COS/MOS INTEGRATED CIRCUIT

STROBED HEX INVERTER/BUFFER

- 2 TTL-LOAD OUTPUT DRIVE CAPABILITY
- 3-STATE OUTPUTS
- COMMON OUTPUT-DISABLE CONTROL
- INHIBIT CONTROL
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- 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 4502B** (extended temperature range) and **HCF 4502B** (intermediate temperature range) are monolithic integrated circuit, available in 16-lead dual in-line plastic or ceramic package, ceramic flat package and plastic micropackage. The **HCC/HCF 4502B** consists of six inverter-buffers with 3-state outputs. A logic "1" on the OUTPUT DISABLE input produces a high-impedance state in all six outputs. This feature permits common busing of the outputs, thus simplifying system design. A logic "1" on the INHIBIT input switches all six outputs to logic "0" if the OUTPUT DISABLE input is a logic "0". This device is capable of driving two standard TTL loads, which is equivalent to six times the JEDEC "B" series I_{OL} standard.

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

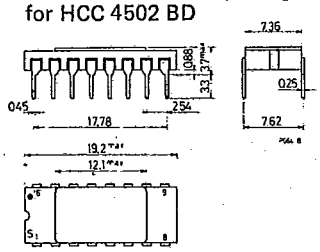
ORDERING NUMBERS:

HCC 4502 BD for dual in-line ceramic package
HCC 4502 BF for dual in-line ceramic package, frit seal
HCC 4502 BK for ceramic flat package
HCF 4502 BE for dual in-line plastic package
HCF 4502 BF for dual in-line ceramic package, frit seal
HCF 4502 BM for plastic micropackage

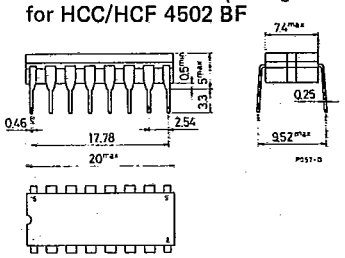
HCC/HCF 4502B

MECHANICAL DATA (dimensions in mm)

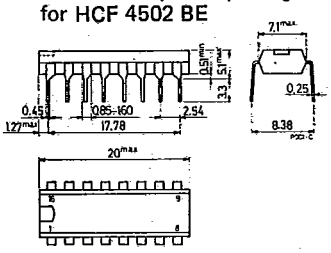
Dual in-line ceramic package for HCC 4502 BD



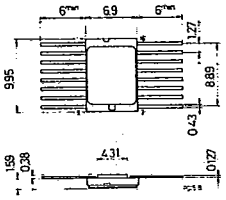
Dual in-line ceramic package for HCC/HCF 4502 BF



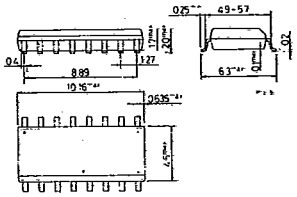
Dual in-line plastic package for HCF 4502 BE



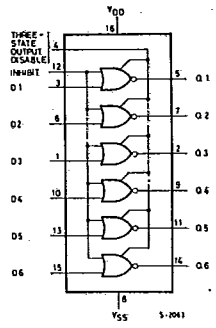
Ceramic flat package for HCC 4502 BK



Plastic micropackage for HCF 4502 BM



CONNECTION DIAGRAM



TRUTH TABLE

DISABLE	INHIBIT	Dn	Qn
0	0	0	1
0	0	1	0
0	1	X	0
1	X	X	Z

X = Don't Care
Z = High Impedance
Logic 1 = High
Logic 0 = Low

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

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}* Min.	T_{Low}* Max.	25°C Min.	25°C Typ.	25°C Max.	T_{High}* Min.	T_{High}* Max.	
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	3.84		3.06	6		2.10		mA
			0/10	0.5		10	9.6		7.8	15.6		5.4		
			0/15	1.5		15	25.2		20.4	40.8		14.4		
		HCF types	0/ 5	0.4		5	3.11		2.6	6		2.10		
			0/10	0.5		10	7.05		6.63	15.6		5.61		
			0/15	1.5		15	20.4		17.3	40.8		14.2		
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	
I_{OH} I_{OL}	3-state output	HCC types	0/18			18		±0.4		$±10^{-4}$	±0.4		± 12	μA
		HCF types	0/15			15		±1.0		$±10^{-4}$	±1.0		±7.5	
C_I	Input capacitance			Any input						5	7.5			pF

