

TYPES SN5420, SN54H20, SN54L20, SN54LS20, SN54S20, SN7420, SN74H20, SN74LS20, SN74S20 DUAL 4-INPUT POSITIVE-NAND GATES

REVISED DECEMBER 1983

- Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

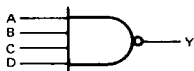
These devices contain two independent 4-input NAND gates.

The SN5420, SN54H20, SN54L20, SN54LS20 and SN54S20 are characterized for operation over the full military range of -55°C to 125°C . The SN7420, SN74H20, SN74LS20 and SN74S20 are characterized for operation from 0°C to 70°C .

FUNCTION TABLE (each gate)

INPUTS				OUTPUT Y
A	B	C	D	
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)

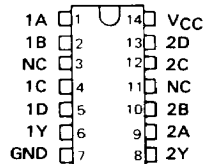


positive logic

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

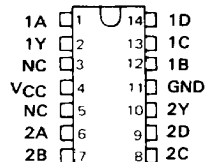
SN5420, SN54H20, SN54L20 ... J PACKAGE
SN54LS20, SN54S20 ... J OR W PACKAGE
SN7420, SN74H20 ... J OR N PACKAGE
SN74LS20, SN74S20 ... D, J OR N PACKAGE

(TOP VIEW)



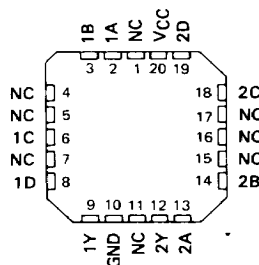
SN5420, SN54H20 ... W PACKAGE

(TOP VIEW)



SN54LS20, SN54S20 ... FK PACKAGE
SN74LS20, SN74S20 ... FN PACKAGE

(TOP VIEW)



NC - No internal connection

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TTL DEVICES

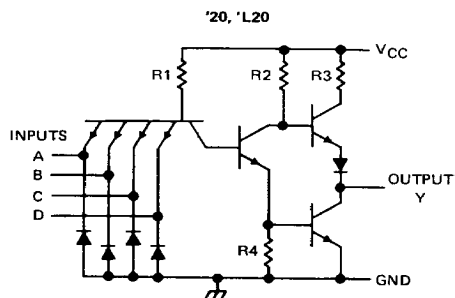
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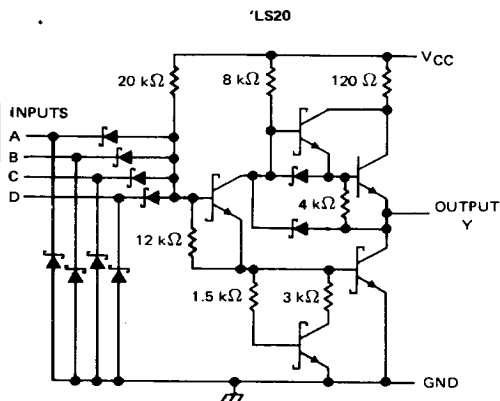
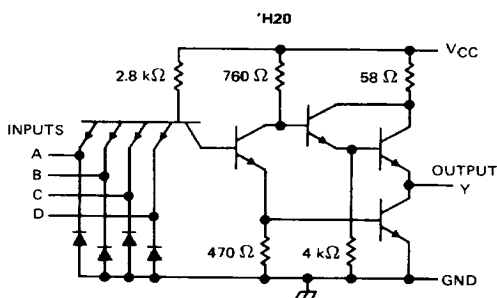
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TYPES SN5420, SN54H20, SN54L20, SN54LS20, SN54S20, SN7420, SN74H20, SN74LS20, SN74S20 DUAL 4-INPUT POSITIVE-NAND GATES

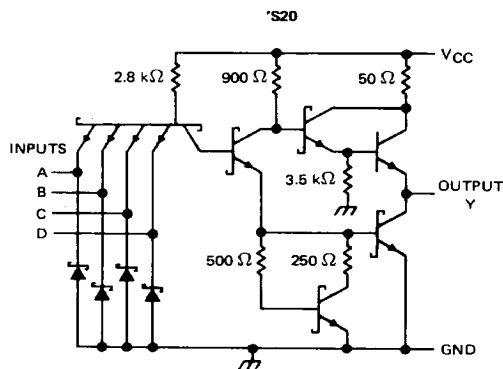
schematics (each gate)



CIRCUIT	R1	R2	R3	R4
'20	4 k Ω	1.6 k Ω	130 Ω	1 k Ω
'L20	40 k Ω	20 k Ω	500 Ω	12 k Ω



Resistor values shown are nominal.



