

74LS283
Adder

4-Bit Full Adder With Fast Carry
Product Specification

Logic Products

FEATURES

- High-speed 4-bit binary addition
- Cascadable in 4-bit increments
- Fast internal carry lookahead

DESCRIPTION

The '283 adds two 4-bit binary words (A_n plus B_n) plus the incoming carry. The binary sum appears on the Sum outputs ($\Sigma_1 - \Sigma_4$) and the outgoing carry (C_{OUT}) according to the equation:

$$\begin{aligned} &C_{IN} + (A_1 + B_1) + 2(A_2 + B_2) \\ &\quad + 4(A_3 + B_3) + 8(A_4 + B_4) \\ &= \Sigma_1 + 2\Sigma_2 + 4\Sigma_3 + 8\Sigma_4 + 16C_{OUT} \end{aligned}$$

Where (+) = plus.

Due to the symmetry of the binary add function, the '283 can be used with either all active HIGH operands (positive logic) or all active LOW operands (negative logic) - see Function Table. In case of all active LOW operands the results $\Sigma_1 - \Sigma_4$ and C_{OUT} should be interpreted also as active LOW. With active HIGH inputs, C_{IN} cannot be left open; it must be held LOW when no "carry in" is

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74LS283	13ns	20mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP	N74LS283N
Plastic SO-16	N74LS283D

NOTE:

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

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

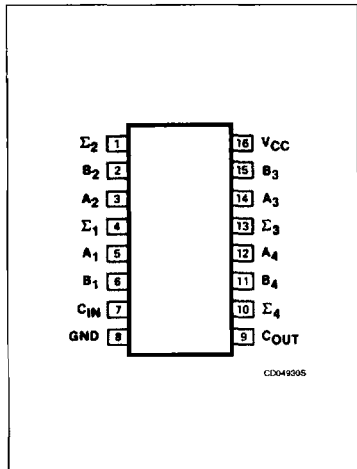
PINS	DESCRIPTION	74LS
A, B	Inputs	2LSul
C_{IN}	Input	1LSul
All	Outputs	10LSul

NOTE:

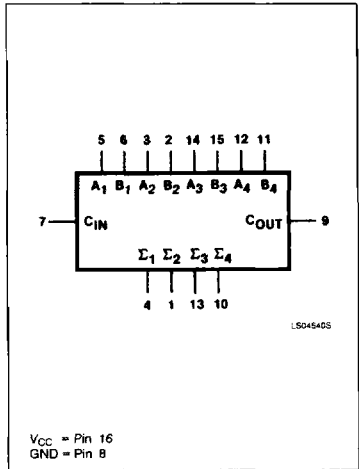
A 74LS unit load (LSul) is 20 μA I_{IH} and -0.4mA I_{IL} .

intended. Interchanging inputs of equal weight does not affect the operation, thus C_{IN} , A_1 , B_1 can arbitrarily be assigned to pins 5, 6, 7, etc.

