

# DATA SHEET

## **74AC00/74ACT00** Quad 2-input NAND gate

Product specification

1997 Sep 15

# Quad 2-input NAND gate

## 74AC00 74ACT00

### FEATURES

- 74ACT00 has TTL-compatible inputs
- 74AC00 has CMOS-compatible inputs
- Meets or exceeds JEDEC standard standard for 74AC(T)XX family
- Superior ground bounce noise immunity
- Output source/sink 24mA

### DESCRIPTION

The 74AC00/74ACT00 provides the 2-input NAND function.

### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYPICAL			UNIT
			AC		ACT	
			V <sub>CC</sub> = 3.3V	V <sub>CC</sub> = 5.0V	V <sub>CC</sub> = 5.0V	
t <sub>PLH</sub> /t <sub>PHL</sub>	Propagation delay A <sub>n</sub> or B <sub>n</sub> to Y <sub>n</sub>	C <sub>L</sub> = 50pF	3.5	2.6	3.6	ns
C <sub>I</sub>	Input capacitance		4.5			pF
C <sub>PD</sub>	Power dissipation capacitance per gate	V <sub>I</sub> = GND to V <sub>CC</sub> <sup>1</sup>	25		28	pF

#### NOTE:

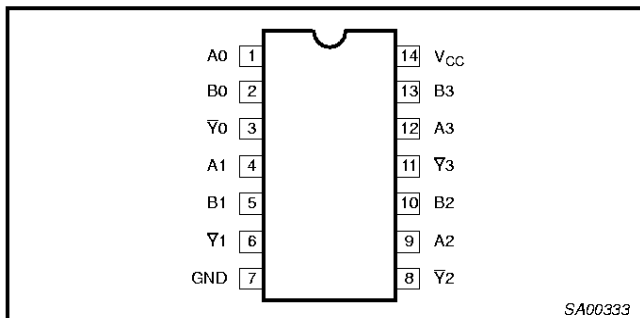
1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):  

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$$
 where:  
 f<sub>i</sub> = input frequency in MHz; C<sub>L</sub> = output load capacity in pF;  
 f<sub>o</sub> = output frequency in MHz; V<sub>CC</sub> = supply voltage in V;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

### ORDERING AND PACKAGE INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DRAWING NUMBER
14-Pin Plastic SO	-40°C to +85°C	74AC00D 74ACT00D	74AC00D 74ACT00D	SOT108-1
14-Pin Plastic SSOP Type II	-40°C to +85°C	74AC00DB 74ACT00DB	74AC00DB 74ACT00DB	SOT337-1
14-Pin Plastic TSSOP Type I	-40°C to +85°C	74AC00PW 74ACT00PW	74AC00PW DH 74ACT00PW DH	SOT402-1

### PIN CONFIGURATION



### PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1, 4, 9, 12 2, 5, 10, 13	A <sub>n</sub> – B <sub>n</sub>	Data inputs
3, 6, 8, 11	Y <sub>n</sub>	Data outputs
7	GND	Ground (0 V)
14	V <sub>CC</sub>	Positive supply voltage

# Quad 2-input NAND gate

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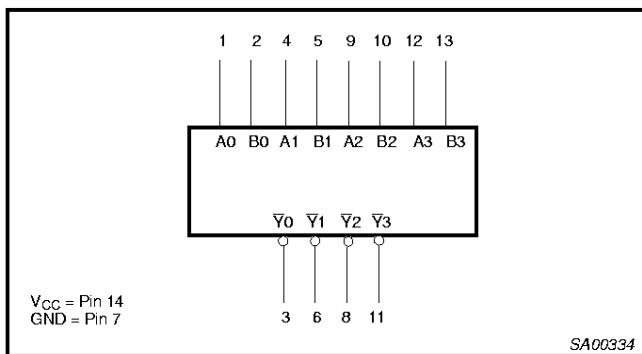
## FUNCTION TABLE

