

# 74HC1G00; 74HCT1G00

## 2-input NAND gate

Rev. 5 — 25 September 2013

Product data sheet

## 1. General description

The 74HC1G00; 74HCT1G00 is a single 2-input NAND gate. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

## 2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
  - ◆ For 74HC1G00: CMOS level
  - ◆ For 74HCT1G00: TTL level
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$

## 3. Ordering information

Table 1. Ordering information

Type number	Package				Version
	Temperature range	Name	Description		
74HC1G00GW	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm		SOT353-1
74HCT1G00GW					
74HC1G00GV	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	SC-74A	plastic surface-mounted package; 5 leads		SOT753
74HCT1G00GV					



## 4. Marking

Table 2. Marking codes

Type number	Marking <sup>[1]</sup>
74HC1G00GW	HA
74HCT1G00GW	TA
74HC1G00GV	H00
74HCT1G00GV	T00

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 5. Functional diagram

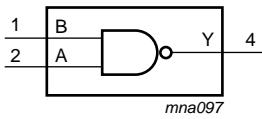


Fig 1. Logic symbol

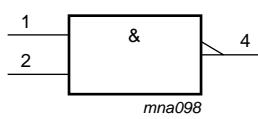


Fig 2. IEC logic symbol

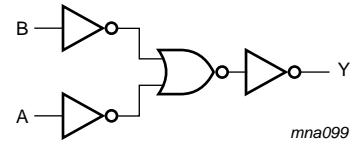


Fig 3. Logic diagram

## 6. Pinning information

### 6.1 Pinning

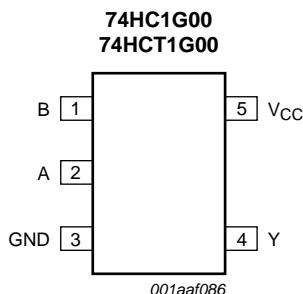


Fig 4. Pin configuration

### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
B	1	data input
A	2	data input
GND	3	ground (0 V)
Y	4	data output
V <sub>CC</sub>	5	supply voltage

## 7. Functional description

**Table 4. Function table***H = HIGH voltage level; L = LOW voltage level*

Input		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

## 8. Limiting values

**Table 5. Limiting values***In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V). [\[1\]](#)*

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V	-	±20	mA
I <sub>O</sub>	output current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V	-	±12.5	mA
I <sub>CC</sub>	supply current		-	25	mA
I <sub>GND</sub>	ground current		-25	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	<a href="#">[2]</a>	-	200 mW

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

[2] Above 55 °C, the value of P<sub>tot</sub> derates linearly with 2.5 mW/K.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions***Voltages are referenced to GND (ground = 0 V).*

Symbol	Parameter	Conditions	74HC1G00			74HCT1G00			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage	0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage	0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature	-40	+25	+125	-40	+25	+125	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	-	139	-	-	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V

## 10. Static characteristics

**Table 7. Static characteristics**

Voltages are referenced to GND (ground = 0 V). All typical values are measured at  $T_{amb} = 25^\circ\text{C}$ .

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>For type 74HC1G00</b>								
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	1.5	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	3.15	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	4.2	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	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 $V_{IL}$						
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$	1.9	2.0	-	1.9	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$	5.9	6.0	-	5.9	-	V
		$I_O = -2.0\text{ mA}; V_{CC} = 4.5\text{ V}$	4.13	4.32	-	3.7	-	V
		$I_O = -2.6\text{ mA}; V_{CC} = 6.0\text{ V}$	5.63	5.81	-	5.2	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$	-	0	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	-	0	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$	-	0	0.1	-	0.1	V
		$I_O = 2.0\text{ mA}; V_{CC} = 4.5\text{ V}$	-	0.15	0.33	-	0.4	V
		$I_O = 2.6\text{ mA}; V_{CC} = 6.0\text{ V}$	-	0.16	0.33	-	0.4	V
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$	-	-	1.0	-	1.0	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$ ; $V_{CC} = 6.0\text{ V}$	-	-	10	-	20	$\mu\text{A}$
$C_I$	input capacitance		-	1.5	-	-	-	pF
<b>For type 74HCT1G00</b>								
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$	2.0	1.6	-	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
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	V
		$I_O = -2.0\text{ mA}; V_{CC} = 4.5\text{ V}$	4.13	4.32	-	3.7	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	-	0	0.1	-	0.1	V
		$I_O = 2.0\text{ mA}; V_{CC} = 4.5\text{ V}$	-	0.15	0.33	-	0.4	V
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$	-	-	1.0	-	1.0	$\mu\text{A}$

