

INTEGRATED CIRCUITS

DATA SHEET

For a complete data sheet, please also download:

- The IC04 LOCMOS HE4000B Logic Family Specifications HEF, HEC
- The IC04 LOCMOS HE4000B Logic Package Outlines/Information HEF, HEC

HEF4067B

MSI

16-channel analogue multiplexer/demultiplexer

Product specification
File under Integrated Circuits, IC04

January 1995

16-channel analogue multiplexer/demultiplexer

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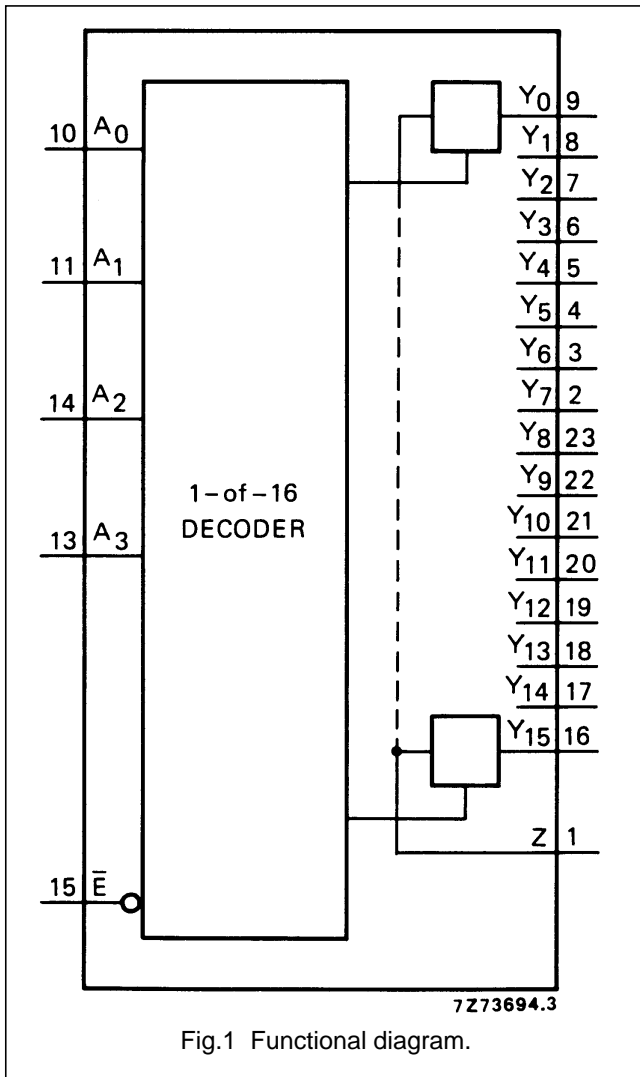
DESCRIPTION

The HEF4067B is a 16-channel analogue multiplexer/demultiplexer with four address inputs (A_0 to A_3), an active LOW enable input (\bar{E}), sixteen independent inputs/outputs (Y_0 to Y_{15}) and a common input/output (Z).

The device contains sixteen bidirectional analogue switches, each with one side connected to an independent input/output (Y_0 to Y_{15}) and the other side connected to the common input/output (Z).

With \bar{E} LOW, one of the sixteen switches is selected (low impedance ON-state) by A_0 to A_3 . All unselected switches are in the high impedance OFF-state. With \bar{E} HIGH all switches are in the high impedance OFF-state, independent of A_0 to A_3 .

The analogue inputs/outputs (Y_0 to Y_{15} and Z) can swing between V_{DD} as a positive limit and V_{SS} as a negative limit. V_{DD} to V_{SS} may not exceed 15 V.



