# 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/HCT4316
## Quad bilateral switches

Product specification
File under Integrated Circuits, IC06

September 1993

Philips Semiconductors

PHILIPS

# Quad bilateral switches 74HC/HCT4316

## FEATURES

- Low "ON" resistance:
  160 Ω (typ.) at $V_{CC} - V_{EE}$ = 4.5 V
  120 Ω (typ.) at $V_{CC} - V_{EE}$ = 6.0 V
  80 Ω (typ.) at $V_{CC} - V_{EE}$ = 9.0 V
- Logic level translation:
  to enable 5 V logic to communicate with ± 5 V analog signals
- Typical "break before make" built in
- Output capability: non-standard
- $I_{CC}$ category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT4316 are high-speed Si-gate CMOS devices. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4316 have four independent analog switches. Each switch has two input/output terminals (nY, nZ) and an active HIGH select input (nS). When the enable input ($\overline{E}$) is HIGH, all four analog switches are turned off.

Current through a switch will not cause additional $V_{CC}$ current provided the voltage at the terminals of the switch is maintained within the supply voltage range; $V_{CC} >> (V_Y, V_Z) >> V_{EE}$. Inputs nY and nZ are electrically equivalent terminals.

$V_{CC}$ and GND are the supply voltage pins for the digital control inputs ($\overline{E}$ and nS). The $V_{CC}$ to GND ranges are 2.0 to 10.0 V for HC and 4.5 to 5.5 V for HCT.
The analog inputs/outputs (nY and nZ) can swing between $V_{CC}$ as a positive limit and $V_{EE}$ as a negative limit. $V_{CC} - V_{EE}$ may not exceed 10.0 V.

See the "4016" for the version without logic level translation.

## QUICK REFERENCE DATA

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

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | | UNIT |
|---|---|---|---|---|---|
| | | | HC | HCT | |
| $t_{PZH}$ | turn "ON" time | $C_L$ = 15 pF; $R_L$ = 1 kΩ; $V_{CC}$ = 5 V | | | |
| | $\overline{E}$ to $V_{OS}$ | | 19 | 19 | ns |
| | nS to $V_{OS}$ | | 16 | 17 | ns |
| $t_{PZL}$ | turn "ON" time | | | | |
| | $\overline{E}$ to $V_{OS}$ | | 19 | 24 | ns |
| | nS to $V_{OS}$ | | 16 | 21 | ns |
| $t_{PHZ}$/ $t_{PLZ}$ | turn "OFF" time | | | | |
| | $\overline{E}$ to $V_{OS}$ | | 20 | 21 | ns |
| | nS to $V_{OS}$ | | 16 | 19 | ns |
| $C_I$ | input capacitance | | 3.5 | 3.5 | pF |
| $C_{PD}$ | power dissipation capacitance per switch | notes 1 and 2 | 13 | 14 | pF |
| $C_S$ | max. switch capacitance | | 5 | 5 | pF |

### Notes

1. $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ 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:

   $f_i$ = 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 $V_I$ = GND to $V_{CC}$
   For HCT the condition is $V_I$ = GND to $V_{CC}$ – 1.5 V

## ORDERING INFORMATION

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

## PIN DESCRIPTION

| PIN NO. | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 1, 4, 10, 13 | 1Z to 4Z | independent inputs/outputs |
| 2, 3, 11, 12 | 1Y to 4Y | independent inputs/outputs |
| 7 | $\overline{E}$ | enable input (active LOW) |
| 8 | GND | ground (0 V) |
| 9 | $V_{EE}$ | negative supply voltage |
| 15, 5, 6, 14 | 1S to 4S | select inputs (active HIGH) |
| 16 | $V_{CC}$ | positive supply voltage |

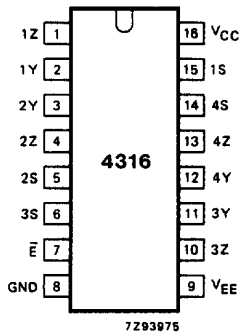



Fig.1 Pin configuration.

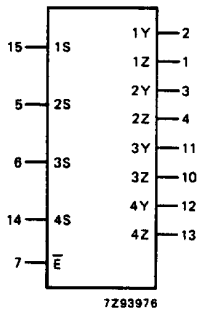



Fig.2 Logic symbol.

