74AHC14BQ,115 Datasheet

www.digi-electronics.com
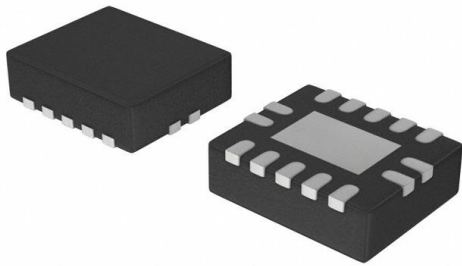
DiGi Electronics Part Number	74AHC14BQ,115-DG
Manufacturer	Nexperia USA Inc.
Manufacturer Product Number	74AHC14BQ,115
Description	IC INVERTER 6CH 1-INP 14DHVQFN
Detailed Description	Inverter IC 6 Channel Schmitt Trigger 14-DHVQFN (2.5x3)

https://www.DiGi-Electronics.com

Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
74AHC14BQ,115	Nexperia USA Inc.
Series:	Product Status:
74AHC	Active
Logic Type:	Number of Circuits:
Inverter	6
Number of Inputs:	Features:
1	Schmitt Trigger
Voltage - Supply:	Current - Quiescent (Max):
2V ~ 5.5V	2 µA
Current - Output High, Low:	Input Logic Level - Low:
8mA, 8mA	0.9V ~ 1.65V
Input Logic Level - High:	Max Propagation Delay @ V, Max CL:
2.2V ~ 3.85V	10.6ns @ 5V, 50pF
Operating Temperature:	Mounting Type:
-40°C ~ 125°C	Surface Mount
Supplier Device Package:	Package / Case:
14-DHVQFN (2.5x3)	14-VFQFN Exposed Pad
Base Product Number:	
74AHC14	

Environmental & Export classification

RoHS Status:	Moisture Sensitivity Level (MSL):
ROHS3 Compliant	1 (Unlimited)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	
8542.39.0001	

74AHC14; 74AHCT14

Hex inverting Schmitt trigger

Rev. 8 — 10 April 2024   **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.
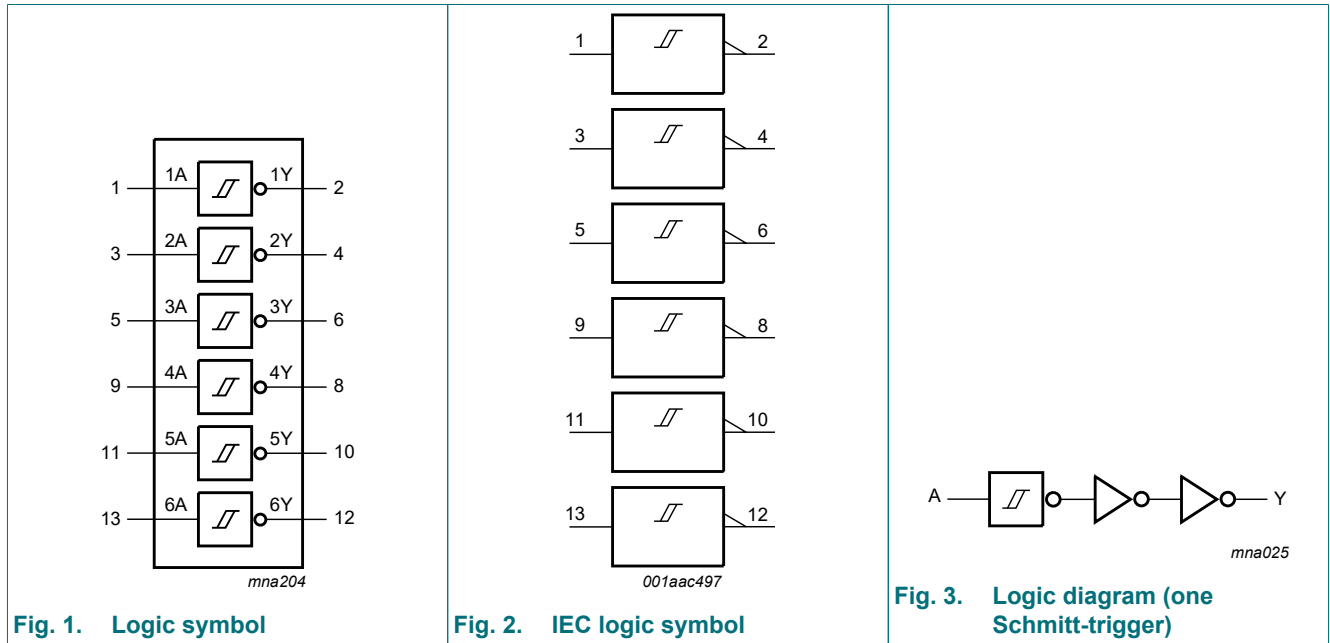
2. Features and benefits

