- 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 NOR buffer gates.

The SN5428, and SN54LS28 are characterized for operation over the full military temperature range of -55°C to 125°C. The SN7428, and SN74LS28 are characterized for operation from 0°C to 70°C.

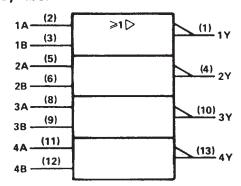
### **FUNCTION TABLE (each gate)**

INP	UTS	ОИТРИТ
A	В	Y
Н	Х	L
Х	Н	Ł
L	L	н

### positive logic

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

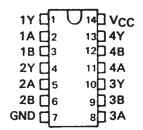
### logic symbol†



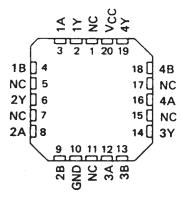
<sup>&</sup>lt;sup>†</sup> This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

SN5428, SN54LS28...J OR W PACKAGE SN7428...N PACKAGE SN74LS28...D OR N PACKAGE (TOP VIEW)

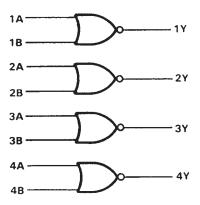


SN54LS28 . . . FK PACKAGE (TOP VIEW)

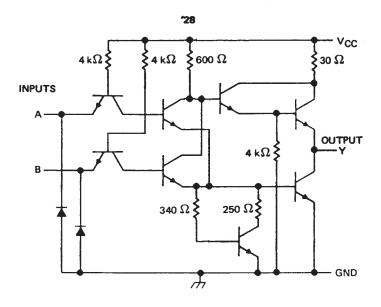


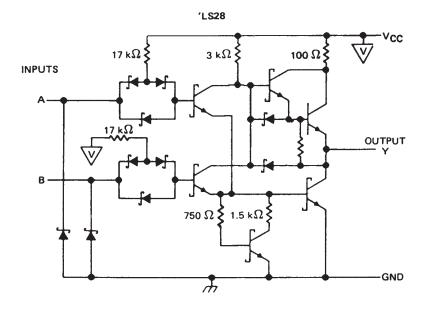
NC - No internal connection

### logic diagram



### schematics (each gate)





Resistor values shown are nominal.

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

Supply voltage, V <sub>CC</sub> (see Note 1)	7 V
Input voltage: '28	5.5 V
'LS28	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.



### recommended operating conditions

			SN5428			SN7428			
		MIN	NOM	MAX	MIN	NOM	MAX 5.25	UNIT	
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	٧	
V <sub>IH</sub>	High-level input voltage	2			2			٧	
VIL	Low-level input voltage			0.8			8.0	<b>v</b>	
ЮН	High-level output current			- 2.4			- 2,4	mA	
loL	Low-level output current			48			48	mA	
TA	Operating free-air temperature	- 55		125	0		70	°c	

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

PARAMETER			TEST CONDITIONS T	MIN	TYP‡	MAX	UNIT
VIK	VCC = MIN, II =	– 12mA				- 1.5	٧
v <sub>OН</sub> .	VCC = MIN, VIL	= 0.8 V,	IOH = - 2,4 mA	2.4	3.4	-	٧
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub>	= 2 V,	I <sub>OL</sub> = 48 mA		0.2	0.4	٧
1 <sub>1</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> =	5.5 V				1	mA
Чн	V <sub>CC</sub> = MAX, V <sub>I</sub> =	2.4 V				40	μΑ
HL.	V <sub>CC</sub> = MAX, V <sub>1</sub> =	0.4 V				-1.6	mA
IOS §	V <sub>CC</sub> = MAX			- 70		<b>– 180</b>	mΑ
<sup>1</sup> ссн	V <sub>CC</sub> = MAX, V <sub>I</sub> =	0 V			12	21	mA
ICCL	V <sub>CC</sub> = MAX, See I	Note 2			33	57	mA

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

### switching characteristics, VCC = 5 V, TA = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST COND	DITIONS	MIN	TYP	MAX	UNIT
<sup>t</sup> PLH			R <sub>L</sub> = 133 Ω,	C <sub>1</sub> = 50 pF		6	9	ns
<sup>t</sup> PHL		V	N_ = 155 12,	C[ - 30 pi		8	12	ns
<sup>t</sup> PLH	A or B	Y	D = 122.0	C: - 150 - F		10	15	ns
<sup>†</sup> PHL		$R_{L} = 133  \Omega$ , $C_{L} = 150  pF$		12	18	ns		

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



<sup>‡</sup> All typical values are at VCC = 5 V, TA = 25°C.

<sup>§</sup> Not more than one output should be shorted at a time and the duration of the short circuit should not exceed one second. NOTE 2: One input at 4.5 V, all others at GND.

# SN5428, SN54LS28, SN7428, SN74LS28 QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS

SDLS094 - DECEMBER 1983 - REVISED MARCH 1988

### recommended operating conditions

			SN54LS28			SN74LS28			
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT	
Vcc	Supply voltage	4.5	5	5.5	4.75	5	5.25	٧	
VIH	High-level input voltage	2			2			٧	
VIL	Low-level input voltage			0.7			0.8	V	
ЮН	High-level output current			- 1.2			- 1.2	mA	
loL	Low-level output current			12			24	mA	
TA	Operating free-air temperature	- 55		125	0		70	°c	

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

	TEST CONDITIONS †			SN54LS28			SN74LS28			
PARAMETER			MIN	TYP‡	MAX	MIN	TYP‡	MAX	UNIT	
VIK	V <sub>CC</sub> = MIN,	I <sub>I</sub> = - 18 mA				- 1.5			- 1.5	٧
V <sub>ОН</sub>	V <sub>CC</sub> = MIN,	VIL = MAX,	I <sub>OH</sub> = - 1.2 mA	2.5	3.4		2.7	3.4		٧
V -	V <sub>CC</sub> = MIN,	V <sub>1H</sub> = 2 V,	I <sub>OL</sub> = 12 mA		0.25	0.4		0.24	0.4	V
VOL	V <sub>CC</sub> = MIN,	V <sub>IH</sub> = 2 V,	IOL = 24 mA					0.35	0.5	· ·
11	V <sub>CC</sub> = MAX,	V <sub>1</sub> = 7 V				0.1			0.1	mA
<sup>1</sup> IH	V <sub>CC</sub> = MAX,	V <sub>1</sub> = 2.7 V				20			20	μΑ
IIL	V <sub>CC</sub> = MAX,	V <sub>1</sub> = 0.4 V				- 0.4			- 0.4	mA
IOS §	V <sub>CC</sub> = MAX			- 30		- 130	- 30		- 130	mA
1ссн	V <sub>CC</sub> = MAX,	V1 = 0 V			1.8	3.6		1.8	3.6	'nΑ
CCL	V <sub>CC</sub> = MAX,	See Note 2			6.9	13.8		6.9	13.8	mA

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

NOTE 2: One input at 4.5 V, all others at GND.

## switching characteristics, VCC = 5 V, TA = 25°C (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<sup>t</sup> PLH	A or B	V	$R_1 = 667 \Omega$ , $C_L = 45 pF$		12	24	ns
<sup>t</sup> PHL	AOIB	,	NE - 607 12, CE - 43 pi		12	24	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.



<sup>‡</sup> All typical values are at  $V_{CC}$  = 5 V,  $T_A$  = 25°C.

<sup>§</sup> Not more than one output should be shorted at a time and the duration of the short circuit should not exceed one second,

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