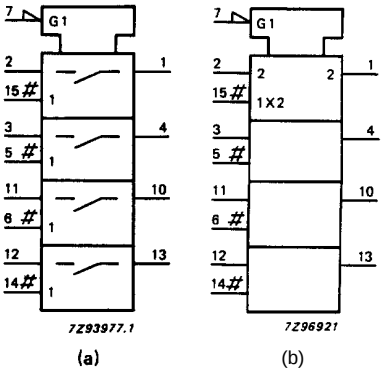



Fig.3 IEC logic symbol.

## FUNCTION TABLE

| INPUTS | | SWITCH |
|---|---|---|
| $\overline{E}$ | nS | |
| L | L | off |
| L | H | on |
| H | X | off |

**Note**

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

## APPLICATIONS

- Signal gating
- Modulation
- Demodulation
- Chopper

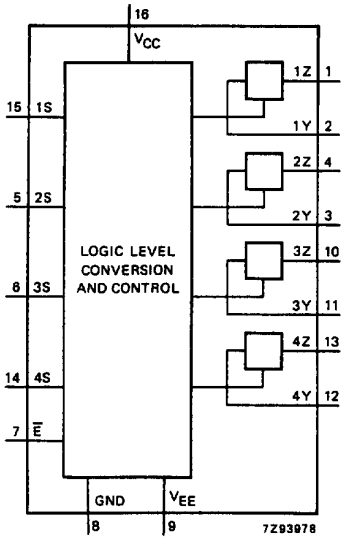



Fig.4 Functional diagram.

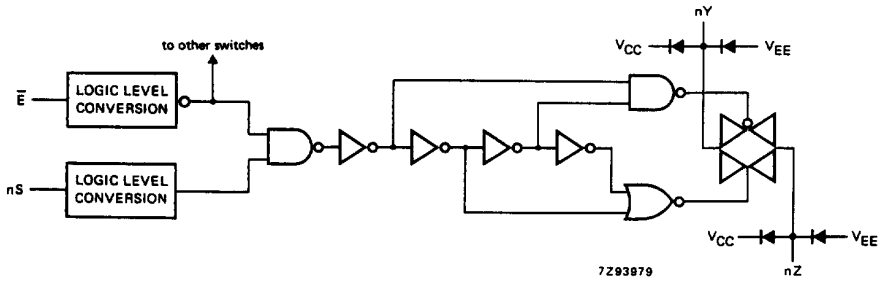



Fig.5 Schematic diagram (one switch).

## RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)
Voltages are referenced to $V_{EE}$ = 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 $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V |
| $\pm I_{SK}$ | DC switch diode current | | 20 | mA | for $V_S < -0.5$ V 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 |
| $\pm I_{EE}$ | DC $V_{EE}$ current | | 20 | mA | |
| $\pm I_{CC}$; $\pm I_{GND}$ | 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 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 ratings

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 terminals Z, no $V_{CC}$ current will flow out of terminal $Y_n$. 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 $V_{EE}$.

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | 74HC | | | 74HCT | | | UNIT | CONDITIONS |
|---|---|---|---|---|---|---|---|---|---|
| | | min. | typ. | max. | min. | typ. | max. | | |
| $V_{CC}$ | DC supply voltage $V_{CC}$–GND | 2.0 | 5.0 | 10.0 | 4.5 | 5.0 | 5.5 | V | see Figs 6 and 7 |
| $V_{CC}$ | DC supply voltage $V_{CC}$–$V_{EE}$ | 2.0 | 5.0 | 10.0 | 2.0 | 5.0 | 10.0 | V | see Figs 6 and 7 |
| $V_I$ | DC input voltage range | GND | | $V_{CC}$ | GND | | $V_{CC}$ | V | |
| $V_S$ | DC switch voltage range | $V_{EE}$ | | $V_{CC}$ | $V_{EE}$ | | $V_{CC}$ | 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 |

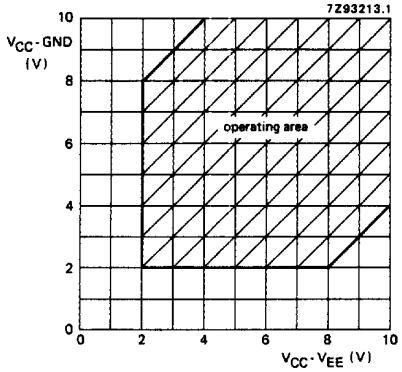



Fig.6 Guaranteed operating area as a function of the supply voltages for 74HC4316.

