

# 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

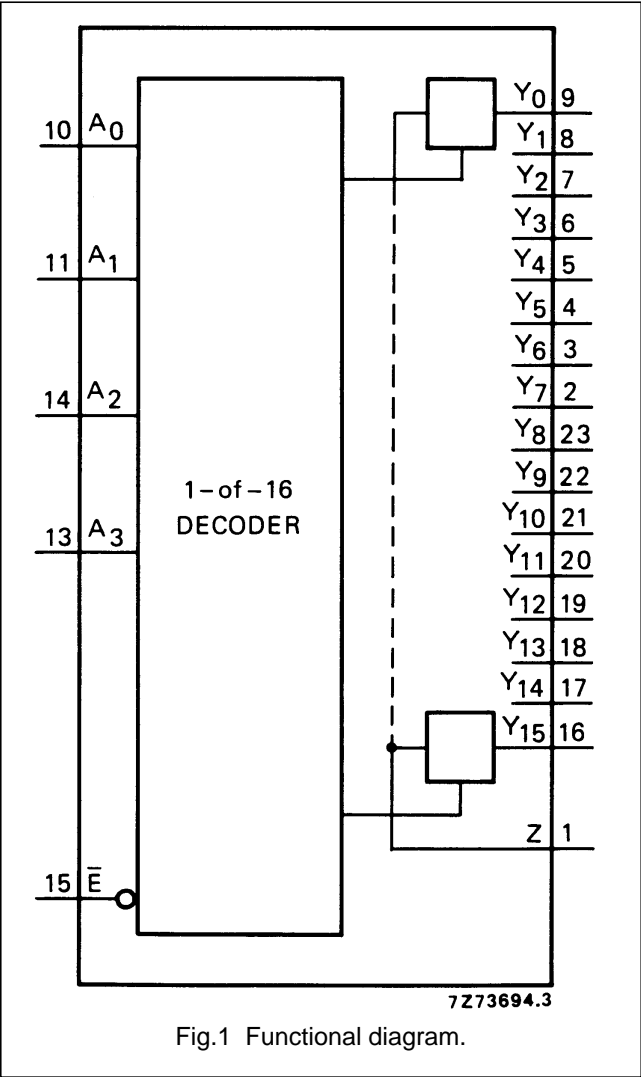
January 1995

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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.

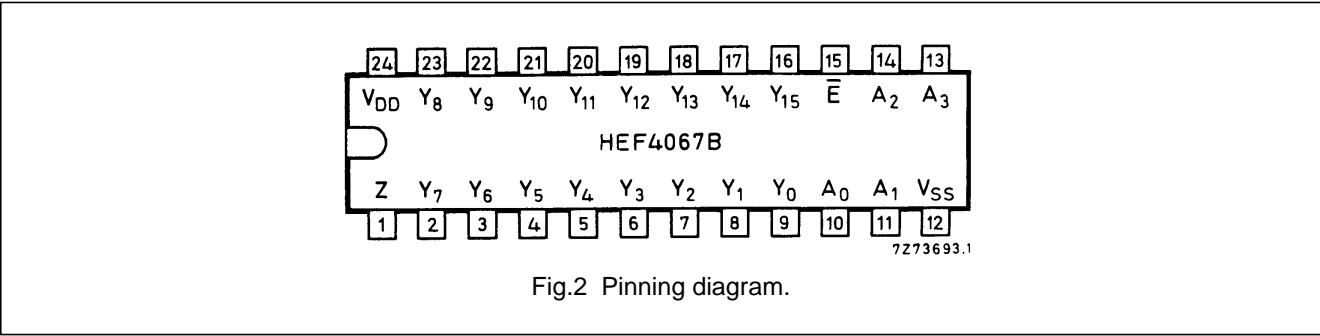
FAMILY DATA,  $I_{DD}$  LIMITS category MSI

