COS/MOS INTEGRATED CIRCUITS

4555 B
4556 B

DUAL BINARY TO 1 OF 4 DECODER/DEMULTIPLEXERS:

4555B OUTPUTS HIGH ON SELECT
4556B OUTPUTS LOW ON SELECT

- EXPANDABLE WITH MULTIPLE PACKAGES
- STANDARD, SYMMETRICAL OUTPUT CHARACTERISTICS
- 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 4555B**, **HCC 4556B** (extended temperature range) and the **HCF 4555B**, **HCF 4556B** (intermediate temperature range) are monolithic integrated circuits available in 16-lead dual in-line plastic or ceramic package, ceramic flat package and plastic micropackage.
The **HCC/HCF 4555B** and **HCC/HCF 4556B** are dual one-of-four decoders/demultiplexers. Each decoder has two select inputs (A and B), an Enable input ($\overline{E}$), and four mutually exclusive outputs. On the **HCC/HCF 4555B** the outputs are high on select; on the **HCC/HCF 4556B** the outputs are low on select. When the Enable input is high, the outputs of the **HCC/HCF 4555B** remain low and the outputs of the **HCC/HCF 4556B** remain high regardless of the state of the select inputs A and B.

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:
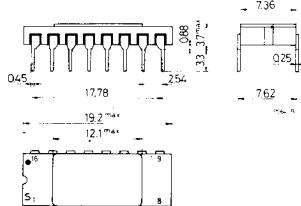
HCC 4XXX BD   for dual in-line ceramic package
HCC 4XXX BF   for dual in-line ceramic package, frit seal
HCC 4XXX BK   for ceramic flat package
HCF 4XXX BE   for dual in-line plastic package
HCF 4XXX BF   for dual in-line ceramic package, frit seal
HCF 4XXX BM   for plastic micropackage
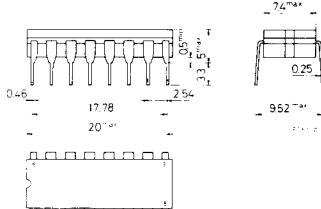
HCC/HCF 4555B
HCC/HCF 4556B

MECHANICAL DATA (dimensions in mm)
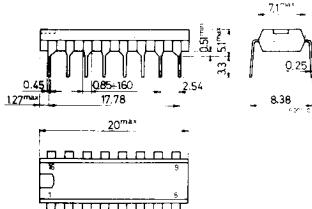
Dual in-line ceramic package
for HCC 45XX BD
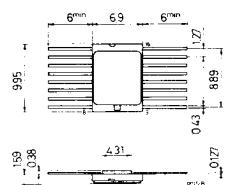
Dual in-line ceramic package
for HCC/HCF 45XX BF
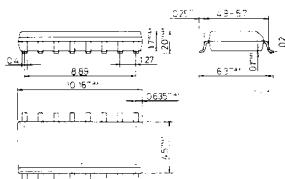
Dual in-line plastic package
for HCF 45XX BE

Ceramic flat package for
HCC 45XX BK
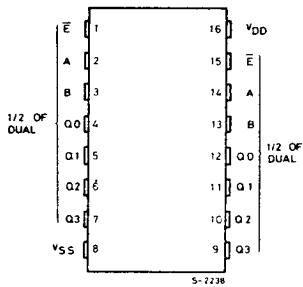
Plastic micropackage for
HCF 45XX BM
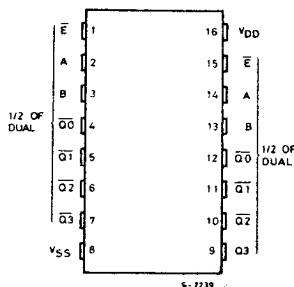
CONNECTION DIAGRAMS