PIN CONFIGURATION

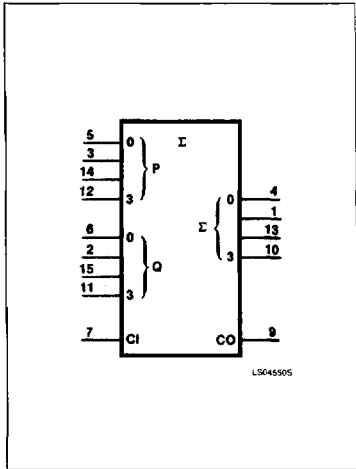


LOGIC SYMBOL



V_{CC} = Pin 16
GND = Pin 8

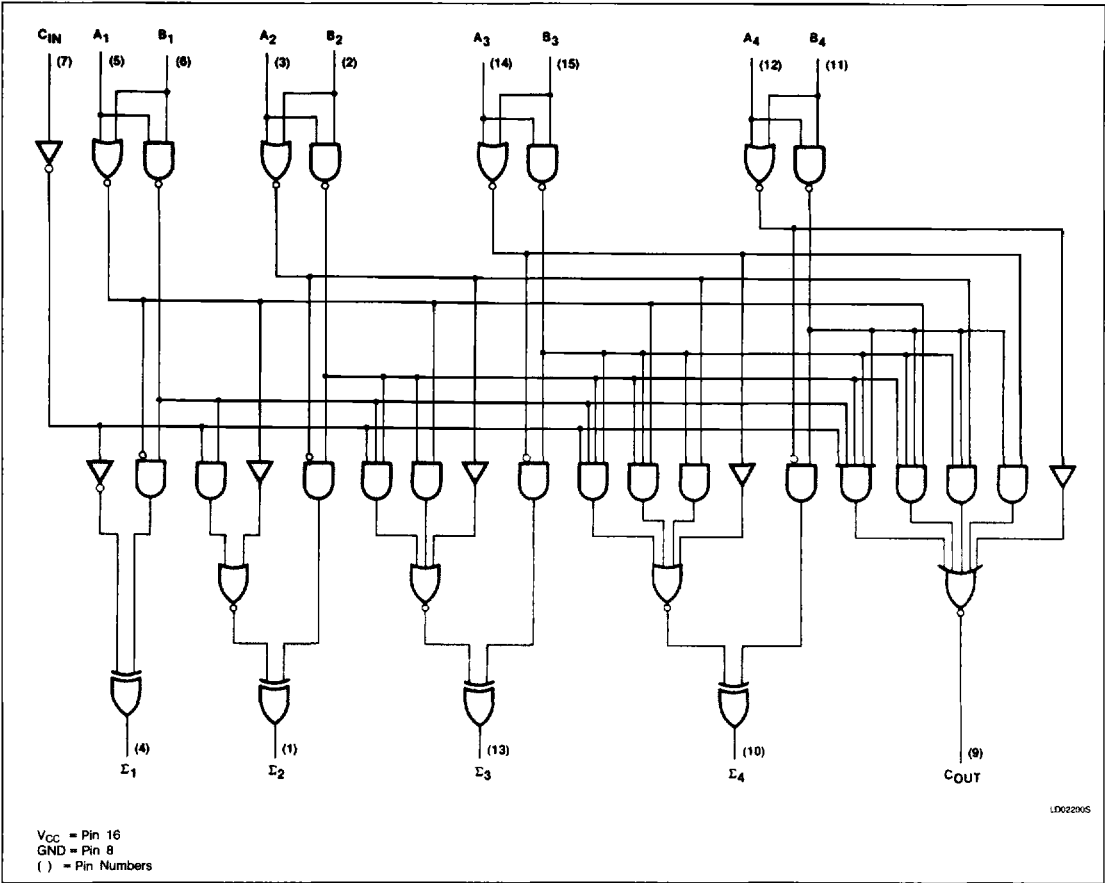
LOGIC SYMBOL (IEEE/IEC)



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LOGIC DIAGRAM



FUNCTION TABLE

PINS	C _{IN}	A ₁	A ₂	A ₃	A ₄	B ₁	B ₂	B ₃	B ₄	Σ ₁	Σ ₂	Σ ₃	Σ ₄	C _{OUT}
Logic levels	L	L	H	L	H	H	L	L	H	H	H	L	L	H
Active HIGH	0	0	1	0	1	1	0	0	1	1	1	0	0	1
Active LOW	1	1	0	1	0	0	1	1	0	0	0	1	1	0

H = HIGH voltage level
L = LOW voltage level

Example:
1001
1010

10011
(10 + 9 = 19)
(carry + 5 + 6 = 12)

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

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

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RECOMMENDED OPERATING CONDITIONS

PARAMETER		74LS			UNIT
		Min	Nom	Max	
V _{CC}	Supply voltage	4.75	5.0	5.25	V
V _{IH}	HIGH-level input voltage	2.0			V
V _{IL}	LOW-level input voltage			+0.8	V
I _{IK}	Input clamp current			-18	mA
I _{OH}	HIGH-level output current			-400	μA
I _{OL}	LOW-level output current			8	mA
T _A	Operating free-air temperature	0		70	°C

