

# TYPES SN5410, SN54H10, SN54L10, SN54LS10, SN54S10, SN7410, SN74H10, SN74LS10, SN74S10 TRIPLE 3-INPUT POSITIVE-NAND GATES

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 three independent 3-input NAND gates.

The SN5410, SN54H10, SN54L10, 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, SN74H10, 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 diagram (each gate)

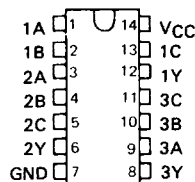


## positive logic

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

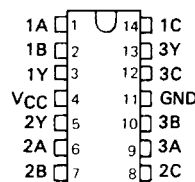
SN5410, SN54H10, SN54L10 ... J PACKAGE  
SN54LS10, SN54S10 ... J OR W PACKAGE  
SN7410, SN74H10 ... J OR N PACKAGE  
SN74LS10, SN74S10 ... D, J OR N PACKAGE

(TOP VIEW)



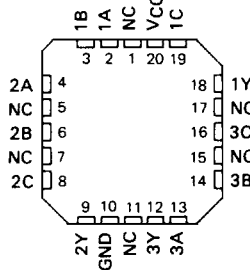
SN5410, SN54H10 ... W PACKAGE

(TOP VIEW)



SN54LS10, SN54S10 ... FK PACKAGE  
SN74LS10, SN74S10 ... FN PACKAGE

(TOP VIEW)



NC - No internal connection

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## PRODUCTION DATA

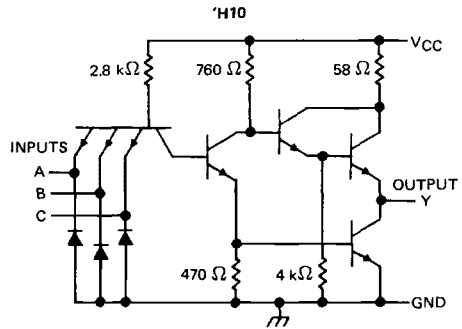
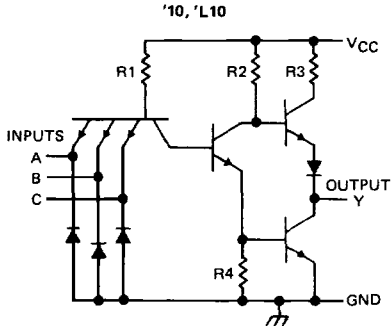
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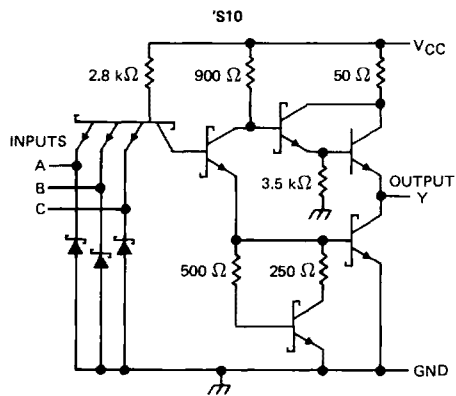
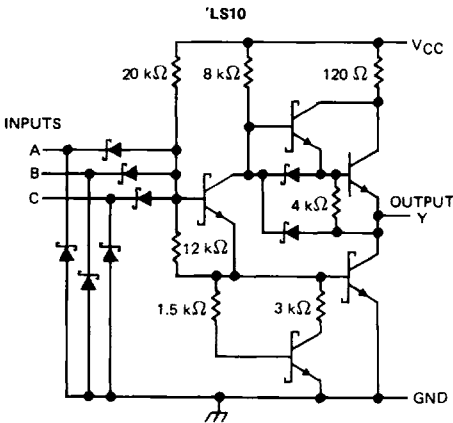
**TYPES SN5410, SN54H10, SN54L10, SN54LS10,  
SN54S10, SN7410, SN74H10, SN74LS10, SN74S10  
TRIPLE 3-INPUT POSITIVE-NAND GATES**

schematics (each gate)



CIRCUIT	R1	R2	R3	R4
'10	4 kΩ	1.6 kΩ	130 Ω	1 kΩ
'L10	40 kΩ	20 kΩ	500 Ω	12 kΩ

Input clamp diodes not on SN54L10 circuit.



