1. General description

The 74AHC14-Q100; 74AHCT14-Q100 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- 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-Q100: CMOS level
 - For 74AHCT14-Q100: 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
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

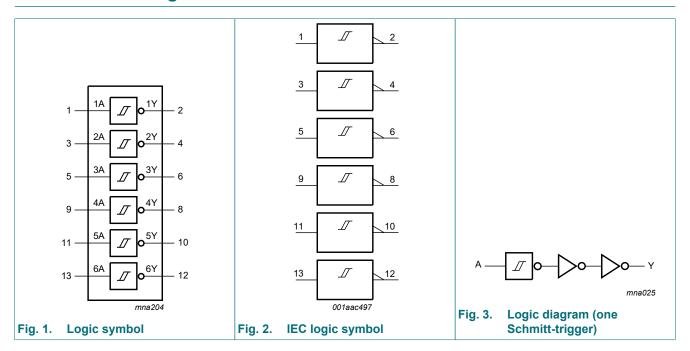
3. Ordering information

Table 1. Ordering information

Type number	Package								
	Temperature range	Name	Description	Version					
74AHC14D-Q100 74AHCT14D-Q100	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1					
74AHC14PW-Q100 74AHCT14PW-Q100	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1					
74AHC14BQ-Q100 74AHCT14BQ-Q100	-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					

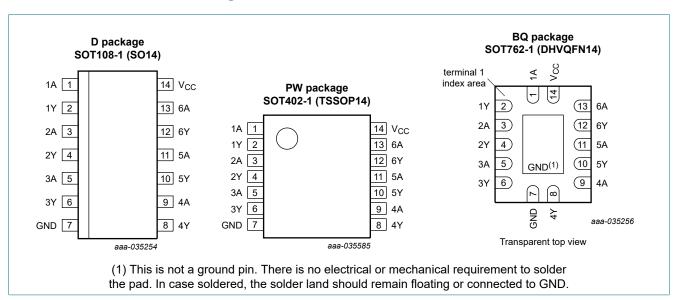


4. Functional diagram



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 _{CC}	14	supply voltage

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 _{CC}	supply voltage			-0.5	+7.0	V
VI	input voltage			-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V	[1]	-20	-	mA
lok	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 _{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-Q100			74A	Unit		
			Min	Тур	Max	Min	Тур	Max	
V _{CC}	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 _{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	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC1	4-Q100		'					<u>'</u>	<u>'</u>	
V _{OH}	HIGH-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	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	$V_I = V_{T+}$ or V_{T-}								
	output voltage	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	μΑ
I _{CC}	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-Q100									
V _{OH}	HIGH-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	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	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	2.0	-	20	-	40	μΑ
Δl _{CC}	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 _I	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 C		Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHC14	4-Q100									
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	$f_i = 1 \text{ MHz}; V_i = \text{GND to } V_{CC}$ [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-Q100				•			,		
	propagation	nA to nY; see Fig. 4 [2]								
	delay	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	$f_i = 1 \text{ MHz}; V_i = \text{GND to } V_{CC}$ [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 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;

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

10.1. Waveforms and test circuit

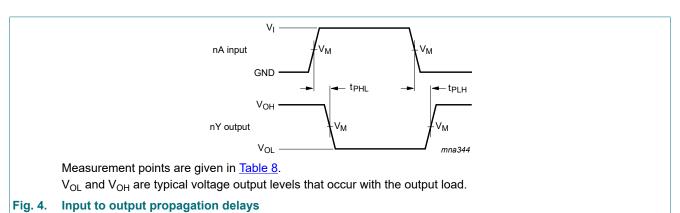
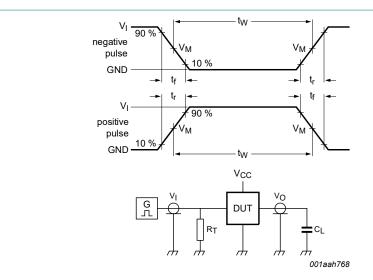


Table 8. Measurement points

Туре	Input	Output
	V _M	V _M
74AHC14-Q100	0.5 × V _{CC}	0.5 × V _{CC}
74AHCT14-Q100	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

Туре	Input L		Load	Test
	V _I	t _r , t _f	CL	
74AHC14-Q100	V _{CC}	≤ 3.0 ns	50 pF, 15 pF	t _{PLH} , t _{PHL}
74AHCT14-Q100	3.0 V	≤ 3.0 ns	50 pF, 15 pF	t _{PLH} , t _{PHL}

