

DATA SHEET

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

HEF4053B

MSI

Triple 2-channel analogue
multiplexer/demultiplexer

Product specification
File under Integrated Circuits, IC04

January 1995

Triple 2-channel analogue multiplexer/demultiplexer

HEF4053B MSI

DESCRIPTION

The HEF4053B is a triple 2-channel analogue multiplexer/demultiplexer with a common enable input (\bar{E}). Each multiplexer/demultiplexer has two independent inputs/outputs (Y_0 and Y_1), a common input/output (Z), and select inputs (S_n). Each also contains two-bidirectional analogue switches, each with one side connected to an independent input/output (Y_0 and Y_1) and the other side connected to a common input/output (Z).

With \bar{E} LOW, one of the two switches is selected (low impedance ON-state) by S_n . With \bar{E} HIGH, all switches are in the high impedance OFF-state, independent of S_A to S_C .

V_{DD} and V_{SS} are the supply voltage connections for the digital control inputs (S_A to S_C and \bar{E}).

The V_{DD} to V_{SS} range is 3 to 15 V. The analogue inputs/outputs (Y_0 , Y_1 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).

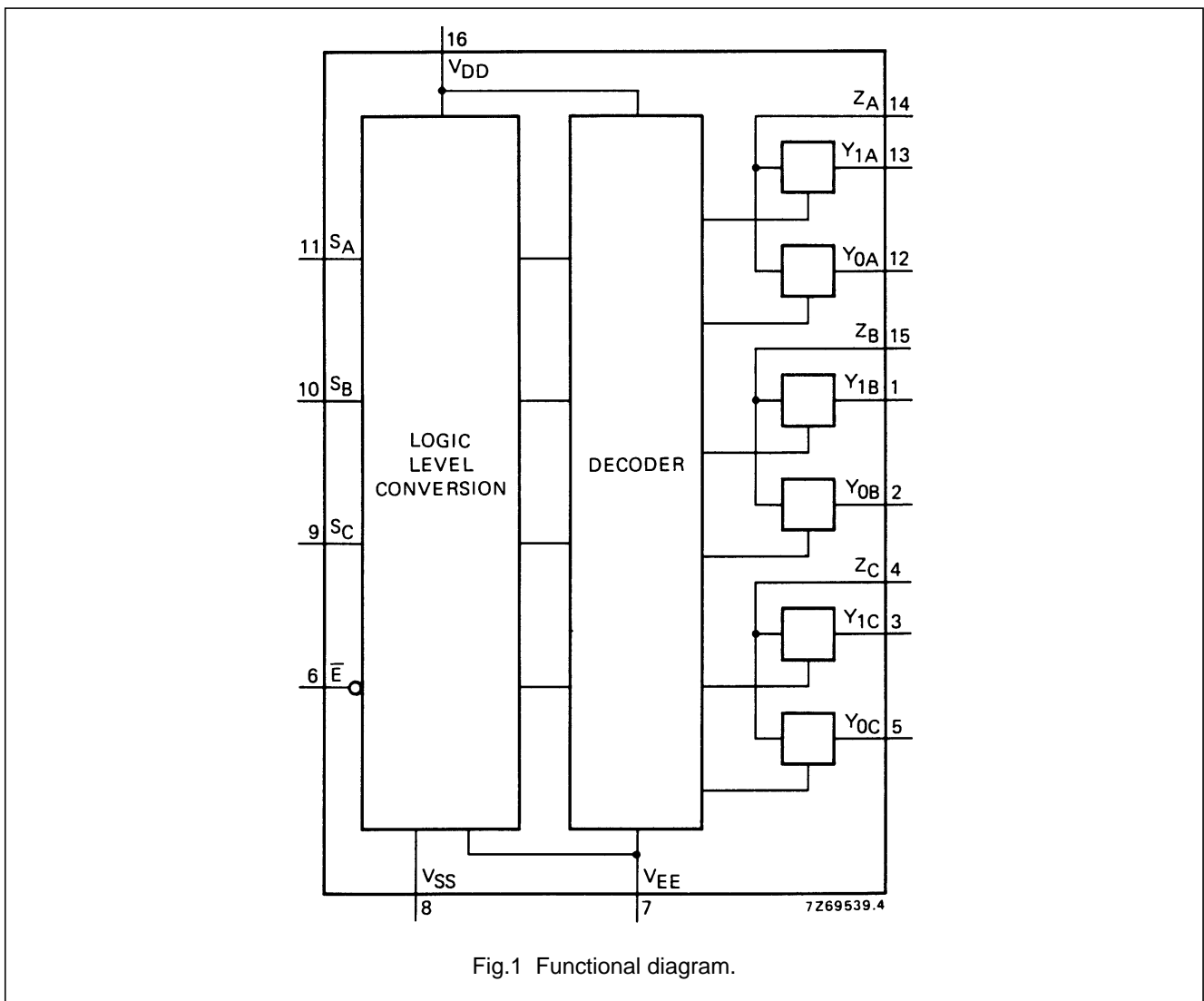


Fig.1 Functional diagram.

FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

Triple 2-channel analogue multiplexer/demultiplexer

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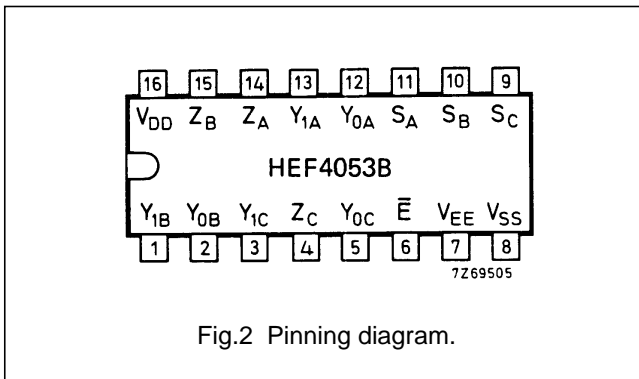


Fig.2 Pinning diagram.

PINNING

Y_{0A} to Y_{0C} independent inputs/outputs
 Y_{1A} to Y_{1C} independent inputs/outputs
 S_A to S_C select inputs
 \bar{E} enable input (active LOW)
 Z_A to Z_C common inputs/outputs

FUNCTION TABLE

| INPUTS | | CHANNEL ON |
|-----------|----------------|---------------------------------|
| \bar{E} | S _n | |
| L | L | Y _{0n} -Z _n |
| L | H | Y _{1n} -Z _n |
| H | X | none |

Notes

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

HEF4053BP(N): 16-lead DIL; plastic (SOT38-1)

HEF4053BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)

HEF4053BT(D): 16-lead SO; plastic (SOT109-1)

