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SDLS028

**QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

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**

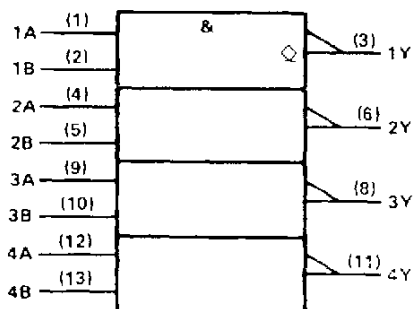
These devices contain four independent 2-input-NAND gates. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher  $V_{OH}$  levels.

The SN5403, SN54LS03 and SN54S03 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7403, SN74LS03 and SN74S03 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**FUNCTION TABLE (each gate)**

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

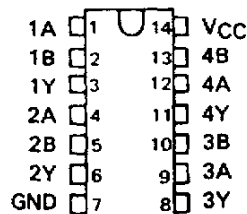
**logic symbol †**



† 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.

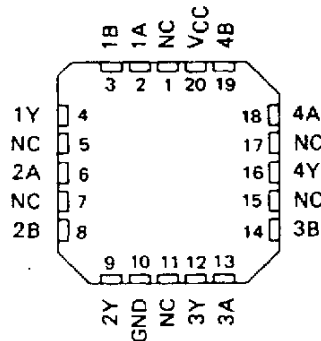
SN5403 . . . J OR W PACKAGE  
 SN54LS03, SN54S03 . . . J OR W PACKAGE  
 SN7403 . . . N PACKAGE  
 SN74LS03, SN74S03 . . . D OR N PACKAGE

(TOP VIEW)



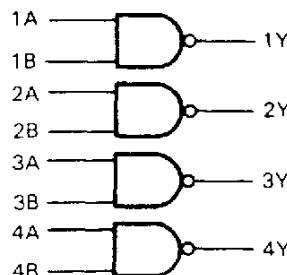
SN54LS03, SN54S03 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

**logic diagram (positive logic)**



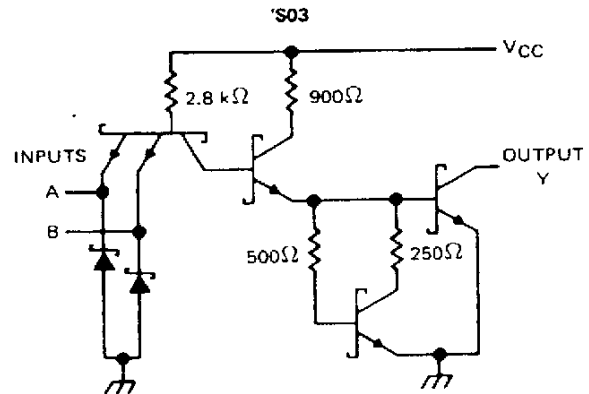
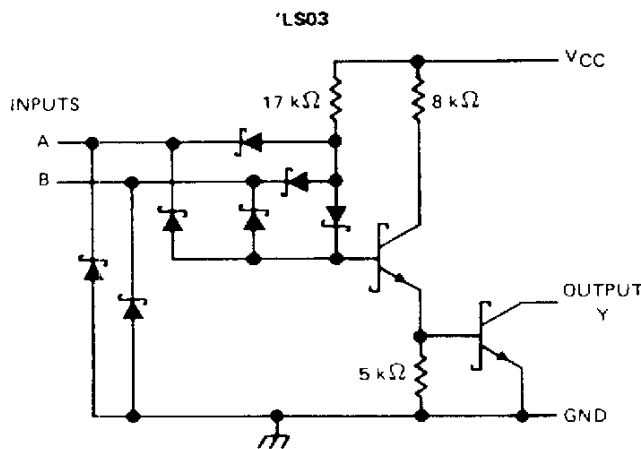
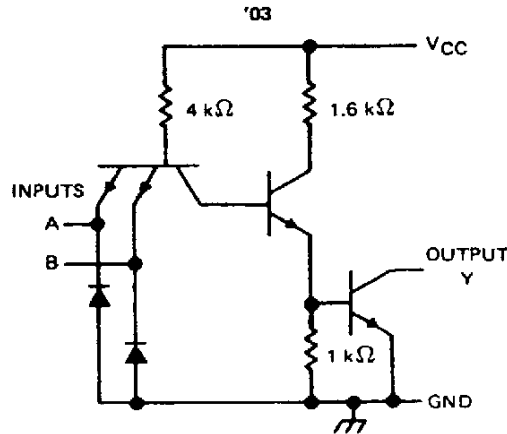
$$Y = \overline{A \cdot B} \text{ or } Y = \overline{A} + \overline{B}$$

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.



**SN5403, SN54LS03, SN54S03,  
 SN7403, SN74LS03, SN74S03**  
**QUADRUPLE 2-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: '03, 'S03 .....	5.5 V
'LS03 .....	7 V
Off-state output voltage .....	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.

## SN5403, SN7403 QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

	SN5403			SN7403			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 <sup>†</sup>	SN5403			SN7403			UNIT
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	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		4	8		4	8	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V		12	22		12	22	mA

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

<sup>‡</sup>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
<sup>†</sup> PLH	A or B	Y	R <sub>L</sub> = 4 kΩ, C <sub>L</sub> = 15 pF		35	45	ns
<sup>†</sup> PHL			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.

