SGS-THOMSON
MICROELECTRONICS

# HCC/HCF4030B

QUAD EXCLUSIVE-OR GATE

- MEDIUM-SPEED OPERATION – $t_{PHL} = t_{PLH} = 60ns$ (typ.) @ $C_L = 50pF$ and $V_{DD} - V_{SS} = 10V$
- LOW OUTPUT IMPEDANCE : 500Ω (typ.) @ $V_{DD} - V_{SS} = 10V$
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100nA AT 18V AND 25℃ FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TEN-TATIVE STANDARD N° 13A, "STANDARD SPE-CIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"

EY
(Plastic Package)

F
(Ceramic Frit Seal Package)

M1
(Micro Package)

C1
(Plastic Chip Carrier)

ORDER CODES :

HCC4030BF   HCF4030BM1
HCF4030BEY   HCF4030BC1
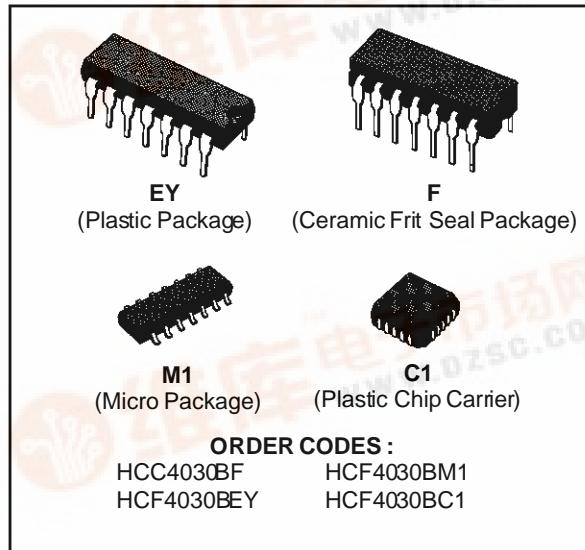
DESCRIPTION

The **HCC4030B** (extended temperature range) and **HCF4030B** (intermediate temperature range) are monolithic integrated circuit, available in 14-lead dual in-line plastic or ceramic package and plastic micro package.

The **HCC/HCF4030B** types consist of four independent exclusive-OR gates integrated on a single monolithic silicon chip. Each exclusive-OR gate consists of four n-channel and four p-channel enhancement-type transistors. All inputs and outputs are protected against electrostatic effects.

PIN CONNECTIONS

B — 1	14 — V_{DD}
A — 2	13 — H
J = A ⊕ B — 3	12 — G
K = C ⊕ D — 4	11 — M = G ⊕ H
C — 5	10 — L = E ⊕ F
D — 6	9 — F
V_{SS} — 7	8 — E

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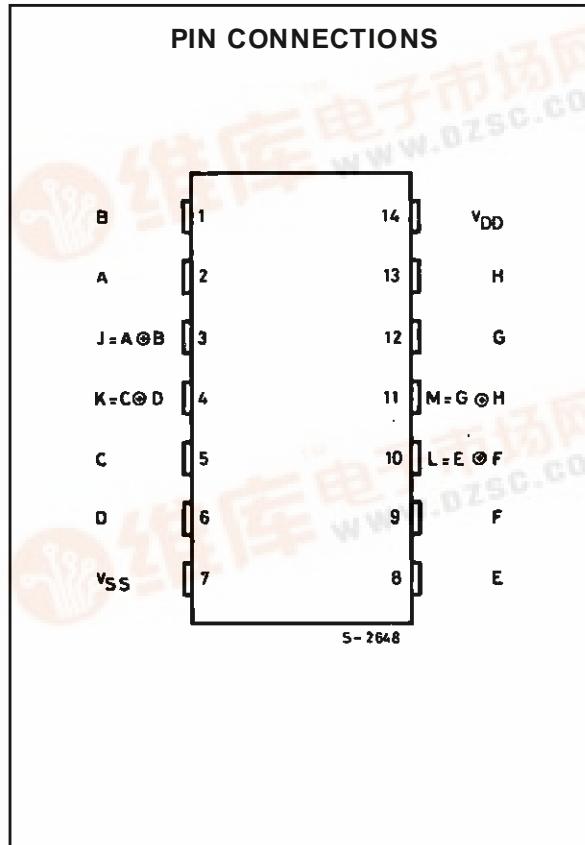
FUNCTIONAL DIAGRAM

