

## 54LS368A/DM54LS368A/DM74LS368A Hex TRI-STATE® Inverting Buffers

### General Description

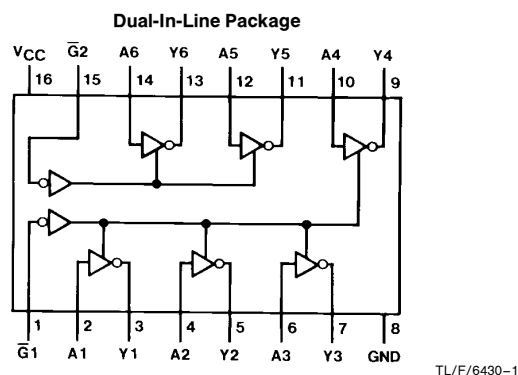
This device contains six independent gates each of which performs an inverting buffer function. The outputs have the TRI-STATE feature. When enabled, the outputs exhibit the low impedance characteristics of a standard LS output with additional drive capability to permit the driving of bus lines without external resistors. When disabled, both the output transistors are turned off presenting a high-impedance state to the bus line. Thus the output will act neither as a significant load nor as a driver. To minimize the possibility that two

outputs will attempt to take a common bus to opposite logic levels, the disable time is shorter than the enable time of the outputs.

### Features

- Alternate Military/Aerospace device (54LS368) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

### Connection Diagram



Order Number 54LS368ADMQB, 54LS368AFMQB, 54LS368ALMQB,  
DM54LS368AJ, DM54LS368AW, DM74LS368AM or DM74LS368AN  
See NS Package Number E20A, J16A, M16A, N16E or W16A

### Function Table

$$Y = \bar{A}$$

| Inputs |           | Output |
|--------|-----------|--------|
| A      | $\bar{G}$ | Y      |
| L      | L         | H      |
| H      | L         | L      |
| X      | H         | Hi-Z   |

H = High Logic Level

L = Low Logic Level

X = Either Low or High Logic Level

Hi-Z = TRI-STATE (Outputs are disabled)

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## 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                      | DM54LS368A |     |     | DM74LS368A |     |      | 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 | 2.4                  | 3.4             |      | V     |
| 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> = 0.5V<br>(Note 4)                                     | A Input              |                 | −20  | μA    |
|                  |                                                                 | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V<br>(Note 5)                                     | A Input              |                 | −0.4 | mA    |
|                  |                                                                 | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V                                                 | $\overline{G}$ Input |                 | −0.4 |       |
| I <sub>OZH</sub> | Off-State Output Current with High Level Output Voltage Applied | V <sub>CC</sub> = Max, V <sub>O</sub> = 2.4V<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>CC</sub>  | Supply Current                                                  | V <sub>CC</sub> = Max (Note 3)                                                               |                      | 12              | 21   | 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 the DATA inputs grounded and the OUTPUT CONTROLS at 4.5V.

Note 4: Both  $\overline{G}$  inputs are at 2V.

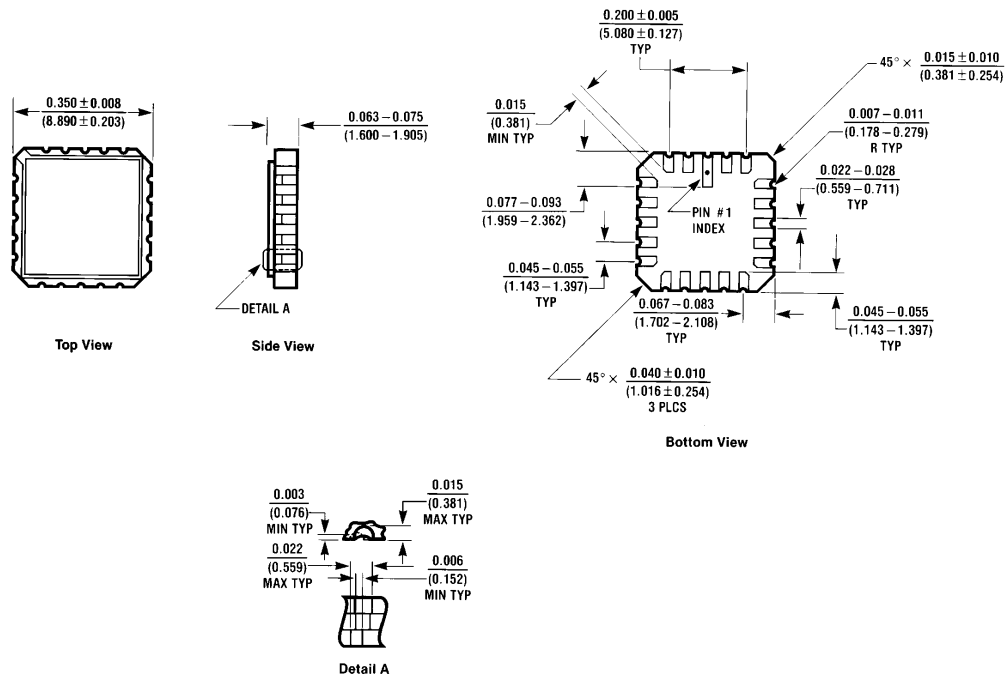
Note 5: Both  $\overline{G}$  inputs at 0.4V.