10.2. Transfer characteristics

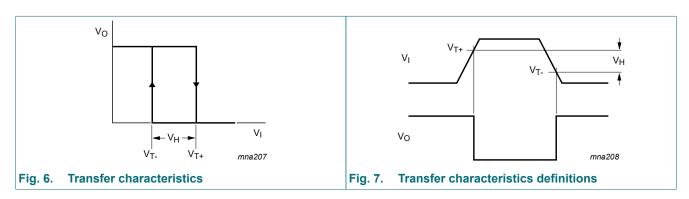
Table 10. Transfer characteristics

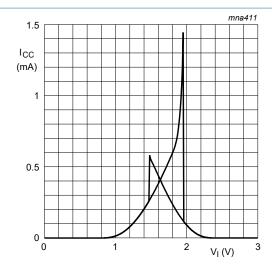
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Fig. 6 and Fig. 7.

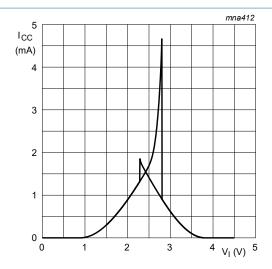
Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC14	4-Q100									
V _{T+} positive-going threshold voltage		V _{CC} = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
	V _{CC} = 4.5 V	-	-	3.15	-	3.15	-	3.15	V	
	Voltage	V _{CC} = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V _{T-}	negative-going	V _{CC} = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
	threshold voltage	V _{CC} = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
	Voltage	V _{CC} = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
V _H	hysteresis	V _{CC} = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
	voltage	V _{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V _{CC} = 5.5 V	0.5	-	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	
74AHCT14-Q100										
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

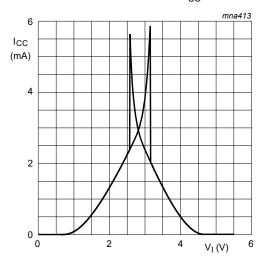






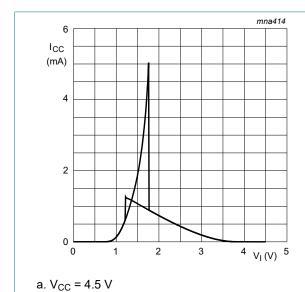
a. $V_{CC} = 3.0 \text{ V}$

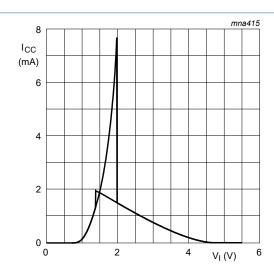




c. V_{CC} = 5.5 V

Fig. 8. Typical 74AHC14-Q100 transfer characteristics

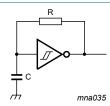




b. $V_{CC} = 5.5 \text{ V}$

Fig. 9. Typical 74AHCT14-Q100 transfer characteristics

11. Application information



For 74AHC14-Q100: $f = \frac{1}{T} \approx \frac{1}{0.55 \times RC}$

For 74AHCT14-Q100: $f = \frac{1}{T} \approx \frac{1}{0.60 \times RC}$

Fig. 10. Relaxation oscillator

12. Package outline

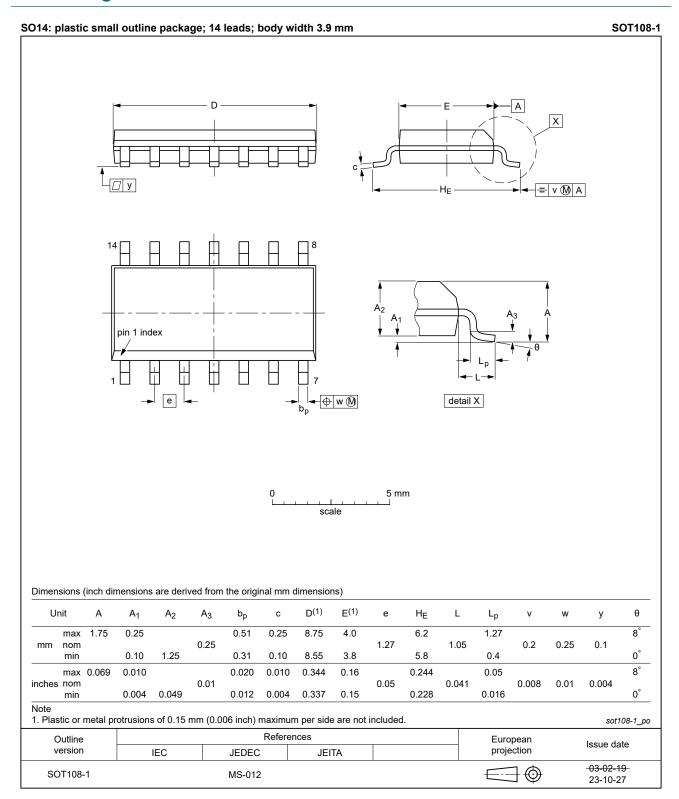


Fig. 11. Package outline SOT108-1 (SO14)

