Signetics

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:

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

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 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.

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

ORDERING CODE

PACKAGES	COMMERCIAL RANGE V_{CC} = 5V ±5%; T_A = 0°C to +70°C
Plastic DIP	N74LS283N
Plastic SO-16	N74LS283D

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

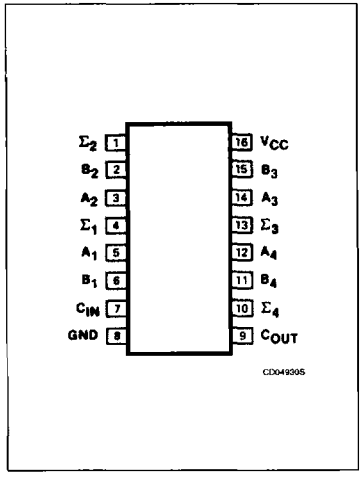
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

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

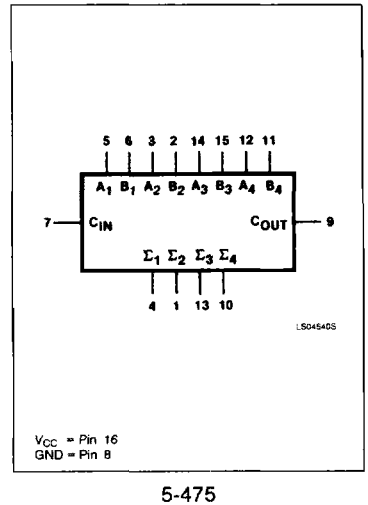
NOTE:
A 74LS unit load (LSul) is 20μA I_{IH} and −0.4mA I_{IL}.

5

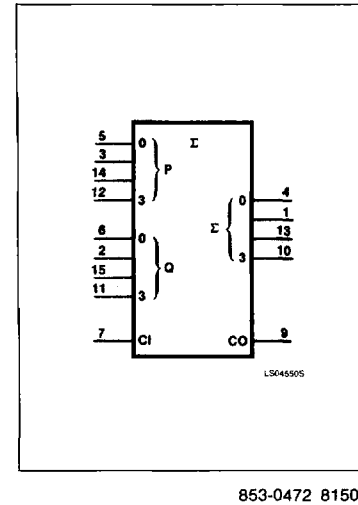
PIN CONFIGURATION



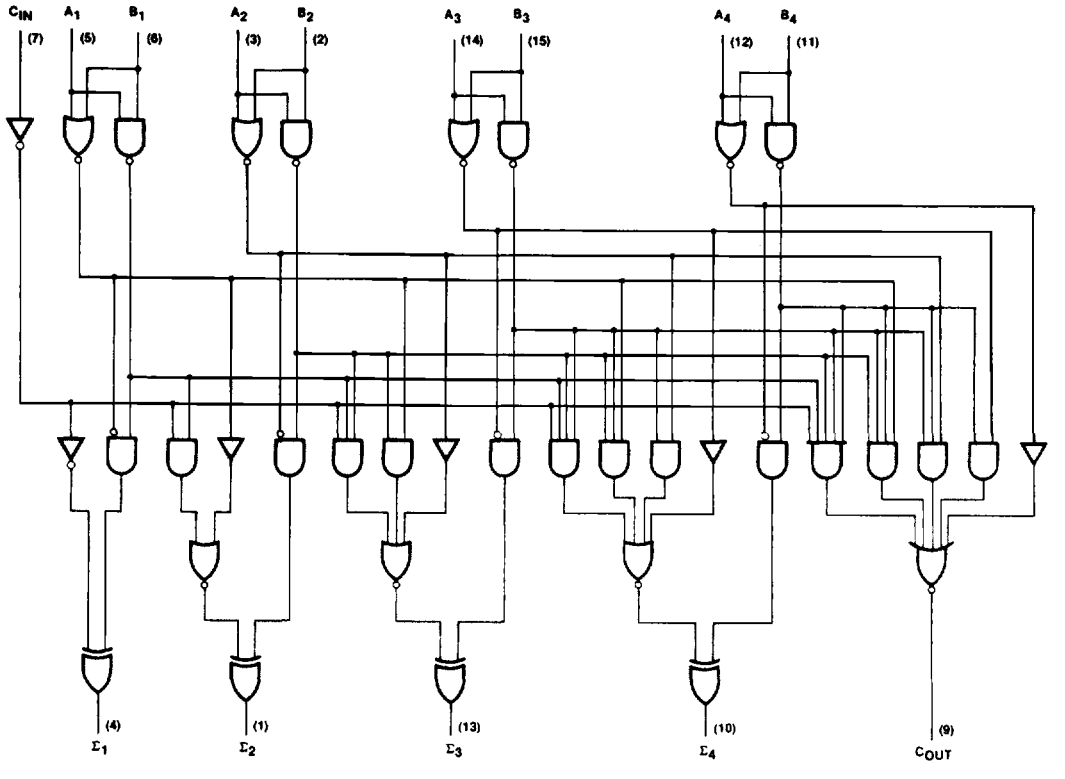
LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



