

# DATA SHEET

**74ALVC02**

**Quad 2-input NOR gate**

Product specification  
Supersedes data of 2003 Feb 05

2003 Jul 14

## Quad 2-input NOR gate

## 74ALVC02

## FEATURES

- Wide supply voltage range from 1.65 to 3.6 V
- 3.6 V tolerant inputs/outputs
- CMOS low power consumption
- Direct interface with TTL levels (2.7 to 3.6 V)
- Power-down mode
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standard:  
JESD8-7 (1.65 to 1.95 V)  
JESD8-5 (2.3 to 2.7 V)  
JESD8B/JESD36 (2.7 to 3.6 V).
- ESD protection:  
HBM EIA/JESD22-A114-A exceeds 2000 V  
MM EIA/JESD22-A115-A exceeds 200 V.

## DESCRIPTION

The 74ALVC02 is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Schmitt-trigger action at all inputs makes the circuit tolerant for slower input rise and fall times.

The 74ALVC02 provides the 2-input NOR function.

## QUICK REFERENCE DATA

GND = 0 V; T<sub>amb</sub> = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay nA, nB to nY	V <sub>CC</sub> = 1.8 V; C <sub>L</sub> = 30 pF; R <sub>L</sub> = 1 kΩ	2.8	ns
		V <sub>CC</sub> = 2.5 V; C <sub>L</sub> = 30 pF; R <sub>L</sub> = 500 Ω	2.0	ns
		V <sub>CC</sub> = 2.7 V; C <sub>L</sub> = 50 pF; R <sub>L</sub> = 500 Ω	2.5	ns
		V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 50 pF; R <sub>L</sub> = 500 Ω	2.2	ns
C <sub>I</sub>	input capacitance		3.5	pF
C <sub>PD</sub>	power dissipation capacitance per buffer	V <sub>CC</sub> = 3.3 V; notes 1 and 2	32	pF

## Notes

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

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

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;

V<sub>CC</sub> = supply voltage in Volts;

N = total load switching outputs;

Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

2. The condition is V<sub>I</sub> = GND to V<sub>CC</sub>.

# Quad 2-input NOR gate

# 74ALVC02

### ORDERING INFORMATION

TYPE NUMBER	PACKAGE				
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE
74ALVC02D	-40 to +85 °C	14	SO14	plastic	SOT108-1
74ALVC02PW	-40 to +85 °C	14	TSSOP14	plastic	SOT402-1
74ALVC02BQ	-40 to +85 °C	14	DHVQFN14	plastic	SOT762-1

### FUNCTION TABLE

See note 1.

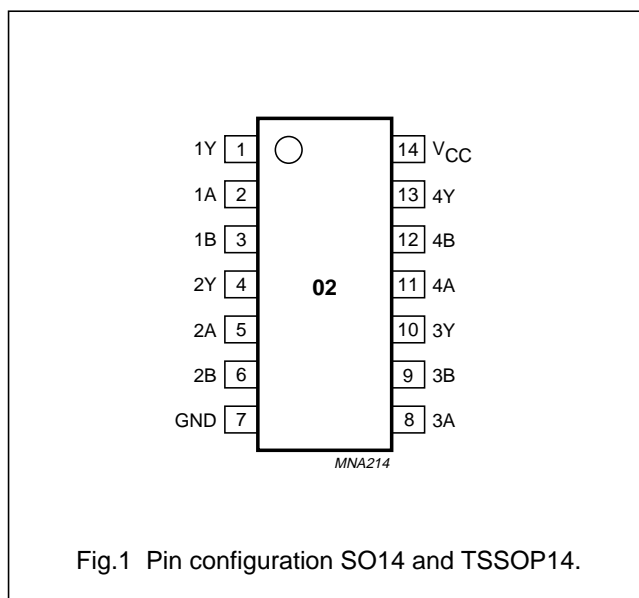
INPUT		OUTPUT
nA	nB	nY
L	L	H
L	H	L
H	L	L
H	H	L

