

SN5440, SN54LS40, SN54S40 SN7440, SN74LS40, SN74S40 DUAL 4-INPUT POSITIVE-NAND BUFFERS

SDLS108 – APRIL 1985 – REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages in Addition to Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

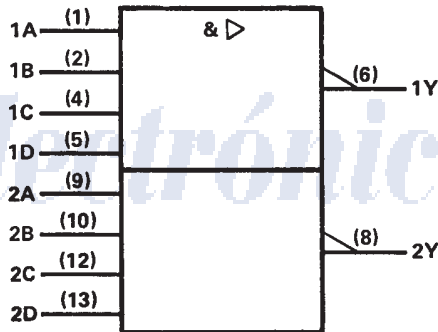
These devices contain two independent 4-input NAND buffer gates.

The SN5440, SN54LS40, and SN54S40 are characterized for operation over the full military temperature range of -55°C to 125°C. The SN7440, SN74LS40, and SN74S40 are characterized for operation from 0°C to 70°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

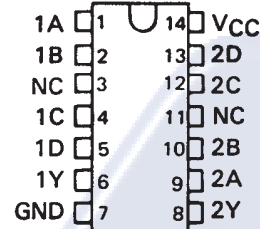
logic symbol†



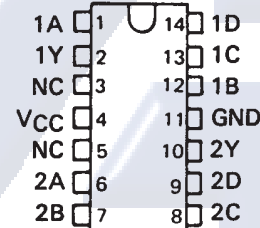
†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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

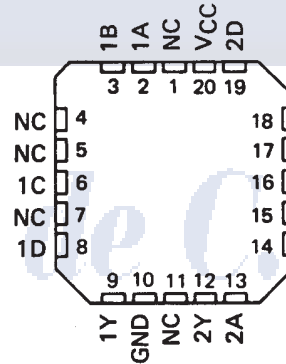
SN5440 . . . J PACKAGE
SN54LS40, SN54S40 . . . J OR W PACKAGE
SN7440 . . . N PACKAGE
SN74LS40, SN74S40 . . . D OR N PACKAGE
(TOP VIEW)



SN5440 . . . W PACKAGE
(TOP VIEW)

