

# 74AHC00; 74AHCT00

## Quad 2-input NAND gate

Rev. 5 — 26 May 2020

Product data sheet

## 1. General description

The 74AHC00; 74AHCT00 are quad 2-input NAND gates. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

## 2. Features

- Wide supply voltage range from 2.0 V to 5.5 V
- Input levels:
  - For 74AHC00: CMOS level
  - For 74AHCT00: TTL level
- Balanced propagation delays
- All inputs have Schmitt-trigger actions
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- ESD protection:
  - HBM EIA/JESD22-A114E exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V
  - CDM EIA/JESD22-C101C exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC00D	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74AHCT00D				
74AHC00PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74AHCT00PW				
74AHC00BQ	-40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm	SOT762-1
74AHCT00BQ				

### 4. Functional diagram



### 5. Pinning information

#### 5.1. Pinning



#### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1A, 2A, 3A, 4A	1, 4, 9, 12	data inputs
1B, 2B, 3B, 4B	2, 5, 10, 13	data inputs
1Y, 2Y, 3Y, 4Y	3, 6, 8, 11	data outputs
GND	7	ground (0 V)
V <sub>CC</sub>	14	supply voltage

## 6. Functional description

**Table 3. Function selection**

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

Input		Output
nA	nB	nY
L	X	H
X	L	H
H	H	L

## 7. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+7.0	V
$V_I$	input voltage		-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5$ V [1]	-20	-	mA
$I_{OK}$	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1]	-20	+20	mA
$I_O$	output current	$V_O = -0.5$ V to $(V_{CC} + 0.5)$ V	-25	+25	mA
$I_{CC}$	supply current		-	+75	mA
$I_{GND}$	ground current		-75	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C [2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT108-1 (SO14) package:  $P_{tot}$  derates linearly with 10.1 mW/K above 100 °C.

For SOT402-1 (TSSOP14) package:  $P_{tot}$  derates linearly with 7.3 mW/K above 81 °C.

For SOT762-1 (DHVQFN14) package:  $P_{tot}$  derates linearly with 9.6 mW/K above 98 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74AHC00			74AHCT00			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	5.5	0	-	5.5	V
$V_O$	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 3.3$ V $\pm$ 0.3 V	-	-	100	-	-	-	ns/V
		$V_{CC} = 5.0$ V $\pm$ 0.5 V	-	-	20	-	-	20	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74AHC00</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V <sub>CC</sub> = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V <sub>CC</sub> = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
		I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	2.0	-	20	-
C <sub>I</sub>	input capacitance	V <sub>I</sub> = V <sub>CC</sub> or GND	-	3.0	10	-	10	-	10	pF
<b>74AHCT00</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -50 µA	4.4	4.5	-	4.4	-	4.4	-	V
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = -8.0 mA	3.94	-	-	3.80	-	3.70	-	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
I <sub>I</sub>	input leakage current	I <sub>O</sub> = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	2.0	-	20	-	40	µA

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}$ ; $I_O = 0 \text{ A}$ ; other pins at $V_{CC}$ or GND; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	1.35	-	1.5	-	1.5	mA
$C_I$	input capacitance	$V_I = V_{CC}$ or GND	-	3.0	10	-	10	-	10	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
<b>74AHC00</b>										
$t_{pd}$	propagation delay	nA, nB to nY; see Fig. 6 [2]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	4.5	7.9	1.0	9.5	1.0	10.0	ns
		$C_L = 50 \text{ pF}$	-	6.0	11.4	1.0	13.0	1.0	14.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	3.2	5.5	1.0	6.5	1.0	7.0	ns
		$C_L = 50 \text{ pF}$	-	4.5	7.5	1.0	8.5	1.0	9.5	ns
$C_{PD}$	power dissipation capacitance	$C_L = 50 \text{ pF}$ ; $f_i = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$ [3]	-	7.0	-	-	-	-	-	pF
<b>74AHCT00</b>										
$t_{pd}$	propagation delay	nA, nB to nY; see Fig. 6 [2]								
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	3.3	6.9	1.0	8.0	1.0	9.0	ns
		$C_L = 50 \text{ pF}$	-	4.5	7.9	1.0	9.0	1.0	10.0	ns
$C_{PD}$	power dissipation capacitance	$C_L = 50 \text{ pF}$ ; $f_i = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$ [3]	-	7.0	-	-	-	-	-	pF

[1] Typical values are measured at nominal supply voltage ( $V_{CC} = 3.3 \text{ V}$  and  $V_{CC} = 5.0 \text{ V}$ ).

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

10.1. Waveforms



Table 8. Measurement points

Type	Input	Output
	$V_M$	$V_M$
74AHC00	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74AHCT00	1.5 V	$0.5 \times V_{CC}$



Table 9. Test data

Type	Input		Load	Test
	$V_I$	$t_r, t_f$	$C_L$	
74AHC00	$V_{CC}$	$\leq 3.0$ ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$
74AHCT00	3.0 V	$\leq 3.0$ ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$

### 11. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



Fig. 8. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



Fig. 9. Package outline SOT402-1 (TSSOP14)



DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1



Fig. 10. Package outline SOT762-1 (DHVQFN14)

## 12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charge Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT00 v.5	20200526	Product data sheet	-	74AHC_AHCT00 v.4
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation have been updated.</li> <li>Package outline drawing of SOT762-1 (<a href="#">Fig. 10</a>) updated.</li> </ul>			
74AHC_AHCT00 v.4	20080428	Product data sheet	-	74AHC_AHCT00 v.3
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 6</a>: the conditions for input leakage current have been changed.</li> </ul>			
74AHC_AHCT00 v.3	20080108	Product data sheet	-	74AHC_AHCT00 v.2
74AHC_AHCT00 v.2	19990923	Product specification	-	74AHC_AHCT00 v.1
74AHC_AHCT00 v.1	19981209	Product specification	-	-

## 14. Legal information

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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