

DATA SHEET

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

Datasheet.Directory

HEF4052B

MSI

Dual 4-channel analogue
multiplexer/demultiplexer

Product specification
File under Integrated Circuits, IC04

January 1995

Dual 4-channel analogue multiplexer/demultiplexer

HEF4052B MSI

DESCRIPTION

The HEF4052B is a dual 4-channel analogue multiplexer/demultiplexer with common channel select logic. Each multiplexer/demultiplexer has four independent inputs/outputs (Y_0 to Y_3) and a common input/output (Z). The common channel select logic includes two address inputs (A_0 and A_1) and an active LOW enable input (\bar{E}).

Both multiplexers/demultiplexers contain four bidirectional analogue switches, each with one side connected to an independent input/output (Y_0 to Y_3) and the other side connected to a common input/output (Z).

With \bar{E} LOW, one of the four switches is selected (low impedance ON-state) by A_0 and A_1 . With \bar{E} HIGH, all switches are in the high impedance OFF-state, independent of A_0 and A_1 .

V_{DD} and V_{SS} are the supply voltage connections for the digital control inputs (A_0 , A_1 and \bar{E}). The V_{DD} to V_{SS} range is 3 to 15 V. The analogue inputs/outputs (Y_0 to Y_3 , and Z) can swing between V_{DD} as a positive limit and V_{EE} as a negative limit. $V_{DD} - V_{EE}$ may not exceed 15 V.

For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to V_{SS} (typically ground).

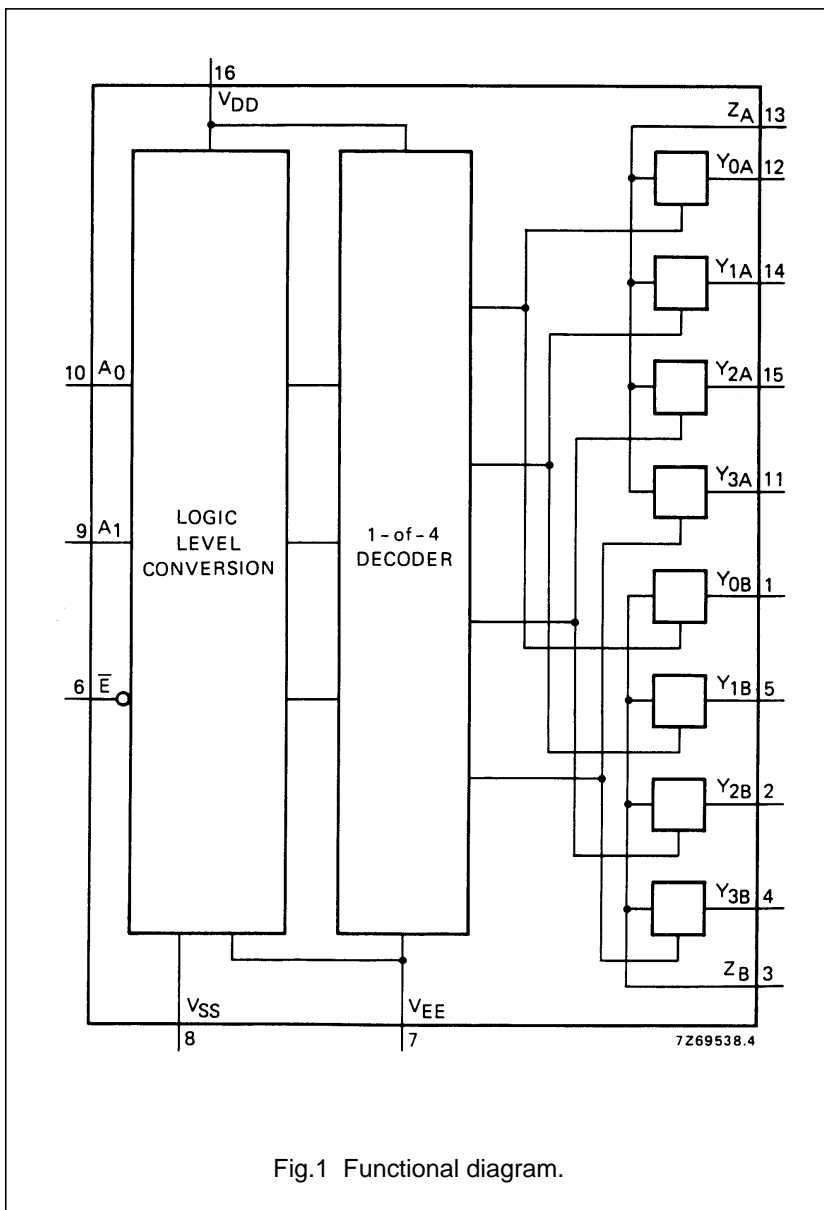


Fig.1 Functional diagram.

