

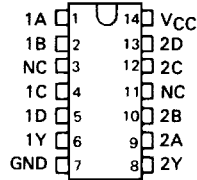
# TYPES SN5422, SN54H22, SN54LS22, SN54S22, SN7422, SN74H22, SN74LS22, SN74S22

## DUAL 4-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

REVISED DECEMBER 1983

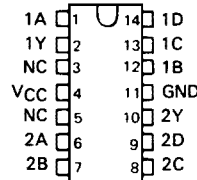
SN5422, SN54LS22, SN54S22 ... J OR W PACKAGE  
SN54H22 ... J PACKAGE  
SN7422, SN74H22 ... J OR N PACKAGE  
SN74LS22, SN74S22 ... D, J OR N PACKAGE

(TOP VIEW)



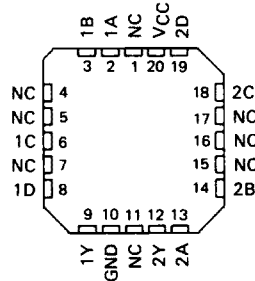
SN54H22 ... W PACKAGE

(TOP VIEW)



SN54LS22, SN54S22 ... FK PACKAGE  
SN74LS22, SN74S22 ... FN PACKAGE

(TOP VIEW)



NC - No internal connection

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

- Dependable Texas Instruments Quality and Reliability

### description

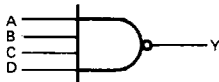
These devices contain two independent 4-input NAND gates. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher  $V_{OH}$  levels.

The SN5422, SN54H22, SN54LS22 and SN54S22 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7422, SN74H22, SN74LS20 and SN74S22 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

### FUNCTION TABLE (each gate)

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

### logic diagram (each gate)



### positive logic

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

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### PRODUCTION DATA

This document contains 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.

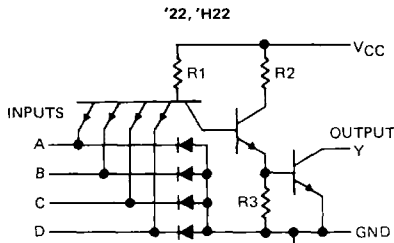
TEXAS  
INSTRUMENTS

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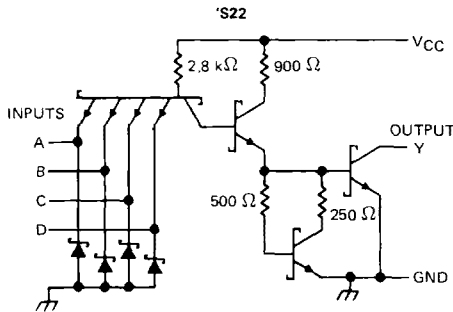
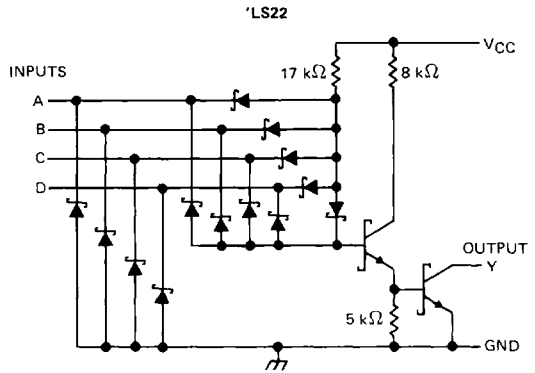
3-117

**TYPES SN5422, SN54H22, SN54LS22, SN54S22  
SN7422, SN74H22, SN74LS22, SN74S22  
DUAL 4-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

schematics (each gate)



CIRCUIT	R1	R2	R3
'22	4 kΩ	1.6 kΩ	1 kΩ
'H22	2.8 kΩ	760 Ω	470 Ω



Resistor values shown are nominal.

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage: '22, 'H22, 'S22	5.5 V
'LS22	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.

# TYPES SN5422, SN7422

## DUAL 4-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

	SN5422			SN7422			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†	MIN	TYP‡	MAX	UNIT
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = - 12 mA			- 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>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 16 mA		0.2	0.4	V
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			40	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			- 1.6	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V		2	4	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V		6	11	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>	Any	Y	R <sub>L</sub> = 4 k Ω, 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: See General Information Section for load circuits and voltage waveforms.

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# TYPES SN54H22, SN74H22

## DUAL 4-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

	SN54H22			SN74H22			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
$V_{OH}$ High-level output voltage			5.5			5.5	V
$I_{OL}$ 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
$I_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $V_{OH} = 5.5 \text{ V}$			0.25	mA
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 20 \text{ mA}$		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
$I_{CCH}$	$V_{CC} = \text{MAX}$ , $V_I = 0 \text{ V}$		5	8.4	mA
$I_{CCL}$	$V_{CC} = \text{MAX}$ , $V_I = 4.5 \text{ V}$		13	20	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
$t_{PLH}$	Any	Y	$R_L = 280 \Omega$ ,	$C_L = 25 \text{ pF}$		10	15	ns
$t_{PHL}$						7.5	12	ns

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

# TYPES SN54LS22, SN74LS22

## DUAL 4-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

	SN54LS22			SN74LS22			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			V
V <sub>OH</sub> High-level output voltage				5.5			V
I <sub>OL</sub> Low-level output current				4			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†	SN54LS22		SN74LS22		UNIT
		MIN	TYP‡	MAX	MIN	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = - 18 mA			- 1.5		V
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V			0.1		mA
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		V
	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA			0.35		
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V			0.1		mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			20		μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			- 0.4		mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V	0.4		0.8		mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V	1.2		2.2		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>	Any	Y	R <sub>L</sub> = 2 kΩ,	C <sub>L</sub> = 15 pF		17	32	ns
t <sub>PHL</sub>						15	28	ns

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

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**TYPES SN54S22, SN74S22**  
**DUAL 4-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

**recommended operating conditions**

	SN54S22			SN74S22			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			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†	MIN	TYP‡	MAX	UNIT	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.2	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>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 20 mA			0.5	V	
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1	mA	
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			50	μA	
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V			-2	mA	
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V			3	6.6	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V			10	18	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>	Any	Y	R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 15 pF	2	5	7.5	ns
t <sub>PHL</sub>				2	4.5	7	ns
t <sub>PLH</sub>			R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 50 pF	7.5		ns	
t <sub>PHL</sub>				7		ns	

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

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