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

| Symbol           | Parameter                                           | R <sub>L</sub> = 667Ω  |     |                         |     | Units |
|------------------|-----------------------------------------------------|------------------------|-----|-------------------------|-----|-------|
|                  |                                                     | C <sub>L</sub> = 50 pF |     | C <sub>L</sub> = 150 pF |     |       |
|                  |                                                     | Min                    | Max | Min                     | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time Low to High Level Output     |                        | 15  |                         | 25  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time High to Low Level Output     |                        | 18  |                         | 25  | ns    |
| t <sub>PZH</sub> | Output Enable Time to High Level Output             |                        | 30  |                         | 35  | ns    |
| t <sub>PZL</sub> | Output Enable Time to Low Level Output              |                        | 30  |                         | 40  | ns    |
| t <sub>PHZ</sub> | Output Disable Time from High Level Output (Note 6) |                        | 20  |                         |     | ns    |
| t <sub>PLZ</sub> | Output Disable Time from Low Level Output (Note 6)  |                        | 20  |                         |     | ns    |

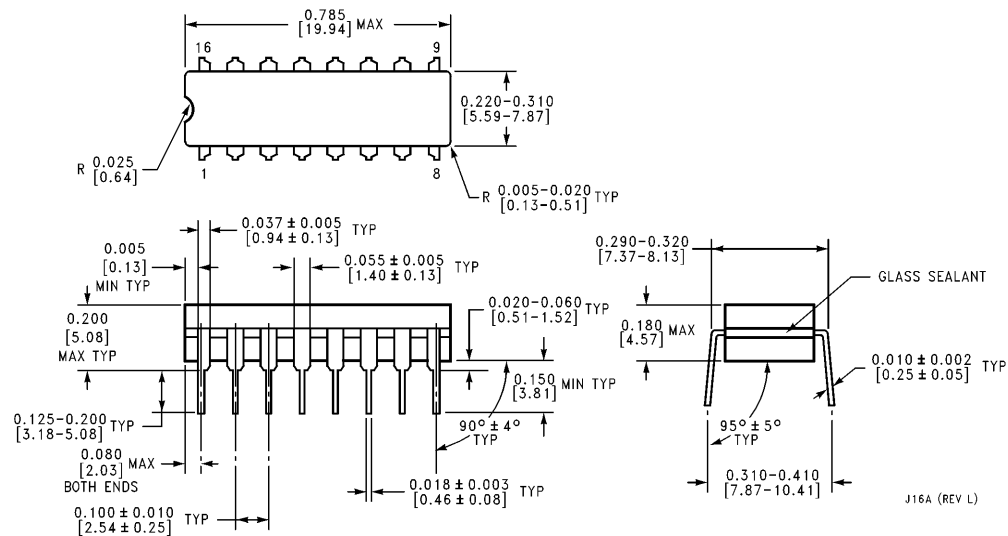
**Note 6:**  $C_L = 5\text{ pF}$ .

## Physical Dimensions inches (millimeters)



**Ceramic Leadless Chip Carrier Package (E)**  
**Order Number 54LS368ALMQB**  
**NS Package Number E20A**

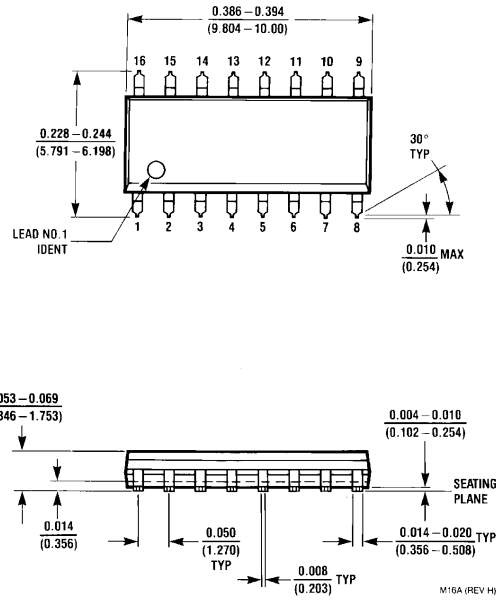
E20A (REV D)