### Note

1. H = HIGH voltage level;  
L = LOW voltage level

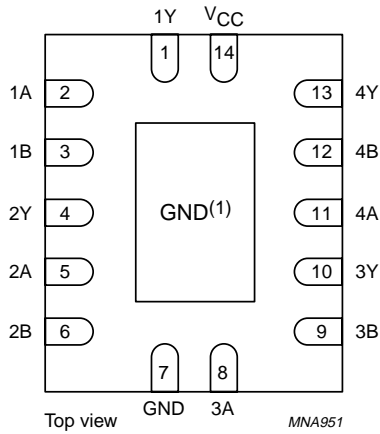
### PINNING

Pin	SYMBOL	DESCRIPTION
1	1Y	data output
2	1A	data input
3	1B	data input
4	2Y	data output
5	2A	data input
6	2B	data input
7	GND	ground (0 V)
8	3A	data input
9	3B	data input
10	3Y	data output
11	4A	data input
12	4B	data input
13	4Y	data output
14	V <sub>CC</sub>	supply voltage



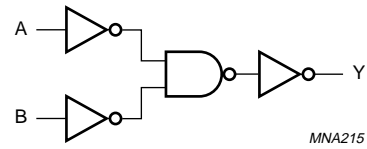
Quad 2-input NOR gate

74ALVC02



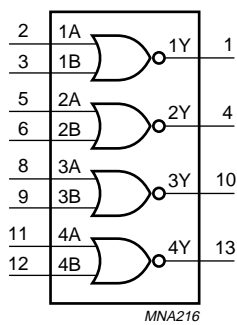
(1) (1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig.2 Pin configuration DHVQFN14.



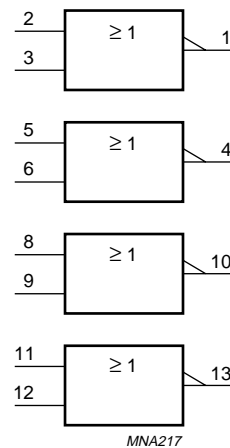
MNA215

Fig.3 Logic diagram (one gate).



MNA216

Fig.4 Function diagram.



MNA217

Fig.5 IEC logic symbol.

## Quad 2-input NOR gate

74ALVC02

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CC}$	supply voltage		1.65	3.6	V
$V_I$	input voltage		0	3.6	V
$V_O$	output voltage	$V_{CC} = 1.65$ to $3.6$ V	0	$V_{CC}$	V
		$V_{CC} = 0$ V; Power-down mode	0	4.6	V
$T_{amb}$	operating ambient temperature		-40	+85	°C
$t_r, t_f$	input rise and fall times	$V_{CC} = 1.65$ to $2.7$ V	0	20	ns/V
		$V_{CC} = 2.7$ to $3.6$ V	0	10	ns/V

## 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	+4.6	V
$I_{IK}$	input diode current	$V_I < 0$	-	-50	mA
$V_I$	input voltage		-0.5	+4.6	V
$I_{OK}$	output diode current	$V_O > V_{CC}$ or $V_O < 0$	-	±50	mA
$V_O$	output voltage	notes 1 and 2	-0.5	$V_{CC} + 0.5$	V
		Power-down mode; note 2	-0.5	+4.6	V
$I_O$	output source or sink current	$V_O = 0$ to $V_{CC}$	-	±50	mA
$I_{CC}, I_{GND}$	$V_{CC}$ or GND current		-	±100	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	power dissipation	$T_{amb} = -40$ to $+85$ °C; note 3	-	500	mW

## Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. When  $V_{CC} = 0$  V (Power-down mode), the output voltage can be 3.6 V in normal operation.
3. For SO14 packages: above 70 °C derate linearly with 8 mW/K.  
For TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.  
For DHVQFN14 packages: above 60 °C derate linearly with 4.5 mW/K.