INPUTS		OUTPUTS
An	Bn	Yn
L	L	H
L	H	H
H	L	H
H	H	L

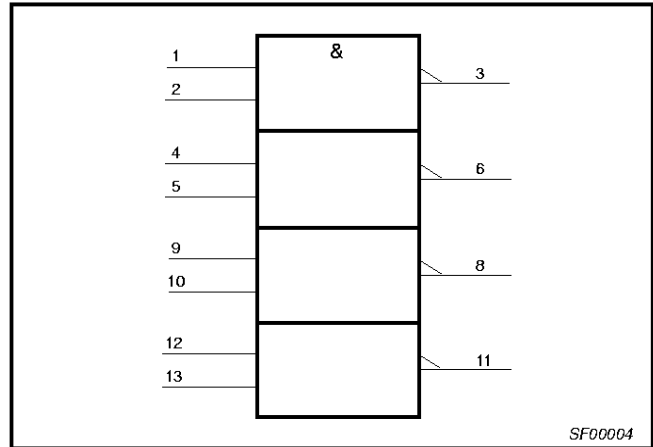
### NOTES:

H = HIGH voltage level  
L = LOW voltage level

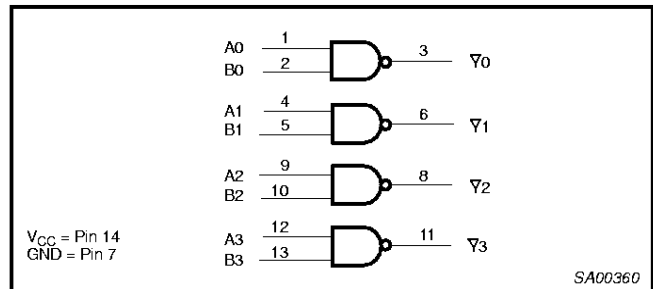
## LOGIC SYMBOL



## LOGIC SYMBOL (IEEE/IEC)



## LOGIC DIAGRAM



## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
$V_{CC}$	DC supply voltage for 'AC	2.0	6.0	V
$V_{CC}$	DC supply voltage for 'ACT	4.5	5.5	V
$V_{IN}$	DC input voltage range	0	$V_{CC}$	V
$V_O$	DC output voltage range	0	$V_{CC}$	V
$T_{amb}$	Operating free-air temperature range	-40	+85	°C
$\Delta V/\Delta t$	Minimum input edge rate — AC devices $V_{IN}$ from 30% to 70% of $V_{CC}$ $V_{CC}$ @ 3.3V, 4.5V, 5.5V	125		mV/ns
	— ACT devices $V_{IN}$ from 0.8V to 2.0V $V_{CC}$ @ 4.5V, 5.5V	125		

## Quad 2-input NAND gate

74AC00  
74ACT00**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>**

in accordance with the Absolute Maximum Rating System (IEC134)

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 to +7.0	V
$I_{IK}$	DC input diode current	$V_{IN} = -0.5V$	-20	mA
		$V_{IN} = V_{CC} + 0.5V$	+20	
$V_{IN}$	DC input voltage		-0.5 to $V_{CC} + 0.5$	V
$I_{OK}$	DC output diode current	$V_O = -0.5V$	-20	mA
		$V_O = V_{CC} + 0.5V$	+20	
$V_O$	DC output voltage		-0.5 to $V_{CC} + 0.5$	V
$I_O$	DC output source or sink current		$\pm 50$	mA
$I_{CC}, I_{GND}$	DC $V_{CC}$ or GND current per output		$\pm 50$	mA
$I_{CC}, I_{GND}$	DC $V_{CC}$ or GND current		$\pm 200$	mA
$T_{stg}$	Storage temperature range		-65 to +150	°C
$P_{TOT}$	Power dissipation per package – plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	above +70°C derate linearly with 8 mW/K	500	mW
		above +60°C derate linearly with 5.5 mW/K	500	

