

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC/HCT4067** 16-channel analog multiplexer/demultiplexer

Product specification  
File under Integrated Circuits, IC06

September 1993

# 16-channel analog multiplexer/demultiplexer

## 74HC/HCT4067

### FEATURES

- Low "ON" resistance:  
80  $\Omega$  (typ.) at  $V_{CC} = 4.5$  V  
70  $\Omega$  (typ.) at  $V_{CC} = 6.0$  V  
60  $\Omega$  (typ.) at  $V_{CC} = 9.0$  V  
typical "break before make" built-in
- Output capability: non-standard
- $I_{CC}$  category: MSI

### GENERAL DESCRIPTION

The 74HC/HCT4067 are high-speed Si-gate CMOS devices and are pin compatible with the "4067" of the "4000B" series. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4067 are 16-channel analog multiplexers/demultiplexers with four address inputs ( $S_0$  to  $S_3$ ), an active LOW enable input ( $\bar{E}$ ), sixteen independent inputs/outputs ( $Y_0$  to  $Y_{15}$ ) and a common input/output ( $Z$ ). The "4067" contains sixteen bidirectional analog switches, each with one side connected to an independent input/output ( $Y_0$  to  $Y_{15}$ ) and the other side connected to a common input/output ( $Z$ ).

With  $\bar{E}$  LOW, one of the sixteen switches is selected (low impedance ON-state) by  $S_0$  to  $S_3$ . 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  $S_0$  to  $S_3$ .

The analog inputs/outputs ( $Y_0$  to  $Y_{15}$ , and  $Z$ ) can swing between  $V_{CC}$  as a positive limit and GND as a negative limit.  $V_{CC}$  to GND may not exceed 10 V.

### QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25$  °C;  $t_r = t_f = 6$  ns

| SYMBOL              | PARAMETER   | CONDITIONS   | TYPICAL |     | UNIT |
|---------------------|---|--|---------|-----|------|
|                     |   |  | HC      | HCT |      |
| $t_{PZL} / t_{PZH}$ | turn-on time<br>$\bar{E}$ to $V_{OS}$<br>$S_n$ to $V_{OS}$  | $C_L = 15$ pF; $R_L = 1$ k $\Omega$ ; $V_{CC} = 5$ V | 26      | 32  | ns   |
|                     |   |  | 29      | 33  | ns   |
| $t_{PLZ} / t_{PHZ}$ | turn-off time<br>$\bar{E}$ to $V_{OS}$<br>$S_n$ to $V_{OS}$ |  | 27      | 26  | ns   |
|                     |   |  | 29      | 30  | ns   |
| $C_I$               | input capacitance   |  | 3.5     | 3.5 | pF   |
| $C_{PD}$            | power dissipation capacitance per switch                    | notes 1 and 2  | 29      | 29  | pF   |
| $C_S$               | max. switch capacitance<br>independent (Y)<br>common (Z)    |  | 5       | 5   | pF   |
|                     |   |  | 45      | 45  | pF   |

### Notes

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum \{ (C_L + C_S) \times V_{CC}^2 \times f_o \} \text{ where:}$$

$f_i$  = input frequency in MHz

$f_o$  = output frequency in MHz

$\sum \{ (C_L + C_S) \times V_{CC}^2 \times f_o \}$  = sum of outputs

$C_L$  = output load capacitance in pF

$C_S$  = max. switch capacitance in pF

$V_{CC}$  = supply voltage in V

2. For HC the condition is  $V_I = \text{GND to } V_{CC}$   
For HCT the condition is  $V_I = \text{GND to } V_{CC} - 1.5$  V

# 16-channel analog multiplexer/demultiplexer

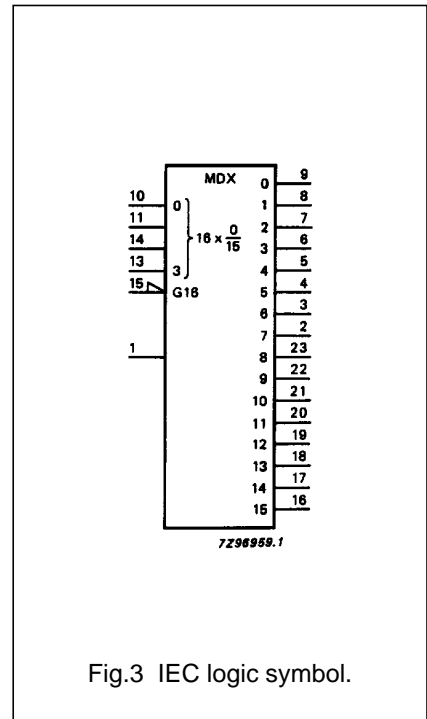
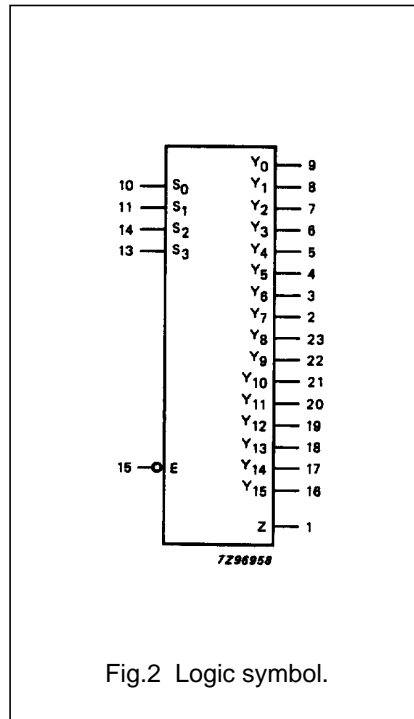
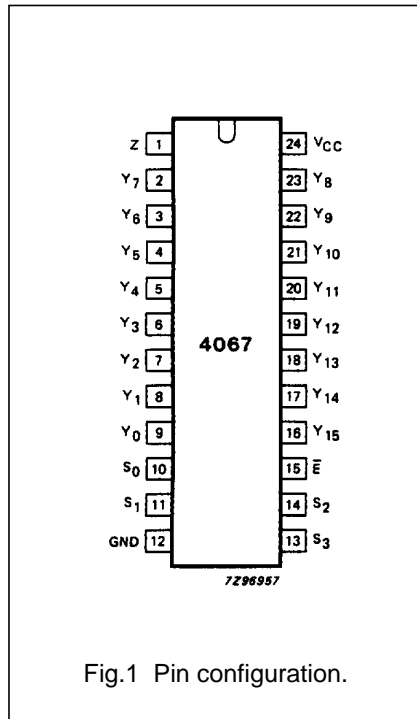
## 74HC/HCT4067

### ORDERING INFORMATION

See "74HC/HCT/HCU/HCMOS Logic Package Information".