J = A ⊕ B   L = E ⊕ F   K = C ⊕ D   M = G ⊕ H

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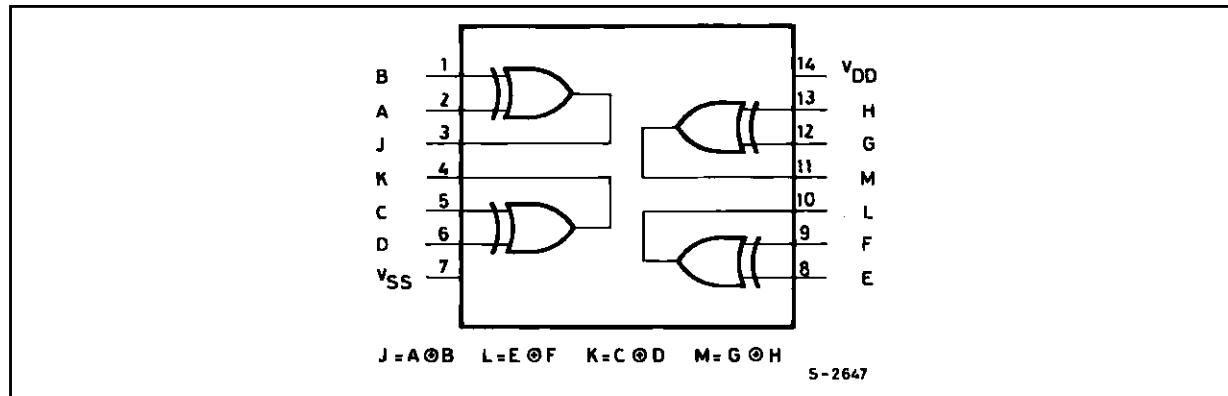
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}*	Supply Voltage : **HCC** Types **HCF** Types	− 0.5 to + 20 − 0.5 to + 18	V 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	200 100	mW mW
T_{op}	Operating Temperature : **HCC** Types **HCF** Types	− 55 to + 125 − 40 to + 85	°C °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.

RECOMMENDED OPERATING CONDITIONS

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

TRUTH TABLE
One of Four Identical Gates

A	B	J
0	0	0
1	0	1
0	1	1
1	0	0

Where "1" = High level
"0" = Low level.

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ALL INPUTS ARE PROTECTED BY
COS/MOS PROTECTION NETWORK

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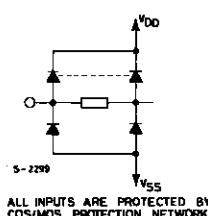
STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter		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.	Unit
I_L	Quiescent Current	HCC Types	0/ 5			5		1		0.02	1		30	µA
			0/10			10		2		0.02	2		60	
			0/15			15		4		0.02	4		120	
			0/20			20		20		0.04	20		600	
		HCF Types	0/ 5			5		4		0.02	4		30	
			0/10			10		8		0.02	8		60	
			0/15			15		16		0.02	16		120	
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		± 0.1		$\pm 10^{-5}$	± 0.1		± 1	µA
		HCF Types	0/15			15		± 0.3		$\pm 10^{-5}$	± 0.3		± 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°C, C_L = 50pF, R_L = 200kΩ, typical temperature coefficient for all V_{DD} = 0.3%/°C values, all input rise and fall time = 20ns)

Symbol	Parameter	Test Conditions		Value			Unit
			V_{CC} (V)	Min.	Typ.	Max.	
t_{PLH}, t_{PHL}	Propagation Delay Time		5		140	280	ns
			10		65	130	
			15		50	100	
t_{TLH}, t_{THL}	Transition Time		5		100	200	ns
			10		50	100	
			15		40	80	

