National Semiconductor

DM54S283/DM74S283 4-Bit Binary Adders 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 look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

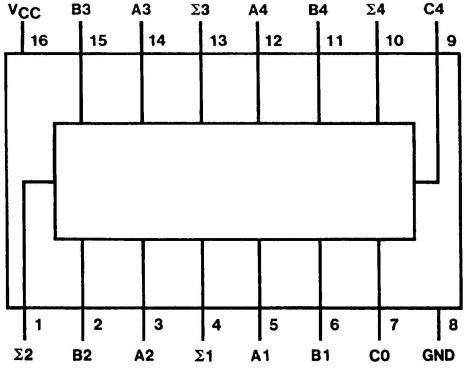
The adder logic, including the carry, is implemented in its true form meaning that the end-around carry can be accomplished without the need for logic or level inversion.

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 15 ns
  - Two 16-bit words 30 ns
- Typical power dissipation 510 mW

Connection Diagram

Dual-In-Line Package



TL/F/6484–1

Order Number DM54S283J or DM74S283N
See NS Package Number J16A or N16E

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	7V
Input Voltage	5.5V
Operating Free Air Temperature Range	
DM54S	−55°C to +125°C
DM74S	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: *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" table 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	DM54S283			DM74S283			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.8			0.8	V
I_{OH}	High Level Output Current (Output C4)			−0.5			−0.5	mA
	High Level Output Current (Other Outputs)			−1			−1	
I_{OL}	Low Level Output Current (Output C4)			10			10	mA
	Low Level Output Current (Other Outputs)			20			20	
T_A	Free Air Operating Temperature	−55		125	0		70	°C

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

Symbol	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.2	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max, V_{IH} = Min	DM54	2.5	3.4		V
			DM74	2.7	3.4		
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min, V_{IL} = Max				0.5	V
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 5.5V				1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V				50	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.5V				−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)	C4 Output	−20		−100	mA
			Other Outputs	−40		−100	
I_{CC1}	Supply Current	V_{CC} = Max (Note 3)			80	120	mA
I_{CC2}	Supply Current	V_{CC} = Max (Note 4)			95	160	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: I_{CC1} is measured with all outputs open, all B inputs low and all other inputs at 4.5V.

Note 4: I_{CC2} is measured with all outputs open and all inputs at 4.5V.

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

Symbol	Parameter	From (Input) To (Output)	R_L = 280Ω				Units
			C_L = 15 pF		C_L = 50 pF		
			Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time Low to High Level Output	C0 to Σ1 or Σ2		18		20	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	C0 to Σ1 or Σ2		18		20	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	C0 to Σ3		18		20	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	C0 to Σ3		18		20	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	C0 to Σ4		18		20	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	C0 to Σ4		18		20	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	A_i, B_i to S_i		18		20	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	A_i, B_i to S_i		18		20	ns
t_{PLH}	Propagation Delay Time Low to High Level Output (Note 1)	C0 to Σ4		11		15	ns
t_{PHL}	Propagation Delay Time High to Low Level Output (Note 1)	C0 to Σ4		11		15	ns
t_{PLH}	Propagation Delay Time Low to High Level Output (Note 1)	A_i, B_i to C4		12		16	ns
t_{PHL}	Propagation Delay Time High to Low Level Output (Note 1)	A_i, B_i to C4		12		16	ns

Note 1: R_L = 560Ω.

Function Table

Input				Output					
				When CO = L			When CO = H		
				When C2 = L			When C2 = H		
A1 / A3	B1 / B3	A2 / A4	B2 / B4	Σ1 / Σ3	Σ2 / Σ4	C2 / C4	Σ1 / Σ3	Σ2 / Σ4	C2 / C4
L	L	L	L	L	L	L	H	L	L
H	L	L	L	H	L	L	L	H	L
L	H	L	L	H	L	L	L	H	L
H	H	L	L	L	H	L	H	H	L
L	L	H	L	L	H	L	H	H	L
H	L	H	L	H	H	L	L	L	H
L	H	H	L	H	H	L	L	L	H
H	H	H	L	L	L	H	H	L	H
L	L	L	H	L	H	L	H	H	L
H	L	L	H	H	H	L	L	L	H
L	H	L	H	H	H	L	L	L	H
H	H	L	H	L	L	H	H	L	H
L	L	H	H	L	L	H	H	L	H
H	L	H	H	H	L	H	L	H	H
L	H	H	H	H	L	H	L	H	H
H	H	H	H	L	H	H	H	H	H

H = High Level, L = Low Level

TL/F/6484–3

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.