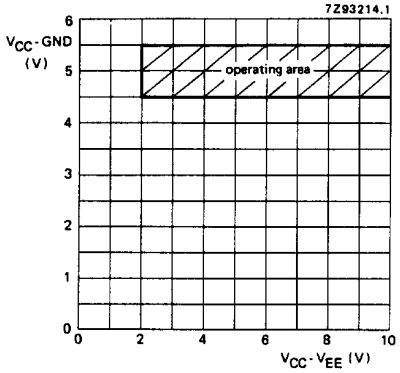



Fig.7 Guaranteed operating area as a function of the supply voltages for 74HCT4316.

**DC CHARACTERISTICS FOR 74HC/HCT**

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

For 74HCT: $V_{CC}$ – GND = 4.5 and 5.5 V; $V_{CC}$ – $V_{EE}$ = 2.0, 4.5, 6.0 and 9.0 V

| SYMBOL | PARAMETER | $T_{amb}$ (°C) | | | | | | | UNIT | TEST CONDITIONS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 74HC/HCT | | | | | | | | $V_{CC}$ (V) | $V_{EE}$ (V) | $I_S$ (μA) | $V_{is}$ | $V_I$ |
| | | +25 | | | –40 to +85 | | –40 to +125 | | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | | | |
| $R_{ON}$ | ON resistance (peak) | | –<br>160<br>120<br>85 | –<br>320<br>240<br>170 | | –<br>400<br>300<br>215 | | –<br>480<br>360<br>255 | Ω<br>Ω<br>Ω<br>Ω | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>–4.5 | 100<br>1000<br>1000<br>1000 | $V_{CC}$ to $V_{EE}$ | $V_{IH}$ or $V_{IL}$ |
| $R_{ON}$ | ON resistance (rail) | | 160<br>80<br>70<br>60 | –<br>160<br>140<br>120 | | –<br>200<br>175<br>150 | | –<br>240<br>210<br>180 | Ω<br>Ω<br>Ω<br>Ω | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>–4.5 | 100<br>1000<br>1000<br>1000 | $V_{EE}$ | $V_{IH}$ or $V_{IL}$ |
| $R_{ON}$ | ON resistance (rail) | | 170<br>90<br>80<br>65 | –<br>180<br>160<br>135 | | –<br>225<br>200<br>170 | | –<br>270<br>240<br>205 | Ω<br>Ω<br>Ω<br>Ω | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>–4.5 | 100<br>1000<br>1000<br>1000 | $V_{CC}$ | $V_{IH}$ or $V_{IL}$ |
| $\Delta R_{ON}$ | maximum ΔON resistance between any two channels | | –<br>16<br>9<br>6 | | | | | | Ω<br>Ω<br>Ω<br>Ω | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>–4.5 | | $V_{CC}$ to $V_{EE}$ | $V_H$ or $V_{IL}$ |

**Notes**

1. At supply voltages ($V_{CC}$ – $V_{EE}$) approaching 2.0 V the analog switch ON-resistance becomes extremely non-linear. Therefore it is recommended that these devices are used to transmit digital signals only, when using these supply voltages.
2. For test circuit measuring $R_{ON}$ see Fig.8.

**DC CHARACTERISTICS FOR 74HC**

Voltages are referenced to GND (ground = 0 V)

| SYMBOL | PARAMETER | $T_{amb}$ (°C) | | | | | | | UNIT | TEST CONDITIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 74HC | | | | | | | | $V_{CC}$ (V) | $V_{EE}$ (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<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 | | | |
| $V_{IL}$ | LOW level input voltage | | 0.8<br>2.1<br>2.8<br>4.3 | 0.5<br>1.35<br>1.8<br>2.7 | | 0.5<br>1.35<br>1.8<br>2.7 | | 0.5<br>1.35<br>1.8<br>2.7 | V | 2.0<br>4.5<br>6.0<br>9.0 | | | |
| $\pm I_I$ | input leakage current | | | 0.1<br>0.2 | | 1.0<br>2.0 | | 1.0<br>2.0 | µA | 6.0<br>10.0 | 0<br>0 | $V_{CC}$ or GND | |
| $\pm I_S$ | analog switch OFF-state current | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | 0 | $V_{IH}$ or $V_{IL}$ | $\lvert V_S \rvert$ = $V_{CC} - V_{EE}$ (see Fig.10) |
| $\pm I_S$ | analog switch ON-state current | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | 0 | $V_{IH}$ or $V_{IL}$ | $\lvert V_S \rvert$ = $V_{CC} - V_{EE}$ (see Fig.11) |
| $I_{CC}$ | quiescent supply current | | | 8.0<br>16.0 | | 80.0<br>160.0 | | 160.0<br>320.0 | µA | 6.0<br>10.0 | 0<br>0 | $V_{CC}$ or GND | $V_{is} = V_{EE}$ or $V_{CC}$; $V_{OS} = V_{CC}$ or $V_{EE}$ |

