

QUADRILATERAL SWITCHES 查询"74HC4016D.T"供应商

FEATURES

- Low "ON" resistance:  
160 Ω (typ.) at V<sub>CC</sub> = 4.5 V  
120 Ω (typ.) at V<sub>CC</sub> = 6.0 V  
80 Ω (typ.) at V<sub>CC</sub> = 9.0 V
- Individual switch controls
- Typical "break before make" built in
- Output capability: non-standard
- I<sub>CC</sub> category: SSI

GENERAL DESCRIPTION

The 74HC/HCT4016 are high-speed Si-gate CMOS devices and are pin compatible with the "4016" of the "4000B" series. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4016 have four independent analog switches (transmission gates).

Each switch has two input/output terminals (Y<sub>n</sub>, Z<sub>n</sub>) and an active HIGH enable input (E<sub>n</sub>). When E<sub>n</sub> is connected to V<sub>CC</sub>, a low bidirectional path between Y<sub>n</sub> and Z<sub>n</sub> is established (ON condition). When E<sub>n</sub> is connected to ground (GND), the switch is disabled and a high impedance between Y<sub>n</sub> and Z<sub>n</sub> is established (OFF condition).

Current through a switch will not cause additional V<sub>CC</sub> current provided the voltage at the terminals of the switch is maintained within the supply voltage range; V<sub>CC</sub> ≥ (V<sub>Y</sub>, V<sub>Z</sub>) ≥ GND. Inputs Y<sub>n</sub> and Z<sub>n</sub> are electrically equivalent terminals.

| SYMBOL                                 | PARAMETER  | CONDITIONS   | TYPICAL |     | UNIT |
|--|--|--|---------|-----|------|
|  |  |  | HC      | HCT |      |
| t <sub>PZH</sub> /<br>t <sub>PZL</sub> | turn "ON" time<br>E <sub>n</sub> to V <sub>OS</sub>  | C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 1 kΩ<br>V <sub>CC</sub> = 5 V | 16      | 17  | ns   |
| t <sub>PHZ</sub> /<br>t <sub>PLZ</sub> | turn "OFF" time<br>E <sub>n</sub> to V <sub>OS</sub> |  | 14      | 20  | ns   |
| C <sub>I</sub>                         | input capacitance                                    |  | 3.5     | 3.5 | pF   |
| C <sub>PD</sub>                        | power dissipation<br>capacitance per switch          | notes 1 and 2  | 12      | 12  | pF   |
| C <sub>S</sub>                         | max. switch capacitance                              |  | 5       | 5   | pF   |

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

Notes

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):

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

where:  
f<sub>i</sub> = input frequency in MHz  
f<sub>o</sub> = output frequency in MHz  
C<sub>L</sub> = output load capacitance in pF  
C<sub>S</sub> = max. switch capacitance in pF  
Σ{(C<sub>L</sub> + C<sub>S</sub>) × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>} = sum of outputs  
V<sub>CC</sub> = supply voltage in V

2. For HC the condition is V<sub>I</sub> = GND to V<sub>CC</sub>  
For HCT the condition is V<sub>I</sub> = GND to V<sub>CC</sub> - 1.5 V

PACKAGE OUTLINES

14-lead DIL; plastic (SOT27).

14-lead mini-pack; plastic (SO14; SOT108A).

PIN DESCRIPTION

| PIN NO.      | SYMBOL                           | NAME AND FUNCTION           |
|--------------|----------------------------------|-----------------------------|
| 1, 4, 8, 11  | Y <sub>0</sub> to Y <sub>3</sub> | independent inputs/outputs  |
| 7            | GND                              | ground (0 V)                |
| 2, 3, 9, 10  | Z <sub>0</sub> to Z <sub>3</sub> | independent inputs/outputs  |
| 13, 5, 6, 12 | E <sub>0</sub> to E <sub>3</sub> | enable inputs (active HIGH) |
| 14           | V <sub>CC</sub>                  | positive supply voltage     |

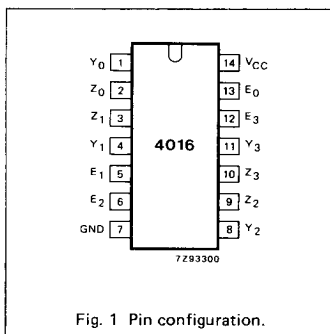


Fig. 1 Pin configuration.