PINNING

- Y_{0A} to Y_{3A} independent inputs/outputs
- Y_{0B} to Y_{3B} independent inputs/outputs
- A_0 , A_1 address inputs
- \bar{E} enable input (active LOW)
- Z_A , Z_B common inputs/outputs

FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

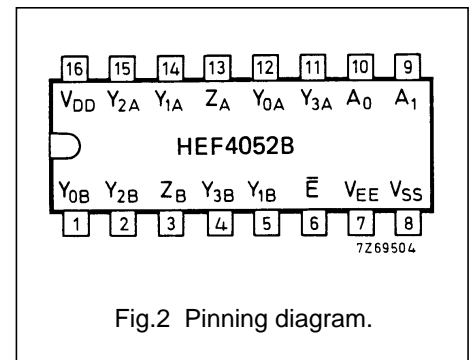


Fig.2 Pinning diagram.

- HEF4052BP(N): 16-lead DIL; plastic (SOT38-1)
 - HEF4052BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
 - HEF4052BT(D): 16-lead SO; plastic (SOT109-1)
- (): Package Designator North America

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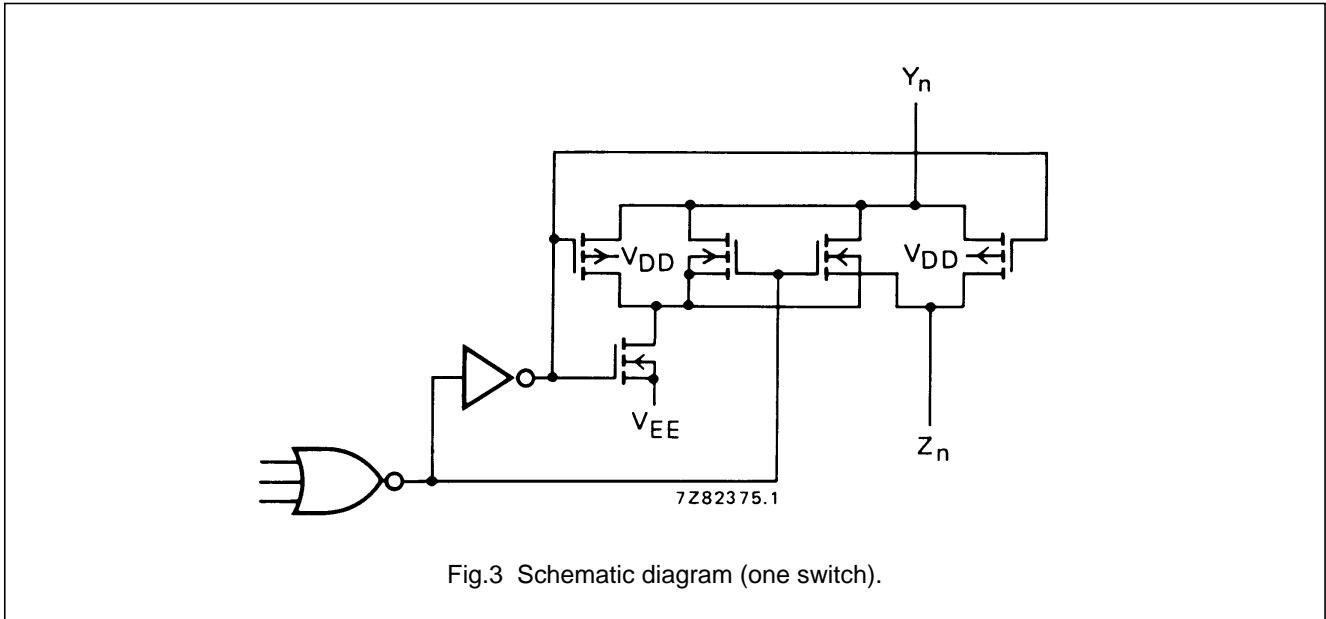


Fig.3 Schematic diagram (one switch).