**AC CHARACTERISTICS FOR 74HC**

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

| SYMBOL | PARAMETER | $T_{amb}$ (°C) | | | | | | | UNIT | TEST CONDITIONS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 74HC | | | | | | | | | | |
| | | +25 | | | −40 to +85 | | −40 to +125 | | | $V_{CC}$ (V) | $V_{EE}$ (V) | OTHER |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | |
| $t_{PHL}$/ $t_{PLH}$ | propagation delay $V_{is}$ to $V_{os}$ | | 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>4.5 | 0<br>0<br>0<br>−4.5 | $R_L = \infty$; $C_L$ = 50 pF (see Fig.18) |
| $t_{PZH}$/ $t_{PZL}$ | turn “ON” time $\overline{E}$ to $V_{os}$ | | 61<br>22<br>18<br>19 | 205<br>41<br>35<br>37 | | 255<br>51<br>43<br>47 | | 310<br>62<br>53<br>56 | ns | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>−4.5 | $R_L$ = 1 kΩ; $C_L$ = 50 pF (see Figs 19, 20 and 21) |
| $t_{PZH}$/ $t_{PZL}$ | turn “ON” time nS to $V_{os}$ | | 52<br>19<br>15<br>17 | 175<br>35<br>30<br>34 | | 220<br>44<br>37<br>43 | | 265<br>53<br>45<br>51 | ns | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>−4.5 | $R_L$ = 1 kΩ; $C_L$ = 50 pF (see Figs 19, 20 and 21) |
| $t_{PHZ}$/ $t_{PLZ}$ | turn “OFF” time $\overline{E}$ to $V_{os}$ | | 63<br>23<br>18<br>21 | 220<br>44<br>37<br>39 | | 275<br>55<br>47<br>49 | | 330<br>66<br>56<br>59 | ns | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>−4.5 | $R_L$ = 1 kΩ; $C_L$ = 50 pF (see Figs 19, 20 and 21) |
| $t_{PHZ}$/ $t_{PLZ}$ | turn “OFF” time nS to $V_{os}$ | | 55<br>20<br>16<br>18 | 175<br>35<br>30<br>36 | | 220<br>44<br>37<br>45 | | 265<br>53<br>45<br>54 | ns | 2.0<br>4.5<br>6.0<br>4.5 | 0<br>0<br>0<br>−4.5 | $R_L$ = 1 kΩ; $C_L$ = 50 pF (see Figs 19, 20 and 21) |

**DC CHARACTERISTICS FOR 74HCT**

Voltages are referenced to GND (ground = 0)

| SYMBOL | PARAMETER | $T_{amb}$ (°C) | | | | | | | UNIT | TEST CONDITIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 74HCT | | | | | | | | $V_{CC}$ (V) | $V_{EE}$ (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 | µA | 5.5 | 0 | $V_{CC}$ or GND | |
| $\pm I_S$ | analog switch OFF-state current | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | 0 | $V_{IH}$ or $V_{IL}$ | $\lvert V_S \rvert$ = $V_{CC} - V_{EE}$ (see Fig.10) |
| $\pm I_S$ | analog switch ON-state current | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | 0 | $V_{IH}$ or $V_{IL}$ | $\lvert V_S \rvert$ = $V_{CC} - V_{EE}$ (see Fig.11) |
| $I_{CC}$ | quiescent supply current | | | 8.0<br>16.0 | | 80.0<br>160.0 | | 160.0<br>320.0 | µA | 5.5<br>5.0 | 0<br>–5.0 | $V_{CC}$ or GND | $V_{is} = V_{EE}$ or $V_{CC}$; $V_{OS} = V_{CC}$ or $V_{EE}$ |
| $\Delta I_{CC}$ | additional quiescent supply current per input pin for unit load coefficient is 1 (note 1) | | 100 | 360 | | 450 | | 490 | µA | 4.5 to 5.5 | 0 | $V_{CC}$ –2.1 V | other inputs at $V_{CC}$ or 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 |
|---|---|
| nS | 0.50 |
| $\overline{E}$ | 0.50 |

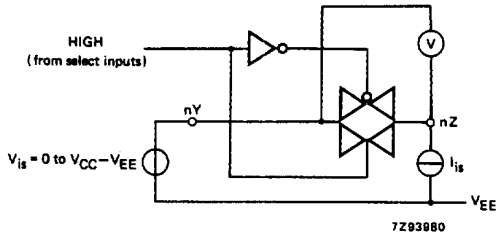



Fig.8 Test circuit for measuring $R_{ON}$.

