



PRELIMINARY DATA

NOR GATES: DUAL 3 INPUT PLUS INVERTER HCC/HCF 4000B
QUAD 2 INPUT HCC/HCF 4001B
DUAL 4 INPUT HCC/HCF 4002B
TRIPLE 3 INPUT HCC/HCF 4025B

- PROPAGATION DELAY TIME = 60 ns (TYP.) AT $C_L = 50$ pF, $V_{DD} = 10$ V
- BUFFERED INPUTS AND OUTPUTS
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- MAXIMUM INPUT CURRENT OF 1 μ A AT 18V (FULL PACKAGE-TEMP. RANGE)
- QUIESCENT CURRENT SPECIFIED TO 20V
- 5V, 10V, AND 15V PARAMETRIC RATINGS

The **HCC 4000B**, **HCC 4001B**, **HCC 4002B** and **HCC 4025B** (extended temperature range) and **HCF 4000B**, **HCF 4001B**, **HCF 4002B** and **HCF 4025B** (intermediate temperature range) are monolithic integrated circuit, available in 14-lead dual in-line plastic or ceramic package, and ceramic flat package. The **HCC/HCF 4000B**, **HCC/HCF 4001B**, **HCC/HCF 4002B** and **HCC/HCF 4025B** NOR gates provide the system designer with direct implementation of the NOR function and supplement the existing family of COS/MOS gates. All inputs and outputs are buffered.

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	$^{\circ}$ C
	for HCF types	-40 to 85	$^{\circ}$ C
T_{stg}	Storage temperature	-65 to 150	$^{\circ}$ C

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

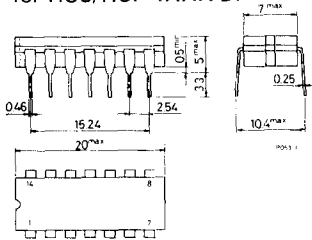
ORDERING NUMBERS:

HCC 4XXX BD for dual in-line ceramic package
HCC 4XXX BF for dual in-line ceramic package, frit seal
HCC 4XXX BK for ceramic flat package
HCF 4XXX BE for dual in-line plastic package
HCF 4XXX BF for dual in-line ceramic package, frit seal

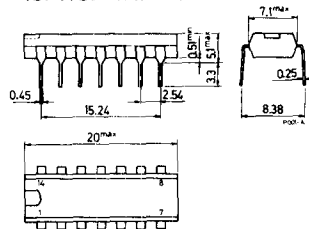


MECHANICAL DATA (dimensions in mm)

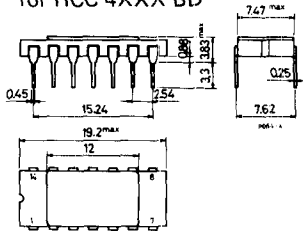
Dual in-line ceramic package for HCC/HCF 4XXX BF



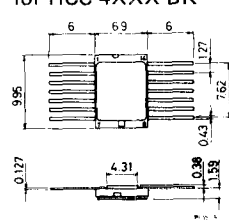
Dual in-line plastic package for HCF 4XXX BE



Dual in-line ceramic package for HCC 4XXX BD

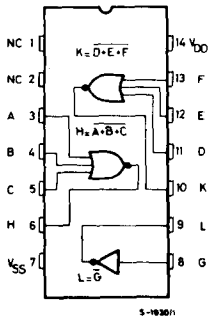


Ceramic flat package for HCC 4XXX BK

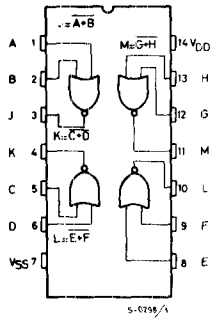


CONNECTION DIAGRAMS

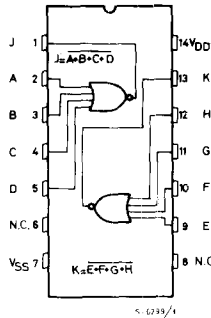
for 4000B



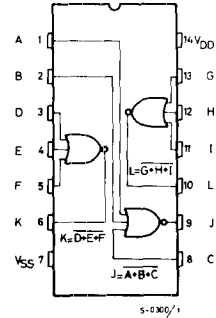
for 4001B



for 4002B



for 4025B



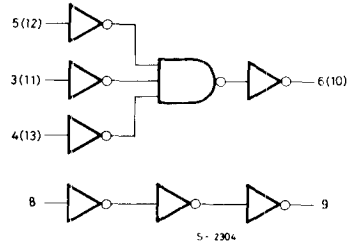
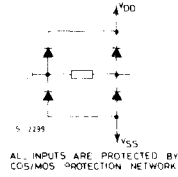
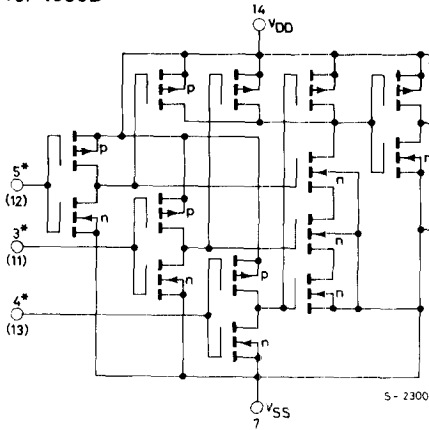
RECOMMENDED OPERATING CONDITIONS

