

# SN5433, SN54LS33, SN7433, SN74LS33

## QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

SDLS101

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

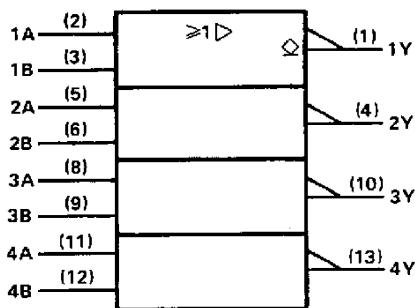
These devices contain four independent 2-input NOR buffer gates with open-collector outputs. Open-collector outputs require resistive pull-up to perform logically but can deliver higher  $V_{OH}$  levels and are commonly used in wired-AND applications.

The SN5433 and SN54LS33 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7433, and SN74LS33 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

### FUNCTION TABLE (each gate)

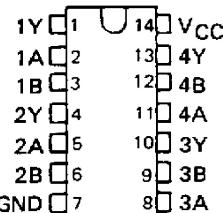
INPUTS		OUTPUT
A	B	Y
H	X	L
X	H	L
L	L	H

### logic symbol†

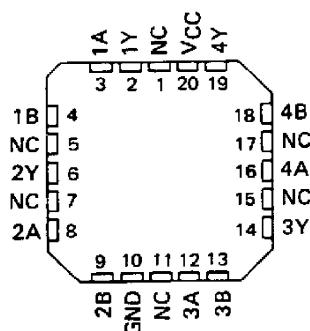


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for D, J, N, and W packages.

SN5433, SN54LS33 . . . J OR W PACKAGE  
SN7433 . . . N PACKAGE  
SN74LS33 . . . D OR N PACKAGE  
(TOP VIEW)

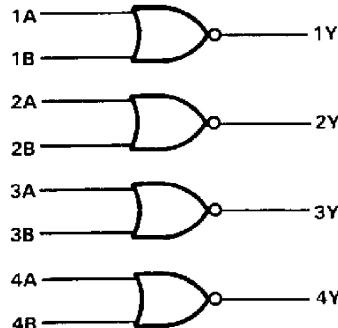


SN54LS33 . . . FK PACKAGE  
(TOP VIEW)



NC — No internal connection

### logic diagram



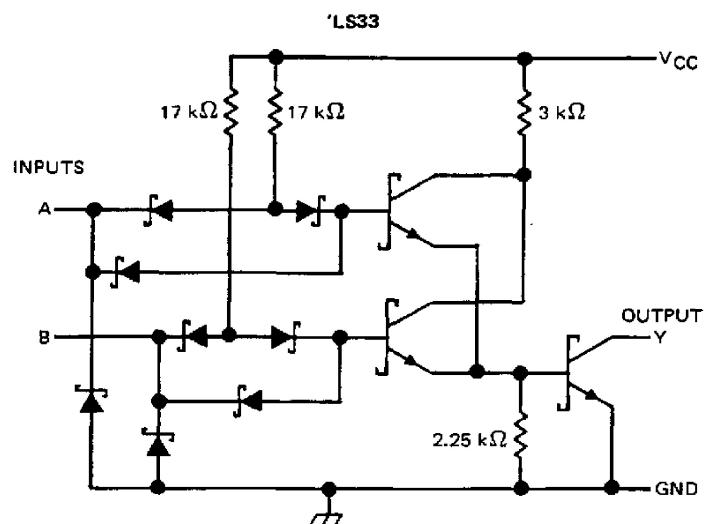
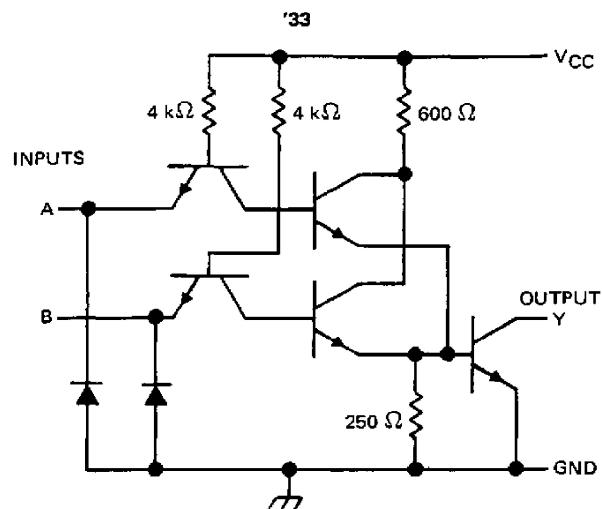
### positive logic

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

**SN5433, SN54LS33, SN7433, SN74LS33**  
**QUADRUPLE 2-INPUT POSITIVE-NOR 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 range (unless otherwise noted)**

Supply voltage, V <sub>CC</sub> (see Note 1) .....	7 V
Input voltage: '33 .....	5.5 V
'LS33 .....	7 V
Off-state output voltage .....	7 V
Operating free-air temperature: 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.

TEXAS  
INSTRUMENTS

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SN5433, SN7433  
QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

**recommended operating conditions**

		SN5433			SN7433			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub>	High-level input voltage	2			2			V
V <sub>IL</sub>	Low-level input voltage			0.8			0.8	V
V <sub>OH</sub>	High-level output voltage			5.5			5.5	V
I <sub>OL</sub>	Low-level output current			48			48	mA
T <sub>A</sub>	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS <sup>†</sup>	SN5433			SN7433			UNIT
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA			-1.5			-1.5	V
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, V <sub>OH</sub> = 5.5 V						0.25	mA
	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.7 V, V <sub>OH</sub> = 5.5 V			0.25				
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 16 mA	0.2	0.4		0.2	0.4		V
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1			1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			40			40	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-1.6			-1.6	mA
I <sub>ICCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0	3	6		3	6		mA
I <sub>ICCL</sub>	V <sub>CC</sub> = MAX, See Note 2	9	16.5		9	16.5		mA

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

<sup>‡</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

NOTE 2: One input at 4.5 V, all others at 0 V.

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A or B	Y	R <sub>L</sub> = 133 kΩ, C <sub>L</sub> = 50 pF		10	15	ns
t <sub>PHL</sub>					12	18	ns
t <sub>PLH</sub>			R <sub>L</sub> = 133 kΩ, C <sub>L</sub> = 150 pF		15	22	ns
t <sub>PHL</sub>					16	24	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



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**SN54LS33, SN74LS33**  
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**recommended operating conditions**

	SN54LS33			SN74LS33			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage				0.7		0.8	V
V <sub>OH</sub> High-level output voltage				5.5		5.5	V
I <sub>OL</sub> Low-level output current				12		24	mA
T <sub>A</sub> Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS †	SN54LS33			SN74LS33			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA				-1.5		-1.5	V
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V				0.25		0.25	mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, I <sub>OL</sub> = 12 mA		0.25	0.4	0.25	0.4		V
	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OL</sub> = 24 mA				0.35	0.5		
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V				0.1		0.1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V				20		20	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V				-0.4		-0.4	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0		1.8	3.6	1.8	3.6		mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, See Note 2		6.9	13.8	6.9	13.8		mA

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

‡All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

NOTE 2: One input at 4.5 V, all others at 0 V.

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 3)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A or B	Y	R <sub>L</sub> = 667 Ω, C <sub>L</sub> = 45 pF	20	32		ns
t <sub>PHL</sub>				18	28		ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



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