

For:joe

Printed on:Fri, Aug 27, 1999 08:30:42

Document:mc74f283rev5ltb

Last saved on:Wed, Aug 25, 1999 11:53:22



4-BIT BINARY FULL ADDER (With Fast Carry)

The MC54/74F283 high-speed 4-bit binary full adder with internal carry lookahead, accepts two 4-bit binary words (A_0 – A_3 , B_0 – B_3) and a Carry input (C_0). It generates the binary Sum outputs (S_0 – S_3) and the Carry output (C_4) from the most significant bit. The F283 will operate with either active-HIGH or active-LOW operands (positive or negative logic).

FUNCTIONAL DESCRIPTION

The F283 adds two 4-bit binary words (A plus B) plus the incoming carry C_0 . The binary sum appears on the Sum (S_0 – S_3) and outgoing carry (C_4) outputs. The binary weight of the various inputs and outputs is indicated by the subscript numbers, representing powers of two.

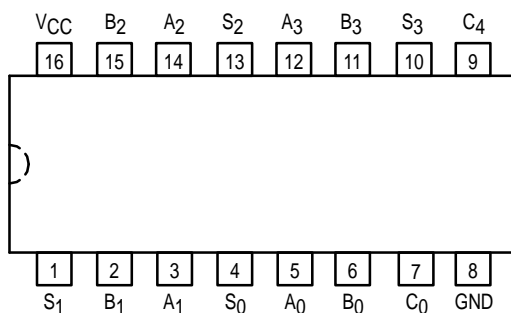
$$2^0 (A_0 + B_0 + C_0) + 2^1 (A_1 + B_1) + 2^2 (A_2 + B_2) + 2^3 (A_3 + B_3) \\ = S_0 + 2S_1 + 4S_2 + 8S_3 + 16C_4$$

Where (+) = plus

Interchanging inputs of equal weight does not affect the operation. Thus C_0 , A_0 , B_0 can be arbitrarily assigned to pins 5, 6 and 7. Due to the symmetry of the binary add function, the F283 can be used either with all inputs and outputs active HIGH (positive logic) or with all inputs and outputs active LOW (negative logic). See Figure A. Note that if C_0 is not used it must be tied LOW for active-HIGH logic or tied HIGH for active-LOW logic.

Due to pin limitations, the intermediate carries of the F283 are not brought out for use as inputs or outputs. However, other means can be used to effectively insert a carry into, or bring a carry out from, an intermediate stage. Figure B shows how to make a 3-bit adder. Tying the operand inputs of the fourth adder (A_3 , B_3) LOW makes S_3 dependent only on, and equal to, the carry from the third adder. Using somewhat the same principle, Figure C shows a way of dividing the F283 into a 2-bit and a 1-bit adder. The third stage adder (A_2 , B_2 , S_2) is used merely as a means of getting a carry (C_{10}) signal into the fourth stage (via A_2 and B_2) and bringing out the carry from the second stage on S_2 . Note that as long as A_2 and B_2 are the same, whether HIGH or LOW, they do not influence S_2 . Similarly, when A_2 and B_2 are the same the carry into the third stage does not influence the carry out of the third stage. Figure D shows a method of implementing a 5-input encoder, where the inputs are equally weighted. The outputs S_0 , S_1 and S_2 present a binary number equal to the number of inputs I_1 – I_5 that are true. Figure E shows one method of implementing a 5-input majority gate. When three or more of the inputs I_1 – I_5 are true, the output M_5 is true.

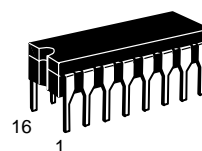
CONNECTION DIAGRAM



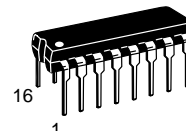
MC54/74F283

4-BIT BINARY FULL ADDER
(With Fast Carry)

