PRELIMINARY DATA

4-BIT FULL ADDER WITH PARALLEL CARRY OUTPUT

- 4 SUM OUTPUTS PLUS PARALLEL LOOK-AHERD CARRY-OUTPUT
- HIGH-SPEED OPERATION-SUM IN-TO-SUM OUT 160 ns (TYP.): CARRY IN-TO-CARRY OUT 50 ns (TYP.) AT V_{DD}= 10V, C_L= 50 pF.
- QUIESCENT CURRENT SPECIFIED TO 20V
- MAXIMUM INPUT CURRENT OF 1 μA AT 18V (FULL PACKAGE-TEMPERATURE RANGE)
- 5V, 10V, AND 15V PARAMETRIC RATING

The **HCC 4008B** (extended temperature range) and **HCF 4008B** (intermediate temperature range) are monolithic integrated circuits, available in 16-lead dual in-line plastic or ceramic package and ceramic flat package.

The **HCC/HCF 4008B** types consist of four full adder stages with fast look ahead carry provision from stage to stage. Circuitry is included to provide a fast "parallel-carry-out" to permit high-speed operation in arithmetic sections using several **HCC/HCF 4008B's.**

HCC/HCF 4008B inputs include the four sets of bits to be added, A_1 to A_4 and B_1 to B_4, in addition to the "Carry In" bit from a previous section. **HCC/HCF 4008B** outputs include the four sum bits, S_1 to S_4. In addition to the high speed "parallel-carry-out" which may be utilized at a succeeding **HCC/HCF 4008B** section.

ABSOLUTE MAXIMUM RATINGS

V_{DD}*	Supply voltage	-0.5 to 20	V
V_I	Input voltage	-0.5 to V_{DD} +0.5	V
I_I	DC input current (any one input)	± 10	mA
P_{tot}	Total power dissipation (per package)	200	mW
	Dissipation per output transistor for T_{op}= full package-temperature range	100	mW
T_{op}	Operating temperature: for **HCC** types	-55 to 125	°C
	for **HCF** types	-40 to 85	°C
T_{stg}	Storage temperature	-65 to 150	°C

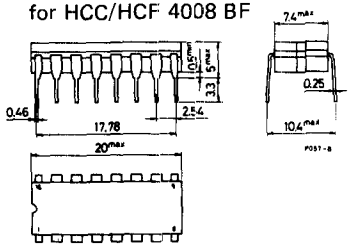
* All voltage values are referred to V_{SS} pin voltage

ORDERING NUMBERS:

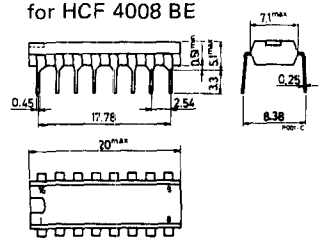
HCC 4008 BD for dual in-line ceramic package
HCC 4008 BF for dual in-line ceramic package, frit seal
HCC 4008 BK for ceramic flat package
HCF 4008 BE for dual in-line plastic package
HCF 4008 BF for dual in-line ceramic package, frit seal

MECHANICAL DATA (dimensions in mm)

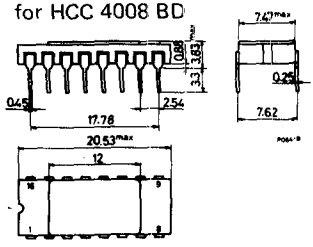
Daul in-line ceramic package
for HCC/HCF 4008 BF



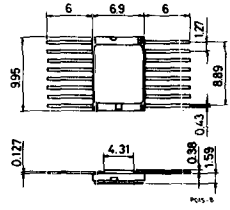
Dual in-line plastic package
for HCF 4008 BE



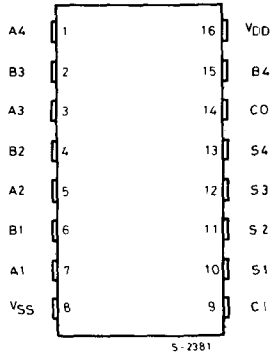
Dual in-line ceramic package
for HCC 4008 BD