LOGIC DIAGRAM



V_{CC} = Pin 16
GND = Pin 8
( ) = Pin Numbers

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

RECOMMENDED OPERATING CONDITIONS

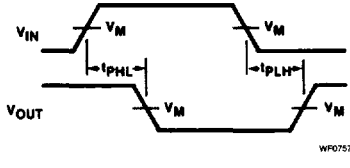
PARAMETER		74LS			UNIT
		Min	Nom	Max	
V_{CC}	Supply voltage	4.75	5.0	5.25	V
V_{IH}	HIGH-level input voltage	2.0			V
V_{IL}	LOW-level input voltage			+0.8	V
I_{IK}	Input clamp current			−18	mA
I_{OH}	HIGH-level output current			−400	μA
I_{OL}	LOW-level output current			8	mA
T_A	Operating free-air temperature	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, V_{IL} = MAX	I_{OL} = MAX		0.35	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	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7.0V	A, B inputs			0.2	mA
			C_{IN} input			0.1	mA
I_{IH}	HIGH-level input current	V_{CC} = MAX, V_I = 2.7V	A, B inputs			40	μA
			C_{IN} input			20	μA
I_{IL}	LOW-level input current	V_{CC} = MAX, V_I = 0.4V	A, B inputs			−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	Condition 1		22	39	mA
			Condition 2		19	34	mA
			Condition 3		19	34	mA

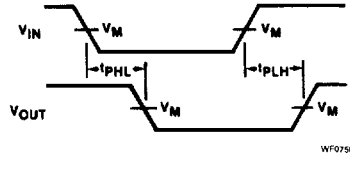
NOTES:
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_A = 25°C.
3. I_{OS} is tested with V_{OUT} = +0.5V and V_{CC} = V_{CC} MAX + 0.5V. Not more than one output should 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



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

Waveform 1. Waveform For Inverting Outputs



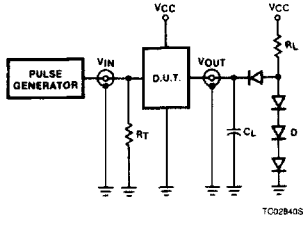
V_M = 1.3V for 74LS; V_M = 1.5V for all other TTL families.

Waveform 2. Waveform For Non-Inverting Outputs

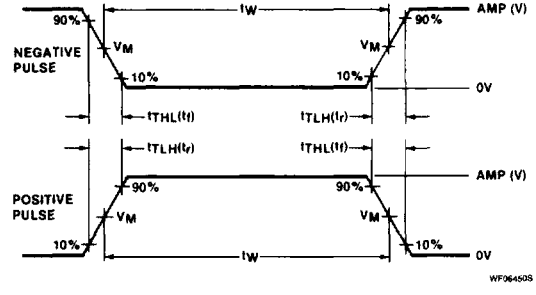
AC ELECTRICAL CHARACTERISTICS $T_A = 25°C$, $V_{CC} = 5.0V$

PARAMETER		TEST CONDITIONS	74LS		UNIT
			$C_L = 15pF$, $R_L = 2k\Omega$		
			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 BV_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



Test Circuit For 74 Totem-Pole Outputs



$V_M = 1.3V$ for 74LS; $V_M = 1.5V$ 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

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.