

54LS38/DM54LS38/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 National Semiconductor Sales Office/Distributor for specifications.

Pull-Up Resistor Equations

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

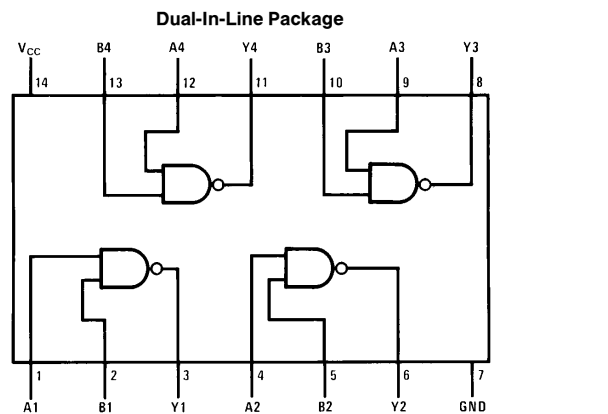
$$R_{MIN} = \frac{V_{CC} (Max) - V_{OL}}{I_{OL} - N_3 (I_{IL})}$$

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



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

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	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

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

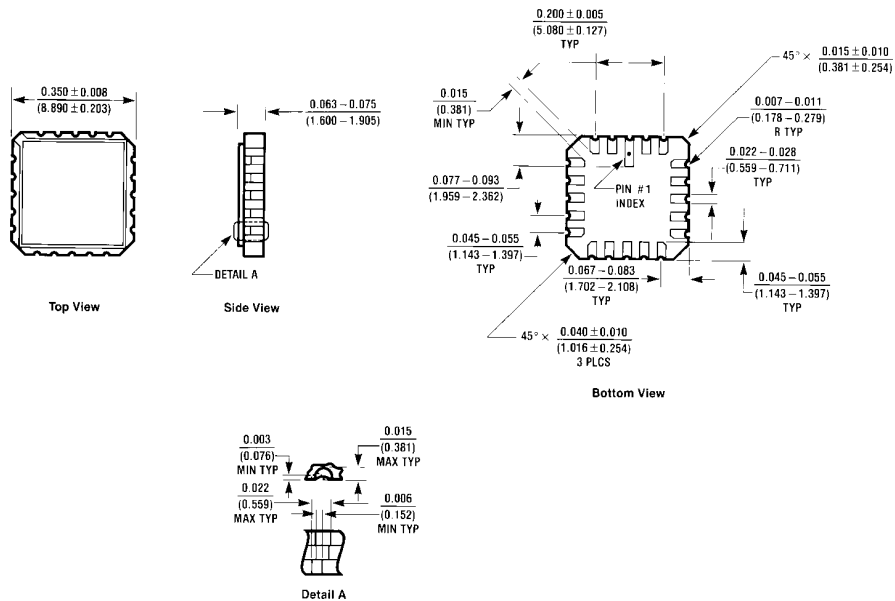
Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = −18 mA			−1.5	V
I _{CEX}	High Level Output Current	V _{CC} = Min, V _O = 5.5V V _{IL} = Max			250	μA
V _{OL}	Low Level Output Voltage	V _{CC} = Min, I _{OL} = Max V _{IH} = Min	DM54	0.25	0.4	V
			DM74	0.35	0.5	
		I _{OL} = 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

