

#### 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:

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

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

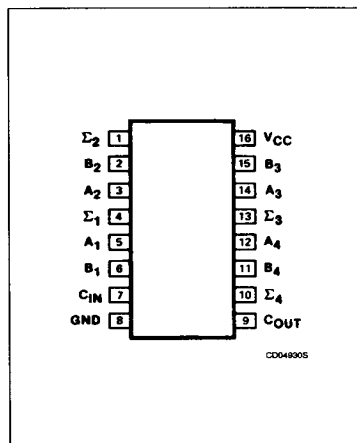
PINS	DESCRIPTION	74LS
A, B	Inputs	2LSul
$C_{IN}$	Input	1LSul
All	Outputs	10LSul

#### NOTE:

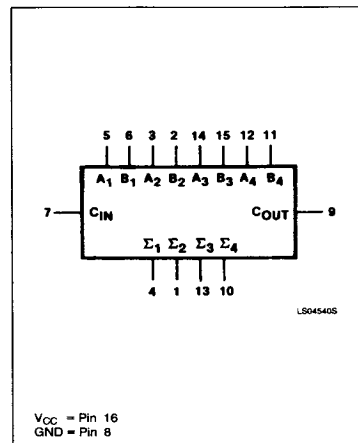
A 74LS unit load (LSul) is  $20\mu A$   $I_{IH}$  and  $-0.4mA$   $I_{IL}$ .

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.

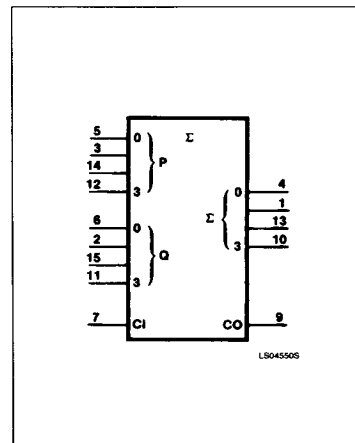
#### PIN CONFIGURATION



#### LOGIC SYMBOL



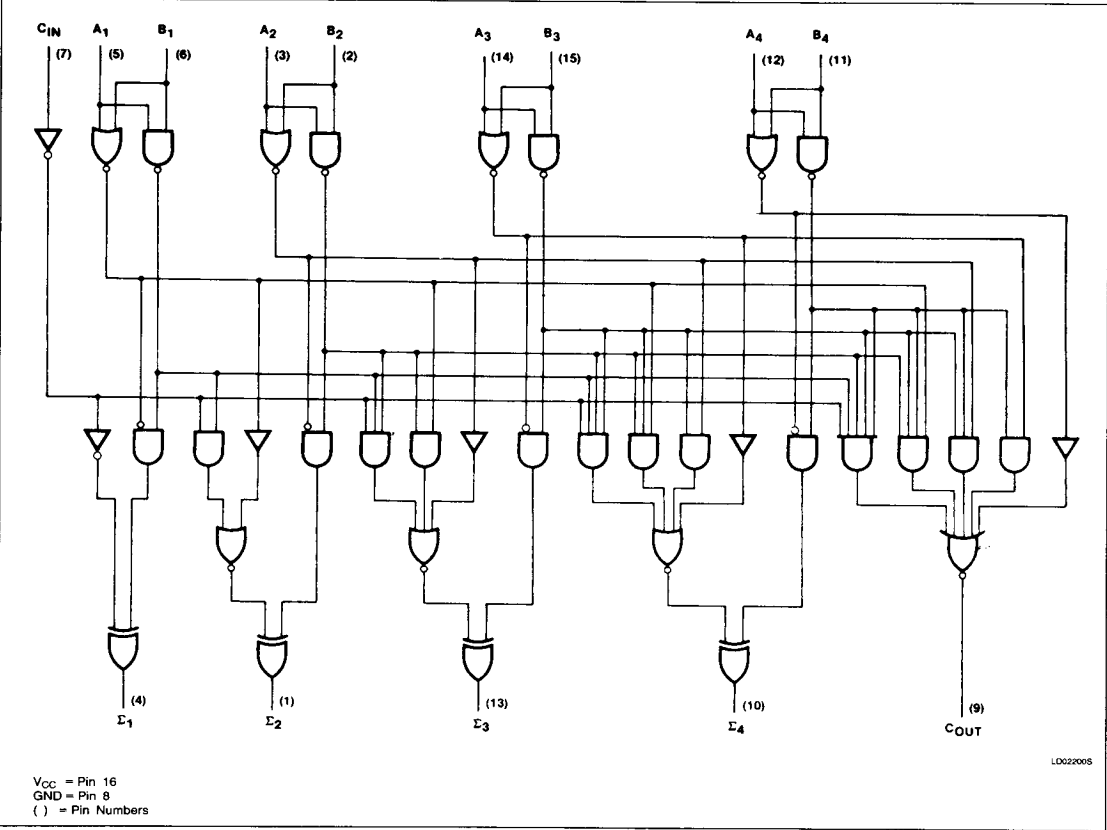
#### LOGIC SYMBOL (IEEE/IEC)



