

# 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>.

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## 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.

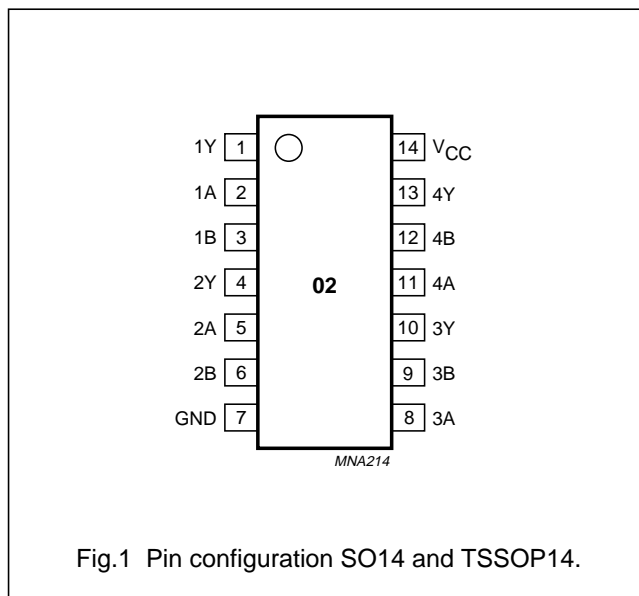
INPUT		OUTPUT
nA	nB	nY
L	L	H
L	H	L
H	L	L
H	H	L

### Note

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

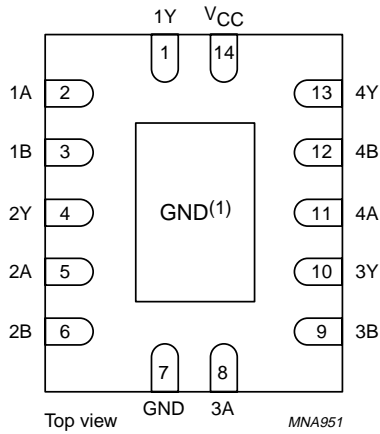
## PINNING

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



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(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.

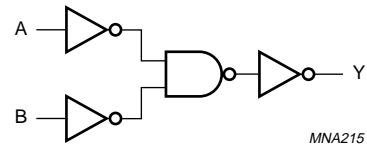


Fig.3 Logic diagram (one gate).

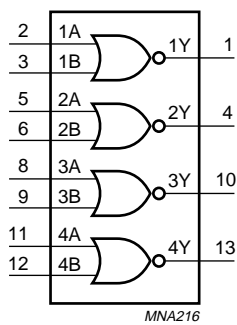


Fig.4 Function diagram.

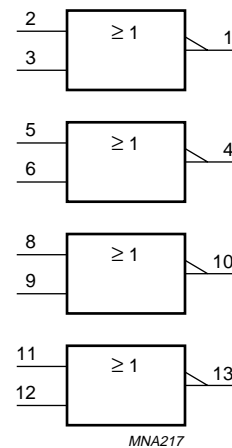


Fig.5 IEC logic symbol.

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## 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.

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## 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.

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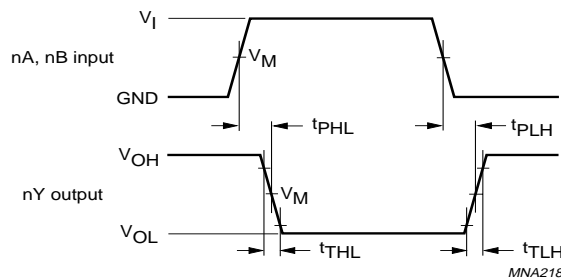
AC CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
		WAVEFORMS	V <sub>CC</sub> (V)				
T <sub>amb</sub> = -40 to +85 °C							
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

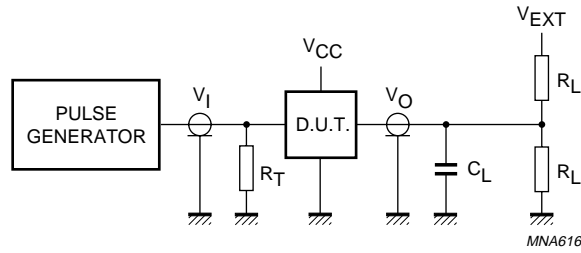


V <sub>CC</sub>	V <sub>M</sub>	INPUT	
		V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>
1.65 to 1.95 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns
2.3 to 2.7 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns

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

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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.