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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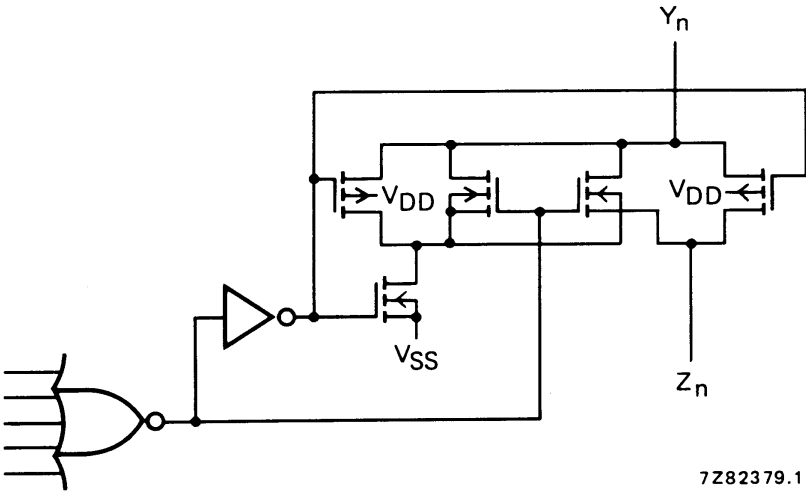


Fig.3 Schematic diagram (one switch).

FUNCTION TABLE

INPUTS					CHANNEL
$\bar{E}$	$A_3$	$A_2$	$A_1$	$A_0$	ON
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

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

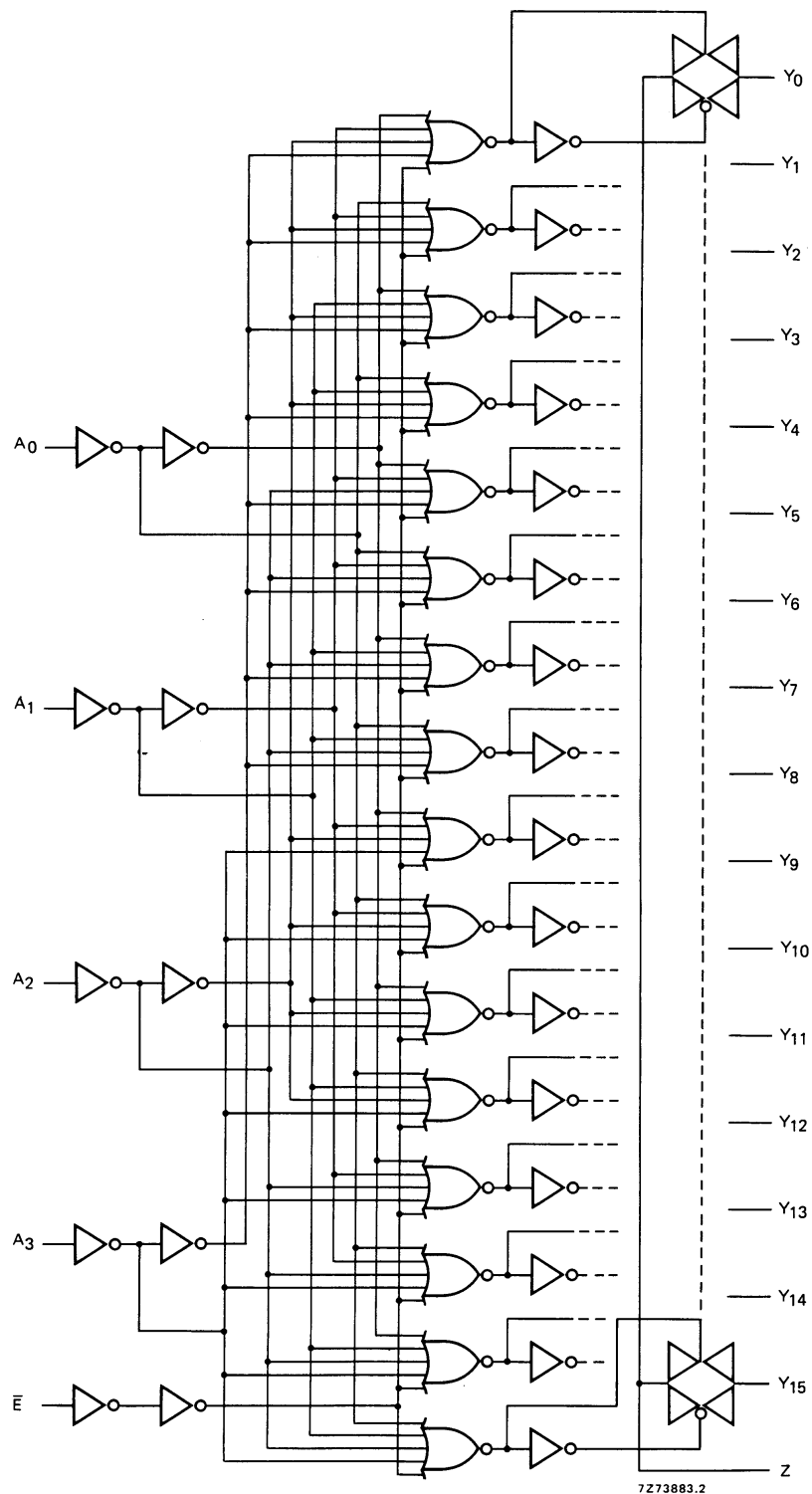
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Fig.4 Logic diagram.

