FAIRCHILD SEMICONDUCTOR™

March 1998

DM74LS38
Quad 2-Input NAND Buffers 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 (54LS38) is available. Contact a Fairchild Semiconductor Sales Office/Distributor for specifications.

Pull-Up Resistor Equations

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

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

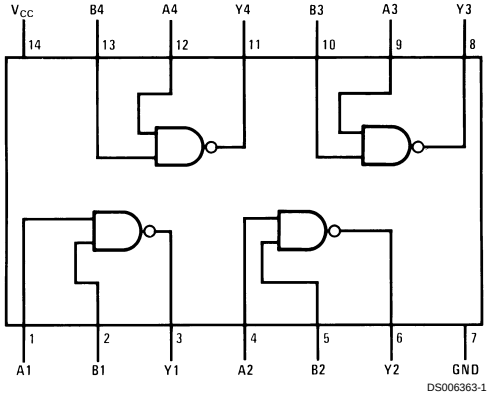
Where: $N_1\,(I_{OH})$ = total maximum output high current for all outputs tied to pull-up resistor

$N_2\,(I_{IH})$ = 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



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Order Number 54LS38DMQB, 54LS38FMQB, 54LS38LMQB, DM54LS38J, DM74LS38M or DM74LS38N
See 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

Absolute Maximum Ratings (Note 1)

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

Recommended Operating Conditions

Symbol	Parameter	DM54LS38			DM74LS38			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			12			24	mA
T_A	Free Air Operating Temperature	−55		125	0		70	˚C

Note 1: *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.*

Electrical Characteristics

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

Symbol	Parameter	Conditions		Min	Typ (Note 2)	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				250	µA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max	DM54		0.25	0.4	V
		V_{IH} = Min	DM74		0.35	0.5	
		I_{OL} = 12 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			0.9	2	mA
I_{CCL}	Supply Current with Outputs Low	V_{CC} = Max			6	12	mA

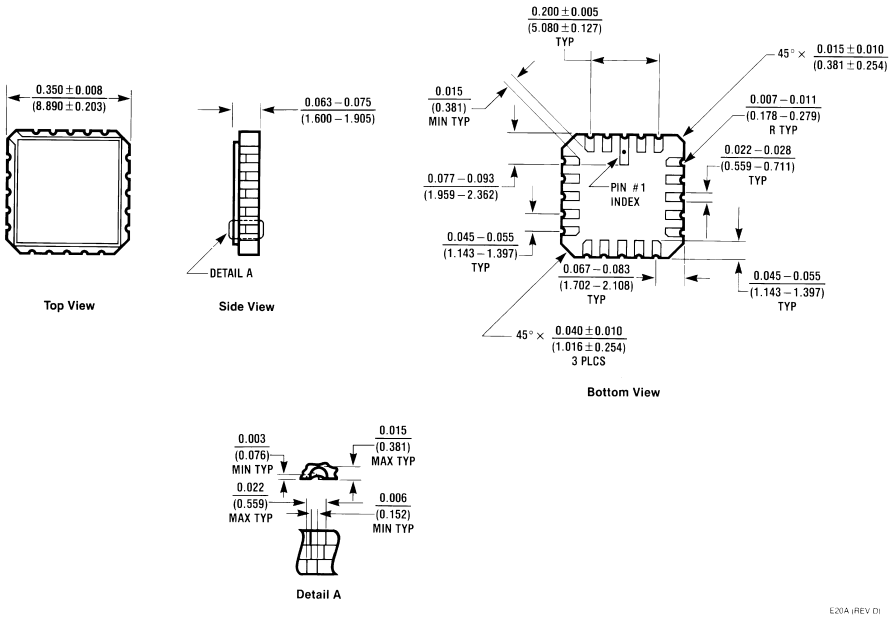
Switching Characteristics

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

Symbol	Parameter	R_L = 667Ω				Units
		C_L = 45 pF		C_L = 150 pF		
		Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time Low to High Level Output		22		48	ns
t_{PHL}	Propagation Delay Time High to Low Level Output		22		29	ns

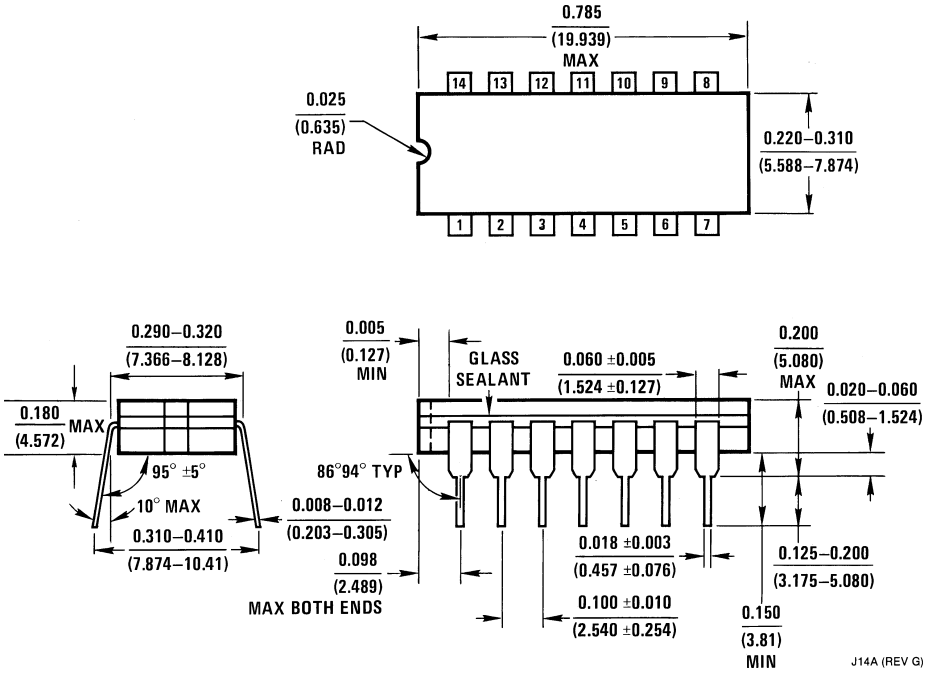
Note 2: All typicals are at V_{CC} = 5V, T_A = 25˚C.