## SN54LS03, SN74LS03 QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

	SN54LS03			SN74LS03			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
V <sub>OH</sub> High-level output voltage			5.5			5.5	V
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†	SN54LS03		SN74LS03		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
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V			0.1		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	0.25	0.4		V
	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 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	0.8	1.6	0.8	1.6		mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V	2.4	4.4	2.4	4.4		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 or B	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: Load circuits and voltage waveforms are shown in Section 1.

## SN54S03, SN74S03 QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

	SN54S03			SN74S03			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 <sup>†</sup>	SN54S03			SN74S03			UNIT	
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX		
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA			-1.2			-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>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> = 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>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0			6	13.2		6	13.2	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V			20	36		20	36	mA

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

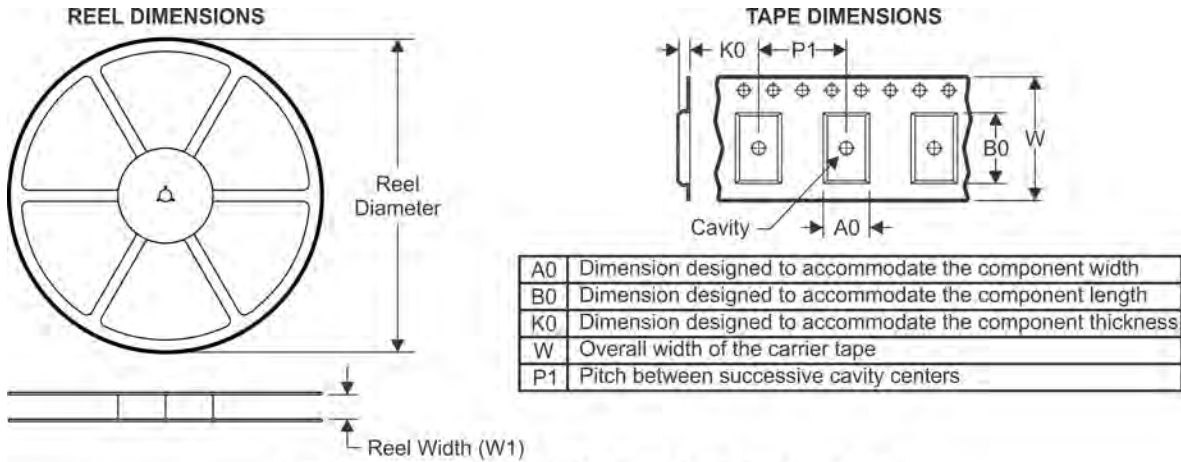
<sup>‡</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

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

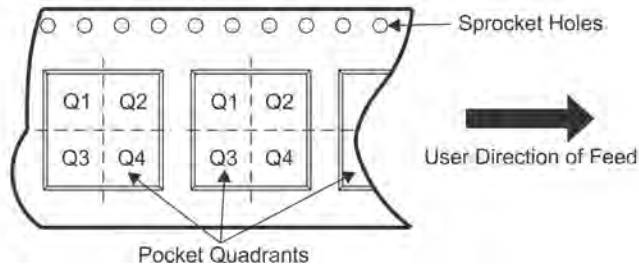
PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A or B	Y	R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 15 pF	2	5	7.5	ns
t <sub>PHL</sub>				2	4.5	7	ns
t <sub>PLH</sub>			R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 50 pF	7.5			ns
t <sub>PHL</sub>				7			ns

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

TAPE AND REEL INFORMATION



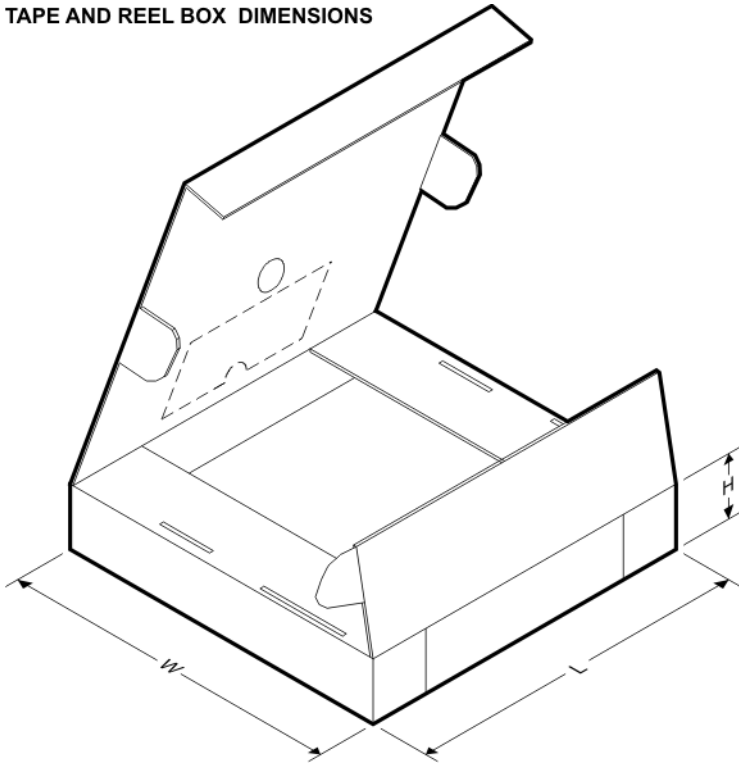
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS03DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS03DR	SOIC	D	14	2500	367.0	367.0	38.0