

August 1986 Revised March 2000

DM74LS83A 4-Bit Binary Adder with Fast Carry

General Description

These full adders perform the addition of two 4-bit binary numbers. The sum (Σ) outputs are provided for each bit and the resultant carry (C4) is obtained from the fourth bit. These adders feature full internal look ahead across all four bits. This provides the system designer with partial lookahead performance at the economy and reduced package count of a ripple-carry implementation.

The adder logic, including the carry, is implemented in its true form meaning that the end-around carry can be accomplished without the need for logic or level inversion.

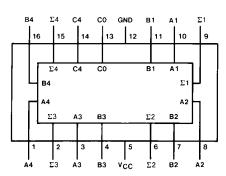
Features

- Full-carry look-ahead across the four bits
- Systems achieve partial look-ahead performance with the economy of ripple carry
- Typical add times
 Two 8-bit words 25 ns
 Two 16-bit words 45 ns
- Typical power dissipation per 4-bit adder 95 mW

Ordering Code:

Order Number	Package Number	Package Description
DM74LS83AN	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Connection Diagram

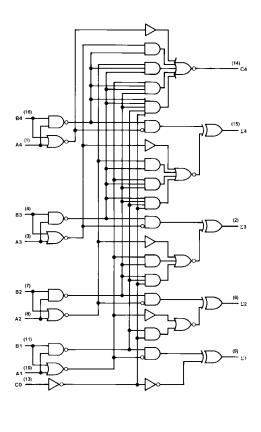


Truth Table

	Outputs									
	Inp	uts		When C0 = L			When C0 = H			
				When C2 = L			When C2 = H			
A1 /	B1 /	A2 /	B2 /	Σ1 Σ2 C2		Σ1	Σ2	C2 /		
A3	В3	A4	B4	Σ3	Σ4	C4	Σ3	Σ4	C4	
L	L	L	L	L	L	L	Н	L	L	
Н	L	L	L	н	L	L	L	н	L	
L	н	L	L	н	L	L	L	н	L	
Н	н	L	L	L	н	L	Н	Н	L	
L	L	Н	L	L	н	L	н	Н	L	
Н	L	н	L	н	н	L	L	L	н	
L	н	Н	L	н	Н	L	L	L	н	
н	н	н	L	L	L	н	Н	L	Н	
L	L	L	Н .	L	Н	L	Н	Н	L	
Н	L	L	Н	Н	н	L	L	L	Н	
L	н	L	н	н	н	L	L	L	Н	
н	Н	L	Н	L	L	н	Н	L	Н	
L	L	н	н	L	L L	Н	н	L	Н	
Н	L	н	н	н	L	Н	L	н	н	
L	H	н	н	н	L	н	L	н	н	
Н	Н	Н	Н	L	н	Н	Н	н	н	

H = HIGH Level, L = LOW Level Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs Σ 1 and Σ 2 and the value of the internal carry C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs Σ 3, Σ 4, and C4.

Logic Diagram



Absolute Maximum Ratings(Note 1)

Supply Voltage 7V Input Voltage 7V Operating Free Air Temperature Range 0°C to +70°C

Operating Free Air Temperature Range $0^{\circ}\text{C to } +70^{\circ}\text{C}$ Storage Temperature Range $-65^{\circ}\text{C to } +150^{\circ}\text{C}$ Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{IH}	HIGH Level Input Voltage	2			V
V _{IL}	LOW Level Input Voltage			0.8	V
Тон	HIGH Level Output Current			-0.4	mA
I _{OL}	LOW Level Output Current			8	mA
T _A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ (Note 2)	Max	Units
VI	Input Clamp Voltage	$V_{CC} = Min, I_I = -18 \text{ mA}$				-1.5	V
V _{OH}	HIGH Level	V _{CC} = Min, I _{OH} = Max		2.7	3.4		V
	Output Voltage	$V_{IL} = Max, V_{IH} = Min$		2.1	3.4		\
V _{OL}	LOW Level	V _{CC} = Min, I _{OL} = Max			0.35	0.5	
	Output Voltage	$V_{IL} = Max, V_{IH} = Min$ $I_{OL} = 4 mA, V_{CC} = Min$			0.33	0.5	V
					0.25	0.4	
lı	Input Current @ Max	V _{CC} = Max	A or B			0.2	mA
	Input Voltage	$V_{I} = 7V$	C0			0.1	IIIA
I _{IH}	HIGH Level	V _{CC} = Max	A or B			40	μА
	Input Current	$V_{I} = 2.7V$	C0			20	μΑ
I _{IL}	LOW Level	V _{CC} = Max	A or B			-0.8	mA
	Input Current	$V_{I} = 0.4V$	C0		-0.4	IIIA	
Ios	Short Circuit Output Current	V _{CC} = Max (Note 3)		-20		-100	mA
I _{CC1}	Supply Current	V _{CC} = Max (Note 4)			19	34	mA
I _{CC2}	Supply Current	V _{CC} = Max (Note 5)			22	39	mA

