**Product data sheet** 

# 1. General description

The 74AHC14; 74AHCT14 is a hex inverter with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

### 2. Features and benefits

- Wide supply voltage range from 2.0 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- · High noise immunity
- · CMOS low power dissipation
- Balanced propagation delays
- Input levels:
  - For 74AHC14: CMOS level
  - For 74AHCT14: TTL level
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- · ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- · Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

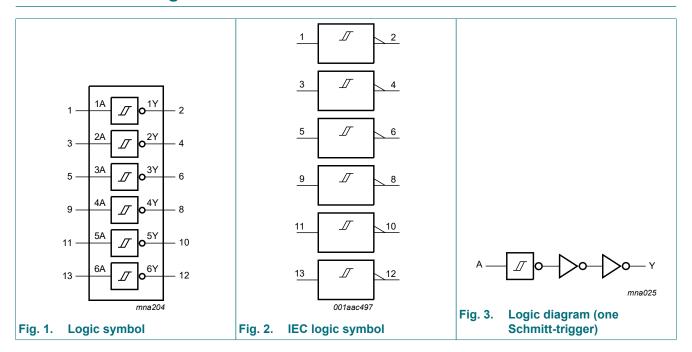
# 3. Ordering information

**Table 1. Ordering information** 

Type number	Package			
	Temperature range	Name	Description	Version
74AHC14D 74AHCT14D	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74AHC14PW 74AHCT14PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74AHC14BQ 74AHCT14BQ	-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
74AHC14BZ 74AHCT14BZ	-40 °C to +125 °C	DHXQFN14	plastic, leadless dual in-line compatible thermal enhanced extreme thin quad flat package; no leads; 14 terminals; 0.4 mm pitch; body 2 mm × 2 mm × 0.48 mm	SOT8014-1



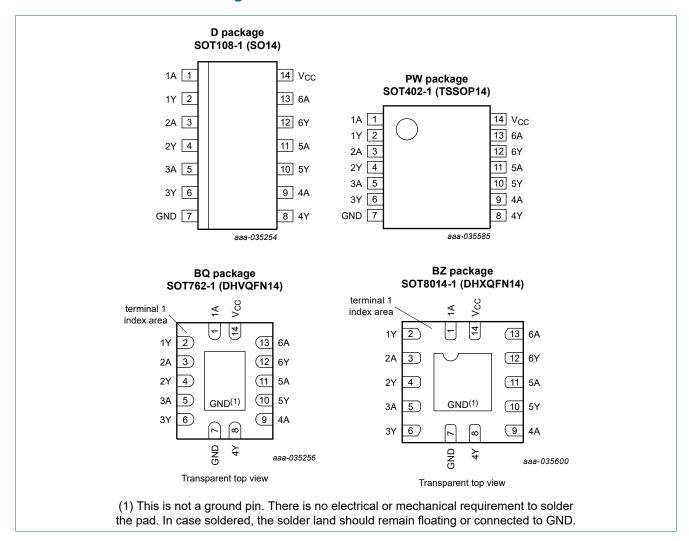
# 4. Functional diagram



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# 5. Pinning information

### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

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

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## 6. Functional description

#### Table 3. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level.$ 

Input	Output
nA	nY
L	Н
Н	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 <sub>CC</sub>	supply voltage			-0.5	+7.0	V
VI	input voltage			-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V	[1]	-20	-	mA
I <sub>OK</sub>	output clamping current	$V_{O} < -0.5 \text{ V or } V_{O} > V_{CC} + 0.5 \text{ V}$	[1]	-20	+20	mA
Io	output current	$V_{O} = -0.5 \text{ V to } (V_{CC} + 0.5 \text{ V})$		-25	+25	mA
I <sub>CC</sub>	supply current			-	+75	mA
I <sub>GND</sub>	ground current			-75	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	SOT108-1, SOT402-1, SOT762-1 T <sub>amb</sub> = -40 °C to +125 °C	[2]	-	500	mW
		SOT8014-1 T <sub>amb</sub> = -40 °C to +125 °C	[3]	-	250	mW

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

<sup>[2]</sup> For SOT108-1 (SO14) package: P<sub>tot</sub> derates linearly with 10.1 mW/K above 100 °C. For SOT402-1 (TSSOP14) package: P<sub>tot</sub> derates linearly with 7.3 mW/K above 81 °C. For SOT762-1 (DHVQFN14) package: P<sub>tot</sub> derates linearly with 9.6 mW/K above 98 °C.