Ceramic flat package
for HCC 4008 BK



CONNECTION DIAGRAM



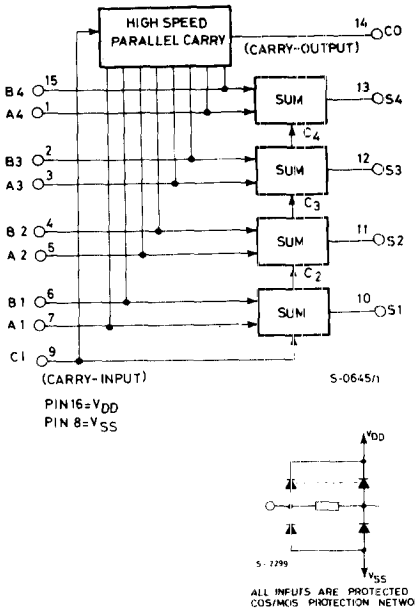
TRUTH TABLE

A_i	B_i	CI	CO	SUM
0	0	0	0	0
1	0	0	0	1
0	1	0	0	1
1	1	0	1	0
0	0	1	0	1
1	0	1	1	0
0	1	1	1	0
1	1	1	1	1

RECOMMENDED OPERATING CONDITIONS

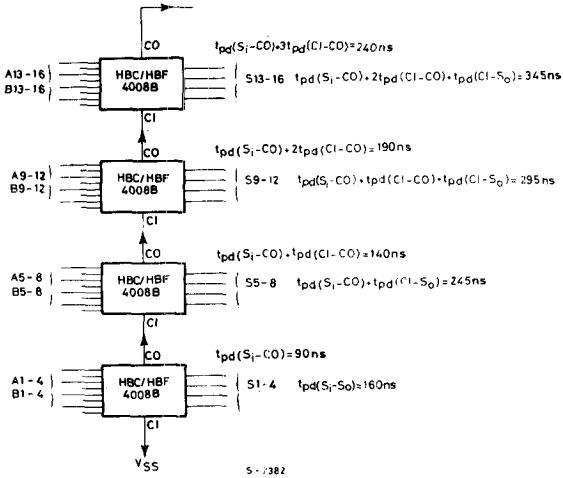
V_{DD}	Supply voltage	3 to 18	V
V_I	Input voltage	0 to V_{DD}	V
T_{op}	Operating temperature: for HCC types	-55 to 125	°C
	for HCF types	-40 to 85	°C

LOGIC DIAGRAM



TYPICAL APPLICATION

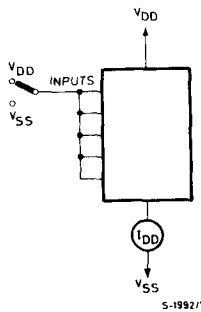
Speed characteristics of a 16-bit adder



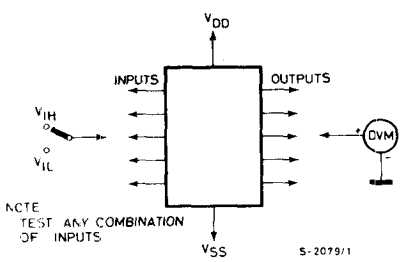
NOTES: All "A" and "B" input bits occur at t = 0
All sums settled at t = 345 ns.
C_L = 50 pF, T_{amb} = 25°C, V_{DD} - V_{SS} = 10V

TEST CIRCUITS

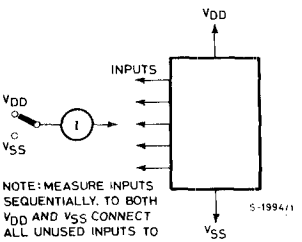
Quiescent device current



Input voltage



Input current



STATIC ELECTRICAL CHARACTERISTICS (under recommended operating conditions)

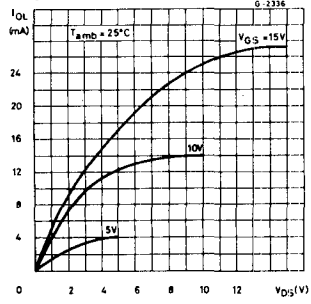
Parameter			Test conditions				Values							Unit
			V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_{Low}* Min.	T_{Low}* Max.	25°C Min.	25°C Typ.	25°C Max.	T_{High}* Min.	T_{High}* Max.	
I_L	Quiescent supply current		0/ 5			5		5		0.04	5		150	μA
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	
V_{OH}	Output high voltage		0/ 5		< 1	5	4.95		4.95			4.95		V
			0/10		< 1	10	9.95		9.95			9.95		
			0/15		< 1	15	14.95		14.95			14.95		
V_{OL}	Output low voltage		5/0		< 1	5		0.05			0.05		0.05	V
			10/0		< 1	10		0.05			0.05		0.05	
			15/0		< 1	15		0.05			0.05		0.05	
V_{IH}	Input high voltage			0.5/4.5	< 1	5	3.5		3.5			3.5		V
				1/9	< 1	10	7		7			7		
				1.5/13.5	< 1	15	11		11			11		
V_{IL}	Input low voltage			4.5/0.5	< 1	5		1.5			1.5		1.5	V
				9/1	< 1	10		3			3		3	
				13.5/1.5	< 1	15		4			4		4	
I_{OH}	Output drive current	HCC types	0/ 5	2.5		5	-2		-1.6	-3.2		-1.15		mA
			0/ 5	4.6		5	-0.64		-0.51	-1		-0.36		
			0/10	9.5		10	-1.6		-1.3	-2.6		-0.9		
			0/15	13.5		15	-4.2		-3.4	-6.8		-2.4		
		HCF types	0/ 5	2.5		5	-1.8		-1.6	-3.2		-1.3		
			0/ 5	4.6		5	-0.61		-0.51	-1		-0.42		
			0/10	9.5		10	-1.5		-1.3	-2.6		-1.1		
			0/15	13.5		15	-4		-3.4	-6.8		-2.8		
I_{OL}	Output sink current	HCC types	0/ 5	0.4		5	0.64		0.51	1		0.36		mA
			0/10	0.5		10	1.6		1.3	2.6		0.9		
			0/15	1.5		15	4.2		3.4	6.8		2.4		
		HCF types	0/ 5	0.4		5	0.61		0.51	1		0.42		
			0/10	0.5		10	1.5		1.3	2.6		1.1		
			0/15	1.5		15	4		3.4	6.8		2.8		
I_{IH}, I_{IL}**	Input leakage current		0/18			18		±0.1		±10^{-5}	±0.1		±1	μA
C_I**	Input capacitance									5	7.5			pF