FUNCTION TABLE

| INPUTS | | | CHANNEL ON |
|-----------|-------|-------|--------------------------|
| \bar{E} | A_1 | A_0 | |
| L | L | L | $Y_{0A}-Z_A; Y_{0B}-Z_B$ |
| L | L | H | $Y_{1A}-Z_A; Y_{1B}-Z_B$ |
| L | H | L | $Y_{2A}-Z_A; Y_{2B}-Z_B$ |
| L | H | H | $Y_{3A}-Z_A; Y_{3B}-Z_B$ |
| H | X | X | none |

Notes

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

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (with reference to V_{DD}) V_{EE} -18 to +0,5 V

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_{EE} .

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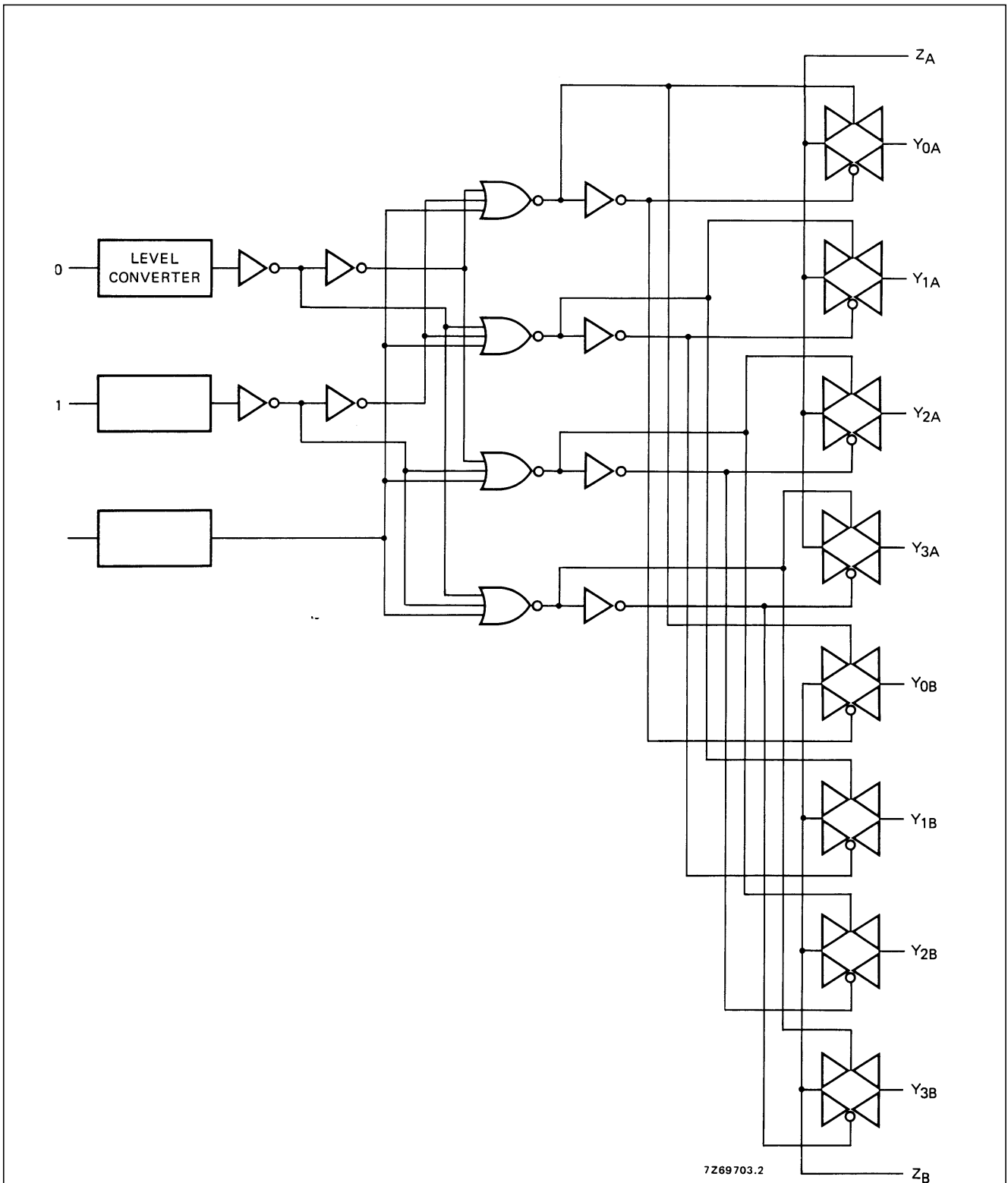


Fig.4 Logic diagram.