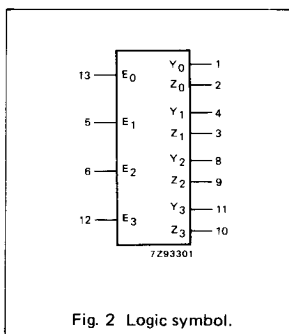


Fig. 2 Logic symbol.

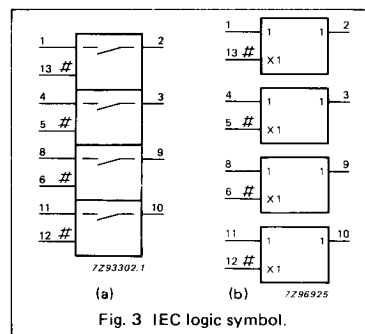
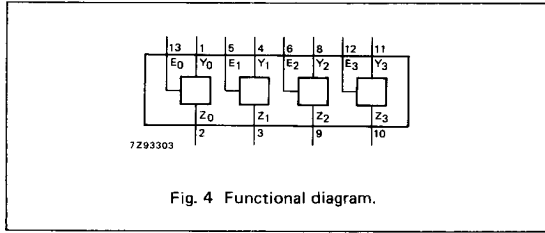


Fig. 3 IEC logic symbol.

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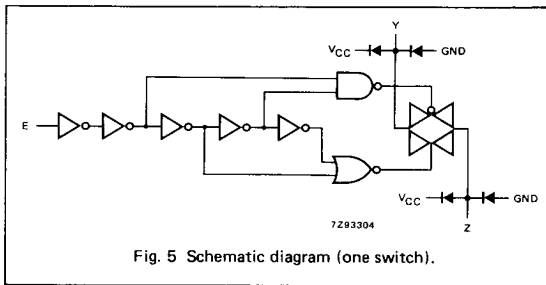
**APPLICATIONS**

- Signal gating
- Modulation
- Demodulation
- Chopper

**FUNCTION TABLE**

| INPUT<br>$E_n$ | CHANNEL<br>IMPEDANCE |
|----------------|----------------------|
| L              | high                 |
| H              | low                  |

H = HIGH voltage level  
L = LOW voltage level



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**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 <sub>CC</sub>                         | DC supply voltage                 | -0.5 | +11.0 | V    |   |
| ±I <sub>IK</sub>                        | DC digital input diode current    |      | 20    | mA   | for V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V |
| ±I <sub>SK</sub>                        | DC switch diode current           |      | 20    | mA   | for V <sub>S</sub> < -0.5 V or V <sub>S</sub> > V <sub>CC</sub> + 0.5 V |
| ±I <sub>S</sub>                         | DC switch current                 |      | 25    | mA   | for -0.5 V < V <sub>S</sub> < V <sub>CC</sub> + 0.5 V                   |
| ±I <sub>CC</sub> ;<br>±I <sub>GND</sub> | DC V <sub>CC</sub> or GND current |      | 50    | mA   |   |
| T <sub>stg</sub>                        | storage temperature range         | -65  | +150  | °C   |   |
| P <sub>tot</sub>                        | 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 <sub>S</sub>                          | power dissipation per switch      |      | 100   | mW   |   |

**RECOMMENDED OPERATING CONDITIONS**

| SYMBOL                          | PARAMETER                           | 74HC |      |                           | 74HCT |      |                 | UNIT | CONDITIONS  |
|---------------------------------|-------------------------------------|------|------|---------------------------|-------|------|-----------------|------|---|
|                                 |                                     | min. | typ. | max.                      | min.  | typ. | max.            |      |   |
| V <sub>CC</sub>                 | DC supply voltage                   | 2.0  | 5.0  | 10.0                      | 4.5   | 5.0  | 5.5             | V    |   |
| V <sub>I</sub>                  | DC input voltage range              | GND  |      | V <sub>CC</sub>           | GND   |      | V <sub>CC</sub> | V    |   |
| V <sub>S</sub>                  | DC switch voltage range             | GND  |      | V <sub>CC</sub>           | GND   |      | V <sub>CC</sub> | V    |   |
| T <sub>amb</sub>                | operating ambient temperature range | -40  |      | +85                       | -40   |      | +85             | °C   | see DC and AC CHARACTERISTICS   |
| T <sub>amb</sub>                | operating ambient temperature range | -40  |      | +125                      | -40   |      | +125            | °C   |   |
| t <sub>r</sub> , t <sub>f</sub> | input rise and fall times           |      | 6.0  | 1000<br>500<br>400<br>250 |       | 6.0  | 500             | ns   | V <sub>CC</sub> = 2.0 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6.0 V<br>V <sub>CC</sub> = 10.0 V |

