



41C 08841 DT-45-17

4-BIT MAGNITUDE COMPARATOR

- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- STANDARD B-SERIES OUTPUT DRIVE
- EXPANSION TO 8-16V 4N BITS BY CASCADING UNITS
- MEDIUM SPEED OPERATION: COMPARES TWO 4-BIT WORDS IN 250 ns (TYP.) AT 10V
- INPUT CURRENT OF 100 nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD No. 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"

The **HCC 4063B** (extended temperature range) and **HCF 4063B** (intermediate temperature range) are available in 16-lead dual in-line plastic or ceramic package, ceramic flat package and plastic micropackage. The **HCC/HCF 4063B** is a low-power 4-bit magnitude comparator designed for use in computer and logic applications that require the comparison of two 4-bit words. This logic circuit determines whether one 4-bit word (Binary or BCD) is "less than", "equal to" or "greater than" a second 4-bit word. The **HCC/HCF 4063B** has eight comparing inputs (A3, B3, through A0, B0), three outputs (A < B, A = B, A > B) and three cascading inputs (A < B, A = B, A > B) that permit systems designers to expand the comparator function to 8, 12, 16 . . . 4N bits. When a single **HCC/HCF 4063B** is used, the cascading inputs are connected as follows: (A < B) = low, (A = B) = high, (A > B) = low. For words longer than 4 bits, **HCC/HCF 4063B** devices may be cascaded by connecting the outputs of the less-significant comparator to the corresponding cascading inputs of the more-significant comparator. Cascading inputs (A < B, A = B, and A > B) on the least significant comparator are connected to a low, a high, and a low level, respectively.

ABSOLUTE MAXIMUM RATINGS

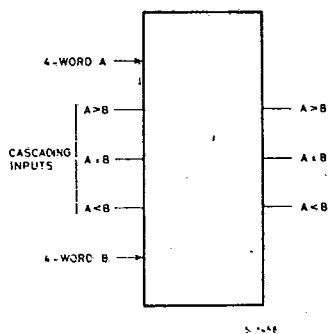
V_{DD}^*	Supply voltage: HCC types	-0.5 to 20	V
	HCF types	-0.5 to 18	V
V_i	Input voltage	-0.5 to $V_{DD} + 0.5$	V
I_i	DC input current (any one input)	± 10	mA
P_{tot}	Total power dissipation (per package)	200	mW
	Dissipation per output transistor		
	for T_{op} = full package-temperature range	100	mW
T_{op}	Operating temperature: HCC types	-55 to 125	°C
	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 4063 BD for dual in-line ceramic package
HCC 4063 BF for dual in-line ceramic package, frit seal
HCC 4063 BK for ceramic flat package
HCF 4063 BE for dual in-line plastic package
HCF 4063 BF for dual in-line ceramic package, frit seal
HCF 4063 BM for plastic micropackage

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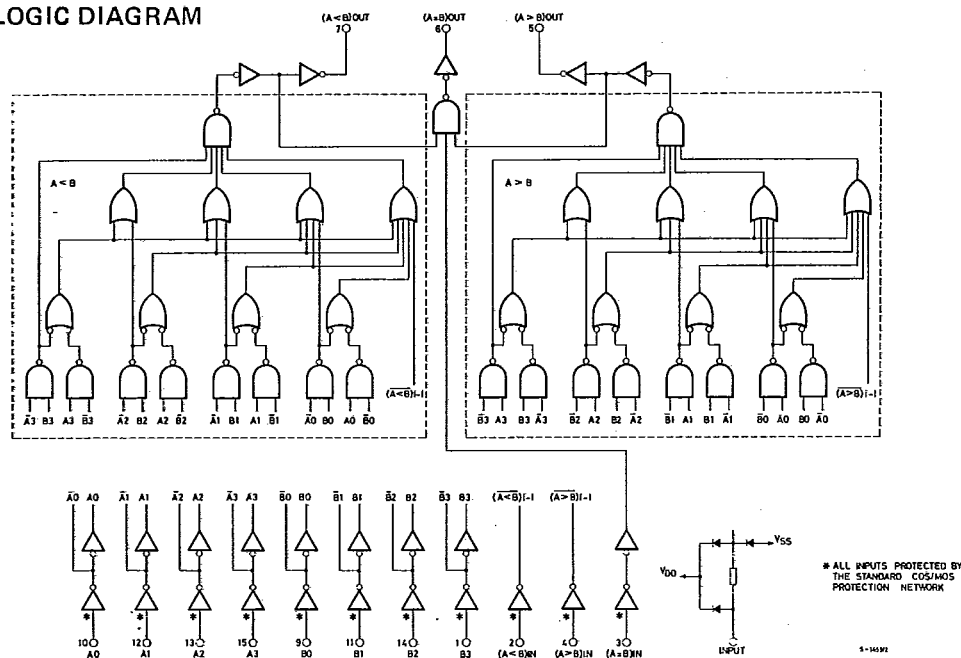




