

7420, 7421, LS20, LS21, S20 Gates

Dual Four-Input NAND ('20) AND ('21) Gate
Product Specification

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
7420	10ns	8mA
74LS20	10ns	0.8mA
74S20	3ns	8mA
7421	12ns	8mA
74LS21	9ns	1.7mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP '20	N7420N, N74LS20N, N74S20N
'21	N7421N, N74LS21N
Plastic SO	N74LS20D, N74S20D, N74LS21D

FUNCTION TABLE

INPUTS				OUTPUTS	
A	B	C	D	Y('20)	Y('21)
L	X	X	X	H	L
X	L	X	X	H	L
X	X	L	X	H	L
X	X	X	L	H	L
H	H	H	H	L	H

H = HIGH voltage level
L = LOW voltage level
X = Don't care

NOTE:

For information regarding devices processed to Military Specifications, see the Signetics Military Products Data Manual.

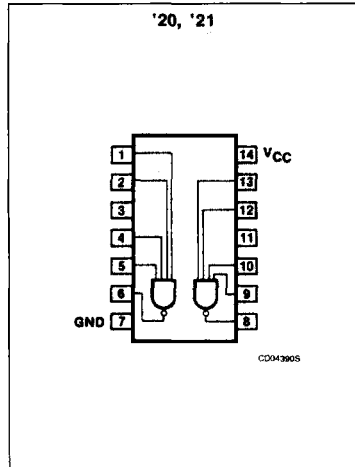
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74	74S	74LS
A - D	Inputs	1ul	1Sul	1LSul
Y	Output	10ul	10Sul	10LSul

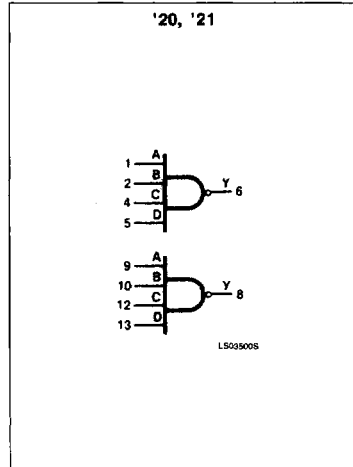
NOTE:

Where a 74 unit load (ul) is understood to be $40\mu A$ I_{IH} and $-1.6mA$ I_{IL} , a 74S unit load (Sul) is $50\mu A$ I_{IH} and $-2.0mA$ I_{IL} , and 74LS unit load (LSul) is $20\mu A$ I_{IH} and $-0.4mA$ I_{IL} .

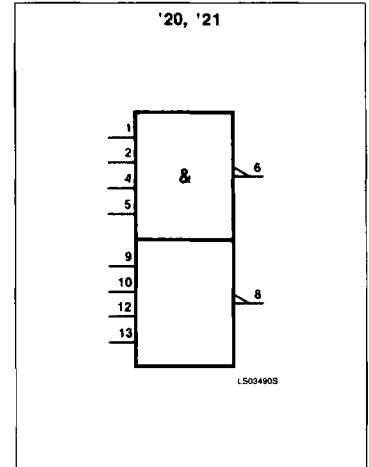
PIN CONFIGURATION



LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



Gates

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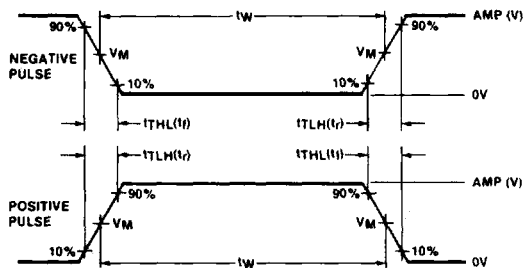
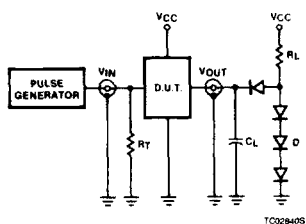
ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

PARAMETER	74	74LS	74S	UNIT
V _{CC} Supply voltage	7.0	7.0	7.0	V
V _{IN} Input voltage	-0.5 to +5.5	-0.5 to +7.0	-0.5 to +5.5	V
I _{IN} Input current	-30 to +5	-30 to +1	-30 to +5	mA
V _{OUT} Voltage applied to output in HIGH output state	-0.5 to +V _{CC}	-0.5 to +V _{CC}	-0.5 to +V _{CC}	V
T _A Operating free-air temperature range	0 to 70			°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER	74			74LS			74S			UNIT
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
V _{CC} Supply voltage	4.75	5.0	5.25	4.75	5.0	5.25	4.75	5.0	5.25	V
V _{IH} HIGH-level input voltage	2.0			2.0			2.0			V
V _{IL} LOW-level input voltage			+0.8			+0.8			+0.8	V
I _{IK} Input clamp current			-12			-18			-18	mA
I _{OH} HIGH-level output current	'20		-400			-400			-1000	μA
	'21		-800			-400			-1000	μA
I _{OL} LOW-level output current			16			8			20	mA
T _A Operating free-air temperature	0		70	0		70	0		70	°C

TEST CIRCUITS AND WAVEFORMS



V_M = 1.3V for 74LS; V_M = 1.5V for all other TTL families.