<sup>[3]</sup> For SOT8014-1 (DHXQFN14) package:  $P_{tot}$  derates linearly with 8.7 mW/K above 121 °C.

# 8. Recommended operating conditions

#### Table 5. Recommended operating conditions

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

Symbol	Parameter	Conditions		74AHC14	ı	7	Unit		
			Min	Тур	Max	Min	Тур	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	0	-	5.5	V
Vo	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C

### 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	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC1	4		'					<u>'</u>		'
V <sub>OH</sub>	HIGH-level	$V_I = V_{T+}$ or $V_{T-}$								
	output voltage	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
		I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V	3.94	-	-	3.80	-	3.70	-	V
0_	LOW-level	$V_I = V_{T+}$ or $V_{T-}$								
	output voltage	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>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 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	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	2.0	-	20	-	40	μΑ
Cı	input capacitance		-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHCT	14									
V <sub>OH</sub>	HIGH-level	$V_I = V_{T+}$ or $V_{T-}$								
	output voltage	I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.80	-	3.70	-	V
OL	LOW-level	$V_I = V_{T+}$ or $V_{T-}$								
	output voltage	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> = 8.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
l <sub>l</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	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	2.0	-	20	-	40	μΑ
ΔI <sub>CC</sub>	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}$ ; other pins at $V_{CC}$ or GND; $I_O = 0 \text{ A}$ ; $V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C <sub>I</sub>	input capacitance		-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF

# 10. Dynamic characteristics

### **Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 5.

Symbol	Parameter	Conditions		25 °C		-40 °C 1	to +85 °C	-40 °C t	o +125 °C	Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHC14	4									
t <sub>pd</sub> propagation delay	propagation	nA to nY; see Fig. 4 [2]								
	V <sub>CC</sub> = 3.0 V to 3.6 V									
		C <sub>L</sub> = 15 pF	-	4.3	12.8	1.0	15.0	1.0	16.0	ns
		C <sub>L</sub> = 50 pF	-	5.8	16.3	1.0	18.0	1.0	20.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3.2	8.6	1.0	10.0	1.0	11.0	ns
		C <sub>L</sub> = 50 pF	-	4.2	10.6	1.0	12.0	1.0	13.5	ns
C <sub>PD</sub>	power dissipation capacitance	$f_i = 1 \text{ MHz}; V_I = \text{GND to } V_{CC}$ [3]	-	10	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit	
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHCT	14									
t <sub>pd</sub>	propagation delay	nA to nY; see Fig. 4 [2]								
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	4.0	7.0	1.0	8.0	1.0	9.0	ns
		C <sub>L</sub> = 50 pF	-	5.4	8.0	1.0	9.0	1.0	10.0	ns
C <sub>PD</sub>	power dissipation capacitance	$f_i = 1 \text{ MHz}; V_I = \text{GND to } V_{CC}$ [3]	-	12	-	-	-	-	-	pF

- [1] Typical values are measured at nominal supply voltage ( $V_{CC}$  = 3.3 V and  $V_{CC}$  = 5.0 V).
- $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ).

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

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

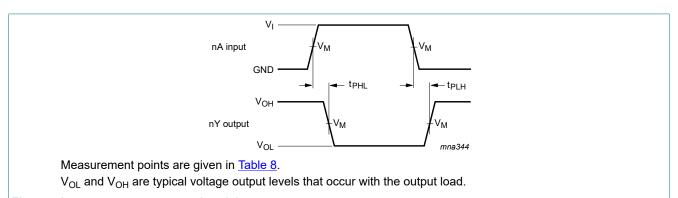
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_0) = \text{sum of the outputs.}$ 

### 10.1. Waveforms and test circuit

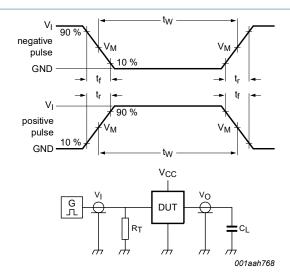


#### Fig. 4. Input to output propagation delays

### **Table 8. Measurement points**

Туре	Input	Output
	$V_{M}$	V <sub>M</sub>
74AHC14	0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>
74AHCT14	1.5 V	0.5 × V <sub>CC</sub>

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Test data is given in Table 9.

Definitions test circuit:

 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator;

 $C_L$  = Load capacitance including jig and probe capacitance.

