

74AHCT04A

Hex inverter

Rev. 2 — 2 October 2023

Product data sheet

1. General description

The 74AHCT04A is a hex inverter.

Designed to operate over a V_{CC} range from 4.5 V to 5.5 V, the inputs are TTL compatible, which allows the device to be used to translate from 3.3 V to 5 V.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial Power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

2. Features and benefits

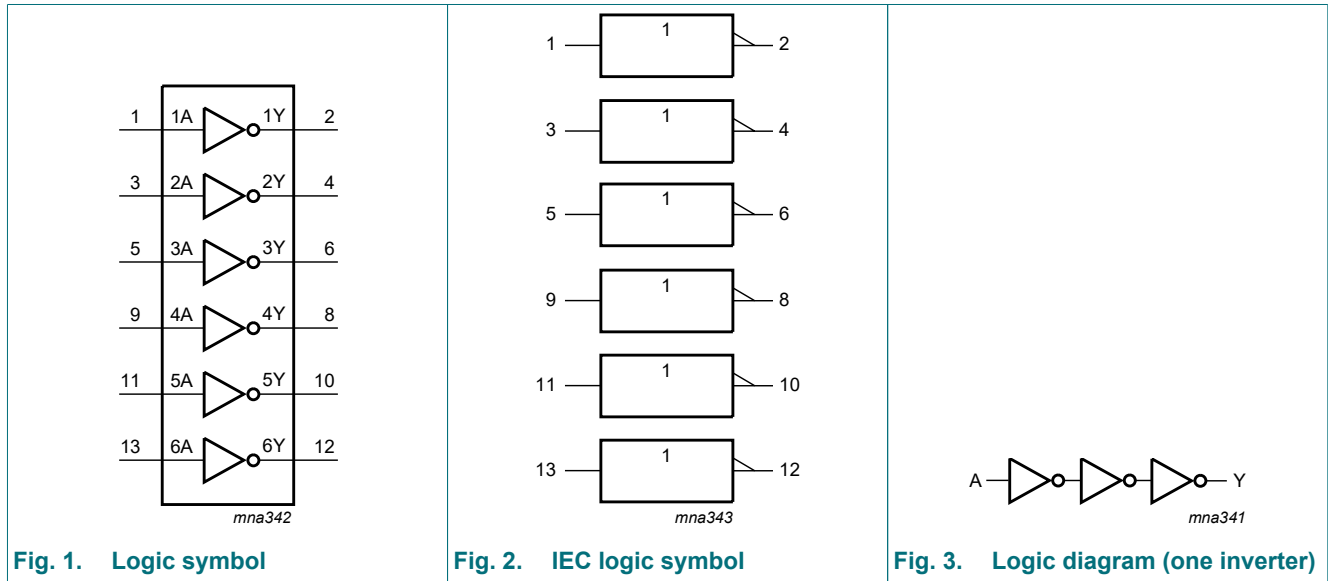
- Direct interface with TTL levels
- Supply voltage range from 4.5 V to 5.5 V
- Typical t_{pd} of 3.1 ns at 5 V
- Typical $V_{OL(p)} < 0.8$ V at $V_{CC} = 5$ V, $T_{amb} = 25$ °C
- Typical $V_{OH(v)} > 2.3$ V at $V_{CC} = 5$ V, $T_{amb} = 25$ °C
- Supports mixed-mode voltage operation on all ports
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 3000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 2000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

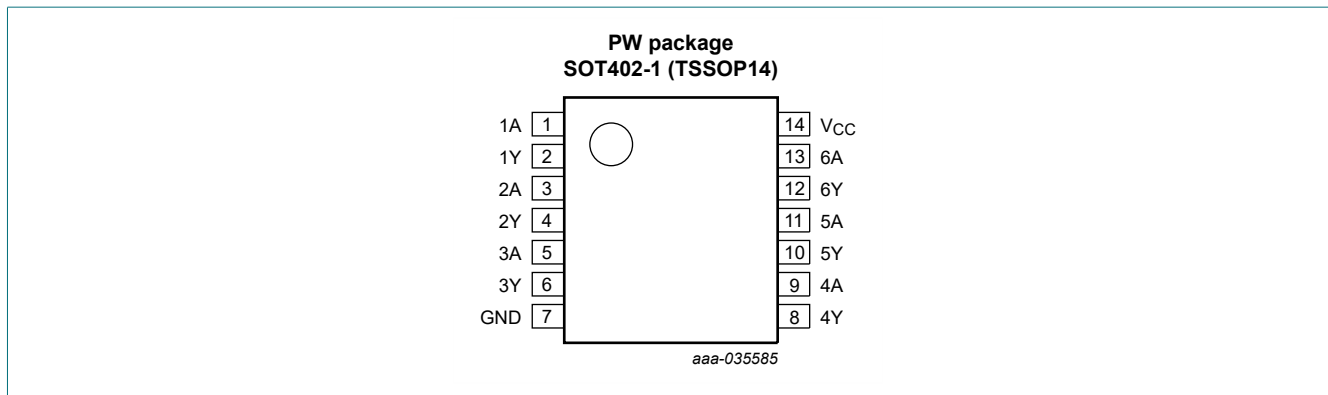
Type number	Package			Version
	Temperature range	Name	Description	
74AHCT04APW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1