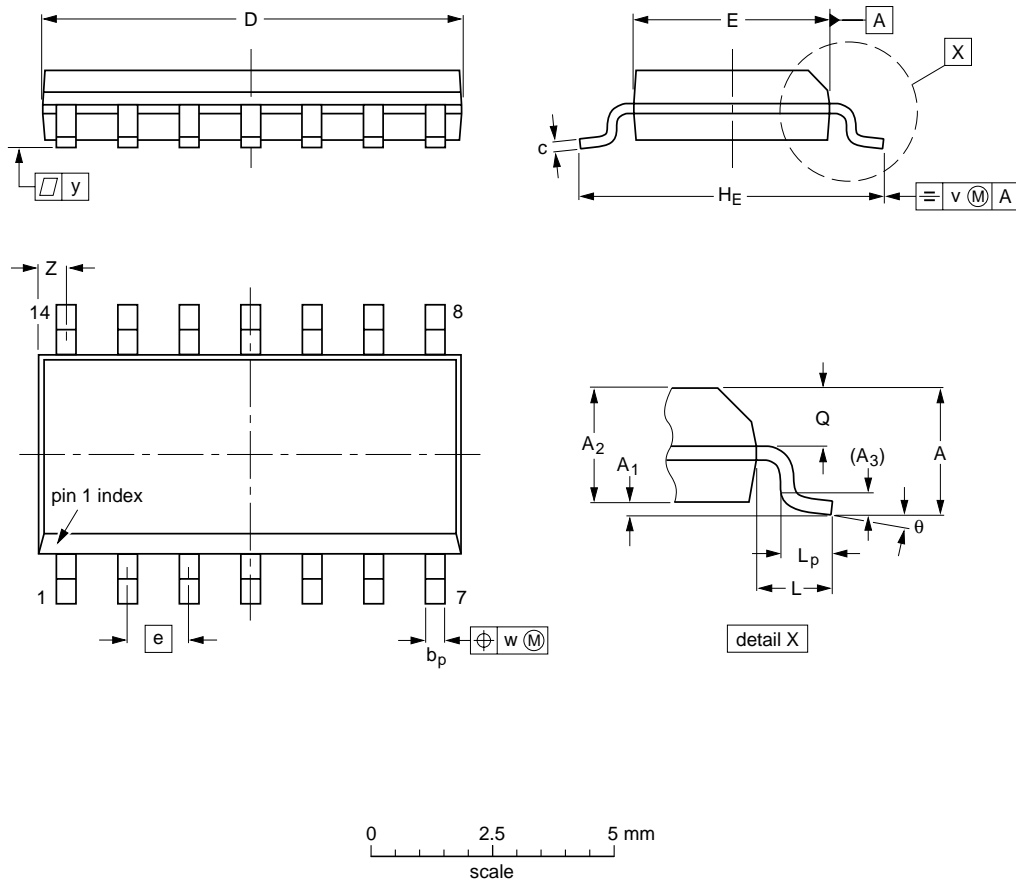
Quad 2-input NOR gate

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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.

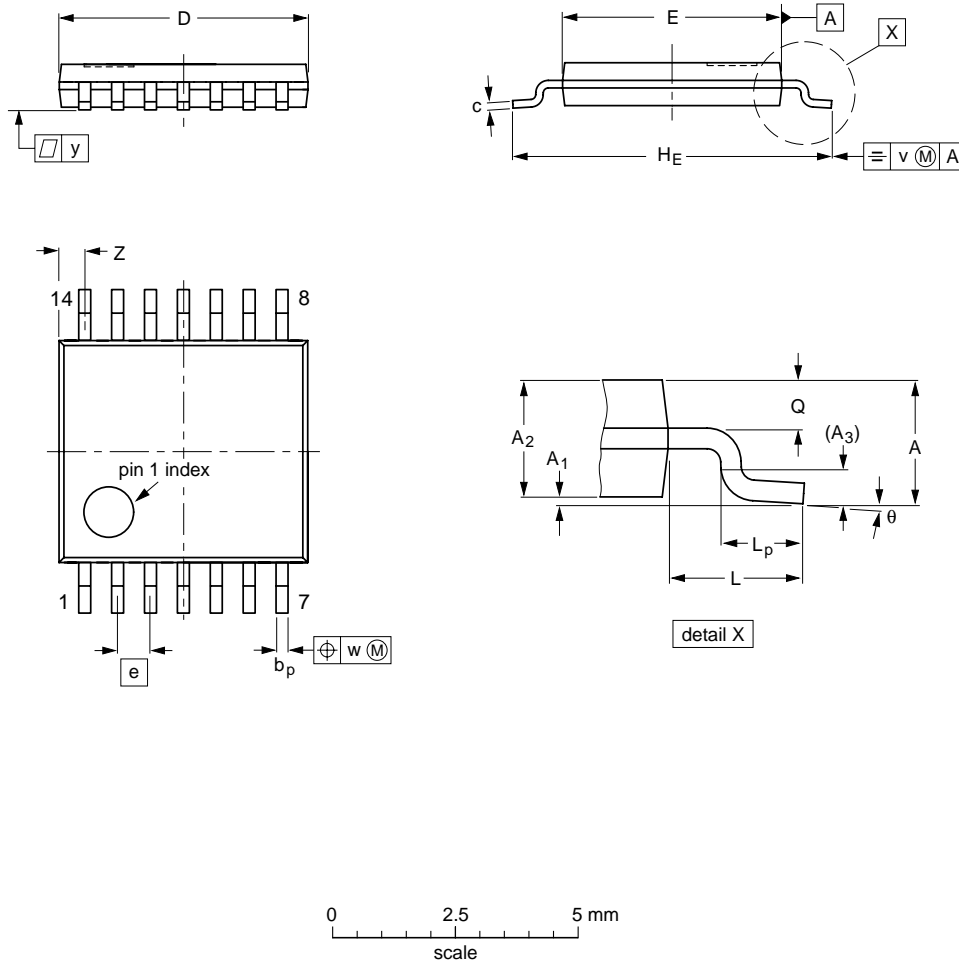
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT108-1	076E06	MS-012				99-12-27 03-02-19

