

# DATA SHEET

## **74HC1G00; 74HCT1G00** 2-input NAND gate

Product specification  
File under Integrated Circuits, IC06

1998 Jul 30

## 2-input NAND gate

74HC1G00;  
74HCT1G00

## FEATURES

- Wide operating voltage: 2.0 to 6.0 V
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Very small 5 pins package
- Output capability: standard.

## DESCRIPTION

The 74HC1G/HCT1G00 is a high speed Si-gate CMOS device.

The 74HC1G/HCT1G00 provides the 2-input NAND function. The standard output currents are  $\frac{1}{2}$  compared to the 74HC/HCT00.

## FUNCTION TABLE

See note 1.

INPUTS		OUTPUT
inA	inB	outY
L	L	H
L	H	H
H	L	H
H	H	L

## Note

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

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $t_r = t_f \leq 6.0\text{ ns}$

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC1G	HCT1G	
$t_{PHL}/t_{PLH}$	propagation delay inA, inB to outY	$C_L = 15\text{ pF}$ ; $V_{CC} = 5\text{ V}$	7	10	ns
$C_i$	input capacitance		1.5	1.5	pF
$C_{PD}$	power dissipation capacitance	notes 1 and 2	19	21	pF

## Notes

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

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

2. For HC1G the condition is  $V_i = \text{GND to } V_{CC}$ .  
For HCT1G the condition is  $V_i = \text{GND to } V_{CC} - 1.5\text{ V}$ .

