

4-BIT BINARY FULL ADDER

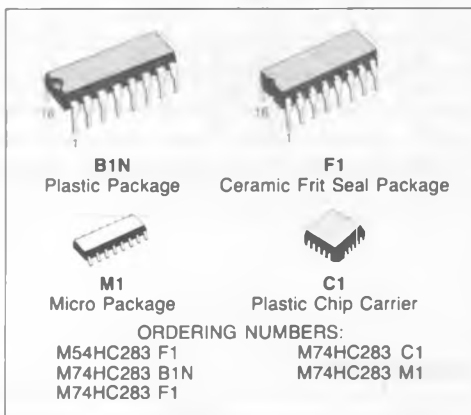
- **HIGH SPEED**
 $t_{PD} = 30 \text{ ns (TYP.) at } V_{CC} = 5V$
- **LOW POWER DISSIPATION**
 $I_{CC} = 4 \mu A \text{ (MAX.) at } 25^\circ C$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**
 10 LSTTL LOADS
- **SYMMETRICAL OUTPUT IMPEDANCE**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

DESCRIPTION

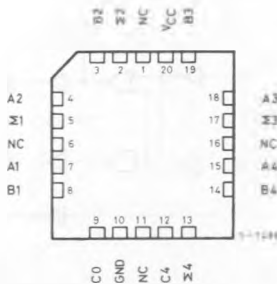
The M54/74HC283 is a high speed CMOS 4-BIT BINARY FULL ADDER fabricated in silicon gate C²MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

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 × 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.



PIN CONNECTIONS (top view)

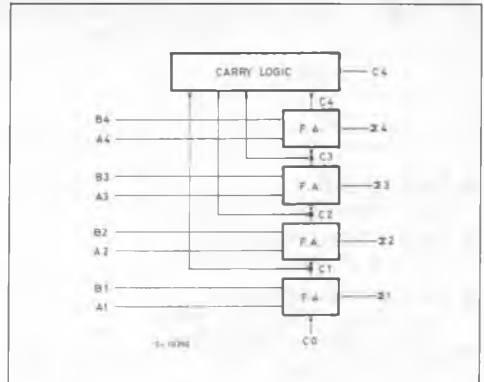


NC =
No Internal
Connection

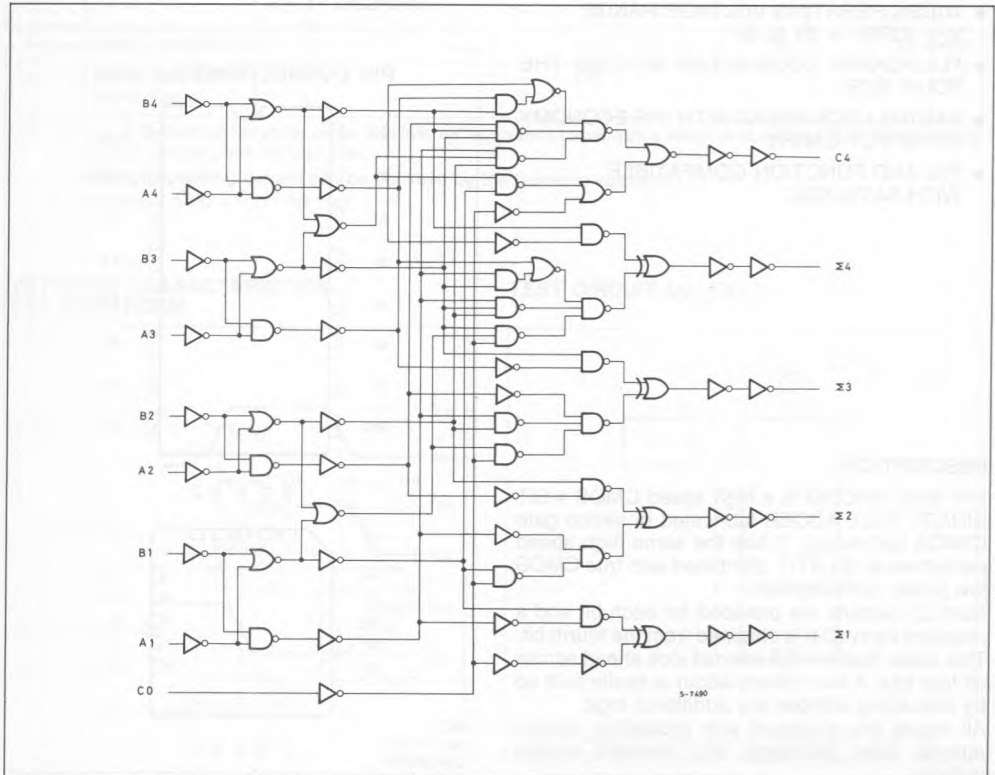
TRUTH TABLE (1 bit)

