

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

SDLS105 - DECEMBER 1983 - REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

These devices contain four independent 2-input NAND buffer gates with open-collector outputs. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate high V_{OH} levels.

The SN5438, SN54LS38, and SN54S38 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7438, SN74LS38, and SN74S38 are characterized for operation from 0°C to 70°C .

FUNCTION TABLE (each gate)

INPUTS		OUTPUT
A	B	Y
H	H	L
L	X	H
X	L	H

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

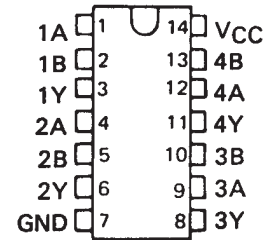
Pin numbers shown are for D, J, N, and W packages.

SN5438, SN54LS38, SN54S38 . . . J OR W PACKAGE

SN7438 . . . N PACKAGE

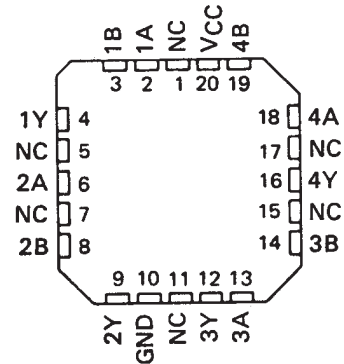
SN74LS38, SN74S38 . . . D OR N PACKAGE

(TOP VIEW)



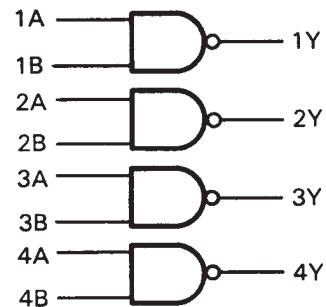
SN54LS38, SN54S38 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

logic diagram



positive logic

$$Y = \overline{A \cdot B} \text{ or } Y = \overline{\overline{A} + \overline{B}}$$

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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schematics (each gate)



Resistor values shown are nominal.

absolute maximum ratings over operating free-air temperature (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: '38	5.5 V
LS38	7 V
Off-state output voltage	7 V
Operating free-air temperature range: SN54'	-55°C to 125°C
SN74'	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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recommended operating conditions

	SN5438			SN7438			UNIT
	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	0.8			0.8			V
V _{OH} High-level output voltage	5.5			5.5			V
I _{OL} Low-level output current	48			48			mA
T _A Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN5438			SN7438			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}	V _{CC} = MIN, I _I = -12 mA	-1.5			-1.5			V
I _{OH}	V _{CC} = MIN, V _{IL} = 0.8 V, V _{OH} = 5.5 V				0.25			mA
	V _{CC} = MIN, V _{IL} = 0.7 V, V _{OH} = 5.5 V	0.25						
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 16 mA	0.4			0.4			V
I _I	V _{CC} = MAX, V _I = 5.5 V	1			1			mA
I _{IH}	V _{CC} = MAX, V _I = 2.4 V	40			40			μA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V	-1.6			-1.6			mA
I _{CCH}	V _{CC} = MAX, V _I = 0	5	8.5		5	8.5	mA	
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V	34	54		34	54	mA	

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	A or B	Y	R _L = 133 Ω, C _L = 45 pF		14	22	ns
t _{PHL}					11	18	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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recommended operating conditions

	SN54LS38			SN74LS38			UNIT
	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 Operating free-air temperature	- 55 125			0 70			°C

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

PARAMETER	TEST CONDITIONS †	SN54LS38			SN74LS38			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
V _{IK}	V _{CC} = MIN, I _I = - 18 mA	- 1.5			- 1.5			V
I _{OH}	V _{CC} = MIN, V _{IL} = MAX, V _{OH} = 5.5 V	0.25			0.25			mA
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 12 mA	0.25 0.4			0.25 0.4			V
	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 24 mA				0.35 0.5			
I _I	V _{CC} = MAX, V _I = 7 V	0.1			0.1			mA
I _{IH}	V _{CC} = MAX, V _I = 2.7 V	20			20			µA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V	- 0.4			- 0.4			mA
I _{CCH}	V _{CC} = MAX, V _I = 0	0.9 2			0.9 2			mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V	6 12			6 12			mA

† For conditons shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{PLH}	A or B	Y	R _L = 667 Ω, C _L = 45 pF	20 32		ns	
t _{PHL}				18 28			

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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recommended operating conditions

	SN54S38			SN74S38			UNIT
	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			0.8			0.8	V
V _{OH} High-level output voltage			5.5			5.5	V
I _{OL} Low-level output current			60			60	mA
T _A Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54S38		SN74S38		UNIT		
		MIN	TYP‡	MAX	MIN		TYP‡	MAX
V _{IK}	V _{CC} = MIN, I _I = -18 mA			-1.2		-1.2	V	
I _{OH}	V _{CC} = MIN, V _{IL} = 0.8 V, V _{OH} = 5.5 V					0.25	mA	
	V _{CC} = MIN, V _{IL} = 0.7 V, V _{OH} = 5.5 V			0.25				
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 60 mA			0.5		0.5	V	
I _I	V _{CC} = MAX, V _I = 5.5 V			1		1	mA	
I _{IH}	V _{CC} = MAX, V _I = 2.4 V			0.1		0.1	mA	
I _{IL}	V _{CC} = MAX, V _I = 0.5 V			-4		-4	mA	
I _{CCH}	V _{CC} = MAX, V _I = 0			20	36	20	36	mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V			46	80	46	80	mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t _{PLH}	A or B	Y	R _L = 93 Ω,	C _L = 50 pF	6.5	10	ns	
t _{PHL}					6.5	10	ns	
t _{PLH}			R _L = 93 Ω,	C _L = 150 pF	9		ns	
t _{PHL}					8.5		ns	

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.