## PINNING

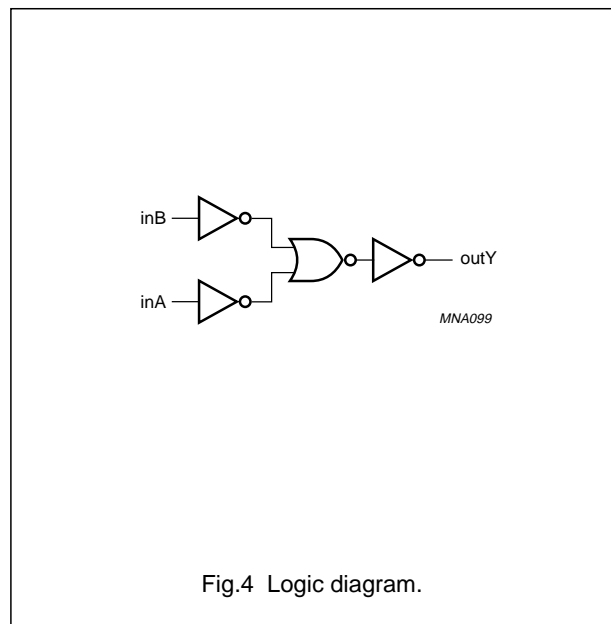
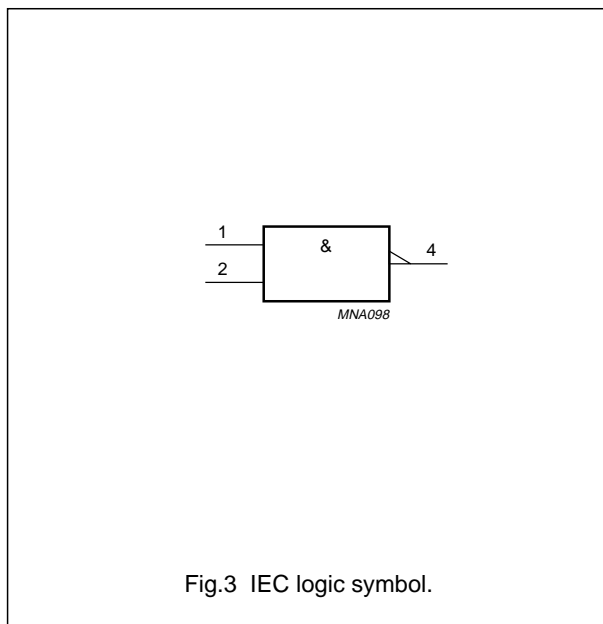
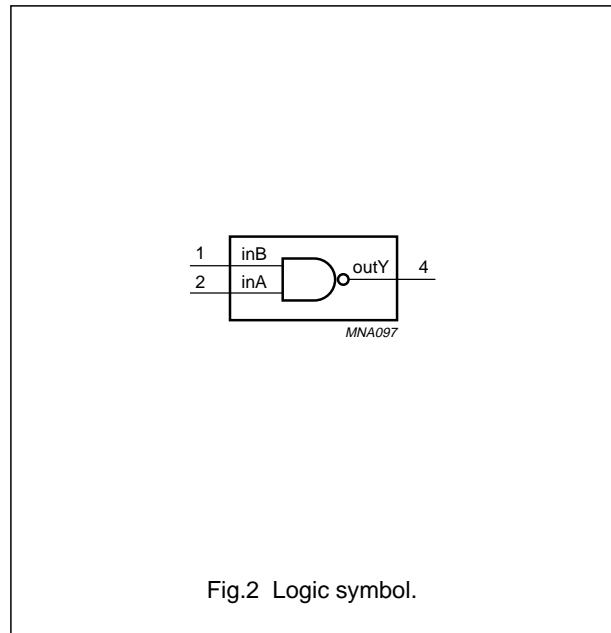
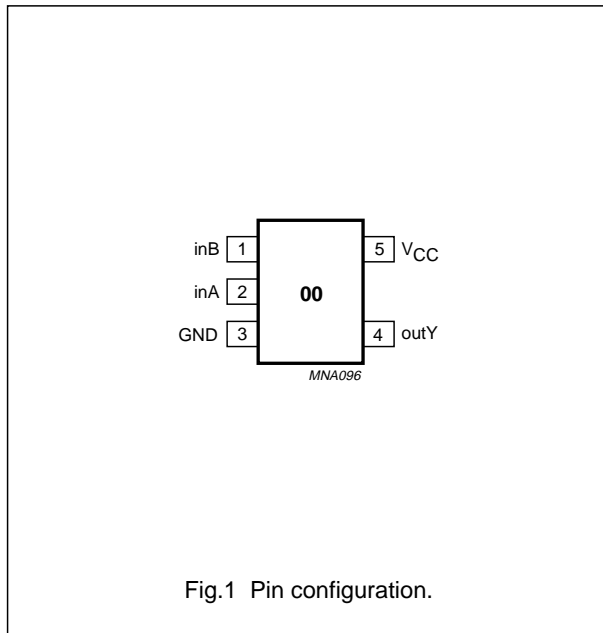
PIN	SYMBOL	DESCRIPTION
1	inB	data input B
2	inA	data input A
3	GND	ground (0 V)
4	outY	data output
5	$V_{CC}$	DC supply voltage

2-input NAND gate

74HC1G00; 74HCT1G00

ORDERING INFORMATION

OUTSIDE NORTH AMERICA	PACKAGES					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74HC1G00GW	-40 to +125 °C	5	SC-88A	plastic	SOT353	HA
74HCT1G00GW		5	SC-88A	plastic	SOT353	TA



## 2-input NAND gate

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## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	74HC1G			74HCT1G			UNIT	CONDITIONS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
$V_{CC}$	DC supply voltage	2.0	5.0	6.0	4.5	5.0	5.5	V	
$V_I$	input voltage	0	–	$V_{CC}$	0	–	$V_{CC}$	V	
$V_O$	output voltage	0	–	$V_{CC}$	0	–	$V_{CC}$	V	
$T_{amb}$	operating ambient temperature range	–40	+25	+125	–40	+25	+125	°C	see DC and AC characteristics per device
$t_r, t_f$	input rise and fall times except for Schmitt-trigger inputs	–	–	1000	–	–	–	ns	$V_{CC} = 2.0\text{ V}$
		–	–	500	–	–	500		$V_{CC} = 4.5\text{ V}$
		–	–	400	–	–	–		$V_{CC} = 6.0\text{ V}$