- 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

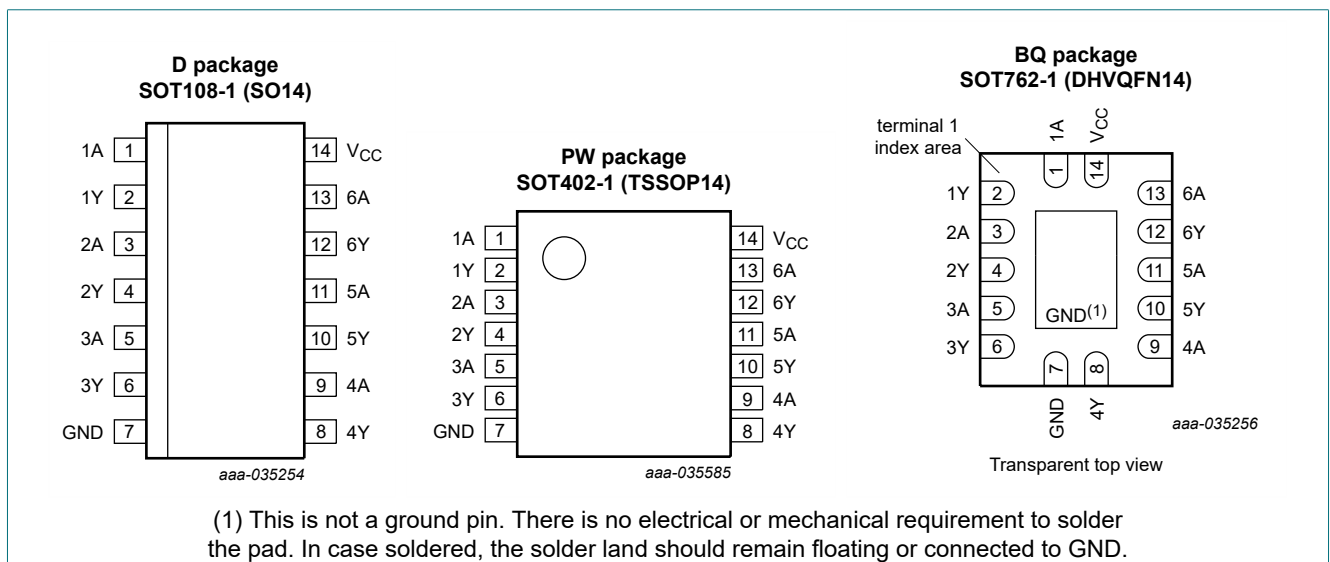## 3. Ordering information

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

nexperia

4. Functional diagram

Fig. 1. Logic symbol

mna204

Fig. 2. IEC logic symbol

001aac497

Fig. 3. Logic diagram (one Schmitt-trigger)

mna025

5. Pinning information

5.1. Pinning

D package
SOT108-1 (SO14)

aaa-035254

PW package
SOT402-1 (TSSOP14)

aaa-035585

BQ package
SOT762-1 (DHVQFN14)

