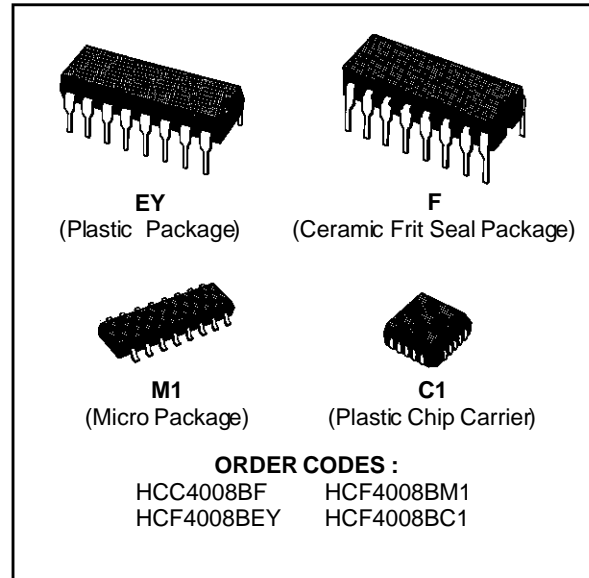


4-BIT FULL ADDER WITH PARALLEL CARRY OUTPUT

- 4 SUM OUTPUTS PLUS PARALLEL LOOK-AHEAD CARRY-OUTPUT
- HIGH-SPEED OPERATION-SUM IN-TO-SUM OUT 160ns (typ.) : CARRY IN-TO-CARRY OUT 50ns (typ.) AT $V_{DD} = 10V$, $C_L = 50pF$
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- 5V, 10V, AND 15V PARAMETRIC RATING
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N° 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"

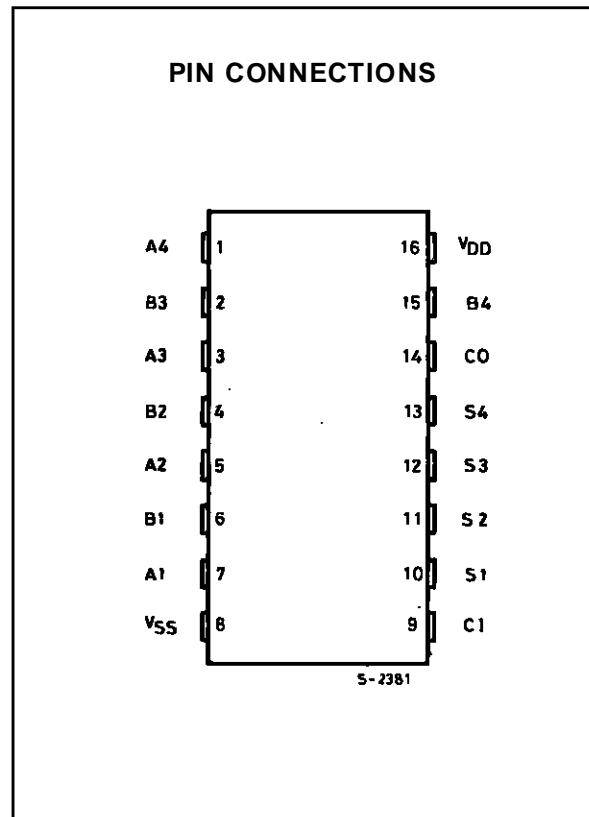


DESCRIPTION

The **HCC4008B** (extended temperature range) and **HCF4008B** (intermediate temperature range) are monolithic integrated circuits, available in 16-lead dual in-line plastic or ceramic package and plastic micropackage.

The **HCC/HCF4008B** 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/HCF4008B 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/HCF4008B** 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/HCF4008B** section.



HCC/HCF4008B

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}^*	Supply Voltage : HCC Types HCF Types	- 0.5 to + 20	V
		- 0.5 to + 18	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) Dissipation per Output Transistor for T_{op} = Full Package-temperature Range	200	mW
		100	mW
T_{op}	Operating Temperature : HCC Types HCF Types	- 55 to + 125	°C
		- 40 to + 85	°C
T_{stg}	Storage Temperature	- 65 to + 150	°C