Typical Output Low (sink) Current Characteristics.
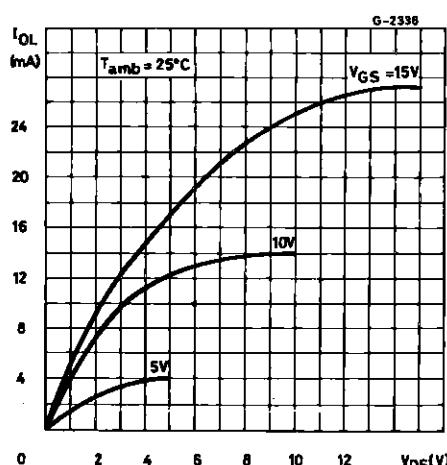
Minimum Output Low (sink) Current Characteristics.
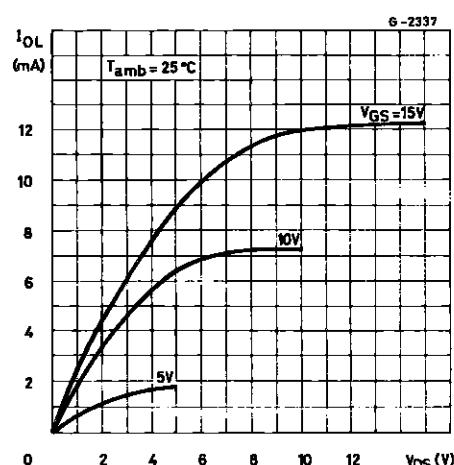
Typical Output High (source) Current Characteristics.
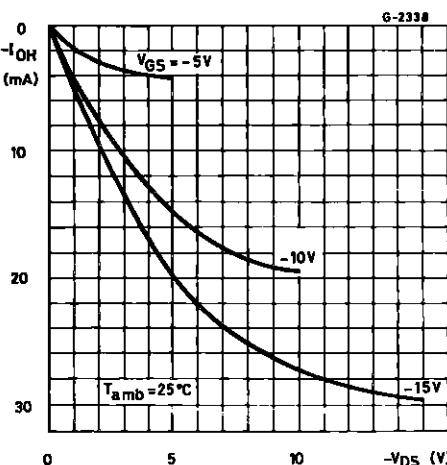
Minimum Output High (source) Current Characteristics.
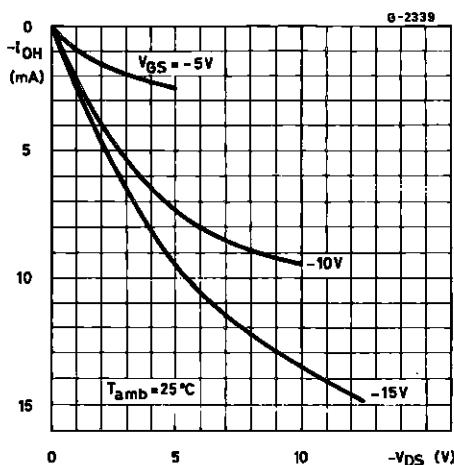
TYPICAL APPLICATIONS