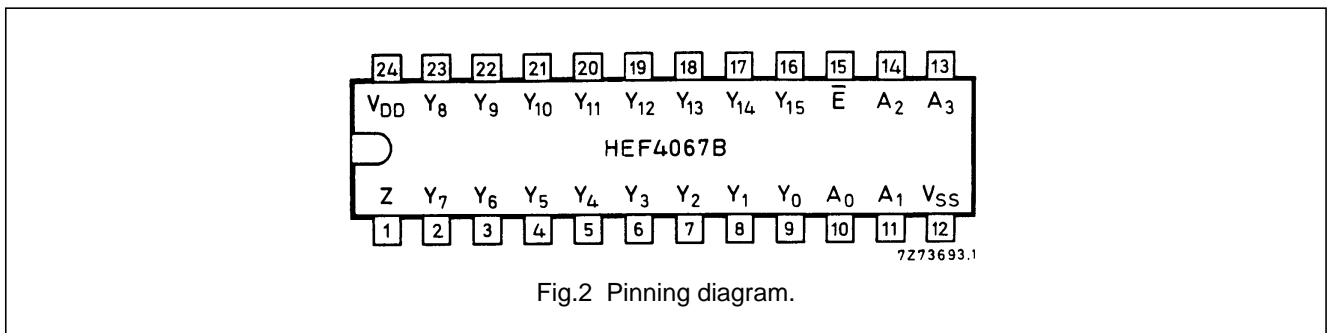
FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

- HEF4067BP(N): 24-lead DIL; plastic (SOT101-1)
 - HEF4067BD(F): 24-lead DIL; ceramic (cerdip) (SOT94)
 - HEF4067BT(D): 24-lead SO; plastic (SOT137-1)
- (): Package Designator North America

PINNING

- Y_0 to Y_{15} independent inputs/outputs
- A_0 to A_3 address inputs
- \bar{E} enable input (active LOW)
- Z common input/output



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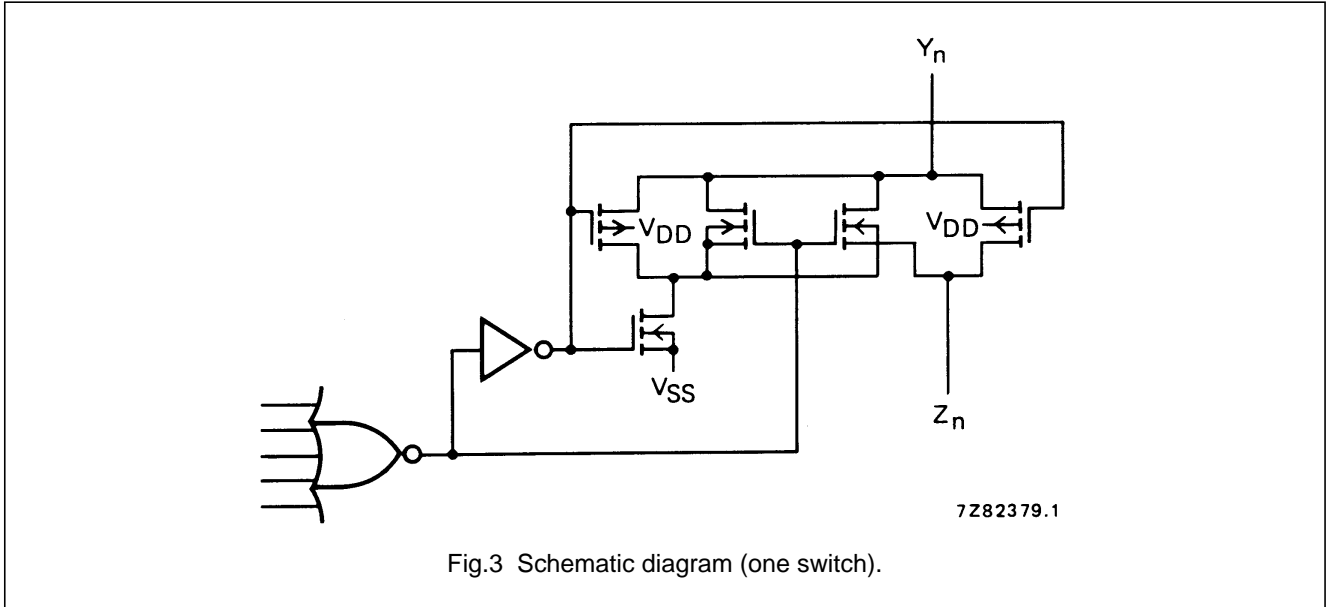


Fig.3 Schematic diagram (one switch).