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LOGIC DIAGRAM



TRUTH TABLE

INPUTS							OUTPUTS		
COMPARING				CASCADING					
A3, B3	A2, B2	A1, B1	A0, B0	A < B	A = B	A > B	A < B	A = B	A > B
A3 > B3	X	X	X	X	X	X	0	0	1
A3 = B3	A2 > B2	X	X	X	X	X	0	0	1
A3 = B3	A2 = B2	A1 > B1	X	X	X	X	0	0	1
A3 = B3	A2 = B2	A1 = B1	A0 > B0	X	X	X	0	0	1
A3 = B3	A2 = B2	A1 = B1	A0 = B0	0	0	1	0	0	1
A3 = B3	A2 = B2	A1 = B1	A0 = B0	0	1	0	0	1	0
A3 = B3	A2 = B2	A1 = B1	A0 = B0	1	0	0	1	0	0
A3 = B3	A2 = B2	A1 = B1	A0 < B0	X	X	X	1	0	0
A3 = B3	A2 = B2	A1 < B1	X	X	X	X	1	0	0
A3 = B3	A2 < B2	X	X	X	X	X	1	0	0
A3 < B3	X	X	X	X	X	X	1	0	0

X = Don't care
1 = High state
0 = Low state

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

HCC/HCF 4063B

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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 current	HCC types	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	
	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			
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		±10 ⁻⁵	±0.1		± 1	μA	
		HCF types	0/15		15		±0.3		±10 ⁻⁵	±0.3		± 1		
C _I	Input capacitance				Any input				5	7.5			pF	

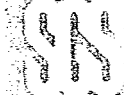
* T_{Low} = - 55°C for HCC device; -40°C for HCF device.* T_{High} = +125°C for HCC device; +85°C for HCF device.

The Noise Margin for both "1" and "0" level is:

1V min. with V_{DD} = 5V

2V min. with V_{DD} = 10V

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



HCC/HCF 4063B

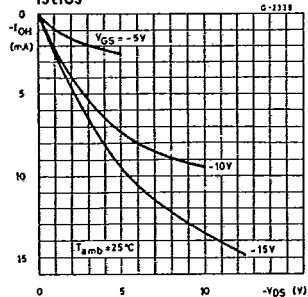
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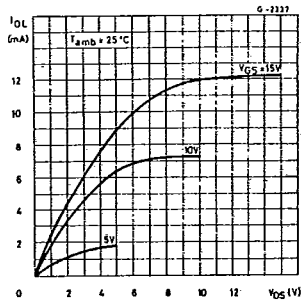
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$, typical temperature coefficient for all V_{DD} values is $0.3\%/^\circ\text{C}$, all input rise and fall times = 20 ns)

Parameter	Test conditions	Values			Unit
		V_{DD} (V)	Min.	Typ.	Max.
t_{PLH} , t_{PHL} Propagation delay time	Comparing inputs to outputs	5		625	1250
		10		250	500
		15		175	350
	Cascading inputs to outputs	5		500	1000
		10		200	400
		15		140	280
t_{TLH} , t_{THL} Transition time		5		100	200
		10		50	100
		15		40	80

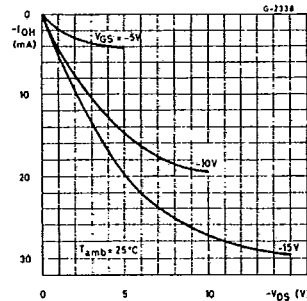
Minimum output high (source) current characteristics



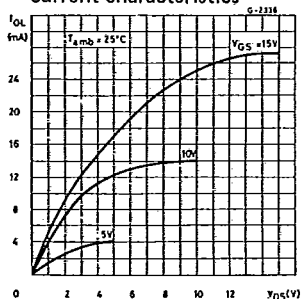
Minimum output low (sink) current characteristics



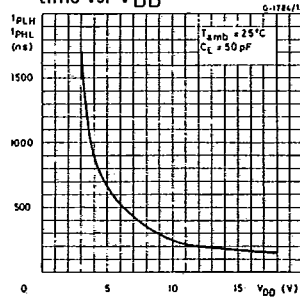
Typical output high (source) current characteristics



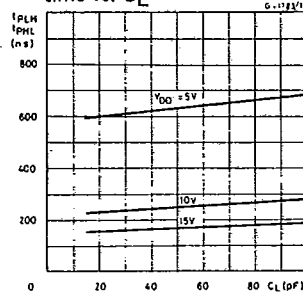
Typical output low (sink) current characteristics



Typical propagation delay time vs. V_{DD}



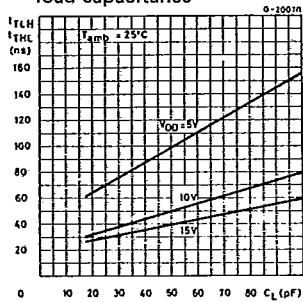
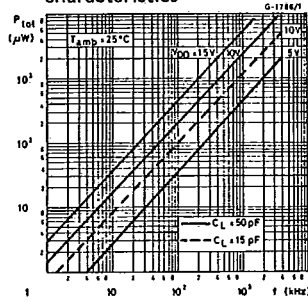
Typical propagation delay time vs. C_L