Transparent top view

aaa-035256

(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

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_{CC}	14	supply voltage

6. Functional description

Table 3. Function table

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

Input	Output
nA	**nY**
L	H
H	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_{CC}	supply voltage			-0.5	+7.0	V
V_I	input voltage			-0.5	+7.0	V
I_{IK}	input clamping current	V_I < -0.5 V	[1]	-20	-	mA
I_{OK}	output clamping current	V_O < -0.5 V or V_O > V_{CC} + 0.5 V	[1]	-20	+20	mA
I_O	output current	V_O = -0.5 V to (V_{CC} + 0.5 V)		-25	+25	mA
I_{CC}	supply current			-	+75	mA
I_{GND}	ground current			-75	-	mA
T_{stg}	storage temperature			-65	+150	°C
P_{tot}	total power dissipation	T_{amb} = -40 °C to +125 °C	[2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For SOT108-1 (SO14) package: P_{tot} derates linearly with 10.1 mW/K above 100 °C.
  For SOT402-1 (TSSOP14) package: P_{tot} derates linearly with 7.3 mW/K above 81 °C.
  For SOT762-1 (DHVQFN14) package: P_{tot} derates linearly with 9.6 mW/K above 98 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74AHC14			74AHCT14			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V_I	input voltage		0	-	5.5	0	-	5.5	V
V_O	output voltage		0	-	V_{CC}	0	-	V_{CC}	V
T_{amb}	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 +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHC14										
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}								
		$I_O = -50$ µA; $V_{CC} = 2.0$ V	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50$ µA; $V_{CC} = 3.0$ V	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50$ µA; $V_{CC} = 4.5$ V	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -4.0$ mA; $V_{CC} = 3.0$ V	2.58	-	-	2.48	-	2.40	-	V
		$I_O = -8.0$ mA; $V_{CC} = 4.5$ V	3.94	-	-	3.80	-	3.70	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}								
		$I_O = 50$ µA; $V_{CC} = 2.0$ V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50$ µA; $V_{CC} = 3.0$ V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50$ µA; $V_{CC} = 4.5$ V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0$ mA; $V_{CC} = 3.0$ V	-	-	0.36	-	0.44	-	0.55	V
		$I_O = 8.0$ mA; $V_{CC} = 4.5$ V	-	-	0.36	-	0.44	-	0.55	V
I_I	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 0$ V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	2.0	-	20	-	40	µA
C_I	input capacitance		-	3	10	-	10	-	10	pF
C_O	output capacitance		-	4	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHCT14										
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}								
		$I_O = -50$ μA; $V_{CC} = 4.5$ V	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -8.0$ mA; $V_{CC} = 4.5$ V	3.94	-	-	3.80	-	3.70	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}								
		$I_O = 50$ μA; $V_{CC} = 4.5$ V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 8.0$ mA; $V_{CC} = 4.5$ V	-	-	0.36	-	0.44	-	0.55	V
I_I	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 0$ V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	2.0	-	20	-	40	μA
ΔI_{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1$ V; other pins at V_{CC} or GND; $I_O = 0$ A; $V_{CC} = 4.5$ V to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C_I	input capacitance		-	3	10	-	10	-	10	pF
C_O	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 to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHC14										
t_{pd}	propagation delay	nA to nY; see Fig. 4 [2]								
		$V_{CC} = 3.0$ V to 3.6 V								
		$C_L = 15$ pF	-	4.3	12.8	1.0	15.0	1.0	16.0	ns
		$C_L = 50$ pF	-	5.8	16.3	1.0	18.0	1.0	20.5	ns
		$V_{CC} = 4.5$ V to 5.5 V								
		$C_L = 15$ pF	-	3.2	8.6	1.0	10.0	1.0	11.0	ns
		$C_L = 50$ pF	-	4.2	10.6	1.0	12.0	1.0	13.5	ns
C_{PD}	power dissipation capacitance	$f_i = 1$ MHz; $V_I = $ 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	
74AHCT14											
t_{pd}	propagation delay	nA to nY; see Fig. 4 [2]									
		V_{CC} = 4.5 V to 5.5 V									
		C_L = 15 pF		-	4.0	7.0	1.0	8.0	1.0	9.0	ns
		C_L = 50 pF		-	5.4	8.0	1.0	9.0	1.0	10.0	ns
C_{PD}	power dissipation capacitance	f_i = 1 MHz; V_I = 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).

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] C_{PD} is used to determine the dynamic power dissipation (P_D in µW).