INPUTS			OUTPUTS	
B _n	A _n	C _{n-1}	Σ _n	C _n
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

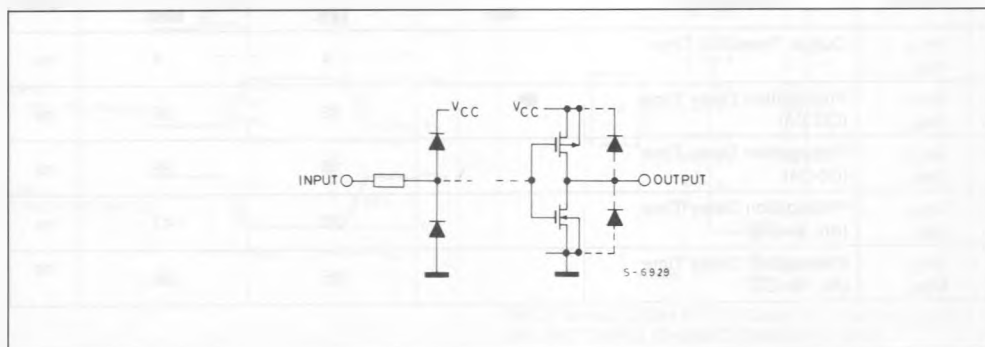
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: $\cong$ 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	°C
t_r, t_f	Input Rise and Fall Time	$V_{CC} \begin{cases} 2 \text{ V} & 0 \text{ to } 1000 \\ 4.5 \text{ V} & 0 \text{ to } 500 \\ 6 \text{ V} & 0 \text{ to } 400 \end{cases}$	ns

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 4.5 6.0		1.5 3.15 4.2	— — —	— — —	1.5 3.15 4.2	— — —	1.5 3.15 4.2	— — —	V
V _{IL}	Low Level Input Voltage	2.0 4.5 6.0		— — —	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	— — —	0.5 1.35 1.8	V
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	
V _{OL}	Low Level Output Voltage	2.0	V _{IH} or V _{IL}	– 4.0 mA – 5.2 mA	4.18 5.68	4.31 5.8	— —	4.13 5.63	— —	4.10 5.60	V
		4.5		20 µA	—	0.0	0.1	—	0.1	—	
		6.0			—	0.0	0.1	—	0.1	—	
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND		—	—	±0.1	—	±1.0	—	µA
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND		—	—	4	—	40	—	µA

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

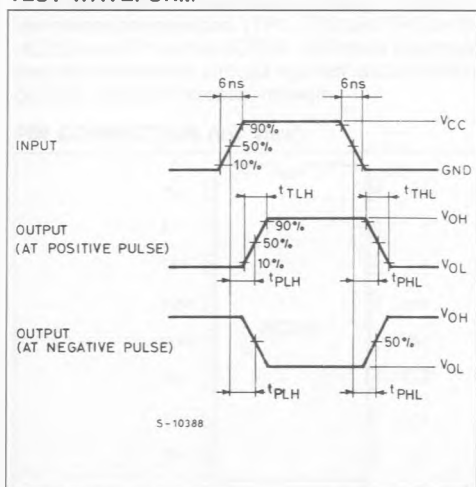
Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t _{TLH} t _{THL}	Output Transition Time		4	8	ns
t _{PLH} t _{PHL}	Propagation Delay Time (C0-Σn)		23	36	ns
t _{PLH} t _{PHL}	Propagation Delay Time (C0-C4)		18	29	ns
t _{PLH} t _{PHL}	Propagation Delay Time (An, Bn-Σn)		30	47	ns
t _{PLH} t _{PHL}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

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

Symbol	Parameter	V_{CC}	Test Condition	$T_A = 25^\circ\text{C}$ 54HC and 74HC			$-40\text{ to }85^\circ\text{C}$ 74HC		$-55\text{ to }125^\circ\text{C}$ 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0 4.5 6.0		— — —	30 8 7	75 15 13	— — —	95 19 16	110 22 19		ns
t_{PLH} t_{PHL}	Propagation Delay Time (C_0 - Σn)	2.0 4.5 6.0		— — —	108 27 23	210 42 36	— — —	265 53 45	315 63 54		ns
t_{PLH} t_{PHL}	Propagation Delay Time (C_0 - C_4)	2.0 4.5 6.0		— — —	88 22 19	175 35 30	— — —	220 44 37	265 53 45		ns
t_{PLH} t_{PHL}	Propagation Delay Time (A_n , B_n - Σn)	2.0 4.5 6.0		— — —	140 35 30	270 54 46	— — —	340 68 58	405 81 69		ns
t_{PLH} t_{PHL}	Propagation Delay Time (A_n , B_n - C_4)	2.0 4.5 6.0		— — —	116 29 25	225 45 38	— — —	280 56 48	340 68 58		ns
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 WAVEFORMTEST CIRCUIT I_{CC} (Opr.)