

# COS/MOS INTEGRATED CIRCUITS

4011B  
4012B  
4023B



**NAND GATES: QUAD 2 INPUT HCC/HCF 4011B**  
**DUAL 4 INPUT HCC/HCF 4012B**  
**TRIPLE 3 INPUT HCC/HCF 4023B**

- PROPAGATION DELAY TIME = 60 ns (TYP.) AT  $C_L = 50$  pF,  $V_{DD} = 10$  V
- BUFFERED INPUTS AND OUTPUTS
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- INPUT CURRENT OF 100 nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- 5V, 10V AND 15V PARAMETRIC RATINGS
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD NO. 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"

The **HCC 4011B**, **HCC 4012B** and **HCC 4023B** (extended temperature range) and **HCF 4011B**, **HCF 4012B** and **HCF 4023B** (intermediate temperature range) are monolithic, integrated circuit, available in 14-lead dual in-line plastic or ceramic package, ceramic flat package and plastic micropackage.

The **HCC/HCF 4011B**, **HCC/HCF 4012B** and **HCC/HCF 4023B** NAND gates provide the system designer with direct implementation of the NAND function and supplement the existing family of COS/MOS gates. All inputs and outputs are buffered.

## ABSOLUTE MAXIMUM RATINGS

$V_{DD}^*$	Supply voltage: <b>HCC</b> types <b>HCF</b> 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)	$\pm 10$ 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: <b>HCC</b> types <b>HCF</b> types	-55 to 125 °C -40 to 85 °C
$T_{stg}$	Storage temperature	-65 to 150 °C

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

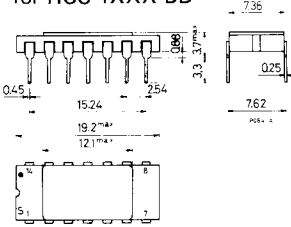
## ORDERING NUMBERS:

**HCC 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  
**HCF 4XXX BM** for plastic micropackage

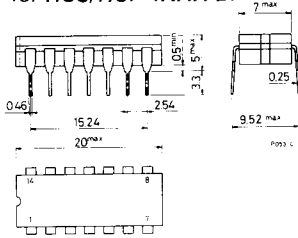


**MECHANICAL DATA** (dimensions in mm)

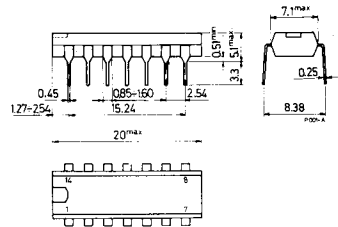
Dual in-line ceramic package for HCC 4XXX BD



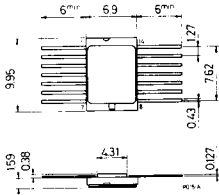
Dual in-line ceramic package for HCC/HCF 4XXX BF



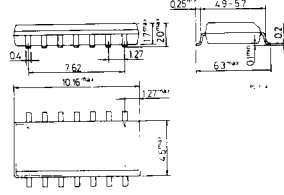
Dual in-line plastic package for HCF 4XXX BE



Ceramic flat package for HCC 4XXX BK

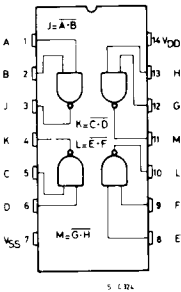


Plastic micropackage for HCF 4XXX BM

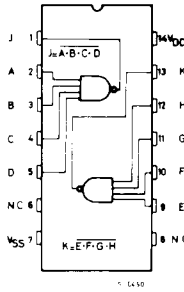


**CONNECTION DIAGRAMS**

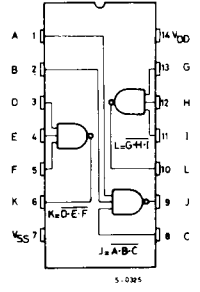
for 4011B



for 4012B



for 4023B

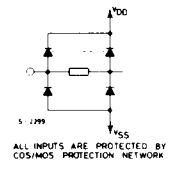
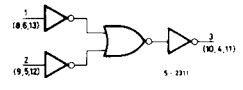
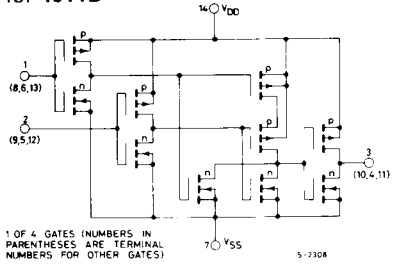