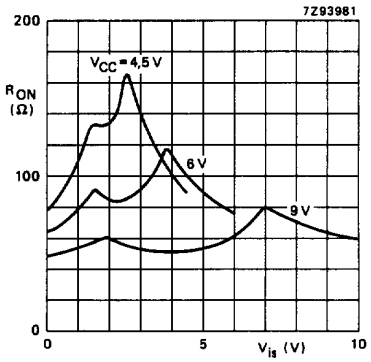



Fig.9 Typical $R_{ON}$ as a function of input voltage $V_{is}$ for $V_{is}$ = 0 to $V_{CC} - V_{EE}$.

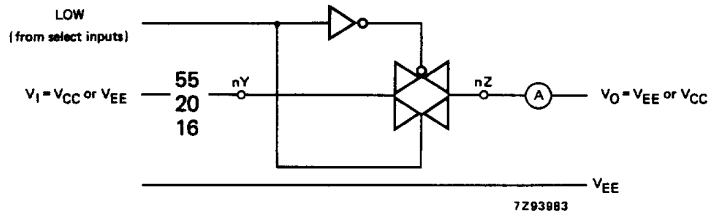



Fig.10 Test circuit for measuring OFF-state current.

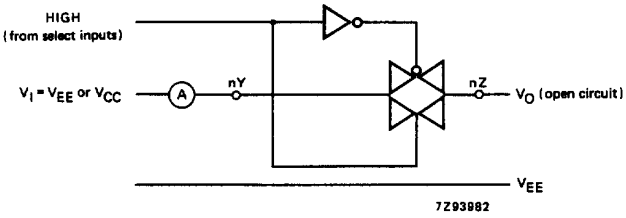



Fig.11 Test circuit for measuring ON-state current.

**AC CHARACTERISTICS FOR 74HCT**

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

| SYMBOL | PARAMETER | $T_{amb}$ (°C) | | | | | | | UNIT | TEST CONDITIONS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 74HCT | | | | | | | | $V_{CC}$ (V) | $V_{EE}$ (V) | OTHER |
| | | +25 | | | −40 TO +85 | | −40 to +125 | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | |
| $t_{PHL}$/ $t_{PLH}$ | propagation delay $V_{is}$ to $V_{os}$ | | 6<br>4 | 12<br>8 | | 15<br>10 | | 18<br>12 | ns | 4.5<br>4.5 | 0<br>–4.5 | $R_L$ = ∞;<br>$C_L$ = 50 pF<br>(see Fig.18) |
| $t_{PZH}$ | turn “ON” time $\overline{E}$ to $V_{os}$ | | 22<br>21 | 44<br>42 | | 55<br>53 | | 66<br>63 | ns | 4.5<br>4.5 | 0<br>–4.5 | $R_L$ = 1 kΩ;<br>$C_L$ = 50 pF<br>(see Figs 19, 20 and 21) |
| $t_{PZL}$ | turn “ON” time $\overline{E}$ to $V_{os}$ | | 28<br>21 | 56<br>42 | | 70<br>53 | | 84<br>63 | ns | 4.5<br>4.5 | 0<br>–4.5 | |
| $t_{PZH}$ | turn “ON” time nS to $V_{os}$ | | 20<br>17 | 40<br>34 | | 53<br>43 | | 60<br>51 | ns | 4.5<br>4.5 | 0<br>–4.5 | $R_L$ = 1 kΩ;<br>$C_L$ = 50 pF<br>(see Figs 19, 20 and 21) |
| $t_{PZL}$ | turn “ON” time nS to $V_{os}$ | | 25<br>17 | 50<br>34 | | 63<br>43 | | 75<br>51 | ns | 4.5<br>4.5 | 0<br>–4.5 | |
| $t_{PHZ}$/ $t_{PLZ}$ | turn “OFF” time $\overline{E}$ to $V_{os}$ | | 25<br>23 | 50<br>46 | | 63<br>58 | | 75<br>69 | ns | 4.5<br>4.5 | 0<br>–4.5 | $R_L$ = 1 kΩ;<br>$C_L$ = 50 pF<br>(see Figs 19, 20 and 21) |
| $t_{PHZ}$/ $t_{PLZ}$ | turn “OFF” time nS to $V_{os}$ | | 22<br>20 | 44<br>40 | | 55<br>50 | | 66<br>60 | ns | 4.5<br>4.5 | 0<br>–4.5 | $R_L$ = 1 kΩ;<br>$C_L$ = 50 pF<br>(see Figs 19, 20 and 21) |