FUNCTION TABLE

INPUTS					CHANNEL ON
\bar{E}	A ₃	A ₂	A ₁	A ₀	
L	L	L	L	L	Y ₀ - Z
L	L	L	L	H	Y ₁ - Z
L	L	L	H	L	Y ₂ - Z
L	L	L	H	H	Y ₃ - Z
L	L	H	L	L	Y ₄ - Z
L	L	H	L	H	Y ₅ - Z
L	L	H	H	L	Y ₆ - Z
L	L	H	H	H	Y ₇ - Z
L	H	L	L	L	Y ₈ - Z
L	H	L	L	H	Y ₉ - Z
L	H	L	H	L	Y ₁₀ - Z
L	H	L	H	H	Y ₁₁ - Z
L	H	H	L	L	Y ₁₂ - Z
L	H	H	L	H	Y ₁₃ - Z
L	H	H	H	L	Y ₁₄ - Z
L	H	H	H	H	Y ₁₅ - Z
H	X	X	X	X	none

Note

- H = HIGH state (the more positive voltage)
L = LOW state (the less positive voltage)
X = state is immaterial

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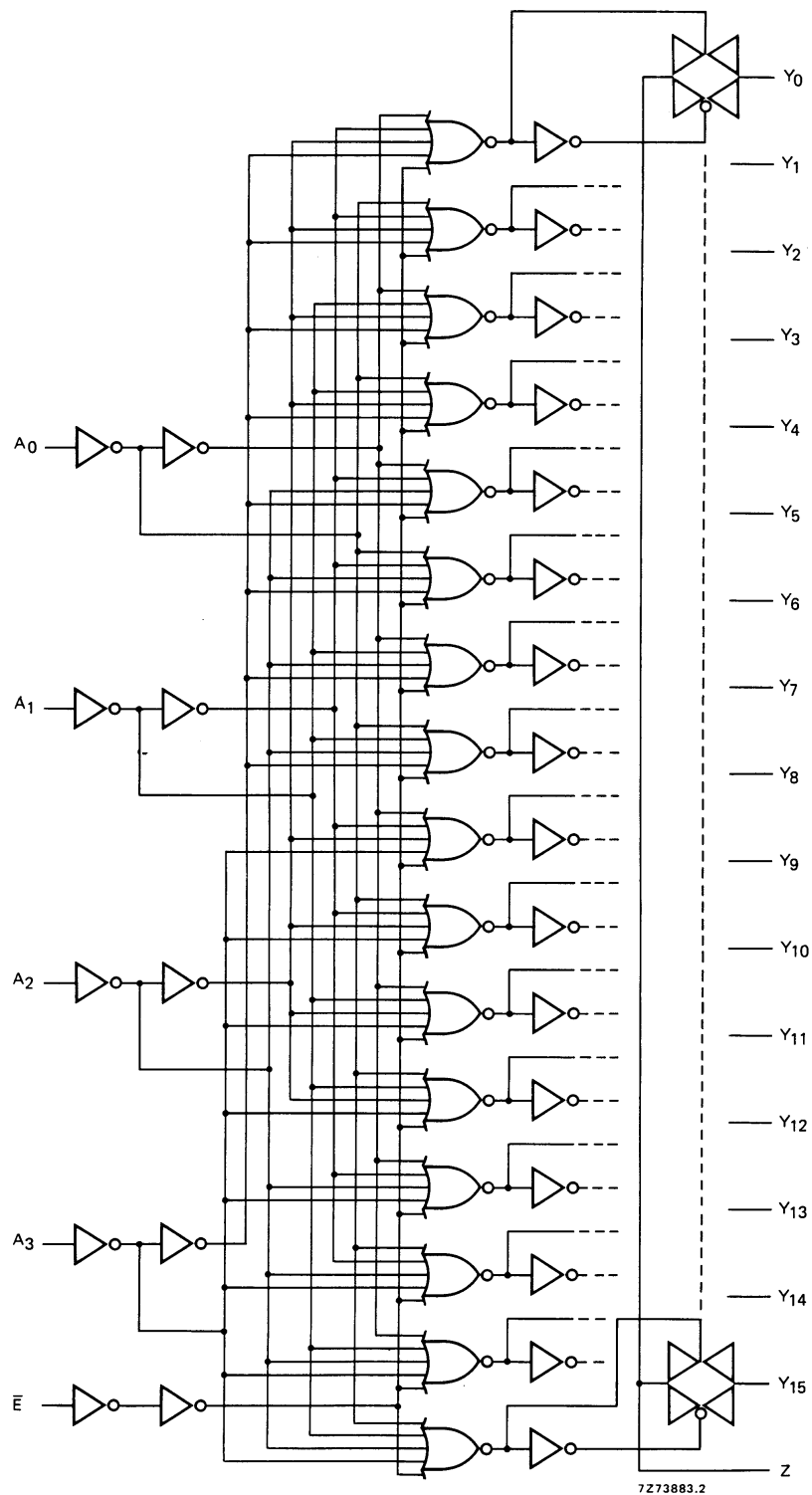