#### Fig. 5. Test circuit for measuring switching times

Table 9. Test data

Туре	Input L		Load	Test
	V <sub>I</sub>	t <sub>r</sub> , t <sub>f</sub>	CL	
74AHC14	V <sub>CC</sub>	≤ 3.0 ns	50 pF, 15 pF	t <sub>PLH</sub> , t <sub>PHL</sub>
74AHCT14	3.0 V	≤ 3.0 ns	50 pF, 15 pF	t <sub>PLH</sub> , t <sub>PHL</sub>

#### 10.2. Transfer characteristics

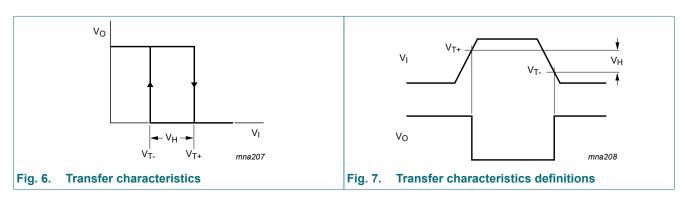
**Table 10. Transfer characteristics** 

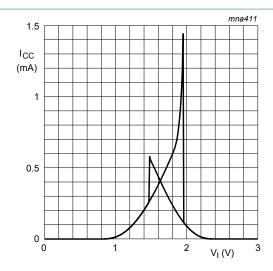
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Fig. 6 and Fig. 7.

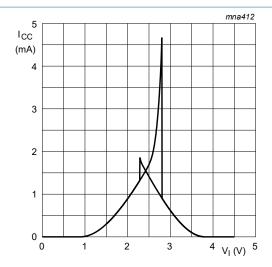
Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC14										
V <sub>T+</sub> positive-going threshold voltage		V <sub>CC</sub> = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
	V <sub>CC</sub> = 4.5 V	-	-	3.15	-	3.15	-	3.15	V	
	Voltage	V <sub>CC</sub> = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V <sub>T-</sub>	negative-going	V <sub>CC</sub> = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
	threshold voltage	V <sub>CC</sub> = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
	Voltage	V <sub>CC</sub> = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V <sub>CC</sub> = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit	
			Min	Тур	Max	Min	Max	Min	Max	
74AHCT	14									
V <sub>T+</sub>	positive-going threshold voltage	V <sub>CC</sub> = 4.5 V	-	-	1.9	-	1.9	-	1.9	V
		V <sub>CC</sub> = 5.5 V	-	-	2.1	-	2.1	-	2.1	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>CC</sub> = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
		V <sub>CC</sub> = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V <sub>CC</sub> = 5.5 V	0.4	-	1.5	0.4	1.5	0.35	1.5	V

# 10.3. Transfer characteristics waveforms

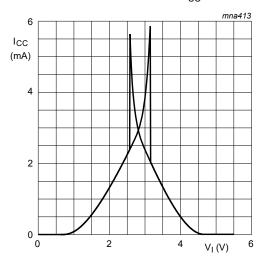






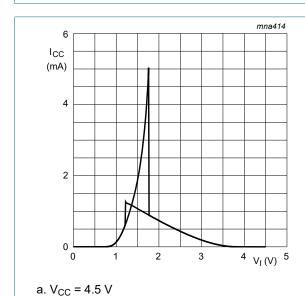
a.  $V_{CC} = 3.0 \text{ V}$ 





c.  $V_{CC}$  = 5.5 V

Fig. 8. Typical 74AHC14 transfer characteristics



b.  $V_{CC} = 5.5 \text{ V}$ 

2

8  $I_{CC}$ 

(mA)

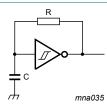
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Fig. 9. Typical 74AHCT14 transfer characteristics

