



## 4-BIT BINARY FULL ADDER WITH FAST CARRY

### DESCRIPTION

The T54LS283/T74LS283 is a high speed 4-Bit Binary Full Adder with internal carry lookahead. It accepts two 4-bit binary words ( $A_1$ - $A_4$ ,  $B_1$ - $B_4$ ) and a Carry Input ( $C_{IN}$ ). It generates the binary Sum outputs ( $\Sigma_1$ - $\Sigma_4$ ) and the Carry Output ( $C_{OUT}$ ) from the most significant bit. The LS283 operates with either active HIGH or active LOW operands (positive or negative logic).

**B1**  
Plastic Package

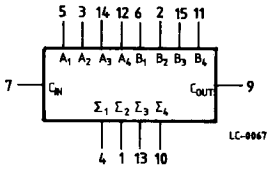
**D1/D2**  
Ceramic Package

**M1**  
Micro Package

**C1**  
Plastic Chip Carrier

**ORDERING NUMBERS:**  
 T54LS283 D2      T74LS283 C1  
 T74LS283 D1      T74LS283 M1  
 T74LS283 B1

### LOGIC SYMBOL



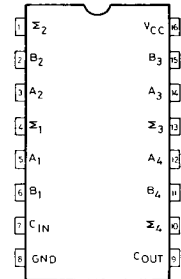
$V_{CC}$  = Pin 16  
 $GND$  = Pin 8

### PIN NAMES

$A_1$ - $A_4$	Operand A Inputs
$B_1$ - $B_4$	Operand B Inputs
$C_{IN}$	Carry Inputs
$\Sigma_1$ - $\Sigma_4$	Sum Outputs
$C_{OUT}$	Carry Outputs

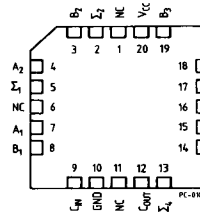
### PIN CONNECTION (top view)

#### DUAL IN LINE



S-8023

#### CHIP CARRIER



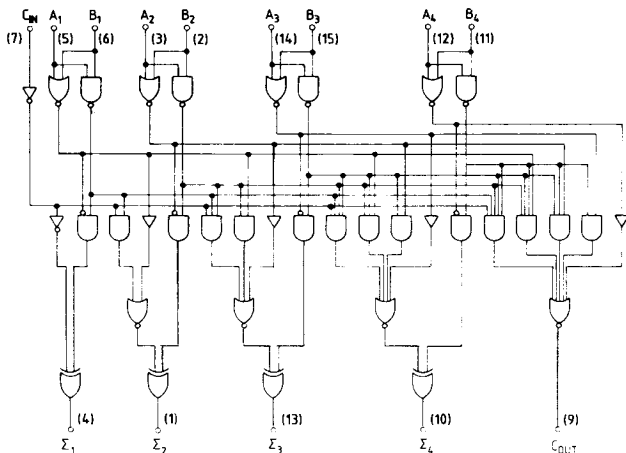
NC = No Internal Connection



**T54LS283**

**T74LS283**

**LOGIC DIAGRAM**



V<sub>CC</sub> = Pin 16  
 GND = Pin 8  
 ( ) = Pin numbers

LC-4102

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.5 to 7	V
V <sub>I</sub>	Input Voltage, Applied to Input	-0.5 to 15	V
V <sub>O</sub>	Output Voltage, Applied to Output	-0.5 to 10	V
I <sub>I</sub>	Input Current, Into Inputs	-30 to 5	mA
I <sub>O</sub>	Output Current, Into Outputs	50	mA

Stresses in excess of those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions in excess of those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**GUARANTEED OPERATING RANGES**

Part Numbers	Supply Voltage			Temperature
	Min	Typ	Max	
T54LS283D2	4.5 V	5.0 V	5.5 V	-55°C to +125°C
T74LS283XX	4.75 V	5.0 V	5.25 V	0°C to +70°C

XX = package type.

### FUNCTIONAL DESCRIPTION

The LS283 adds two 4-bit binary words (A plus B) plus the incoming carry. The binary sum appears on the sum outputs ( $\Sigma_1$ - $\Sigma_4$ ) and outgoing carry ( $C_{OUT}$ ) outputs.