Fig.4 Logic diagram.

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DC CHARACTERISTICS

T_{amb} = 25 °C

	V _{DD} V	SYMBOL	TYP.	MAX.		CONDITIONS
ON resistance	5	R _{ON}	350	2500	Ω	V _{is} = V _{SS} to V _{DD} see Fig.5
	10		80	245	Ω	
	15		60	175	Ω	
ON resistance	5	R _{ON}	115	340	Ω	V _{is} = V _{SS} see Fig.5
	10		50	160	Ω	
	15		40	115	Ω	
ON resistance	5	R _{ON}	120	365	Ω	V _{is} = V _{DD} see Fig.5
	10		65	200	Ω	
	15		50	155	Ω	
'Δ' ON resistance between any two channels	5	ΔR _{ON}	25	–	Ω	V _{is} = V _{SS} to V _{DD} see Fig.5
	10		10	–	Ω	
	15		5	–	Ω	
OFF-state leakage current, all channels OFF	5	I _{OZZ}	–	–	nA	E̅ at V _{DD}
	10		–	–	nA	
	15		–	1000	nA	
OFF-state leakage current, any channel	5	I _{OZY}	–	–	nA	E̅ at V _{SS}
	10		–	–	nA	
	15		–	200	nA	

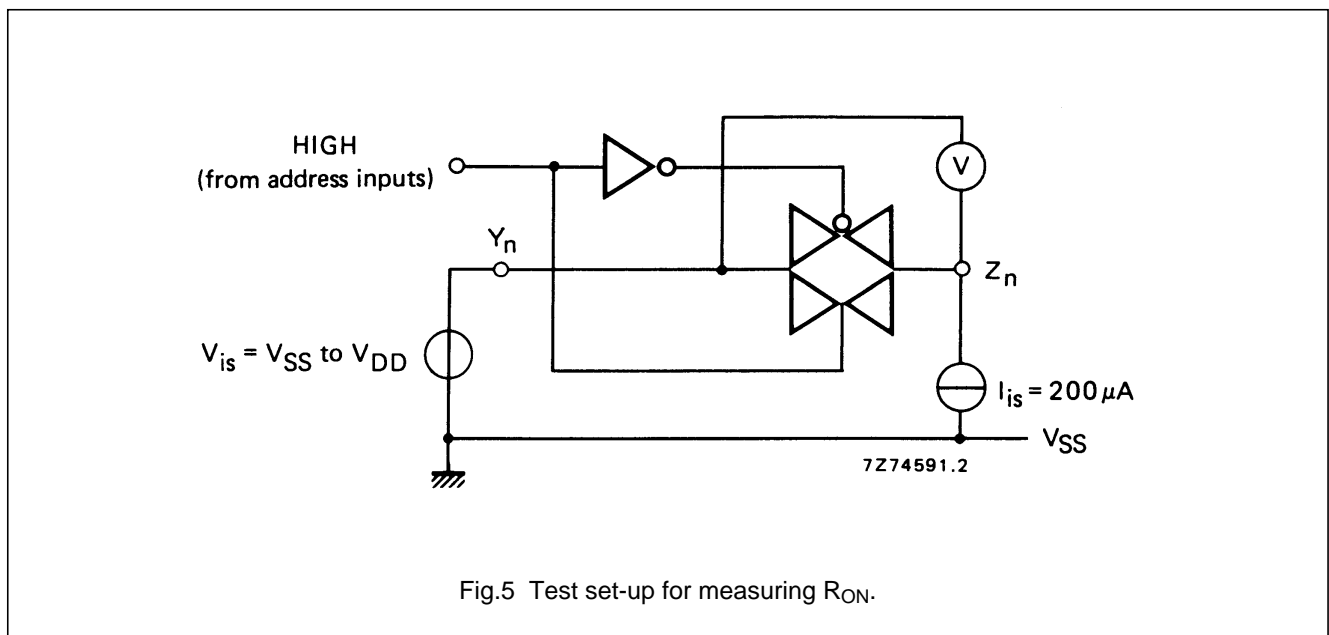
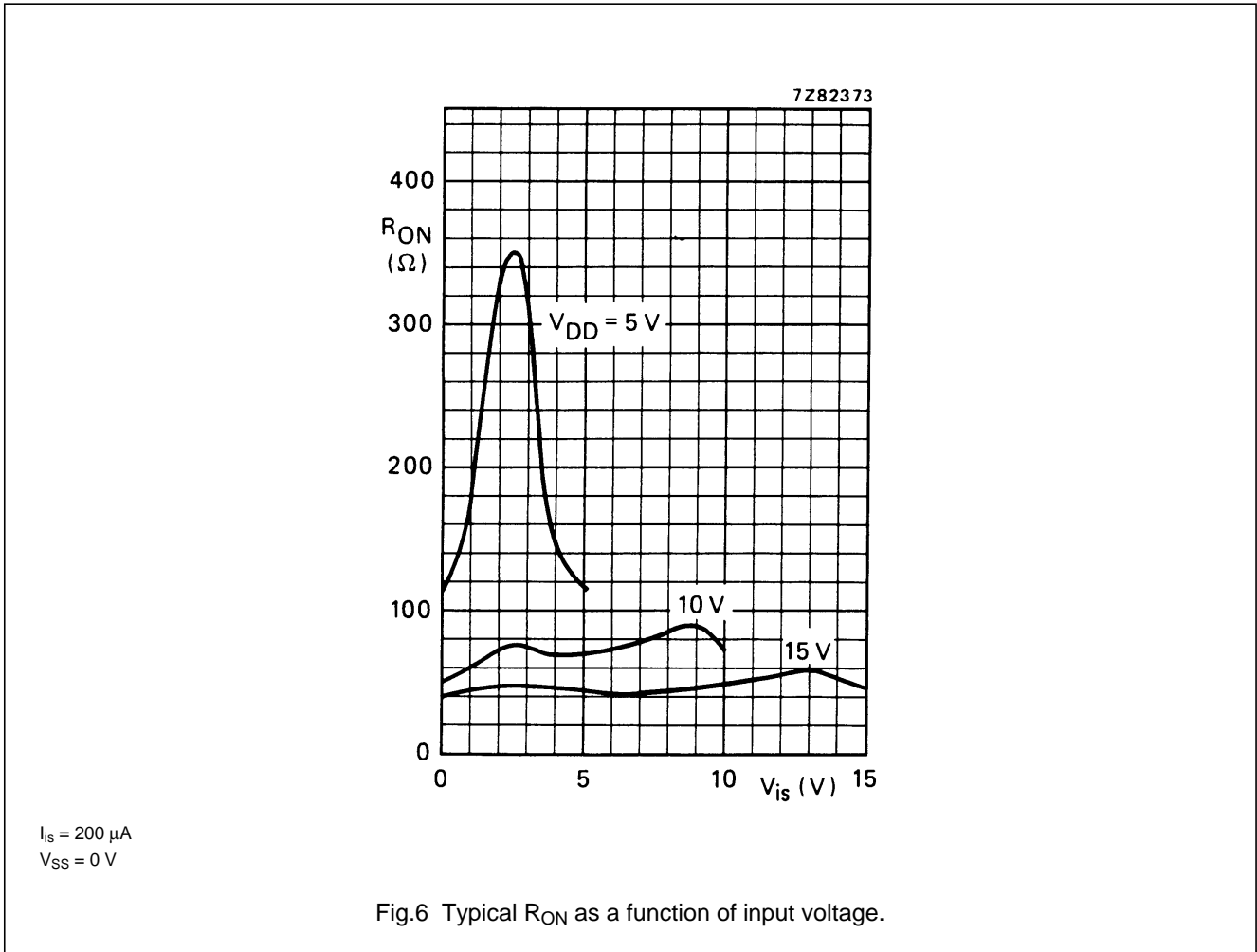