EVEN-PARITY-BIT GENERATOR
(1-3/4 x **HCC/HCF4030B**).
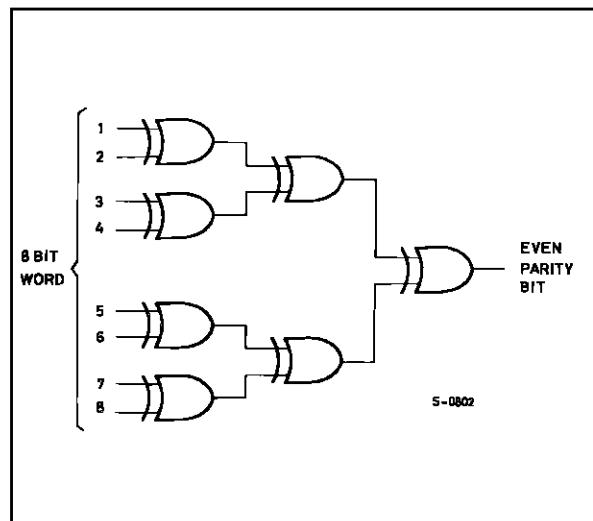
EVEN-PARITY-CHECKER
(2 x **HCC/HCF4030B**).
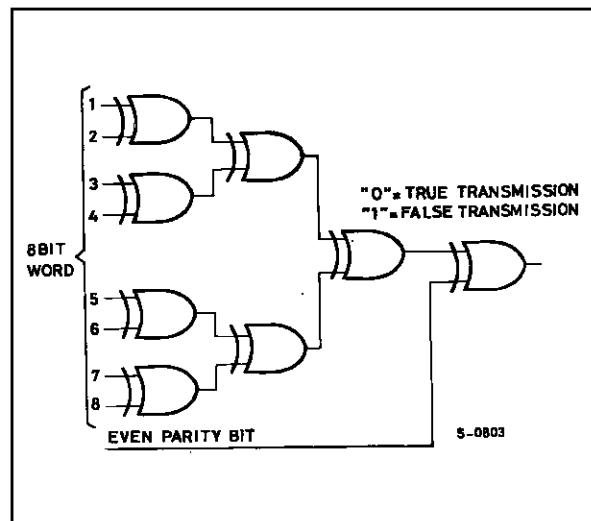
ODD-PARITY-BIT GENERATOR
(2 x **HCC/HCF4030B**).
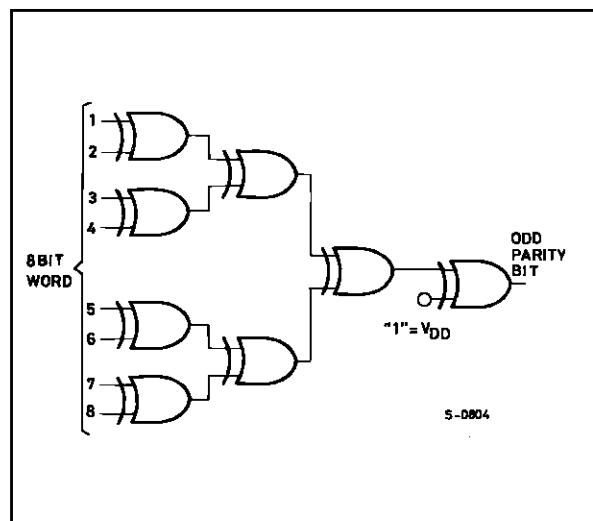
ODD-PARITY CHECKER
(2 x **HCC/HCF4030B**).
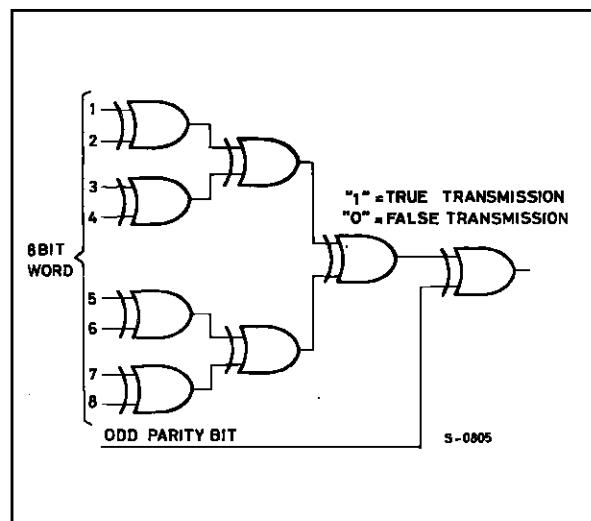
TYPICAL APPLICATIONS (continued)

8-BIT COMPARATOR

Z = 1 WHEN INPUT WORD X1 --- X8 IS Y1 --- Y8

Z = 0 WHEN INPUT WORD X1 --- X8 DIFFERS
       FROM INPUT WORD Y1 --- Y8 IN AT LEAST
       ONE POSITION

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8-BIT TWO'S COMPLEMENT ADDER-SUBSTRACTOR

"0" = ADD
"1" = SUBTRACT

S1 --- S8 = X1 --- X8 ± Y1 --- Y8

■ = LEAST SIGNIFICANT BIT
● = MOST SIGNIFICANT BIT (SIGN BIT)