## ADDITIONAL AC CHARACTERISTICS FOR 74HC/HCT

### Recommended conditions and typical values

GND = 0 V; $T_{amb}$ = 25 °C

| SYMBOL | PARAMETER | typ. | UNIT | $V_{CC}$ (V) | $V_{EE}$ (V) | $V_{is(p-p)}$ (V) | CONDITIONS |
|---|---|---|---|---|---|---|---|
| | sine-wave distortion<br>f = 1 kHz | 0.80<br>0.40 | %<br>% | 2.25<br>4.5 | –2.25<br>–4.5 | 4.0<br>8.0 | $R_L$ = 10 kΩ; $C_L$ = 50 pF<br>(see Fig.14) |
| | sine-wave distortion<br>f = 10 kHz | 2.40<br>1.20 | %<br>% | 2.25<br>4.5 | –2.25<br>–4.5 | 4.0<br>8.0 | $R_L$ = 10 kΩ; $C_L$ = 50 pF<br>(see Fig.14) |
| | switch “OFF” signal<br>feed-through | –50<br>–50 | dB<br>dB | 2.25<br>4.5 | –2.25<br>–4.5 | note 1 | $R_L$ = 600 Ω; $C_L$ = 50 pF<br>f = 1 MHz (see Figs 12 and 15) |
| | crosstalk between<br>any two switches | –60<br>–60 | dB<br>dB | 2.25<br>4.5 | –2.25<br>–4.5 | note 1 | $R_L$ = 600 Ω; $C_L$ = 50 pF;<br>f = 1 MHz; (see Fig.16) |
| $V_{(p-p)}$ | crosstalk voltage between<br>control and any switch<br>(peak-to-peak value) | 110<br>220 | mV<br>mV | 4.5<br>4.5 | 0<br>–4.5 | | $R_L$ = 600 kΩ; $C_L$ = 50 pF;<br>f = 1 MHz ($\overline{E}$ or nS,<br>square-wave between $V_{CC}$<br>and GND, $t_r = t_f$ = 6 ns)<br>(see Fig.17) |
| $f_{max}$ | minimum frequency response<br>(–3 dB) | 150<br>160 | MHz<br>MHz | 2.25<br>4.5 | –2.25<br>–4.5 | note 2 | $R_L$ = 50 Ω ; $C_L$ = 10 pF<br>(see Figs 13 and 14) |
| $C_S$ | maximum switch capacitance | 5 | pF | | | | |

### Notes

1. Adjust input voltage $V_{is}$ to 0 dBm level (0 dBm = 1 mW into 600 Ω).
2. Adjust input voltage $V_{is}$ to 0 dBm level at $V_{OS}$ for 1 MHz (0 dBm = 1 mW into 50 Ω).

*General note*

$V_{is}$ is the input voltage at an nY or nZ terminal, whichever is assigned as an input.
$V_{os}$ is the output voltage at an nY or nZ terminal, whichever is assigned as an output.

Test conditions:
$V_{CC}$ = 4.5 V; GND = 0 V; $V_{EE}$ = –4.5 V;
$R_L$ = 50 Ω; $R_{source}$ = 1 kΩ.

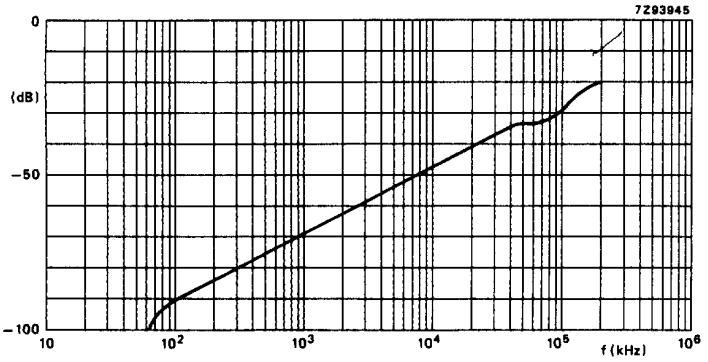



Fig.12 Typical switch “OFF” signal feed-through as a function of frequency.