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 [1]

Input	Output
nA	nY
L	H
H	L

[1] H = HIGH voltage level; L = LOW voltage level

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
V_O	output voltage	active mode	-0.5	$V_{CC} + 0.5$	V
		power-down or 3-state mode	-0.5	+7.0	V
I_{IK}	input clamping current	$V_I < 0$ V	-20	-	mA
I_{OK}	output clamping current	$V_O < 0$ V	-20	-	mA
I_O	output current	$V_O = 0$ V to V_{CC}	-	± 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	-	500	mW

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

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

[3] This value is limited to 7.0 V maximum.

[4] For SOT402-1 (TSSOP14) package: P_{tot} derates linearly with 7.3 mW/K above 81 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		4.5	5.5	V
V_I	input voltage		0	5.5	V
V_O	output voltage	active mode	0	V_{CC}	V
		power-down or 3-state mode	0	5.5	V
T_{amb}	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 5.0$ V \pm 0.5 V	-	20	ns/V

9. Static characteristics

Table 6. Static characteristics

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	
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2	-	-	2	-	2	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		I _O = -50 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -8 mA	3.94	-	-	3.8	-	3.7	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		I _O = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8 mA	-	-	0.36	-	0.44	-	0.55	V
I _{OFF}	power-off leakage current	V _I or V _O = GND to 5.5 V; V _{CC} = 0 V	-	-	0.5	-	5	-	5	µA
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 0 V to 5.5 V	-	-	±0.1	-	±1	-	±1	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	2	-	20	-	20	µA
ΔI _{CC}	additional supply current	per input pin; V _I = 3.4 V; other pins at V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA

10. Dynamic characteristics

Table 7. Dynamic characteristics

$GND = 0\text{ V}$. 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	
t_{pd}	propagation delay	nA to nY; see Fig. 4 [2]								
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$								
		$C_L = 15\text{ pF}$	-	3.1	6.7	1	7.5	1	8.5	ns
		$C_L = 50\text{ pF}$	-	4.8	7.7	1	8.5	1	10.0	ns
C_I	input capacitance	$V_I = V_{CC}$ or GND; $V_{CC} = 5\text{ V}$	-	2	6	-	6	-	6	pF
C_O	output capacitance	$V_O = V_{CC}$ or GND; $V_{CC} = 5\text{ V}$	-	5	-	-	-	-	-	pF
C_{PD}	power dissipation capacitance	per buffer; $C_L = 0\text{ pF}$; $f = 10\text{ MHz}$; $V_I = GND$ to V_{CC} [3]	-	9.3	-	-	-	-	-	pF

[1] Typical values are measured at $T_{amb} = 25\text{ °C}$ and $V_{CC} = 5\text{ V}$.

[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).

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

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.

Table 8. Noise characteristics

$GND = 0\text{ V}$. For test circuit see Fig. 5.

Symbol	Parameter	Conditions	$T_{amb} = 25\text{ °C}$			Unit
			Min	Typ	Max	
$V_{CC} = 5\text{ V}$; $C_L = 50\text{ pF}$						
$V_{OL(p)}$	LOW-level output voltage (peak)		-	0.4	0.8	V
$V_{OL(v)}$	LOW-level output voltage (valley)		-0.8	-0.2	-	V
$V_{OH(v)}$	HIGH-level output voltage (valley)		-	4.5	-	V
$V_{IH(AC)}$	AC HIGH-level input voltage		2	-	-	V
$V_{IL(AC)}$	AC LOW-level input voltage		-	-	0.8	V

