SGS-THOMSON MICROELECTRONICS

M54HC283
M74HC283

4-BIT BINARY FULL ADDER

- HIGH SPEED
  t_{PD} = 30 ns (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION
  I_{CC} = 4 μA (MAX.) at 25°C
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{NIL}$ = 28% V_{CC} (MIN).
- OUTPUT DRIVE CAPABILITY
  10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL}$ = 4 mA (MIN.)
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{NIL}$ = 28% V_{CC} (MIN).
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2V to 6V
- FULL-CARRY LOOK-AHEAD ACROSS THE FOUR BITS
- PARTIAL LOOK-AHEAD WITH THE ECONOMY OF RIPPLY CARRY
- PIN AND FUNCTION COMPATIBLE WITH 54/74LS283

B1N
Plastic Package

F1
Ceramic Frit Seal Package

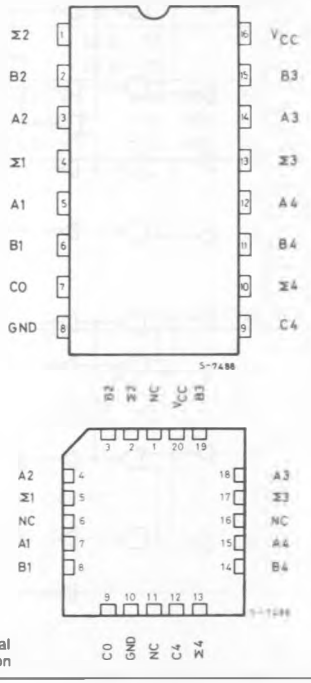
M1
Micro Package

C1
Plastic Chip Carrier

ORDERING NUMBERS:

M54HC283 F1
M74HC283 B1N
M74HC283 F1
M74HC283 C1
M74HC283 M1

PIN CONNECTIONS (top view)



NC = No Internal Connection

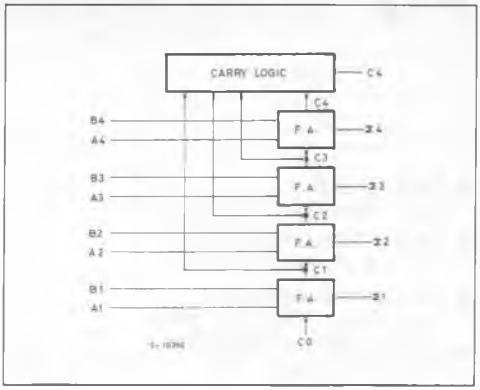
DESCRIPTION

The M54/74HC283 is a high speed CMOS 4-BIT BINARY FULL ADDER fabricated in silicon gate C²MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.
Sum (Σ) outputs are provided for each bit and a resultant carry (C4) is obtained from the fourth bit. This adder features full internal look ahead across all four bits. A 4 x n binary adder is easily built up by cascading without any additional logic.
All inputs are equipped with protection circuits against static discharge and transient excess voltage.

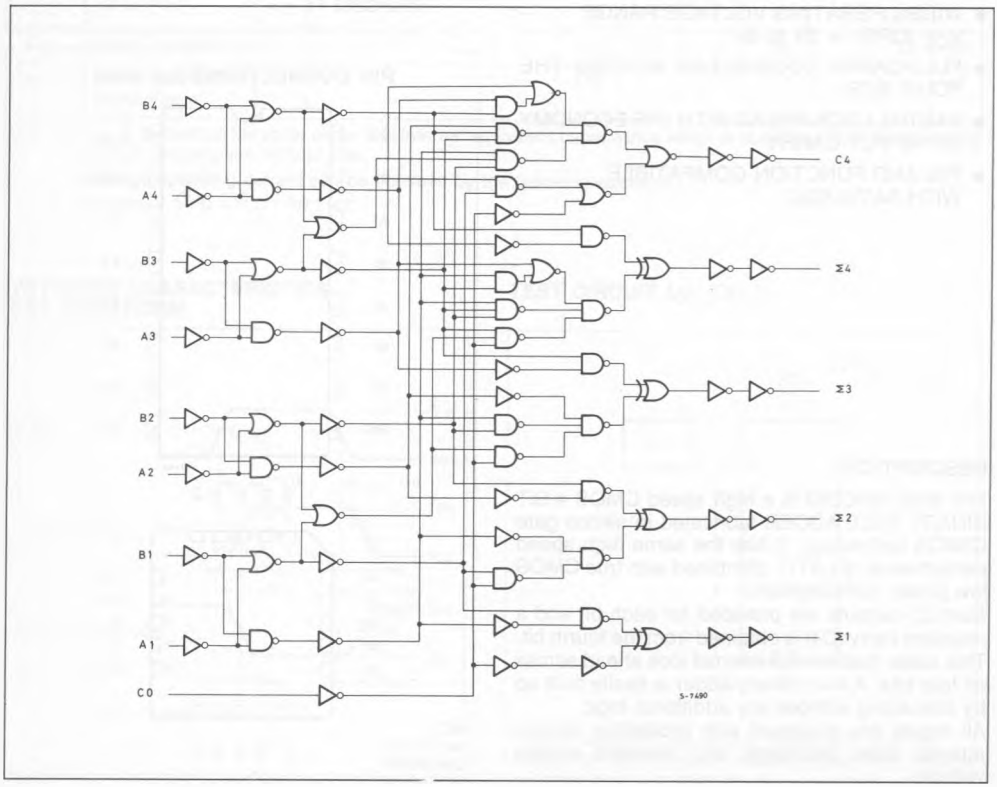
TRUTH TABLE (1 bit)

