

May 1989

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

### General Description

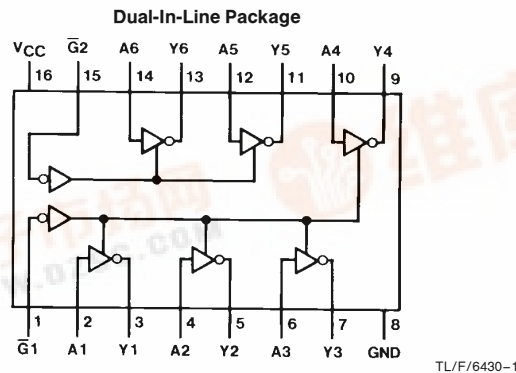
This device contains six independent gates each of which performs an inverting buffer function. The outputs have the TRI-STATE feature. When enabled, the outputs exhibit the low impedance characteristics of a standard LS output with additional drive capability to permit the driving of bus lines without 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 (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 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 V <sub>IL</sub> = Max, V <sub>IH</sub> = Min		0.25	0.4	V	
			DM54				
			DM74	0.35	0.5		
		I <sub>OL</sub> = 12 mA, V <sub>CC</sub> = Min		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 (Note 4)	A Input			-20	μA
		V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V (Note 5)	A Input			-0.4	mA
		V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V	$\bar{G}$ 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 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 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 (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.

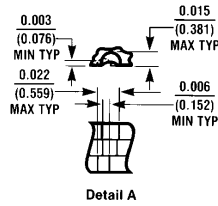
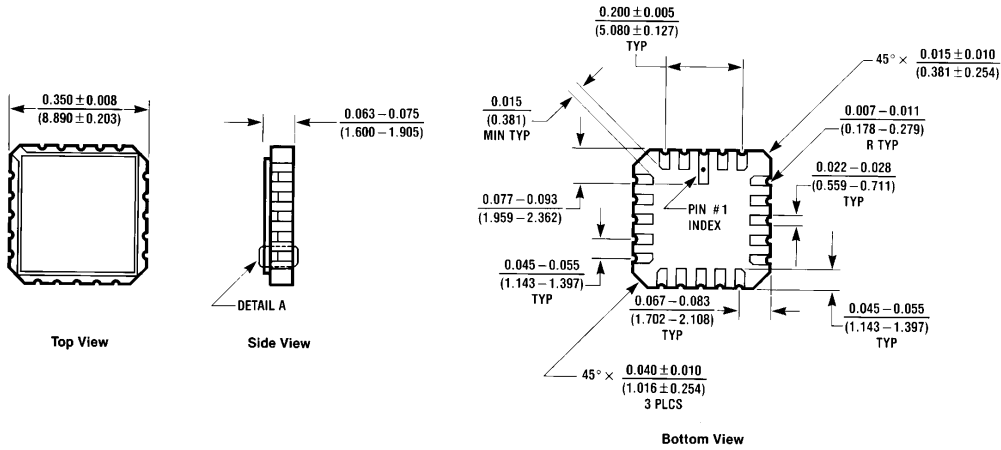
Note 4: Both  $\bar{G}$  inputs are at 2V.

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

<b>Switching Characteristics</b> at $V_{CC} = 5V$ and $T_A = 25^\circ C$ (See Section 1 for Test Waveforms and Output Load)						
Symbol	Parameter	$R_L = 667\Omega$				Units
		$C_L = 50\text{ pF}$		$C_L = 150\text{ pF}$		
		Min	Max	Min	Max	
$t_{PLH}$	Propagation Delay Time Low to High Level Output		15		25	ns
$t_{PHL}$	Propagation Delay Time High to Low Level Output		18		25	ns
$t_{PZH}$	Output Enable Time to High Level Output		30		35	ns
$t_{PZL}$	Output Enable Time to Low Level Output		30		40	ns
$t_{PHZ}$	Output Disable Time from High Level Output (Note 6)		20			ns
$t_{PLZ}$	Output Disable Time from Low Level Output (Note 6)		20			ns

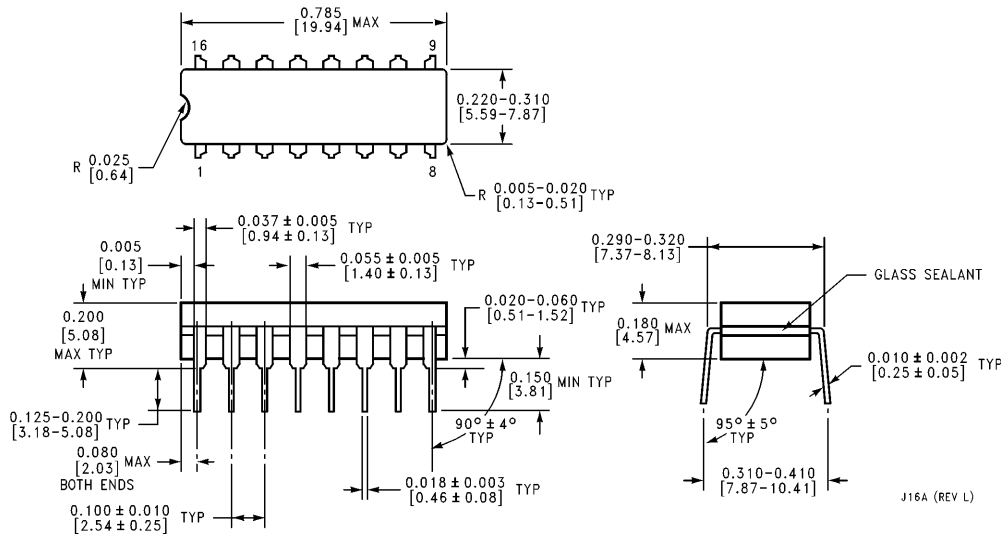
**Note 6:**  $C_L = 5\text{ pF}$ .