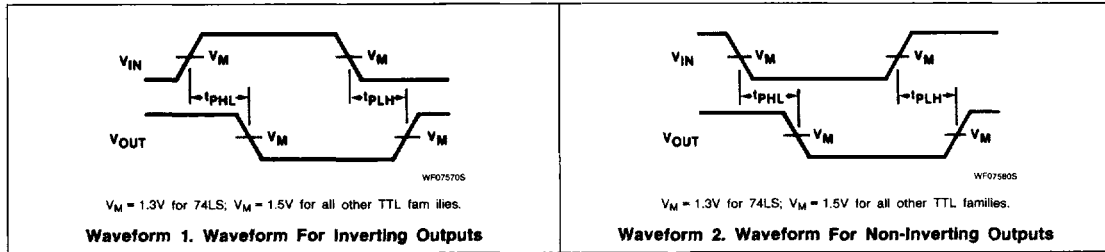
DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER		TEST CONDITIONS ¹	74LS283			UNIT
			Min	Typ ²	Max	
V _{OH}	HIGH-level output voltage	V _{CC} = MIN, V _{IH} = MIN, V _{IL} = MAX, I _{OH} = MAX	2.7	3.4		V
V _{OL}	LOW-level output voltage	V _{CC} = MIN, V _{IH} = MIN, I _{OL} = MAX		0.35	0.5	V
		V _{IL} = MAX, I _{OL} = 4mA (74LS)		0.25	0.4	V
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = I _{IK}			-1.5	V
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 7.0V			0.2	mA
		A, B inputs			0.1	mA
I _{IH}	HIGH-level input current	V _{CC} = MAX, V _I = 2.7V			40	μA
		C _{IN} input			20	μA
I _{IL}	LOW-level input current	V _{CC} = MAX, V _I = 0.4V			-0.8	mA
		C _{IN} input			-0.4	mA
I _{OS}	Short-circuit output current ³	V _{CC} = MAX	-20		-100	mA
I _{CC}	Supply current ⁴ (total)	V _{CC} = MAX		22	39	mA
		Condition 2		19	34	mA
		Condition 3		19	34	mA

NOTES:

- 1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- 2. All typical values are at V_{CC} = 5V, T_A = 25°C.
- 3. 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.
- 4. I_{CC} should be measured with all outputs open and the following conditions:
Condition 1: All inputs grounded.
Condition 2: All B inputs LOW, other inputs at 4.5V.
Condition 3: All inputs at 4.5V.

AC WAVEFORMS



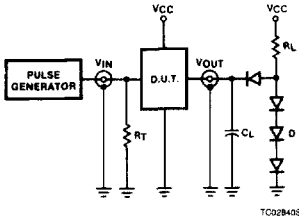
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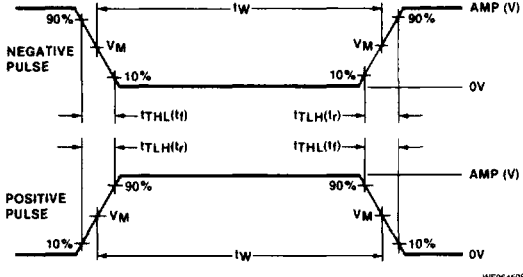
AC ELECTRICAL CHARACTERISTICS $T_A = 25^{\circ}\text{C}$, $V_{CC} = 5.0\text{V}$

PARAMETER		TEST CONDITIONS	74LS		UNIT
			$C_L = 15\text{pF}$, $R_L = 2\text{k}\Omega$		
			Min	Max	
t_{PLH} t_{PHL}	Propagation delay C_{IN} to Σ_1	Waveforms 1 & 2		24 24	ns
t_{PLH} t_{PHL}	Propagation delay C_{IN} to Σ_2	Waveforms 1 & 2		24 24	ns
t_{PLH} t_{PHL}	Propagation delay C_{IN} to Σ_3	Waveforms 1 & 2		24 24	ns
t_{PLH} t_{PHL}	Propagation delay C_{IN} to Σ_4	Waveforms 1 & 2		24 24	ns
t_{PLH} t_{PHL}	Propagation delay A_i or B_i to Σ_i	Waveforms 1 & 2		24 24	ns
t_{PLH} t_{PHL}	Propagation delay C_{IN} to C_{OUT}	Waveform 2		17 22	ns
t_{PLH} t_{PHL}	Propagation delay A_i or B_i to C_{OUT}	Waveforms 1 & 2		17 17	ns

TEST CIRCUITS AND WAVEFORMS



TC02B40S



WP36450S

$V_M = 1.3\text{V}$ for 74LS; $V_M = 1.5\text{V}$ 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