## Quad 2-input NOR gate

74ALVC02

## DC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 to +85 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage		1.65 to 1.95	0.65 × V <sub>CC</sub>	–	–	V
			2.3 to 2.7	1.7	–	–	V
			2.7 to 3.6	2	–	–	V
V <sub>IL</sub>	LOW-level input voltage		1.65 to 1.95	–	–	0.35 × V <sub>CC</sub>	V
			2.3 to 2.7	–	–	0.7	V
			2.7 to 3.6	–	–	0.8	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> = 100 μA	1.65 to 3.6	–	–	0.2	V
		I <sub>O</sub> = 6 mA	1.65	–	0.11	0.3	V
		I <sub>O</sub> = 12 mA	2.3	–	0.17	0.4	V
		I <sub>O</sub> = 18 mA	2.3	–	0.25	0.6	V
		I <sub>O</sub> = 12 mA	2.7	–	0.16	0.4	V
		I <sub>O</sub> = 18 mA	3.0	–	0.23	0.4	V
		I <sub>O</sub> = 24 mA	3.0	–	0.30	0.55	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> = -100 μA	1.65 to 3.6	V <sub>CC</sub> - 0.2	–	–	V
		I <sub>O</sub> = -6 mA	1.65	1.25	1.51	–	V
		I <sub>O</sub> = -12 mA	2.3	1.8	2.10	–	V
		I <sub>O</sub> = -18 mA	2.3	1.7	2.01	–	V
		I <sub>O</sub> = -12 mA	2.7	2.2	2.53	–	V
		I <sub>O</sub> = -18 mA	3.0	2.4	2.76	–	V
		I <sub>O</sub> = -24 mA	3.0	2.2	2.68	–	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = 3.6 V or GND	3.6	–	±0.1	±5	μA
I <sub>off</sub>	power OFF leakage current	V <sub>I</sub> or V <sub>O</sub> = 3.6 V	0.0	–	±0.1	±10	μA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	3.6	–	0.2	20	μA
ΔI <sub>CC</sub>	additional quiescent supply current per input pin	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0	3.0 to 3.6	–	5	750	μA

## Note

1. All typical values are measured at T<sub>amb</sub> = 25 °C.

Quad 2-input NOR gate

74ALVC02

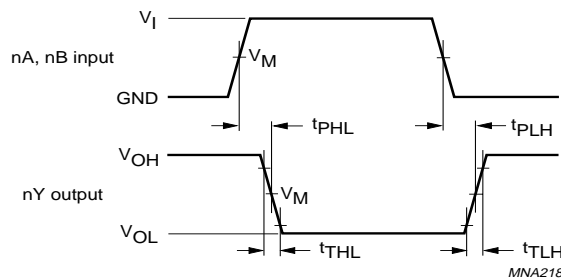
AC CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
		WAVEFORMS	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 to +85 °C</b>							
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay nA, nB to nY	see Figs 6 and 7	1.65 to 1.95	1.0	2.8	4.7	ns
			2.3 to 2.7	1.0	2.0	3.1	ns
			2.7	1.0	2.5	2.9	ns
			3.0 to 3.6	1.0	2.2	2.8	ns

Note

1. All typical values are measured at T<sub>amb</sub> = 25 °C.

AC WAVEFORMS

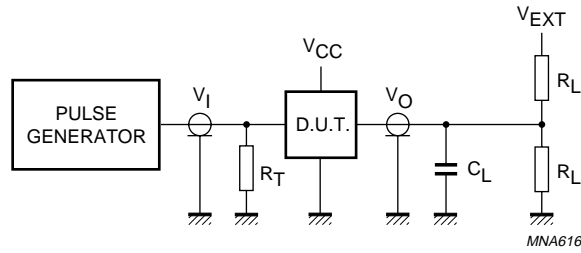


V <sub>CC</sub>	V <sub>M</sub>	INPUT	
		V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>
1.65 to 1.95 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns
2.3 to 2.7 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns

Fig.6 Inputs nA, nB to output nY propagation delay times.

Quad 2-input NOR gate

74ALVC02



V <sub>CC</sub>	V <sub>I</sub>	C <sub>L</sub>	R <sub>L</sub>	V <sub>EXT</sub>		
				t <sub>PLH</sub> /t <sub>PHL</sub>	t <sub>PZH</sub> /t <sub>PHZ</sub>	t <sub>PZL</sub> /t <sub>PLZ</sub>
1.65 to 1.95 V	V <sub>CC</sub>	30 pF	1 kΩ	open	GND	2 × V <sub>CC</sub>
2.3 to 2.7 V	V <sub>CC</sub>	30 pF	500 Ω	open	GND	2 × V <sub>CC</sub>
2.7 V	2.7 V	50 pF	500 Ω	open	GND	6 V
3.0 to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V

Definitions for test circuit:

R<sub>L</sub> = Load resistor.