 $V_{I}(V)$ 

mna415

# 11. Application information



For 74AHC14:  $f = \frac{1}{T} \approx \frac{1}{0.55 \times RC}$ 

For 74AHCT14:  $f = \frac{1}{T} \approx \frac{1}{0.60 \times RC}$ 

Fig. 10. Relaxation oscillator

# 12. Package outline

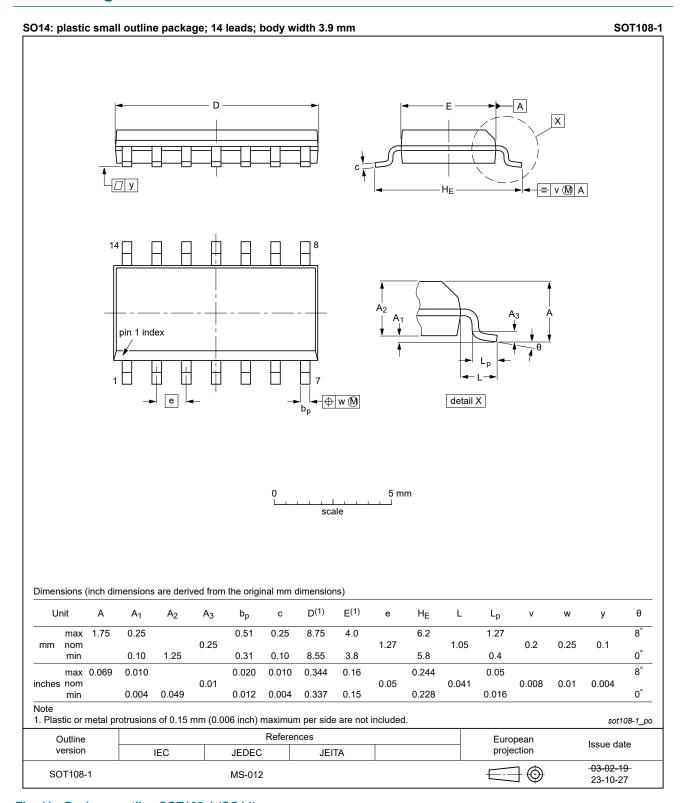


Fig. 11. Package outline SOT108-1 (SO14)

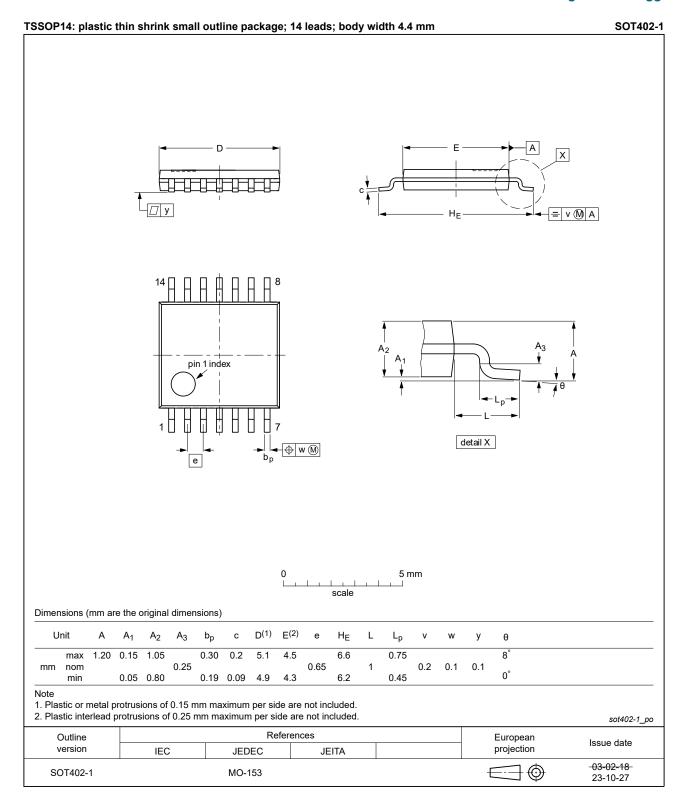


Fig. 12. Package outline SOT402-1 (TSSOP14)

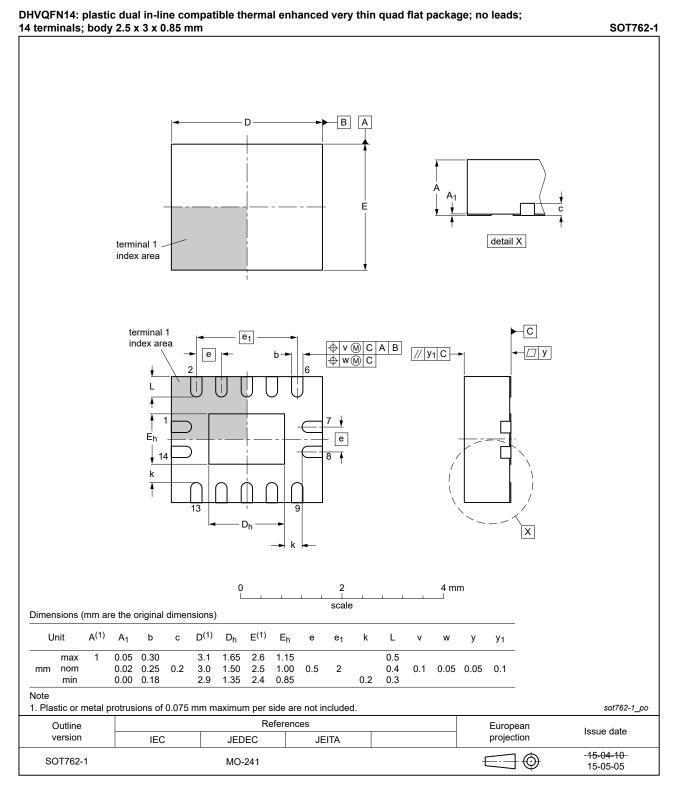


Fig. 13. Package outline SOT762-1 (DHVQFN14)