* T_{Low} = - 55°C for **HCC** device; - 40°C for **HCF** device.
* T_{High} = +125°C for **HCC** device; + 85°C for **HCF** device.
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD} = 5V
2V min. with V_{DD} = 10V
2.5V min. with V_{DD} = 15V
** Any input

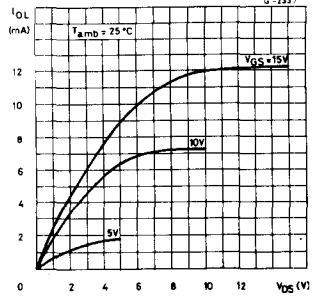
DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb}= 25°C, C_L= 50 pF, R_L= 200 kΩ, typical temperature coefficient for all V_{DD} values is 0,3%/°C, all input rise and fall times = 20 ns)

Parameter		Test conditions	Values				Unit
			V_{DD}(V)	Min.	Typ.	Max.	
t_{PLH}, t_{PHL} Propagation delay time	Sum In to Sum Out		5		400	800	ns
			10		160	320	
			15		115	230	
	Carry In to Sum Out		5		370	740	
			10		155	310	
			15		115	230	
	Sum In to Carry Out		5		200	400	
			10		90	180	
			15		65	130	
	Carry In to Carry Out		5		100	200	
			10		50	100	
			15		40	80	
t_{THL}, t_{TLH} Transition time			5		100	200	ns
			10		50	100	
			15		40	80	

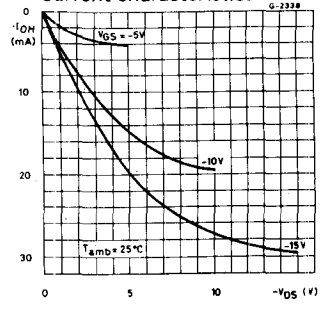
Typical output low (sink) current



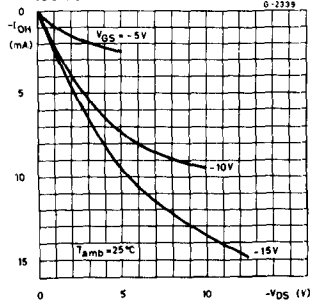
Minimum output low (sink) current characteristics



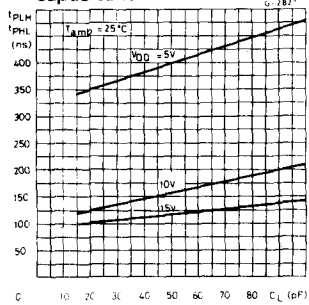
Typical output high (source) current characteristics



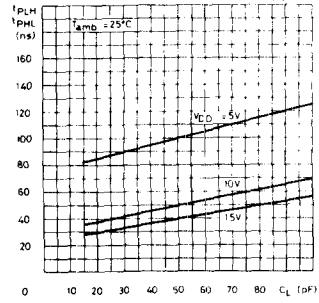
Minimum output high (source) current characteristics



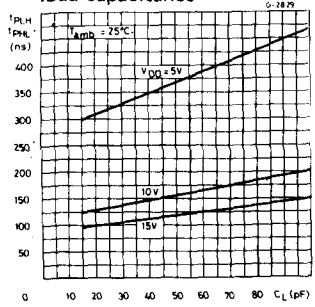
Typical sum-in to sum out propagation delay vs. load capacitance



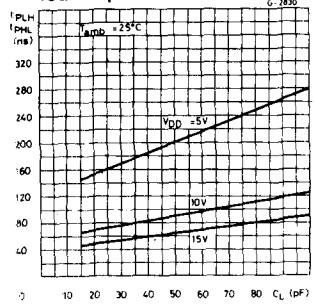
Typical carry-in to carry-out propagation delay vs. load capacitance



Typical carry-in to sum out propagation delay time vs. load capacitance



Typical sum-in to carry-out propagation delay time vs. load capacitance



Typical dynamic power dissipation/package vs. frequency