



## 4-BIT BINARY FULL ADDER WITH FAST CARRY

### DESCRIPTION

The T54LS83A/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 operands (positive or negative logic). The T54LS83A/T74LS83A is recommended for new designs since it is identical in function with this device and features standard corner power pins.

**B1**  
Plastic Package

**D1/D2**  
Ceramic Package

**M1**  
Micro Package

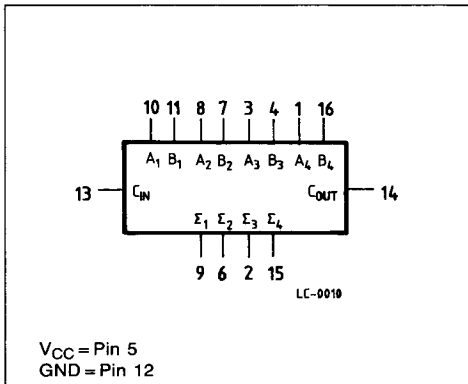
**C1**  
Plastic Chip Carrier

**ORDERING NUMBERS:**  
 T54LS83A D2      T74LS83A C1  
 T74LS83A D1      T74LS83A M1  
 T74LS83A B1

### PIN NAMES

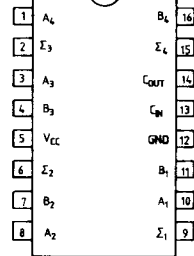
$A_1$ - $A_4$	Operand A Inputs
$B_1$ - $B_4$	Operand B Inputs
$C_{IN}$	Carry Inputs
$\Sigma_1$ - $\Sigma_4$	Sum Outputs
$C_{OUT}$	Carry Outputs

### LOGIC SYMBOL

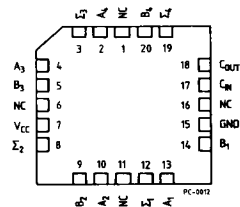


### PIN CONNECTION (top view)

#### DUAL IN LINE



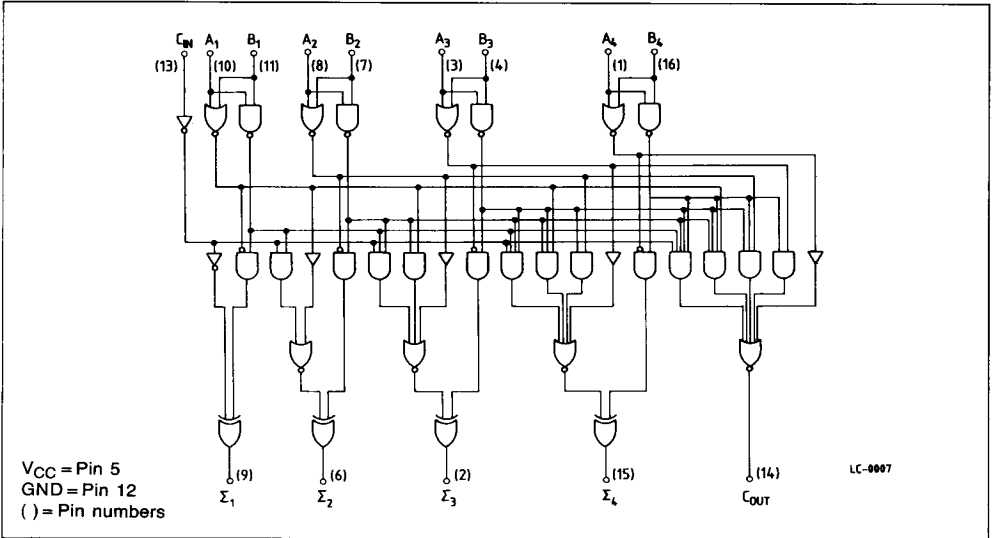
#### CHIP CARRIER



NC = No Internal Connection



## 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
$I_O$	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	
T54LS83AD2	4.5 V	5.0 V	5.5 V	-55°C to +125°C
T74LS83AXX	4.75 V	5.0 V	5.25 V	0°C to +70°C

XX = package type.

**T54LS83A**

**T74LS83A**

**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 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 <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

(10 + 9 = 19)  
(Carry + 5 + 6 = 12)

Interchanging inputs of equal weight does not affect operation, thus C<sub>IN</sub>, A<sub>1</sub>, B<sub>1</sub>, can be arbitrarily assigned to pins 10, 11, 13, etc.

**DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE**

Symbol	Parameter	Limits			Test Conditions (Note 1)	Units
		Min.	Typ.	Max.		
V <sub>IH</sub>	Input HIGH Voltage	2.0			Guaranteed input HIGH Threshold Voltage for all Inputs	V
V <sub>IL</sub>	Input LOW Voltage	54		0.7	Guaranteed input LOW Threshold Voltage for all Inputs	V
		74		0.8		
V <sub>CD</sub>	Input Clamp Diode Voltage		-0.65	-1.5	V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18mA	V
V <sub>OH</sub>	Output HIGH Voltage	54	2.5	3.4	V <sub>CC</sub> = MIN, I <sub>OH</sub> = -400μA, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table	V
		74	2.7	3.4		
V <sub>OL</sub>	Output LOW Voltage	54,74	0.25	0.4	I <sub>OL</sub> = 4.0mA I <sub>OL</sub> = 8.0mA V <sub>CC</sub> = MIN, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table	V
		74	0.35	0.5		
I <sub>IH</sub>	Input HIGH Current C <sub>IN</sub> Any A or B			20 40	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7V	μA
				0.1 0.2		
I <sub>IL</sub>	Input LOW Current C <sub>IN</sub> Any A or B			-0.4 -0.8	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4V	mA
I <sub>OS</sub>	Output Short Circuit Current (Note 2)	-20		-100	V <sub>CC</sub> = MAX, V <sub>OUT</sub> = 0V	mA
I <sub>CC</sub>	Power Supply Current		22	39	V <sub>CC</sub> = MAX, All Inputs 0V V <sub>CC</sub> = MAX, A Inputs = 4.5V	mA
			19	34		

**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<sub>CC</sub> = 5.0V, T<sub>A</sub> = 25°C

**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 $\Sigma$ 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 to $C_{OUT}$ Output		11 12	17 17		ns

**AC WAVEFORMS**