(): Package Designator North America

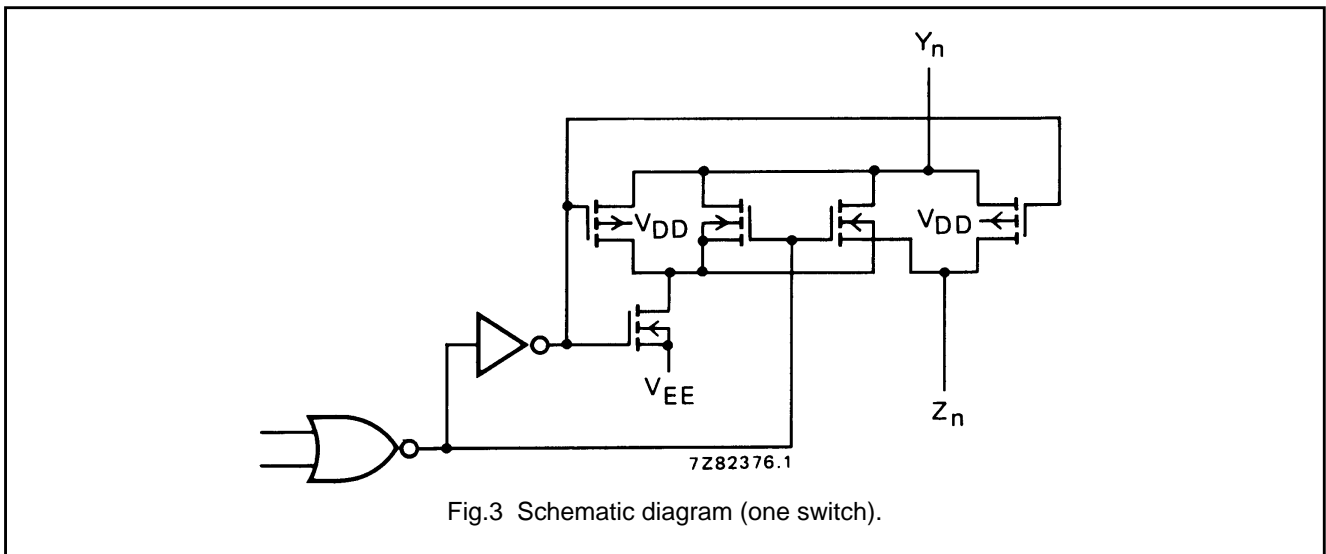


Fig.3 Schematic diagram (one switch).

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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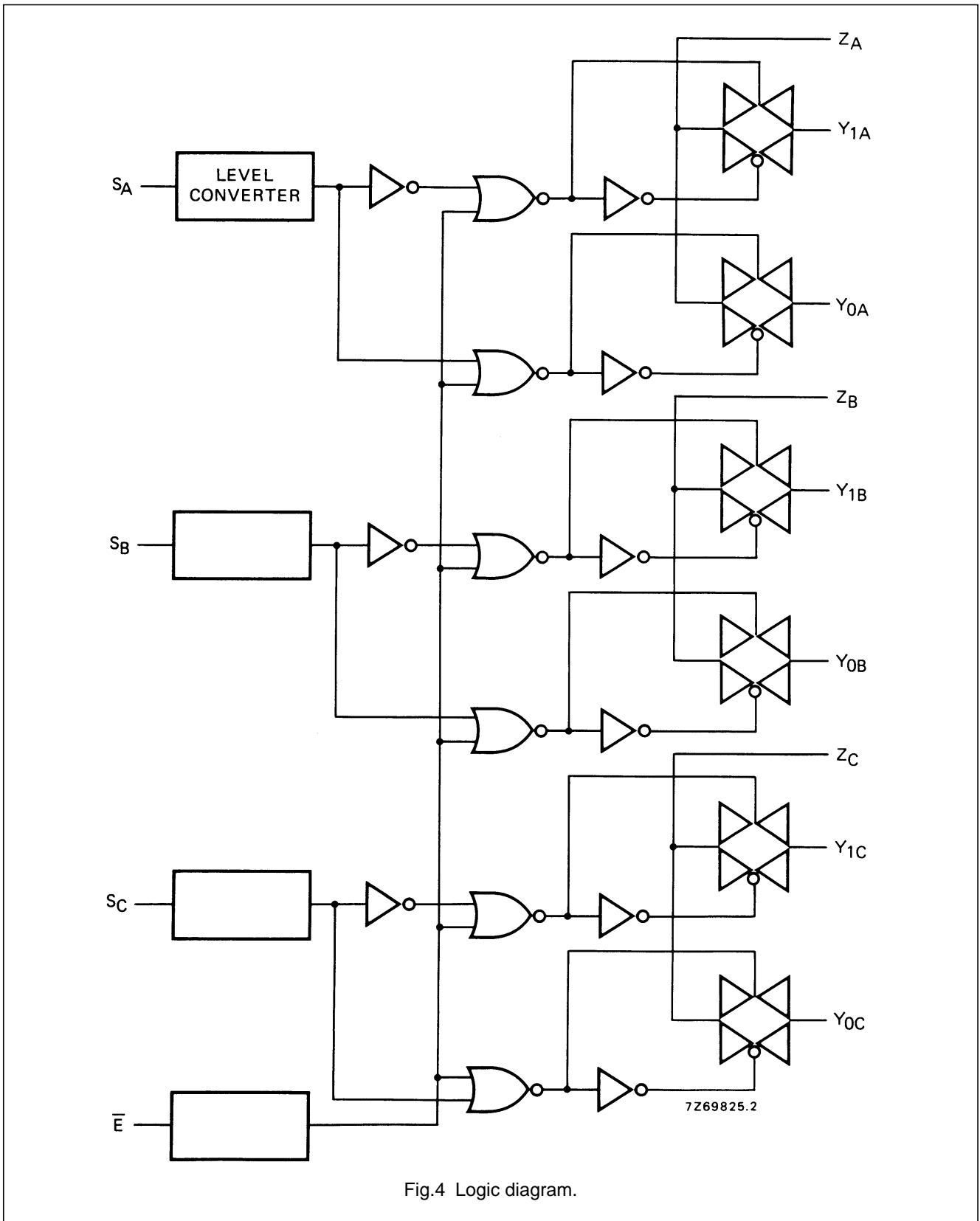