Note 2: All typicals are at $V_{CC} = 5V$, $T_A = 25^{\circ}C$.

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 4: I_{CC1} is measured with all outputs open, all B inputs LOW and all other inputs at 4.5V, or all inputs at 4.5V.

Note 5: \mathbf{I}_{CC2} is measured with all outputs OPEN and all inputs grounded.

Switching Characteristics at $V_{CC} = 5V$ and $T_A = 25^{\circ}C$

		From (Input)	$R_L = 2 k\Omega$				
Symbol	Parameter	To (Output)	C _L = 15 pF		C _L = 50 pF		Units
			Min	Max	Min	Max	1
t _{PLH}	Propagation Delay Time	C0 to Σ 1 or Σ 2		24		28	ns
	LOW-to-HIGH Level Output	C0 t0 21 01 22			20	20	
t _{PHL}	Propagation Delay Time	C0 to Σ1 or Σ2		24		30	ns
	HIGH-to-LOW Level Output	C0 t0 Z1 01 Z2		24		30	115
t _{PLH}	Propagation Delay Time	C0 to Σ3		24	28	ns	
	LOW-to-HIGH Level Output	00 10 23		24		20	115
t _{PHL}	Propagation Delay Time	C0 to ∑3		24		30	ns
	HIGH-to-LOW Level Output	00 10 23			30		118
t _{PLH}	Propagation Delay Time	C0 to Σ4	24	24		28	ns
	LOW-to-HIGH Level Output	C0 t0 24		24			
t _{PHL}	Propagation Delay Time	C0 to ∑4		24		30	ns
	HIGH-to-LOW Level Output	00 10 24		24			
t _{PLH}	Propagation Delay Time	A_i , B_i to Σ_i		24		28	ns
	LOW-to-HIGH Level Output	Α, Β, το Ζ,		27		20	113
t _{PHL}	Propagation Delay Time	A_i , B_i to Σ_i		24		30	ns
	HIGH-to-LOW Level Output	74, 51 10 21					
t _{PLH}	Propagation Delay Time	C0 to C4	17	17		24	ns
	LOW-to-HIGH Level Output	001001		''			
t _{PHL}	Propagation Delay Time	C0 to C4		17		25	ns
	HIGH-to-LOW Level Output	00 10 04		''		20	113
t _{PLH}	Propagation Delay Time	A _i , B _i to C4		17		24	ns
	LOW-to-HIGH Level Output	7 4, 5, 60 07		''			"
t _{PHL}	Propagation Delay Time	A _i , B _i to C4		17		26	ns
	HIGH-to-LOW Level Output	, ,, 5, 10 04		''		20	"

N16E (REV F)

(8.255 +1.016) -0.381)

Physical Dimensions inches (millimeters) unless otherwise noted $\frac{0.740 - 0.780}{(18.80 - 19.81)}$ 16 15 14 13 12 11 10 9 INDEX AREA $\frac{0.250 \pm 0.010}{(6.350 \pm 0.254)}$ PIN NO. 1 PIN NO. 1 1 2 3 4 5 6 7 8 1 2 OPTION 01 OPTION 02 0.065 $\frac{0.130 \pm 0.005}{(3.302 \pm 0.127)}$ $\frac{0.060}{(1.524)}$ TYP 4° TYP OPTIONAL 0.300 - 0.320 (7.620 - 8.128) (1.651)¥ 0.145 = 0.200 (3.683 = 5.080) 95°±5° 0.008 = 0.016 (0.203 = 0.406) TYP 0.280 (7.112) MIN 0.125 - 0.150 (3.175 - 3.810) $\frac{0.030 \pm 0.015}{(0.762 \pm 0.381)}$ 0.014 - 0.023 0.100 ± 0.010 (0.325 +0.040 -0.015

16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N16E

0.050 ± 0.010 (1.270 ± 0.254) TYP

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