INPUTS			OUTPUTS	
Bn	An	Cn-1	Σn	Cn
L	L	L	L	L
L	L	H	H	L
L	H	L	H	L
L	H	H	L	H
H	L	L	H	L
H	L	H	L	H
H	H	L	L	H
H	H	H	H	H

BLOCK DIAGRAM



LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	−0.5 to 7	V
V_I	DC Input Voltage	−0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	−0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Source Sink Current Per Output Pin	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
P_D	Power Dissipation	500 (*)	mW
T_{stg}	Storage Temperature	−65 to 150	°C

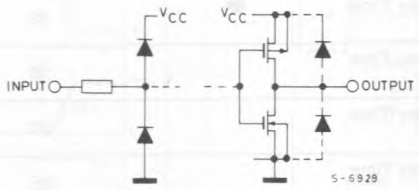
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: ≅ 65°C derate to 300 mW/°C: 65 to 85°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value		Unit
V_{CC}	Supply Voltage	2 to 6		V
V_I	Input Voltage	0 to V_{CC}		V
V_O	Output Voltage	0 to V_{CC}		V
T_A	Operating Temperature 74HC Series 54HC Series	−40 to 85 −55 to 125		°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2 V	0 to 1000	ns
		V_{CC} = 4.5V	0 to 500	
		V_{CC} = 6 V	0 to 400	

INPUT AND OUTPUT EQUIVALENT CIRCUIT



DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CC}	Test Condition		$T_A = 25°C$ 54HC and 74HC			−40 to 85°C 74HC		−55 to 125°C 54HC		Unit
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0			1.5	—	—	1.5	—	1.5	—	V
		4.5			3.15	—	—	3.15	—	3.15	—	
		6.0			4.2	—	—	4.2	—	4.2	—	
V_{IL}	Low Level Input Voltage	2.0			—	—	0.5	—	0.5	—	0.5	V
		4.5			—	—	1.35	—	1.35	—	1.35	
		6.0			—	—	1.8	—	1.8	—	1.8	
V_{OH}	High Level Output Voltage	2.0	V_I	I_O	1.9	2.0	—	1.9	—	1.9	—	V
		4.5	V_{IH} or V_{IL}	−20 μA	4.4	4.5	—	4.4	—	4.4	—	
		6.0			5.9	6.0	—	5.9	—	5.9	—	
		4.5		−4.0 mA	4.18	4.31	—	4.13	—	4.10	—	
		6.0		−5.2 mA	5.68	5.8	—	5.63	—	5.60	—	
V_{OL}	Low Level Output Voltage	2.0	V_{IH} or V_{IL}	20 μA	—	0.0	0.1	—	0.1	—	0.1	V
		4.5			—	0.0	0.1	—	0.1	—	0.1	
		6.0			—	0.0	0.1	—	0.1	—	0.1	
		4.5		4.0 mA	—	0.17	0.26	—	0.33	—	0.40	
		6.0		5.2 mA	—	0.18	0.26	—	0.33	—	0.40	
I_I	Input Leakage Current	6.0	$V_I = V_{CC}$ or GND		—	—	±0.1	—	±1.0	—	±1.0	μA
I_{CC}	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND		—	—	4	—	40	—	80	μA

