

SN54HC20, SN74HC20 DUAL 4-INPUT POSITIVE-NAND GATES

SCLS086C – DECEMBER 1982 – REVISED MAY 1997

- Package Options Include Plastic Small-Outline (D) and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

description

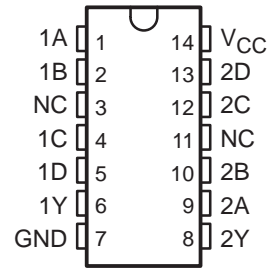
These devices contain two independent 4-input NAND gates. They perform the Boolean function $Y = A \cdot B \cdot C \cdot D$ or $Y = A + B + C + D$ in positive logic.

The SN54HC20 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74HC20 is characterized for operation from -40°C to 85°C .

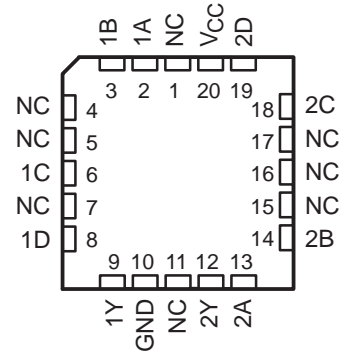
FUNCTION TABLE
(each gate)

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

SN54HC20 . . . J OR W PACKAGE
SN74HC20 . . . D OR N PACKAGE
(TOP VIEW)

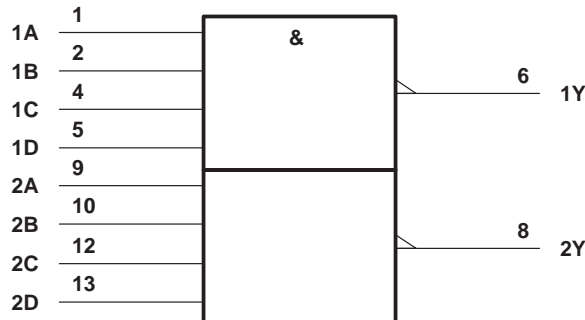


SN54HC20 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, J, N, and W packages.



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PRODUCTION DATA information is 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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logic diagram (positive logic)



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

absolute maximum ratings over operating free-air temperature range†

Supply voltage range, V_{CC}	-0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1)	± 20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1)	± 20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	± 25 mA
Continuous current through V_{CC} or GND	± 50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package	127°C/W
N package	78°C/W
Storage temperature range, T_{stg}	-65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. The package thermal impedance is calculated in accordance with JEDEC 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions

		SN54HC20			SN74HC20			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	2	5	6	2	5	6	V
V_{IH}	High-level input voltage	$V_{CC} = 2$ V	1.5		1.5			V
		$V_{CC} = 4.5$ V	3.15		3.15			
		$V_{CC} = 6$ V	4.2		4.2			
V_{IL}	Low-level input voltage	$V_{CC} = 2$ V	0	0.5	0	0.5	V	
		$V_{CC} = 4.5$ V	0	1.35	0	1.35		
		$V_{CC} = 6$ V	0	1.8	0	1.8		
V_I	Input voltage	0		V_{CC}	0		V_{CC}	V
V_O	Output voltage	0		V_{CC}	0		V_{CC}	V
t_t	Input transition (rise and fall) time	$V_{CC} = 2$ V	0	1000	0	1000	ns	
		$V_{CC} = 4.5$ V	0	500	0	500		
		$V_{CC} = 6$ V	0	400	0	400		
T_A	Operating free-air temperature	-55		125	-40		85	°C



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

PARAMETER	TEST CONDITIONS		V _{CC}	T _A = 25°C			SN54HC20		SN74HC20		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	V _I = V _{IH} or V _{IL}	I _{OH} = -20 μA	2 V	1.9	1.998		1.9		1.9	V	
			4.5 V	4.4	4.499		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		
		I _{OH} = -4 mA	4.5 V	3.98	4.3		3.7		3.84		
		I _{OH} = -5.2 mA	6 V	5.48	5.8		5.2		5.34		
V _{OL}	V _I = V _{IH} or V _{IL}	I _{OL} = 20 μA	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		I _{OL} = 4 mA	4.5 V		0.17	0.26		0.4		0.33	
		I _{OL} = 5.2 mA	6 V		0.15	0.26		0.4		0.33	
I _I	V _I = V _{CC} or 0		6 V		±0.1	±100		±1000		±1000	nA
I _{CC}	V _I = V _{CC} or 0, I _O = 0		6 V			2		40		20	μA
C _i			2 V to 6 V		3	10		10		10	pF

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			SN54HC20		SN74HC20		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{pd}	A, B, C, or D	Y	2 V		45	110		165		140	ns
			4.5 V		14	22		33		28	
			6 V		11	19		28		24	
t _t		Y	2 V		27	75		110		95	ns
			4.5 V		9	15		22		19	
			6 V		7	13		19		16	

operating characteristics, T_A = 25°C

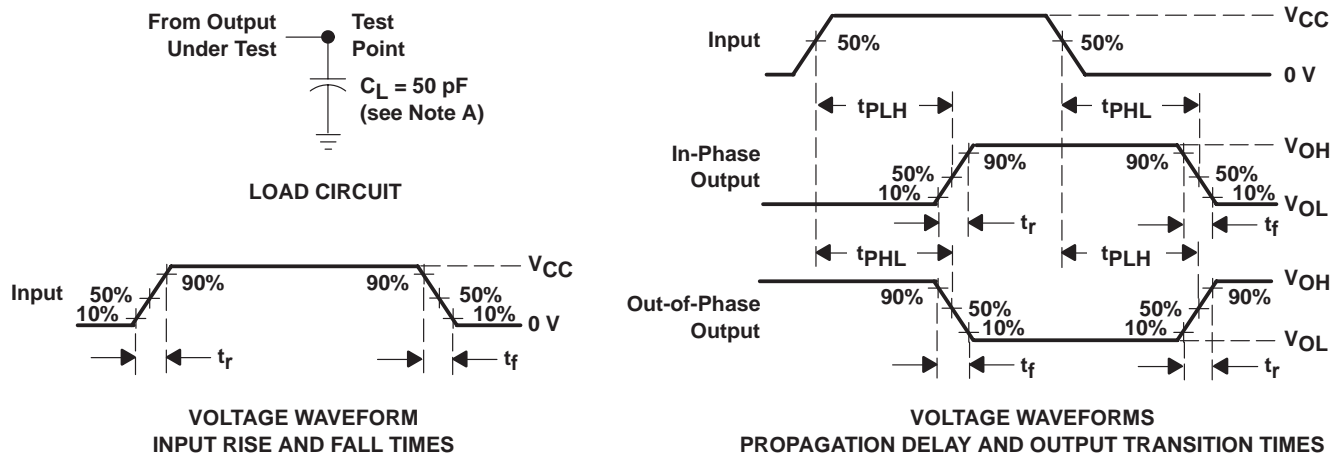
PARAMETER	TEST CONDITIONS	TYP	UNIT
C _{pd} Power dissipation capacitance per gate	No load	25	pF



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PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A. C_L includes probe and test-fixture capacitance.
 - B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r = 6$ ns, $t_f = 6$ ns.
 - C. The outputs are measured one at a time with one input transition per measurement.
 - D. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

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