

# 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

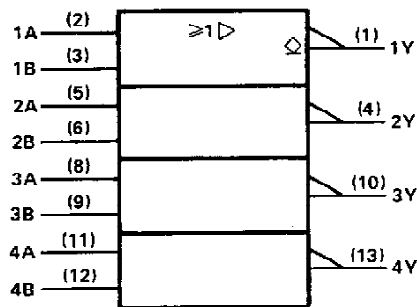
These devices contain four independent 2-input NOR buffer gates with open-collector outputs. Open-collector outputs require resistive pull-up to perform logically but can deliver higher  $V_{OH}$  levels and are commonly used in wired-AND applications.

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

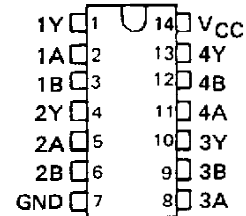
## logic symbol†



† 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.

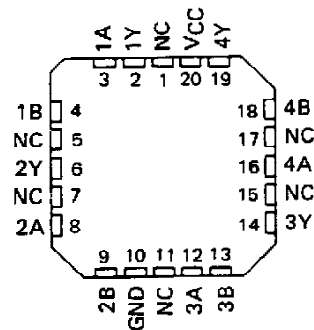
SN5433, SN54LS33 . . . J OR W PACKAGE  
SN7433 . . . N PACKAGE  
SN74LS33 . . . D OR N PACKAGE

(TOP VIEW)



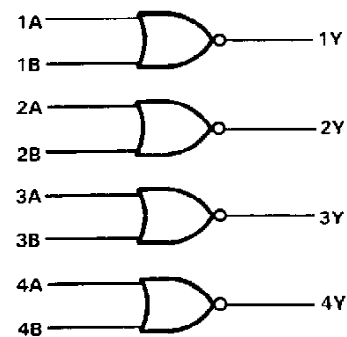
SN54LS33 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

## logic diagram



## positive logic

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

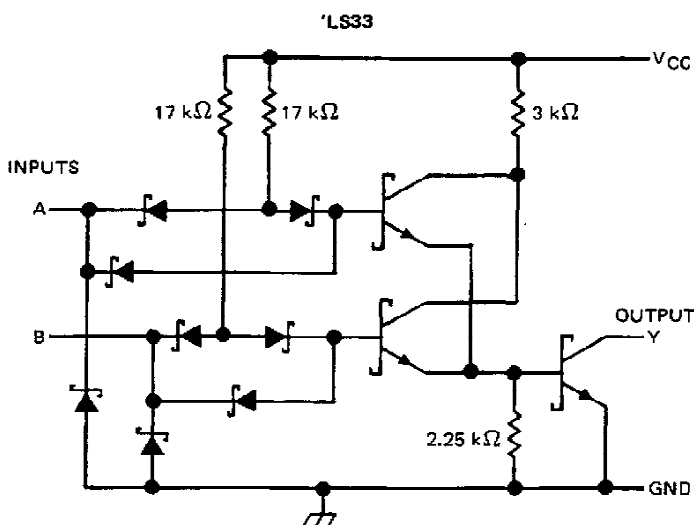
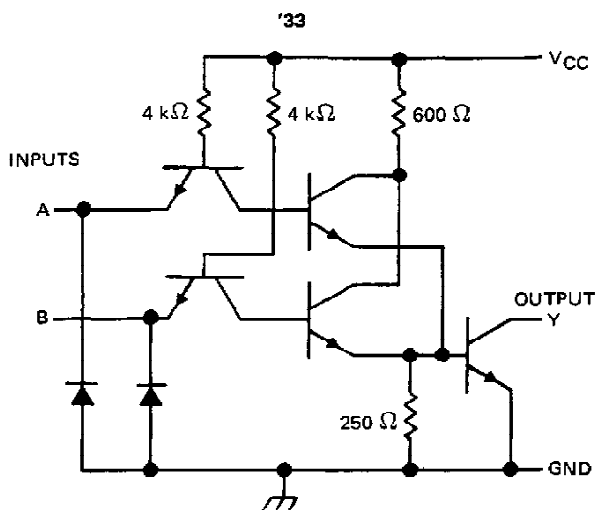
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# SN5433, SN54LS33, SN7433, SN74LS33 QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

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: '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.