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

where: (+) = plus

Due to the symmetry of the binary add function the LS283 can be used with either all input and outputs active HIGH (positive logic) or with all inputs and outputs active LOW (negative logic).

Note that with active HIGH inputs, Carry In can not be left open, but must be held LOW when no carry in is intended.

Example:

	$C_{IN}$	$A_1$	$A_2$	$A_3$	$A_4$	$B_1$	$B_2$	$B_3$	$B_4$	$\Sigma_1$	$\Sigma_2$	$\Sigma_3$	$\Sigma_4$	$C_{OUT}$	
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	(10 + 9 = 19)
Active LOW	1	1	0	1	0	0	1	1	0	0	0	1	1	0	(Carry + 5 + 6 = 12)

Interchanging inputs of equal weight does not affect operation, thus  $C_{IN}$ ,  $A_1$ ,  $B_1$ , can be arbitrarily assigned to pins 7, 8 or 3.

### AC WAVEFORMS

Fig. 1

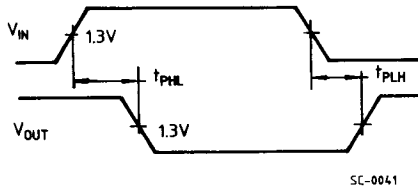
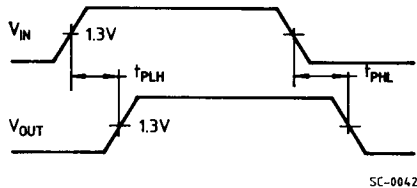


Fig. 2





## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

Symbol	Parameter		Limits			Test Conditions (Note 1)	Units
			Min.	Typ.	Max.		
$V_{IH}$	Input HIGH Voltage		2.0			Guaranteed input HIGH Voltage for all Inputs	V
$V_{IL}$	Input LOW Voltage	54			0.7	Guaranteed input LOW Voltage for all Inputs	V
		74			0.8		
$V_{CD}$	Input Clamp Diode Voltage			-0.65	-1.5	$V_{CC} = \text{MIN}, I_{IN} = -18\text{mA}$	V
$V_{OH}$	Output HIGH Voltage	54	2.5	3.4		$V_{CC} = \text{MIN}, I_{OH} = -400\mu\text{A}, V_{IN} = V_{IH}$ or $V_{IL}$ per Truth Table	V
		74	2.7	3.4			
$V_{OL}$	Output LOW Voltage	54,74		0.25	0.4	$I_{OL} = 4.0\text{mA}$	V
		74		0.35	0.5		
$I_{IH}$	Input HIGH Current $C_{IN}$ Any A or B				20 40	$V_{CC} = \text{MAX}, V_{IN} = 2.7\text{V}$	$\mu\text{A}$
	$C_{IN}$ Any A or B				0.1 0.2	$V_{CC} = \text{MAX}, V_{IN} = 7.0\text{V}$	mA
$I_{IL}$	Input LOW Current $C_{IN}$ Any A or B				-0.4 -0.8	$V_{CC} = \text{MAX}, V_{IN} = 0.4\text{V}$	mA
$I_{OS}$	Output Short Circuit Current (Note 2)		-20		-100	$V_{CC} = \text{MAX}, V_{OUT} = 0\text{V}$	mA
$I_{CC}$	Power Supply Current			22	39	$V_{CC} = \text{MAX}, \text{All Inputs } 0\text{V}$ $V_{CC} = \text{MAX}, \text{A Inputs} = 4.5\text{V}$	mA
				19	34		

## AC CHARACTERISTICS: $T_A = 25^\circ\text{C}$

Symbol	Parameter		Limits			Test Conditions	Units
			Min.	Typ.	Max.		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $C_{IN}$ Input to Any $\Sigma$ Output			16 15	24 24	$V_{CC} = 5.0\text{V}$ $C_L = 15\text{pF}$ Figures 1 and 2	ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Any A or B Input to $\Sigma$ Outputs			15 15	24 24		ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $C_{IN}$ Input to $C_{OUT}$ Output			11 11	17 22		ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Any A or B Input to $C_{OUT}$ Output			11 12	17 17		ns

### Notes:

- 1) Conditions for testing, not shown in the Table, are chosen to guarantee operation under "worst case" conditions
- 2) Not more than one output should be shorted at a time.
- 3) Typical values are at  $V_{CC} = 5.0\text{V}, T_A = 25^\circ\text{C}$