### PIN DESCRIPTION

| PIN NO.  | SYMBOL                            | NAME AND FUNCTION          |
|--|-----------------------------------|----------------------------|
| 1  | Z                                 | common input/output        |
| 9, 8, 7, 6, 5, 4, 3, 2, 23, 22, 21, 20, 19, 18, 17, 16 | Y <sub>0</sub> to Y <sub>15</sub> | independent inputs/outputs |
| 10, 11, 14, 13   | S <sub>0</sub> to S <sub>3</sub>  | address inputs             |
| 12   | GND                               | ground (0 V)               |
| 15   | $\bar{E}$                         | enable input (active LOW)  |
| 24   | V <sub>CC</sub>                   | positive supply voltage    |

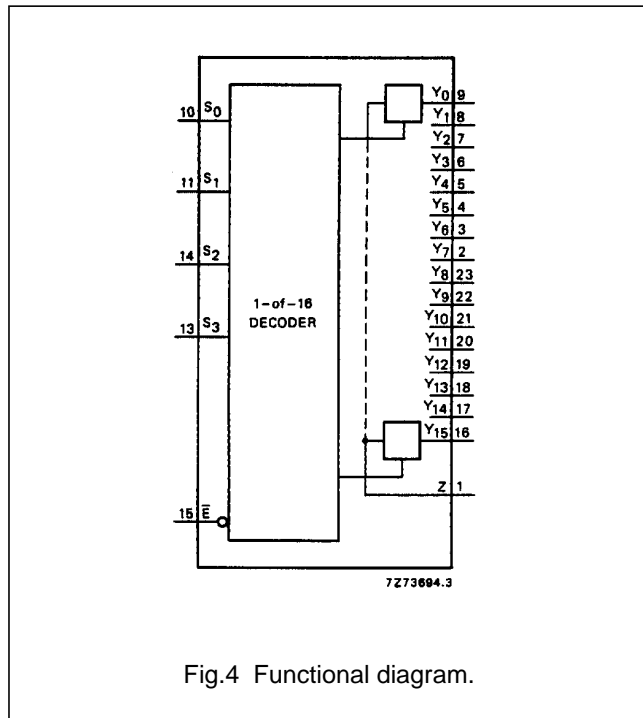


# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

## APPLICATIONS

- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating

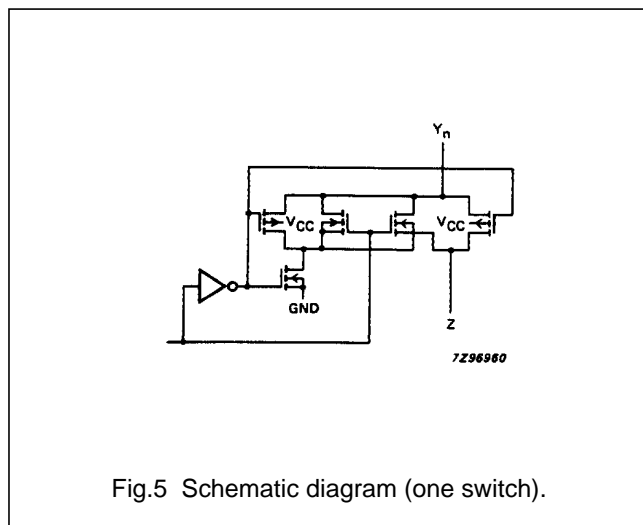


## FUNCTION TABLE

| INPUTS    |       |       |       |       | CHANNEL ON   |
|-----------|-------|-------|-------|-------|--------------|
| $\bar{E}$ | $S_3$ | $S_2$ | $S_1$ | $S_0$ |              |
| 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         |

## Notes

1. H = HIGH voltage level  
L = LOW voltage level  
X = don't care



# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

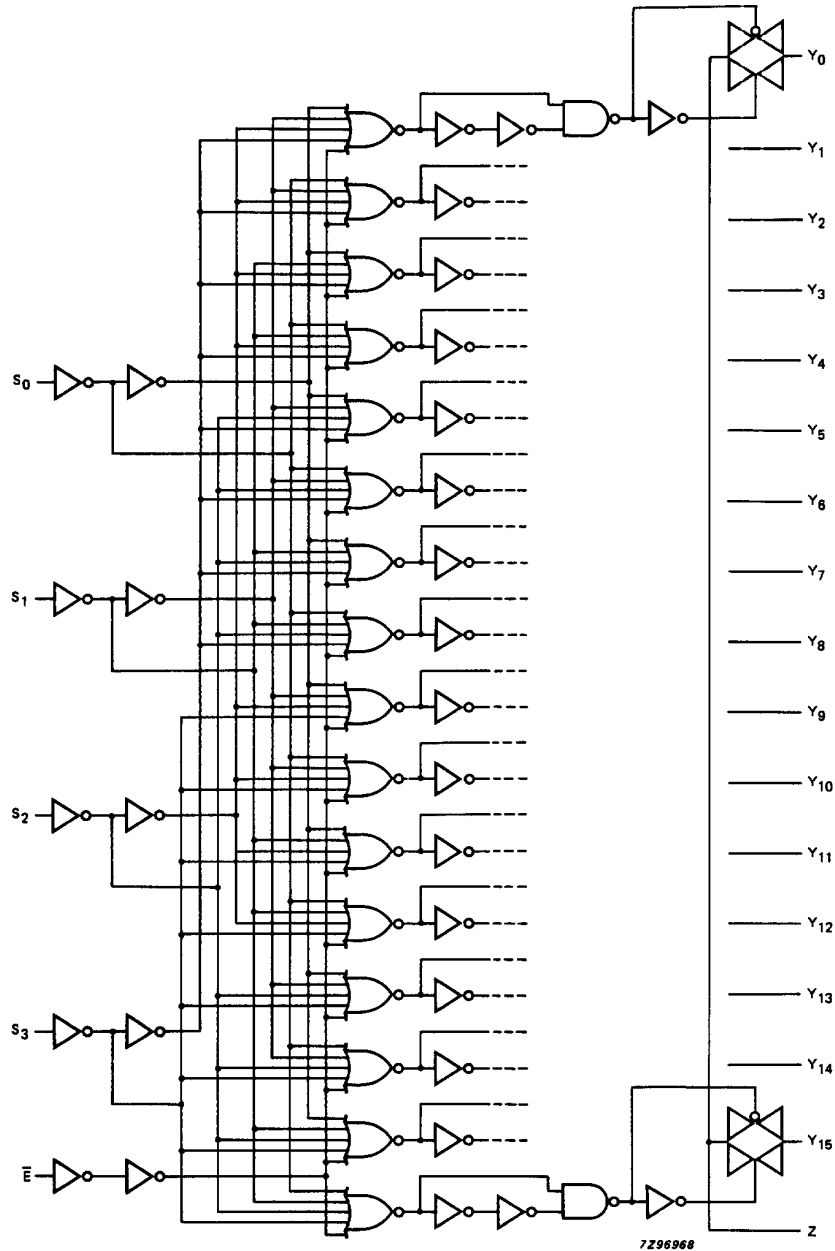


Fig.6 Logic diagram.

# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

## RATINGS

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

Voltages are referenced to GND (ground = 0 V)

| SYMBOL                    | PARAMETER                      | MIN. | MAX.  | UNIT | CONDITIONS  |
|---------------------------|--------------------------------|------|-------|------|---|
| $V_{CC}$                  | DC supply voltage              | -0.5 | +11.0 | V    |   |
| $\pm I_{IK}$              | DC digital input diode current |      | 20    | mA   | for $V_I < -0.5$ or $V_I > V_{CC} + 0.5$ V        |
| $\pm I_{SK}$              | DC switch diode current        |      | 20    | mA   | for $V_S < -0.5$ or $V_S > V_{CC} + 0.5$ V        |
| $\pm I_S$                 | DC switch current              |      | 25    | mA   | for $-0.5$ V $< V_S < V_{CC} + 0.5$ V             |
| $\pm I_{CC}; \pm I_{GND}$ | DC $V_{CC}$ or GND current     |      | 50    | mA   |   |
| $T_{stg}$                 | storage temperature range      | -65  | +150  | °C   |   |
| $P_{tot}$                 | power dissipation per package  |      |       |      | for temperature range: -40 to +125 °C<br>74HC/HCT |
|                           | plastic DIL                    |      | 750   | mW   | above +70 °C: derate linearly with 12 mW/K        |
|                           | plastic mini-pack (SO)         |      | 500   | mW   | above +70 °C: derate linearly with 8 mW/K         |
| $P_S$                     | power dissipation per switch   |      | 100   | mW   |   |

## Note

- To avoid drawing  $V_{CC}$  current out of terminal Z, when switch current flows in terminals  $Y_n$ , the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no  $V_{CC}$  current will flow out of terminals  $Y_n$ . In this case there is no limit for the voltage drop across the switch, but the voltages at  $Y_n$  and Z may not exceed  $V_{CC}$  or GND.

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL     | PARAMETER                           | 74HC |      |                           | 74HCT |      |          | UNIT | CONDITIONS  |
|------------|-------------------------------------|------|------|---------------------------|-------|------|----------|------|---|
|            |                                     | min. | typ. | max.                      | min.  | typ. | max.     |      |   |
| $V_{CC}$   | DC supply voltage                   | 2.0  | 5.0  | 10.0                      | 4.5   | 5.0  | 5.5      | V    |   |
| $V_I$      | DC input voltage range              | GND  |      | $V_{CC}$                  | GND   |      | $V_{CC}$ | V    |   |
| $V_S$      | DC switch voltage range             | GND  |      | $V_{CC}$                  | GND   |      | $V_{CC}$ | V    |   |
| $T_{amb}$  | operating ambient temperature range | -40  |      | +85                       | -40   |      | +85      | °C   | see DC and AC CHARACTERISTICS   |
| $T_{amb}$  | operating ambient temperature range | -40  |      | +125                      | -40   |      | +125     | °C   |   |
| $t_r, t_f$ | input rise and fall times           |      | 6.0  | 1000<br>500<br>400<br>250 |       | 6.0  | 500      | ns   | $V_{CC} = 2.0$ V<br>$V_{CC} = 4.5$ V<br>$V_{CC} = 6.0$ V<br>$V_{CC} = 10.0$ V |

# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

## DC CHARACTERISTICS FOR 74HC/HCT

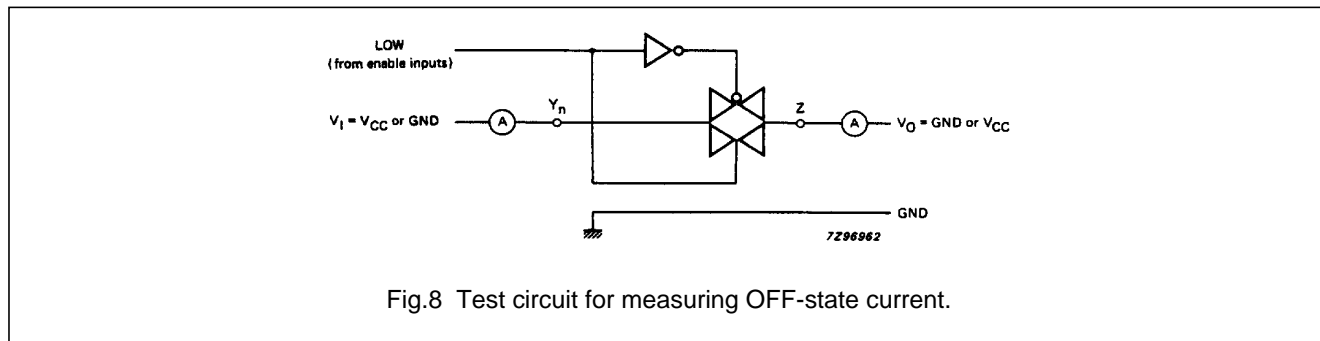
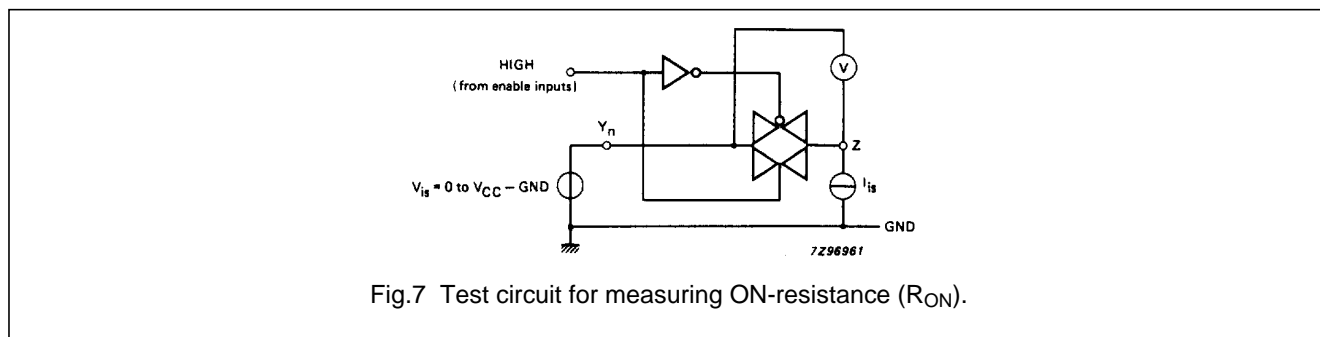
For 74HC:  $V_{CC} - GND = 2.0, 4.5, 6.0$  and  $9.0$  V

