

## 4-BIT BINARY FULL ADDER WITH FAST CARRY

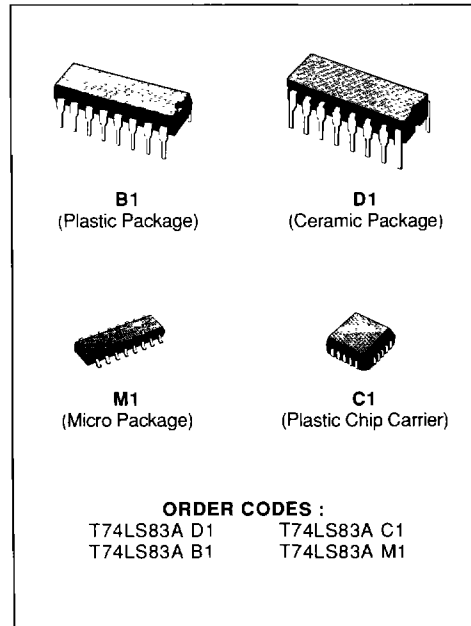
### DESCRIPTION

The T74LS83A is a high-speed 4-Bit Binary Full Adder with internal carry lookahead.

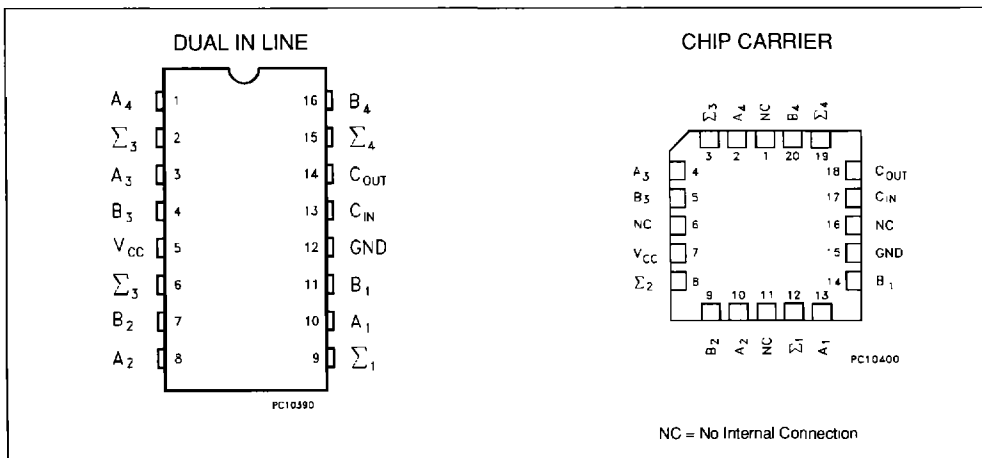
It accepts two 4-bit binary words ( $A_1$ - $A_4$ ,  $B_1$ - $B_4$ ) and a Carry ( $C_{IN}$ ). It generates the binary Sum outputs ( $\Sigma_1$ - $\Sigma_4$ ) and the Carry Output ( $C_{OUT}$ ) from the most significant bit. The LS83A operates with either active HIGH or LOW operand (positive or negative logic). The T74LS83A is recommended for new designs since it is identical in function with this device and features standard corner power pins.

### PIN NAMES

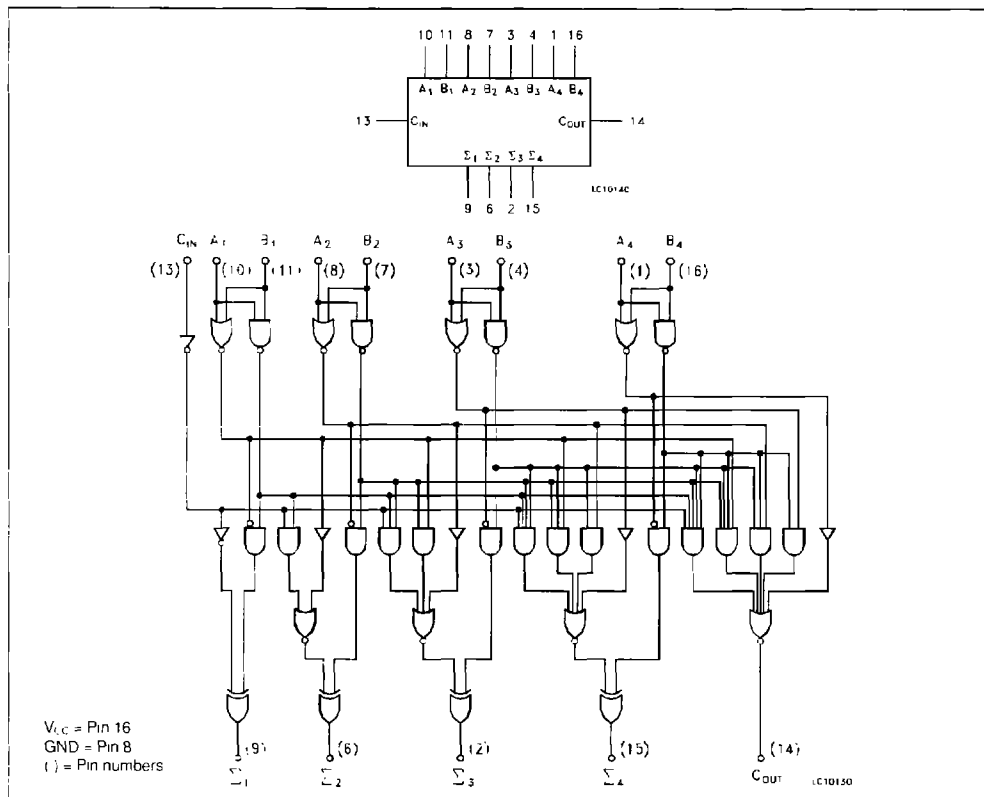
$A_1$ - $A_4$	Operand A Inputs
$B_1$ - $B_4$	Operand B Inputs
$C_{IN}$	Carry Inputs
$S_1$ - $S_4$	Sum Outputs
$C_{OUT}$	Carry Outputs



