74HC00; 74HCT00

Quad 2-input NAND gate Rev. 6 — 14 December 2011

Product data sheet

1. **General description**

The 74HC00; 74HCT00 are high-speed Si-gate CMOS devices that comply with JEDEC standard no. 7A. They are pin compatible with Low-power Schottky TTL (LSTTL).

The 74HC00; 74HCT00 provides a quad 2-input NAND function.

Features and benefits 2.

- Input levels:
 - ◆ For 74HC00: CMOS level
 - ◆ For 74HCT00: TTL level
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ♦ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

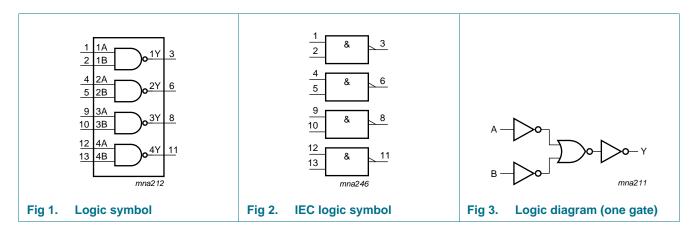
Ordering information 3.

Table 1. **Ordering information**

Type number	Package							
	Temperature range	Name	Description	Version				
74HC00N	–40 °C to +125 °C	DIP14	plastic dual in-line package; 14 leads (300 mil)	SOT27-1				
74HCT00N								
74HC00D			plastic small outline package; 14 leads; body width	dth SOT108-1				
74HCT00D			3.9 mm					
74HC00DB	−40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body	SOT337-1				
74HCT00DB			width 5.3 mm					
74HC00PW	−40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads;	SOT402-1				
74HCT00PW			body width 4.4 mm					
74HC00BQ	–40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very	SOT762-1				
74HCT00BQ			thin quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85$ mm					

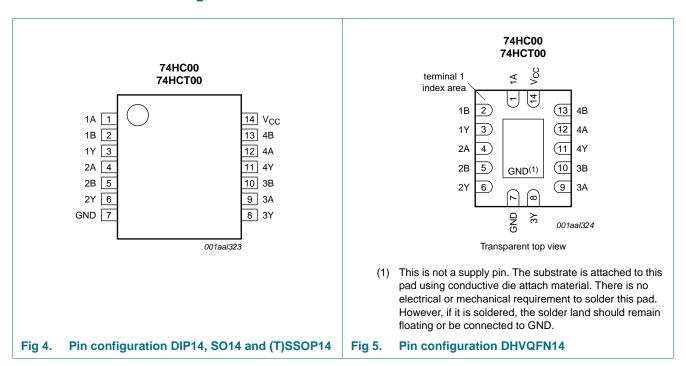


4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1A to 4A	1, 4, 9, 12	data input
1B to 4B	2, 5, 10, 13	data input

Table 2. Pin description ...continued

Symbol	Pin	Description
1Y to 4Y	3, 6, 8, 11	data output
GND	7	ground (0 V)
V _{CC}	14	supply voltage

6. Functional description

Table 3. Function table[1]

Input	Output	
nA	nB	nY
L	X	Н
X	L	Н
Н	Н	L

^[1] H = HIGH voltage level; L = LOW voltage level; X = don't care.

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	V
I _{IK}	input clamping current	$V_I < -0.5 \text{ V or } V_I > V_{CC} + 0.5 \text{ V}$	<u>[1]</u> _	±20	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$	<u>[1]</u> _	±20	mA
I _O	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$	-	±25	mA
I _{CC}	supply current		-	50	mA
I _{GND}	ground current		-50	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation		[2]		
	DIP14 package		-	750	mW
	SO14, (T)SSOP14 and DHVQFN14 packages		-	500	mW

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

For SO14 package: Ptot derates linearly with 8 mW/K above 70 °C.