For 74HCT:  $V_{CC} - GND = 4.5$  V

| SYMBOL          | PARAMETER   | $T_{amb} (°C)$ |      |      |            |      |             | UNIT | TEST CONDITIONS |                      |          |                       |                            |
|-----------------|---|----------------|------|------|------------|------|-------------|------|-----------------|----------------------|----------|-----------------------|----------------------------|
|                 |   | 74HC/HCT       |      |      |            |      |             |      | $V_{CC}$<br>(V) | $I_S$<br>( $\mu A$ ) | $V_{is}$ | $V_I$                 |                            |
|                 |   | +25            |      |      | -40 to +85 |      | -40 to +125 |      |                 |                      |          |                       |                            |
|                 |   | min.           | typ. | max. | min.       | max. | min.        |      |                 |                      |          |                       | max.                       |
| $R_{ON}$        | ON-resistance (peak)  |                | -    | -    |            | -    |             | -    | $\Omega$        | 2.0                  | 100      | $V_{CC}$<br>to<br>GND | $V_{IH}$<br>or<br>$V_{IL}$ |
|                 |   |                | 110  | 180  |            | 225  |             | 270  | $\Omega$        | 4.5                  | 1000     |                       |                            |
|                 |   |                | 95   | 160  |            | 200  |             | 240  | $\Omega$        | 6.0                  | 1000     |                       |                            |
|                 |   |                | 75   | 130  |            | 165  |             | 195  | $\Omega$        | 9.0                  | 1000     |                       |                            |
| $R_{ON}$        | ON-resistance (rail)  |                | 150  | -    |            | -    |             | -    | $\Omega$        | 2.0                  | 100      | GND<br>or<br>$V_{CC}$ | $V_{IH}$<br>or<br>$V_{IL}$ |
|                 |   |                | 90   | 160  |            | 200  |             | 240  | $\Omega$        | 4.5                  | 1000     |                       |                            |
|                 |   |                | 80   | 140  |            | 175  |             | 210  | $\Omega$        | 6.0                  | 1000     |                       |                            |
|                 |   |                | 70   | 120  |            | 150  |             | 180  | $\Omega$        | 9.0                  | 1000     |                       |                            |
| $\Delta R_{ON}$ | maximum variation of ON-resistance between any two channels |                | -    |      |            |      |             |      | $\Omega$        | 2.0                  |          | $V_{CC}$<br>to<br>GND | $V_{IH}$<br>or<br>$V_{IL}$ |
|                 |   |                | 9    |      |            |      |             |      | $\Omega$        | 4.5                  |          |                       |                            |
|                 |   |                | 8    |      |            |      |             |      | $\Omega$        | 6.0                  |          |                       |                            |
|                 |   |                | 6    |      |            |      |             |      | $\Omega$        | 9.0                  |          |                       |                            |

### Notes

- At supply voltages ( $V_{CC} - GND$ ) approaching 2 V, the analog switch ON-resistance becomes extremely non-linear. Therefore it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.
- For test circuit measuring  $R_{ON}$  see Fig.7.



# 16-channel analog multiplexer/demultiplexer

## 74HC/HCT4067

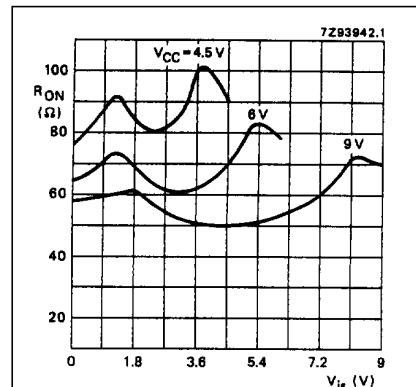
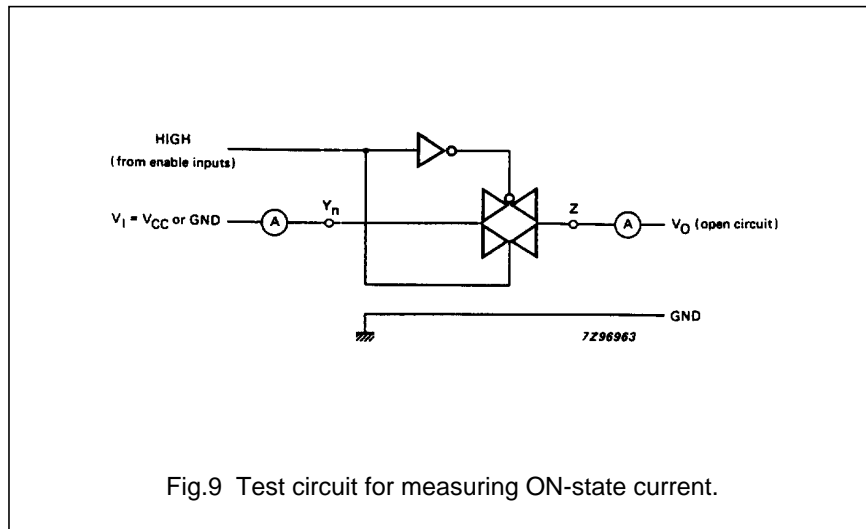


Fig.10 Typical ON-resistance ( $R_{ON}$ ) as a function of input voltage ( $V_{is}$ ) for  $V_{is} = 0$  to  $V_{CC} - GND$ .

### DC CHARACTERISTICS FOR 74HC

Voltagess are referenced to GND (ground = 0 V)

| SYMBOL    | PARAMETER                                    | $T_{amb} (^{\circ}C)$ |      |      |            |      |             |      | UNIT    | TEST CONDITIONS |                            |  |
|-----------|--|-----------------------|------|------|------------|------|-------------|------|---------|-----------------|----------------------------|--|
|           |  | 74HC                  |      |      |            |      |             |      |         | $V_{CC}$<br>(V) | $V_I$                      | OTHER  |
|           |  | +25                   |      |      | -40 to +85 |      | -40 to +125 |      |         |                 |                            |  |
|           |  | min.                  | typ. | max. | min.       | max. | min.        | max. |         |                 |                            |  |
| $V_{IH}$  | HIGH level input voltage                     | 1.5                   | 1.2  |      | 1.5        |      | 1.5         |      | V       | 2.0             |                            |  |
|           |  | 3.15                  | 2.4  |      | 3.15       |      | 3.15        |      |         | 4.5             |                            |  |
|           |  | 4.2                   | 3.2  |      | 4.2        |      | 4.2         |      |         | 6.0             |                            |  |
|           |  | 6.3                   | 4.7  |      | 6.3        |      | 6.3         |      |         | 9.0             |                            |  |
| $V_{IL}$  | LOW level input voltage                      |                       | 0.8  | 0.50 |            | 0.50 |             | 0.50 | V       | 2.0             |                            |  |
|           |  |                       | 2.1  | 1.35 |            | 1.35 |             | 1.35 |         | 4.5             |                            |  |
|           |  |                       | 2.8  | 1.80 |            | 1.80 |             | 1.80 |         | 6.0             |                            |  |
|           |  |                       | 4.3  | 2.70 |            | 2.70 |             | 2.70 |         | 9.0             |                            |  |
| $\pm I_I$ | input leakage current                        |                       |      | 0.1  |            | 1.0  |             | 1.0  | $\mu A$ | 6.0             | $V_{CC}$<br>or<br>GND      |  |
|           |  |                       |      | 0.2  |            | 2.0  |             | 2.0  |         | 10.0            |                            |  |
| $\pm I_S$ | analog switch OFF-state current per channel  |                       |      | 0.1  |            | 1.0  |             | 1.0  | $\mu A$ | 10.0            | $V_{IH}$<br>or<br>$V_{IL}$ | $ V_S  = V_{CC} - GND$<br>(see Fig.8)                          |
| $\pm I_S$ | analog switch OFF-state current all channels |                       |      | 0.8  |            | 8.0  |             | 8.0  | $\mu A$ | 10.0            | $V_{IH}$<br>or<br>$V_{IL}$ | $ V_S  = V_{CC} - GND$<br>(see Fig.9)                          |
| $\pm I_S$ | analog switch ON-state current               |                       |      | 0.8  |            | 8.0  |             | 8.0  | $\mu A$ | 10.0            | $V_{IH}$<br>or<br>$V_{IL}$ | $ V_S  = V_{CC} - GND$<br>(see Fig.9)                          |
| $I_{CC}$  | quiescent supply current                     |                       |      | 8.0  |            | 80.0 |             | 160  | $\mu A$ | 6.0             | $V_{CC}$<br>or<br>GND      | $V_{is} = GND$<br>or $V_{CC}$ ;<br>$V_{os} = V_{CC}$<br>or GND |
|           |  |                       |      | 16.0 |            | 160  |             | 320  |         | 10.0            |                            |  |



# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

**AC CHARACTERISTICS FOR 74HC**GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

| SYMBOL                              | PARAMETER  | T <sub>amb</sub> (°C) |      |      |            |      |             | UNIT | TEST CONDITIONS        |                          |   |
|-------------------------------------|--|-----------------------|------|------|------------|------|-------------|------|------------------------|--------------------------|---|
|                                     |  | 74HC                  |      |      |            |      |             |      | V <sub>CC</sub><br>(V) | OTHER                    |   |
|                                     |  | +25                   |      |      | -40 to +85 |      | -40 to +125 |      |                        |                          |   |
|                                     |  | min.                  | typ. | max. | min.       | max. | min.        |      |                        |                          | max.  |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>V <sub>is</sub> to V <sub>os</sub> ;<br>Y <sub>n</sub> to Z |                       | 25   | 75   |            | 95   |             | 110  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 | R <sub>L</sub> = ∞;<br>C <sub>L</sub> = 50 pF<br>(see Fig.16) |
|                                     |  |                       | 9    | 15   |            | 19   |             | 22   |                        |                          |   |
|                                     |  |                       | 7    | 13   |            | 16   |             | 19   |                        |                          |   |
|                                     |  |                       | 5    | 9    |            | 11   |             | 14   |                        |                          |   |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>V <sub>is</sub> to V <sub>os</sub> ;<br>Z to Y <sub>n</sub> |                       | 18   | 60   |            | 75   |             | 90   | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 6    | 12   |            | 15   |             | 18   |                        |                          |   |
|                                     |  |                       | 5    | 10   |            | 13   |             | 15   |                        |                          |   |
|                                     |  |                       | 4    | 8    |            | 10   |             | 12   |                        |                          |   |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>Ē to Y <sub>n</sub>  |                       | 74   | 250  |            | 315  |             | 375  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 27   | 50   |            | 63   |             | 75   |                        |                          |   |
|                                     |  |                       | 22   | 43   |            | 54   |             | 64   |                        |                          |   |
|                                     |  |                       | 20   | 38   |            | 48   |             | 57   |                        |                          |   |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>S <sub>n</sub> to Y <sub>n</sub>                                |                       | 83   | 250  |            | 315  |             | 375  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 30   | 50   |            | 63   |             | 75   |                        |                          |   |
|                                     |  |                       | 24   | 43   |            | 54   |             | 64   |                        |                          |   |
|                                     |  |                       | 21   | 38   |            | 48   |             | 57   |                        |                          |   |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>Ē to Z   |                       | 85   | 275  |            | 345  |             | 415  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 31   | 55   |            | 69   |             | 83   |                        |                          |   |
|                                     |  |                       | 25   | 47   |            | 59   |             | 71   |                        |                          |   |
|                                     |  |                       | 24   | 42   |            | 53   |             | 63   |                        |                          |   |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>S <sub>n</sub> to Z   |                       | 94   | 290  |            | 365  |             | 435  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 34   | 58   |            | 73   |             | 87   |                        |                          |   |
|                                     |  |                       | 27   | 47   |            | 62   |             | 74   |                        |                          |   |
|                                     |  |                       | 25   | 45   |            | 56   |             | 68   |                        |                          |   |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>Ē to Y <sub>n</sub>   |                       | 80   | 275  |            | 345  |             | 415  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 29   | 55   |            | 69   |             | 83   |                        |                          |   |
|                                     |  |                       | 23   | 47   |            | 59   |             | 71   |                        |                          |   |
|                                     |  |                       | 17   | 42   |            | 53   |             | 63   |                        |                          |   |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>S <sub>n</sub> to Y <sub>n</sub>                                 |                       | 88   | 300  |            | 375  |             | 450  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 32   | 60   |            | 75   |             | 90   |                        |                          |   |
|                                     |  |                       | 26   | 51   |            | 64   |             | 77   |                        |                          |   |
|                                     |  |                       | 18   | 45   |            | 56   |             | 68   |                        |                          |   |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>Ē to Z  |                       | 85   | 275  |            | 345  |             | 415  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 31   | 55   |            | 69   |             | 83   |                        |                          |   |
|                                     |  |                       | 25   | 47   |            | 59   |             | 71   |                        |                          |   |
|                                     |  |                       | 18   | 42   |            | 53   |             | 63   |                        |                          |   |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>S <sub>n</sub> to Z  |                       | 94   | 300  |            | 375  |             | 450  | ns                     | 2.0<br>4.5<br>6.0<br>9.0 |   |
|                                     |  |                       | 34   | 60   |            | 75   |             | 90   |                        |                          |   |
|                                     |  |                       | 27   | 51   |            | 64   |             | 77   |                        |                          |   |
|                                     |  |                       | 19   | 45   |            | 56   |             | 68   |                        |                          |   |

# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

**Note to AC CHARACTERISTICS FOR 74HC**

- Due to higher Z terminal capacitance (16 switches versus 1) the delay figures to the Z terminal are higher than those to the Y terminal.

**DC CHARACTERISTICS FOR 74HCT**

Voltages are referenced to GND (ground = 0 V)

| SYMBOL          | PARAMETER   | $T_{amb}$ (°C) |      |      |            |      |             |      | UNIT    | TEST CONDITIONS |                      |   |
|-----------------|---|----------------|------|------|------------|------|-------------|------|---------|-----------------|----------------------|---|
|                 |   | 74HCY          |      |      |            |      |             |      |         | $V_{CC}$<br>(V) | $V_I$                | OTHER   |
|                 |   | +25            |      |      | -40 to +85 |      | -40 to +125 |      |         |                 |                      |   |
|                 |   | min.           | typ. | max. | min.       | max. | min.        | max. |         |                 |                      |   |
| $V_{IH}$        | HIGH level input voltage  | 2.0            | 1.6  |      | 2.0        |      | 2.0         |      | V       | 4.5 to 5.5      |                      |   |
| $V_{IL}$        | LOW level input voltage   |                | 1.2  | 0.8  |            | 0.8  |             | 0.8  | V       | 4.5 to 5.5      |                      |   |
| $\pm I_I$       | input leakage current   |                |      | 0.1  |            | 1.0  |             | 1.0  | $\mu A$ | 5.5             | $V_{CC}$ or GND      |   |
| $\pm I_S$       | analog switch OFF-state current per channel   |                |      | 0.1  |            | 1.0  |             | 1.0  | $\mu A$ | 5.5             | $V_{IH}$ or $V_{IL}$ | $ V_S  = V_{CC} - GND$ (see Fig.8)                    |
| $\pm I_S$       | analog switch OFF-state current all channels  |                |      | 0.8  |            | 8.0  |             | 8.0  | $\mu A$ | 5.5             | $V_{IH}$ or $V_{IL}$ | $ V_S  = V_{CC} - GND$ (see Fig.9)                    |
| $\pm I_S$       | analog switch ON-state current  |                |      | 0.8  |            | 8.0  |             | 8.0  | $\mu A$ | 5.5             | $V_{IH}$ or $V_{IL}$ | $ V_S  = V_{CC} - GND$ (see Fig.9)                    |
| $I_{CC}$        | quiescent supply current  |                |      | 8.0  |            | 80.0 |             | 160  | $\mu A$ | 4.5 to 5.5      | $V_{CC}$ or GND      | $V_{is} = GND$ or $V_{CC}$ ; $V_{os} = V_{CC}$ or GND |
| $\Delta I_{CC}$ | additional quiescent supply current per input pin for unit load coefficient is 1 (note 1) |                | 100  | 360  |            | 450  |             | 490  | $\mu A$ | 4.5 to 5.5      | $V_{CC}$ -2.1 V      | other inputs at $V_{CC}$ or GND                       |

