

## DM54LS251/DM74LS251 TRI-STATE® Data Selectors/Multiplexers

### General Description

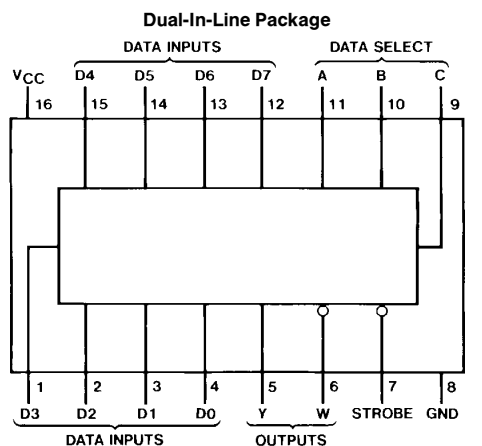
These data selectors/multiplexers contain full on-chip binary decoding to select one-of-eight data sources, and feature a strobe-controlled TRI-STATE output. The strobe must be at a low logic level to enable these devices. The TRI-STATE outputs permit direct connection to a common bus. When the strobe input is high, both outputs are in a high-impedance state in which both the upper and lower transistors of each totem-pole output are off, and the output neither drives nor loads the bus significantly. When the strobe is low, the outputs are activated and operate as standard TTL totem-pole outputs.

To minimize the possibility that two outputs will attempt to take a common bus to opposite logic levels, the output control circuitry is designed so that the average output disable time is shorter than the average output enable time.

### Features

- TRI-STATE version of LS151
- Interface directly with system bus
- Perform parallel-to-serial conversion
- Permit multiplexing from N-lines to one line
- Complementary outputs provide true and inverted data
- Maximum number of common outputs
  - 54LS 49
  - 74LS 129
- Typical propagation delay time (D to Y)
  - 54LS 17 ns
  - 74LS 17 ns
- Typical power dissipation
  - 54LS 35 mW
  - 74LS 35 mW

### Connection Diagram



Order Number DM54LS251J, DM54LS251W,  
DM74LS251M or DM74LS251N  
See NS Package Number J16A, M16A, N16E or W16A

### Function Table

| Inputs |   |   |             | Outputs |                 |
|--------|---|---|-------------|---------|-----------------|
| Select |   |   | Strobe<br>S | Y       | W               |
| C      | B | A |             |         |                 |
| X      | X | X | H           | Z       | Z               |
| L      | L | L | L           | D0      | $\overline{D0}$ |
| L      | L | H | L           | D1      | $\overline{D1}$ |
| L      | H | L | L           | D2      | $\overline{D2}$ |
| L      | H | H | L           | D3      | $\overline{D3}$ |
| H      | L | L | L           | D4      | $\overline{D4}$ |
| H      | L | H | L           | D5      | $\overline{D5}$ |
| H      | H | L | L           | D6      | $\overline{D6}$ |
| H      | H | H | L           | D7      | $\overline{D7}$ |

H = High Logic Level, L = Low Logic Level,

X = Don't Care, Z = High Impedance (Off)

D0, D1 ... D7 = The level of the respective D input

## 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                               | −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                      | DM54LS251 |     |     | DM74LS251 |     |      | 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      |           |     | −1  |           |     | −2.6 | mA    |
| I <sub>OL</sub> | Low Level Output Current       |           |     | 12  |           |     | 24   | mA    |
| T <sub>A</sub>  | Free Air Operating Temperature | −55       |     | 125 | 0         |     | 70   | °C    |