Logic Diagram

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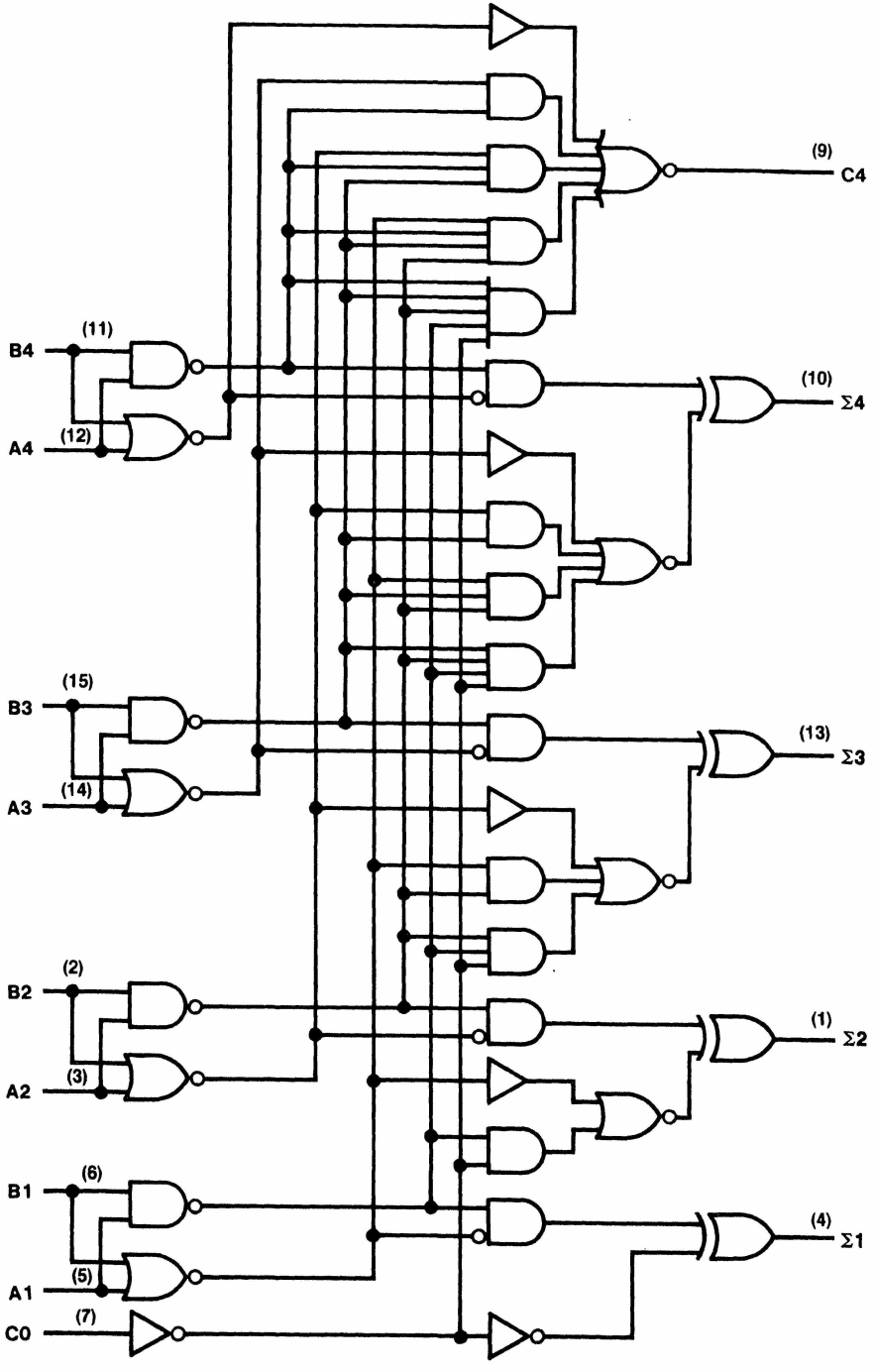

TL/F/6484–2