**NOTES:**

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## Quad 2-input NAND gate

74AC00  
74ACT00**DC CHARACTERISTICS FOR THE AC FAMILY**

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V <sub>CC</sub> (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	3.0	2.1	1.5		V
			4.5	3.15	2.25		
			5.5	3.85	2.75		
V <sub>IL</sub>	LOW level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	3.0		1.5	0.9	V
			4.5		2.25	1.35	
			5.5		2.75	1.65	
V <sub>OH</sub>	HIGH level output voltage	I <sub>OUT</sub> = -50 μA	3.0	2.9	2.99		V
			4.5	4.4	4.49		
			5.5	5.4	5.49		
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -12mA <sup>1</sup>	3.0	2.46			
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>1</sup>	4.5	3.76			
V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>1</sup>	5.5	4.76					
V <sub>OL</sub>	LOW level output voltage	I <sub>OUT</sub> = 50 μA	3.0		0.01	0.1	V
			4.5		0.01	0.1	
			5.5		0.01	0.1	
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 12mA <sup>1</sup>	3.0			0.44	
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>1</sup>	4.5			0.44	
V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>1</sup>	5.5			0.44			
I <sub>IN</sub>	Input leakage current	V <sub>IN</sub> = V <sub>CC</sub> , GND	5.5			± 1.0	μA
I <sub>OLD</sub>	Dynamic output current <sup>2</sup>	V <sub>OLD</sub> = 1.65V max	5.5	75			mA
I <sub>OHD</sub>	Dynamic output current <sup>2</sup>	V <sub>OHD</sub> = 3.85V min	5.5			-75	mA
I <sub>CC</sub>	Quiescent supply current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			40	μA

**NOTES:**

- All outputs loaded
- Maximum test duration 2.0 ms; one output loaded at a time

## Quad 2-input NAND gate

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74ACT00

## DC CHARACTERISTICS FOR THE ACT FAMILY

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V <sub>CC</sub> (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	4.5	2.0	1.5		V
			5.5	2.0	1.5		
V <sub>IL</sub>	LOW level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	4.5		1.5	0.8	V
			5.5		1.5	0.8	
V <sub>OH</sub>	HIGH level output voltage	I <sub>OUT</sub> = -50 μA	4.5	4.4	4.49		V
			5.5	5.4	5.49		
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>1</sup>	4.5	3.76			
			5.5	4.76			
V <sub>OL</sub>	LOW level output voltage	I <sub>OUT</sub> = 50 μA	4.5		0.01	0.1	V
			5.5		0.01	0.1	
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>1</sup>	4.5			0.44	
			5.5			0.44	
I <sub>IN</sub>	Input leakage current	V <sub>IN</sub> = V <sub>CC</sub> , GND	5.5			±1.0	μA
ΔI <sub>CC</sub>	Additional quiescent supply current per input pin	V <sub>IN</sub> = V <sub>CC</sub> - 2.1V Other inputs at V <sub>CC</sub> or GND; I <sub>OUT</sub> = 0	5.5			1.5	mA
I <sub>OLD</sub>	Dynamic output current <sup>2</sup>	V <sub>OLD</sub> = 1.65V max	5.5	75			mA
I <sub>OHD</sub>	Dynamic output current <sup>2</sup>	V <sub>OHD</sub> = 3.85V min	5.5			-75	mA
I <sub>CC</sub>	Quiescent supply current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			40	μA

## NOTES:

- All outputs loaded
- Maximum test duration 2.0ms, one output loaded at a time

## AC CHARACTERISTICS FOR 74AC00

GND = 0V; t<sub>r</sub> = t<sub>f</sub> = 2.5ns; C<sub>L</sub> = 50pF; R<sub>L</sub> = 500Ω; .

SYMBOL	PARAMETER	V <sub>CC</sub> <sup>1</sup>	LIMITS					UNIT	WAVEFORM
			T <sub>amb</sub> = +25°C			T <sub>amb</sub> = -40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t <sub>PLH</sub>	Propagation delay A <sub>n</sub> , B <sub>n</sub> to $\bar{Y}_n$	3.3 5.0	2.0 1.5	3.7 2.7	7.5 5	1.5 1.0	8.5 6	ns	1, 2
t <sub>PHL</sub>	Propagation delay A <sub>n</sub> , B <sub>n</sub> to $\bar{Y}_n$	3.3 5.0	2.0 1.5	3.2 2.5	7.5 5	1.5 1.0	8.5 6	ns	

## NOTE:

- Voltage range 3.3V is V<sub>CC</sub> = 3.3V ± 0.3V  
Voltage range 5.0V is V<sub>CC</sub> = 5.0V ± 0.5V

## AC CHARACTERISTICS FOR 74ACT00

GND = 0V; t<sub>r</sub> = t<sub>f</sub> = 2.5ns; C<sub>L</sub> = 50pF; R<sub>L</sub> = 500Ω; .