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to the output impedance Z<sub>o</sub> of the pulse generator.

Fig.7 Load circuitry for switching times.



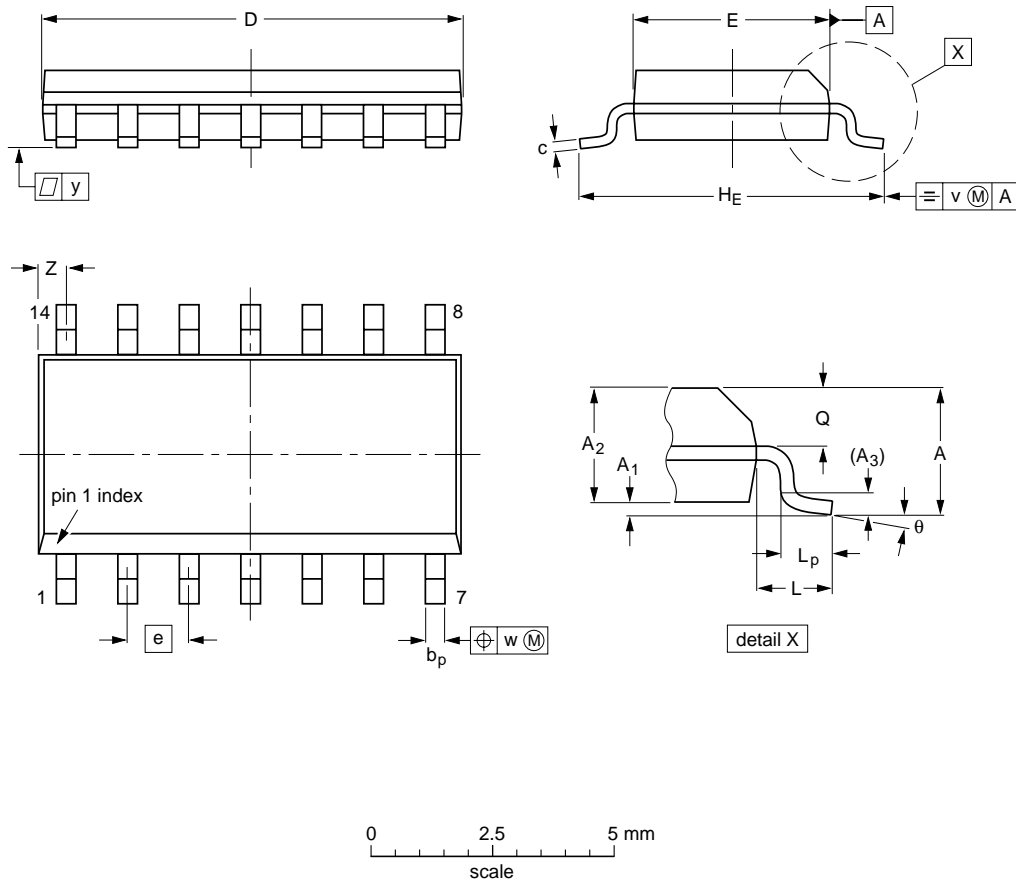
Quad 2-input NOR gate

74ALVC02

PACKAGE OUTLINES

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	H <sub>E</sub>	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	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.35 0.34	0.16 0.15	0.05	0.244 0.228	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 (0.006 inch) maximum per side are not included.