DHXQFN14: plastic, leadless dual in-line compatible thermal enhanced extreme thin quad flat package; no leads; 14 terminals; 0.4 mm pitch; body 2 mm x 2 mm x 0.48 mm

SOT8014-1

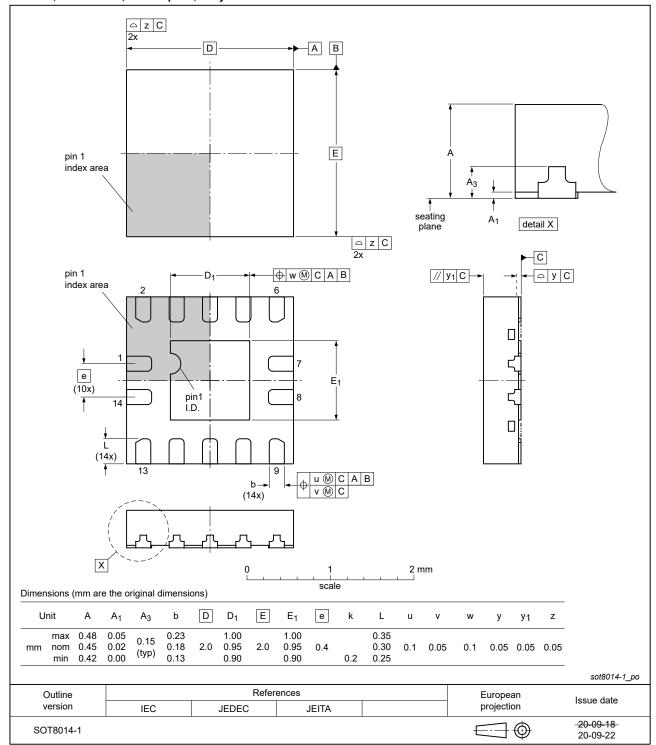


Fig. 14. Package outline SOT8014-1 (DHXQFN14)

## 13. Abbreviations

#### **Table 11. Abbreviations**

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESDA	ElectroStatic Discharge Association
ESD	ElectroStatic Discharge
НВМ	Human Body Model
JEDEC	Joint Electron Device Engineering Council
TTL	Transistor-Transistor Logic

# 14. Revision history

#### **Table 12. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74AHC_AHCT14 v.9	20250428	Product data sheet	-	74AHC_AHCT14 v.8		
Modifications:	Type numbers 74AHC14BZ and 74AHCT14BZ (SOT8014-1/DHXFNQ14) added.					
74AHC_AHCT14 v.8	20240410	Product data sheet	-	74AHC_AHCT14 v.7		
Modifications:	Fig. 11, Fig. 12: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.					
74AHC_AHCT14 v.7	20230905	Product data sheet	-	74AHC_AHCT14 v.6		
Modifications:	<u>Section 2</u> : ESD specification updated according to the latest JEDEC standard.					
74AHC_AHCT14 v.6	20200616	Product data sheet	-	74AHC_AHCT14 v.5		
Modifications:	<ul> <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>Section 1 and Section 2 updated.</li> <li>Table 4: Derating values for P<sub>tot</sub> total power dissipation have been updated.</li> <li>Package outline drawing of SOT762-1 (Fig. 13) updated.</li> </ul>					
74AHC_AHCT14 v.5	20090504	Product data sheet	-	74AHC_AHCT14 v.4		
Modifications:	<u>Table 6</u> : the conditions for HIGH-level output voltage and LOW-level output voltage have been changed.					
74AHC_AHCT14 v.4	20080425	Product data sheet	-	74AHC_AHCT14 v.3		
74AHC_AHCT14 v.3	20030526	Product specification	-	74AHC_AHCT14 v.2		
74AHC_AHCT14 v.2	19990927	Product specification	-	74AHC_AHCT14 v.1		
74AHC_AHCT14 v.1	19990111	Preliminary specification	-	-		

### 15. Legal information

#### **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.

- 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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