SYMBOL	PARAMETER	V <sub>CC</sub> <sup>1</sup>	LIMITS					UNIT	WAVEFORM
			T <sub>amb</sub> = +25°C			T <sub>amb</sub> = -40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t <sub>PLH</sub>	Propagation delay A <sub>n</sub> , B <sub>n</sub> to $\bar{Y}_n$	5.0	2.0	3.4	7	1.5	8	ns	1, 2
t <sub>PHL</sub>	Propagation delay A <sub>n</sub> , B <sub>n</sub> to $\bar{Y}_n$	5.0	2.0	3.8	7	1.5	8	ns	

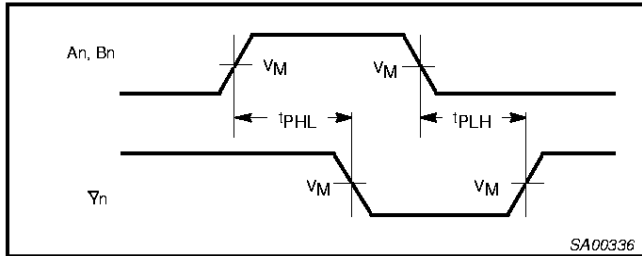
## NOTE:

- Voltage range 5.0V is V<sub>CC</sub> = 5.0V ± 0.5V

# Quad 2-input NAND gate

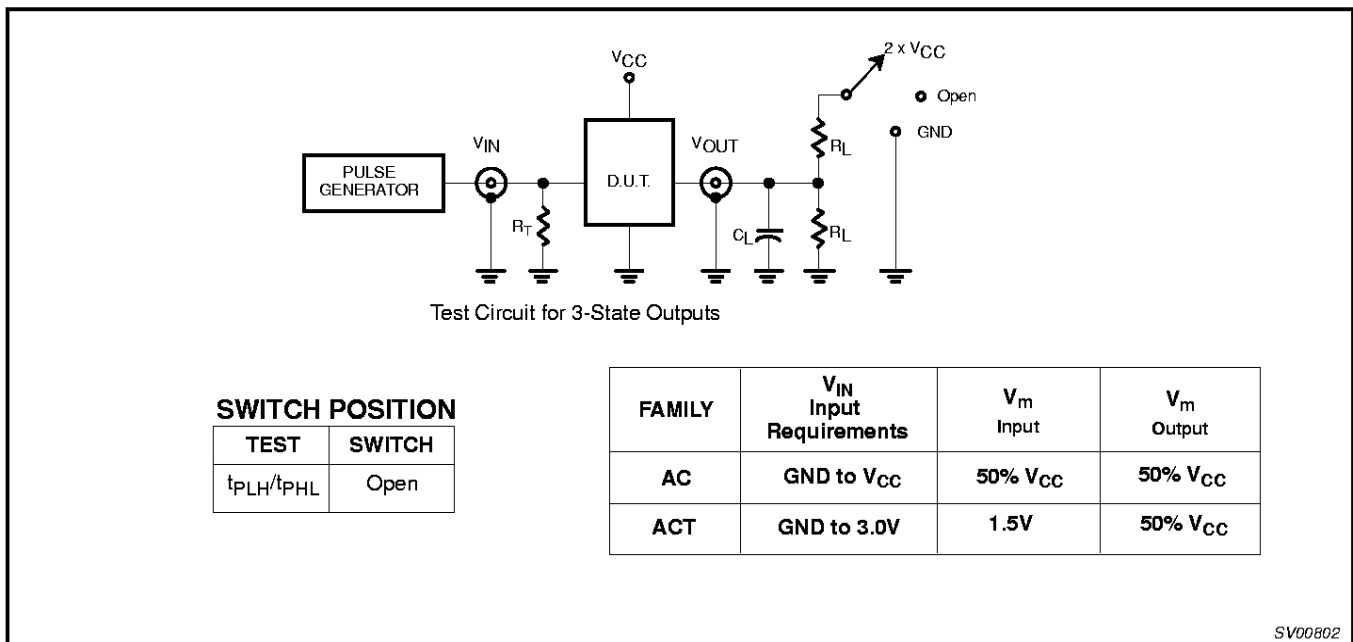
74AC00  
74ACT00

## AC WAVEFORMS



Waveform 1. Propagation delay for inverting outputs

## TEST CIRCUIT



Waveform 2. Load circuitry for switching times.