**RECOMMENDED OPERATING CONDITIONS**

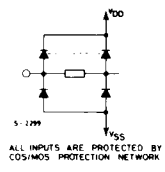
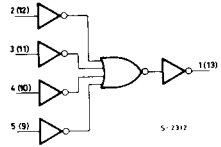
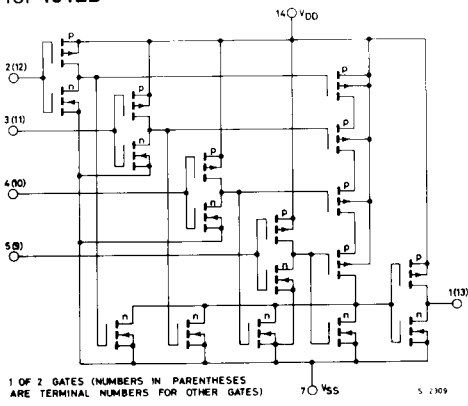
$V_{DD}$	Supply voltage: HCC types	3 to 18	V
	HCF types	3 to 15	V
$V_I$	Input voltage	0 to $V_{DD}$	V
$T_{op}$	Operating temperature: HCC types	-55 to 125	°C
	HCF types	-40 to 85	°C

**SCHEMATIC AND LOGIC DIAGRAMS**

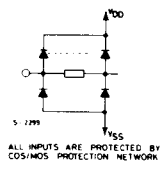
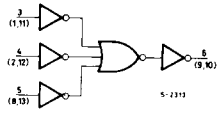
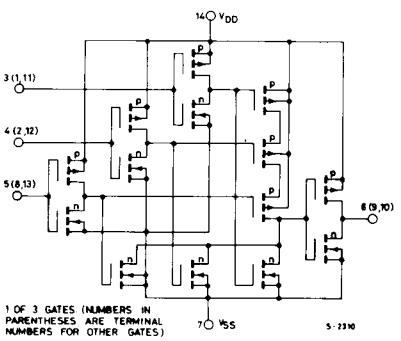
for 4011B



for 4012B



for 4023B





*Compl*

*10003*

**STATIC ELECTRICAL CHARACTERISTICS** (over recommended operating conditions)

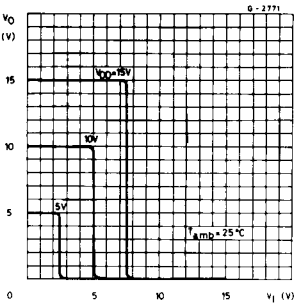
Parameter		Test conditions				Values						Unit		
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>OI</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>Low</sub> *		25°C			T <sub>High</sub> *			
						Min.	Max.	Min.	Typ.	Max.	Min.		Max.	
I <sub>L</sub>	Quiescent current	HCC types	0/ 5			5		0.25		0.01	0.25		7.5	$\mu$ 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	
	HCF types	0/ 5			5		1		0.01	1		7.5		
		0/10			10		2		0.01	2		15		
		0/15			15		4		0.01	4		30		
V <sub>OH</sub>	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 <sub>OL</sub>	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 <sub>IH</sub>	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 <sub>IL</sub>	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 <sub>OH</sub>	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 <sub>OL</sub>	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 <sub>IH</sub> , I <sub>IL</sub>	Input leakage current	HCC types	0/18	Any input	18		+0.1		+10 <sup>-5</sup>	+0.1		+1	$\mu$ A	
		HCF types	0/15		15		+0.3		+10 <sup>-5</sup>	+0.3		+1		
C <sub>i</sub>	Input capacitance			Any input					5	7.5		pF		