Test conditions:
$V_{CC}$ = 4.5 V; GND = 0 V; $V_{EE}$ = −4.5 V;
$R_L$ = 50 Ω; $R_{source}$ = 1 kΩ.

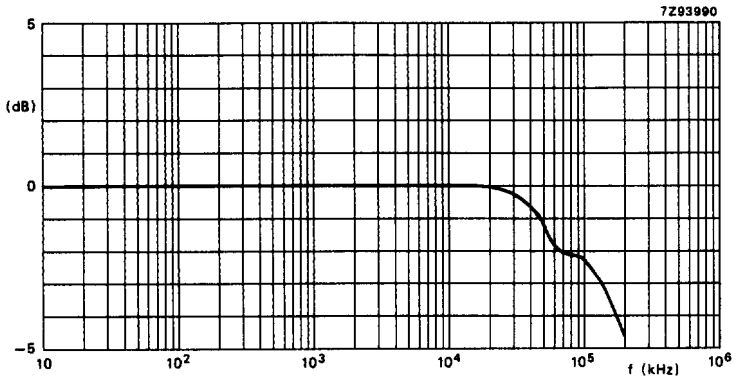



Fig.13 Typical frequency response.

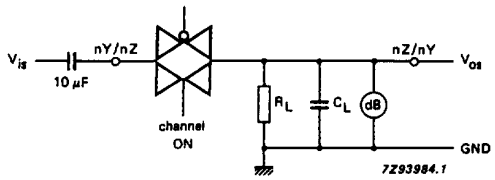



Fig.14 Test circuit for measuring sine-wave distortion and minimum frequency response.

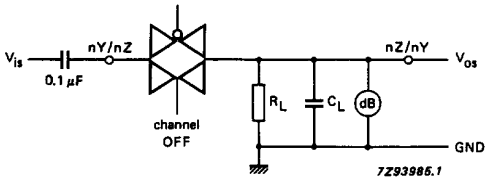



Fig.15 Test circuit for measuring switch “OFF” signal feed-through.

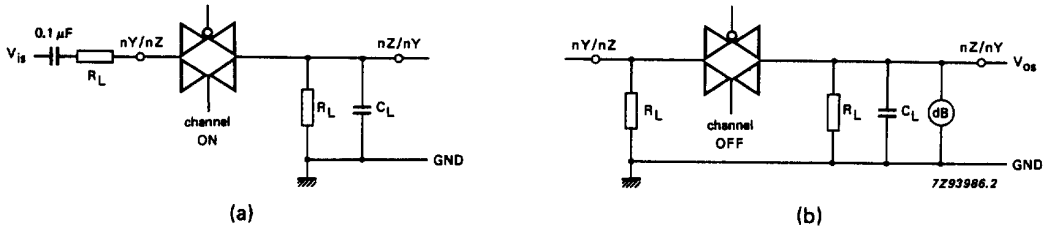
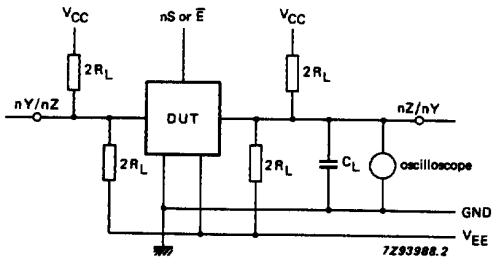



Fig.16 Test circuit for measuring crosstalk between any two switches.
(a) channel ON condition; (b) channel OFF condition.




The crosstalk is defined as follows (oscilloscope output):

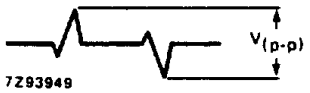



Fig.17 Test circuit for measuring crosstalk between control and any switch.