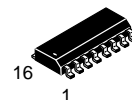
FAST™ SCHOTTKY TTL



J SUFFIX
CERAMIC
CASE 620-09



N SUFFIX
PLASTIC
CASE 648-08

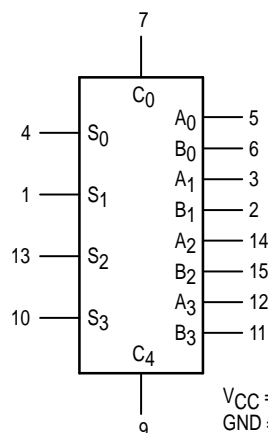


D SUFFIX
SOIC
CASE 751B-03

ORDERING INFORMATION

MC54FXXXJ	Ceramic
MC74FXXXN	Plastic
MC74FXXXD	SOIC

LOGIC SYMBOL

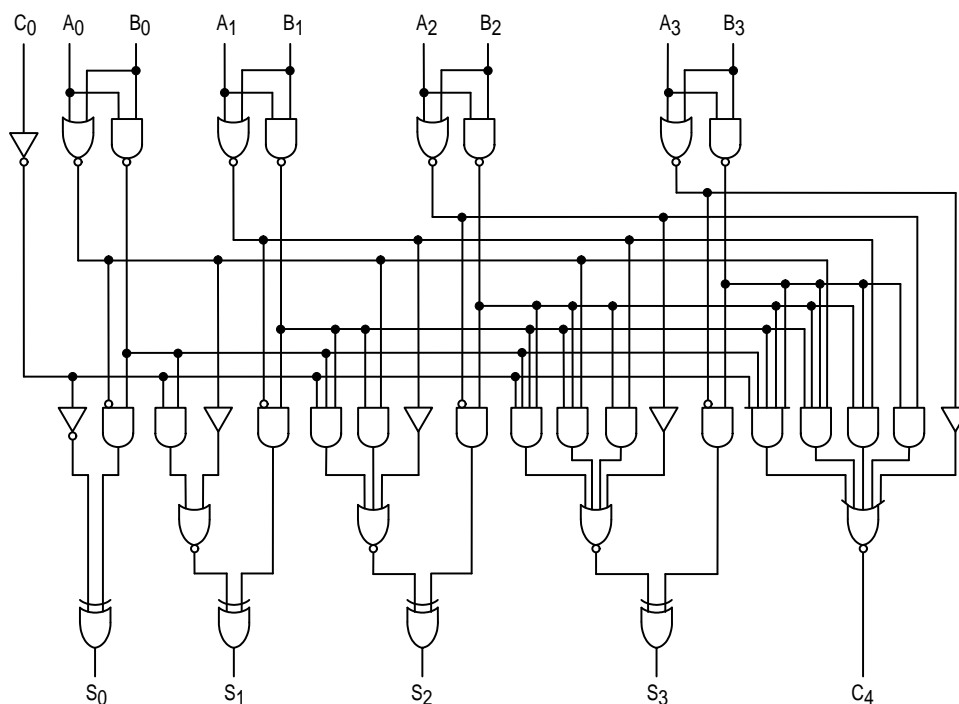


V_{CC} = PIN 16
GND = PIN 8

LAST ORDER 31/03/99 LAST SHIP 30/09/99

MC54/74F283

LOGIC DIAGRAM



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

GUARANTEED OPERATING RANGES

Symbol	Parameter		Min	Typ	Max	Unit
V _{CC}	Supply Voltage	54, 74	4.5	5.0	5.5	V
T _A	Operating Ambient Temperature Range	54	-55	25	125	°C
		74	0	25	70	
I _{OH}	Output Current — High	54, 74	—	—	-1.0	mA
I _{OL}	Output Current — Low	54, 74	—	—	20	mA

Figure A. Active-HIGH versus Active-LOW Interpretation

	C ₀	A ₀	A ₁	A ₂	A ₃	B ₀	B ₁	B ₂	B ₃	S ₀	S ₁	S ₂	S ₃	C ₄
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