**Physical Dimensions** inches (millimeters)



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

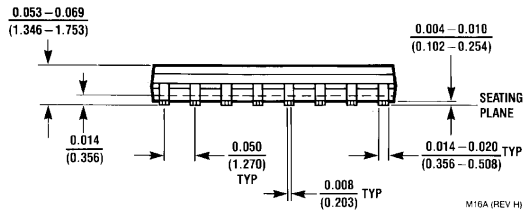
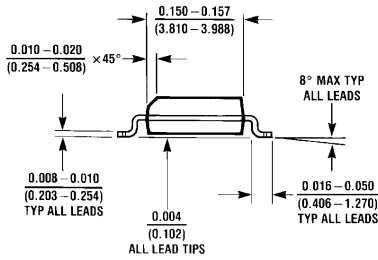
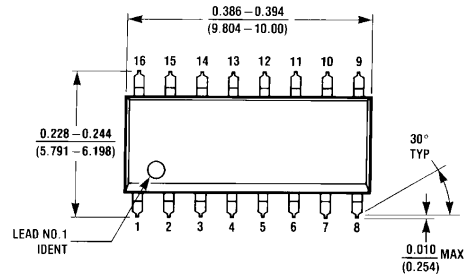
E20A (REV D)



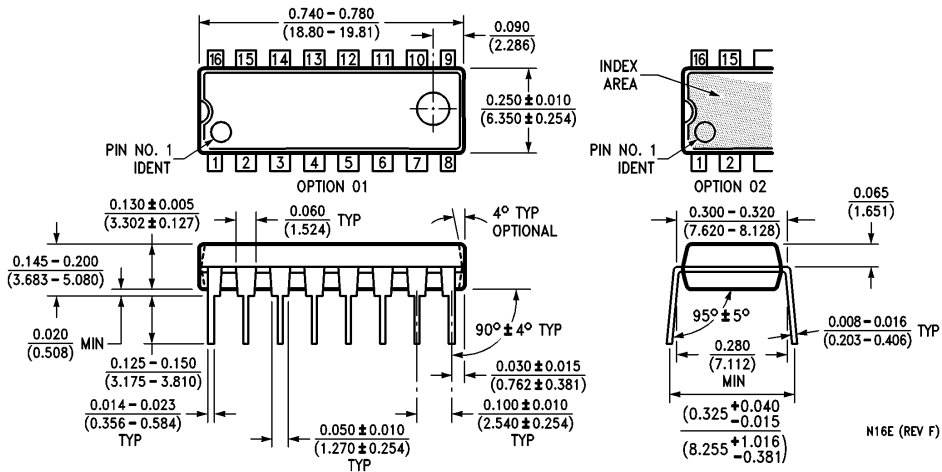
**16-Lead Ceramic Dual-In-Line Package (J)**  
 Order Number 54LS368ADMQB or DM54LS368AJ  
 NS Package Number J16A

J16A (REV L)

**Physical Dimensions** inches (millimeters) (Continued)

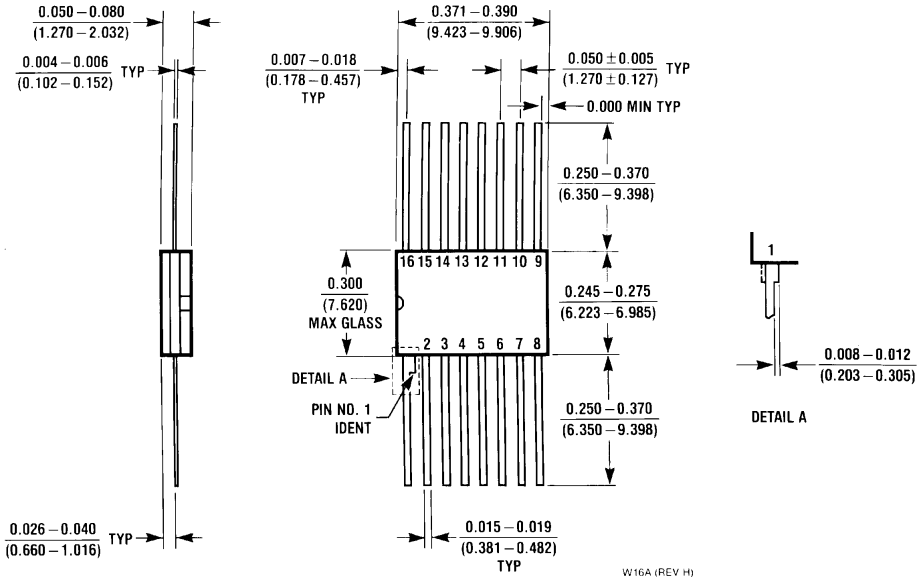


**16-Lead Small Outline Molded Package (M)**  
**Order Number DM74LS368AM**  
**NS Package Number M16A**



**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**

W16A (REV. H)

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