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



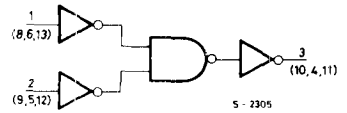
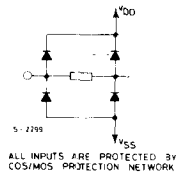
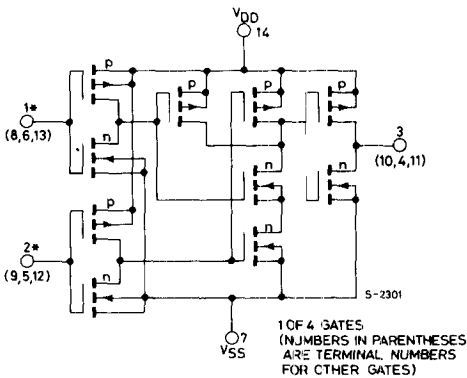
SCHEMATIC AND LOGIC DIAGRAMS

for 4000B



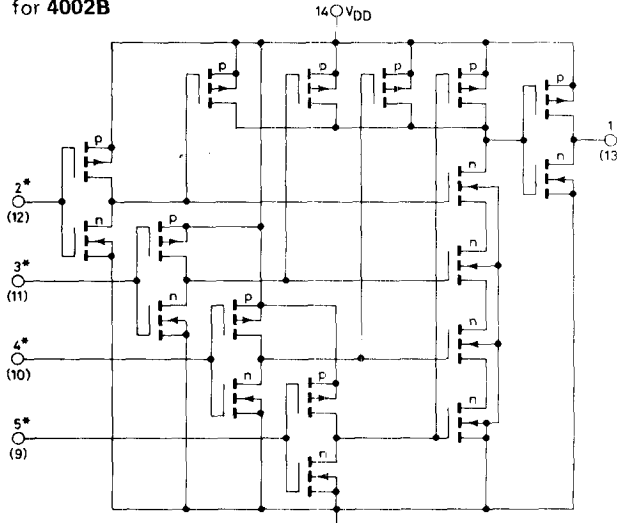
INVERTER AND 1 OF 2 GATES (NUMBERS IN PARENTHESES ARE TERMINAL NUMBERS FOR SECOND GATE)

for 4001B



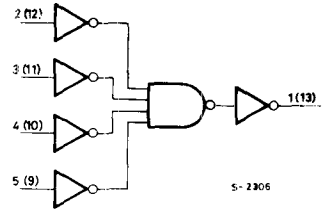
SCHEMATIC AND LOGIC DIAGRAMS (continued)

for **4002B**

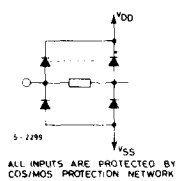


1 OF 2 GATES (NUMBERS IN PARENTHESES ARE TERMINAL NUMBERS FOR SECOND GATE)

5-2302

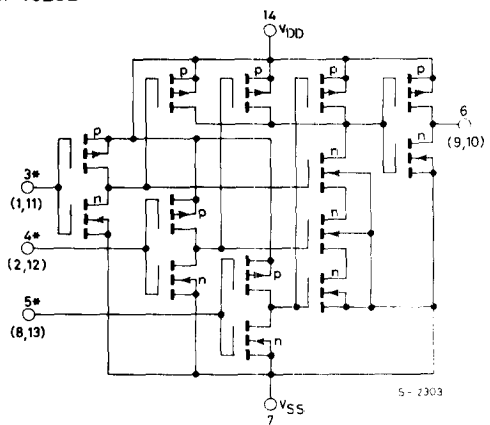


5-2306



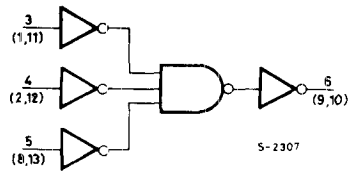
ALL INPUTS ARE PROTECTED BY COS/MOS PROTECTION NETWORK

for **4025B**

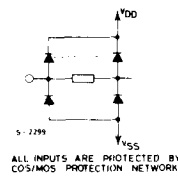


INVERTER AND 1 OF 3 GATES (NUMBERS IN PARENTHESES ARE THERMINAL NUMBERS FOR SECOND GATE)

5-2303



5-2307



ALL INPUTS ARE PROTECTED BY COS/MOS PROTECTION NETWORK



HCC/HCF 4000 B
HCC/HCF 4001 B
HCC/HCF 4002 B
HCC/HCF 4025 B

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Parameter	Test conditions				Values						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 supply current	0/ 5			5			0.25		0.01	0.25		7.5	μ A
	0/10			10			0.5		0.01	0.5		15	
	0/15			15			1		0.01	1		30	
	0/20			20			5		0.02	5		150	
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		
		2/13	< 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	
		13/2	< 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		
	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		
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	Any input	18		\pm 0.1			\pm 10 ⁻⁵	\pm 0.1		\pm 1	μ A	
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.