Fig.4 Logic diagram.

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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 | 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 | |

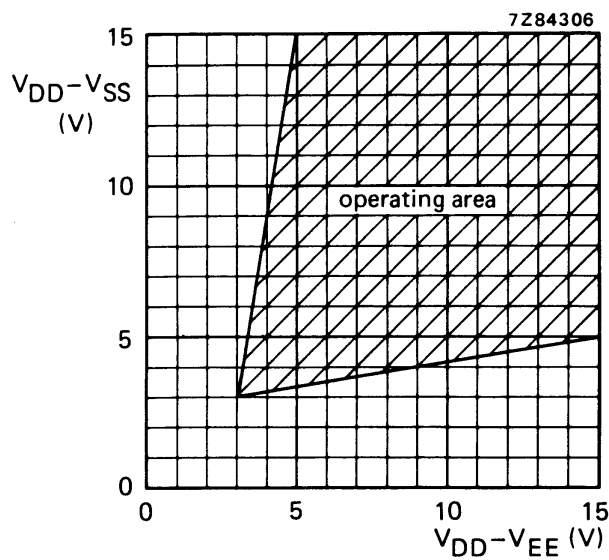


Fig.5 Operating area as a function of the supply voltages.

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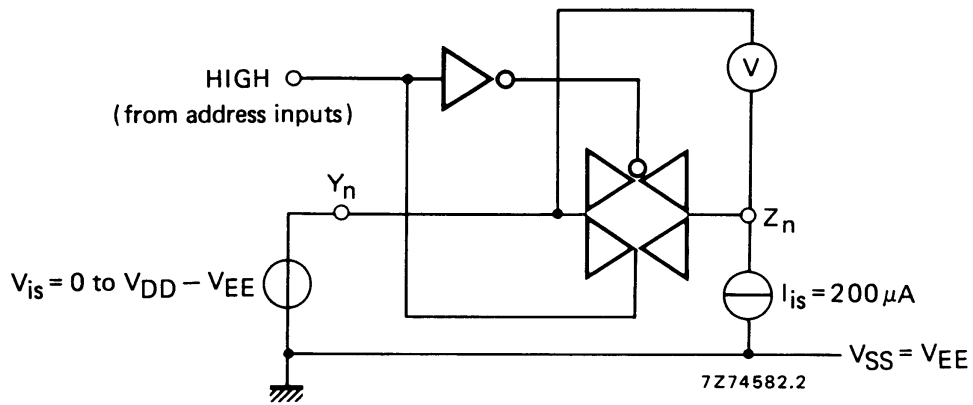
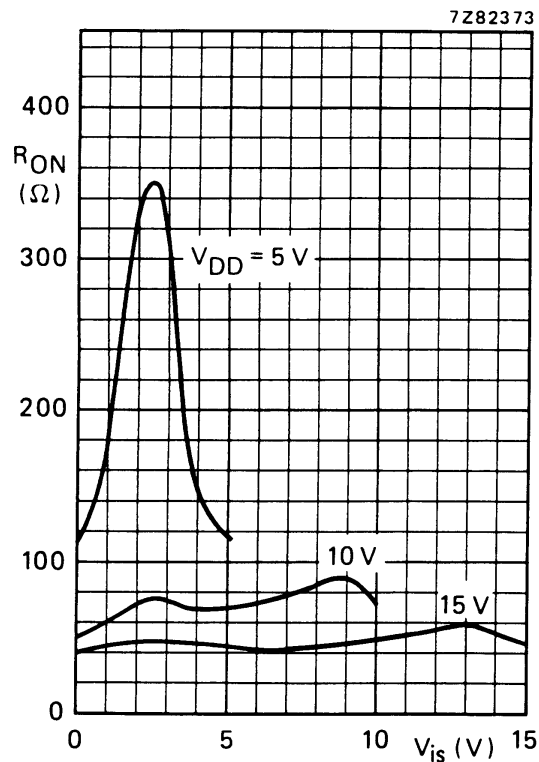


Fig.6 Test set-up for measuring R_{ON} .