For (T)SSOP14 packages: P_{tot} derates linearly with 5.5 mW/K above 60 $^{\circ}\text{C}.$

For DHVQFN14 packages: P_{tot} derates linearly with 4.5 mW/K above 60 $^{\circ}\text{C}.$

^[2] For DIP14 package: P_{tot} derates linearly with 12 mW/K above 70 $^{\circ}\text{C}.$

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	l Parameter Conditions		74HC00			74HCT00			Unit
			Min	Тур	Max	Min	Тур	Max	
V_{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V_{CC}	0	-	V_{CC}	V
Vo	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	$V_{CC} = 2.0 \text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5 \text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0 \text{ V}$	-	-	83	-	-	-	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	Тур	Max	Min	Max	Min	Max	
74HC00						1	'			
V _{IH}	HIGH-level	V _{CC} = 2.0 V	-	1.2	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 4.5 V	-	2.4	-	3.15	-	3.15	-	V
		V _{CC} = 6.0 V	-	3.2	-	4.2	-	4.2	-	V
V _{IL}	LOW-level	V _{CC} = 2.0 V	-	0.8	-	-	0.5	-	0.5	V
	input voltage	V _{CC} = 4.5 V	-	2.1	-	-	1.35	-	1.35	V
		$V_{CC} = 6.0 \text{ V}$	-	2.8	-	-	1.8	-	1.8	V
V _{OH} HIGH-level output voltage		$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_{O} = -20 \mu A; V_{CC} = 2.0 V$	-	2.0	-	1.9	-	1.9	-	V
		$I_O = -20 \mu A$; $V_{CC} = 4.5 V$	-	4.5	-	4.4	-	4.4	-	V
		$I_O = -20 \mu A$; $V_{CC} = 6.0 \text{ V}$	-	6.0	-	5.9	-	5.9	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	4.32	-	3.84	-	3.7	-	V
		$I_{O} = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	5.81	-	5.34	-	5.2	-	V
V_{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}								
	output voltage	I_{O} = 20 μ A; V_{CC} = 2.0 V	-	0	-	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	0	-	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 6.0 V$	-	0	-	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$	-	0.15	-	-	0.33	-	0.4	V
		$I_{O} = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	-	-	0.33	-	0.4	V
II	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	-	-	±1	-	±1	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$	-	-	-	-	20	-	40	μΑ

 Table 6.
 Static characteristics ...continued

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

Symbol	Parameter	Conditions		25 °C		-40 °C 1	to +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
Cı	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT0	0									
V _{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	1.6	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	1.2	-	-	0.8	-	0.8	V
OH	HIGH-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	$I_{O} = -20 \mu A$	-	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -4.0 \text{ mA}$	-	4.32	-	3.84	-	3.7	-	V
OL	LOW-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	0	-	-	0.1	-	0.1	V
		$I_{O} = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.15	-	-	0.33	-	0.4	V
II	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	-	-	±1	-	±1	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0$ V	-	-	-	-	20	-	40	μΑ
Δl _{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}; I_O = 0 \text{ A};$ other inputs at V_{CC} or GND; $V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	150	-	-	675	-	735	μА
C _I	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

 $GND = 0 \ V; \ C_L = 50 \ pF;$ for load circuit see <u>Figure 7</u>.

Symbol	Parameter	Conditions			25 °C		-40 °C to +125 °C		Unit
				Min	Тур	Max	Max (85 °C)	Max (125 °C)	
74HC00									
t _{pd} propagation delay	nA, nB to nY; see Figure 6	<u>[1]</u>							
		$V_{CC} = 2.0 \text{ V}$		-	25	-	115	135	ns
		$V_{CC} = 4.5 \text{ V}$		-	9	-	23	27	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	7	-	-	-	ns
		$V_{CC} = 6.0 \text{ V}$		-	7	-	20	23	ns
t _t	transition time	see Figure 6	[2]						
		$V_{CC} = 2.0 \text{ V}$		-	19	-	95	110	ns
		$V_{CC} = 4.5 \text{ V}$		-	7	-	19	22	ns
		$V_{CC} = 6.0 \text{ V}$		-	6	-	16	19	ns

Table 7. Dynamic characteristics ...continued GND = 0 V; $C_L = 50$ pF; for load circuit see Figure 7.