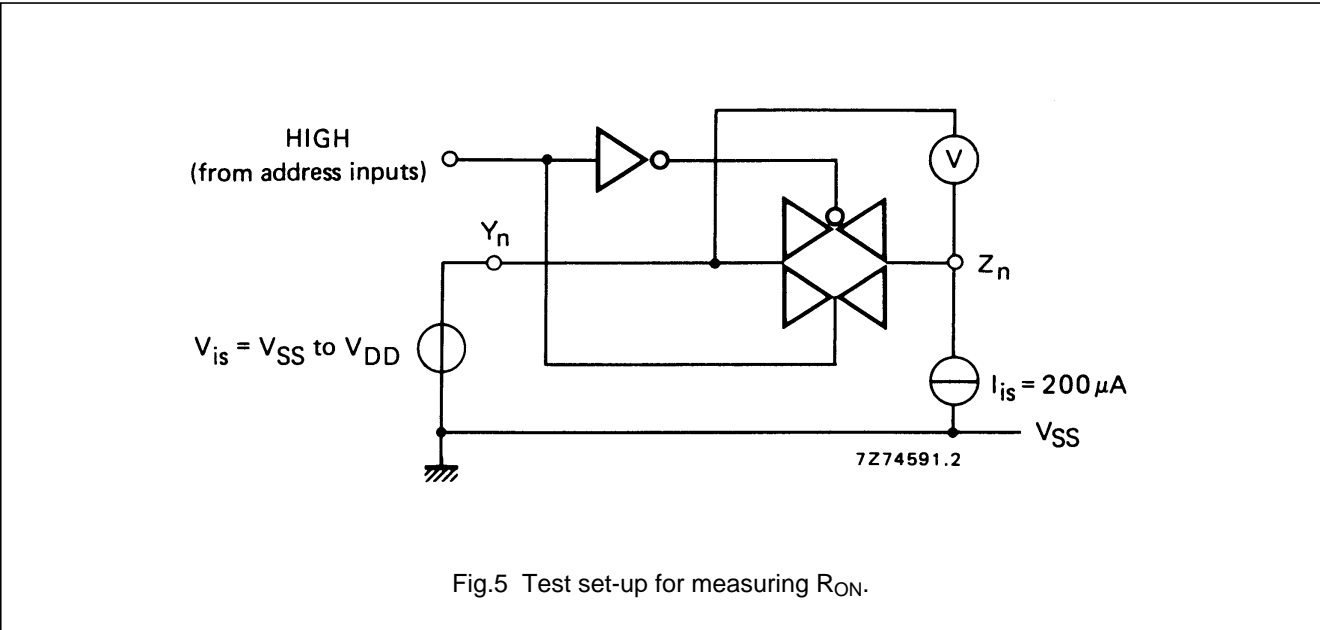
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DC CHARACTERISTICS

