

# SN5410, SN54LS10, SN54S10, SN7410, SN74LS10, SN74S10 TRIPLE 3-INPUT POSITIVE-NAND GATES

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

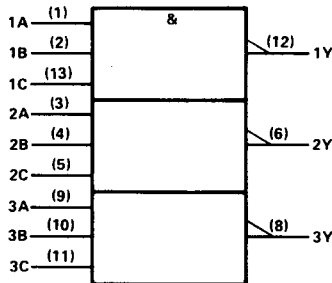
These devices contain three independent 3-input NAND gates.

The SN5410, SN54LS10, and SN54S10 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7410, SN74LS10, and SN74S10 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (each gate)

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

## logic symbol†



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

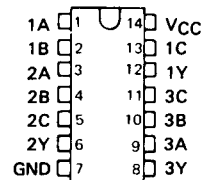
Pin numbers shown are for D, J, and N packages.

## positive logic

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

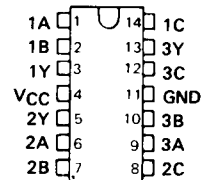
SN5410 . . . J PACKAGE  
SN54LS10, SN54S10 . . . J OR W PACKAGE  
SN7410 . . . N PACKAGE  
SN74LS10, SN74S10 . . . D OR N PACKAGE

(TOP VIEW)



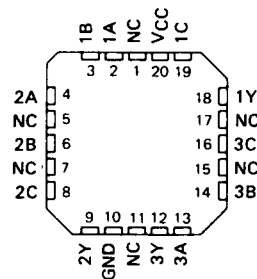
SN5410 . . . W PACKAGE

(TOP VIEW)



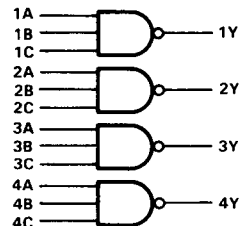
SN54LS10, SN54S10 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

## logic diagram (positive logic)



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PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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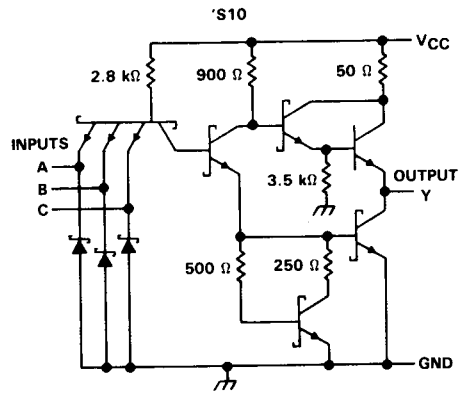
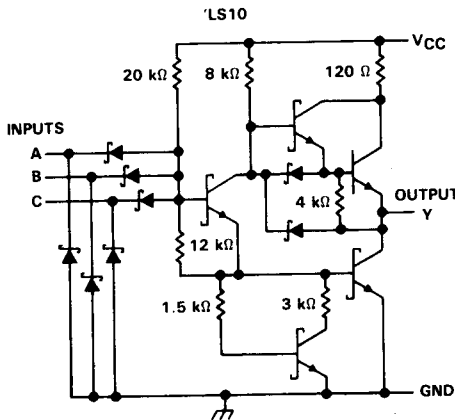
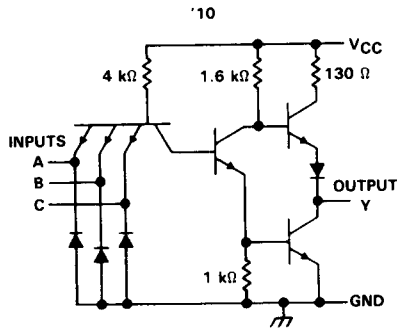
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# SN5410, SN54LS10, SN54S10, SN7410, SN74LS10, SN74S10 TRIPLE 3-INPUT POSITIVE-NAND GATES

schematics (each gate)

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Resistor values shown are nominal.

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

Supply voltage, VCC (see Note 1)	7 V
Input voltage: '10, 'S10	5.5 V
'LS10	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.

# SN5410, SN7410

## TRIPLE 3-INPUT POSITIVE-NAND GATES

### recommended operating conditions

	SN5410			SN7410			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
$I_{OH}$ High-level output current	-0.4			-0.4			mA
$I_{OL}$ Low-level output current	16			16			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 †	SN5410			SN7410			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$	-1.5			-1.5			V
$V_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OH} = -0.4 \text{ mA}$	2.4	3.4		2.4	3.4		V
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 16 \text{ mA}$	0.2	0.4		0.2	0.4		V
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$	1			1			mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$	40			40			µA
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	-1.6			-1.6			mA
$I_{OS}§$	$V_{CC} = \text{MAX}$	-20		-55	-18		-55	mA
$I_{CCH}$	$V_{CC} = \text{MAX}$ , $V_I = 0 \text{ V}$	3	6		3	6		mA
$I_{CCL}$	$V_{CC} = \text{MAX}$ , $V_I = 4.5 \text{ V}$	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  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

§ Not more than one output should be shorted at a time.

### switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^\circ\text{C}$ (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A, B or C	Y	$R_L = 400 \Omega$ , $C_L = 15 \text{ pF}$		11	22	ns
$t_{PHL}$					7	15	ns

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

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# SN54LS10, SN74LS10

## TRIPLE 3-INPUT POSITIVE-NAND GATES

### recommended operating conditions

	SN54LS10			SN74LS10			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
I <sub>OH</sub> High-level output current			-0.4			-0.4	mA
I <sub>OL</sub> Low-level output current			4			8	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 †	SN54LS10		SN74LS10		UNIT	
		MIN	TYP ‡	MAX	MIN		TYP ‡
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.5		-1.5	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OH</sub> = -0.4 mA	2.5	3.4	2.7	3.4		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 4 mA	0.25	0.4			0.4	V
	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA					0.25 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>OS</sub> §	V <sub>CC</sub> = MAX	-20		-100	-20	-100	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V	0.6	1.2	0.6	1.2		mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V	1.8	3.3	1.8	3.3		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.

§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A, B or C	Y	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF		9	15	ns
t <sub>PHL</sub>					10	15	ns

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

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# SN54S10, SN74S10

## TRIPLE 3-INPUT POSITIVE-NAND GATES

### recommended operating conditions

	SN54S10			SN74S10			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
I <sub>OH</sub> High-level output current			-1			-1	mA
I <sub>OL</sub> Low-level output current			20			20	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 †	SN54S10			SN74S10			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.2			-1.2	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -1 mA	2.5	3.4		2.7	3.4		V
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 20 mA			0.5			0.5	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> = 2.7 V			50			50	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V			-2			-2	mA
I <sub>OS</sub> §	V <sub>CC</sub> = MAX	-40		-100	-40		-100	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V		7.5	12		7.5	12	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V		15	27		15	27	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.

§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A, B or C	Y	R <sub>L</sub> = 280 Ω,	C <sub>L</sub> = 15 pF		3	4.5	ns
t <sub>PHL</sub>						3	5	ns
t <sub>PLH</sub>			R <sub>L</sub> = 280 Ω,	C <sub>L</sub> = 50 pF		4.5		ns
t <sub>PHL</sub>						5		ns

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

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