Physical Dimensions inches (millimeters) unless otherwise noted



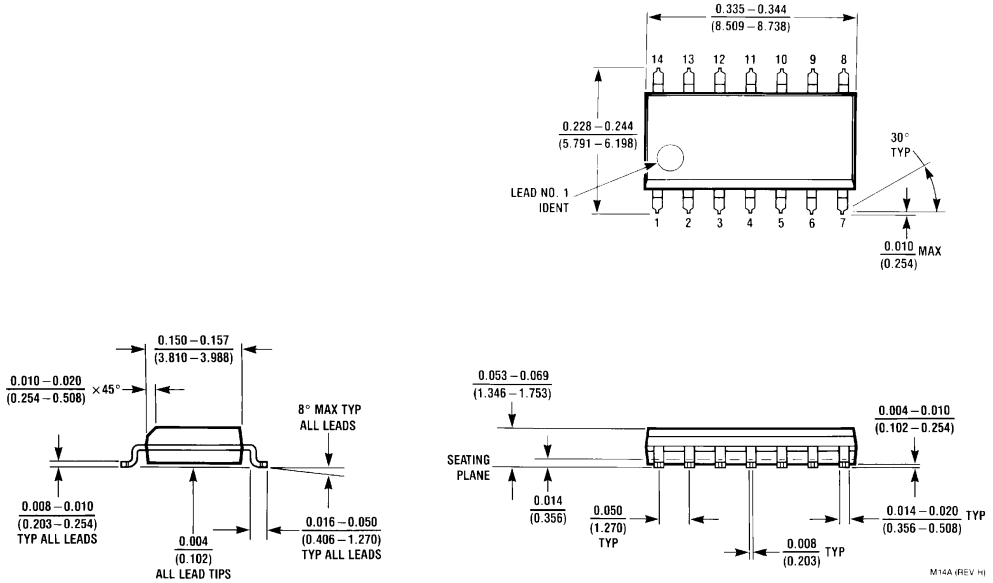
Ceramic Leadless Chip Carrier Package (E)
Order Number 54LS38LMQB
Package Number E20A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

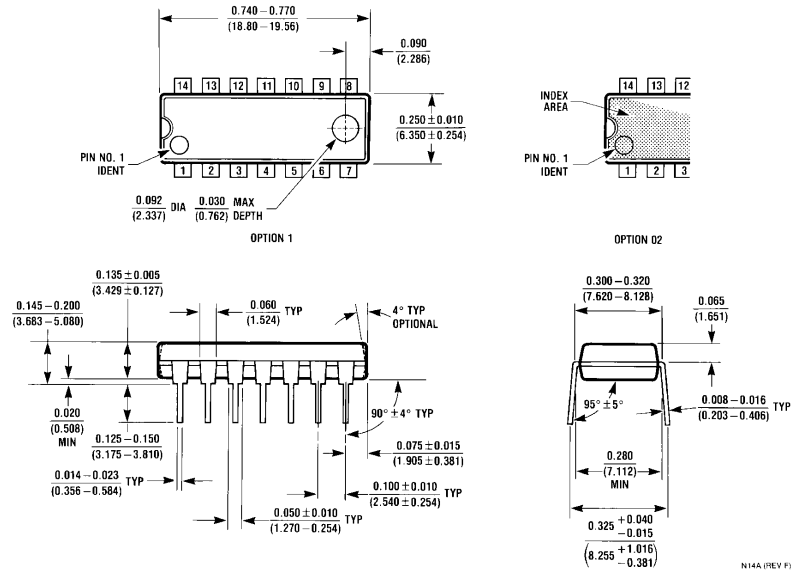


14-Lead Ceramic Dual-In-Line Package (J)
Order Number 54LS538DMQB or DM54LS38J
Package Number J14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

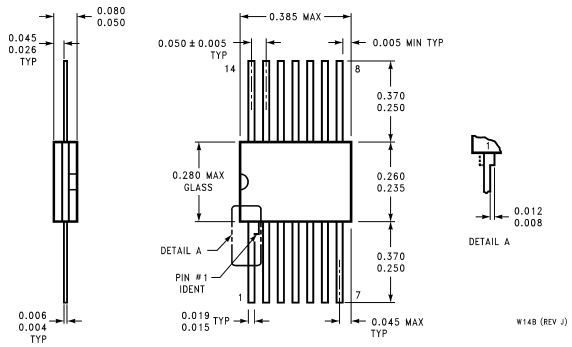


14-Lead Small Outline Molded Package (M)
Order Number DM74LS38M
Package Number M14A



14-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS38N
Package Number N14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Ceramic Flat Package (N)
Order Number 54LS538DMQB or DM54LS38W
Package Number W14B

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2. A critical component in 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.

Fairchild Semiconductor Corporation
Americas
Customer Response Center
Tel: 1-888-522-5372

Fairchild Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 8 141-35-0
English Tel: +44 (0) 1 793-85-68-56
Italy Tel: +39 (0) 2 57 5631

Fairchild Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: +852 2737-7200
Fax: +852 2314-0061

National Semiconductor Japan Ltd.
Tel: 81-3-5620-6175
Fax: 81-3-5620-6179

www.fairchildsemi.com