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

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

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MSI**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 | $2\,500 f_i + \sum(f_o C_L) \times V_{DD}^2$ | 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 | $11\,500 f_i + \sum(f_o C_L) \times V_{DD}^2$ | |
| | 15 | $29\,000 f_i + \sum(f_o C_L) \times V_{DD}^2$ | |

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} | 15 | 30 | ns | note 1 |
| | | 10 | | 5 | 10 | ns | |
| | | 15 | | 5 | 10 | ns | |
| $S_n \rightarrow V_{os}$ HIGH to LOW | 5 | t_{PHL} | 200 | 400 | ns | note 2 | |
| | 10 | | 85 | 170 | ns | | |
| | 15 | | 65 | 130 | ns | | |
| | LOW to HIGH | 5 | t_{PLH} | 275 | 555 | ns | note 2 |
| | | 10 | | 100 | 200 | ns | |
| | | 15 | | 65 | 130 | ns | |
| Output disable times $\bar{E} \rightarrow V_{os}$ HIGH | 5 | t_{PHZ} | 200 | 400 | ns | note 3 | |
| | 10 | | 115 | 230 | ns | | |
| | 15 | | 110 | 220 | ns | | |
| | LOW | 5 | t_{PLZ} | 200 | 400 | ns | note 3 |
| | | 10 | | 120 | 245 | ns | |
| | | 15 | | 110 | 215 | ns | |
| Output enable times $\bar{E} \rightarrow V_{os}$ HIGH | 5 | t_{PZH} | 260 | 525 | ns | note 3 | |
| | 10 | | 95 | 190 | ns | | |
| | 15 | | 65 | 130 | ns | | |
| | LOW | 5 | t_{PZL} | 280 | 565 | ns | note 3 |
| | | 10 | | 105 | 205 | ns | |
| | | 15 | | 70 | 140 | 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