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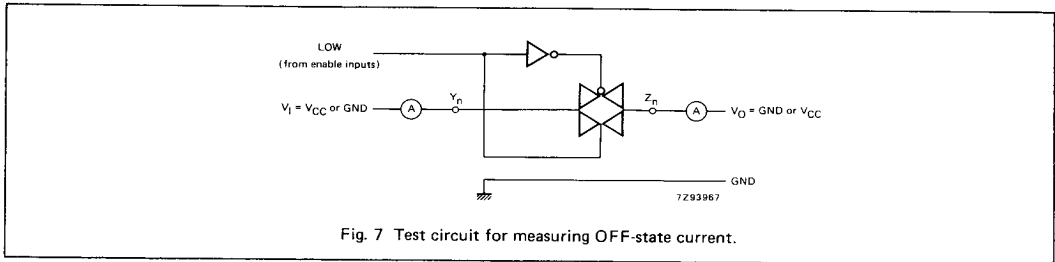
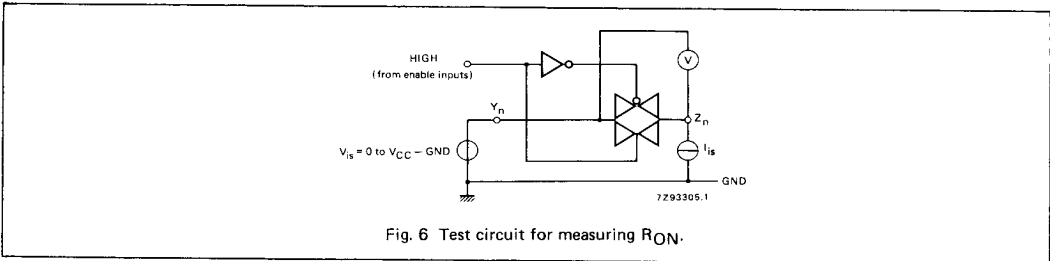
DC CHARACTERISTICS FOR 74HC/HCT

For 74HC:  $V_{CC} = 2.0, 4.5, 6.0$  and  $9.0$  V  
For 74HCT:  $V_{CC} = 4.5$  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>$V_{IL}$ |      |
|                 |  |                | 160  | 320  |            | 400  |             | $\Omega$ | 4.5             | 1000             |                       |                            |      |
|                 |  |                | 120  | 240  |            | 300  |             | $\Omega$ | 6.0             | 1000             |                       |                            |      |
|                 |  |                | 85   | 170  |            | 213  |             | $\Omega$ | 9.0             | 1000             |                       |                            |      |
| $R_{ON}$        | ON resistance (rail)                                       |                | 160  | —    |            | —    |             | $\Omega$ | 2.0             | 100              | GND                   | $V_{IH}$<br>or<br>$V_{IL}$ |      |
|                 |  |                | 80   | 160  |            | 200  |             | $\Omega$ | 4.5             | 1000             |                       |                            |      |
|                 |  |                | 70   | 140  |            | 175  |             | $\Omega$ | 6.0             | 1000             |                       |                            |      |
|                 |  |                | 60   | 120  |            | 150  |             | $\Omega$ | 9.0             | 1000             |                       |                            |      |
| $R_{ON}$        | ON resistance (rail)                                       |                | 170  | —    |            | —    |             | $\Omega$ | 2.0             | 100              | $V_{CC}$              | $V_{IH}$<br>or<br>$V_{IL}$ |      |
|                 |  |                | 90   | 180  |            | 225  |             | $\Omega$ | 4.5             | 1000             |                       |                            |      |
|                 |  |                | 80   | 160  |            | 200  |             | $\Omega$ | 6.0             | 1000             |                       |                            |      |
|                 |  |                | 65   | 135  |            | 170  |             | $\Omega$ | 9.0             | 1000             |                       |                            |      |
| $\Delta R_{ON}$ | maximum $\Delta ON$ resistance<br>between any two channels |                | —    |      |            |      |             | $\Omega$ | 2.0             |                  | $V_{CC}$<br>to<br>GND | $V_{IH}$<br>or<br>$V_{IL}$ |      |
|                 |  |                | 16   |      |            |      |             | $\Omega$ | 4.5             |                  |                       |                            |      |
|                 |  |                | 12   |      |            |      |             | $\Omega$ | 6.0             |                  |                       |                            |      |
|                 |  |                | 9    |      |            |      |             | $\Omega$ | 9.0             |                  |                       |                            |      |

Notes to DC characteristics

- At supply voltages approaching 2.0 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. 6.



