

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

REVISED DECEMBER 1983

- Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to 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

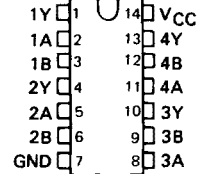
logic diagram (each gate)



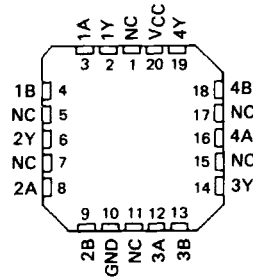
positive logic

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

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



SN54LS33 ... FK PACKAGE  
SN74LS33 ... FN PACKAGE  
(TOP VIEW)

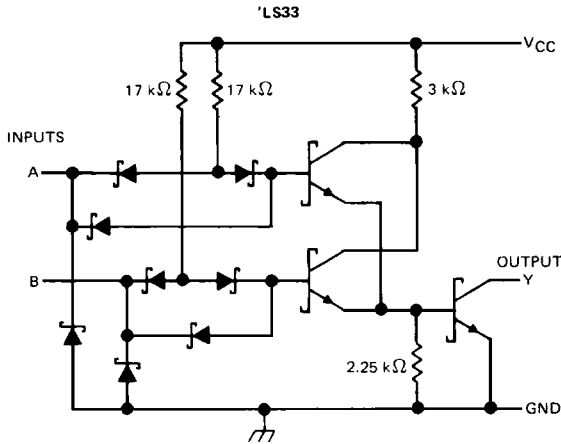
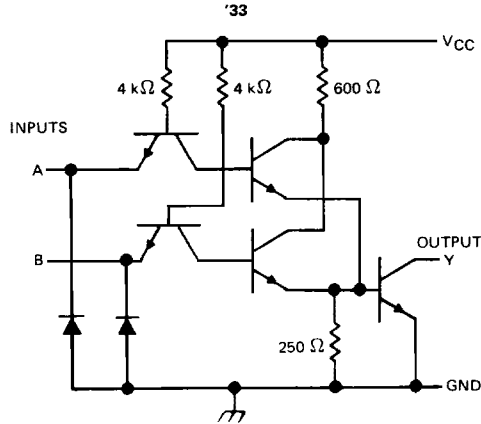


NC - No internal connection

# TYPES 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 range (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.



TTL DEVICES

# TYPES 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 †	SN5433		SN7433		UNIT
		MIN	TYP ‡	MAX	MIN	
V <sub>JK</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>IH</sub> = 2 V, V <sub>OH</sub> = 5.5 V		0.25		0.25	mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 48 mA		0.4		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> = 0V		12 21		12 21	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, See Note 2		33 57		33 57	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 GND.

### 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> = 133 Ω, C <sub>L</sub> = 50 pF		10	15	ns
t <sub>PHL</sub>					12	18	ns
t <sub>PLH</sub>					15	22	ns
t <sub>PHL</sub>					16	24	ns

NOTE 3: See General Information Section for load circuits and voltage waveforms.

3

TTL DEVICES

# TYPES 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 <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 <sub>OH</sub> High-level output voltage				5.5			5.5
I <sub>OL</sub> Low-level output current				12			24
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>OH</sub> = 5.5 V	0.25			0.25			mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OL</sub> = 12 mA	0.25	0.4		0.25	0.4		
	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 V	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 GND.

### 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: See General Information Section for load circuits and voltage waveforms.

3

TTL DEVICES

3

TTL DEVICES