# DUAL 4-INPUT AND GATE

## FEATURES

- **Output capability: standard**
- **$I_{CC}$ category: SSI**

## GENERAL DESCRIPTION

The 74HC/HCT21 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT21 provide the 4-input AND function.

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | | UNIT |
|---|---|---|---|---|---|
| | | | HC | HCT | |
| $t_{PHL}/t_{PLH}$ | propagation delay nA, nB, nC, nD to nY | $C_L$ = 15 pF; $V_{CC}$ = 5 V | 10 | 12 | ns |
| $C_I$ | input capacitance | | 3.5 | 3.5 | pF |
| $C_{PD}$ | power dissipation capacitance per package | notes 1 and 2 | 15 | 16 | pF |

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

Notes

1. $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW):
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
   $f_i$ = input frequency in MHz; $C_L$ = output load capacitance in pF
   $f_o$ = output frequency in MHz; $V_{CC}$ = supply voltage in V
   $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs
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

## PACKAGE OUTLINES

14-lead DIL; plastic (SOT27)
14-lead mini pack; plastic (SO14; SOT108A)

## PIN DESCRIPTION

| PIN NO. | SYMBOL | NAME AND FUNCTION |
|---|---|---|
| 1, 9 | 1A, 2A | data inputs |
| 2, 10 | 1B, 2B | data inputs |
| 3, 11 | n.c. | not connected |
| 4, 12 | 1C, 2C | data inputs |
| 5, 13 | 1D, 2D | data inputs |
| 6, 8 | 1Y, 2Y | data outputs |
| 7 | GND | ground (0 V) |
| 14 | $V_{CC}$ | positive supply voltage |

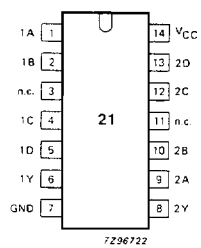


Fig. 1 Pin configuration.

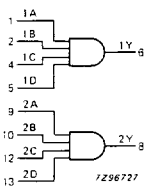


Fig. 2 Logic symbol.

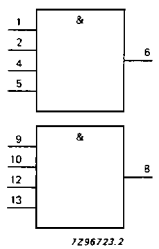


Fig. 3 IEC logic symbol.

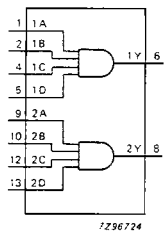


Fig. 4 Functional diagram.

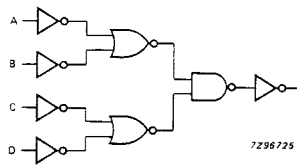


Fig. 5 Logic diagram (one gate).

**FUNCTION TABLE**

| INPUTS | | | | OUTPUT |
|---|---|---|---|---|
| nA | nB | nC | nD | nY |
| L | X | X | X | L |
| X | L | X | X | L |
| X | X | L | X | L |
| X | X | X | L | L |
| H | H | H | H | H |

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

## DC CHARACTERISTICS FOR 74HC

For the DC characteristics see chapter "HCMOS family characteristics", section "Family specifications".

Output capability: standard
$I_{CC}$ category: SSI

## 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 | | | | | | | | $V_{CC}$ V | WAVEFORMS |
| | | +25 | | | −40 to +85 | | −40 to +125 | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | |
| $t_{PHL}/t_{PLH}$ | propagation delay nA, nB, nC, nD to nY | | 33<br>12<br>10 | 110<br>22<br>19 | | 140<br>28<br>24 | | 165<br>33<br>28 | ns | 2.0<br>4.5<br>6.0 | Fig. 6 |
| $t_{THL}/t_{TLH}$ | output transition time | | 19<br>7<br>6 | 75<br>15<br>13 | | 95<br>19<br>16 | | 110<br>22<br>19 | ns | 2.0<br>4.5<br>6.0 | Fig. 6 |

## DC CHARACTERISTICS FOR 74HCT

For the DC characteristics see chapter "HCMOS family characteristics", section "Family specifications".

Output capability: standard
$I_{CC}$ category: SSI

**Note to HCT types**

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

| INPUT | UNIT LOAD COEFFICIENT |
|---|---|
| nA, nB,<br>nC, nD | 1.50<br>1.50 |

## 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 | WAVEFORMS |
| | | +25 | | | −40 to +85 | | −40 to +125 | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | |
| $t_{PHL}/t_{PLH}$ | propagation delay nA, nB, nC, nD to nY | | 15 | 27 | | 34 | | 41 | ns | 4.5 | Fig. 6 |
| $t_{THL}/t_{TLH}$ | output transition time | | 7 | 15 | | 19 | | 22 | ns | 4.5 | Fig. 6 |

## AC WAVEFORMS

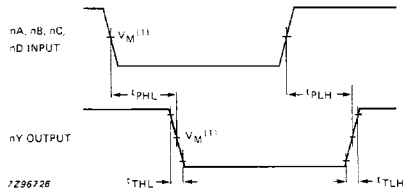


Fig. 6 Waveforms showing the input (nA, nB, nC, nD) to output (nY) propagation delays and the output transition times.

**Note to AC waveforms**

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