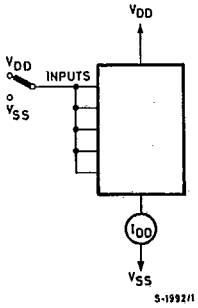
* T_{Low} = - 55°C for **HCC** device: -40°C for **HCF** device.
* T_{High} = +125°C for **HCC** device: +85°C for **HCF** device.
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}= 5V
2V min. with V_{DD}= 10V
2.5V min. with V_{DD}= 15V

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

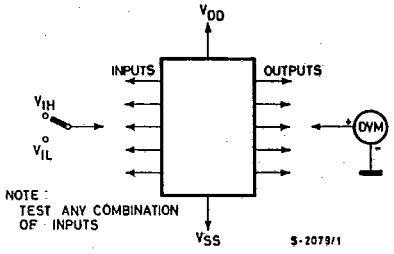
Parameter		Test conditions	Values			Unit
		V_{DD} (V)	Min.	Typ.	Max.	
t_{PHL}	Data or inhibit delay time	5		135	270	ns
		10		60	120	
		15		40	80	
t_{PLH}	Data or inhibit delay time	5		190	380	ns
		10		90	180	
		15		65	30	
t_{PHZ}	Disable delay time (output high to high impedance)	5		60	120	ns
		10		40	80	
		15		30	60	
t_{PZH}	Disable delay time (high impedance to output high)	5		110	220	ns
		10		50	100	
		15		40	80	
t_{PLZ}	Disable delay time (output low to high impedance)	5		125	250	ns
		10		65	130	
		15		55	110	
t_{PZL}	Disable delay time (high impedance to output low)	5		125	250	ns
		10		55	110	
		15		40	80	
t_{TLH}	Transition time	5		100	200	ns
		10		50	100	
		15		40	80	
t_{THL}	Transition time	5		60	120	ns
		10		30	60	
		15		20	40	

TEST CIRCUIT

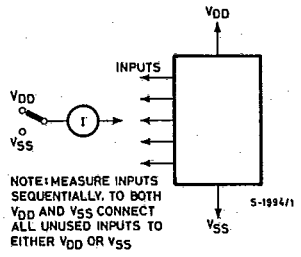
Quiescent device current



Input voltage

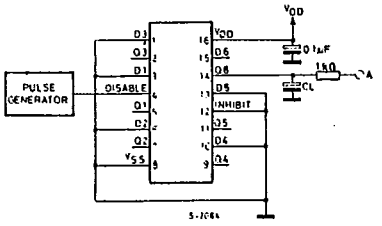


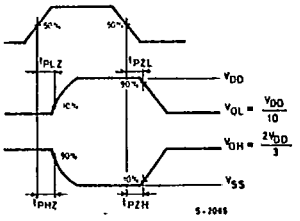
Input leakage current



Test circuit and waveforms

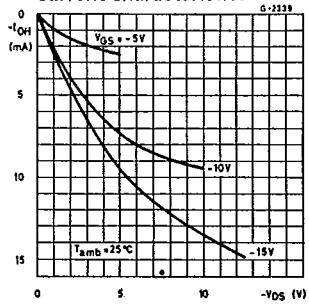
disable delay time



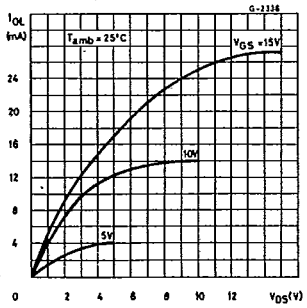


TEST CONDITION		
Test	Pin 15	Point A
t_{PHZ}	V_{SS}	V_{SS}
t_{PLZ}	V_{DD}	V_{DD}
t_{PZL}	V_{DD}	V_{DD}
t_{PZH}	V_{SS}	V_{SS}

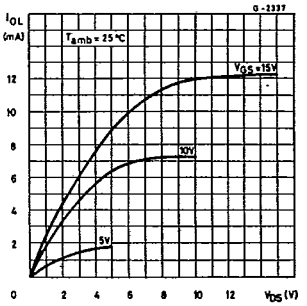
Minimum output high(source) current characteristics



