

## 54LS283/DM54LS283/DM74LS283 4-Bit Binary Adders with Fast Carry

## **General Description**

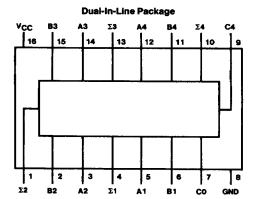
These full adders perform the addition of two 4-bit binary numbers. The sum  $(\Sigma)$  outputs are provided for each bit and the resultant carry (C4) is obtained from the fourth bit. These adders feature full internal look ahead across all four bits. This provides the system designer with partial lookahead 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
- Alternate Military/Aerospace device (54LS283) is available. Contact a National Semiconductor Sales Office/ Distributor for specifications.

## **Connection Diagram**



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Order Number 54LS283DMQB, 54LS283FMQB, 54LS283LMQB, DM54LS283J, DM54LS283W, DM74LS283M or DM74LS283N See NS Package Number E20A, J16A, M16A, N16E or W16A Note: The "Absolute Maximum Ratings" are those values

beyond which the safety of the device cannot be guaran-

teed. The device should not be operated at these limits. The

parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings.

The "Recommended Operating Conditions" table will define

the conditions for actual device operation.

## **Absolute Maximum Ratings (Note)**

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage Input Voltage 7V

Operating Free Air Temperature Range

DM54LS and 54LS DM74LS

-55°C to +125°C 0°C to +70°C

### Storage Temperature Range -65°C to +150°C **Recommended Operating Conditions**

Symbol	Parameter	DM54LS283			DM74LS283			Units
		Min	Nom	Max	Min	Nom	Max	Office
Vcc	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub>	High Level Input Voltage	2			2			V
V <sub>IL</sub>	Low Level Input Voltage			0.7			0.8	V
Іон	High Level Output Current			-0.4			-0.4	mA
loL	Low Level Output Current			4			8	mA
TA	Free Air Operating Temperature	-55		125	0		70	°C

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

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units	
VI	Input Clamp Voltage	$V_{CC} = Min, I_I = -18 mA$			-1.5	v	
Vон	High Level Output	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max	DM54	2.5	3.4		٧
	Voltage	V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	DM74	2.7	3.4		
V <sub>OL</sub>	Low Level Output Voltage	$V_{CC} = Min, I_{OL} = Max$	DM54		0.25	0.4	v
		V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	DM74		0.35	0.5	
		I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min	DM74		0.25	0.4	1
lı	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max	A, B			0.2	mA
		V <sub>I</sub> = 7V	C0			0.1	
l <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max V <sub>I</sub> = 2.7V	A, B			40	μА
			C0			20	
l <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max	A, B			-0.8	mA
		V <sub>I</sub> = 0.4V	C0			-0.4	
los	Short Circuit Output Current	V <sub>CC</sub> = Max	DM54	-20		100	mA
		(Note 2) DM74		-20		-100	] "
lcc1	Supply Current	V <sub>CC</sub> = Max (Note 3)			19	34	mA
CC2	Supply Current	V <sub>CC</sub> = Max (Note 4)		22	39	mA	

Note 1: All typicals are at  $V_{CC} = 5V$ ,  $T_A = 25$ °C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 3: ICC1 is measured with all outputs open, all B inputs low and all other inputs at 4.5V, or all inputs at 4.5V.

Note 4: ICC2 is measured with all outputs open and all inputs grounded.

# Switching Characteristics at $V_{CC} = 5V$ and $T_A = 25^{\circ}C$ (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)		1			
			$C_L = 15  pF$		C <sub>L</sub> = 50 pF		Units
		To (output)	Min	Max	Min	in Max	
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to Σ1, Σ2		24		28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to Σ1, Σ2		24		30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to Σ3	24			28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to Σ3	24			30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to Σ4	24			28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to Σ4		24		30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	A <sub>i</sub> or B <sub>i</sub> to Σ <sub>i</sub>		24		28	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	A <sub>i</sub> or B <sub>i</sub> to Σ <sub>i</sub>		24		30	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C0 to C4		17		24	ns
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C0 to C4		17		25	ns
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	A <sub>i</sub> or B <sub>i</sub> to C4		17		24	ns
t <sub>PHL</sub>	Propagation Delay Time A <sub>i</sub> or B <sub>i</sub> High to Low Level Output to C4			17		26	ns

## **Function Table**

				Outputs							
Input				When C0 =	= L		When C0 = H				
				When C2 = L			Wh		hen C2 = H		
A1 /	B1 /	A2 /	B2 /	Σ1	Σ2	C2 /	Σ1	Σ2	C2		
A3	B3	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	H	<u> </u>	L	Н	L	L	L	H	L		
H	H	<u>L</u>	L	L	Н	<u> </u>	Н	H	L		
<u> </u>	<u> </u>	#	L	L	Н	L	н	H	L		
H		Н	L	н	H	į į	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	H	н	L		
н	L	L	Н	н	н	L	L	L	Н		
L	н	L	Н	н	н	L	L	L	Н		
н	H	L	н	L	L	н	Н	L	Н		
L	L	н	н	L	L	H	н	L	H		
н	L	Н	H	н	L	Н	L	н	[ н		
L	н	Н	н	н	L	н	L	н	l H		
H	_ н	Н	н	L L	Н	Н	н	н	н		

H = High Level, L = Low Level

Note: Input conditions at A1, B1, A2, B2, and C0 are used to determine outputs Σ1 and Σ2 and the value of the internal carry C2. The values at C2, A3, B3, A4, and B4 are then used to determine outputs Σ3, Σ4, and C4.

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