Fig.5 Test set-up for measuring R_{ON}.

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NOTE

To avoid drawing V_{DD} current out of terminal Z, when switch current flows into terminals Y, the voltage drop across the bidirectional switch must not exceed 0,4 V. If the switch current flows into terminal Z, no V_{DD} current will flow out of terminals Y, in this case there is no limit for the voltage drop across the switch, but the voltages at Y and Z may not exceed V_{DD} or V_{SS} .

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AC CHARACTERISTICS

$V_{SS} = 0\text{ V}$; $T_{amb} = 25\text{ °C}$; input transition times $\leq 20\text{ ns}$

	V_{DD} V	TYPICAL FORMULA FOR P (μW)	
Dynamic power dissipation per package (P)	5	$1\ 100\ f_i + \sum (f_o C_L) \times V_{DD}^2$	where f_i = input freq. (MHz) f_o = output freq. (MHz) C_L = load capacitance (pF) $\sum (f_o C_L)$ = sum of outputs V_{DD} = supply voltage (V)
	10	$5\ 000\ f_i + \sum (f_o C_L) \times V_{DD}^2$	
	15	$13\ 300\ f_i + \sum (f_o C_L) \times V_{DD}^2$	

AC CHARACTERISTICS ^{(1), (2)}

$V_{SS} = 0\text{ V}$; $T_{amb} = 25\text{ °C}$; input transition times $\leq 20\text{ ns}$

	V_{DD} V	SYMBOL	TYP.	MAX.			
Propagation delays $V_{is} \rightarrow V_{os}$ HIGH to LOW	5	t_{PHL}	30	60	ns	note 3	
	10		15	25	ns		
	15		10	20	ns		
	LOW to HIGH	5	t_{PLH}	25	50	ns	note 3
		10		10	20	ns	
		15		10	20	ns	
$A_n \rightarrow V_{os}$ HIGH to LOW	5	t_{PHL}	190	380	ns	note 4	
	10		70	145	ns		
	15		50	100	ns		
	LOW to HIGH	5	t_{PLH}	175	345	ns	note 4
		10		70	140	ns	
		15		50	100	ns	
Output disable times $\bar{E} \rightarrow V_{os}$ HIGH	5	t_{PHZ}	195	385	ns	note 5	
	10		140	280	ns		
	15		130	260	ns		
	LOW	5	t_{PLZ}	215	435	ns	note 5
		10		180	355	ns	
		15		170	340	ns	
Output enable times $\bar{E} \rightarrow V_{os}$ HIGH	5	t_{PZH}	155	315	ns	note 5	
	10		70	135	ns		
	15		50	100	ns		
	LOW	5	t_{PZL}	170	340	ns	note 5
		10		70	140	ns	
		15		50	100	ns	

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AC CHARACTERISTICS

$V_{SS} = 0$ V; $T_{amb} = 25$ °C; input transition times ≤ 20 ns

	V_{DD} V	SYMBOL	TYP.	MAX.	
Distortion, sine-wave response	5		0,25	%	note 6
	10		0,04	%	
	15		0,04	%	
Crosstalk between any two channels	5		–	MHz	note 7
	10		1	MHz	
	15		–	MHz	
Crosstalk; enable or address input to output	5		–	mV	note 8
	10		50	mV	
	15		–	mV	
OFF-state feed-through	5		–	MHz	note 9
	10		1	MHz	
	15		–	MHz	
ON-state frequency response	5		13	MHz	note 10
	10		40	MHz	
	15		70	MHz	