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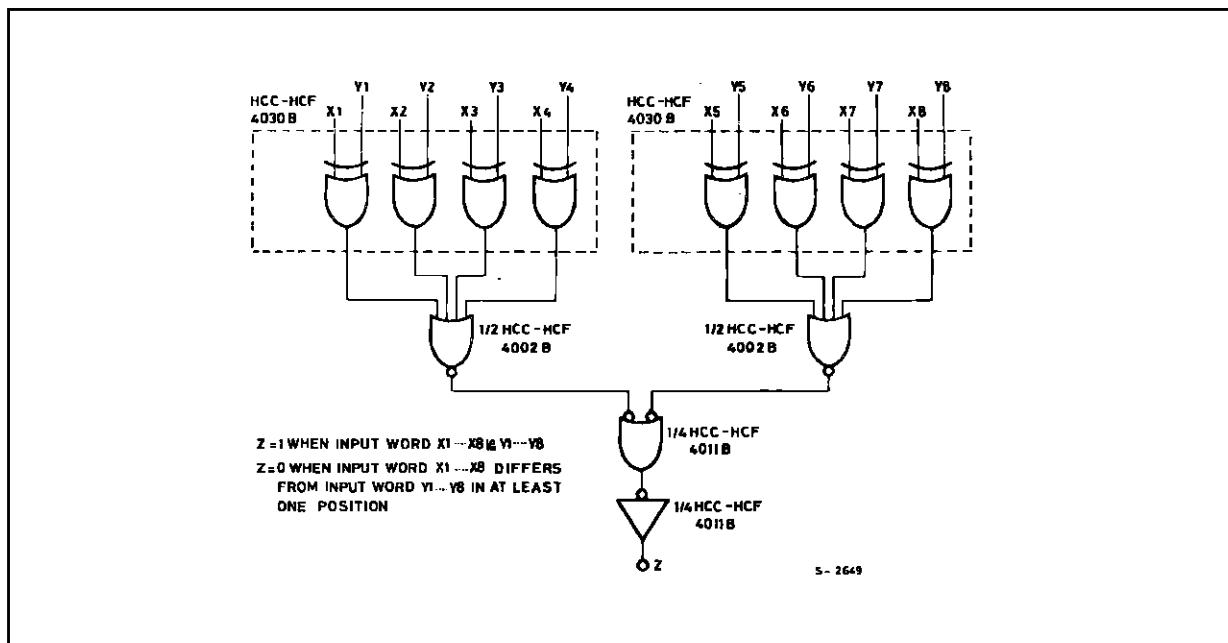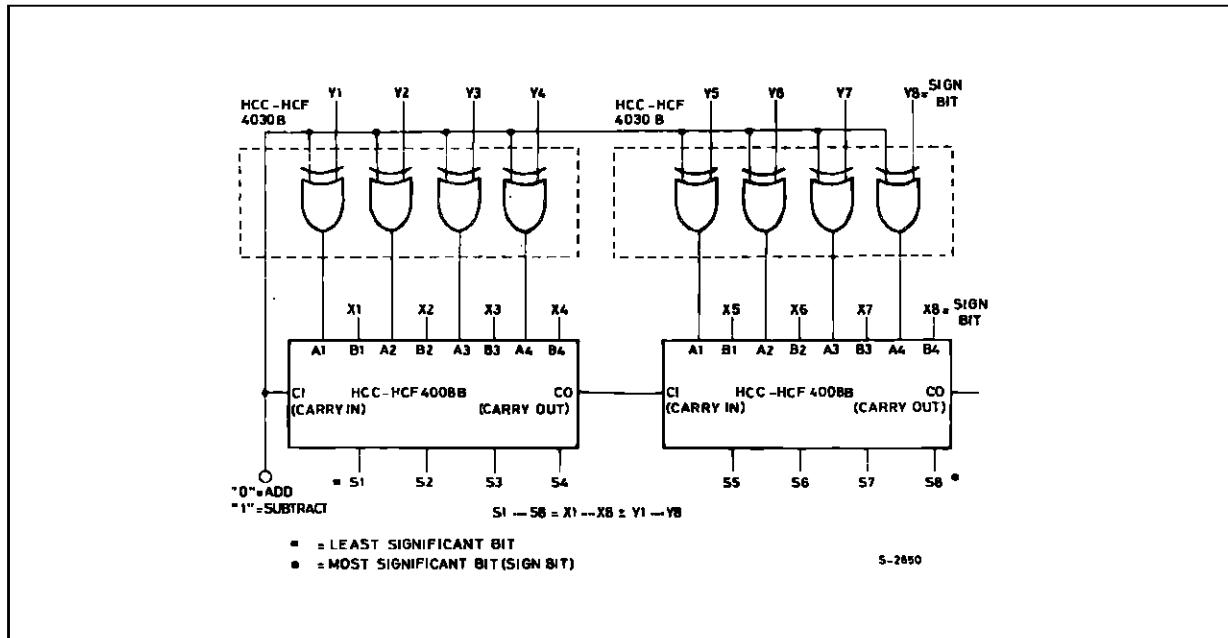
Table 1 : Two's Complement Numbers and Their Equivalent Decimal Values.