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DC CHARACTERISTICS

T_{amb} = 25 °C

| | V _{DD} -V _{EE} V | SYMBOL | TYP. | MAX. | | CONDITIONS |
|---|---------------------------------------|------------------|------|------|----|--|
| ON resistance | 5 | R _{ON} | 350 | 2500 | Ω | V _{is} = 0 to V _{DD} -V _{EE} see Fig.6 |
| | 10 | | 80 | 245 | Ω | |
| | 15 | | 60 | 175 | Ω | |
| ON resistance | 5 | R _{ON} | 115 | 340 | Ω | V _{is} = 0 see Fig.6 |
| | 10 | | 50 | 160 | Ω | |
| | 15 | | 40 | 115 | Ω | |
| ON resistance | 5 | R _{ON} | 120 | 365 | Ω | V _{is} = V _{DD} -V _{EE} see Fig.6 |
| | 10 | | 65 | 200 | Ω | |
| | 15 | | 50 | 155 | Ω | |
| 'Δ' ON resistance between any two channels | 5 | ΔR _{ON} | 25 | - | Ω | V _{is} = 0 to V _{DD} -V _{EE} see Fig.6 |
| | 10 | | 10 | - | Ω | |
| | 15 | | 5 | - | Ω | |
| OFF-state leakage current, all channels OFF | 5 | I _{oZZ} | - | - | nA | \bar{E} at V _{DD} |
| | 10 | | - | - | nA | |
| | 15 | | - | 1000 | nA | |
| OFF-state leakage current, any channel | 5 | I _{oZY} | - | - | nA | \bar{E} at V _{SS} |
| | 10 | | - | - | nA | |
| | 15 | | - | 200 | nA | |

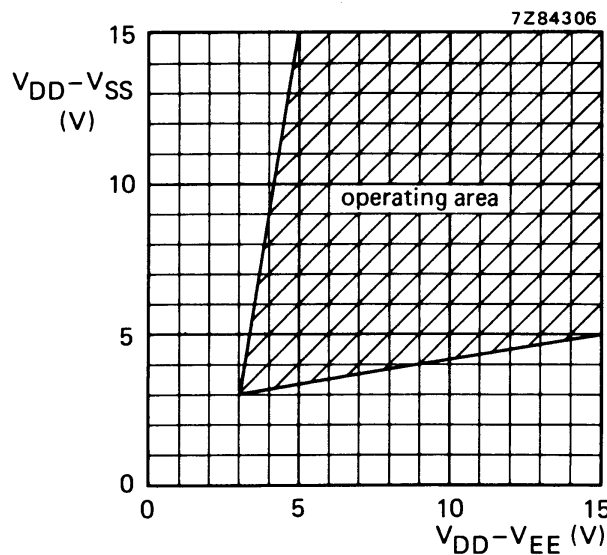


Fig.5 Operating area as a function of the supply voltages.