Symbol	Parameter	Conditions	Conditions		25 °C			-40 °C to +125 °C		
				Min	Тур	Max	Max (85 °C)	Max (125 °C)		
C _{PD}	power dissipation capacitance	per package; $V_I = GND$ to V_{CC}	[3]	-	22	-	-	-	pF	
74HCT00	0									
t _{pd}	propagation delay	nA, nB to nY; see Figure 6	<u>[1]</u>							
		V _{CC} = 4.5 V		-	12	-	24	29	ns	
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	10	-	-	-	ns	
t _t	transition time	V _{CC} = 4.5 V; see <u>Figure 6</u>	[2]	-	-	-	29	22	ns	
C_{PD}	power dissipation capacitance	per package; V _I = GND to V _{CC} – 1.5 V	[3]	-	22	-	-	-	pF	

- [1] t_{pd} is the same as t_{PHL} and t_{PLH} .
- [2] t_t is the same as t_{THL} and t_{TLH} .
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

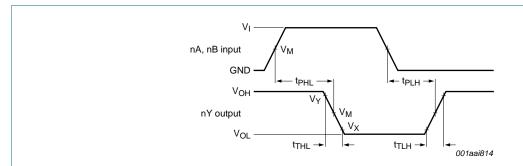
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11. Waveforms



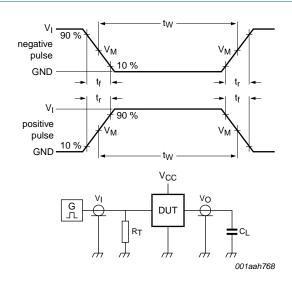
Measurement points are given in Table 9.

 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 6. Input to output propagation delays

Table 8. Measurement points

Туре	Input	Output				
	V _M	V _M	V _X	V _Y		
74HC00	0.5V _{CC}	0.5V _{CC}	0.1V _{CC}	0.9V _{CC}		
74HCT00	1.3 V	1.3 V	0.1V _{CC}	0.9V _{CC}		



Test data is given in Table 9.

Definitions test circuit:

 R_T = termination resistance should be equal to output impedance Z_0 of the pulse generator.

 C_L = load capacitance including jig and probe capacitance.

Fig 7. Load circuitry for measuring switching times

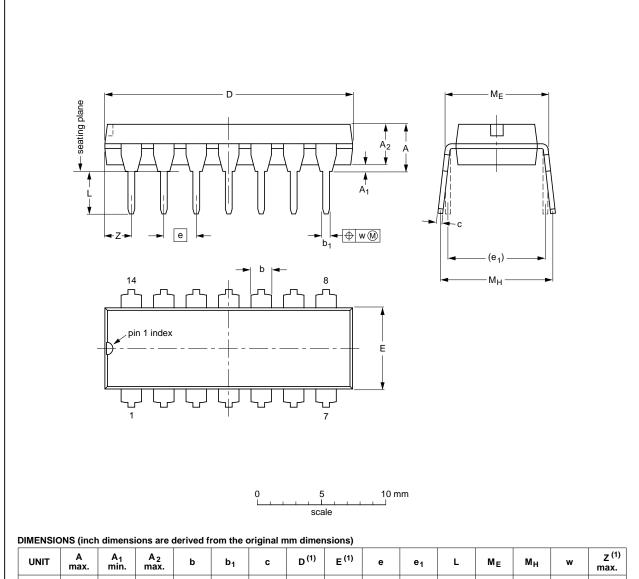
Table 9. Test data

Туре	Input L		Load	Test	
	VI	t _r , t _f	CL		
74HC00	V _{CC}	6.0 ns	15 pF, 50 pF	t _{PLH} , t _{PHL}	
74HCT00	3.0 V	6.0 ns	15 pF, 50 pF	t _{PLH} , t _{PHL}	

12. Package outline

DIP14: plastic dual in-line package; 14 leads (300 mil)

