

- 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

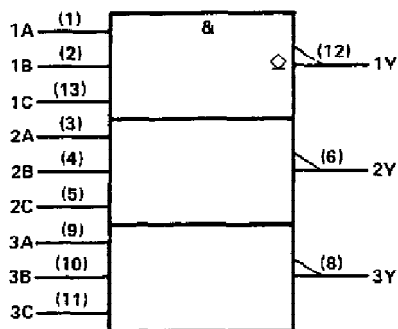
These devices contain three independent 3-input NAND gates with open-collector outputs. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher  $V_{OH}$  levels.

The SN5412 and SN54LS12 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7412 and SN74LS12 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.

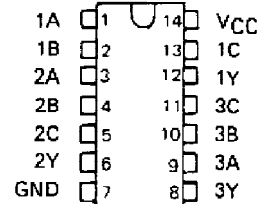
Pin numbers shown are for D, J, N, and W packages.

SN5412, SN54LS12 . . . J OR W PACKAGE

SN7412 . . . N PACKAGE

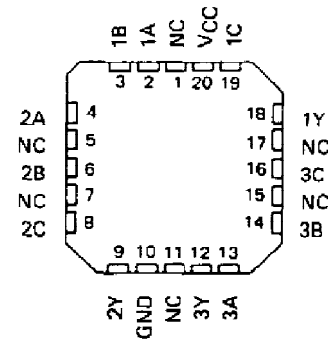
SN74LS12 . . . D OR N PACKAGE

(TOP VIEW)



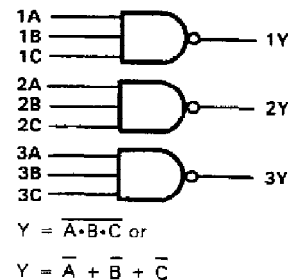
SN54LS12 . . . FK PACKAGE

(TOP VIEW)



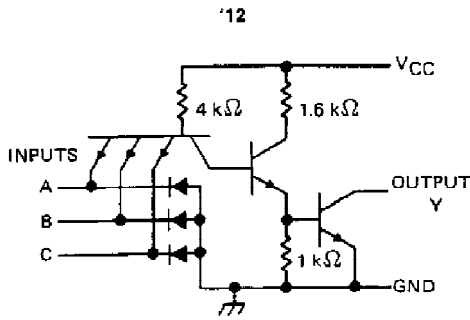
NC—No internal connection

#### logic diagram (positive logic)

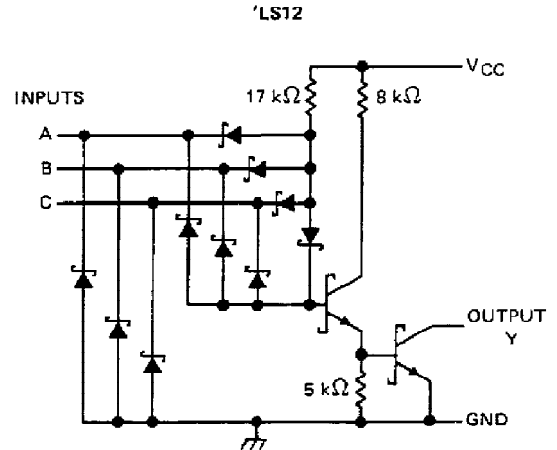


**SN5412, SN54LS12**  
**SN7412, SN74LS12**  
**TRIPLE 3-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

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: '12 .....	5.5 V
'LS12 .....	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.

## SN5412, SN5412

### TRIPLE 3-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

#### recommended operating conditions

	SN5412			SN7412			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			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†	SN5412			SN7412			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, 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.

#### 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> = 4 kΩ,	C <sub>L</sub> = 15 pF		35	45	ns
t <sub>PHL</sub>			R <sub>L</sub> = 400 Ω,	C <sub>L</sub> = 15 pF		8	15	ns

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

  
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## SN54LS12, SN74LS12 TRIPLE 3-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

	SN54LS12			SN74LS12			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	4			8			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 †	SN54LS12		SN74LS12		UNIT
		MIN	TYP ‡	MAX	MIN	
$V_{IK}$	$V_{CC} = \text{MIN.}$ , $I_I = -18 \text{ mA}$	-1.5		-1.5		V
$I_{OH}$	$V_{CC} = \text{MIN.}$ , $V_{IL} = \text{MAX.}$ , $V_{OH} = 5.5 \text{ V}$	0.1		0.1		mA
$V_{OL}$	$V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V.}$ , $I_{OL} = 4 \text{ mA}$	0.25	0.4	0.25	0.4	V
	$V_{CC} = \text{MIN.}$ , $V_{IH} = 2 \text{ V.}$ , $I_{OL} = 8 \text{ mA}$			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
$I_{CCH}$	$V_{CC} = \text{MAX.}$ , $V_I = 0$	0.7	1.4	0.7	1.4	mA
$I_{CCL}$	$V_{CC} = \text{MAX.}$ , $V_I = 4.5 \text{ V}$	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  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

### 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	$R_L = 2 \text{ k}\Omega$ , $C_L = 15 \text{ pF}$	17	32		ns
$t_{PHL}$				15	28		ns

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

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