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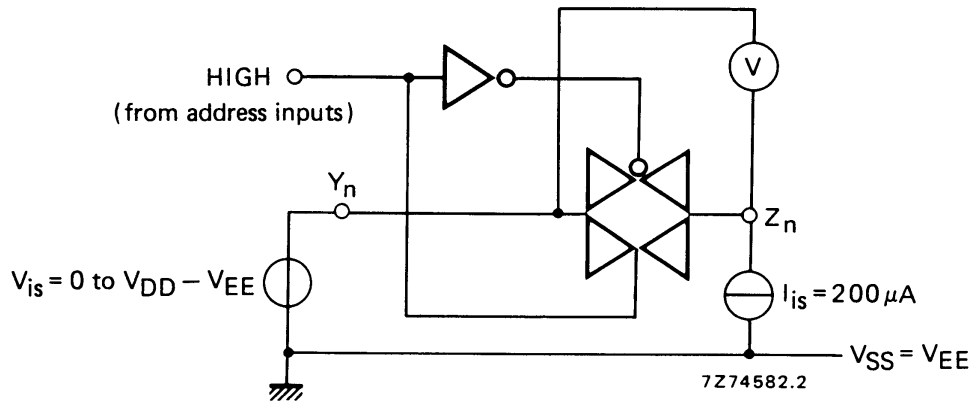
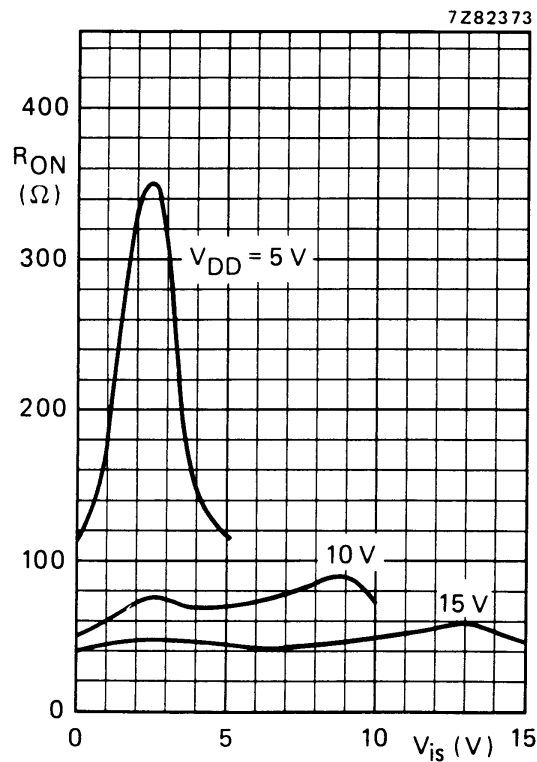


Fig.6 Test set-up for measuring R_{ON} .



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

Fig.7 Typical R_{ON} as a function of input voltage.

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AC CHARACTERISTICS

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

| | V_{DD} V | TYPICAL FORMULA FOR P (μW) | |
|---|---------------|---|--|
| Dynamic power dissipation per package (P) | 5 | $1\ 300 f_i + \sum(f_o C_L) \times V_{DD}^2$ | 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) |
| | 10 | $6\ 100 f_i + \sum(f_o C_L) \times V_{DD}^2$ | |
| | 15 | $15\ 600 f_i + \sum(f_o C_L) \times V_{DD}^2$ | |

AC CHARACTERISTICS

$V_{EE} = V_{SS} = 0\text{ V}$; $T_{amb} = 25\text{ °C}$; 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} | 10 | 20 | ns | note 1 | |
| | 10 | | 5 | 10 | ns | | |
| | 15 | | 5 | 10 | ns | | |
| | LOW to HIGH | 5 | t_{PLH} | 10 | 20 | ns | note 1 |
| | | 10 | | 5 | 10 | ns | |
| | | 15 | | 5 | 10 | ns | |
| $A_n \rightarrow V_{os}$ HIGH to LOW | 5 | t_{PHL} | 150 | 305 | ns | note 2 | |
| | 10 | | 65 | 135 | ns | | |
| | 15 | | 50 | 100 | ns | | |
| | LOW to HIGH | 5 | t_{PLH} | 150 | 300 | ns | note 2 |
| | | 10 | | 75 | 150 | ns | |
| | | 15 | | 50 | 100 | ns | |
| Output disable times $\bar{E} \rightarrow V_{os}$ HIGH | 5 | t_{PHZ} | 95 | 190 | ns | note 3 | |
| | 10 | | 90 | 180 | ns | | |
| | 15 | | 90 | 180 | ns | | |
| | LOW | 5 | t_{PLZ} | 100 | 205 | ns | note 3 |
| | | 10 | | 90 | 180 | ns | |
| | | 15 | | 90 | 180 | ns | |
| Output enable times $\bar{E} \rightarrow V_{os}$ HIGH | 5 | t_{PZH} | 130 | 260 | ns | note 3 | |
| | 10 | | 55 | 115 | ns | | |
| | 15 | | 45 | 85 | ns | | |
| | LOW | 5 | t_{PZL} | 120 | 240 | ns | note 3 |
| | | 10 | | 50 | 100 | ns | |
| | | 15 | | 35 | 75 | ns | |