**Table 7. Static characteristics ...continued**Voltages are referenced to GND (ground = 0 V). All typical values are measured at  $T_{amb} = 25^\circ\text{C}$ .

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	10	-	20	μA
$\Delta I_{CC}$	additional supply current	per input; $V_{CC} = 4.5$ V to 5.5 V; $V_I = V_{CC} - 2.1$ V; $I_O = 0$ A	-	-	500	-	850	μA
$C_I$	input capacitance		-	1.5	-	-	-	pF

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics** $GND = 0$  V;  $t_r = t_f \leq 6.0$  ns; All typical values are measured at  $T_{amb} = 25^\circ\text{C}$ . For test circuit, see [Figure 6](#)

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>For type 74HC1G00</b>								
$t_{pd}$	propagation delay	A and B to Y; see <a href="#">Figure 5</a>	[1]					
		$V_{CC} = 2.0$ V; $C_L = 50$ pF	-	25	115	-	135	ns
		$V_{CC} = 4.5$ V; $C_L = 50$ pF	-	9	23	-	27	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	7	-	-	-	ns
		$V_{CC} = 6.0$ V; $C_L = 50$ pF	-	8	20	-	23	ns
$C_{PD}$	power dissipation	$V_I = \text{GND to } V_{CC}$	[2]	-	19	-	-	-
	capacitance							pF
<b>For type 74HCT1G00</b>								
$t_{pd}$	propagation delay	A and B to Y; see <a href="#">Figure 5</a>	[1]					
		$V_{CC} = 4.5$ V; $C_L = 50$ pF	-	12	24	-	27	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	10	-	-	-	ns
$C_{PD}$	power dissipation	$V_I = \text{GND to } V_{CC} - 1.5$ V	[2]	-	21	-	-	-
	capacitance							pF

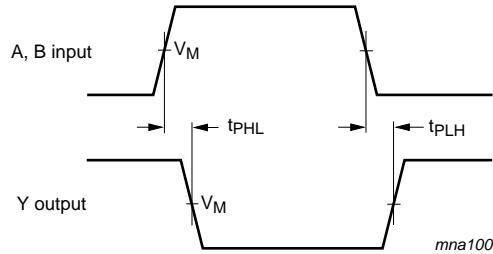
[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .[2]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  (μW).

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

 $f_i$  = input frequency in MHz;  $f_o$  = output frequency in MHz $C_L$  = output load capacitance in pF $V_{CC}$  = supply voltage in Volts

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

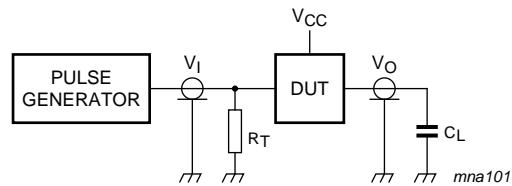
## 12. Waveforms



For HC1G:  $V_M = 0.5 \times V_{CC}$ ;  $V_I = \text{GND to } V_{CC}$

For HCT1G:  $V_M = 1.3 \text{ V}$ ;  $V_I = \text{GND to } 3.0 \text{ V}$

Fig 5. Input to output propagation delays



Test data is given in [Table 8](#).