## 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 | 2.4 | 3.4             |      | V     |
|                  |                                                                 |                                                                                              | DM74 | 2.4 | 3.1             |      |       |
| 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            | 0.4  | V     |
|                  |                                                                 |                                                                                              | DM74 |     | 0.35            | 0.5  |       |
|                  |                                                                 | I <sub>OL</sub> = 12 mA, V <sub>CC</sub> = Min                                               | DM74 |     | 0.25            | 0.4  |       |
| I <sub>I</sub>   | Input Current @ Max Input Voltage                               | V <sub>CC</sub> = Max, V <sub>I</sub> = 7V                                                   |      |     |                 | 0.1  | mA    |
| I <sub>IH</sub>  | High Level Input Current                                        | V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V                                                 |      |     |                 | 20   | μA    |
| I <sub>IL</sub>  | Low Level Input Current                                         | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V                                                 |      |     |                 | −0.4 | mA    |
| I <sub>OZH</sub> | Off-State Output Current with High Level Output Voltage Applied | V <sub>CC</sub> = Max, V <sub>O</sub> = 2.7V<br>V <sub>IH</sub> = Min, V <sub>IL</sub> = Max |      |     |                 | 20   | μA    |
| I <sub>OZL</sub> | Off-State Output Current with Low Level Output Voltage Applied  | V <sub>CC</sub> = Max, V <sub>O</sub> = 0.4V<br>V <sub>IH</sub> = Min, V <sub>IL</sub> = Max |      |     |                 | −20  | μA    |
| 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>CC1</sub> | Supply Current                                                  | V <sub>CC</sub> = Max (Note 3)                                                               |      |     | 6.1             | 10   | mA    |
| I <sub>CC2</sub> | Supply Current                                                  | V <sub>CC</sub> = Max (Note 4)                                                               |      |     | 7.1             | 12   | 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>CC1</sub> is measured with the outputs open, STROBE grounded, and all other inputs at 4.5V.

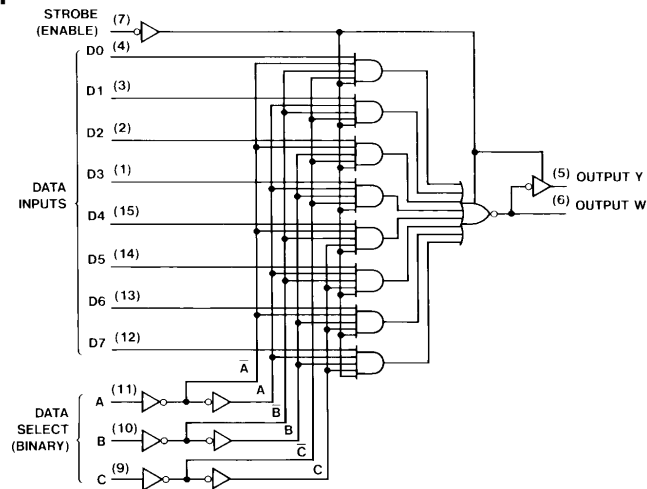
Note 4: I<sub>CC2</sub> is measured with the outputs open and all inputs at 4.5V.

## 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> = 667Ω  |     |                         |     | Units |
|------------------|--------------------------------------------------------|-----------------------------|------------------------|-----|-------------------------|-----|-------|
|                  |                                                        |                             | C <sub>L</sub> = 45 pF |     | C <sub>L</sub> = 150 pF |     |       |
|                  |                                                        |                             | Min                    | Max | Min                     | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output     | A, B, C<br>(4 Levels) to Y  |                        | 45  |                         | 53  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output     | A, B, C<br>(4 Levels) to Y  |                        | 45  |                         | 53  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output     | A, B, C<br>(3 Levels) to W  |                        | 33  |                         | 38  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output     | A, B, C<br>(3 Levels) to W  |                        | 33  |                         | 42  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output     | D<br>to Y                   |                        | 28  |                         | 35  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output     | D<br>to Y                   |                        | 28  |                         | 38  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>Low to High Level Output     | D<br>to W                   |                        | 15  |                         | 25  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>High to Low Level Output     | D<br>to W                   |                        | 15  |                         | 25  | ns    |
| t <sub>PZH</sub> | Output Enable Time to<br>High Level Output             | Strobe<br>to Y              |                        | 45  |                         | 60  | ns    |
| t <sub>PZL</sub> | Output Enable Time to<br>Low Level Output              | Strobe<br>to Y              |                        | 40  |                         | 51  | ns    |
| t <sub>PHZ</sub> | Output Disable Time from<br>High Level Output (Note 1) | Strobe<br>to Y              |                        | 45  |                         |     | ns    |
| t <sub>PLZ</sub> | Output Disable Time from<br>Low Level Output (Note 1)  | Strobe<br>to Y              |                        | 25  |                         |     | ns    |
| t <sub>PZH</sub> | Output Enable Time to<br>High Level Output             | Strobe<br>to W              |                        | 27  |                         | 40  | ns    |
| t <sub>PZL</sub> | Output Enable Time to<br>Low Level Output              | Strobe<br>to W              |                        | 40  |                         | 47  | ns    |
| t <sub>PHZ</sub> | Output Disable Time from<br>High Level Output (Note 1) | Strobe<br>to W              |                        | 55  |                         |     | ns    |
| t <sub>PLZ</sub> | Output Disable Time from<br>Low Level Output (Note 1)  | Strobe<br>to W              |                        | 25  |                         |     | ns    |