Notes

- V_{is} is the input voltage at a Y or Z terminal, whichever is assigned as input.
- V_{os} is the output voltage at a Y or Z terminal, whichever is assigned as output.
- $R_L = 10$ k Ω to V_{SS} ; $C_L = 50$ pF to V_{SS} ; $\bar{E} = V_{SS}$; $V_{is} = V_{DD}$ (square-wave); see Fig.7.
- $R_L = 10$ k Ω ; $C_L = 50$ pF to V_{SS} ; $\bar{E} = V_{SS}$; $A_n = V_{DD}$ (square-wave); $V_{is} = V_{DD}$ and R_L to V_{SS} for t_{PLH} ; $V_{is} = V_{SS}$ and R_L to V_{DD} for t_{PHL} ; see Fig.7.
- $R_L = 10$ k Ω ; $C_L = 50$ pF to V_{SS} ; $\bar{E} = V_{DD}$ (square-wave);
 $V_{is} = V_{DD}$ and R_L to V_{SS} for t_{PHZ} and t_{PZH} ;
 $V_{is} = V_{SS}$ and R_L to V_{DD} for t_{PLZ} and t_{PZL} ; see Fig.7.
- $R_L = 10$ k Ω ; $C_L = 15$ pF; channel ON; $V_{is} = \frac{1}{2} V_{DD(p-p)}$ (sine-wave, symmetrical about $\frac{1}{2} V_{DD}$);
 $f_{is} = 1$ kHz; see Fig.8.
- $R_L = 1$ k Ω ; $V_{is} = \frac{1}{2} V_{DD(p-p)}$ (sine-wave, symmetrical about $\frac{1}{2} V_{DD}$);

$$20 \log \frac{V_{os}}{V_{is}} = -50 \text{ dB; see Fig.9.}$$

- $R_L = 10$ k Ω to V_{SS} ; $C_L = 15$ pF to V_{SS} ; \bar{E} or $A_n = V_{DD}$ (square-wave); crosstalk is $|V_{os}|$ (peak value); see Fig.7.

- $R_L = 1$ k Ω ; $C_L = 5$ pF; channel OFF; $V_{is} = \frac{1}{2} V_{DD(p-p)}$ (sine-wave, symmetrical about $\frac{1}{2} V_{DD}$);