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

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.
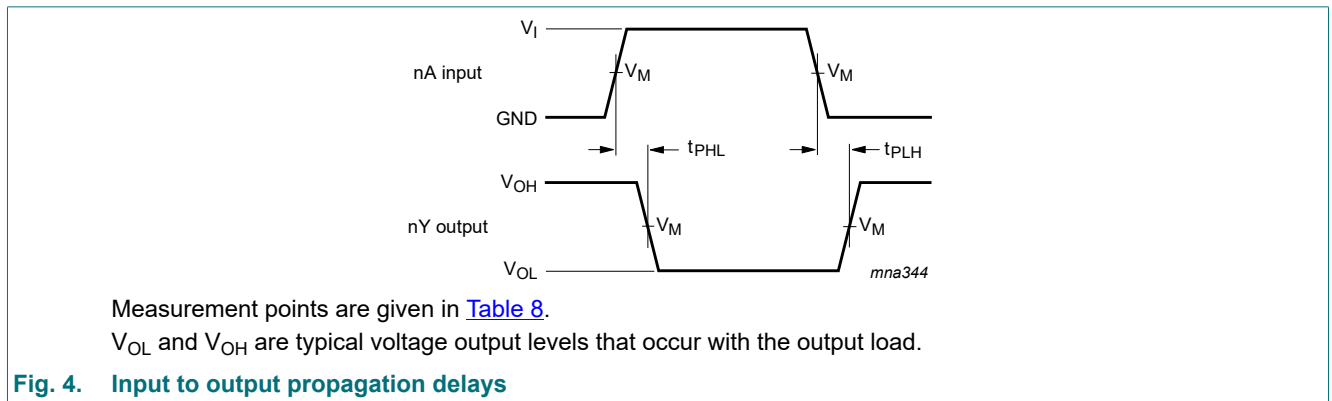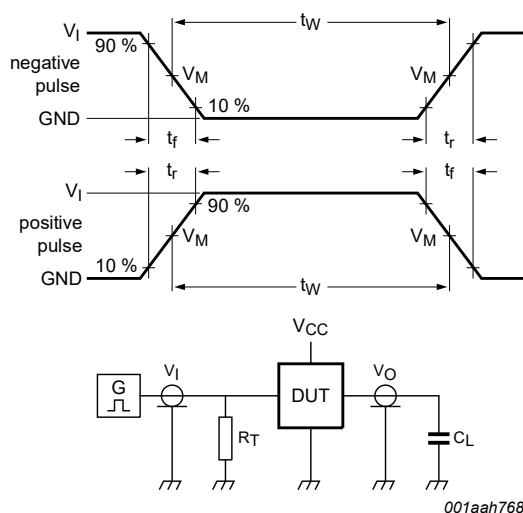
10.1. Waveforms and test circuit

Measurement points are given in Table 8.

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

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

Table 8. Measurement points

Type	Input	Output
	V_M	V_M
74AHC14	0.5 × V_{CC}	0.5 × V_{CC}
74AHCT14	1.5 V	0.5 × V_{CC}

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

| Type	Input		Load	Test
	V_I	t_r, t_f	C_L	
74AHC14	V_{CC}	≤ 3.0 ns	50 pF, 15 pF	t_{PLH}, t_{PHL}
74AHCT14	3.0 V	≤ 3.0 ns	50 pF, 15 pF	t_{PLH}, t_{PHL}