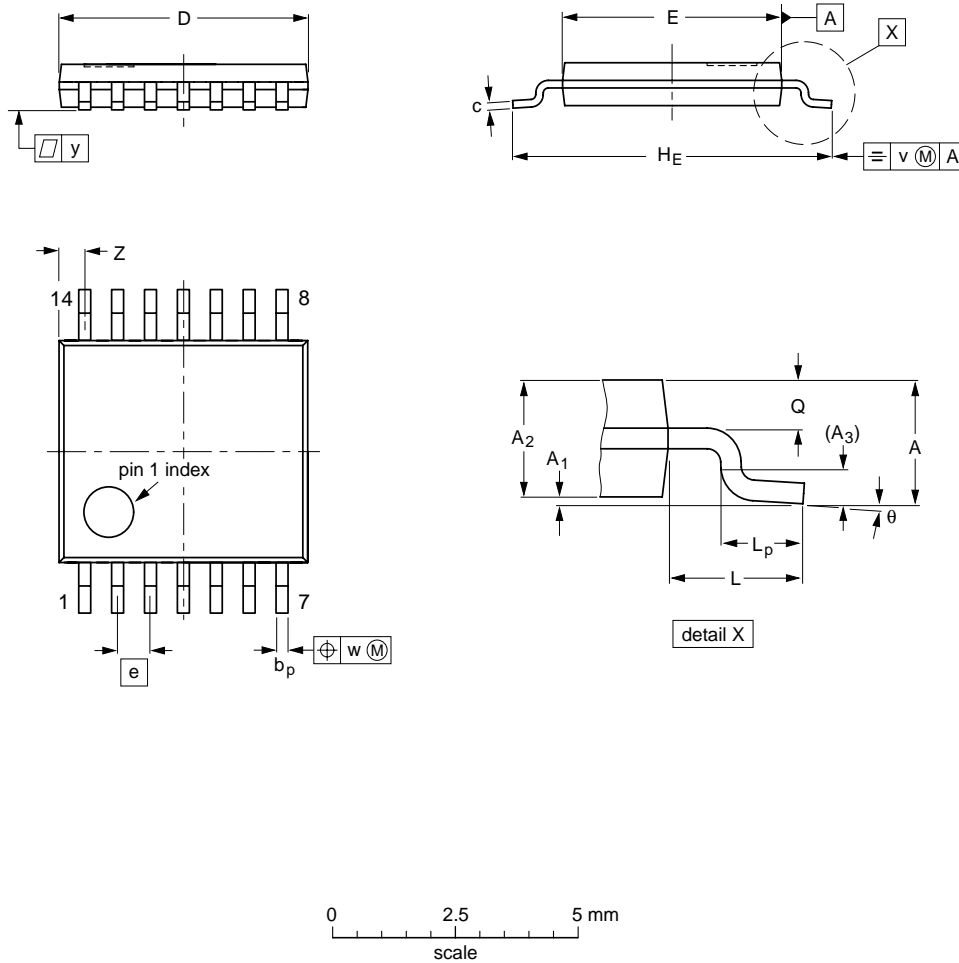
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT108-1	076E06	MS-012				99-12-27 03-02-19

Quad 2-input NOR gate

74ALVC02

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	1.1	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	0.75 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.