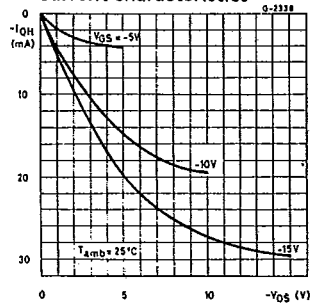
Typical output low (sink) current



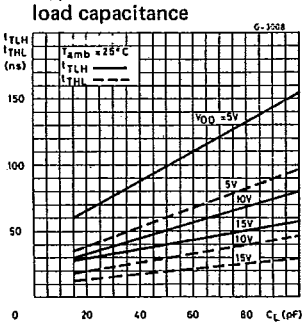
Minimum output low (sink) current characteristics



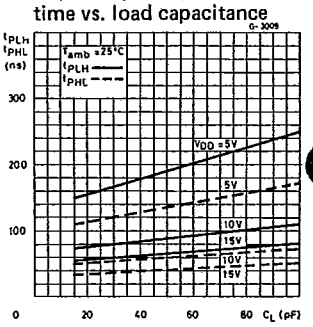
Typical output high (source) current characteristics

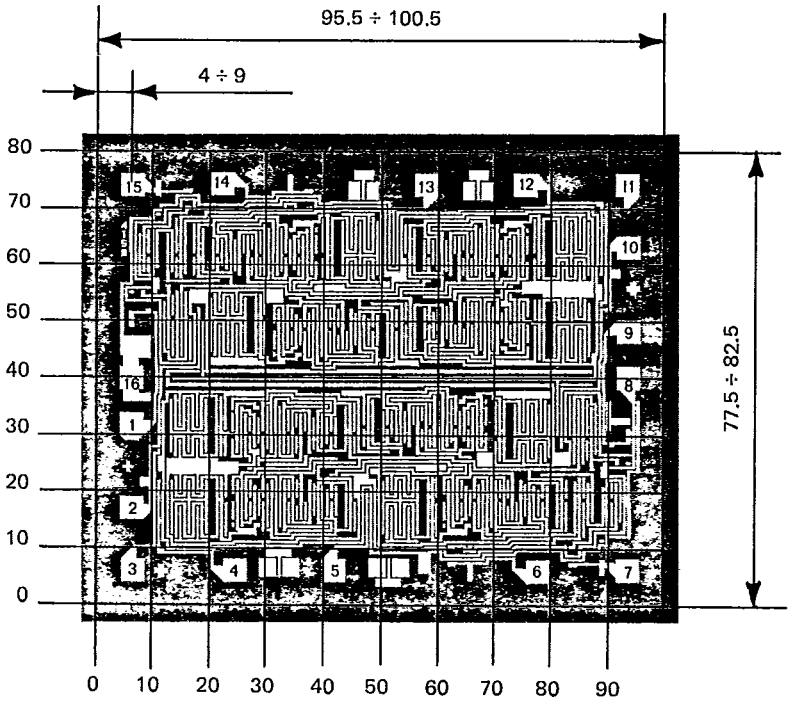


Typical transition time vs. load capacitance

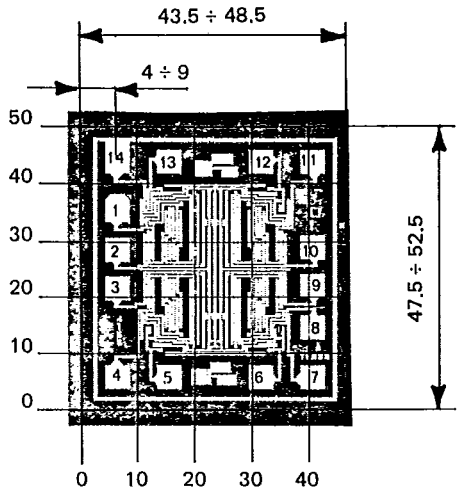


Typical propagation delay time vs. load capacitance




95.5 ÷ 100.5
4 ÷ 9
77.5 ÷ 82.5
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90
15 14 13 12 11 10 9 8 16 1 2 3 4 5 6 7

4015B


43.5 ÷ 48.5
4 ÷ 9
47.5 ÷ 52.5
50
40
30
20
10
0
0 10 20 30 40
14 13 12 11 1 2 3 10 9 8 4 5 6 7

4016B