10.2. Transfer characteristics

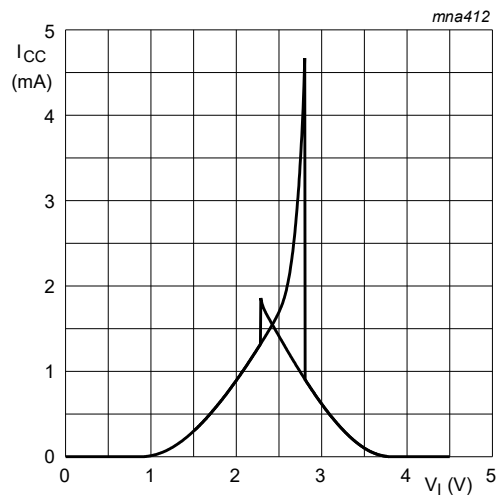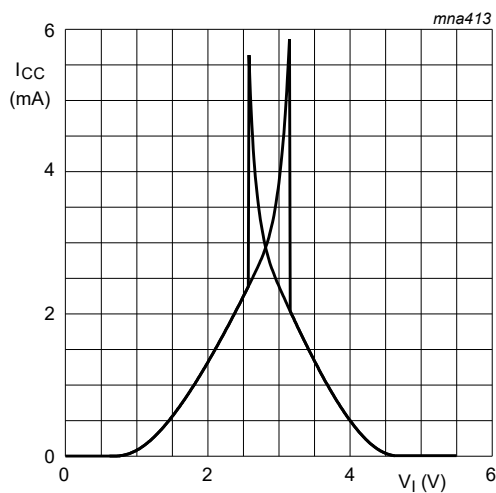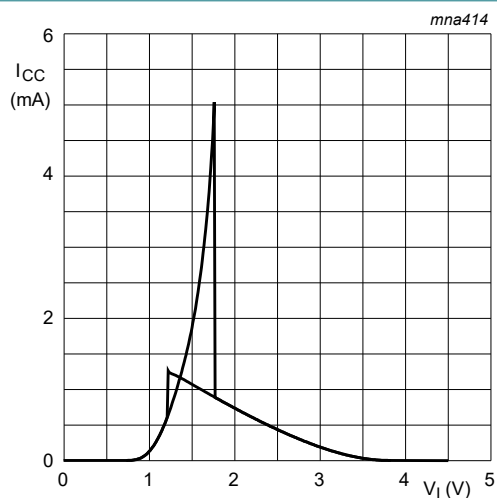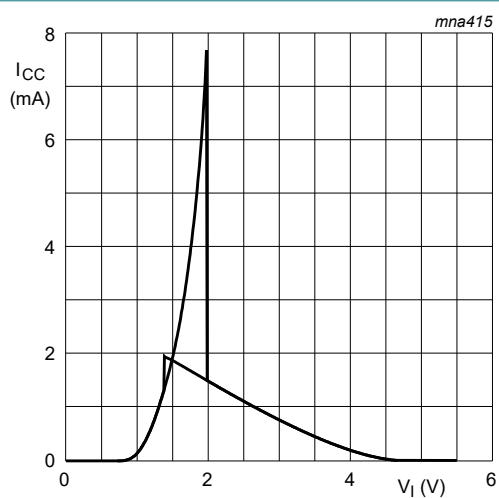**Table 10. Transfer characteristics**

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 to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHC14										
V_{T+}	positive-going threshold voltage	V_{CC} = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
		V_{CC} = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
		V_{CC} = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V_{T-}	negative-going threshold voltage	V_{CC} = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
		V_{CC} = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
		V_{CC} = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
V_H	hysteresis voltage	V_{CC} = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		V_{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V_{CC} = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V

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74AHC14; 74AHCT14

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHCT14										
V_{T+}	positive-going threshold voltage	V_{CC} = 4.5 V	-	-	1.9	-	1.9	-	1.9	V
		V_{CC} = 5.5 V	-	-	2.1	-	2.1	-	2.1	V
V_{T-}	negative-going threshold voltage	V_{CC} = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
		V_{CC} = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V_H	hysteresis voltage	V_{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V_{CC} = 5.5 V	0.4	-	1.5	0.4	1.5	0.35	1.5	V