SOT27-1



UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	С	D ⁽¹⁾	E (1)	e	e ₁	L	ME	Мн	w	Z ⁽¹⁾ max.
mm	4.2	0.51	3.2	1.73 1.13	0.53 0.38	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.2
inches	0.17	0.02	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.087

Note

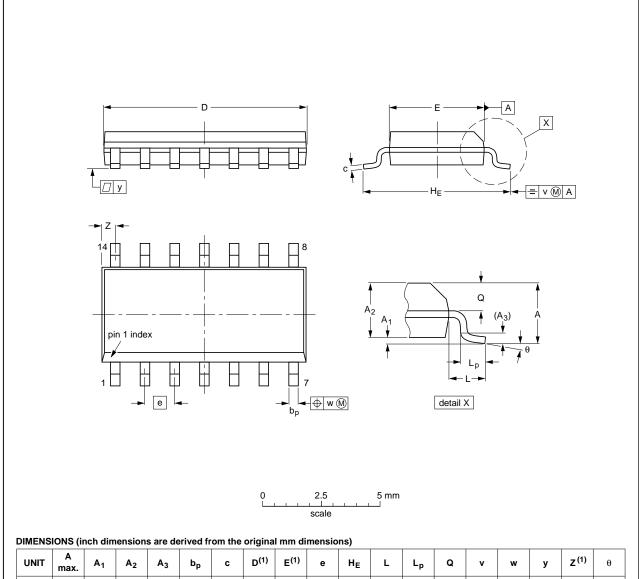
1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT27-1	050G04	MO-001	SC-501-14			99-12-27 03-02-13

Fig 8. Package outline SOT27-1 (DIP14)

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

SOT108-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	z ⁽¹⁾	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°
inches	0.069	0.010 0.004	0.057 0.049	0.01	1	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	0°

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

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

Fig 9. Package outline SOT108-1 (SO14)

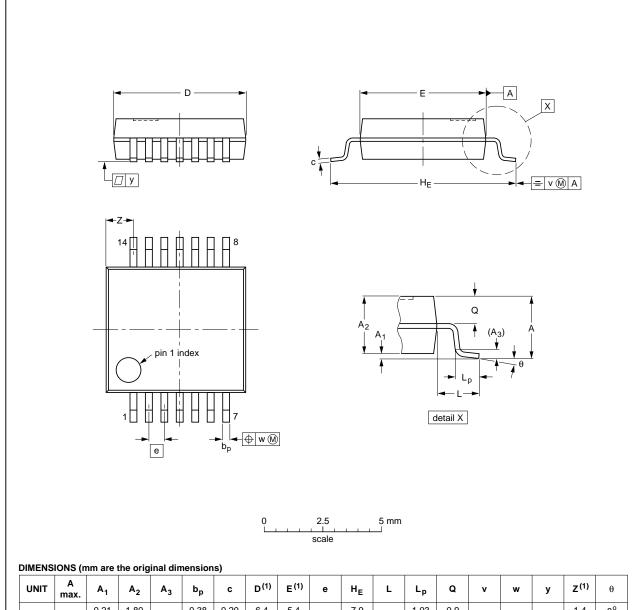
74HC_HCT00

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

SOT337-1



UNIT	A max.	A ₁	A ₂	A ₃	b _p	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
mm	2	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