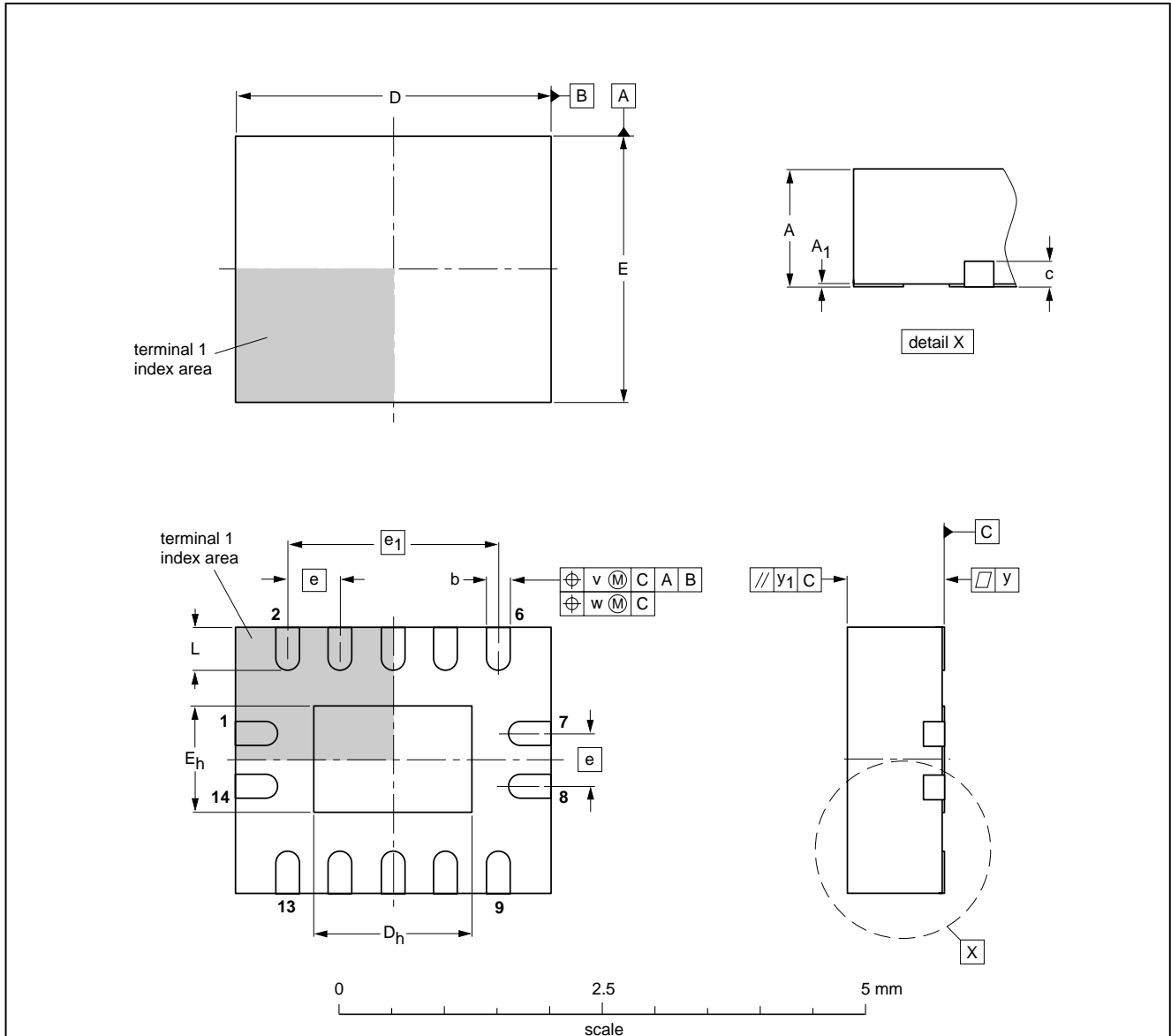
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT402-1		MO-153				99-12-27 03-02-18

Quad 2-input NOR gate

74ALVC02

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



DIMENSIONS (mm are the original dimensions)

UNIT	A <sup>(1)</sup> max.	A <sub>1</sub>	b	c	D <sup>(1)</sup>	D <sub>h</sub>	E <sup>(1)</sup>	E <sub>h</sub>	e	e <sub>1</sub>	L	v	w	y	y <sub>1</sub>
mm	1	0.05 0.00	0.30 0.18	0.2	3.1 2.9	1.65 1.35	2.6 2.4	1.15 0.85	0.5	2	0.5 0.3	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT762-1	---	MO-241	---		-02-10-17 03-01-27

## Quad 2-input NOR gate

74ALVC02

## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

## Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.
3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## DEFINITIONS

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information** — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## DISCLAIMERS

**Life support applications** — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes** — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

# ***Philips Semiconductors – a worldwide company***

## **Contact information**

For additional information please visit <http://www.semiconductors.philips.com>. Fax: +31 40 27 24825

For sales offices addresses send e-mail to: [sales.addresses@www.semiconductors.philips.com](mailto:sales.addresses@www.semiconductors.philips.com).

© Koninklijke Philips Electronics N.V. 2003

SCA75

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

613508/02/pp13

Date of release: 2003 Jul 14

Document order number: 9397 750 11272

*Let's make things better.*

**Philips  
Semiconductors**



**PHILIPS**