10.3. Transfer characteristics waveforms

Fig. 6. Transfer characteristics

Fig. 7. Transfer characteristics definitions
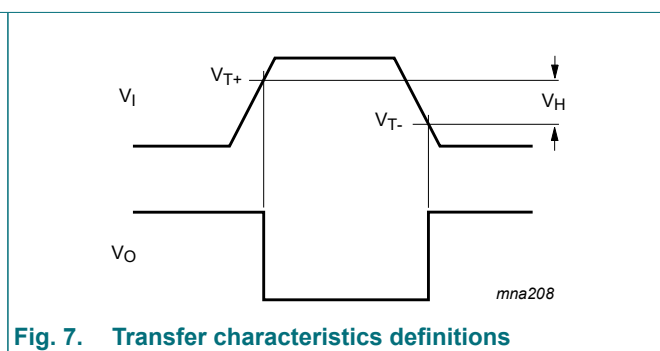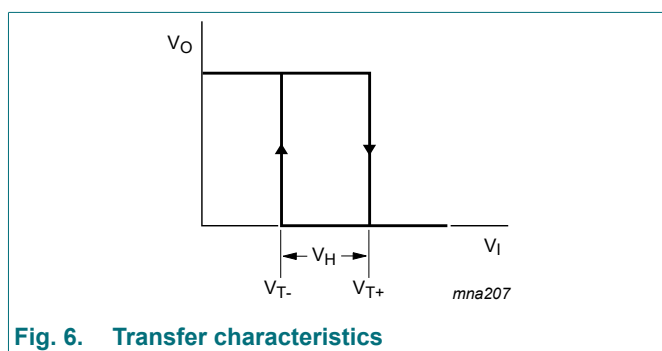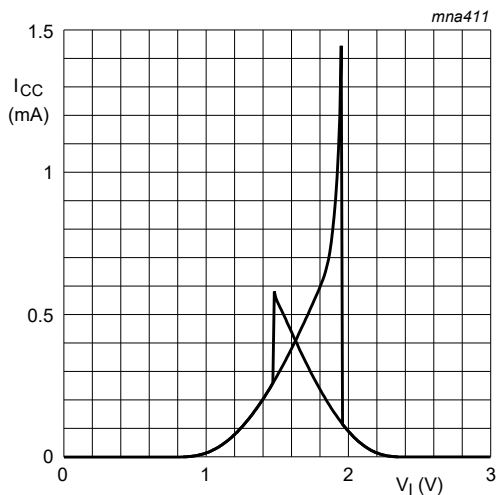
a. V_{CC} = 3.0 V

b. V_{CC} = 4.5 V

c. V_{CC} = 5.5 V

Fig. 8.　Typical 74AHC14 transfer characteristics

a. V_{CC} = 4.5 V

b. V_{CC} = 5.5 V

Fig. 9.　Typical 74AHCT14 transfer characteristics