For **4555B**
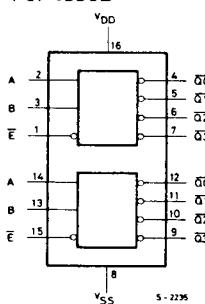
```
       ___
  Ē  [| 1      16 |]  VDD
  A  [| 2      15 |]  Ē
  B  [| 3      14 |]  A
 Q0  [| 4      13 |]  B
 Q1  [| 5      12 |]  Q0
 Q2  [| 6      11 |]  Q1
 Q3  [| 7      10 |]  Q2
 VSS [| 8       9 |]  Q3
```
1/2 OF DUAL (left)   1/2 OF DUAL (right)
S-2238

For **4556B**

```
       ___
  Ē  [| 1      16 |]  VDD
  A  [| 2      15 |]  Ē
  B  [| 3      14 |]  A
 Q̄0  [| 4      13 |]  B
 Q̄1  [| 5      12 |]  Q̄0
 Q̄2  [| 6      11 |]  Q̄1
 Q̄3  [| 7      10 |]  Q̄2
 VSS [| 8       9 |]  Q̄3
```
1/2 OF DUAL (left)   1/2 OF DUAL (right)
S-2239

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

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FUNCTIONAL DIAGRAMS

For 4555B
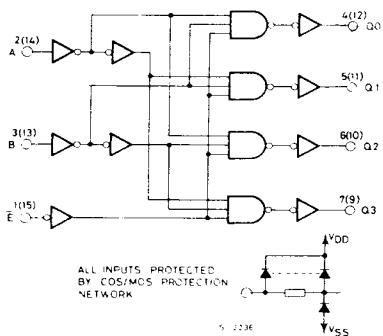
For 4556B

LOGIC DIAGRAMS

For 4555B

For 4556B

ALL INPUTS PROTECTED
BY COS/MOS PROTECTION
NETWORK

ALL INPUTS PROTECTED
BY COS/MOS PROTECTION
NETWORK
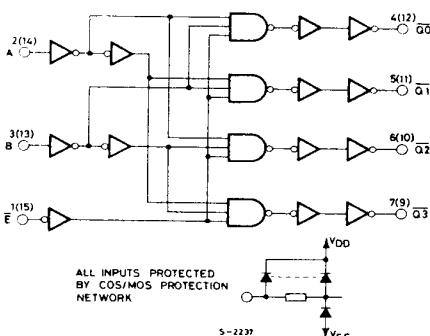
TRUTH TABLE

INPUTS			OUTPUTS 4555B				OUTPUTS 4556B			
ENABLE	SELECT									
$\overline{E}$	B	A	Q3	Q2	Q1	Q0	$\overline{Q3}$	$\overline{Q2}$	$\overline{Q1}$	$\overline{Q0}$
0	0	0	0	0	0	1	1	1	1	0
0	0	1	0	0	1	0	1	1	0	1
0	1	0	0	1	0	0	1	0	1	1
0	1	1	1	0	0	0	0	1	1	1
1	X	X	0	0	0	0	1	1	1	1

X = DON'T CARE

LOGIC 1 ≡ HIGH
LOGIC 0 ≡ LOW

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	
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	μA
		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		
			0/10		< 1	10	9.95		9.95			9.95		V
			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	
			10/0		< 1	10		0.05			0.05		0.05	V
			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		
				1/9	< 1	10	7		7			7		V
				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	
				9/1	< 1	10		3			3		3	V
				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		
			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		mA
			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	0.64		0.51	1		0.36		
			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		mA
			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
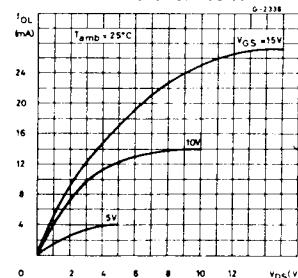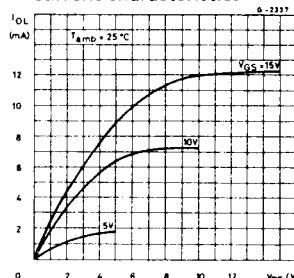
DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50 pF, R_L = 200 kΩ,
typical temperature coefficient for all V_{DD} values is 0,3%/°C, all input rise and fall times = 20 ns)