X8	X7	X6	X5	X4	X3	X2	X1			X8	X7	X6	X5	X4	X3	X2	X1		
0	0	0	0	0	0	0	0	=	0	1	1	1	1	1	1	1	1	=	-1
0	0	0	0	0	0	0	1	=	1	1	1	1	1	1	1	1	0	=	-2
0	0	0	0	0	0	1	0	=	2	1	1	1	1	1	1	0	1	=	-3
0	0	0	0	0	0	1	1	=	3	1	1	1	1	1	1	0	0	=	-4
										1	1	1	1	1	0	1	1	=	-5
0	1	1	1	1	1	1	0	=	126	1	0	0	0	0	0	0	1	=	-127
0	1	1	1	1	1	1	1	=	127	1	0	0	0	0	0	0	0	=	-128

The two's complement adder-substractor can add or substract any two of the numbers in table 1. For example :

```
a)  2    SIGN|
    + =    BIT|
     -5  X    0| 0  0  0  0  0  1  0    2 +
         Y    1| 1  1  1  1  0  1  1   -5 +
         CI           |              0
        ─────────────────────────────────
         S 0|1  1  1  1  1  1  0  1  = -3
          CO|
```

```
                 SIGN|
b) -2     BIT|
    - =  X    1| 1  1  1  1  1  1  0   -2 +
     -5  Y    1| 1  1  1  1  0  1  1   -5
         Ȳ    0| 0  0  0  0  1  0  0      +
         CL           |              1
        ─────────────────────────────────
         S 1|0  0  0  0  0  1  1  = 3
          CO|
```

TEST CIRCUITS

Quiescent Device Current.
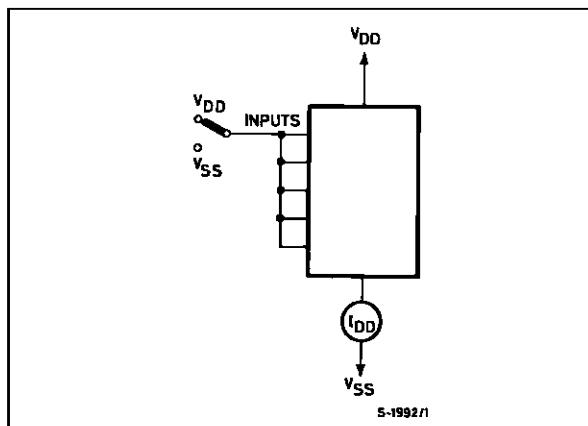
Input Voltage.
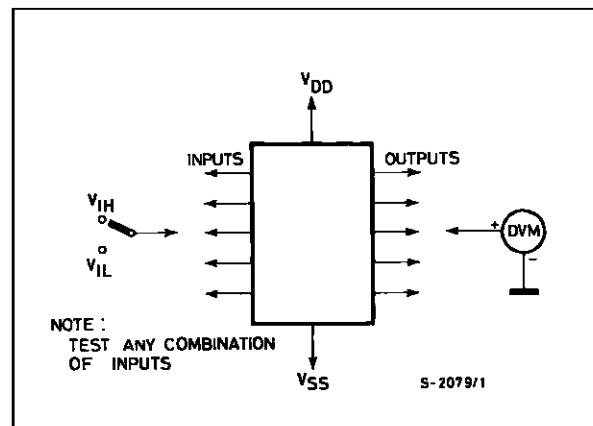
Input Leakage Current.
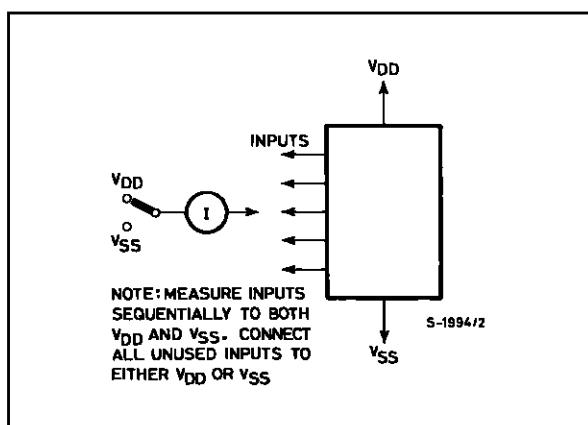
Plastic DIP14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		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		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