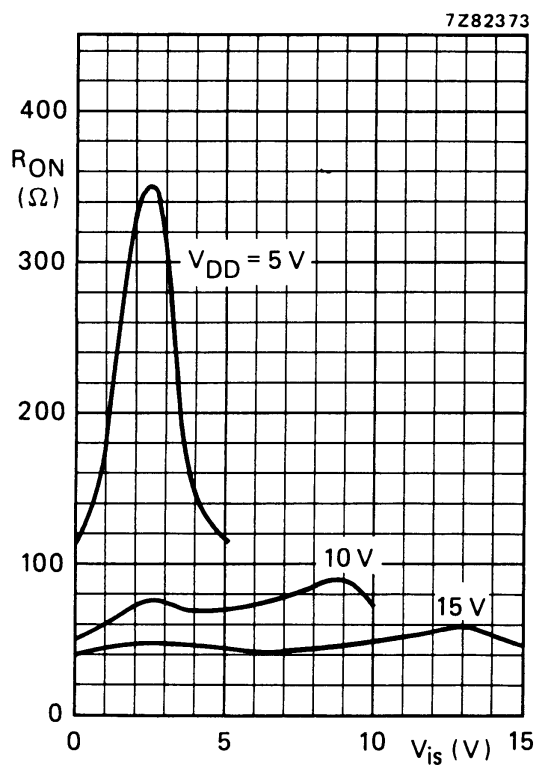
T<sub>amb</sub> = 25 °C

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



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$I_{is} = 200 \mu A$   
 $V_{SS} = 0 V$

Fig.6 Typical  $R_{ON}$  as a function of input voltage.

### 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

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

	$V_{DD}$ V	TYPICAL FORMULA FOR P ( $\mu$ W)	
Dynamic power dissipation per package (P)	5 10 15	$1\,100 f_i + \sum (f_o C_L) \times V_{DD}^2$ $5\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$ $13\,300 f_i + \sum (f_o C_L) \times V_{DD}^2$	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)

### AC CHARACTERISTICS <sup>(1), (2)</sup>

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

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

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### AC CHARACTERISTICS

$V_{SS} = 0$  V;  $T_{amb} = 25$  °C; input transition times  $\leq 20$  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 $\Omega$  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 $\Omega$ ;  $C_L = 50$  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 $\Omega$ ;  $C_L = 50$  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 $\Omega$ ;  $C_L = 15$  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 $\Omega$ ;  $V_{is} = \frac{1}{2} V_{DD(p-p)}$  (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 $\Omega$  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 $\Omega$ ;  $C_L = 5$  pF; channel OFF;  $V_{is} = \frac{1}{2} V_{DD(p-p)}$  (sine-wave, symmetrical about  $\frac{1}{2} V_{DD}$ );