\* T<sub>Low</sub> = - 55°C for **HCC** device; -40°C for **HCF** device.  
 \* T<sub>High</sub> = +125°C for **HCC** device; +85°C for **HCF** device.  
 The Noise Margin for both "1" and "0" level is: 1V min. with V<sub>DD</sub>= 5V  
 2V min. with V<sub>DD</sub>= 10V  
 2.5V min. with V<sub>DD</sub>= 15V

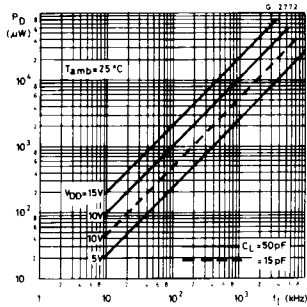
**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ k}\Omega$ , typical temperature coefficient for all  $V_{DD}$  values is  $0.3\%/^{\circ}\text{C}$ , all input rise and fall times =  $20\text{ ns}$ )

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

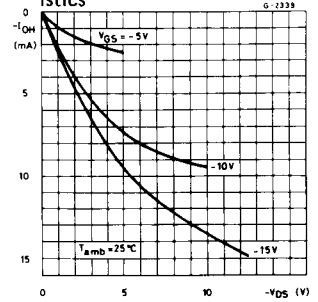
Typical voltage transfer characteristics



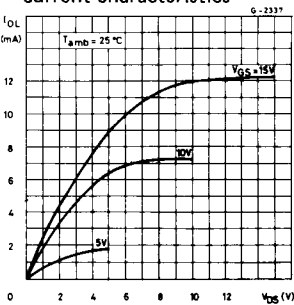
Typical power dissipation/gate vs. frequency



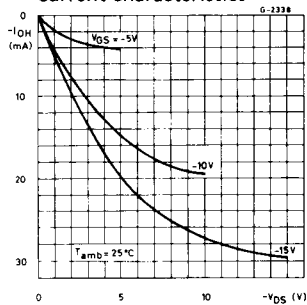
Minimum output high (source) current characteristics



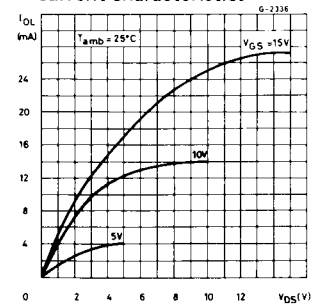
Minimum output low (sink) current characteristics



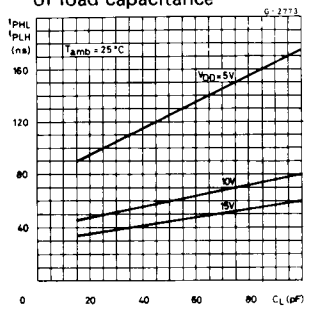
Typical output high (source) current characteristics



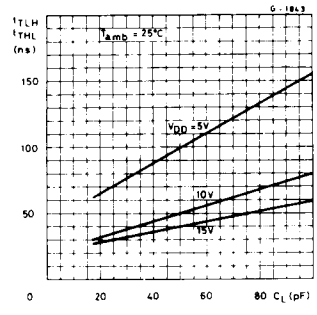
Typical output low (sink) current characteristics



Typical propagation delay time per gate as a function of load capacitance

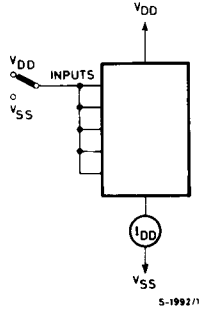


Typical transition time vs. load capacitance

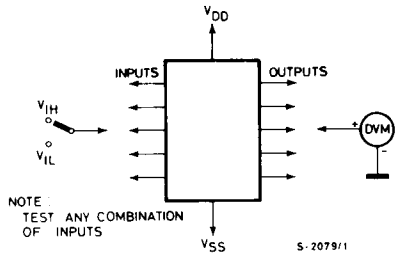


**TEST CIRCUITS**

Quiescent device current



Noise immunity



Input leakage current