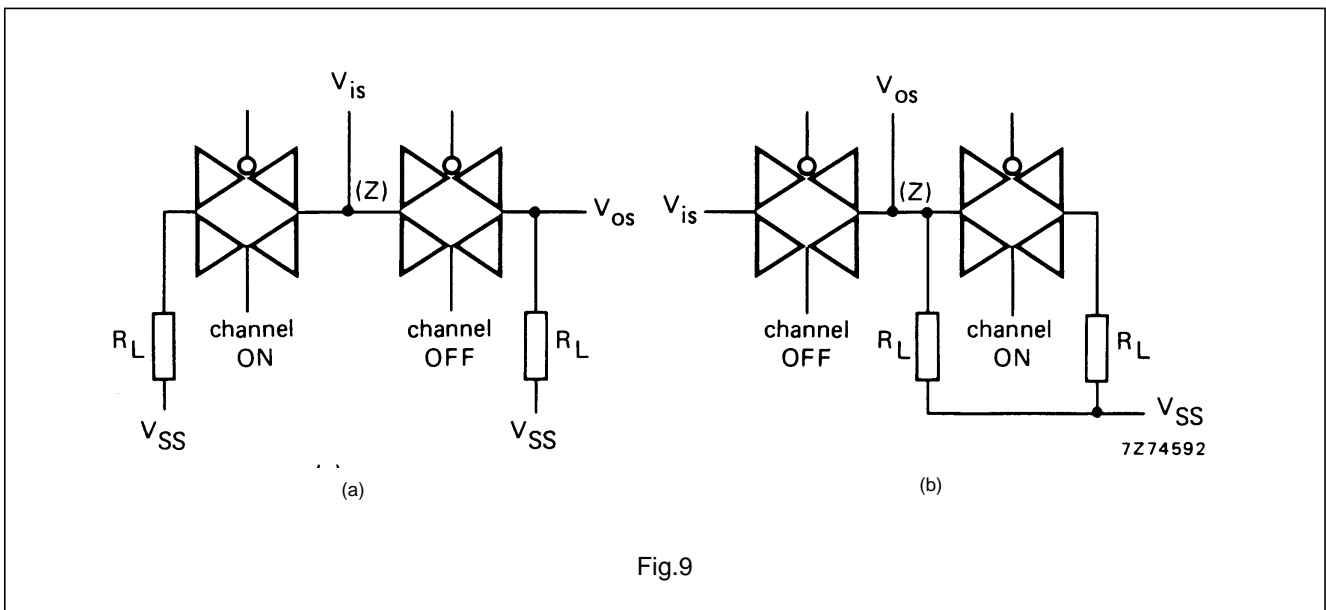
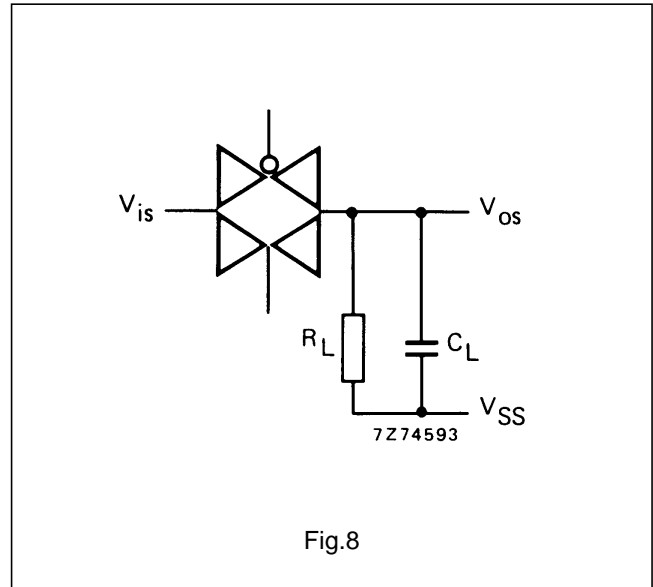
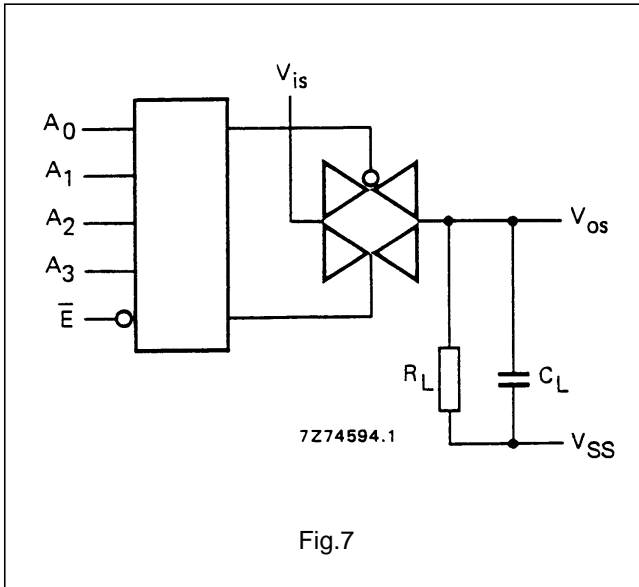
$$20 \log \frac{V_{os}}{V_{is}} = -50 \text{ dB; see Fig.8.}$$

- $R_L = 1$ k Ω ; $C_L = 5$ pF; channel ON; $V_{is} = \frac{1}{2} V_{DD(p-p)}$ (sine-wave, symmetrical about $\frac{1}{2} V_{DD}$);

$$20 \log \frac{V_{os}}{V_{is}} = -3 \text{ dB; see Fig.8.}$$

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APPLICATION INFORMATION

Some examples of applications for the HEF4067B are:

- Analogue multiplexing and demultiplexing.
- Digital multiplexing and demultiplexing.
- Signal gating.

NOTE

If break before make is needed, then it is necessary to use the enable input.