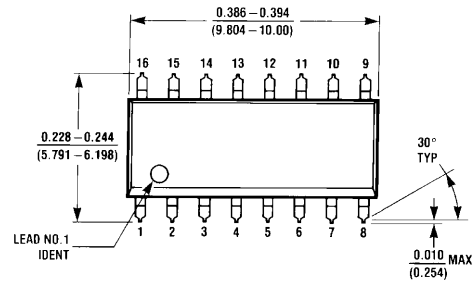
**Ceramic Leadless Chip Carrier Package (E)**  
**Order Number 54LS157LMQB or 54LS158LMQB**  
**NS Package Number E20A**



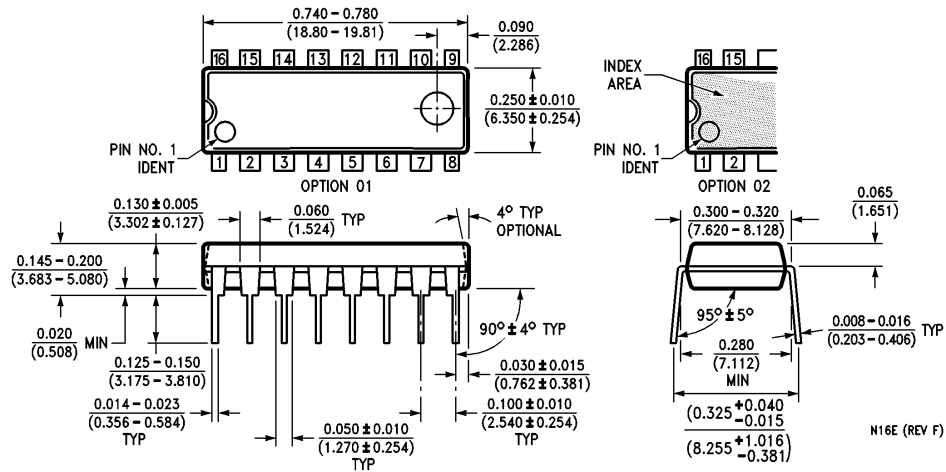
J16A (REV L)

**16-Lead Ceramic Dual-In-Line Package (J)**  
**Order Number 54LS157DMQB, 54LS158DMQB, DM54LS157J or DM54LS158J**  
**NS Package Number J16A**

# Physical Dimensions inches (millimeters) (Continued)

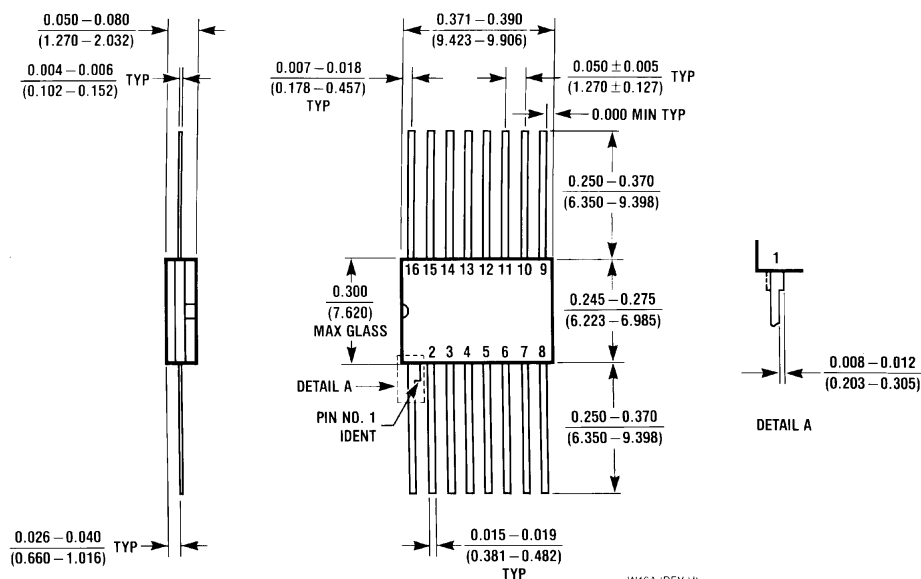


**16-Lead Small Outline Molded Package (M)**  
**Order Number DM74LS157M or DM74LS158M**  
**NS Package Number M16A**



**16-Lead Molded Dual-In-Line Package (N)**  
**Order Number DM74LS157N or DM74LS158N**  
**NS Package Number N16E**

# Physical Dimensions inches (millimeters) (Continued)



**16-Lead Ceramic Flat Package (W)**  
Order Number 54LS157FMQB, 54LS158FMQB, DM54LS157W or DM54LS158W  
NS Package Number W16A

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