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

Supply voltage, V_{CC} (see Note 1): '20, 'H20, 'LS20, 'S20	7 V
'L20	8 V
Input voltage: '20, 'H20, 'L20, 'S20	5.5 V
'LS20	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 SN5420, SN7420

DUAL 4-INPUT POSITIVE-NAND GATES

recommended operating conditions

	SN5420			SN7420			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			- 0.4			- 0.4	mA
I _{OL} Low-level output current			16			16	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 †	SN5420			SN7420			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} = - 0.4 mA	2.4	3.4		2.4	3.4		V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 16 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		- 55	- 18		- 55	mA
I _{CCH}	V _{CC} = MAX, V _I = 0 V		2	4		2	4	mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V		6	11		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_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time.

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 = 400 Ω, C _L = 15 pF		12*	22	ns
t _{PHL}					8	15	ns

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

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TYPES SN54H20, SN74H20 DUAL 4-INPUT POSITIVE-NAND GATES

recommended operating conditions

	SN54H20			SN74H20			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			- 0.5			- 0.5	mA
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} = MIN, I _I = - 8 mA			- 1.5	V
V _{OH}	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = - 0.5 mA	2.4	3.5		V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 20 mA		0.2	0.4	V
I _I	V _{CC} = MAX, V _I = 5.5 V			1	mA
I _{IH}	V _{CC} = MAX, V _I = 2.4 V			50	μA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V			- 2	mA
I _{OS} §	V _{CC} = MAX	- 40		- 100	mA
I _{CCH}	V _{CC} = MAX, V _I = 0 V		5	8.4	mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 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 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 one second.

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 = 280 Ω, C _L = 25 pF		6	10	ns
t _{PHL}					7	10	ns

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

TYPE SN54L20

DUAL 4-INPUT POSITIVE-NAND GATES

recommended operating conditions

	SN54L20			UNIT
	MIN	NOM	MAX	
V_{CC} Supply voltage	4.5	5	5.5	V
V_{IH} High-level input voltage	2			V
V_{IL} Low-level input voltage			0.7	V
I_{OH} High-level output current			-0.1	mA
I_{OL} Low-level output current			2	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 †	SN54L20			UNIT
		MIN	TYP ‡	MAX	
V_{OH}	$V_{CC} = \text{MIN}, V_{IL} = 0.7 \text{ V}, I_{OH} = -0.1 \text{ mA}$	2.4	3.3		V
V_{OL}	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 2 \text{ mA}$		0.15	0.3	V
I_I	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			0.1	mA
I_{IH}	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$			10	µA
I_{IL}	$V_{CC} = \text{MAX}, V_I = 0.3 \text{ V}$			-0.18	mA
$I_{OS} §$	$V_{CC} = \text{MAX}$	-3		-15	mA
I_{CCH}	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$		0.22	0.4	mA
I_{CCL}	$V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$		0.58	1.02	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.

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	$R_L = 4 \text{ k}\Omega, C_L = 50 \text{ pF}$		35	60	ns
t_{PHL}					31	60	ns

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

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TYPES SN54LS20, SN74LS20

DUAL 4-INPUT POSITIVE-NAND GATES

recommended operating conditions

	SN54LS20			SN74LS20			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			-0.4			-0.4	mA
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 †	SN54LS20			SN74LS20			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}	V _{CC} = MIN, I _I = -18 mA			-1.5			-1.5	V
V _{OH}	V _{CC} = MIN, V _{IL} = MAX, I _{OH} = -0.4 mA	2.5	3.4		2.7	3.4		V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 4 mA		0.25	0.4			0.4	V
	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 8 mA					0.25	0.5	
I _I	V _{CC} = MAX, V _I = 7 V			0.1			0.1	mA
I _{IH}	V _{CC} = MAX, V _I = 2.7 V			20			20	µA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V			-0.4			-0.4	mA
I _{OS} §	V _{CC} = MAX	-20		-100	-20		-100	mA
I _{CCH}	V _{CC} = MAX, V _I = 0 V		0.4	0.8		0.4	0.8	mA
I _{CCL}	V _{CC} = MAX, V _I = 4.5 V		1.2	2.2		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_{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 one second.

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 = 2 kΩ,	C _L = 15 pF	9	15	ns
t _{PHL}					10	15	ns

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

TYPES SN54S20, SN74S20 **DUAL 4-INPUT POSITIVE-NAND GATES**

recommended operating conditions

	SN54S20			SN74S20			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			-1			-1	mA
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 †	SN54S20			SN74S20			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}	$V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, I_{OH} = -1 \text{ mA}$	2.5	3.4		2.7	3.4		V
V_{OL}	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 20 \text{ mA}$			0.5			0.5	V
I_I	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1			1	mA
I_{IH}	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$			50			50	µA
I_{IL}	$V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$			-2			-2	mA
$I_{OS}§$	$V_{CC} = \text{MAX}$	-40		-100	-40		-100	mA
I_{CCH}	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$			5			5	mA
I_{CCL}	$V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$			10			10	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}	A, B, C or D	Y	$R_L = 280 \Omega, C_L = 15 \text{ pF}$		3	4.5	ns
t_{PHL}					3	5	ns
t_{PLH}			$R_L = 280 \Omega, C_L = 50 \text{ pF}$		4.5		ns
t_{PHL}					5		ns

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

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