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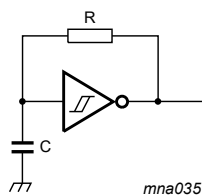
For 74AHC14: $f = \frac{1}{T} \approx \frac{1}{0.55 \times RC}$

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

Fig. 10. Relaxation oscillator

12. Package outline

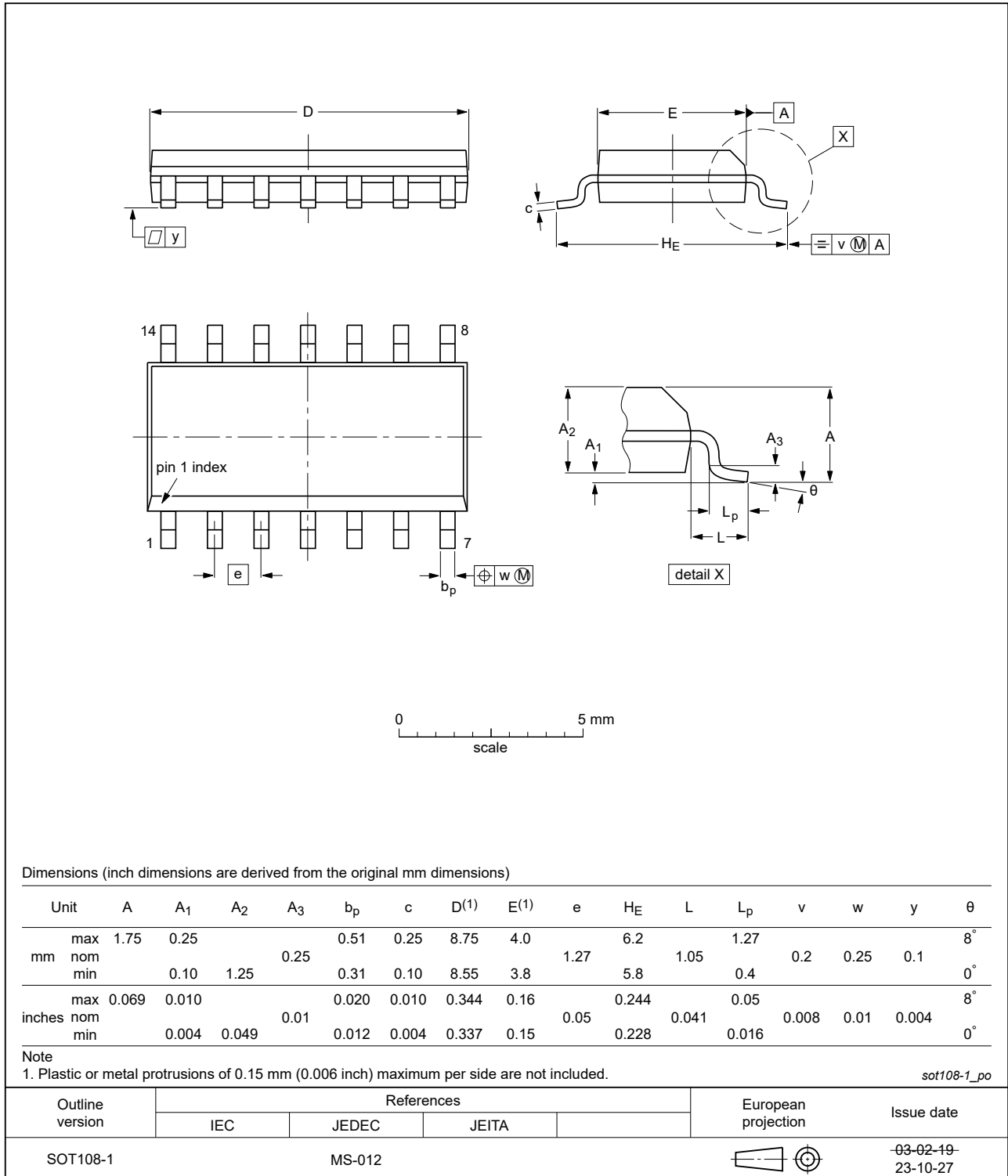**SO14: plastic small outline package; 14 leads; body width 3.9 mm**   **SOT108-1**