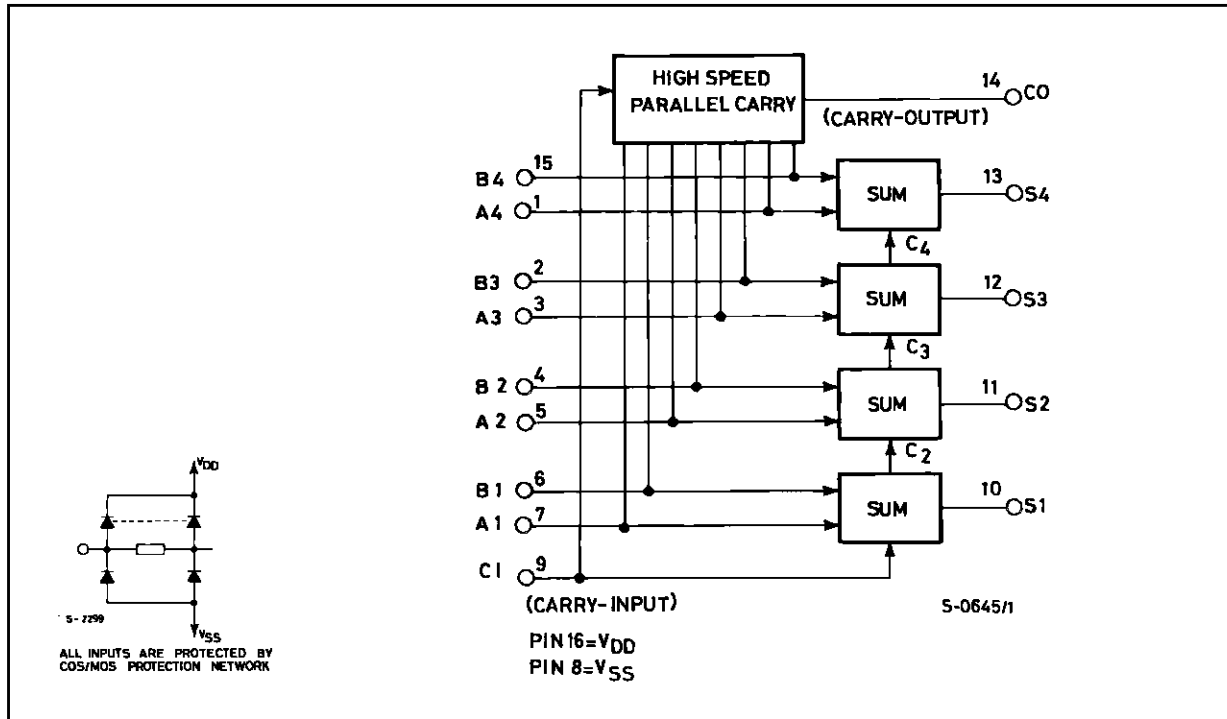
Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage : HCC Types HCF Types	3 to 18	V
		3 to 15	V
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature : HCC Types HCF Types	- 55 to + 125	°C
		- 40 to + 85	°C

LOGIC DIAGRAM



TRUTH TABLE

A _i	B _i	C _i	C _O	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

HCC/HCF4008B

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter		Test Conditions				Value						Unit	
			V _I (V)	V _O (V)	I _O (μ A)	V _{DD} (V)	T _{Low} *		25°C			T _{High} *		
							Min.	Max.	Min.	Typ.	Max.	Min.		Max.
I _L	Quiescent Current	HCC Types	0/ 5			5		5		0.04	5		150	μ A
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	
		HCF Types	0/ 5			5		20		0.04	20		150	
			0/10			10		40		0.04	40		300	
			0/15			15		80		0.04	80		600	
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	- 1.53		- 1.36	- 3.2		- 1.1		
			0/ 5	4.6		5	- 0.52		- 0.44	- 1		- 0.36		
			0/10	9.5		10	- 1.3		- 1.1	- 2.6		- 0.9		
	0/15	13.5		15	- 3.6		- 3.0	- 6.8		- 2.4				
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	0.52		0.44	1		0.36		
			0/10	0.5		10	1.3		1.1	2.6		0.9		
			0/15	1.5		15	3.6		3.0	6.8		2.4		
I _{IH} , I _{IL}	Input Leakage Current	HCC Types	0/18	Any Input		18		\pm 0.1		\pm 10 ⁻⁵	\pm 0.1		\pm 1	μ A
		HCF Types	0/15	Any Input		15		\pm 0.3		\pm 10 ⁻⁵	\pm 0.3		\pm 1	
C _I	Input Capacitance		Any Input						5	7.5			pF	

* T_{Low}= - 55°C for HCC device : - 40°C for HCF device.