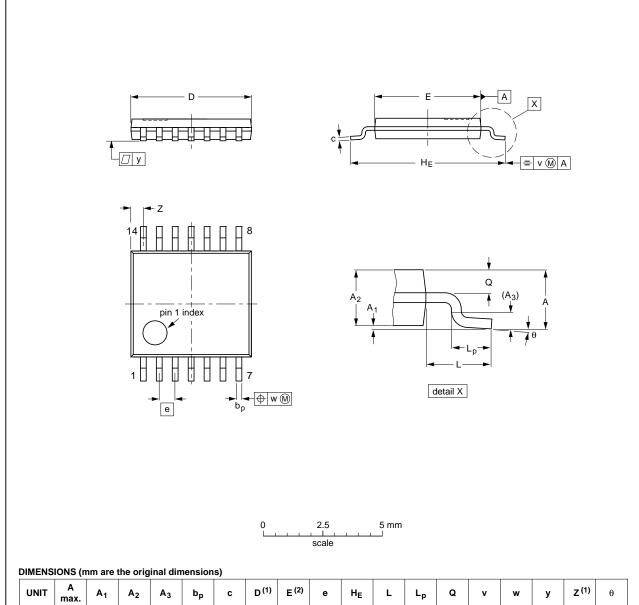
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	ENCES	EUROPEAN	ISSUE DATE	
VERSION	IEC	JEDEC	JEITA	PROJECTION	ISSUE DATE	
SOT337-1		MO-150			-99-12-27 03-02-19	

Fig 10. Package outline SOT337-1 (SSOP14)

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

SOT402-1



						-,												
UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E (2)	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	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°

- 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.

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

Fig 11. 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

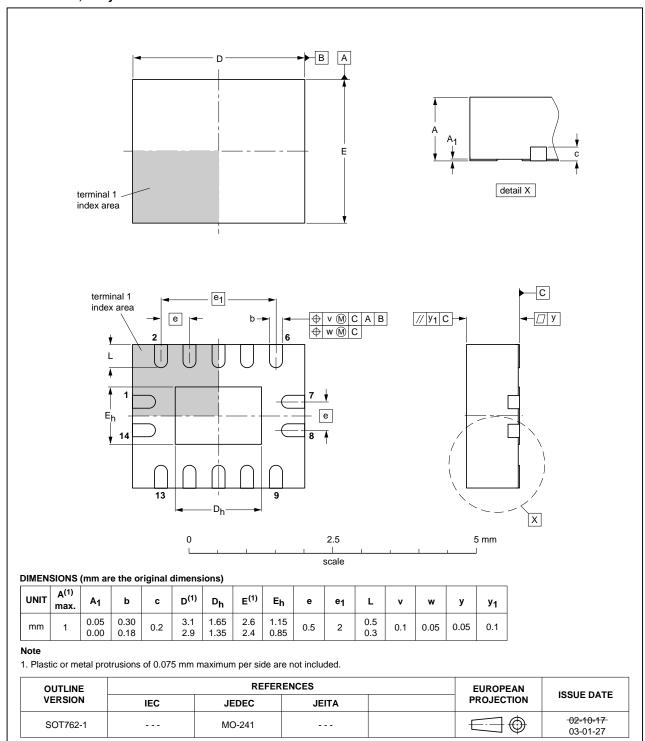


Fig 12. Package outline SOT762-1 (DHVQFN14)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
LSTTL	Low-power Schottky Transistor-Transistor Logic
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT00 v.6	20111214	Product data sheet	-	74HC_HCT00 v.5
Modifications:	 Legal pages update 	ed.		
74HC_HCT00 v.5	20101125	Product data sheet	-	74HC_HCT00 v.4
74HC_HCT00 v.4	20100111	Product data sheet	-	74HC_HCT00 v.3
74HC_HCT00 v.3	20030630	Product data sheet	-	74HC_HCT00_CNV v.2
74HC_HCT00_CNV v.2	19970826	Product specification	-	-

15. Legal information

15.1 Data sheet status

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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions"
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Quad 2-input NAND gate

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For more information, please visit: http://www.nxp.com

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17. Contents

1	General description
2	Features and benefits
3	Ordering information 1
4	Functional diagram 2
5	Pinning information 2
5.1	Pinning
5.2	Pin description 2
6	Functional description 3
7	Limiting values 3
8	Recommended operating conditions 4
9	Static characteristics 4
10	Dynamic characteristics 5
11	Waveforms 6
12	Package outline 8
13	Abbreviations
14	Revision history
15	Legal information
15.1	Data sheet status
15.2	Definitions
15.3	Disclaimers
15.4	Trademarks
16	Contact information 15
17	Contents

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