Parameter		Test conditions	Values			Unit
		V_{DD} (V)	Min.	Typ.	Max.	
t_{PLH}, t_{PHL}	Propagation delay time (A or B input to Any Output)	5		220	440	
		10		95	190	ns
		15		70	140	
t_{PLH}, t_{PHL}	Propagation delay time ($\overline{E}$ input to Any Output)	5		200	400	
		10		85	170	ns
		15		65	130	
t_{TLH}, t_{THL}	Transition time	5		100	200	
		10		50	100	ns
		15		40	80	
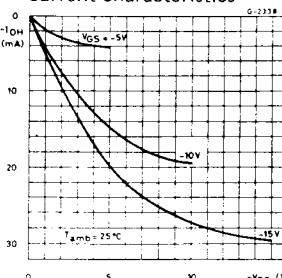
Typical output low (sink) current characteristics
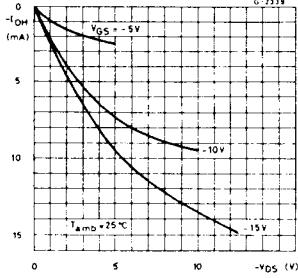
Minimum output low (sink) current characteristics
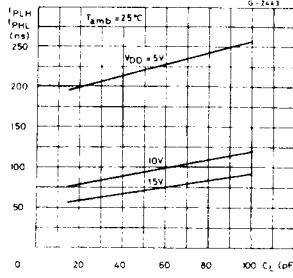
Typical output high (source) current characteristics
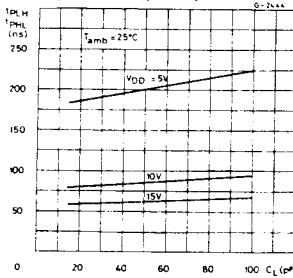
Minimum output high (source) current characteristics

Typical propagation delay time vs. load capacitance (A or B input to any output)
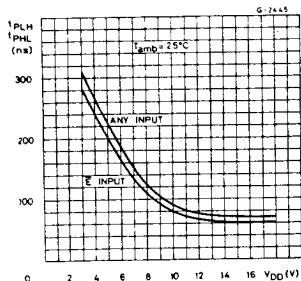
Typical propagation delay time vs. load capacitance ($\overline{E}$ input to any output)

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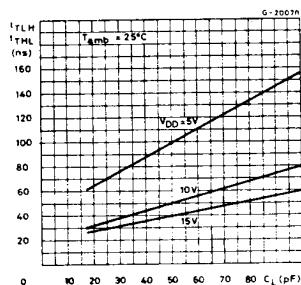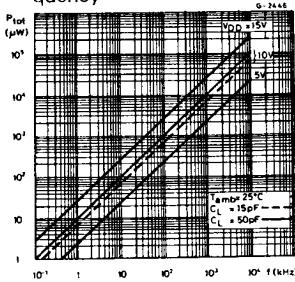
Typical propagation delay time vs. supply voltage

Typical transition time vs. load capacitance
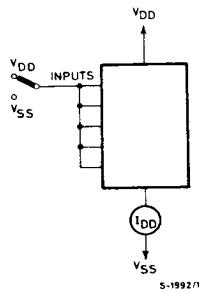
Typical dynamic power dissipation/per device vs. frequency
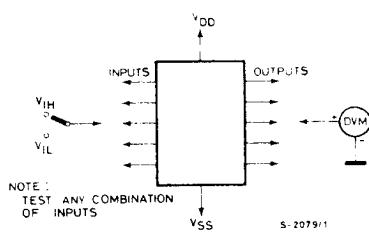

