National Semiconductor

June 1989

54LS03/DM54LS03/DM74LS03 Quad 2-Input NAND Gates with Open-Collector Outputs

General Description

This device contains four independent gates each of which performs the logic NAND function. The open-collector outputs require external pull-up resistors for proper logical operation.

Features

- Alternate Military/Aerospace device (54LS03) is available. Contact a National Semiconductor Sales Office/ Distributor for specifications.

Pull-Up Resistor Equations

$$R_{MAX} = \frac{V_{CC}\,(Min) - V_{OH}}{N_1\,(I_{OH}) + N_2\,(I_{IH})}$$

$$R_{MIN} = \frac{V_{CC}\,(Max) - V_{OL}}{I_{OL} - N_3\,(I_{IL})}$$

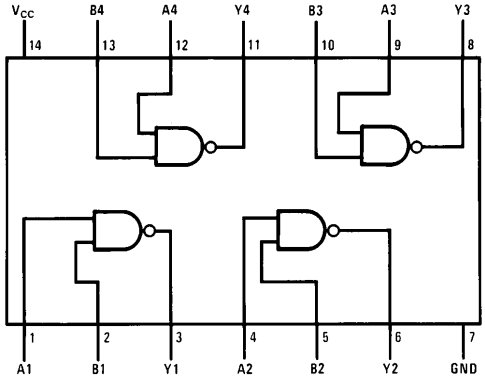
Where: $N_1\,(I_{OH})$ = total maximum output high current for all outputs tied to pull-up resistor

$N_2\,(I_{IH})$ = total maximum input high current for all inputs tied to pull-up resistor

$N_3\,(I_{IL})$ = total maximum input low current for all inputs tied to pull-up resistor

Connection Diagram

Dual-In-Line Package



TL/F/6344–1

Order Number 54LS03DMQB, 54LS03FMQB, 54LS03LMQB, DM54LS03J, DM54LS03W, DM74LS03M or DM74LS03N
See NS Package Number E20A, J14A, M14A, N14A or W14B

Function Table

$$Y = \overline{AB}$$

Inputs		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

H = High Logic Level

L = Low Logic Level

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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
Output 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	DM54LS03			DM74LS03			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
V_{OH}	High Level Output Voltage			5.5			5.5	V
I_{OL}	Low Level Output Current			4			8	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°C

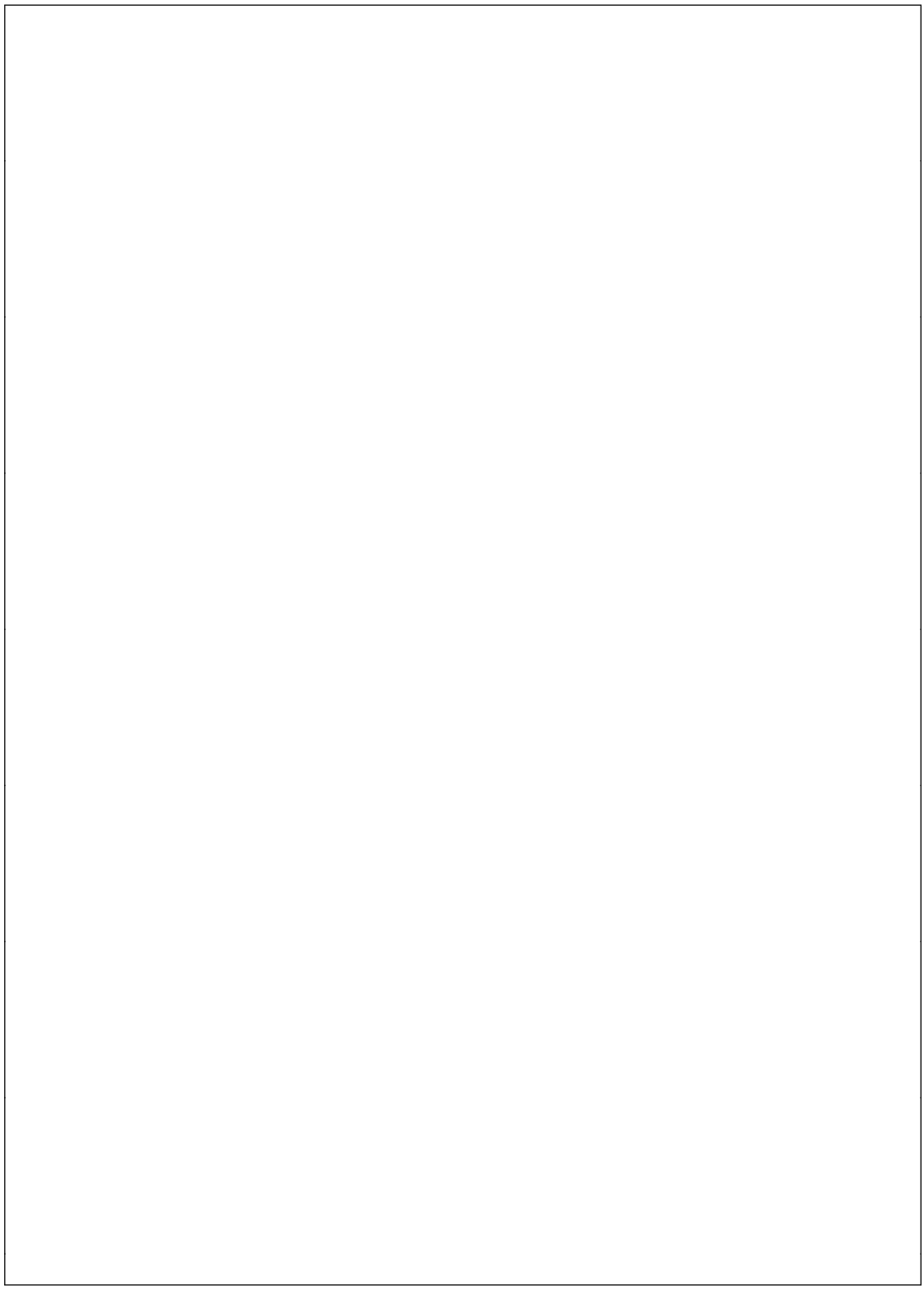
Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.5	V
I_{CEX}	High Level Output Current	V_{CC} = Min, V_O = 5.5V, V_{IL} = Max				100	μA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min	DM54		0.25	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				0.1	mA
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				−0.36	mA
I_{CCH}	Supply Current with Outputs High	V_{CC} = Max			0.8	1.6	mA
I_{CCL}	Supply Current with Outputs Low	V_{CC} = Max			2.4	4.4	mA