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| | V _{DD} V | SYMBOL | TYP. | MAX. | |
|--|----------------------|--------|------|------|--------|
| Distortion, sine-wave response | 5 | | 0,25 | % | note 4 |
| | 10 | | 0,04 | % | |
| | 15 | | 0,04 | % | |
| Crosstalk between any two channels | 5 | | – | MHz | note 5 |
| | 10 | | 1 | MHz | |
| | 15 | | – | MHz | |
| Crosstalk; enable or address input to output | 5 | | – | mV | note 6 |
| | 10 | | 50 | mV | |
| | 15 | | – | mV | |
| OFF-state feed-through | 5 | | – | MHz | note 7 |
| | 10 | | 1 | MHz | |
| | 15 | | – | MHz | |
| ON-state frequency response | 5 | | 13 | MHz | note 8 |
| | 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 kΩ to V_{EE}; C_L = 50 pF to V_{EE}; $\bar{E} = V_{SS}$; V_{is} = V_{DD} (square-wave); see Fig.8.
- R_L = 10 kΩ; C_L = 50 pF to V_{EE}; $\bar{E} = V_{SS}$; A_n = V_{DD} (square-wave); V_{is} = V_{DD} and R_L to V_{EE} for t_{PLH}; V_{is} = V_{EE} and R_L to V_{DD} for t_{PHL}; see Fig.8.
- R_L = 10 kΩ; C_L = 50 pF to V_{EE}; $\bar{E} = V_{DD}$ (square-wave);
V_{is} = V_{DD} and R_L to V_{EE} for t_{PHZ} and t_{PZH};
V_{is} = V_{EE} and R_L to V_{DD} for t_{PLZ} and t_{PZL}; see Fig.8.
- R_L = 10 kΩ; C_L = 15 pF; channel ON; V_{is} = 1/2 V_{DD (p-p)} (sine-wave, symmetrical about 1/2 V_{DD});
f_{is} = 1 kHz; see Fig.9.
- R_L = 1 kΩ; V_{is} = 1/2 V_{DD (p-p)} (sine-wave, symmetrical about 1/2 V_{DD});

$$20 \log \frac{V_{os}}{V_{is}} = -50 \text{ dB}; \text{ see Fig. 10.}$$

- R_L = 10 kΩ to V_{EE}; C_L = 15 pF to V_{EE}; \bar{E} or A_n = V_{DD} (square-wave); crosstalk is |V_{os}| (peak value); see Fig.8.

- R_L = 1 kΩ; C_L = 5 pF; channel OFF; V_{is} = 1/2 V_{DD (p-p)} (sine-wave, symmetrical about 1/2 V_{DD});

