

PRELIMINARY DATA

14-STAGE RIPPLE-CARRY BINARY COUNTER/DIVIDER AND OSCILLATOR

- MEDIUM-SPEED OPERATION
- COMMON RESET
- FULLY STATIC OPERATION
- BUFFERED INPUTS AND OUTPUTS
- QUIESCENT CURRENT SPECIFIED TO 20V
- 5V, 10V, AND 15V PARAMETRIC RATINGS

The **HCC 4060B** (extended temperature range) and **HCF 4060B** (intermediate temperature range) are monolithic integrated circuit, available in 16-lead dual in-line plastic or ceramic package and ceramic flat package. The **HCC/HCF 4060B** consists of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC or crystal oscillator circuits. A RESET input is provided which resets the counter to the all-O's state and disables the oscillator. A high level on the RESET line accomplishes the reset function. All counter stages are master-slave flip-flops. The state of the counter is advanced one step in binary order on the negative transition of ϕ_1 (and ϕ_0). All inputs and outputs are fully buffered. Schmitt trigger action on the clock line permits unlimited clock rise and fall times.

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

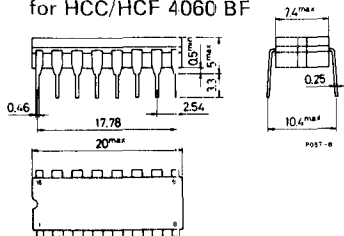
* All voltage values are referred to V_{SS} pin voltage

ORDERING NUMBERS:

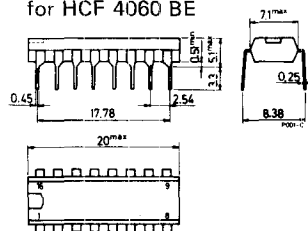
HCC 4060 BD	for dual in-line ceramic package
HCC 4060 BF	for dual in-line ceramic package, frit seal
HCC 4060 BK	for ceramic flat package
HCF 4060 BE	for dual in-line plastic package
HCF 4060 BF	for dual in-line ceramic package, frit seal

MECHANICAL DATA (dimensions in mm)

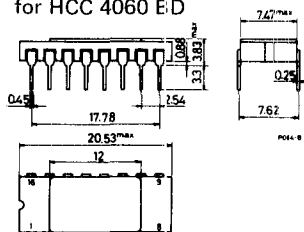
Dual in-line ceramic package
for HCC/HCF 4060 BF



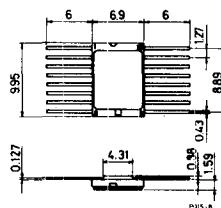
Dual in-line plastic package
for HCF 4060 BE



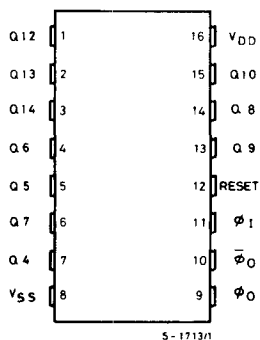
Dual in-line ceramic package
for HCC 4060 E:D



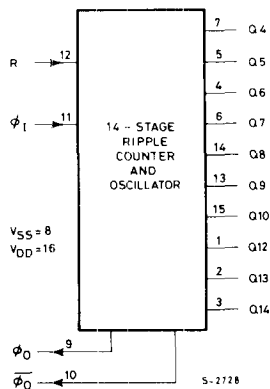
Ceramic flat package
for HCC 4060 BK



CONNECTION DIAGRAM



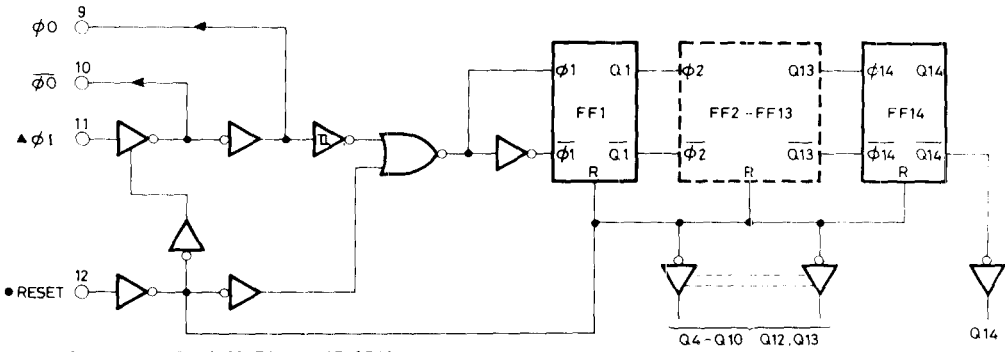
FUNCTIONAL DIAGRAM



RECOMMENDED OPERATING CONDITIONS

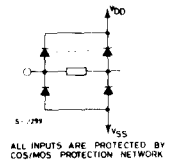
V_{DD}	Supply voltage	3 to 18	V
V_I	Input voltage	0 to V_{DD}	V
T_{op}	Operating temperature: for HCC types	-55 to 125	°C
	for HCF types	-40 to 85	°C