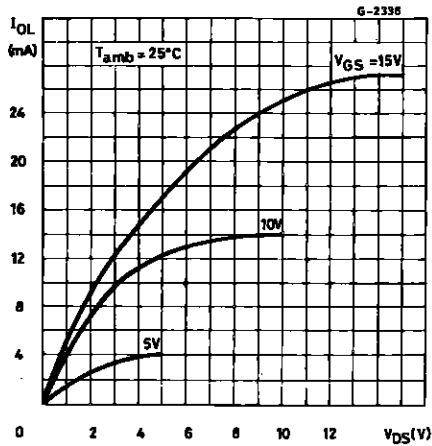
* T_{High}= + 125°C for HCC device : + 85°C for HCF device.

The Noise Margin for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5 V min. with V_{DD} = 15V.

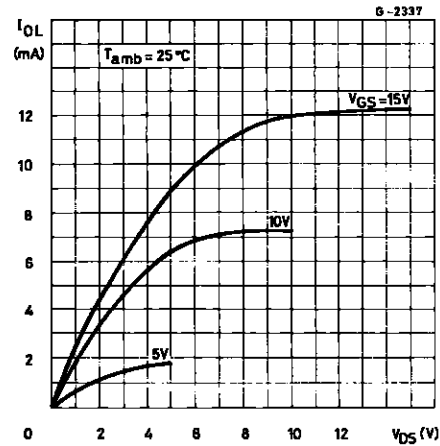
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$, typical temperature coefficient for all V_{DD} values is $0.3\text{ }^{\circ}\text{C}^{-1}$, all input rise and fall times = 20 ns)

Symbol	Parameter	Test Conditions	Value			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

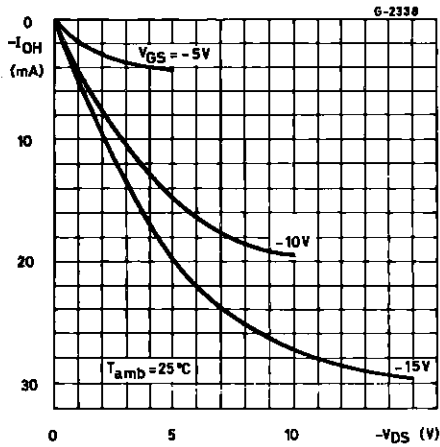


Minimum Output Low (sink) Current Characteristics.

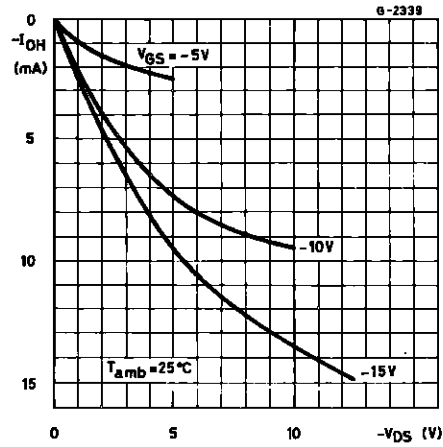


HCC/HCF4008B

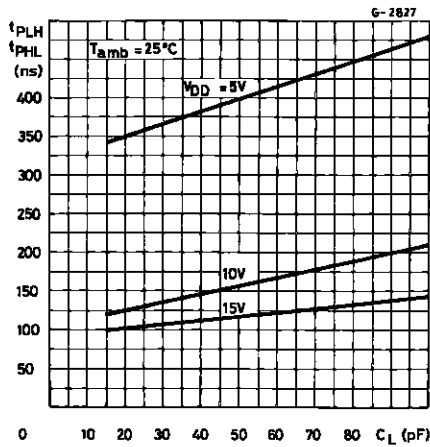
Typical Output High (source) Current Characteristics.



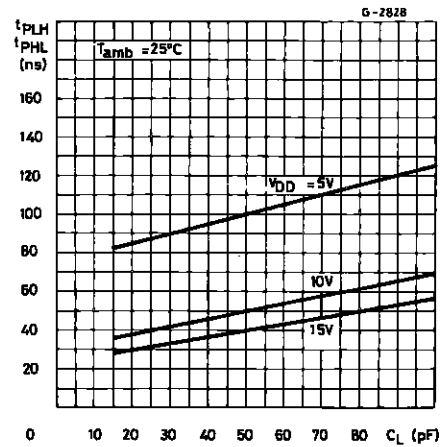
Minimum Output High (source) Current Characteristics.