Test Circuit For 74 Totem-Pole Outputs

DEFINITIONS

R_L = Load resistor to V_{CC}; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of Pulse Generators.

D = Diodes are 1N916, 1N3064, or equivalent.

t_{TLH}, t_{THL} Values should be less than or equal to the table entries.

Input Pulse Definition

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t _{TLH}	t _{THL}
74	3.0V	1MHz	500ns	7ns	7ns
74LS	3.0V	1MHz	500ns	15ns	6ns
74S	3.0V	1MHz	500ns	2.5ns	2.5ns

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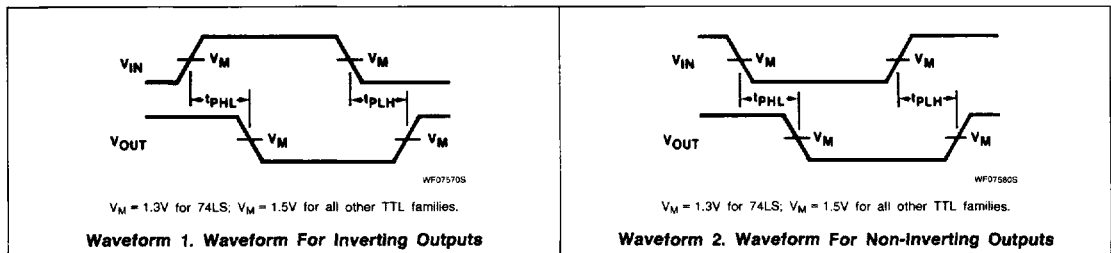
DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER	TEST CONDITIONS ¹	7420, 21			74LS20, 21			74S20			UNIT	
		Min	Typ ²	Max	Min	Typ ²	Max	Min	Typ ²	Max		
V _{OH}	HIGH-level output voltage V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN, I _{OH} = MAX	2.4	3.4		2.7	3.4		2.7	3.4		V	
V _{OL}	LOW-level output voltage V _{CC} = MIN, V _{IH} = MIN, V _{IL} = MAX	I _{OL} = MAX		0.2	0.4		0.35	0.5		0.5	V	
		I _{OL} = 4mA (74LS)					0.25	0.4				V
V _{IK}	Input clamp voltage V _{CC} = MIN, I _I = I _{IK}			-1.5				-1.5			-1.2	V
I _I	Input current at maximum input voltage V _{CC} = MAX	V _I = 5.5V			1.0					1.0	mA	
		V _I = 7.0V						0.1				mA
I _{IH}	HIGH-level input current V _{CC} = MAX	V _I = 2.4V			40						μA	
		V _I = 2.7V						20		50	μA	
I _{IL}	LOW-level input current V _{CC} = MAX	V _I = 0.4V			-1.6			-0.4			mA	
		V _I = 0.5V								-2.0	mA	
I _{OS}	Short-circuit output current ³ V _{CC} = MAX	-18		-55	-20			-100	-40		-100	mA
I _{CC}	Supply current (total) V _{CC} = MAX	I _{CCH} Outputs HIGH	'20	2	4		0.4	0.8		5	8	mA
		I _{CCL} Outputs LOW		6	11		1.2	2.2		10	18	mA
		I _{CCH} Outputs HIGH	'21	6	8		1.2	2.4				mA
		I _{CCL} Outputs LOW		11	13		2.2	4.4				mA

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V_{CC} = 5V, T_A = 25°C.
- I_{OS} is tested with V_{OUT} = +0.5V and V_{CC} = V_{CC} MAX + 0.5V. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

AC WAVEFORMS



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AC ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$

PARAMETER	TEST CONDITIONS	74		74LS		74S		UNIT
		$C_L = 15\text{pF}$, $R_L = 400\Omega$		$C_L = 15\text{pF}$, $R_L = 2\text{k}\Omega$		$C_L = 15\text{pF}$, $R_L = 280\Omega$		
		Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL} Propagation delay	Waveform 1, '20		22 15		15 15		4.5 5.0	ns
t_{PLH} t_{PHL} Propagation delay	Waveform 2, '21		27 19		15 20			ns