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

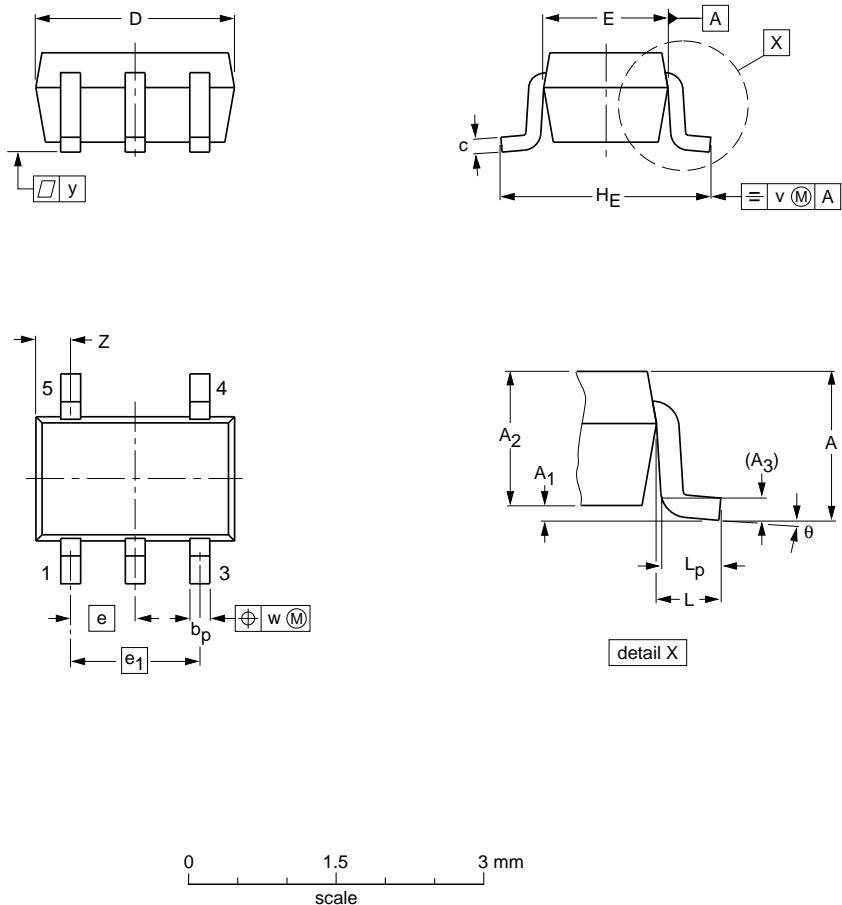
$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

Fig 6. Load circuitry for switching times

## 13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



### DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	H <sub>E</sub>	L	L <sub>p</sub>	v	w	y	z <sup>(1)</sup>	θ
mm	1.1	0.1	1.0	0.15	0.30	0.25	2.25	1.35	0.65	1.3	2.25	0.425	0.46	0.3	0.1	0.1	0.60	7°
		0	0.8	0.15	0.15	0.08	1.85	1.15			2.0	0.21	0.21			0.15	0.15	0°

### Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT353-1		MO-203	SC-88A		-00-09-01 03-02-19

Fig 7. Package outline SOT353-1 (TSSOP5)