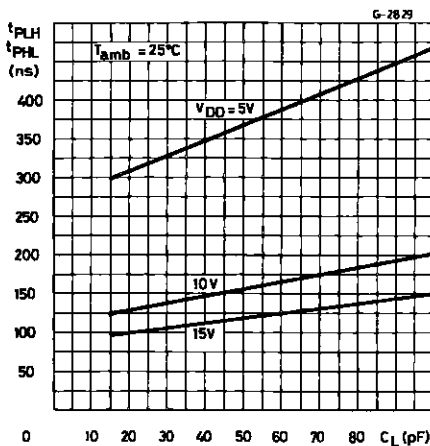
Typical Sum-in to Sum Out Propagation Delay vs. Load Capacitance.



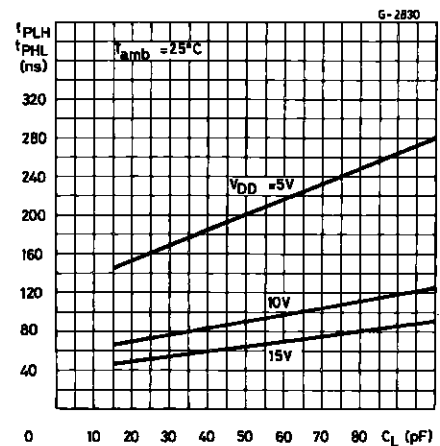
Typical Carry-in to Carry-Out Propagation Delay vs. Load Capacitance.



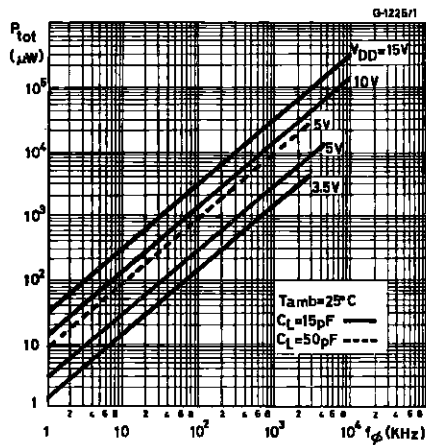
Typical Carry-in to Sum Out Propagation Delay Time vs. Load Capacitance.



Typical Sum-in to Carry-Out Propagation Delay Time vs. Load Capacitance.