TEST CIRCUITS
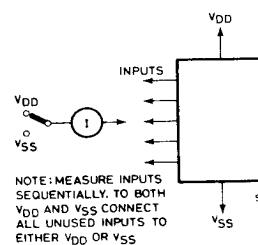
Quiescent device current

Noise immunity

Input leakage current

NOTE : TEST ANY COMBINATION OF INPUTS

NOTE: MEASURE INPUTS SEQUENTIALLY. TO BOTH V_{DD} AND V_{SS} CONNECT ALL UNUSED INPUTS TO EITHER V_{DD} OR V_{SS}
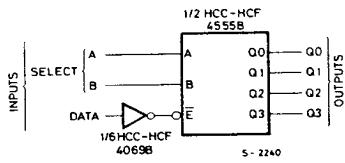
APPLICATIONS

1 of 4 line data demultiplexer using HCC/HCF 4555B
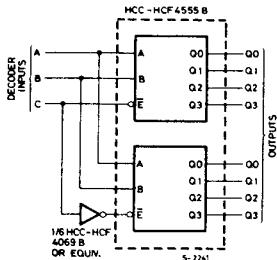
Truth table
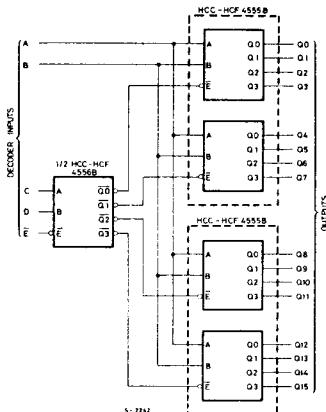
SELECT INPUTS		OUTPUTS			
B	A	Q0	Q1	Q2	Q3
0	0	DATA	0	0	0
0	1	0	DATA	0	0
1	0	0	0	DATA	0
1	1	0	0	0	DATA

APPLICATIONS (continued)
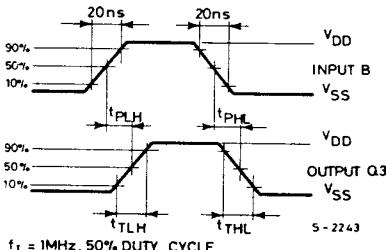
1 of 8 decoder using HCC/HCF 4555B

1 of 16 decoder using HCC/HCF 4555B and HCC/HCF 4556B

Truth table

INPUTS			Q OUTPUTS							
C	B	A	0	1	2	3	4	5	6	7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1

Truth table

| INPUTS					Q OUTPUTS															
E	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

X = don't care

HCC/HCF 4555B input to Q3 output dynamic signal waveforms

$f_I = 1MHz$, 50% DUTY CYCLE

### HCC/HCF 4556B input to $\overline{Q3}$ output dynamic signal waveforms

$f_I = 1MHz$, 50% DUTY CYCLE

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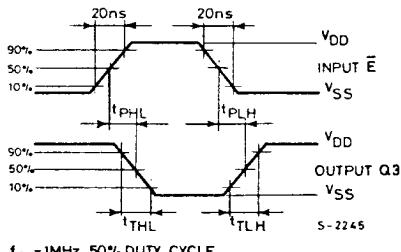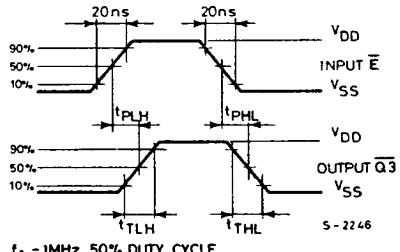
APPLICATIONS (continued)

HCC/HCF 4555B $\overline{E}$ input to Q3
output dynamic signal waveforms

f_I = 1MHz, 50% DUTY CYCLE

HCC/HCF 4556B $\overline{E}$ input to $\overline{Q3}$
output dynamic signal waveforms

f_I = 1MHz, 50% DUTY CYCLE