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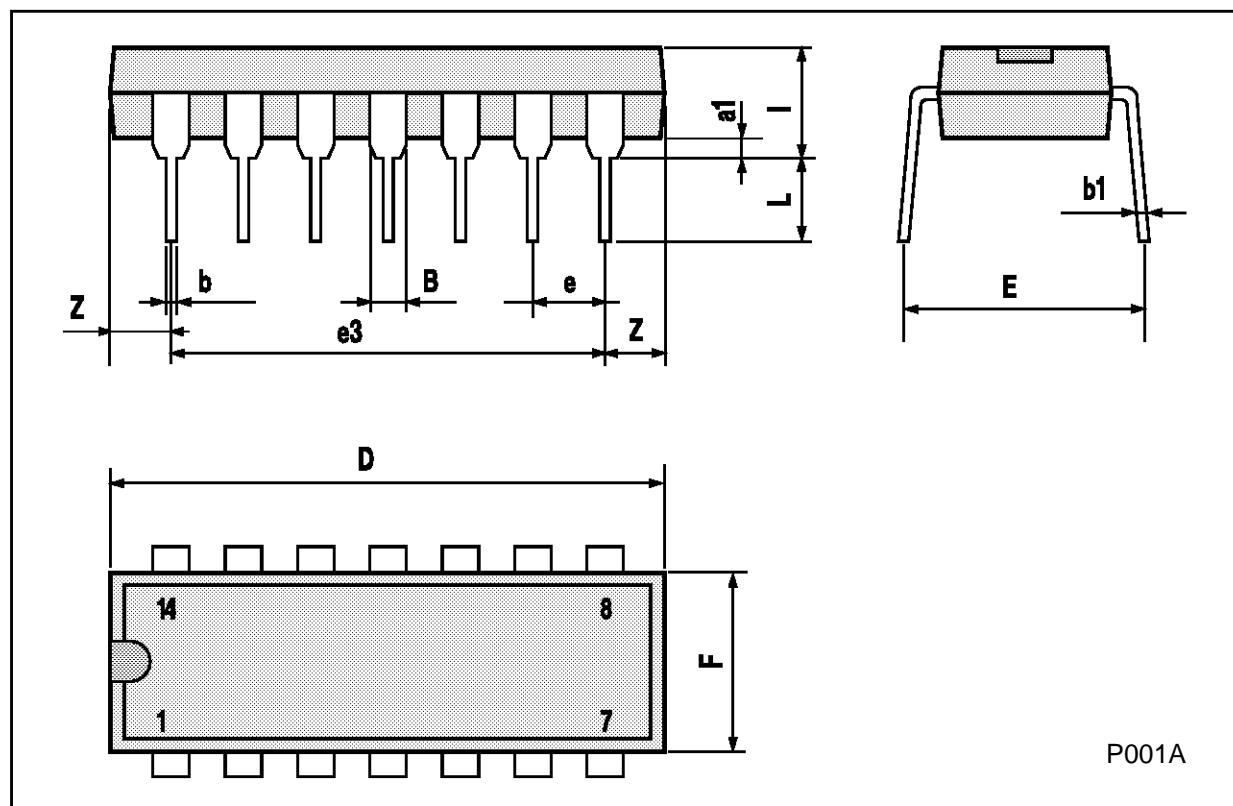
Ceramic DIP14/1 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7.0			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		15.24			0.600	
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	1.52		2.54	0.060		0.100
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200

P053C

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HCC/HCF4030B
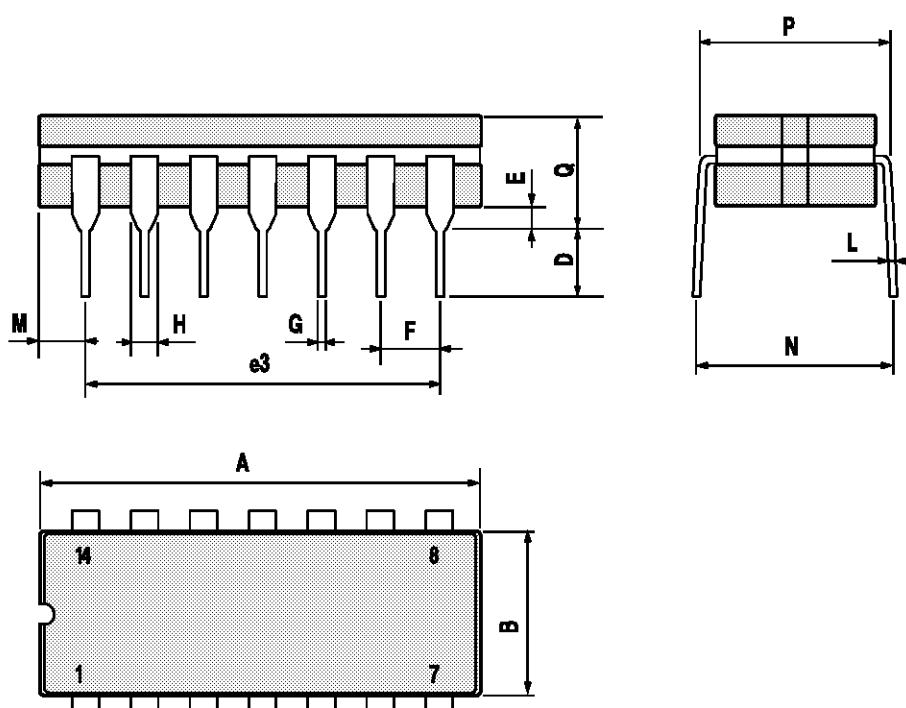
SO14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		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	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
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			0.68			0.026
S	8° (max.)					