10.1. Waveforms and test circuit

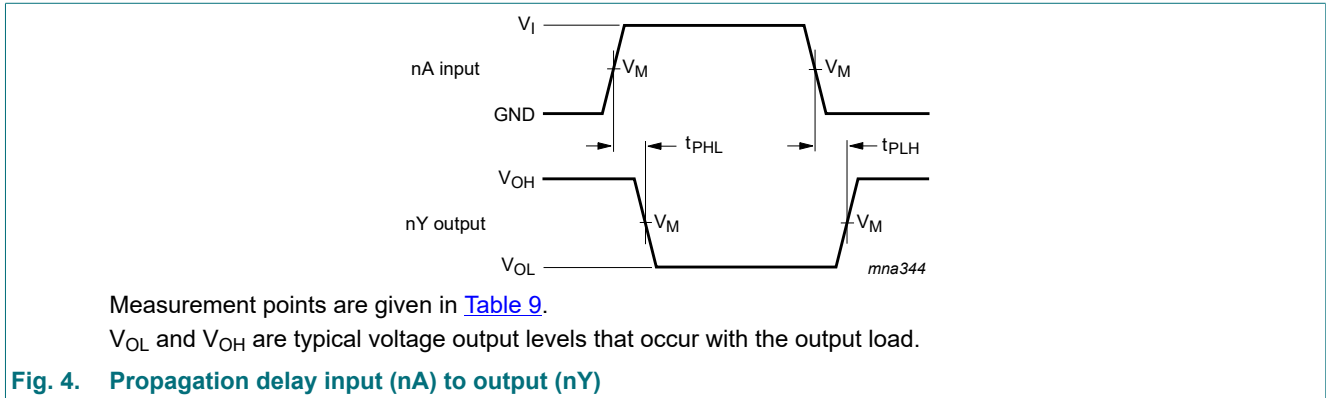


Table 9. Measurement points

Input	Output
V_M	V_M
1.5 V	$0.5V_{CC}$

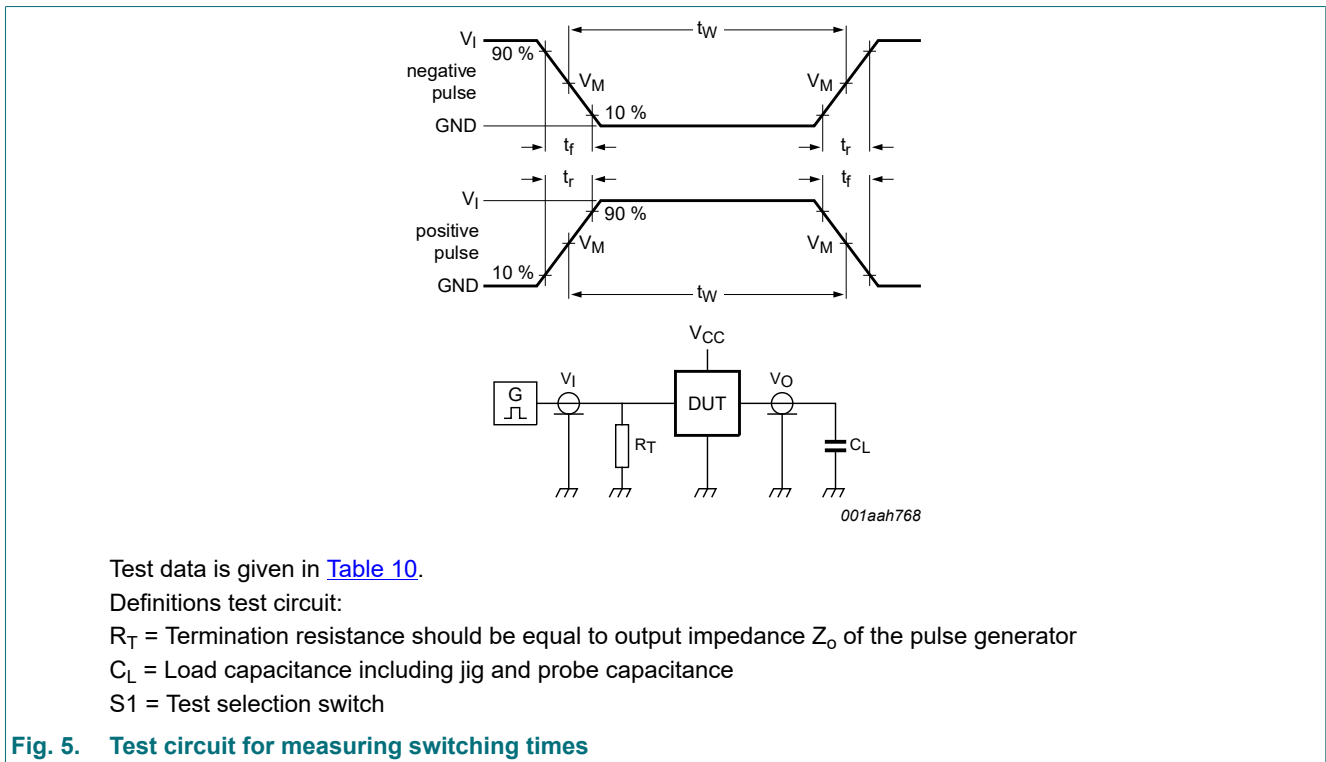


Table 10. Test data

Input		Load	Test
V_I	t_r, t_f	C_L	
GND to 3 V	3.0 ns	15 pF, 50 pF	t_{PLH}, t_{PHL}