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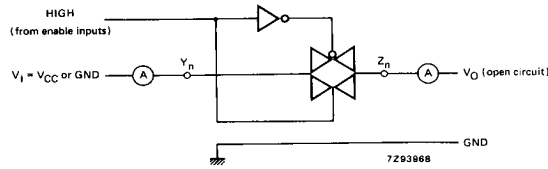


Fig. 8 Test circuit for measuring ON-state current.

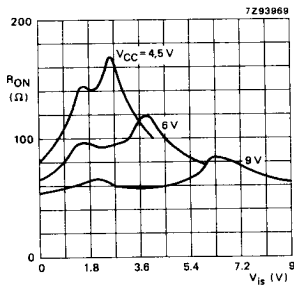


Fig. 9 Typical  $R_{ON}$  as a function of input voltage  $V_{IS}$  for  $V_{IS} = 0$  to  $V_{CC}$ .

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DC CHARACTERISTICS FOR 74HC

Voltages are referenced to GND (ground = 0 V)

| SYMBOL          | PARAMETER                                   | T <sub>amb</sub> (°C)     |                          |                              |                           |                              |                           |                              |    | UNIT                     | TEST CONDITIONS                          |  |       |
|-----------------|---|---------------------------|--------------------------|------------------------------|---------------------------|------------------------------|---------------------------|------------------------------|----|--------------------------|--|--|-------|
|                 |   | 74HC                      |                          |                              |                           |                              |                           |                              |    |                          | V <sub>CC</sub><br>V                     | V <sub>I</sub>   | OTHER |
|                 |   | +25                       |                          |                              | -40 to +85                |                              | -40 to +125               |                              |    |                          |  |  |       |
|                 |   | min.                      | typ.                     | max.                         | min.                      | max.                         | min.                      | max.                         |    |                          |  |  |       |
| V <sub>IH</sub> | HIGH level input voltage                    | 1.5<br>3.15<br>4.2<br>6.3 | 1.2<br>2.4<br>3.2<br>4.3 |                              | 1.5<br>3.15<br>4.2<br>6.3 |                              | 1.5<br>3.15<br>4.2<br>6.3 |                              | V  | 2.0<br>4.5<br>6.0<br>9.0 |  |  |       |
| V <sub>IL</sub> | LOW level input voltage                     |                           | 0.8<br>2.1<br>2.8<br>4.3 | 0.50<br>1.35<br>1.80<br>2.70 |                           | 0.50<br>1.35<br>1.80<br>2.70 |                           | 0.50<br>1.35<br>1.80<br>2.70 | V  | 2.0<br>4.5<br>6.0<br>9.0 |  |  |       |
| ±I <sub>I</sub> | input leakage current                       |                           |                          | 0.1<br>0.2                   |                           | 1.0<br>2.0                   |                           | 1.0<br>2.0                   | μA | 6.0<br>10.0              | V <sub>CC</sub><br>or<br>GND             |  |       |
| ±I <sub>S</sub> | analog switch OFF-state current per channel |                           |                          | 0.1                          |                           | 1.0                          |                           | 1.0                          | μA | 10.0                     | V <sub>IH</sub><br>or<br>V <sub>IL</sub> | V <sub>S</sub>   =<br>V <sub>CC</sub> - GND<br>(see Fig. 7)                              |       |
| ±I <sub>S</sub> | analog switch ON-state current              |                           |                          | 0.1                          |                           | 1.0                          |                           | 1.0                          | μA | 10.0                     | V <sub>IH</sub><br>or<br>V <sub>IL</sub> | V <sub>S</sub>   =<br>V <sub>CC</sub> - GND<br>(see Fig. 8)                              |       |
| I <sub>CC</sub> | quiescent supply current                    |                           |                          | 2.0<br>4.0                   |                           | 20.0<br>40.0                 |                           | 40.0<br>80.0                 | μA | 6.0<br>10.0              | V <sub>CC</sub><br>or<br>GND             | V <sub>I</sub> = GND or<br>V <sub>CC</sub> ; V <sub>OS</sub> =<br>V <sub>CC</sub> or GND |       |