Quad 2-input NOR gate

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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.

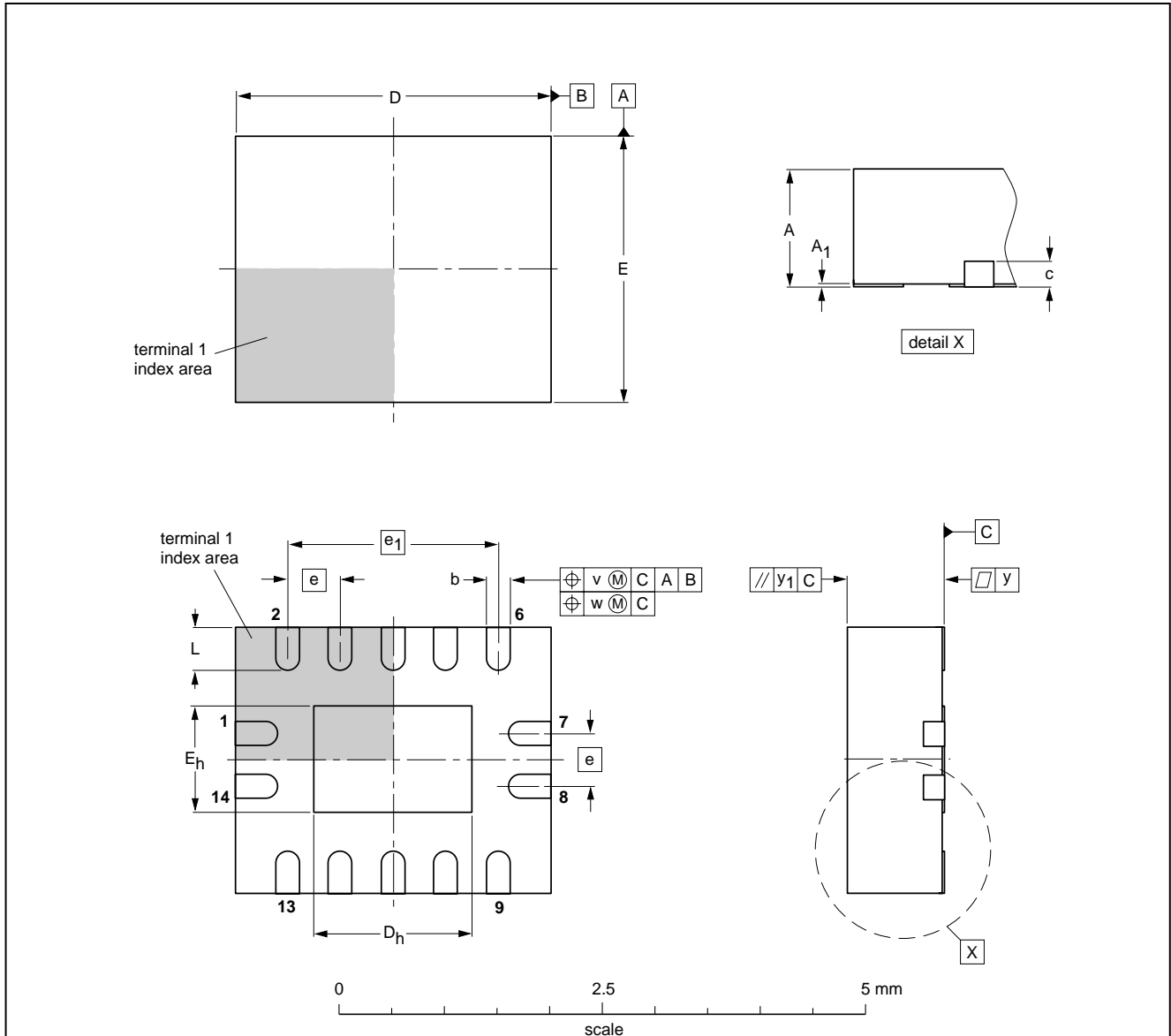
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT402-1		MO-153				99-12-27 03-02-18

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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

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