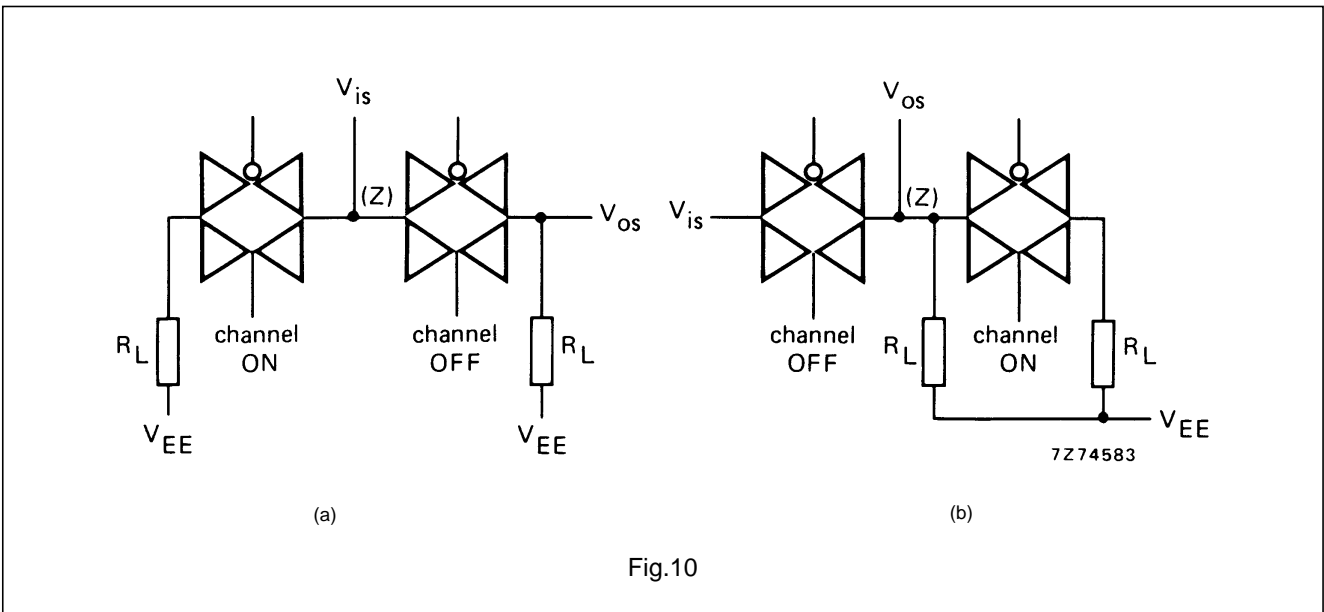
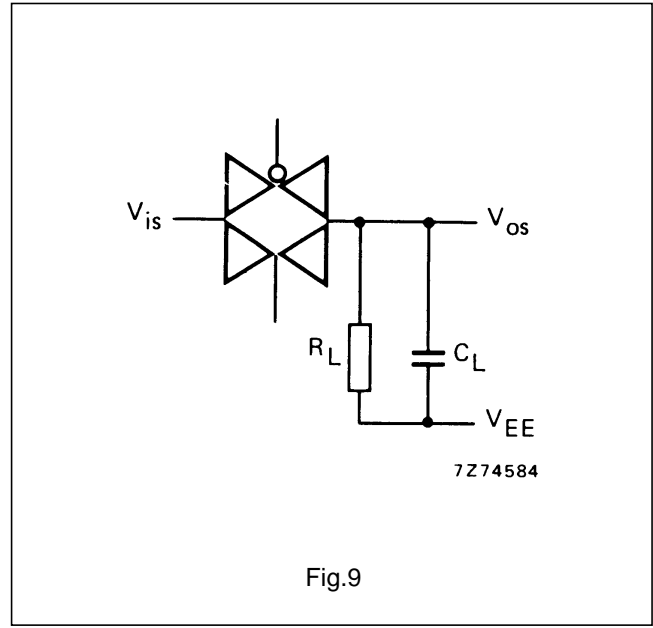
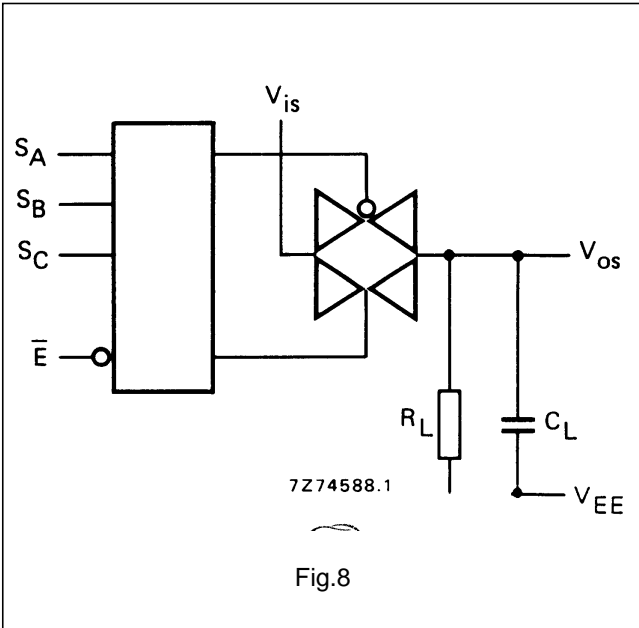
V_{is} is the input voltage at a Y or Z terminal, whichever is assigned as input.

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}; S_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});
 $20 \log \frac{V_{os}}{V_{is}} = -50 \text{ dB}$; see Fig. 10.
- R_L = 10 kΩ to V_{EE}; C_L = 15 pF to V_{EE}; \bar{E} or S_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});
 $20 \log \frac{V_{os}}{V_{is}} = -50 \text{ dB}$; 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});
 $20 \log \frac{V_{os}}{V_{is}} = -3 \text{ dB}$; see Fig. 9.

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APPLICATION INFORMATION

Some examples of applications for the HEF4053B 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.

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