11. Package outline

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

SOT402-1

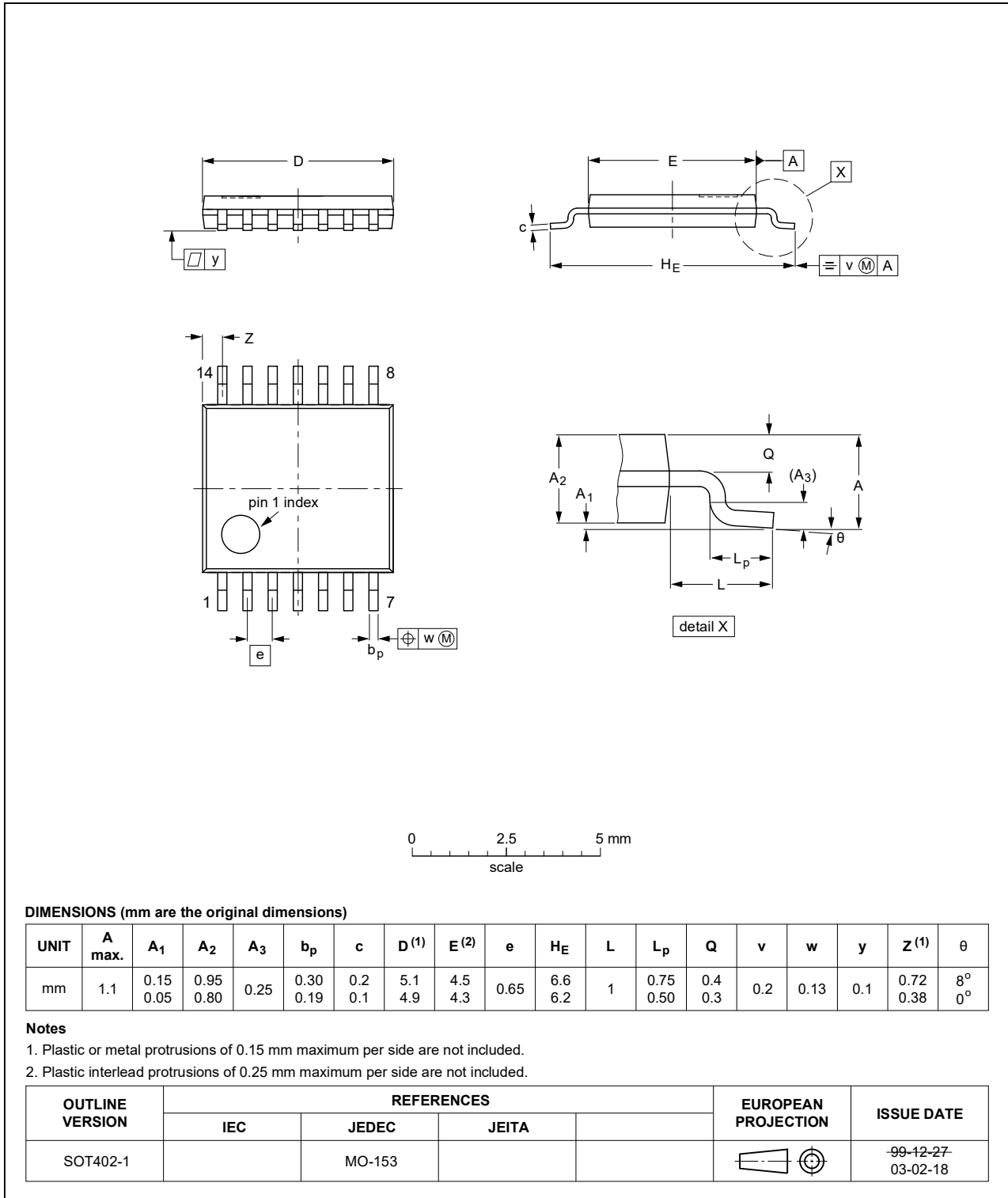


Fig. 6. Package outline SOT402-1 (TSSOP14)

12. Abbreviations

Table 11. Abbreviations

Acronym	Description
CDM	Charge Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHCT04A v.2	20231002	Product data sheet	-	74AHCT04A v.1
Modifications	<ul style="list-style-type: none"> 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 2: ESD specification updated according to the latest JEDEC standard. 			
74AHCT04A v.1	20170322	Product data sheet	-	-

14. 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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