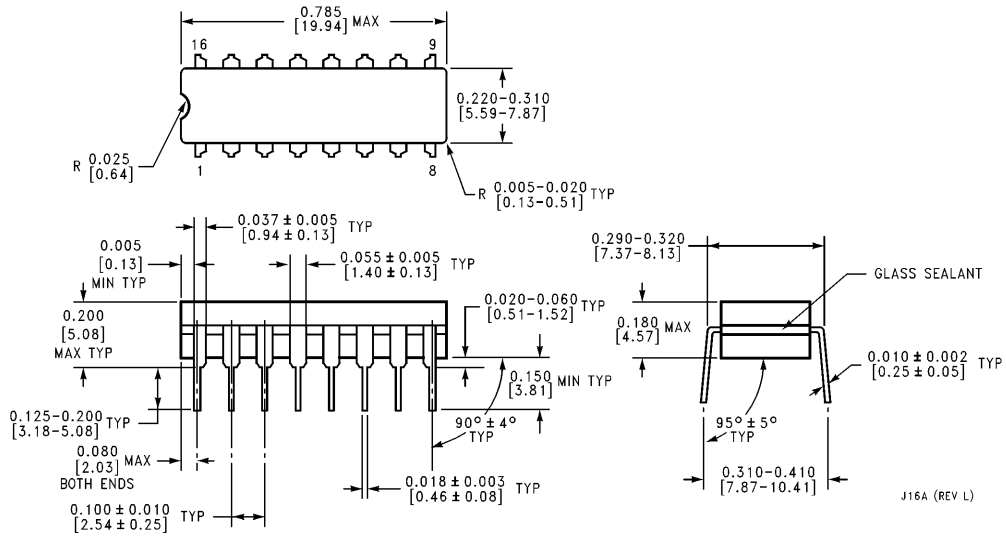
Note 1:  $C_L = 5\text{ pF}$

## Logic Diagram



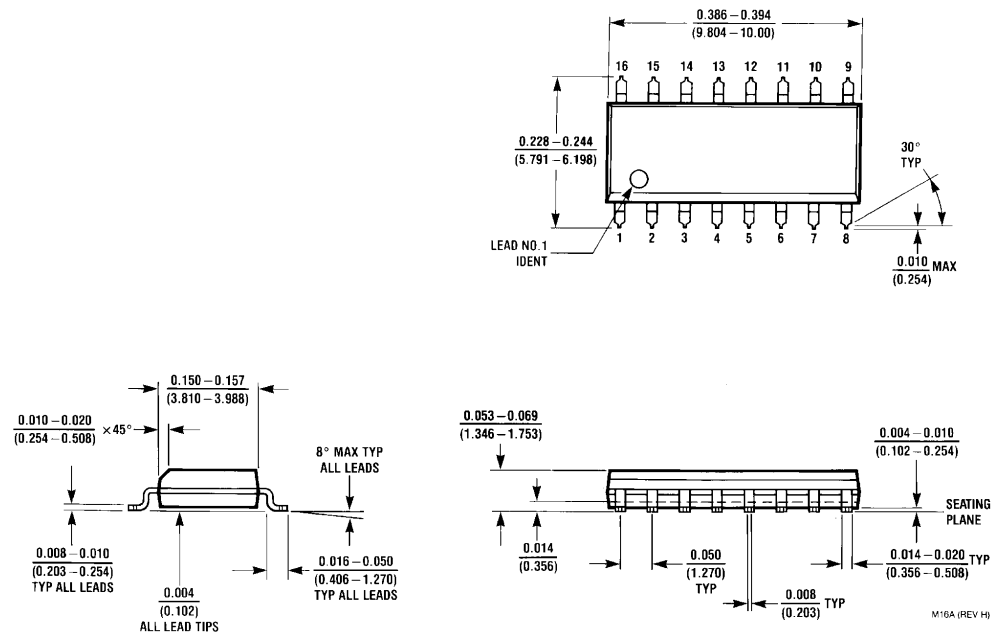
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# Physical Dimensions inches (millimeters)