Dimensions (inch dimensions are derived from the original mm dimensions)

Unit		A	A$_1$	A$_2$	A$_3$	b$_p$	c	D$^{(1)}$	E$^{(1)}$	e	H$_E$	L	L$_p$	v	w	y	θ
mm	max	1.75	0.25			0.51	0.25	8.75	4.0		6.2		1.27				8°
	nom				0.25					1.27		1.05		0.2	0.25	0.1	
	min		0.10	1.25		0.31	0.10	8.55	3.8		5.8		0.4				0°
inches	max	0.069	0.010			0.020	0.010	0.344	0.16		0.244		0.05				8°
	nom				0.01					0.05		0.041		0.008	0.01	0.004	
	min		0.004	0.049		0.012	0.004	0.337	0.15		0.228		0.016				0°

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

sot108-1_po

Outline version	References				European projection		Issue date
	IEC	JEDEC	JEITA				
SOT108-1		MS-012					03-02-19 23-10-27

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

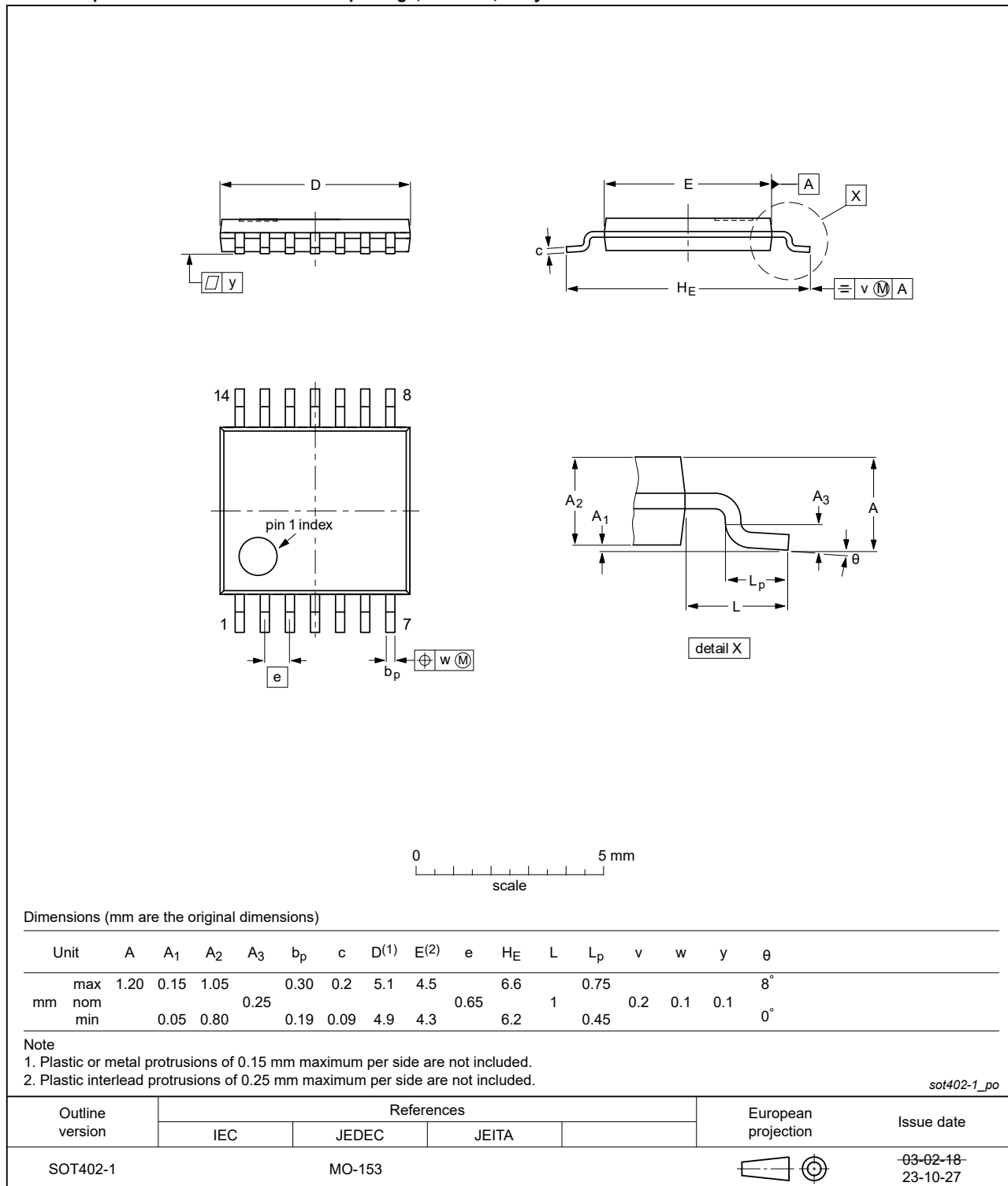**TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm**   SOT402-1

Dimensions (mm are the original dimensions)

	Unit	A	A$_1$	A$_2$	A$_3$	b$_p$	c	D$^{(1)}$	E$^{(2)}$	e	H$_E$	L	L$_p$	v	w	y	θ
mm	max	1.20	0.15	1.05		0.30	0.2	5.1	4.5		6.6		0.75				8°
	nom				0.25					0.65		1		0.2	0.1	0.1	
	min		0.05	0.80		0.19	0.09	4.9	4.3		6.2		0.45				0°

Note
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.

sot402-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT402-1		MO-153				~~03-02-18~~ 23-10-27

Fig. 12. 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

Dimensions (mm are the original dimensions)

Unit	A[(1)]	A_1	b	c	D[(1)]	D_h	E[(1)]	E_h	e	e_1	k	L	v	w	y	y_1
mm max	1	0.05	0.30		3.1	1.65	2.6	1.15				0.5				
nom		0.02	0.25	0.2	3.0	1.50	2.5	1.00	0.5	2		0.4	0.1	0.05	0.05	0.1
min		0.00	0.18		2.9	1.35	2.4	0.85			0.2	0.3				

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

sot762-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT762-1		MO-241				~~15-04-10~~ 15-05-05

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

Nexperia

74AHC14; 74AHCT14

Hex inverting Schmitt trigger

13. Abbreviations

Table 11. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
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:		• Section 2: ESD specification updated according to the latest JEDEC standard.		
74AHC_AHCT14 v.6	20200616	Product data sheet	-	74AHC_AHCT14 v.5
Modifications:		• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Section 1 and Section 2 updated. • Table 4: Derating values for P_{tot} total power dissipation have been updated. • Package outline drawing of SOT762-1 (Fig. 13) updated.		
74AHC_AHCT14 v.5	20090504	Product data sheet	-	74AHC_AHCT14 v.4
Modifications:		• Table 6: 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.

[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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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Hex inverting Schmitt trigger

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