National Semiconductor

May 1992

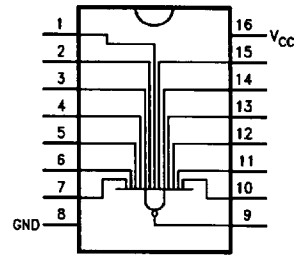
DM54LS133/DM74LS133
13-Input NAND Gate

General Description

This device contains one, 13-input gate that performs the logic NAND functions.

Connection Diagram

Dual-In-Line Package



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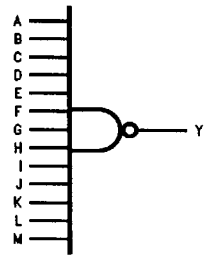
Order Number DM54LS133E, DM54LS133J, DM54LS133N, DM74LS133M or DM74LS133N
See NS Package Number E20A, J16A, M16A, N16E or W16A

Function Table

Inputs A through M	Output Y
All Inputs H	L
One or More Inputs L	H

Logic Diagram



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POSITIVE LOGIC

$Y = \overline{A \cdot B \cdot C \cdot D \cdot E \cdot F \cdot G \cdot H \cdot I \cdot J \cdot K \cdot L \cdot M}$ or

$Y = \overline{A} + \overline{B} + \overline{C} + \overline{D} + \overline{E} + \overline{F} + \overline{G} + \overline{H} + \overline{I} + \overline{J} + \overline{K} + \overline{L} + \overline{M}$

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 acutal device operation.*

Recommended Operating Conditions

Symbol	Parameter	DM54LS133			DM74LS133			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	°C

Electrical Characteristics Over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max	DM54	2.5			V
			DM74	2.7	3.4		
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min	DM54			0.4	V
			DM74		0.35	0.5	
		I_{OL} = 4 mA, V_{CC} = Min	DM74		0.25	0.4	
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 7V	DM74			0.1	mA
		V_I = 10V	DM54				
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V				20	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V				−0.4	mA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)	DM54	−20		−100	mA
			DM74	−20		−100	
I_{CCH}	Supply Current with Outputs High	V_{CC} = Max, V_{IN} = GND				0.5	mA
I_{CCL}	Supply Current with Outputs Low	V_{CC} = Max, V_{IN} = Open				1.1	mA

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

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

Switching Characteristics at V_{CC} = 5V and T_A = 25°C

Symbol	Parameter	R_L = 2 kΩ, C_L = 15 pF		Units
		Min	Max	
t_{PLH}	Propagation Delay Time Low to High Level Output		15	ns
t_{PHL}	Propagation Delay Time High to Low Level Output		38	ns