LOGIC DIAGRAM



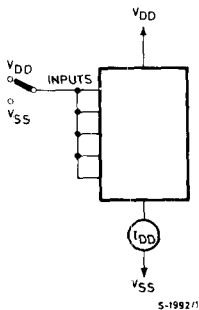
- R = HIGH DOMINATES (RESETS ALL STAGES)
- ▲ COUNTER ADVANCES ONE BINARY COUNT ON EACH NEGATIVE-GOING TRANSITION OF $\phi 1$ (AND $\phi 0$)

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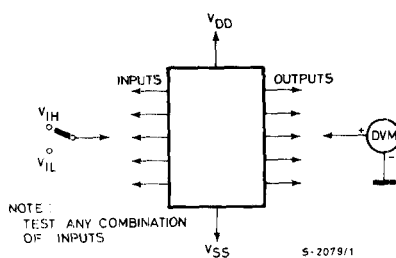


TEST CIRCUITS

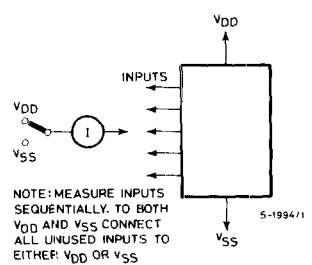
Quiescent device current



Input voltage



Input leakage current





STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Parameter		Test conditions				Values						Unit		
		V _I (V)	V _O (V)	I _O (μA)	V _{DD} (V)	T _{Low} *		25°C			T _{High} *			
						Min.	Max.	Min.	Typ.	Max.	Min.		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

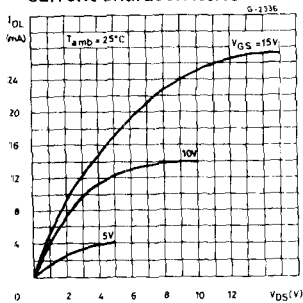
** Any input 2V min. with V_{DD} = 10V

2.5V min. with V_{DD} = 15V

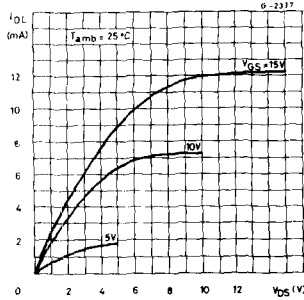
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$, typical temperature coefficient for all V_{DD} values is $0,3\%/^{\circ}\text{C}$, all input rise and fall times = 20 ns)

Parameter	Test conditions	Values				Unit
		V _{DD} (V)	Min.	Typ.	Max.	
INPUT-PULSE OPERATION						
t _{PLH} , t _{PHL} Propagation delay time (φ 1 to Q4 Out)		5		800		ns
		10		340		
		15		240		
t _{PLH} , t _{PHL} Propagation delay time (Q _n to Q _{n+1})		5		200		ns
		10		85		
		15		60		
t _{TLH} , t _{THL} Transition time		5		100		ns
		10		50		
		15		40		
t _W Input pulse width	f = 100 kHz	5		70		ns
		10		30		
		15		20		
t _r , t _f Input pulse rise and fall time		5	Unlimited			μs
		10				
		15				
f _{max} Maximum clock input frequency		5		7		MHz
		10		16		
		15		24		
RESET OPERATION						
t _{PHL} Propagation delay time		5		300		ns
		10		140		
		15		100		
t _W Reset pulse width		5		375		ns
		10		200		
		15		150		

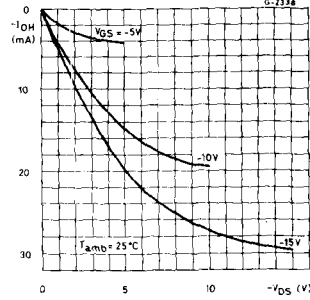
Minimum output low (sink) current characteristics



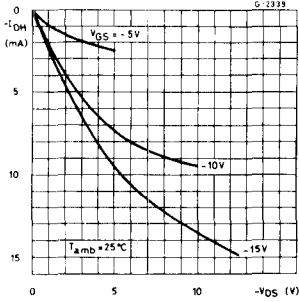
Typical output low (sink) current



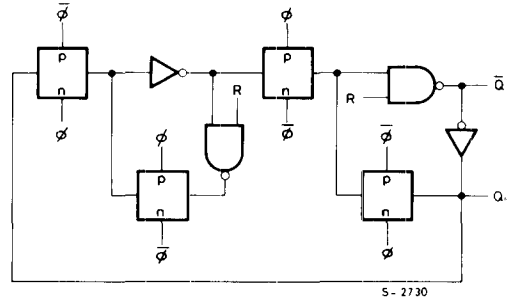
Minimum output high (source) current characteristics



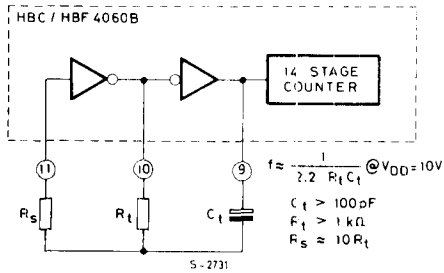
Typical output high (source) current characteristics



Detail of typical flip-flop stage



Typical RC oscillator circuit



Typical crystal oscillator circuit