## DEFINITIONS

R<sub>L</sub> = Load resistor; see AC Characteristics for value

C<sub>L</sub> = Load capacitance; see AC Characteristics

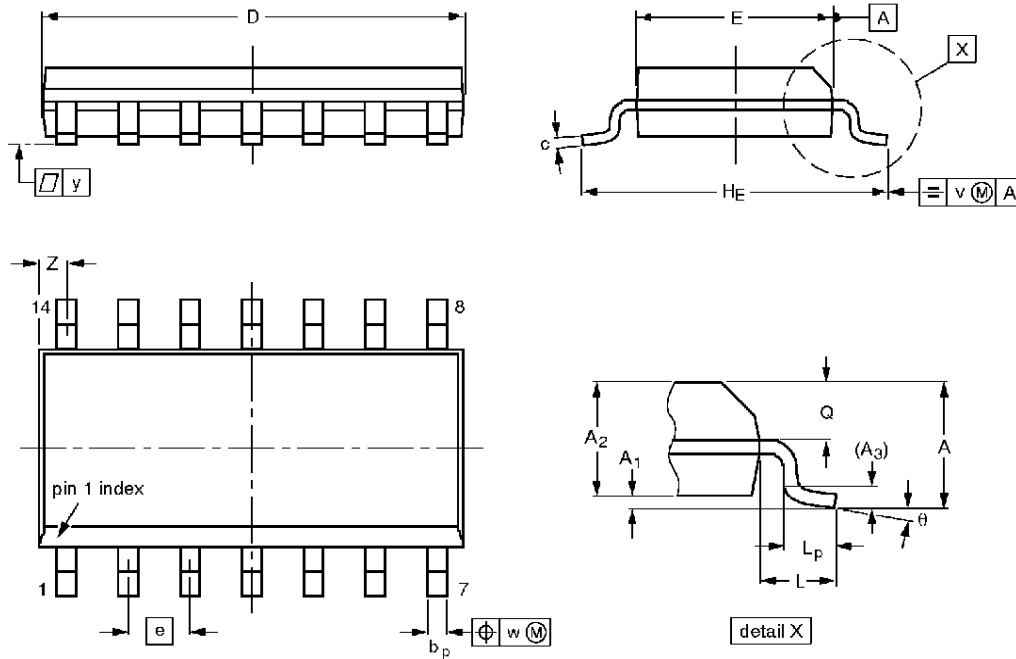
Termination resistance should be equal to Z<sub>OUT</sub> of pulse generators

Quad 2-input NAND gate

74AC00  
74ACT00

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

SOT108-1



**DIMENSIONS** (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	HE	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.35 0.34	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT108-1	076E06S	MS-012AB				91-08-10 95-01-23