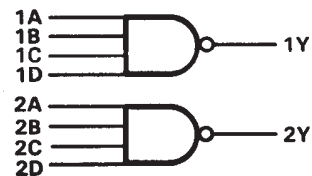


SN54LS40, SN54S40 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

logic diagram



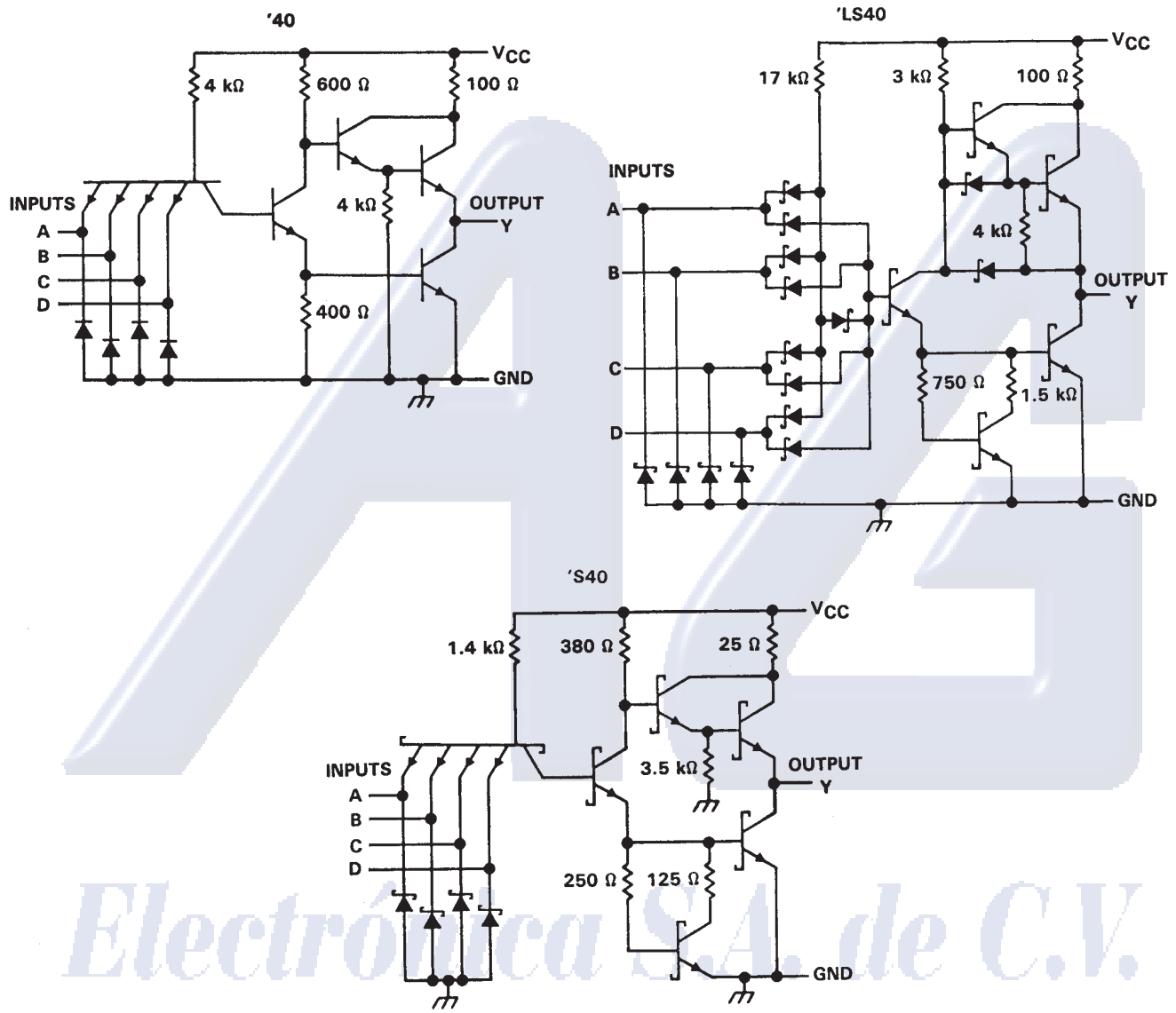
positive logic

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

**SN5440, SN54LS40, SN54S40
SN7440, SN74LS40, SN74S40
DUAL 4-INPUT POSITIVE-NAND BUFFERS**

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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: '40, 'S40	5.5 V
'LS40	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.



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SN7440, SN74LS40, SN74S40
DUAL 4-INPUT POSITIVE-NAND BUFFERS

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recommended operating conditions

	SN5440			SN7440			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			V
I _{OH} High-level output current	-1.2			-1.2			mA
I _{OL} Low-level output current	48			48			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 †	SN5440			SN7440			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
V _{IK}	V _{CC} = MIN, I _I = -12 mA	-1.5			-1.5			V
V _{OH}	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = -1.2 mA	2.4	3.3		2.4	3.3	V	
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 48 mA	0.2 0.4		0.2 0.4			V	
I _I	V _{CC} = MAX, V _I = 5.5 V	1			1			mA
I _{IH}	V _{CC} = MAX, V _I = 2.4 V	40			40			μA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V	-1.6			-1.6			mA
I _{OS} §	V _{CC} = MAX	-20 -70		-18 -70			mA	
I _{CCH}	V _{CC} = MAX, V _I = 0	4 8		4 8			mA	
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V	17 27		17 27			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 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed 100 milliseconds.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
t _{PLH}	Any	Y	R _L = 133 Ω,	C _L = 15 pF		13	22	ns
t _{PHL}						8	15	ns

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

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recommended operating conditions

	SN54LS40			SN74LS40			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
I_{OH} High-level output current	-1.2			-1.2			mA
I_{OL} Low-level output current	12			24			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 †	SN54LS40			SN74LS40			UNIT
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX	
V_{IK}	$V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$	-1.5			-1.5			V
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IL} = \text{MAX}$, $I_{OH} = -1.2 \text{ mA}$	2.5	3.4		2.7	3.4		V
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $I_{OL} = 12 \text{ mA}$	0.25			0.25			V
	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $I_{OL} = 24 \text{ mA}$				0.35			
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
$I_{OS} §$	$V_{CC} = \text{MAX}$	-30		-130	-30		-130	mA
I_{CCH}	$V_{CC} = \text{MAX}$, $V_I = 0$	0.45			0.45			mA
I_{CCL}	$V_{CC} = \text{MAX}$, $V_I = 4.5 \text{ V}$	3			3			mA

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

‡ All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

§ 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}	Any	Y	$R_L = 667 \Omega$, $C_L = 45 \text{ pF}$	12		24	ns
t_{PHL}				12		24	ns

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

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recommended operating conditions

	SN54S40			SN74S40			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	– 3			– 3			mA
I_{OL} Low-level output current	60			60			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 †	SN54S40			SN74S40			UNIT	
		MIN	TYP ‡	MAX	MIN	TYP ‡	MAX		
V_{IK}	$V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$	– 1.2			– 1.2			V	
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -3 \text{ mA}$	2.5	3.4		2.7	3.4	V		
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $I_{OL} = 60 \text{ mA}$	0.5			0.5			V	
I_I	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$	1			1			mA	
I_{IH}	$V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$	0.1			0.1			mA	
I_{IL}	$V_{CC} = \text{MAX}$, $V_I = 0.5 \text{ V}$	– 4			– 4			mA	
$I_{OS} §$	$V_{CC} = \text{MAX}$	– 50		– 225	– 50		– 225	mA	
I_{CCH}	$V_{CC} = \text{MAX}$, $V_I = 0$	10			10			18	mA
I_{CCL}	$V_{CC} = \text{MAX}$, $V_I = 4.5 \text{ V}$	25			25			44	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 100 milliseconds.

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	$R_L = 93 \Omega$, $C_L = 50 \text{ pF}$	4	6.5		ns
t_{PHL}				4	6.5		ns
t_{PLH}			$R_L = 93 \Omega$, $C_L = 150 \text{ pF}$	6			ns
t_{PHL}				6			ns

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

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