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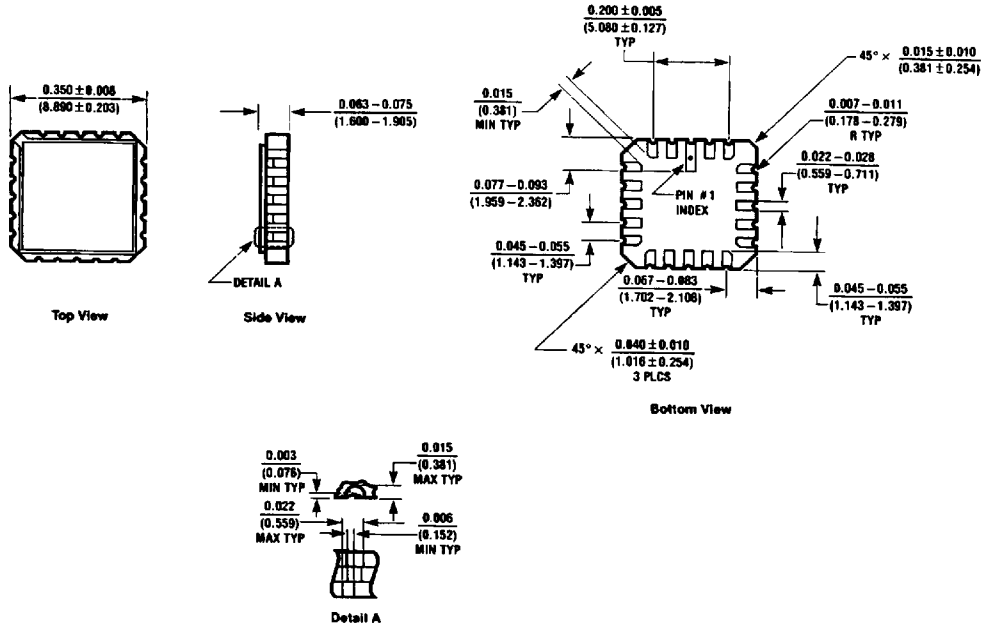
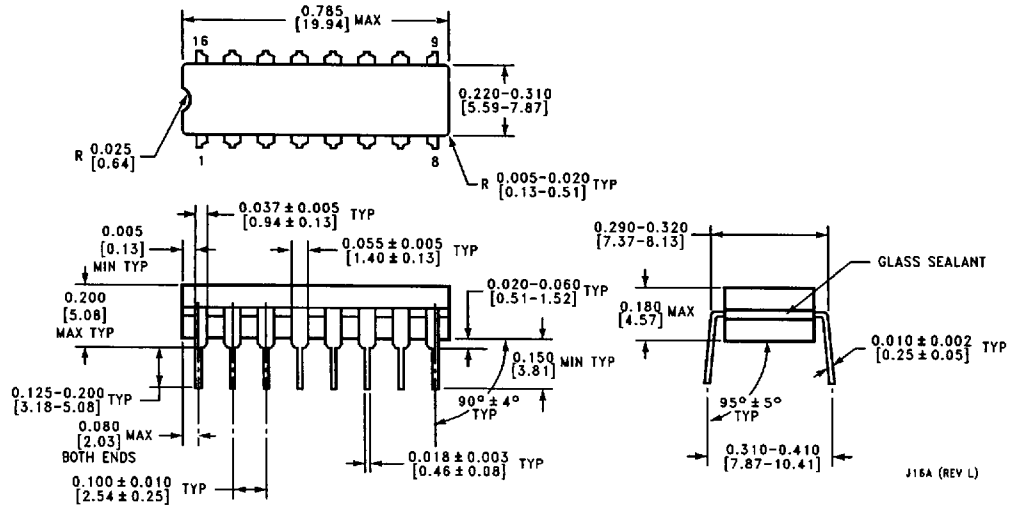
Physical Dimensions inches (millimeters)

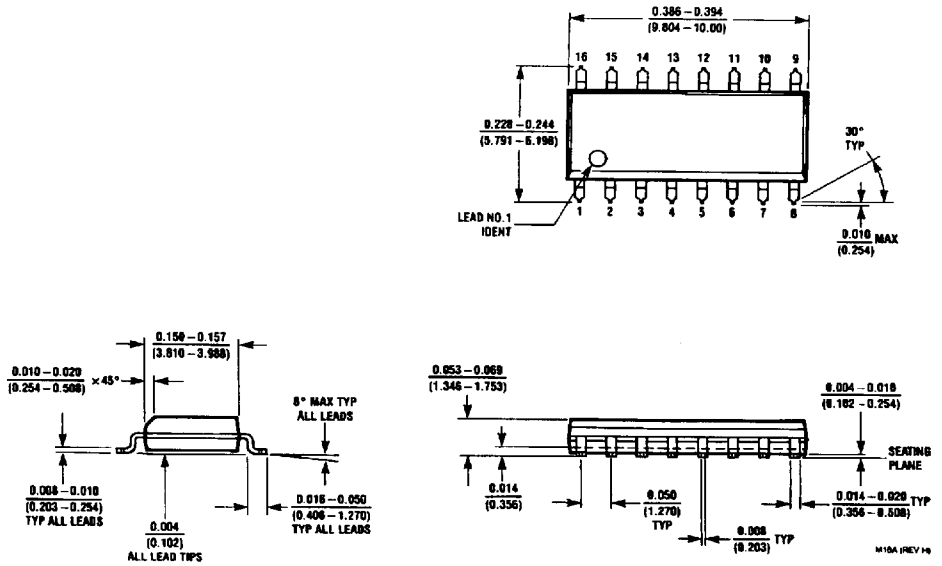


Ceramic Leadless Chip Carrier Package (E)
Order Number DM54LS133E
NS Package Number E20A