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

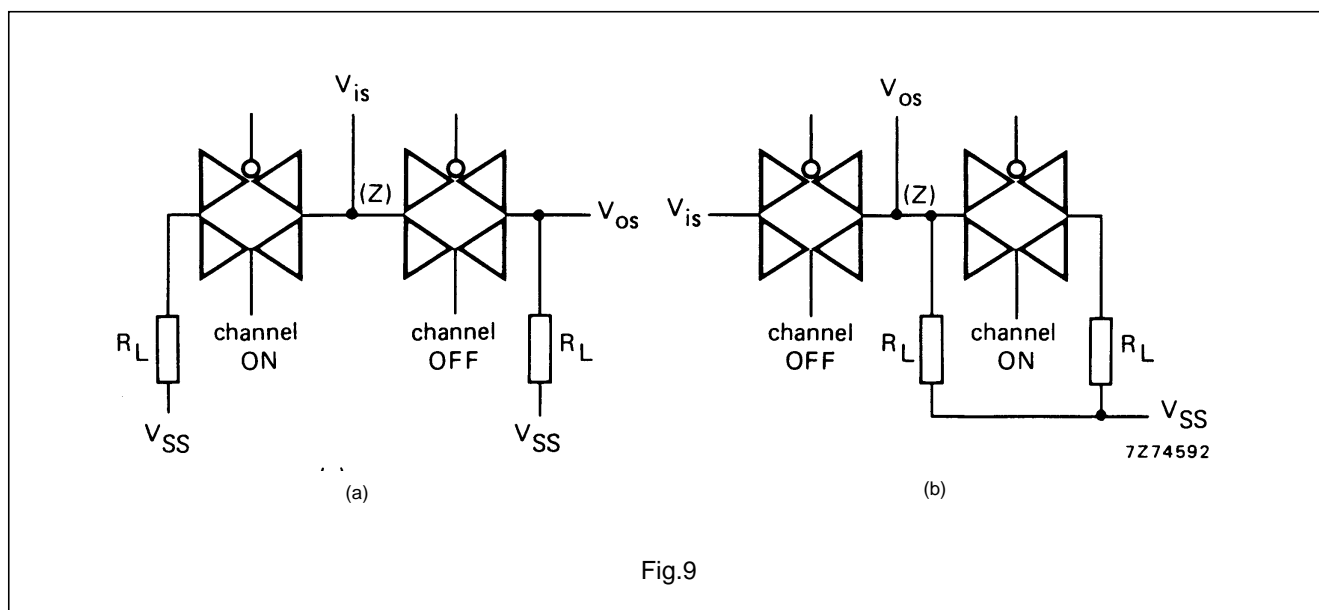
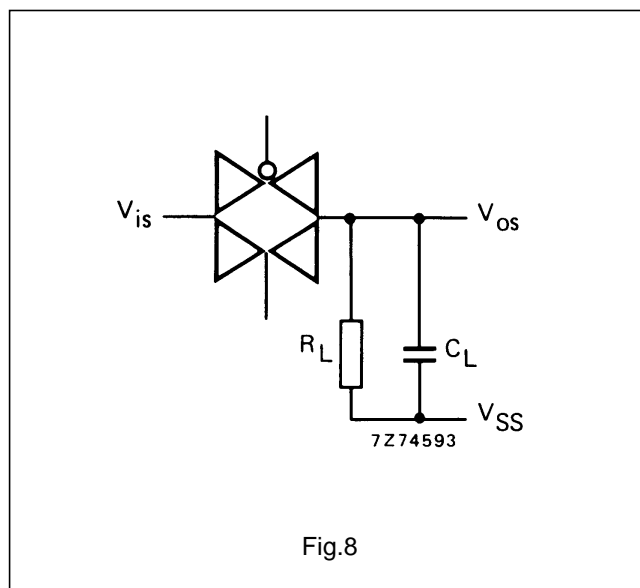
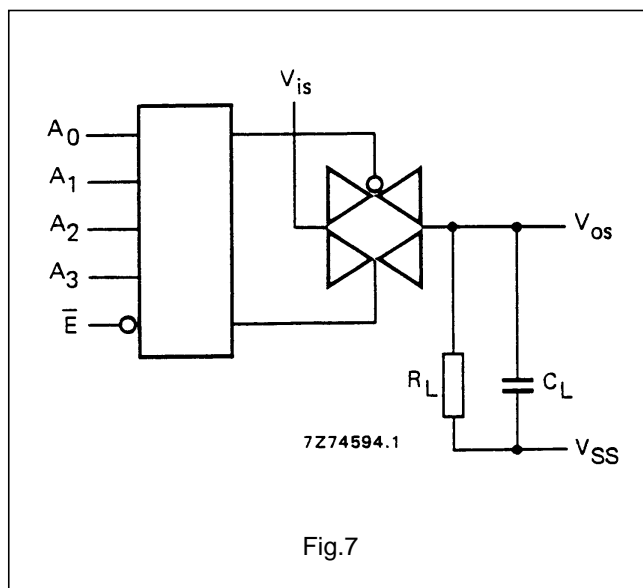
- $R_L = 1$  k $\Omega$ ;  $C_L = 5$  pF; channel ON;  $V_{is} = \frac{1}{2} V_{DD(p-p)}$  (sine-wave, symmetrical about  $\frac{1}{2} V_{DD}$ );

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



# 16-channel analogue multiplexer/demultiplexer

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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.