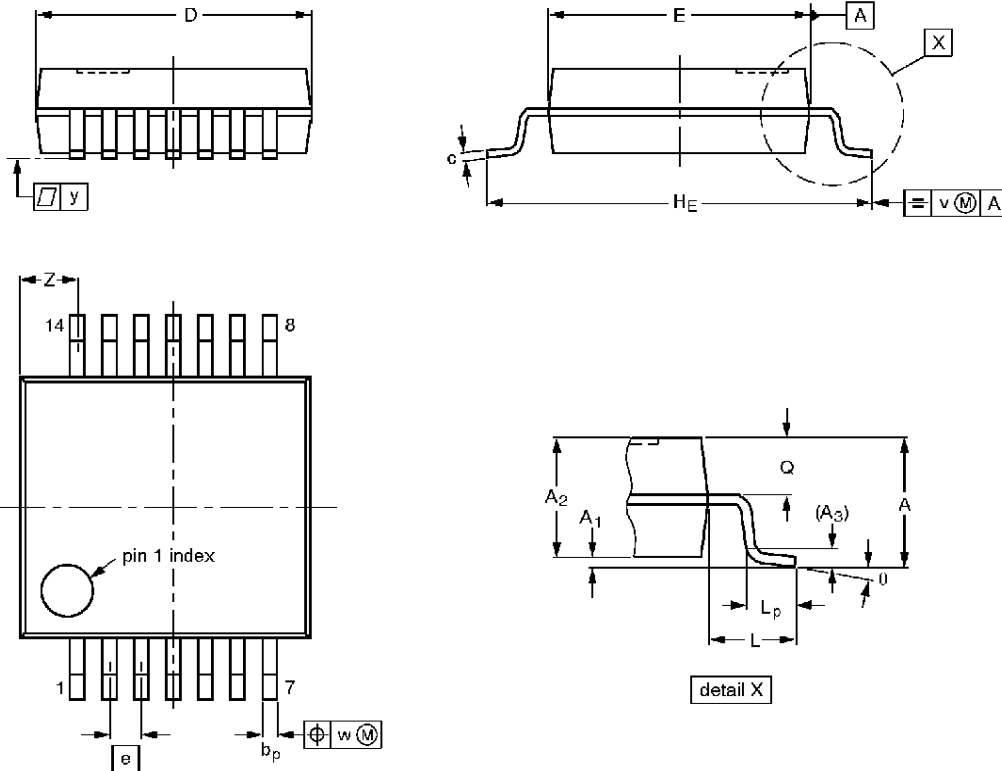


# Quad 2-input NAND gate

74AC00  
74ACT00

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

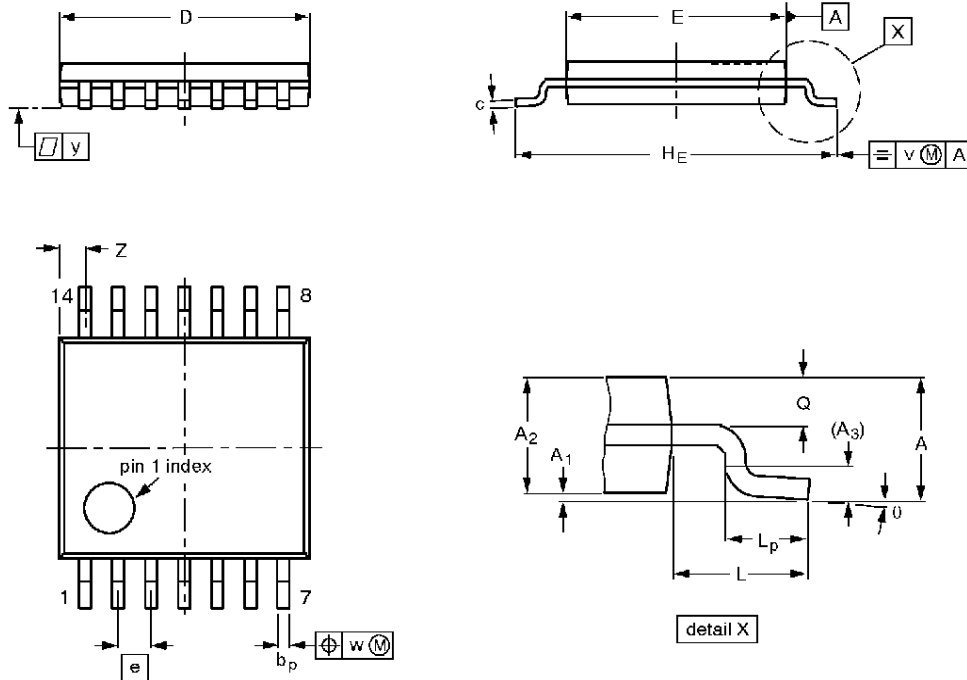
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT337-1		MO-150AB			<del>95-02-04</del> 96-01-18

# Quad 2-input NAND gate

74AC00  
74ACT00

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

SOT402-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT402-1		MO-153				94-07-12 95-04-04

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Quad 2-input NAND gate

74AC00  
74ACT00

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**NOTES**

## Quad 2-input NAND gate

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## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	Preproduction Product	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
<i>Product Specification</i>	Full Production	This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product.

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