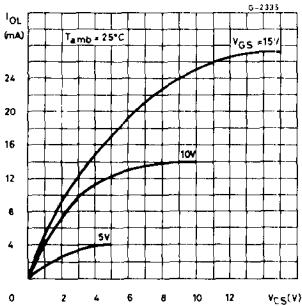
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD} = 5V
2V min. with V_{DD} = 10V
2.5V min. with V_{DD} = 15V

HCC/HCF 4000 B
HCC/HCF 4001 B
HCC/HCF 4002 B
HCC/HCF 4025 B

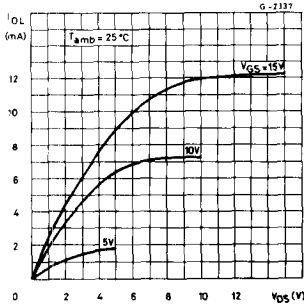
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$, typical temperature coefficient for all V_{DD} values is $0,3\%/^{\circ}\text{C}$, all input rise and fall times = 20 ns)

Parameter	Test conditions	Values			Unit	
		V_{DD} (V)	Min.	Typ.		Max.
t_{PHL} , Propagation delay time t_{PLH}		5		125	250	ns
		10		60	120	
		15		45	90	
t_{THL} , Transition time t_{TLH}		5		100	200	ns
		10		50	100	
		15		40	80	

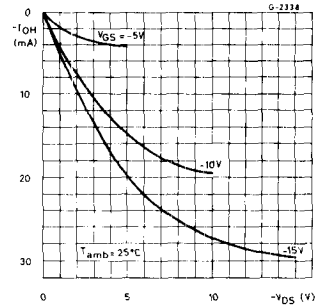
Typical output low (sink) current characteristics



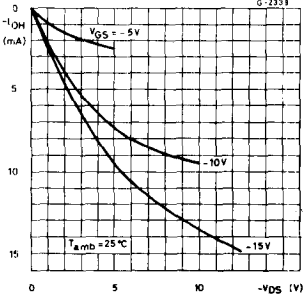
Minimum output low (sink) current characteristics



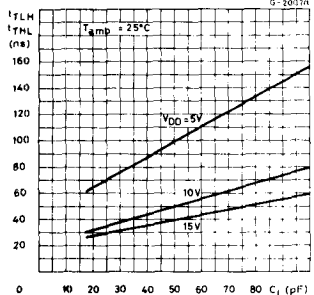
Typical output high (source) current characteristics



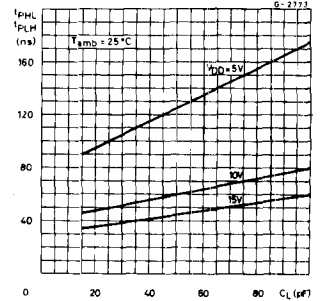
Minimum output high (source) current characteristics



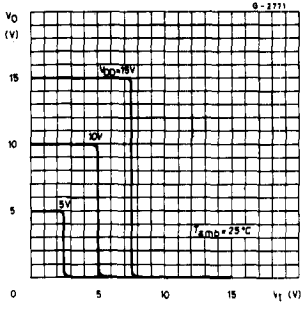
Typical transition time vs. load capacitance



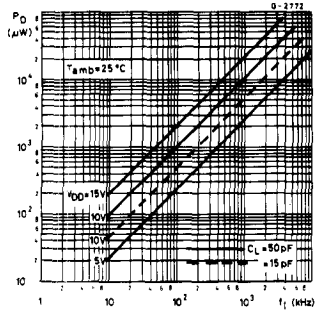
Typical propagation delay time vs. load capacitance



Typical voltage transfer characteristics as a function of temperature

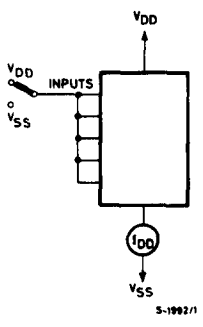


Typical power dissipation per gate vs. frequency

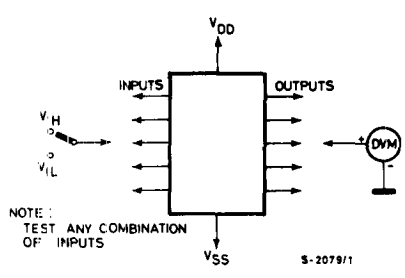


TEST CIRCUITS

Quiescent device current



Input voltage



Input leakage current