AC CHARACTERISTICS FOR 74HC

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 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> /<br>t <sub>pLH</sub> | propagation delay<br>V <sub>I</sub> to V <sub>OS</sub> |                       | 17<br>6<br>5<br>4    | 60<br>12<br>10<br>8   |             | 75<br>15<br>13<br>10  |              | 90<br>18<br>15<br>12  | ns | 2.0<br>4.5<br>6.0<br>9.0 | R <sub>L</sub> = ∞; C <sub>L</sub> = 50 pF<br>(see Fig. 16)           |       |
| t <sub>pZH</sub> /<br>t <sub>pZL</sub> | turn "ON" time<br>E <sub>N</sub> to V <sub>OS</sub>    |                       | 52<br>19<br>15<br>11 | 190<br>38<br>32<br>28 |             | 240<br>48<br>41<br>35 |              | 235<br>57<br>48<br>42 | ns | 2.0<br>4.5<br>6.0<br>9.0 | R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF<br>(see Figs 17 and 18) |       |
| t <sub>pHZ</sub> /<br>t <sub>pLZ</sub> | turn "OFF" time<br>E <sub>N</sub> to V <sub>OS</sub>   |                       | 47<br>17<br>14<br>13 | 145<br>29<br>25<br>22 |             | 180<br>36<br>31<br>28 |              | 220<br>44<br>38<br>33 | ns | 2.0<br>4.5<br>6.0<br>9.0 | R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF<br>(see Figs 17 and 18) |       |

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## DC CHARACTERISTICS FOR 74HCT

Voltages are referenced to GND (ground = 0 V)

| SYMBOL          | PARAMETER   | $T_{amb}$ (°C) |      |      |            |      |             | UNIT | TEST CONDITIONS |                  |                            |  |  |
|-----------------|---|----------------|------|------|------------|------|-------------|------|-----------------|------------------|----------------------------|--|--|
|                 |   | 74HCT          |      |      |            |      |             |      | $V_{CC}$<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<br>to<br>5.5 |                            |  |  |
| $V_{IL}$        | LOW level input voltage   |                | 1.2  | 0.8  |            | 0.8  |             | 0.8  | V               | 4.5<br>to<br>5.5 |                            |  |  |
| $\pm I_I$       | input leakage current   |                |      | 0.1  |            | 1.0  |             | 1.0  | $\mu A$         | 5.5              | $V_{CC}$<br>or<br>GND      |  |  |
| $\pm I_S$       | analog switch OFF-state current per channel   |                |      | 0.1  |            | 1.0  |             | 1.0  | $\mu A$         | 5.5              | $V_{IH}$<br>or<br>$V_{IL}$ | $ V_S  =$<br>$V_{CC} - GND$<br>(see Fig. 7)                |  |
| $\pm I_S$       | analog switch ON-state current  |                |      | 0.1  |            | 1.0  |             | 1.0  | $\mu A$         | 5.5              | $V_{IH}$<br>or<br>$V_{IL}$ | $ V_S  =$<br>$V_{CC} - GND$<br>(see Fig. 8)                |  |
| $I_{CC}$        | quiescent supply current  |                |      | 2.0  |            | 20.0 |             | 40.0 | $\mu A$         | 4.5<br>to<br>5.5 | $V_{CC}$<br>or<br>GND      | $V_{IS} = GND$ or<br>$V_{CC}; V_{OS} =$<br>$V_{CC}$ 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<br>to<br>5.5 | $V_{CC}$<br>-2.1V          | other inputs<br>at $V_{CC}$ or<br>GND                      |  |

## Note

1. 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 |
|-------|-----------------------|
| $E_n$ | 1.00                  |

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## AC CHARACTERISTICS FOR 74HCT

GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

| SYMBOL                                 | PARAMETER   | T <sub>amb</sub> (°C) |      |      |            |      |             | UNIT | V <sub>CC</sub><br>V | TEST CONDITIONS<br>OTHER |   |
|--|---|-----------------------|------|------|------------|------|-------------|------|----------------------|--------------------------|---|
|  |   | 74HCT                 |      |      |            |      |             |      |                      |                          |   |
|  |   | +25                   |      |      | -40 to +85 |      | -40 to +125 |      |                      |                          |   |
|  |   | min.                  | typ. | max. | min.       | max. | min.        |      |                      |                          | max.  |
| t <sub>PHL</sub> /<br>t <sub>PLH</sub> | propagation delay<br>V <sub>is</sub> to V <sub>Os</sub> |                       | 6    | 12   |            | 15   |             | 18   | ns                   | 4.5                      | R <sub>L</sub> = ∞; C <sub>L</sub> = 50 pF<br>(see Fig. 16)           |
| t <sub>PZH</sub>                       | turn "ON" time<br>E <sub>n</sub> to V <sub>Os</sub>     |                       | 19   | 35   |            | 44   |             | 53   | ns                   | 4.5                      | R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF<br>(see Figs 17 and 18) |
| t <sub>PZL</sub>                       | turn "ON" time<br>E <sub>n</sub> to V <sub>Os</sub>     |                       | 20   | 35   |            | 44   |             | 53   | ns                   | 4.5                      | R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF<br>(see Figs 17 and 18) |
| t <sub>PHZ</sub> /<br>t <sub>PLZ</sub> | turn "OFF" time<br>E <sub>n</sub> to V <sub>Os</sub>    |                       | 23   | 35   |            | 44   |             | 53   | ns                   | 4.5                      | R <sub>L</sub> = 1 kΩ; C <sub>L</sub> = 50 pF<br>(see Figs 17 and 18) |

## 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   | 0.80<br>0.40 | %<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  | 2.40<br>1.20 | %<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 1                    | R <sub>L</sub> = 600 Ω; C <sub>L</sub> = 50 pF;<br>f = 1 MHz (see Figs 10 and 15)   |
|                    | crosstalk between<br>any two switches   | -60<br>-60   | dB<br>dB   | 4.5<br>9.0           | note 1                    | R <sub>L</sub> = 600 Ω; C <sub>L</sub> = 50 pF;<br>f = 1 MHz (see Fig. 12)  |
| V <sub>(p-p)</sub> | crosstalk voltage between<br>enable or address input<br>to any switch<br>(peak-to-peak value) | 110<br>220   | mV<br>mV   | 4.5<br>9.0           |                           | R <sub>L</sub> = 600 Ω; C <sub>L</sub> = 50 pF;<br>f = 1 MHz (E <sub>n</sub> , square wave<br>between V <sub>CC</sub> and GND,<br>t <sub>r</sub> = t <sub>f</sub> = 6 ns) (see Fig. 13) |
| f <sub>max</sub>   | minimum frequency response<br>(-3dB)  | 150<br>160   | MHz<br>MHz | 4.5<br>9.0           | note 2                    | R <sub>L</sub> = 50 Ω; C <sub>L</sub> = 10 pF<br>(see Figs 11 and 14)   |
| C <sub>S</sub>     | maximum switch capacitance  | 5            | pF         |                      |                           |   |

## Notes to AC characteristics

## General note

V<sub>is</sub> is the input voltage at a Y<sub>n</sub> or Z<sub>n</sub> terminal, whichever is assigned as an input.  
V<sub>Os</sub> is the output voltage at a Y<sub>n</sub> or Z<sub>n</sub> terminal, whichever is assigned as an output.

## Notes

1. Adjust input voltage V<sub>is</sub> to 0 dBm level (0 dBm = 1 mW into 600 Ω).
2. Adjust input voltage V<sub>is</sub> to 0 dBm level at V<sub>Os</sub> for 1 MHz (0 dBm = 1 mW into 50 Ω).