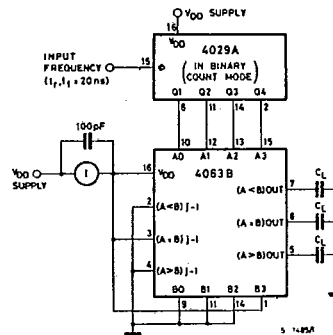
HCC/HCF 4063B

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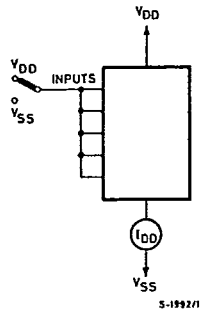
Typical transition time vs.
load capacitanceTypical power dissipation
characteristics

Dynamic power dissipation

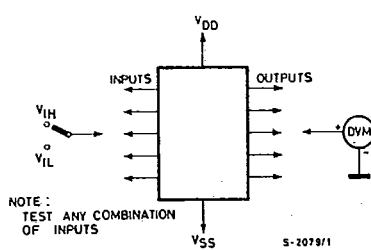


TEST CIRCUITS

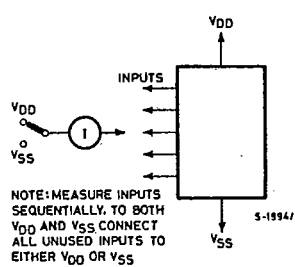
Quiescent device current



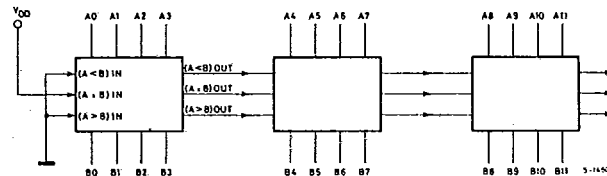
Noise immunity



Input leakage current

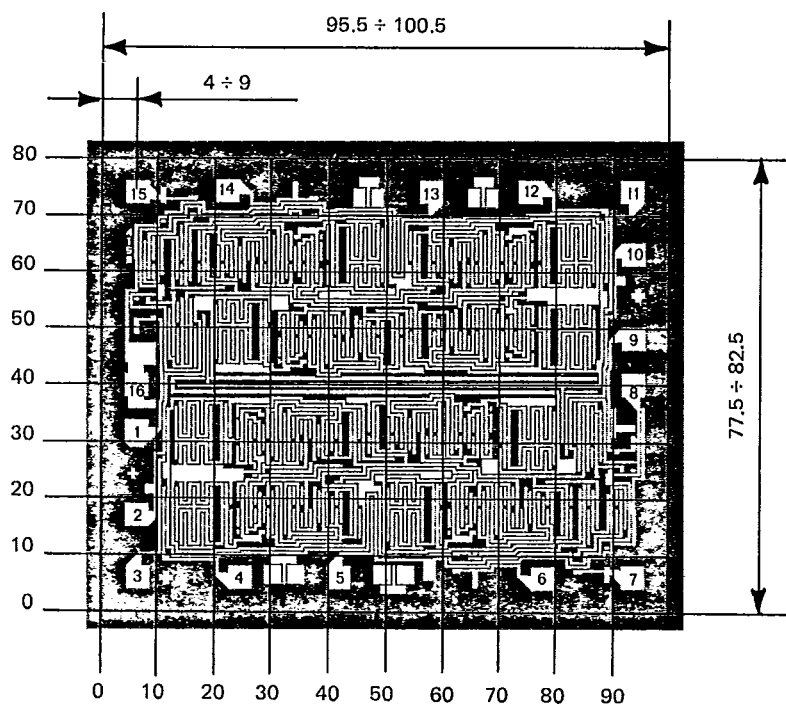


TYPICAL APPLICATION

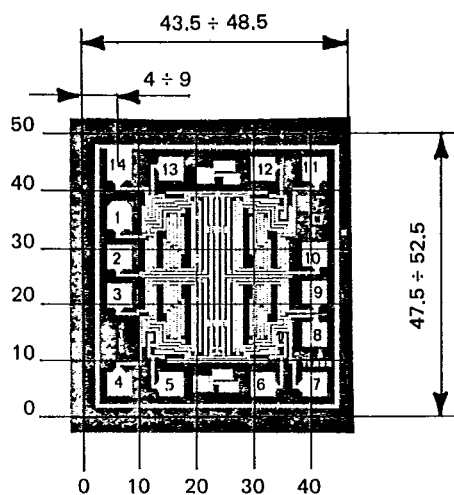
Typical speed characteristics
of a 12-bit comparator

$$t_p (TOT.) = t_p (COMPARE) + 2 \times t_p (CASCADE) \text{ at } C_L = 50 \text{ pF (each output), } V_{DD} = 10 \text{ V (3 stages)}$$

$$= 250 + 2 \times (200) = 650 \text{ ns (typ.)}$$



4015B



4016B