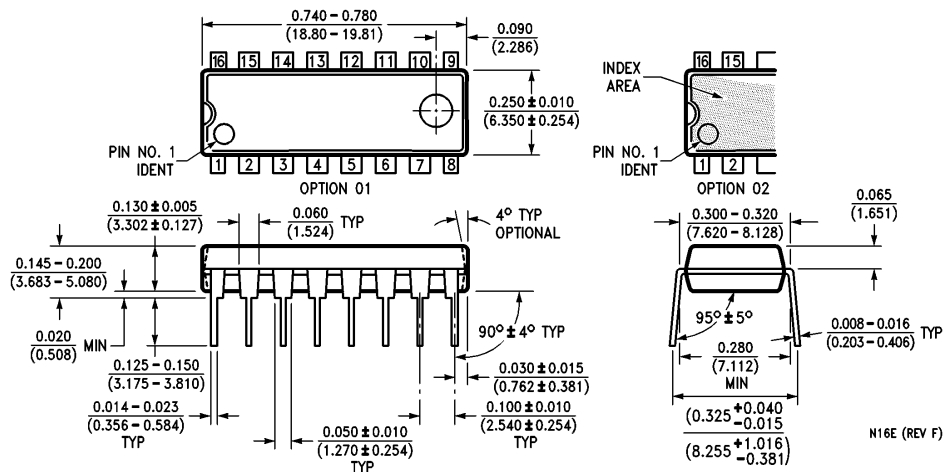
**16-Lead Ceramic Dual-In-Line Package (J)**  
**Order Number 54LS368ADMQB or DM54LS368AJ**  
**NS Package Number J16A**

J16A (REV L)

# Physical Dimensions inches (millimeters) (Continued)

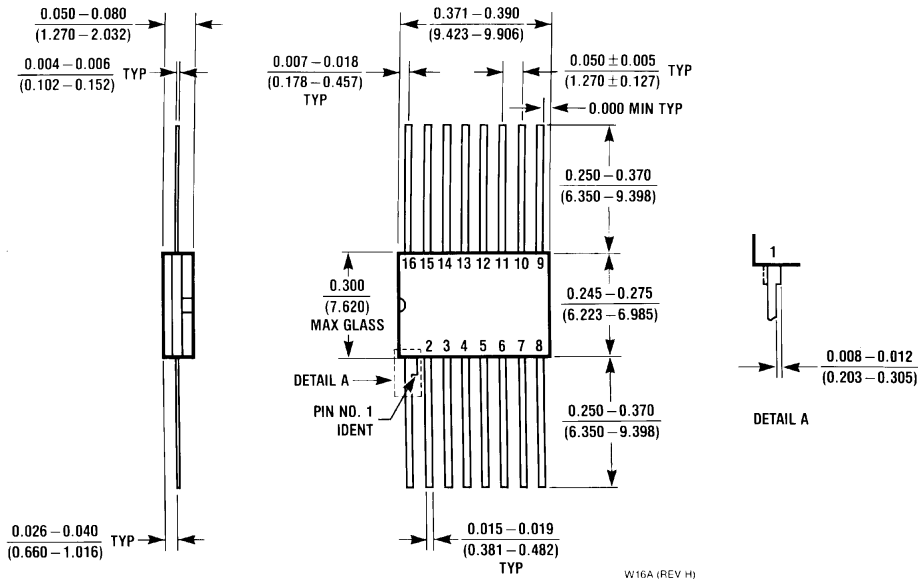


**16-Lead Small Outline Molded Package (M)**  
**Order Number DM74LS368AM**  
**NS Package Number M16A**



**16-Lead Molded Dual-In-Line Package (N)**  
**Order Number DM74LS368AN**  
**NS Package Number N16E**

# Physical Dimensions inches (millimeters) (Continued)



**16-Lead Ceramic Flat Package (W)**  
**Order Number 54LS368AFMQB or DM54LS368AW**  
**NS Package Number W16A**

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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