P013G

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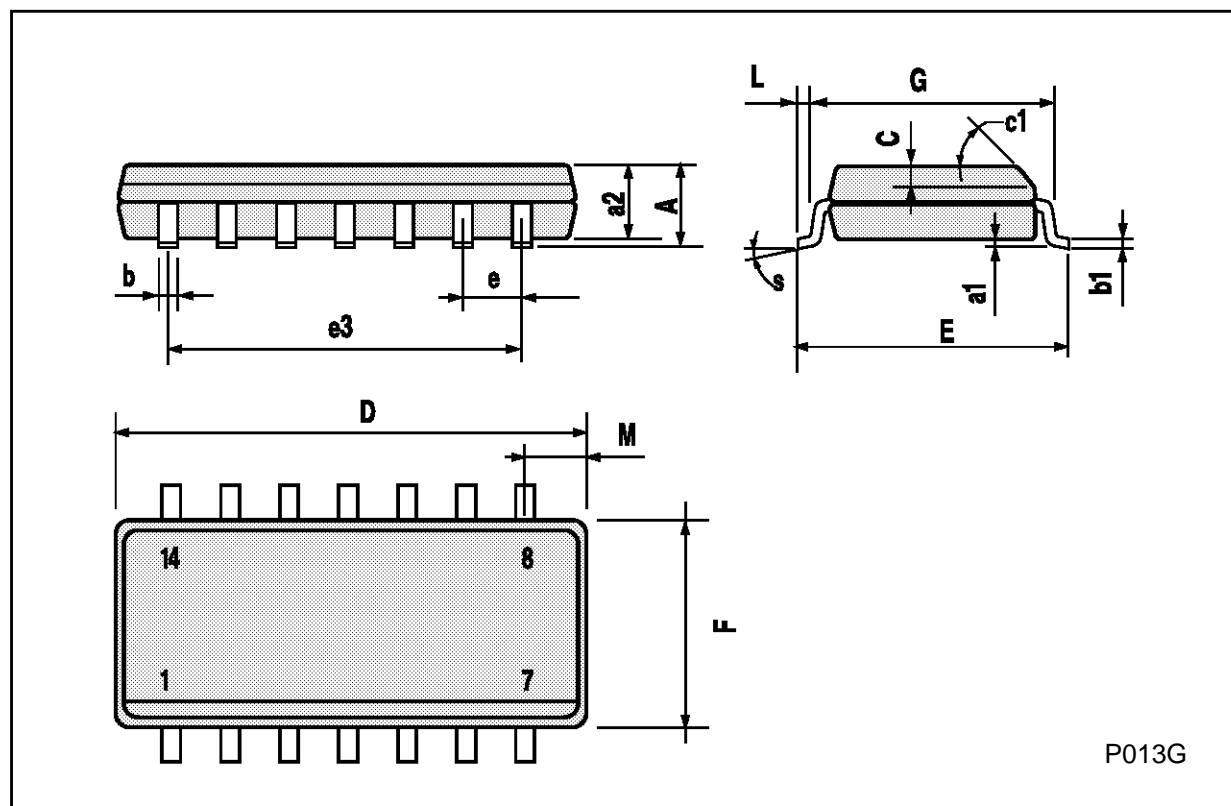
PLCC20 MECHANICAL DATA

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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