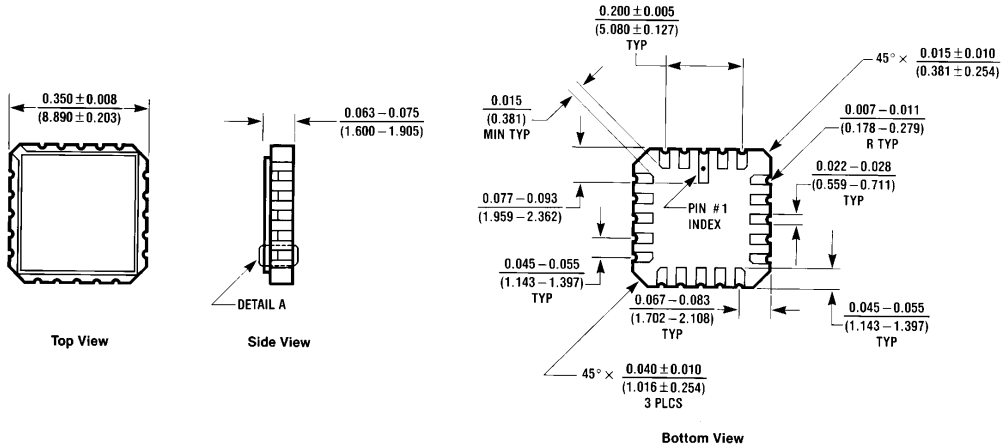
Switching Characteristics at V_{CC} = 5V and T_A = 25°C (See Section 1 for Test Waveforms and Output Load)

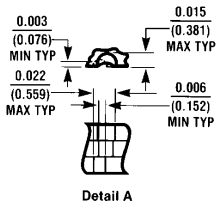
Symbol	Parameter	R_L = 2 kΩ				Units
		C_L = 15 pF		C_L = 50 pF		
		Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time Low to High Level Output	6	20	20	45	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	3	15	4	20	ns

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



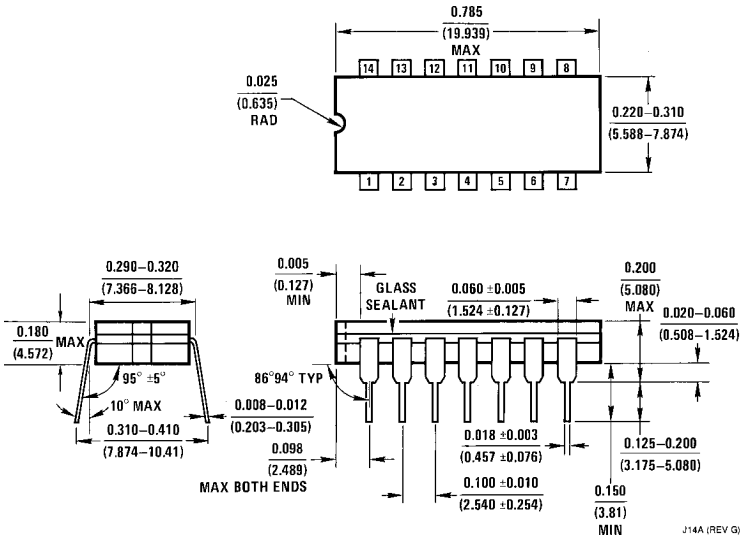
Physical Dimensions inches (millimeters)