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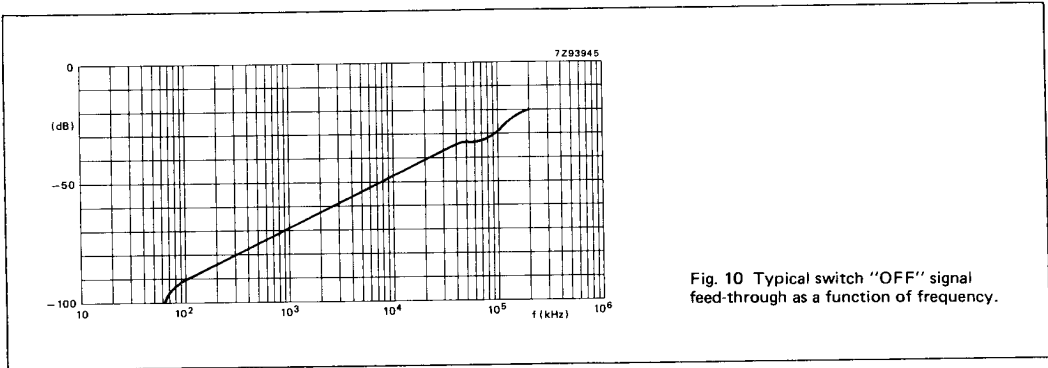
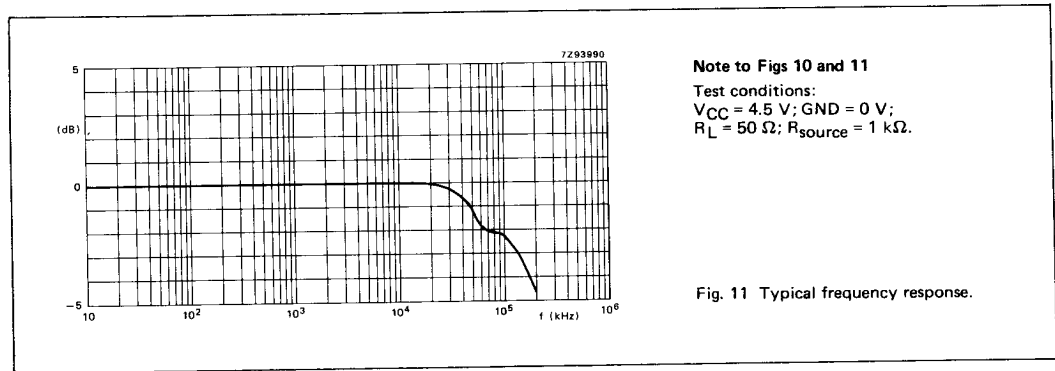


Fig. 10 Typical switch "OFF" signal feed-through as a function of frequency.



**Note to Figs 10 and 11**

Test conditions:  
 $V_{CC} = 4.5 \text{ V}$ ;  $GND = 0 \text{ V}$ ;  
 $R_L = 50 \Omega$ ;  $R_{source} = 1 \text{ k}\Omega$ .

Fig. 11 Typical frequency response.

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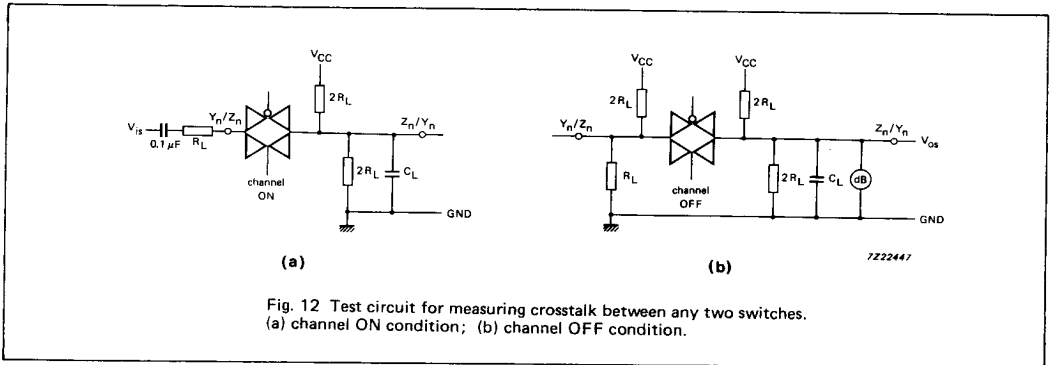


Fig. 12 Test circuit for measuring crosstalk between any two switches. (a) channel ON condition; (b) channel OFF condition.

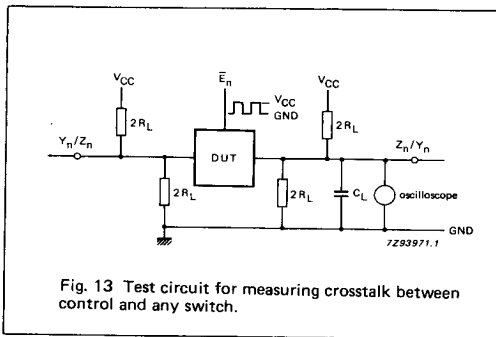


Fig. 13 Test circuit for measuring crosstalk between control and any switch.