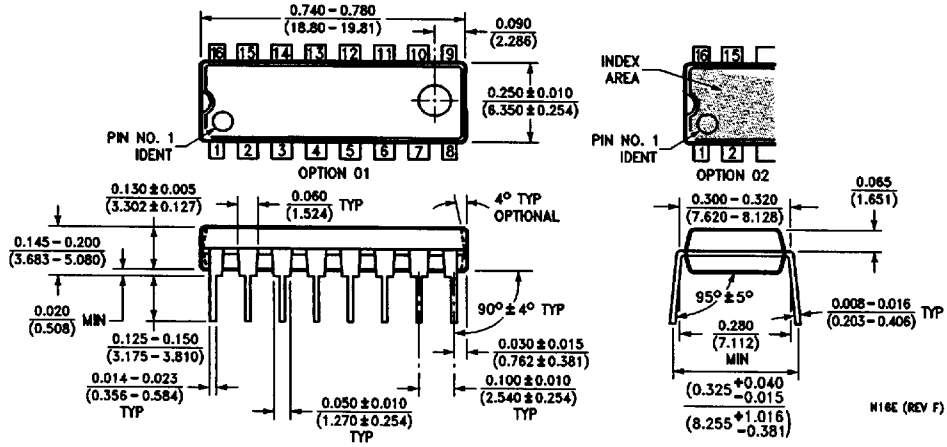


16-Lead Ceramic Dual-In-Line Package (J)
Order Number DM54LS133J
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)

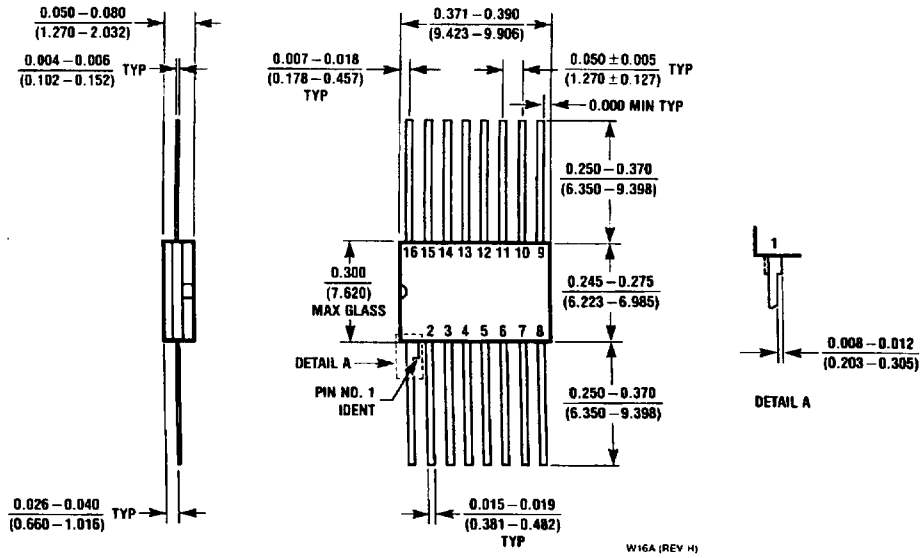


16-Lead Small Outline Molded Package (M)
Order Number DM74LS133M
NS Package Number M16A



16-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS133N
NS Package Number N16E

Physical Dimensions inches (millimeters) (Continued)



16-Lead Ceramic Flat Package (W)
Order Number DM54LS133W
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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