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74LS283

LOGIC DIAGRAM



FUNCTION TABLE

PINS	C <sub>IN</sub>	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	Σ <sub>1</sub>	Σ <sub>2</sub>	Σ <sub>3</sub>	Σ <sub>4</sub>	C <sub>OUT</sub>
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 <sub>CC</sub>	Supply voltage	7.0	V
V <sub>IN</sub>	Input voltage	-0.5 to +7.0	V
I <sub>IN</sub>	Input current	-30 to +1	mA
V <sub>OUT</sub>	Voltage applied to output in HIGH output state	-0.5 to +V <sub>CC</sub>	V
T <sub>A</sub>	Operating free-air temperature range	0 to 70	°C

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RECOMMENDED OPERATING CONDITIONS

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

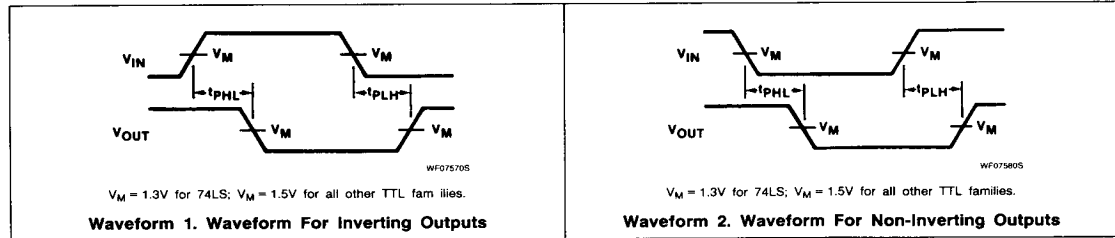
DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER		TEST CONDITIONS <sup>1</sup>	74LS283			UNIT
			Min	Typ <sup>2</sup>	Max	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OH</sub> = MAX	2.7	3.4		V
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OL</sub> = MAX		0.35	0.5	V
		I <sub>OL</sub> = 4mA (74LS)		0.25	0.4	V
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>			-1.5	V
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V, A, B inputs			0.2	mA
		C <sub>IN</sub> input			0.1	mA
I <sub>IH</sub>	HIGH-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V, A, B inputs			40	μA
		C <sub>IN</sub> input			20	μA
I <sub>IL</sub>	LOW-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4V, A, B inputs			-0.8	mA
		C <sub>IN</sub> input			-0.4	mA
I <sub>OS</sub>	Short-circuit output current <sup>3</sup>	V <sub>CC</sub> = MAX	-20		-100	mA
I <sub>CC</sub>	Supply current <sup>4</sup> (total)	V <sub>CC</sub> = MAX, Condition 1		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<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.
3. I<sub>OS</sub> is tested with V<sub>OUT</sub> = +0.5V and V<sub>CC</sub> = V<sub>CC</sub> 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<sub>CC</sub> 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



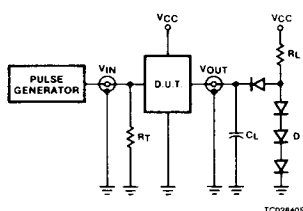
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74LS283

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

PARAMETER		TEST CONDITIONS	74LS		UNIT
			C <sub>L</sub> = 15pF, R <sub>L</sub> = 2kΩ		
			Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay C <sub>IN</sub> to Σ <sub>1</sub>	Waveforms 1 & 2		24 24	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay C <sub>IN</sub> to Σ <sub>2</sub>	Waveforms 1 & 2		24 24	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay C <sub>IN</sub> to Σ <sub>3</sub>	Waveforms 1 & 2		24 24	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay C <sub>IN</sub> to Σ <sub>4</sub>	Waveforms 1 & 2		24 24	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay A <sub>i</sub> or B <sub>V</sub> <sub>i</sub> to Σ <sub>i</sub>	Waveforms 1 & 2		24 24	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay C <sub>IN</sub> to C <sub>OUT</sub>	Waveform 2		17 22	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay A <sub>i</sub> or B <sub>i</sub> to C <sub>OUT</sub>	Waveforms 1 & 2		17 17	ns

## TEST CIRCUITS AND WAVEFORMS

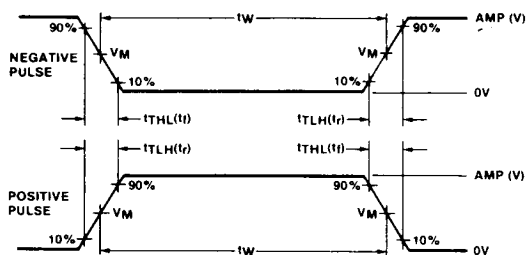


Test Circuit For 74 Totem-Pole Outputs

## 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. $V_M = 1.3\text{V}$  for 74LS;  $V_M = 1.5\text{V}$  for all other TTL families.

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