## Plastic surface-mounted package; 5 leads

SOT753

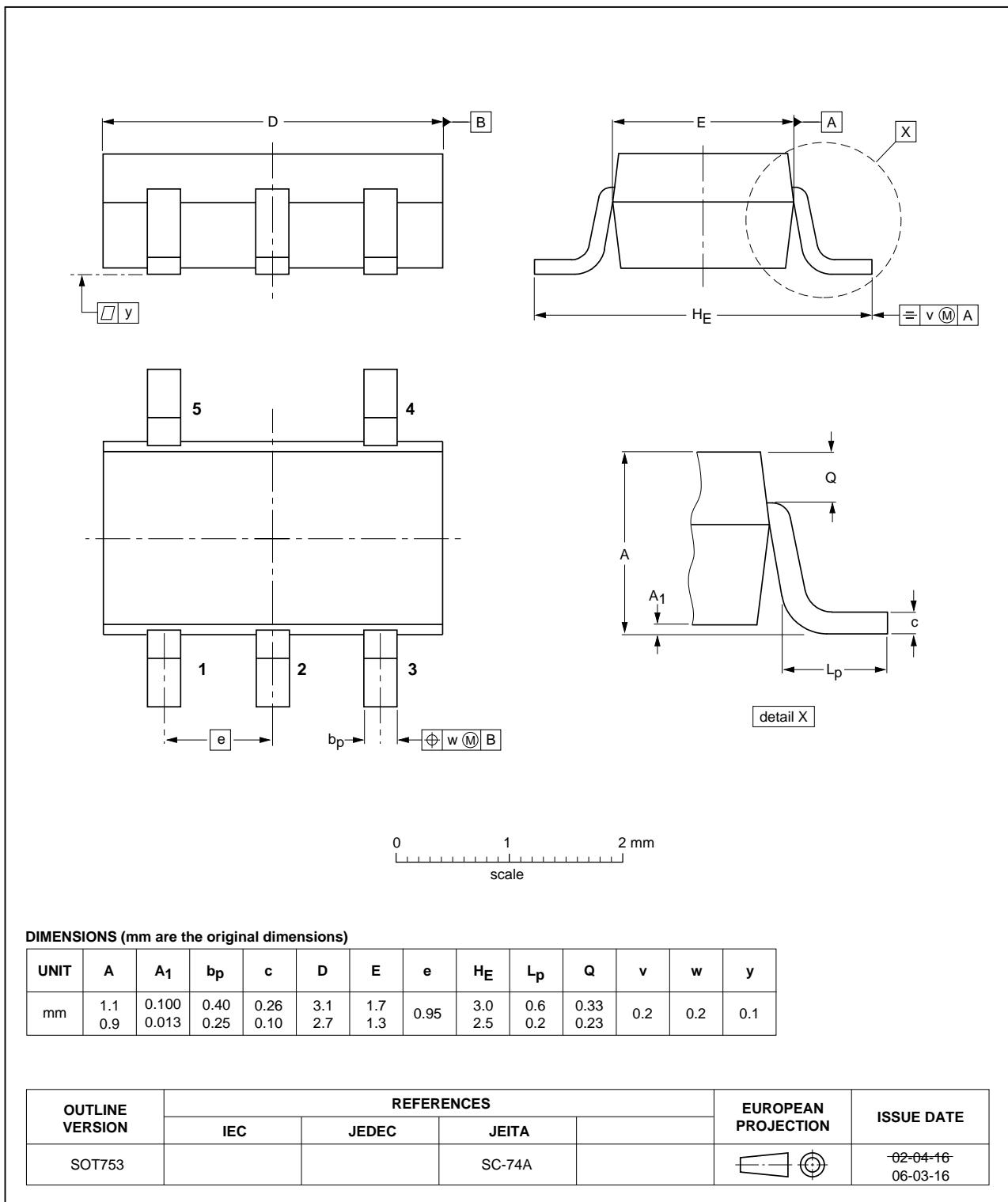


Fig 8. Package outline SOT753 (SC-74A)

## 14. Abbreviations

**Table 9. Abbreviations**

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 15. Revision history

**Table 10. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT1G00 v.5	20130925	Product data sheet	-	74HC_HCT1G00 v.4
Modifications:		• <a href="#">Section 1 "General description"</a> updated.		
74HC_HCT1G00 v.4	20070711	Product data sheet	-	74HC_HCT1G00 v.3
Modifications:		• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Package SOT353 changed to SOT353-1 in <a href="#">Section 3</a> and <a href="#">Section 13</a> . • Quick reference data and Soldering sections removed. • <a href="#">Section 2 "Features and benefits"</a> updated.		
74HC_HCT1G00 v.3	20020515	Product specification	-	74HC_HCT1G00 v.2
74HC_HCT1G00 v.2	20010302	Product specification	-	74HC_HCT1G00 v.1
74HC_HCT1G00 v.1	19980730	Preliminary specification	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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