AC ELECTRICAL CHARACTERISTICS ($V_{CC} = 5V$, $T_A = 25°C$, $C_L = 15pF$, Input $t_r = t_f = 6ns$)

Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t_{TLH} t_{THL}	Output Transition Time		4	8	ns
t_{PLH} t_{PHL}	Propagation Delay Time (CO-Σn)		23	36	ns
t_{PLH} t_{PHL}	Propagation Delay Time (C0-C4)		18	29	ns
t_{PLH} t_{PHL}	Propagation Delay Time (An, Bn-Σn)		30	47	ns
t_{PLH} t_{PHL}	Propagation Delay Time (An, Bn-C4)		25	39	ns

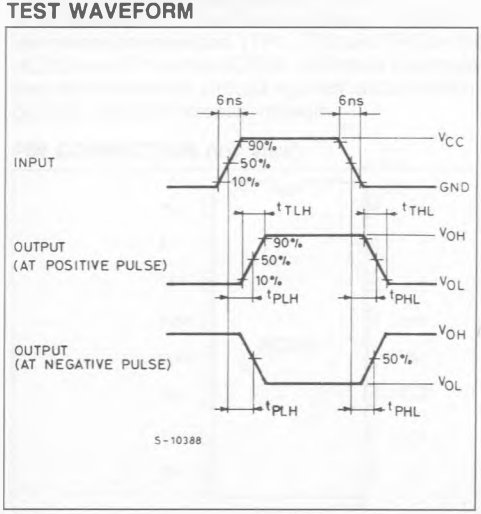
AC ELECTRICAL CHARACTERISTICS ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

Symbol	Parameter	V_{CC}	Test Condition	T_A = 25°C 54HC and 74HC			−40 to 85°C 74HC		−55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0		—	30	75	—	95		110	ns
		4.5		—	8	15	—	19		22	
		6.0		—	7	13	—	16		19	
t_{PLH} t_{PHL}	Propagation Delay Time (C0-Σn)	2.0		—	108	210	—	265		315	ns
		4.5		—	27	42	—	53		63	
		6.0		—	23	36	—	45		54	
t_{PLH} t_{PHL}	Propagation Delay Time (C0-C4)	2.0		—	88	175	—	220		265	ns
		4.5		—	22	35	—	44		53	
		6.0		—	19	30	—	37		45	
t_{PLH} t_{PHL}	Propagation Delay Time (An, Bn-Σn)	2.0		—	140	270	—	340		405	ns
		4.5		—	35	54	—	68		81	
		6.0		—	30	46	—	58		69	
t_{PLH} t_{PHL}	Propagation Delay Time (An, Bn-C4)	2.0		—	116	225	—	280		340	ns
		4.5		—	29	45	—	56		68	
		6.0		—	25	38	—	48		58	
C_{IN}	Input Capacitance			—	5	10	—	10		10	pF
C_{PD} (*)	Power Dissipation Capacitance			—	114	—	—	—			pF

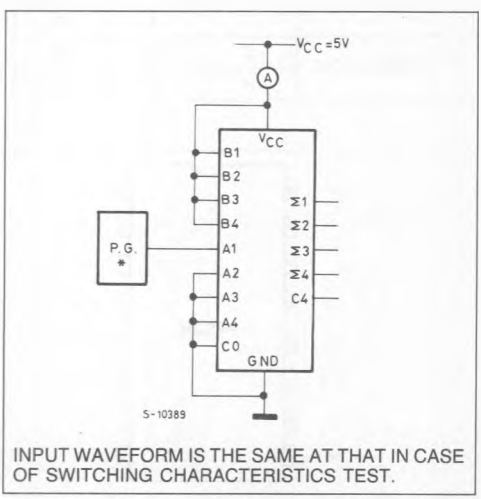
Note (*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit)

Average operating current is: $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

SWITCHING CHARACTERISTICS TEST WAVEFORM



TEST CIRCUIT I_{CC} (Opr.)



INPUT WAVEFORM IS THE SAME AT THAT IN CASE OF SWITCHING CHARACTERISTICS TEST.