**Note**

- The value of additional quiescent supply current ( $\Delta I_{CC}$ ) for a unit load of 1 is given here. To determine  $\Delta I_{CC}$  per input, multiply this value by the unit load coefficient shown in the table below.

| INPUT     | UNIT LOAD COEFFICIENT |
|-----------|-----------------------|
| $\bar{E}$ | 0.6                   |
| $S_n$     | 0.5                   |

# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

**AC CHARACTERISTICS FOR 74HCT**GND = 0 V;  $t_r = t_f = 6$  ns

| SYMBOL                              | PARAMETER  | T <sub>amb</sub> (°C) |      |      |            |      |             | UNIT | TEST CONDITIONS        |       |  |
|-------------------------------------|--|-----------------------|------|------|------------|------|-------------|------|------------------------|-------|--|
|                                     |  | 74HCT                 |      |      |            |      |             |      | V <sub>CC</sub><br>(V) | OTHER |  |
|                                     |  | +25                   |      |      | -40 to +85 |      | -40 to +125 |      |                        |       |  |
|                                     |  | min.                  | typ. | max. | min.       | max. | min.        |      |                        |       | max.   |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>V <sub>is</sub> to V <sub>os</sub> ;<br>Y <sub>n</sub> to Z |                       | 9    | 15   |            | 19   |             | 22   | ns                     | 4.5   | R <sub>L</sub> = ∞;<br>C <sub>L</sub> = 50 pF<br>(see Fig.16)    |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>V <sub>is</sub> to V <sub>os</sub> ;<br>Z to Y <sub>n</sub> |                       | 6    | 12   |            | 15   |             | 18   | ns                     | 4.5   |  |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>Ē to Y <sub>n</sub>  |                       | 26   | 55   |            | 69   |             | 83   | ns                     | 4.5   | R <sub>L</sub> = 1 kΩ;<br>C <sub>L</sub> = 50 pF<br>(see Fig.17) |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>S <sub>n</sub> to Y <sub>n</sub>                                |                       | 31   | 55   |            | 69   |             | 83   | ns                     | 4.5   |  |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>Ē to Z   |                       | 30   | 60   |            | 75   |             | 90   | ns                     | 4.5   |  |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | turn-off time<br>S <sub>n</sub> to Z   |                       | 35   | 60   |            | 75   |             | 90   | ns                     | 4.5   |  |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>Ē to Y <sub>n</sub>   |                       | 32   | 60   |            | 75   |             | 90   | ns                     | 4.5   |  |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>S <sub>n</sub> to Y <sub>n</sub>                                 |                       | 35   | 60   |            | 75   |             | 90   | ns                     | 4.5   |  |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>Ē to Z  |                       | 38   | 65   |            | 81   |             | 98   | ns                     | 4.5   |  |
| t <sub>PZH</sub> / t <sub>PZL</sub> | turn-on time<br>S <sub>n</sub> to Z  |                       | 38   | 65   |            | 81   |             | 98   | ns                     | 4.5   |  |

**Note**

1. Due to higher Z terminal capacitance (16 switches versus 1) the delay figures to the Z terminal are higher than those to the Y terminal.

# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

## ADDITIONAL AC CHARACTERISTICS FOR 74HC/HCT

Recommended conditions and typical values

GND = 0 V;  $t_r = t_f = 6$  ns

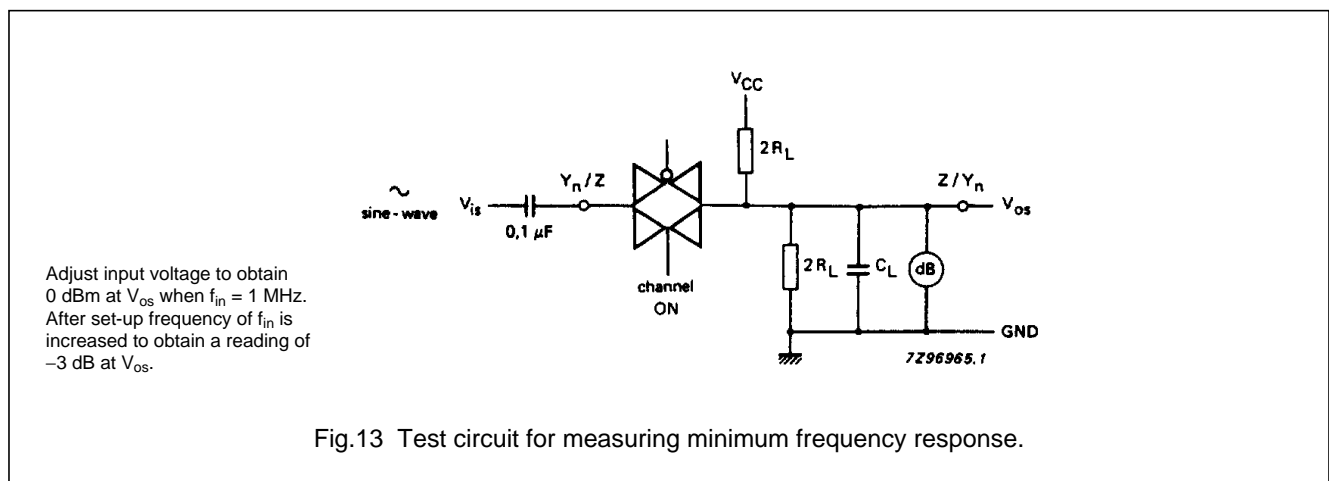
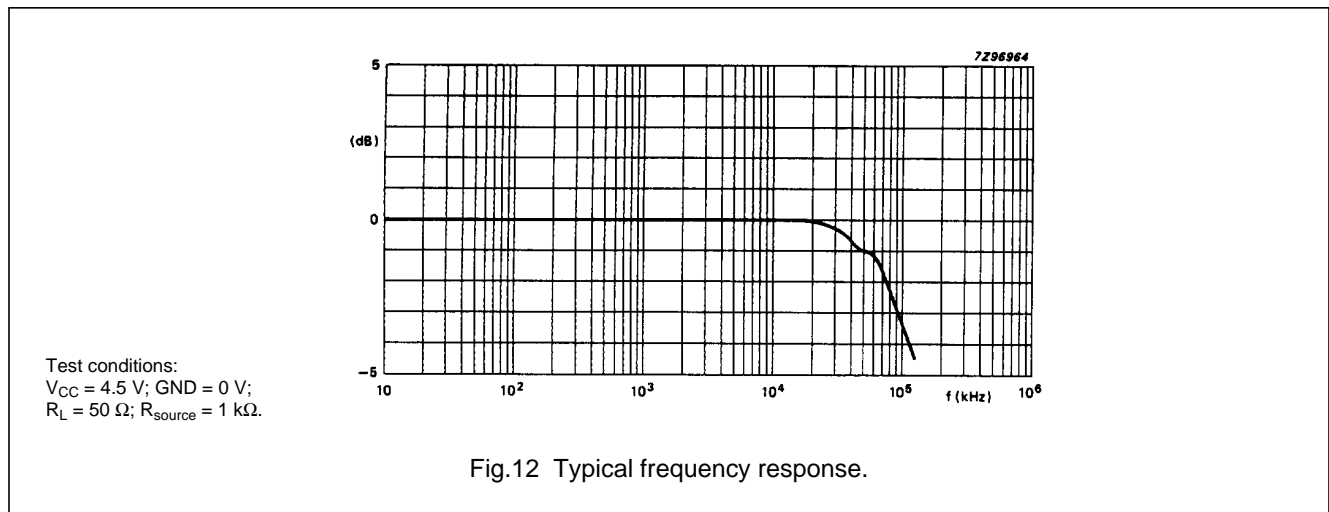
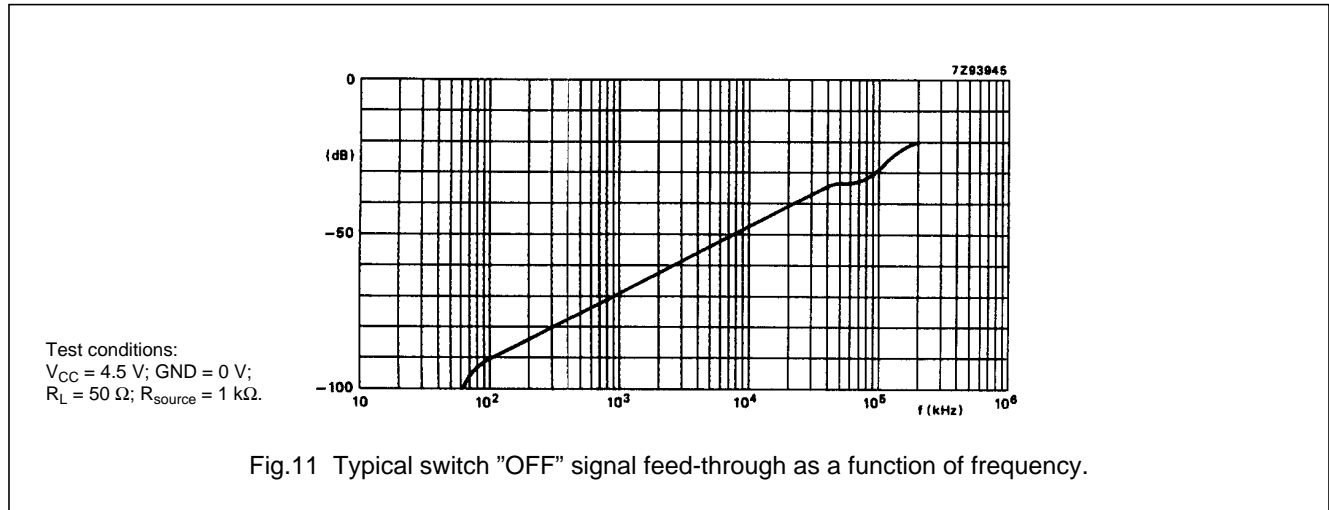
| SYMBOL           | PARAMETER   | TYP.         | UNIT       | V <sub>CC</sub><br>(V) | V <sub>is(p-p)</sub><br>(V) | CONDITIONS   |
|------------------|---|--------------|------------|------------------------|-----------------------------|--|
|                  | sine-wave distortion<br>f = 1 kHz                           | 0.04<br>0.02 | %<br>%     | 4.5<br>9.0             | 4.0<br>8.0                  | R <sub>L</sub> = 10 kΩ; C <sub>L</sub> = 50 pF<br>(see Fig.14)                   |
|                  | sine-wave distortion<br>f = 10 kHz                          | 0.12<br>0.06 | %<br>%     | 4.5<br>9.0             | 4.0<br>8.0                  | R <sub>L</sub> = 10 kΩ; C <sub>L</sub> = 50 pF<br>(see Fig.14)                   |
|                  | switch "OFF" signal<br>feed-through                         | -50<br>-50   | dB<br>dB   | 4.5<br>9.0             | note 3                      | R <sub>L</sub> = 600 Ω; C <sub>L</sub> = 50 pF<br>f = 1 MHz (see Figs 11 and 15) |
| f <sub>max</sub> | minimum frequency response<br>(-3 dB)                       | 90<br>100    | MHz<br>MHz | 4.5<br>9.0             | note 4                      | R <sub>L</sub> = 50 Ω; C <sub>L</sub> = 10 pF<br>(see Figs 12 and 13)            |
| C <sub>S</sub>   | maximum switch capacitance<br>independent (Y)<br>common (Z) | 5<br>45      | pF<br>pF   |                        |                             |  |

### Notes

1. V<sub>is</sub> is the input voltage at Y<sub>n</sub> or Z terminal, whichever is assigned as an input.
2. V<sub>os</sub> is the output voltage at Y<sub>n</sub> or Z terminal, whichever is assigned as an output.
3. Adjust input voltage V<sub>is</sub> is 0 dBm level (0 dBm = 1 mW into 600 Ω).
4. Adjust input voltage V<sub>is</sub> is 0 dBm level at V<sub>os</sub> for 1 MHz (0 dBm = 1 mW into 50 Ω).

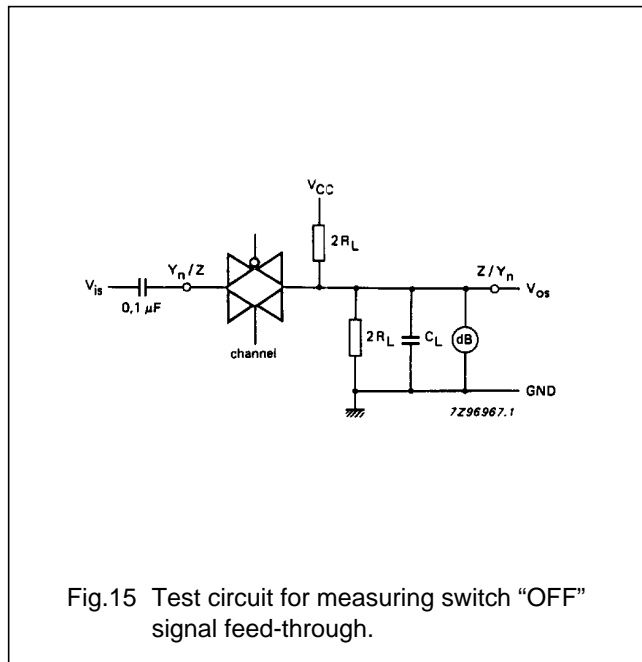
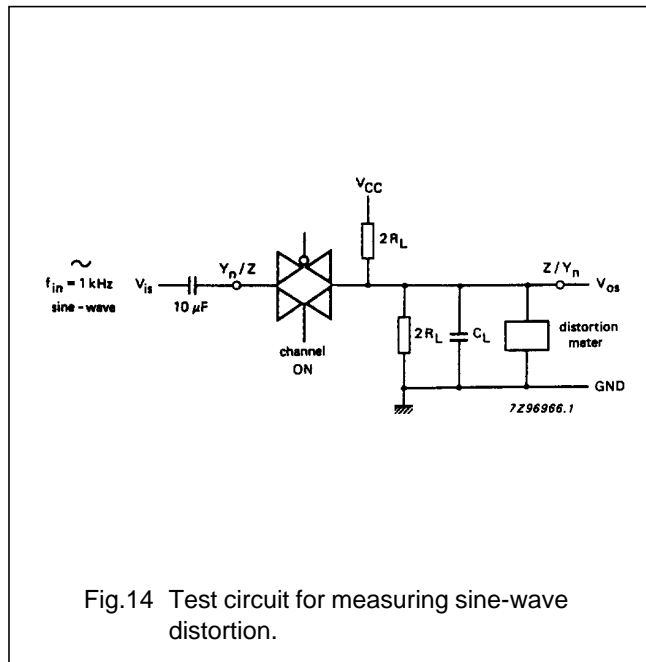
# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