Active HIGH: 0 + 10 + 9 = 3 + 16 Active LOW: 1 + 5 + 6 = 12 + 0

MC54/74F283

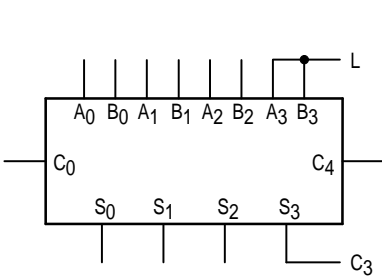


Figure B. 3-Bit Adder

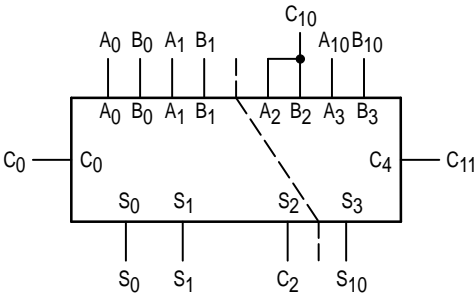


Figure C. 2-Bit and 1-Bit Adders

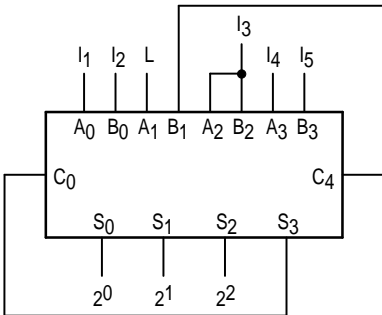


Figure D. 5-Input Encoder

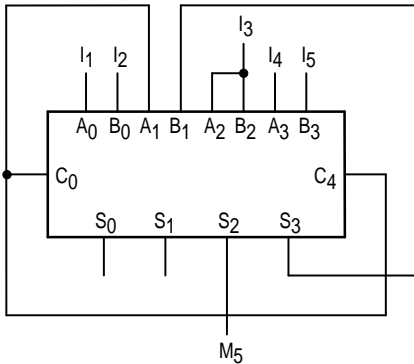


Figure E. 5-Input Majority Gate

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter	Limits			Unit	Test Conditions	
		Min	Typ	Max			
V _{IH}	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage	
V _{IL}	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage	
V _{IK}	Input Clamp Diode Voltage			-1.2	V	I _{IN} = -18 mA	V _{CC} = MIN
V _{OH}	Output HIGH Voltage	54, 74	2.5	3.4	V	I _{OH} = -1.0 mA	V _{CC} = 4.5 V
		74	2.7	3.4	V	I _{OH} = -1.0 mA	V _{CC} = 4.75 V
V _{OL}	Output LOW Voltage		0.35	0.5	V	I _{OL} = 20 mA	V _{CC} = MIN
I _{IH}	Input HIGH Current			20	μA	V _{IN} = 2.7 V	V _{CC} = MAX
				100	μA	V _{IN} = 7.0 V	
I _{IL}	Input LOW Current C ₀ Input			-0.6	mA	V _{IN} = 0.5 V	V _{CC} = MAX
	A and B Inputs			-1.2	mA		
I _{OS}	Output Short Circuit Current (Note 2)	-60		-150	mA	V _{OUT} = 0 V	V _{CC} = MAX
I _{CC}	Power Supply Current		36	55	mA	Inputs = 4.5 V	V _{CC} = MAX

NOTES:

1. For conditions such as MIN or MAX, use the appropriate value specified under guaranteed operating ranges.
2. Not more than one output should be shorted at a time, nor for more than 1 second.

MC54/74F283


AC CHARACTERISTICS

Symbol	Parameter	54/74F			54F		74F		Unit
		T _A = +25°C V _{CC} = +5.0 V C _L = 50 pF			T _A = -55 to +125°C V _{CC} = 5.0 V ±10% C _L = 50 pF		T _A = 0 to +70°C V _{CC} = 5.0 V ±10% C _L = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
t _{PLH} t _{PHL}	Propagation Delay C ₀ to S _n	3.5 4.0	7.0 7.0	9.5 9.5	3.5 4.0	14 14	3.5 4.0	10.5 10.5	ns
t _{PLH} t _{PHL}	Propagation Delay A _n or B _n to S _n	3.0 3.5	7.0 7.0	9.5 9.5	3.0 3.5	14 14	3.0 3.5	10.5 10.5	ns
t _{PLH} t _{PHL}	Propagation Delay C ₀ to C ₄	3.5 3.0	5.7 5.4	7.5 7.0	3.5 3.0	10.5 10	3.5 3.0	8.5 8.0	ns
t _{PLH} t _{PHL}	Propagation A _n or B _n to C ₄	3.0 3.0	5.7 5.3	7.5 7.0	3.0 3.0	10.5 10	3.0 3.0	8.5 8.0	ns

LIFETIME BUY

LAST ORDER 31/03/99 LAST SHIP 30/09/99

Mfax is a trademark of Motorola, Inc.

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution; P.O. Box 5405, Denver, Colorado 80217.
1-303-675-2140 or 1-800-441-2447

JAPAN: Motorola Japan Ltd.; SPS, Technical Information Center, 3-20-1, Minami-Azabu. Minato-ku, Tokyo 106-8573 Japan.
81-3-3440-3569

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre, 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong. 852-26668334

Customer Focus Center: 1-800-521-6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609
Motorola Fax Back System – US & Canada ONLY 1-800-774-1848
– <http://sps.motorola.com/mfax/>

HOME PAGE: <http://motorola.com/sps/>



MOTOROLA