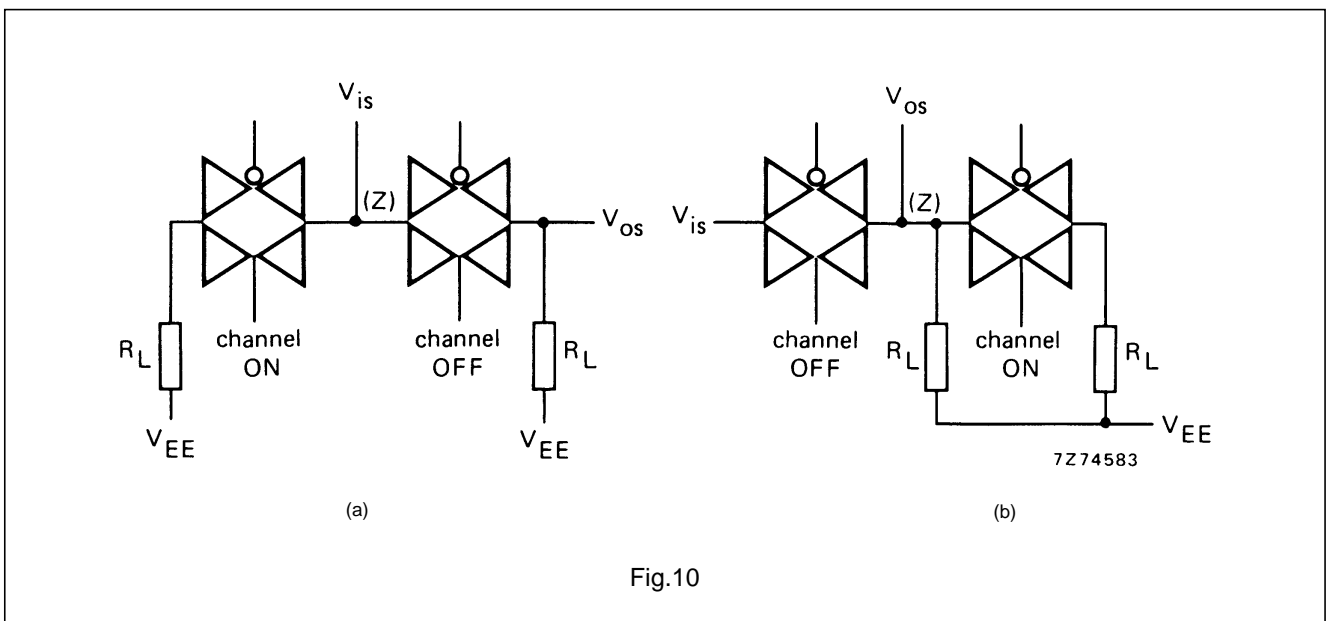
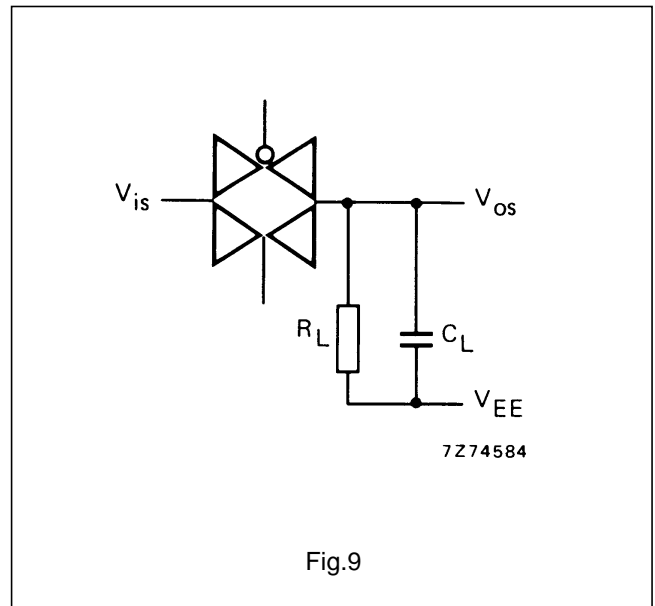
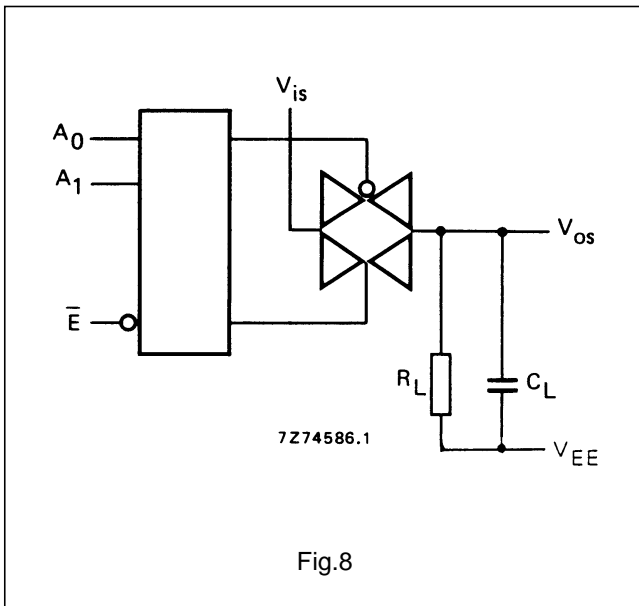
$$20 \log \frac{V_{os}}{V_{is}} = -50 \text{ dB}; \text{ see Fig. 9.}$$

- R_L = 1 kΩ; C_L = 5 pF; channel ON; V_{is} = 1/2 V_{DD (p-p)} (sine-wave, symmetrical about 1/2 V_{DD});

$$20 \log \frac{V_{os}}{V_{is}} = -3 \text{ dB}; \text{ see Fig. 9.}$$

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APPLICATION INFORMATION

Some examples of applications for the HEF4052B 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.