## AC WAVEFORMS

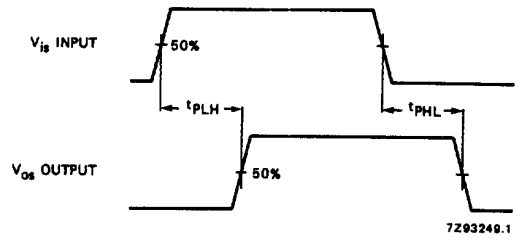
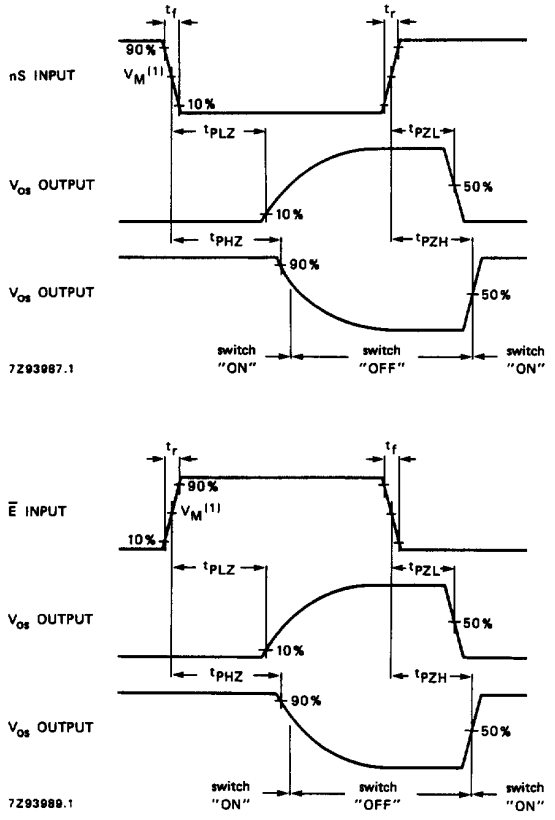



Fig.18 Waveforms showing the input ($V_{is}$) to output ($V_{os}$) propagation delays.




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

Fig.19 Waveforms showing the turn-ON and turn-OFF times.

## TEST CIRCUIT AND WAVEFORMS

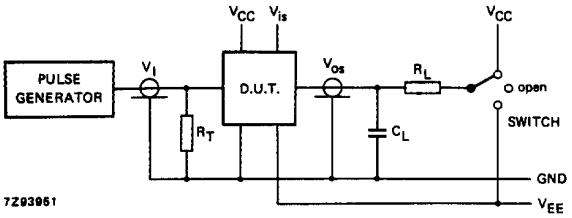



Fig.20 Test circuit for measuring AC performance.

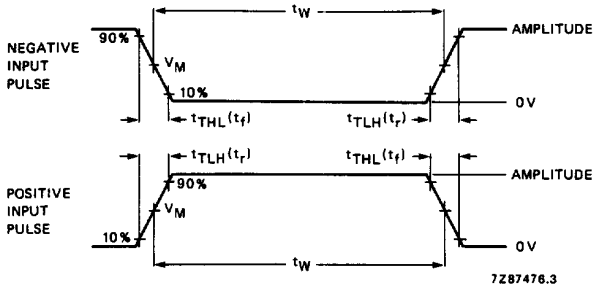



Fig.21 Input pulse definitions.

### Conditions

| TEST | SWITCH | $V_{is}$ |
|---|---|---|
| $t_{PZH}$ | $V_{EE}$ | $V_{CC}$ |
| $t_{PZL}$ | $V_{CC}$ | $V_{EE}$ |
| $t_{PHZ}$ | $V_{EE}$ | $V_{CC}$ |
| $t_{PLZ}$ | $V_{CC}$ | $V_{EE}$ |
| others | open | pulse |

| FAMILY | AMPLITUDE | $V_M$ | $t_r$; $t_f$ | |
|---|---|---|---|---|
| | | | $f_{max}$; PULSE WIDTH | OTHER |
| 74HC | $V_{CC}$ | 50% | < 2 ns | 6 ns |
| 74HCT | 3.0 V | 1.3 V | < 2 ns | 6 ns |

Definitions for Figs 20 and 21:

$C_L$ = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).

$R_T$ = termination resistance should be equal to the output impedance $Z_O$ of the pulse generator.

$t_r = t_f$ = 6 ns; when measuring $f_{max}$, there is no constraint to $t_r$, $t_f$ with 50% duty factor.

## PACKAGE OUTLINES

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

# OCEAN CHIPS
## Океан Электроники
## Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

AVIC JONHON

**«JONHON»** (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

**«FORSTAR»** (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

FORSTAR®

Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А