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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			V
V <sub>OH</sub>	High-level output voltage				5.5			V
I <sub>OL</sub>	Low-level output current				48			mA
T <sub>A</sub>	Operating free-air temperature	-55			125			°C

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

PARAMETER	TEST CONDITIONS†	SN5433			SN7433			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	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>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0	3	6		3	6	mA	
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, See Note 2	9	16.5		9	16.5	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 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.



# SN54LS33, SN74LS33

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

### recommended operating conditions

	SN54LS33			SN74LS33			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 †	SN54LS33			SN74LS33			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$		-1.5			-1.5		V
$I_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = \text{MAX}$ , $V_{OH} = 5.5 \text{ V}$		0.25			0.25		mA
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = \text{MAX}$ , $I_{OL} = 12 \text{ mA}$		0.25	0.4		0.25	0.4	V
	$V_{CC} = \text{MIN}$ , $V_{IL} = \text{MAX}$ , $I_{OL} = 24 \text{ mA}$					0.35	0.5	
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$			0.1			0.1	mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$			20			20	μA
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$			-0.4			-0.4	mA
$I_{CCH}$	$V_{CC} = \text{MAX}$ , $V_I = 0$		1.8	3.6		1.8	3.6	mA
$I_{CCL}$	$V_{CC} = \text{MAX}$ , 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  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

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

### switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^\circ\text{C}$ (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A or B	Y	$R_L = 667 \Omega$ , $C_L = 45 \text{ pF}$		20	32	ns
$t_{PHL}$					18	28	

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

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**

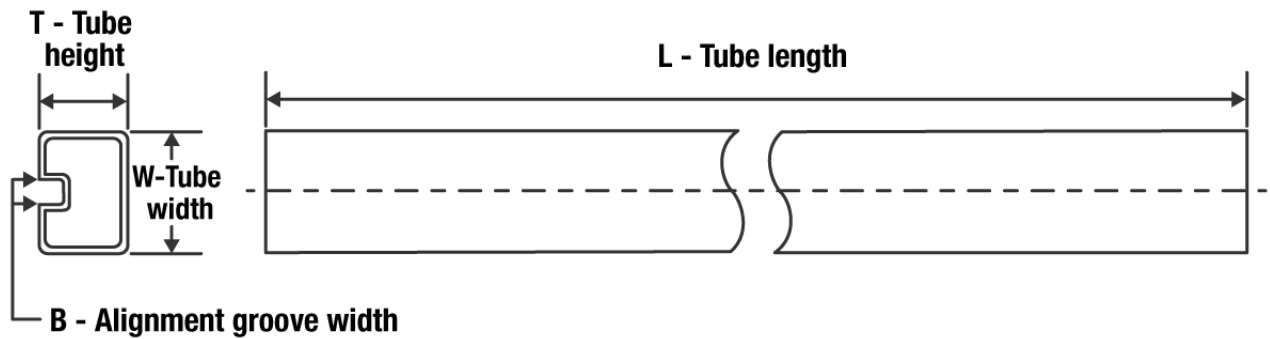

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS33DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LS33NSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS33DR	SOIC	D	14	2500	853.0	449.0	35.0
SN74LS33NSR	SO	NS	14	2000	853.0	449.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74LS33D	D	SOIC	14	50	506.6	8	3940	4.32
SN74LS33N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS33N	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS33NE4	N	PDIP	14	25	506	13.97	11230	4.32
SN74LS33NE4	N	PDIP	14	25	506	13.97	11230	4.32

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