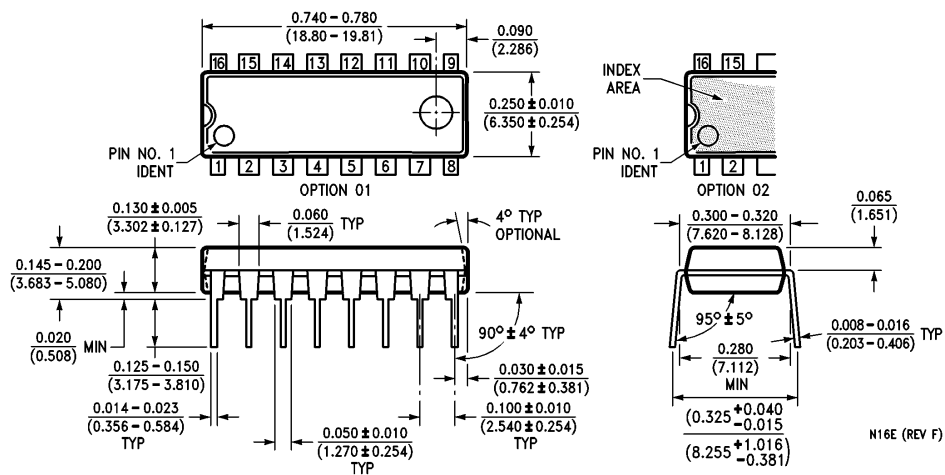


**16-Lead Ceramic Dual-In-Line Package (J)**  
**Order Number DM54LS251J**  
**NS Package Number J16A**

# Physical Dimensions inches (millimeters) (Continued)

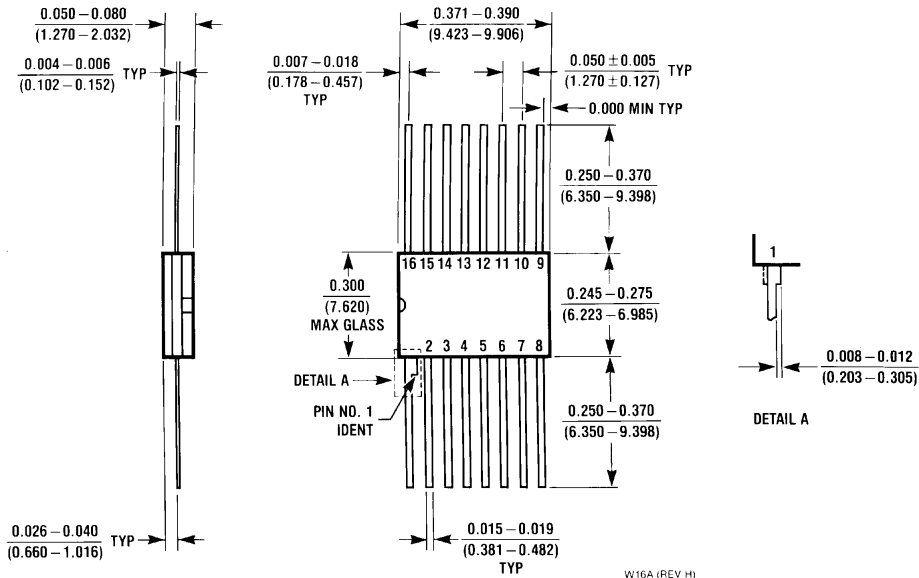


**16-Lead Small Outline Molded Package (M)**  
**Order Number DM74LS251M**  
**NS Package Number M16A**



**Molded Dual-In-Line Package (N)**  
**Order Number DM74LS251N**  
**NS Package Number N16E**

# Physical Dimensions inches (millimeters) (Continued)



**16-Lead Ceramic Flat Package (W)**  
**Order Number DM54LS251W**  
**NS Package Number W16A**

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