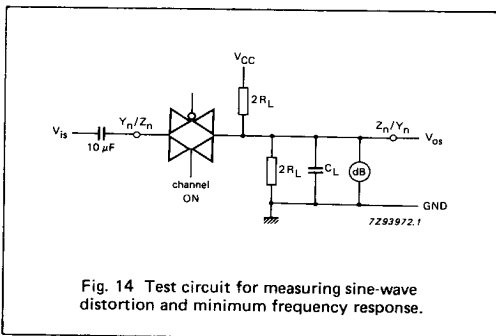
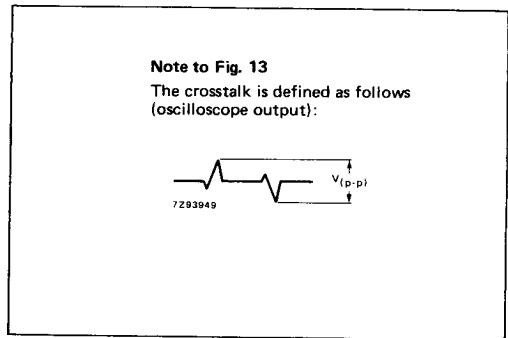


Fig. 14 Test circuit for measuring sine-wave distortion and minimum frequency response.

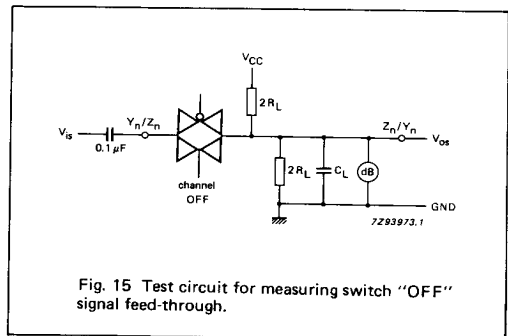
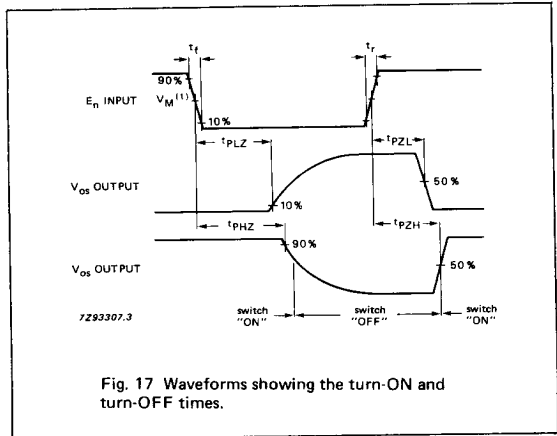
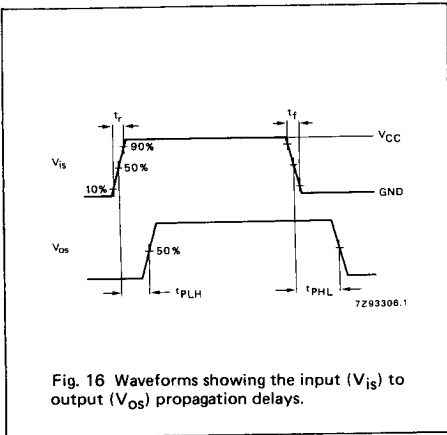


Fig. 15 Test circuit for measuring switch "OFF" signal feed-through.

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AC WAVEFORMS

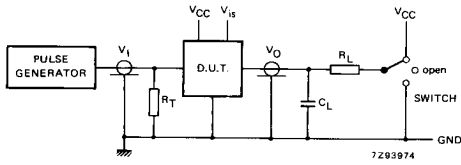


Note to AC waveforms

- (1) HC :  $V_M = 50\%$ ;  $V_I = \text{GND to } V_{CC}$ .
- HCT:  $V_M = 1.3 \text{ V}$ ;  $V_I = \text{GND to } 3 \text{ V}$ .

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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           |

Fig. 18 Test circuit for measuring AC performance.

Definitions for Figs 18 and 19:

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.

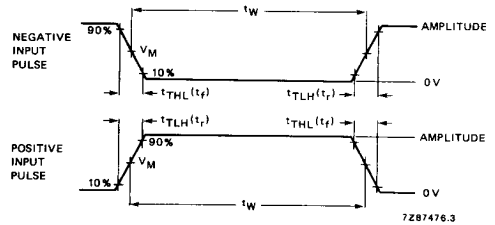


Fig. 19 Input pulse definitions.

| 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  |