E20A (REV D)

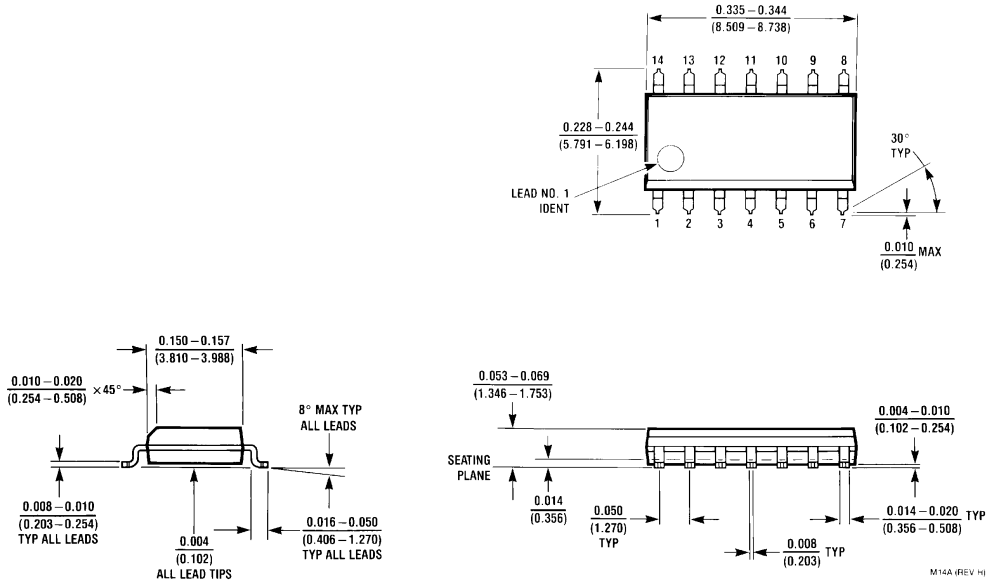
Ceramic Leadless Chip Carrier Package (E)
Order Number 54LS03LMQB
NS Package Number E20A



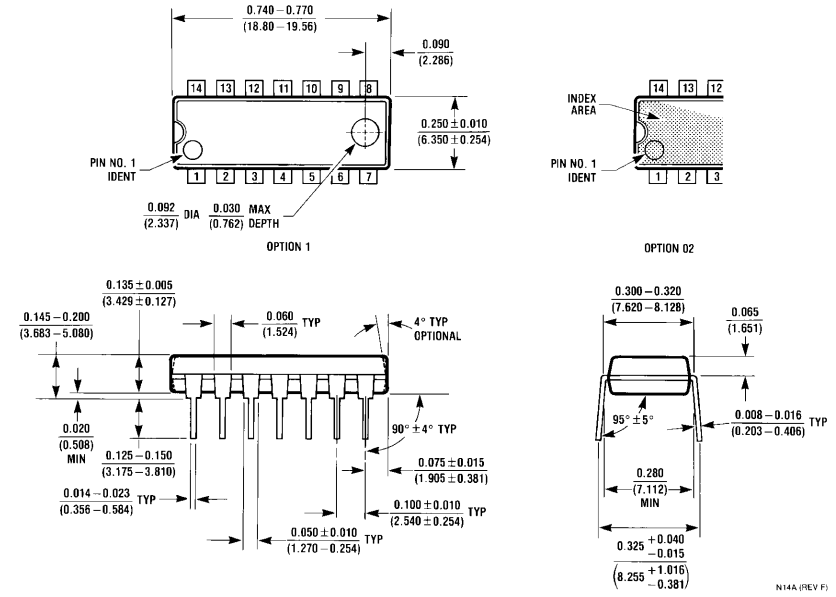
J14A (REV G)

14-Lead Ceramic Dual-In-Line Package (J)
Order Number 54LS03DMQB or DM54LS03J
NS Package Number J14A

Physical Dimensions inches (millimeters) (Continued)

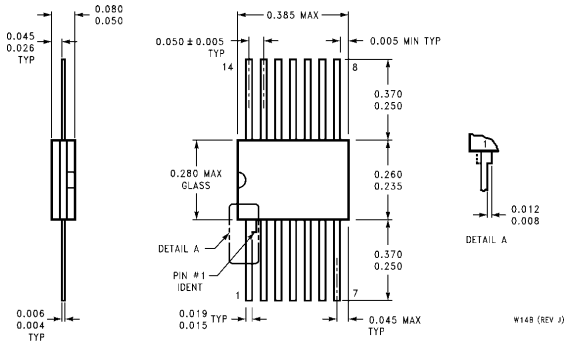


14-Lead Small Outline Molded Package (M)
Order Number DM74LS03M
NS Package Number M14A



14-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS03N
NS Package Number N14A

Physical Dimensions inches (millimeters) (Continued)



14-Lead Ceramic Flat Package (W)
Order Number 54LS03FMQB or DM54LS03W
NS Package Number W14B

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