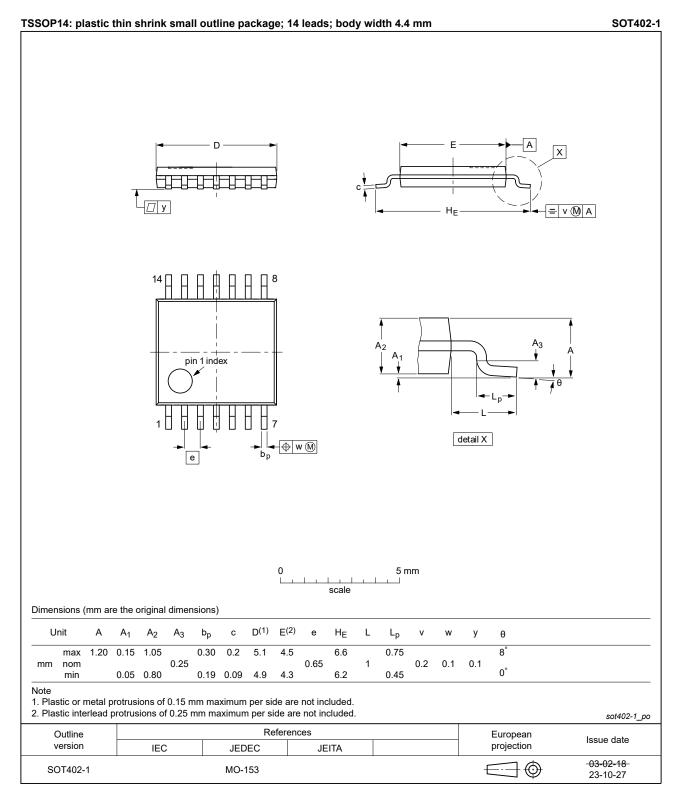


Fig. 12. Package outline SOT402-1 (TSSOP14)

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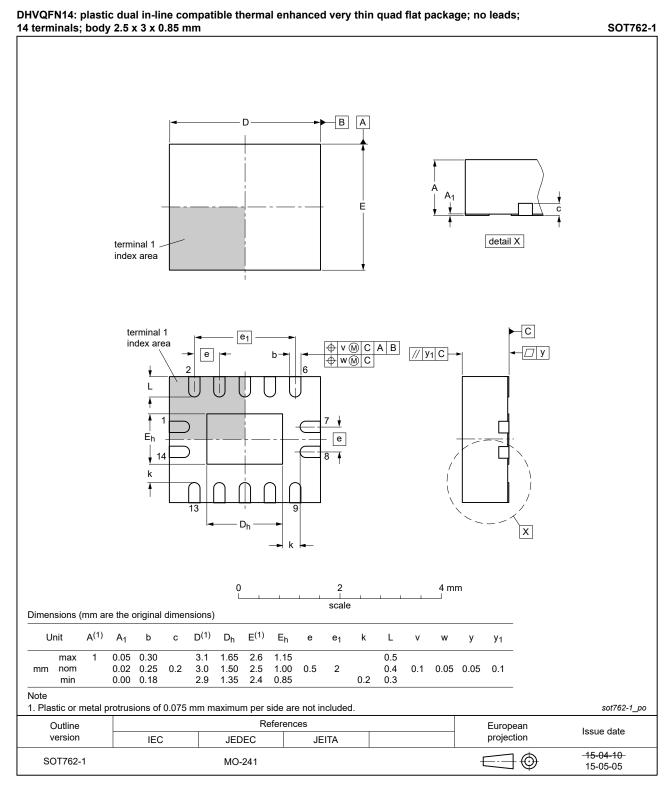


Fig. 13. Package outline SOT762-1 (DHVQFN14)

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_Q100 v.4	20240410	Product data sheet	-	74AHC_AHCT14_Q100 v.3		
Modifications:	 Fig. 11, Fig. 12: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153. 					
74AHC_AHCT14_Q100 v.3	20230905	Product data sheet	-	74AHC_AHCT14_Q100 v.2		
Modifications:	<u>Section 2</u> : ESD specification updated according to the latest JEDEC standard.					
74AHC_AHCT14_Q100 v.2	20200616	Product data sheet	-	74AHC_AHCT14_Q100 v.1		
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 Ptot total power dissipation have been updated. Package outline drawing of SOT762-1 (Fig. 13) updated. 					
74AHC_AHCT14_Q100 v.1	20120709	Product data sheet	-	-		

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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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