Resistor values shown are nominal.

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

Supply voltage, $V_{CC}$ (see Note 1) '10, 'H10, 'LS10, 'S10	7 V
'L10	8 V
Input voltage: '10, 'H10, 'L10, '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.

# TYPES SN5410, SN7410

## TRIPLE 3-INPUT POSITIVE-NAND GATES

### recommended operating conditions

	SN5410			SN7410			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	-0.4			-0.4			mA
I <sub>OL</sub> Low-level output current	16			16			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 †	SN5410			SN7410			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
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -0.4 mA	2.4	3.4		2.4	3.4	V	
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>OS</sub> §	V <sub>CC</sub> = MAX	-20		-55	-18		-55	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V	3 6			3 6			mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

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

### 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> = 400 Ω,	C <sub>L</sub> = 15 pF		11	22	ns
t <sub>PHL</sub>						7	15	ns

NOTE 2: See General Information Section for load circuits and voltage waveforms.

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# TYPES SN54H10, SN74H10

## TRIPLE 3-INPUT POSITIVE-NAND GATES

### recommended operating conditions

	SN54H10			SN74H10			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			-0.5			-0.5	mA
$I_{OL}$ Low-level output current			20			20	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 †	MIN	TYP ‡	MAX	UNIT
$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -8 \text{ mA}$			-1.5	V
$V_{OH}$	$V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -0.5 \text{ mA}$	2.4	3.5		V
$V_{OL}$	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 20 \text{ mA}$		0.2	0.4	V
$I_I$	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1	mA
$I_{IH}$	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$			50	μA
$I_{IL}$	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-2	mA
$I_{OS} §$	$V_{CC} = \text{MAX}$	-40		-100	mA
$I_{CCH}$	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$		7.5	12.6	mA
$I_{CCL}$	$V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$		19.5	30	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, and the duration of the short circuit should not exceed one second.

### 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	$R_L = 280 \Omega, C_L = 25 \text{ pF}$		5.9	10	ns
$t_{PHL}$					6.3	10	ns

NOTE 2: See General Information Section for load circuits and voltage waveforms

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# TYPE SN54L10

## TRIPLE 3-INPUT POSITIVE-NAND GATES

### recommended operating conditions

	SN54L10			UNIT
	MIN	NOM	MAX	
$V_{CC}$ Supply voltage	4.5	5	5.5	V
$V_{IH}$ High-level input voltage	2			V
$V_{IL}$ Low-level input voltage			0.7	V
$I_{OH}$ High-level output current			-0.1	mA
$I_{OL}$ Low-level output current			2	mA
$T_A$ Operating free-air temperature	-55		125	°C

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

PARAMETER	TEST CONDITIONS †	SN54L10			UNIT
		MIN	TYP ‡	MAX	
$V_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.7 \text{ V}$ , $I_{OH} = -0.1 \text{ mA}$	2.4	3.3		V
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 2 \text{ mA}$		0.15	0.3	V
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			0.1	mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			10	µA
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.3 \text{ V}$			-0.18	mA
$I_{OS} §$	$V_{CC} = \text{MAX}$	-3		-15	mA
$I_{CCH}$	$V_{CC} = \text{MAX}$ , $V_I = 0 \text{ V}$		0.33	0.6	mA
$I_{CCL}$	$V_{CC} = \text{MAX}$ , $V_I = 4.5 \text{ V}$		0.87	1.53	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	$R_L = 4 \text{ k}\Omega$ , $C_L = 50 \text{ pF}$		35	60	ns
$t_{PHL}$					31	60	ns

NOTE 2: See General Information Section for load circuits and voltage waveforms.

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# TYPE 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‡	MAX	
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	μA
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: See General Information Section for load circuits and voltage waveforms.

# TYPES 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	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-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: See General Information Section for load circuits and voltage waveforms.

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