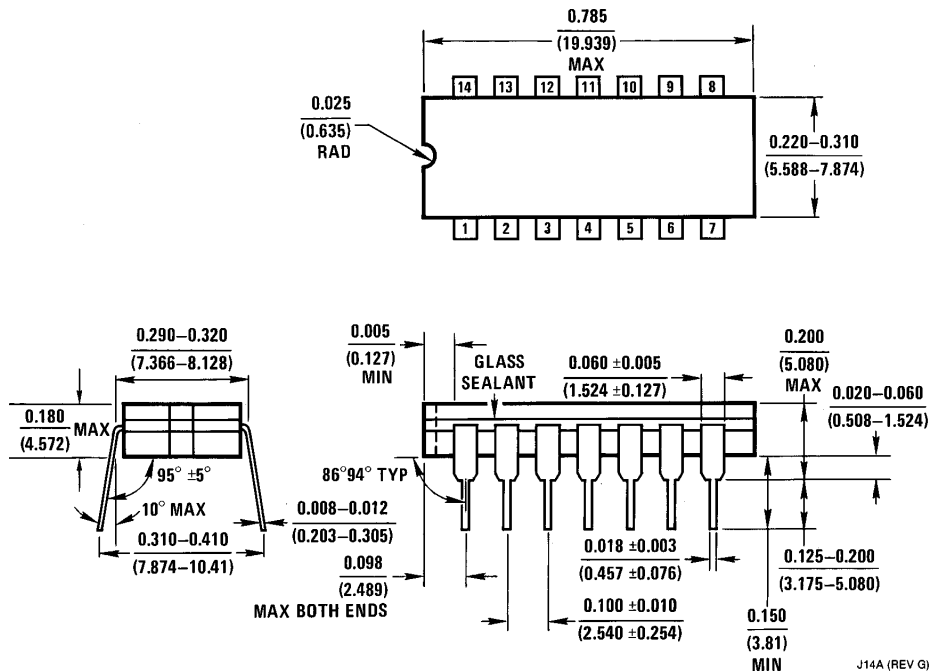
Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

Physical Dimensions inches (millimeters)



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

E20A (REV D)



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

J14A (REV G)

Physical Dimensions

inches (millimeters) (Continued)

0.335 - 0.344
(8.509 - 8.738)

0.228 - 0.244
(5.791 - 6.198)

0.010 MAX
(0.254)

30° TYP

LEAD NO. 1 IDENT

14 13 12 11 10 9 8

1 2 3 4 5 6 7

0.010 - 0.020
(0.254 - 0.508) × 45°

0.008 - 0.010
(0.203 - 0.254) TYP ALL LEADS

0.004
(0.102) ALL LEAD TIPS

0.150 - 0.157
(3.810 - 3.988)

8° MAX TYP ALL LEADS

0.016 - 0.050
(0.406 - 1.270) TYP ALL LEADS

0.053 - 0.069
(1.346 - 1.753)

SEATING PLANE

0.014
(0.356)

0.050
(1.270) TYP

0.008
(0.203) TYP

0.004 - 0.010
(0.102 - 0.254)

0.014 - 0.020 TYP
(0.356 - 0.508)

M14A (REV H)

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

0.740 - 0.770
(18.80 - 19.56)

0.090
(2.286)

0.250 ± 0.010
(6.350 ± 0.254)

PIN NO. 1 IDENT

14 13 12 11 10 9 8

1 2 3 4 5 6 7

0.092 DIA
(2.337)

0.030 MAX
(0.762) DEPTH

OPTION 1

INDEX AREA

PIN NO. 1 IDENT

14 13 12

1 2 3

OPTION 02

0.135 - 0.065
(3.429 ± 0.127)

0.145 - 0.200
(3.683 - 5.080)

0.060 TYP
(1.524)

4° TYP OPTIONAL

90° ± 4° TYP

0.075 ± 0.015
(1.905 ± 0.381)

0.014 - 0.023 TYP
(0.356 - 0.584)

0.0125 - 0.150
(3.175 - 3.810) MIN

0.020
(0.508) MIN

0.050 ± 0.010 TYP
(1.270 ± 0.254)

0.100 ± 0.010 TYP
(2.540 ± 0.254)

0.300 - 0.320
(7.620 - 8.128)

0.065
(1.651)

95° ± 5°

0.008 - 0.016 TYP
(0.203 - 0.406)

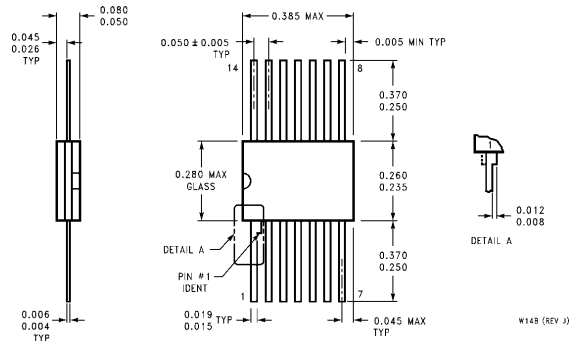
0.280
(7.112) MIN

0.325 + 0.040
- 0.015
(8.255 - 0.381)

N14A (REV F)

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

Physical Dimensions inches (millimeters) (Continued)



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

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