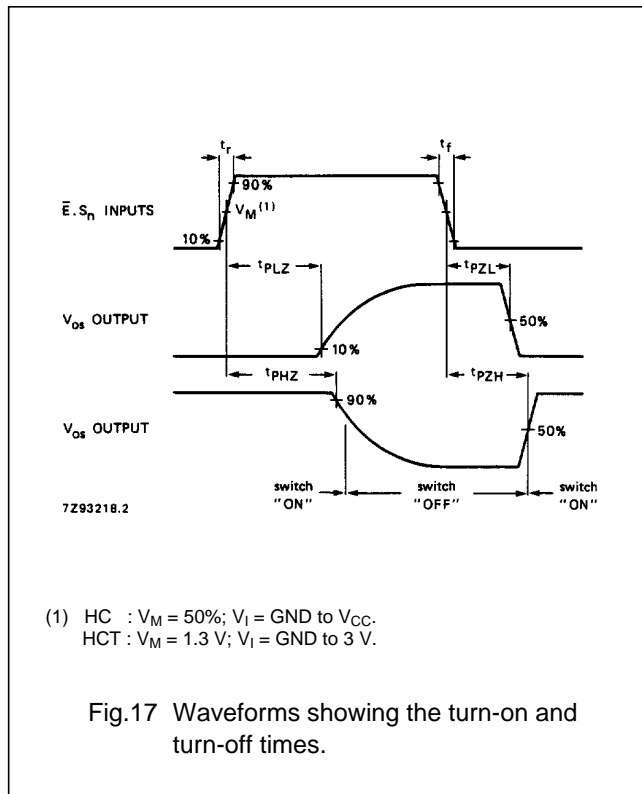
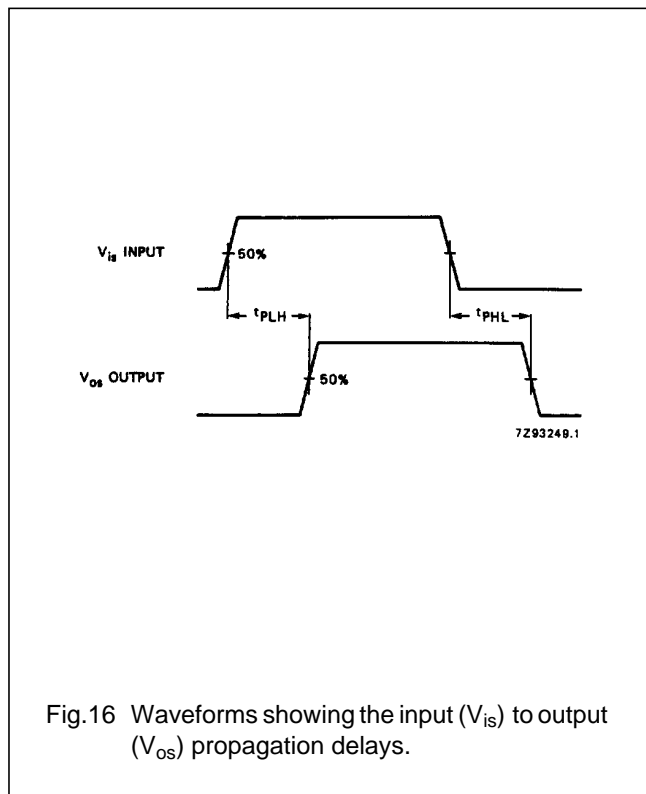


# 16-channel analog multiplexer/demultiplexer

## 74HC/HCT4067



### AC WAVEFORMS



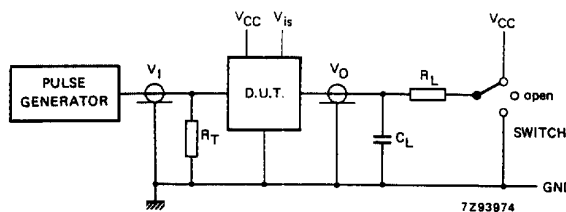
# 16-channel analog multiplexer/demultiplexer

74HC/HCT4067

## TEST CIRCUIT AND WAVEFORMS

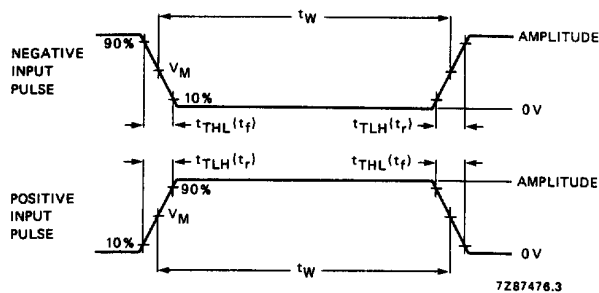
### Conditions

| TEST             | SWITCH          | V <sub>is</sub> |
|------------------|-----------------|-----------------|
| t <sub>PZH</sub> | GND             | V <sub>CC</sub> |
| t <sub>PZL</sub> | V <sub>CC</sub> | GND             |
| t <sub>PHZ</sub> | GND             | V <sub>CC</sub> |
| t <sub>PLZ</sub> | V <sub>CC</sub> | GND             |
| others           | open            | pulse           |



- C<sub>L</sub> = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).
- R<sub>T</sub> = termination resistance should be equal to the output impedance Z<sub>O</sub> of the pulse generator.
- t<sub>r</sub> = t<sub>f</sub> = 6 ns, when measuring f<sub>max</sub>, there is no constraint on t<sub>r</sub>, t<sub>f</sub> with 50% duty factor.

Fig.18 Test circuit for measuring AC performance.



| FAMILY | AMPLITUDE       | V <sub>M</sub> | t <sub>r</sub> , t <sub>f</sub> |       |
|--------|-----------------|----------------|---------------------------------|-------|
|        |                 |                | f <sub>max</sub> ; PULSE WIDTH  | OTHER |
| 74HC   | V <sub>CC</sub> | 50%            | < 2 ns                          | 6 ns  |
| 74HCT  | 3.0 V           | 1.3 V          | < 2 ns                          | 6 ns  |

Fig.19 Input pulse definitions.

## PACKAGE OUTLINES

See "74HC/HCT/HCU/HCMOS Logic Package Outlines".