### PIN CONNECTION (top view)



LOGIC SYMBOL AND LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	- 0.5 to 7	V
$V_i$	Input Voltage, Applied to Input	- 0.5 to 15	V
$V_O$	Output Voltage, Applied to Output	- 0.5 to 10	V
$I_i$	Input Current, Into Inputs	- 30 to 5	mA
$I_C$	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 RANGE

Part Numbers	Supply Voltage			Temperature
	Min.	Typ.	Max.	
T74LS83AXX	4.75 V	5.0 V	5.25 V	0 °C to + 70 °C

XX = package type

## FUNCTIONAL DESCRIPTION

The LS83A adds to 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 LS83A can be used with either all input and output active HIGH (positive logic) or with all inputs and output 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	$Carry + 5 + 6 = 12$

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

Symbol	Parameter	Limits			Test Condition (note 1)	Unit	
		Min.	Typ. (*)	Max.			
$V_{IH}$	Input HIGH Voltage	2.0			Guaranteed Input HIGH Voltage for All Input	V	
$V_{IL}$	Input LOW Voltage			0.8	Guaranteed Input LOW Voltage for All Input	V	
$V_{CD}$	Input Clamp Diode Voltage		- 0.65	- 1.5	$V_{CC} = \text{MIN}$ , $I_{IN} = -18 \text{ mA}$	V	
$V_{OH}$	Output HIGH Voltage	2.7	3.5		$V_{CC} = \text{MIN}$ , $I_{OH} = -400 \mu\text{A}$ $V_{IN} = V_{IH}$ or $V_{IL}$ per Truth Table	V	
$V_{OL}$	Output LOW Voltage		0.25	0.4	$I_{OL} = 4.0 \text{ mA}$	$V_{CC} = \text{MIN}$ $V_{IN} = V_{IH}$ or $V_{IL}$ per Truth Table	V
			0.35	0.5	$I_{OL} = 8.0 \text{ mA}$		V
$I_{IH}$	Input HIGH Current $C_{IN}$ Any A or B			20 40	$V_{CC} = \text{MAX}$ , $V_{IN} = 2.7 \text{ V}$	$\mu\text{A}$	
				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	
				- 20	- 100	$V_{CC} = \text{MAX}$ , $V_{IN} = 0 \text{ V}$	mA
$I_{OS}$	Output Short Circuit Current (note 2)				$V_{CC} = \text{MAX}$ , All Inputs 0 V	mA	
$I_{CC}$	Power Supply Current		22 19	39 34	$V_{CC} = \text{MAX}$ , All Inputs 0 V $V_{CC} = \text{MAX}$ , A Inputs = 4.5 V	mA	

**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.

(\*) Typical values are at  $V_{CC} = 5.0 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

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

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 $\Sigma$ Output		15 15	24 24		ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay, $C_{IN}$ Input to $C_{OUT}$ Output		11 15	17 22		ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Any A or B Input to $C_{OUT}$ Output		11 12	17 17		ns

AC WAVEFORMS

Figure 1

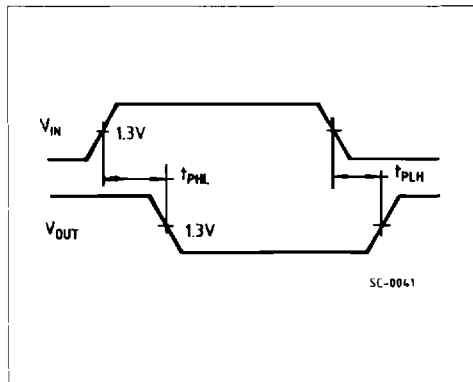


Figure 2