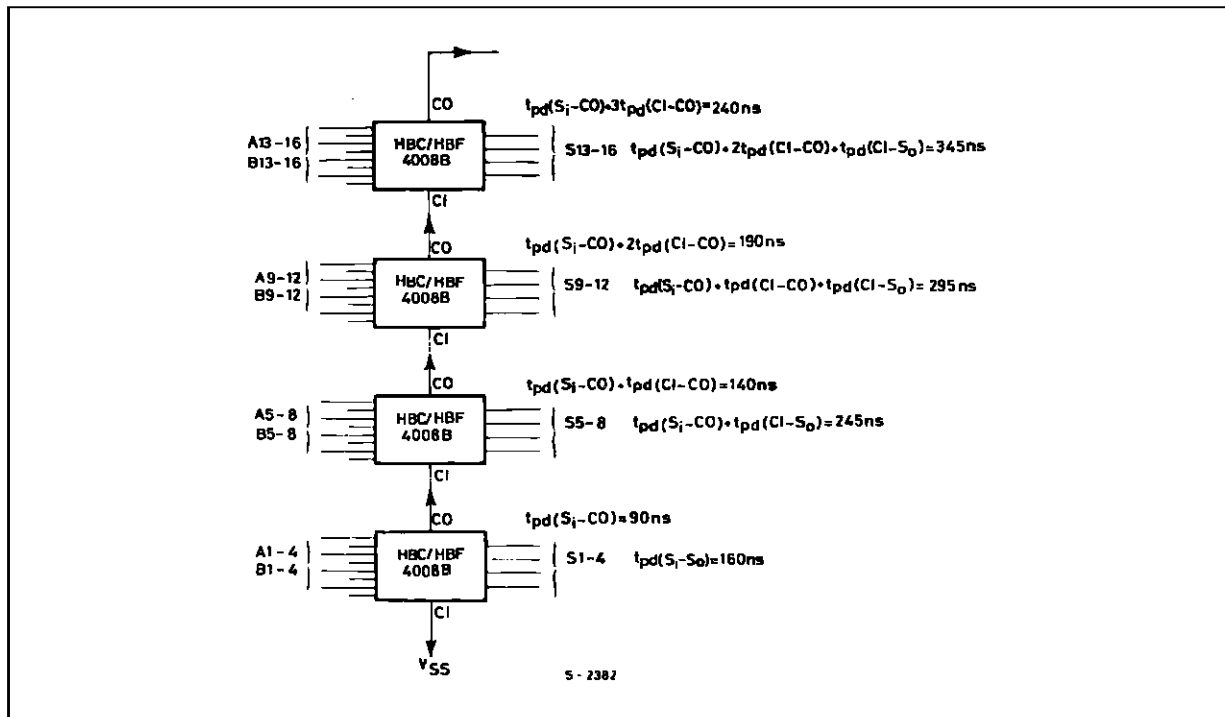


Typical Dynamic Power Dissipation/Package vs. Frequency.



TYPICAL APPLICATIONS

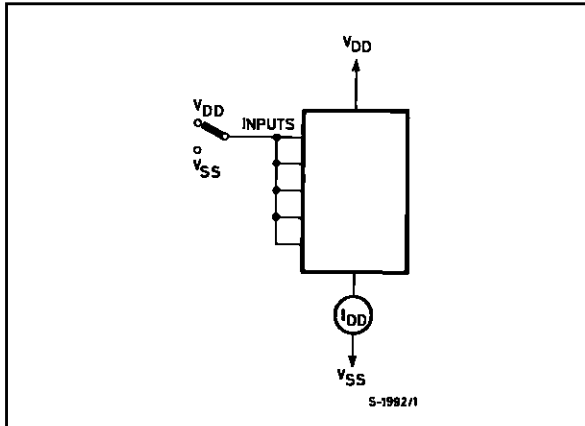
SPEED CHARACTERISTICS OF A 16-BIT ADDER.



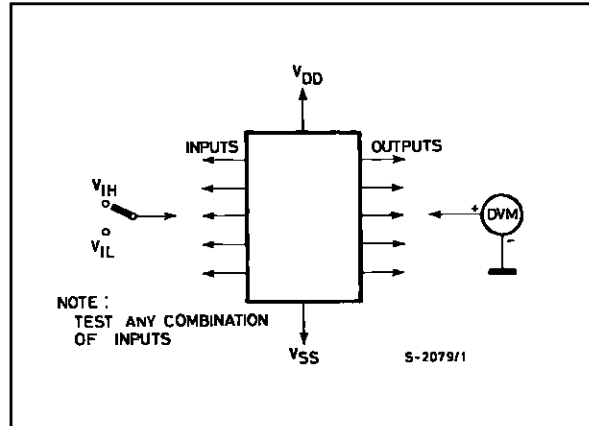
Notes : All "A" and "B" input bits occur at $t = 0$.
 All sums settled at $t = 345ns$
 $C_L = 50pF$, $T_{amb} = 25^\circ C$, $V_{DD} - V_{SS} = 10V$.

TEST CIRCUITS

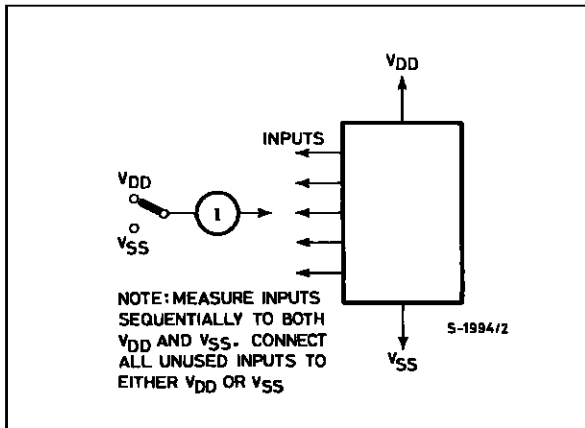
Quiescent Device Current.



Input Voltage.



Input Current.



Plastic DIP16 (0.25) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



Ceramic DIP16/1 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



SO16 (Narrow) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



P013H

PLCC20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	9.78		10.03	0.385		0.395
B	8.89		9.04	0.350		0.356
D	4.2		4.57	0.165		0.180
d1		2.54			0.100	
d2		0.56			0.022	
E	7.37		8.38	0.290		0.330
e		1.27			0.050	
e3		5.08			0.200	
F		0.38			0.015	
G			0.101			0.004
M		1.27			0.050	
M1		1.14			0.045	



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