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134); voltages are referenced to GND (ground = 0 V); see note 1 and 2.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CC}$	DC supply voltage		–0.5	+7.0	V
$\pm I_{IK}$	DC input diode current	$V_I < -0.5$ or $V_I > V_{CC} + 0.5\text{ V}$	–	20	mA
$\pm I_{OK}$	DC output diode current	$V_O < -0.5$ or $V_O > V_{CC} + 0.5\text{ V}$	–	20	mA
$\pm I_O$	DC output source or sink current standard outputs	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	–	12.5	mA
$\pm I_{CC}$	DC $V_{CC}$ or GND current for types with standard outputs		–	25	mA
$T_{stg}$	storage temperature range		–65	+150	°C
$P_D$	power dissipation per package 5 pins plastic SC-88A	for temperature range: –40 to +125 °C; above +55 °C derate linearly with 2.5 mW/K	–	200	mW

## Notes

- Stresses beyond those listed may cause permanent damage to the device. These are stress rating only and functional operation of the device at these or any other conditions beyond those under 'recommended operating conditions' is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 2-input NAND gate

## 74HC1G00; 74HCT1G00

**DC CHARACTERISTICS FOR THE 74HC1G**

Over recommended operating conditions; voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)					UNIT	TEST CONDITIONS	
		-40 to +85			-40 to +125			V <sub>CC</sub> (V)	OTHER
		MIN.	TYP. <sup>(1)</sup>	MAX.	MIN.	MAX.			
V <sub>IH</sub>	HIGH-level input voltage	1.5	1.2	–	1.5	–	V	2.0	
		3.15	2.4	–	3.15	–		4.5	
		4.2	3.2	–	4.2	–		6.0	
V <sub>IL</sub>	LOW-level input voltage	–	0.8	0.5	–	0.5	V	2.0	
		–	2.1	1.35	–	1.35		4.5	
		–	2.8	1.8	–	1.8		6.0	
V <sub>OH</sub>	HIGH-level output voltage; all outputs	1.9	2.0	–	1.9	–	V	2.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; –I <sub>O</sub> = 20 μA
		4.4	4.5	–	4.4	–		4.5	
		5.9	6.0	–	5.9	–		6.0	
V <sub>OH</sub>	HIGH-level output voltage; standard outputs	4.13	4.32	–	3.7	–	V	4.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; –I <sub>O</sub> = 2.0 mA
		5.63	5.81	–	5.2	–		6.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; –I <sub>O</sub> = 2.6 mA
V <sub>OL</sub>	LOW-level output voltage; all outputs	–	0	0.1	–	0.1	V	2.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 20 μA
		–	0	0.1	–	0.1		4.5	
		–	0	0.1	–	0.1		6.0	
V <sub>OL</sub>	LOW-level output voltage; standard outputs	–	0.15	0.33	–	0.4	V	4.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 2.0 mA
		–	0.16	0.33	–	0.4		6.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 2.6 mA
I <sub>I</sub>	input leakage current	–	–	1.0	–	1.0	μA	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND
I <sub>CC</sub>	quiescent supply current	–	–	10	–	20	μA	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0

**Note**

1. All typical values are measured at T<sub>amb</sub> = 25 °C.

## 2-input NAND gate

## 74HC1G00; 74HCT1G00

**DC CHARACTERISTICS FOR THE 74HCT1G**

Over recommended operating conditions; voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	T <sub>amb</sub> (°C)					UNIT	TEST CONDITIONS	
		-40 to +85			-40 to +125			V <sub>CC</sub> (V)	OTHER
		MIN.	TYP. <sup>(1)</sup>	MAX.	MIN.	MAX.			
V <sub>IH</sub>	HIGH-level input voltage	2.0	1.6	–	2.0	–	V	4.5 to 5.5	
V <sub>IL</sub>	LOW-level input voltage	–	1.2	0.8	–	0.8	V	4.5 to 5.5	
V <sub>OH</sub>	HIGH-level output voltage; all outputs	4.4	4.5	–	4.4	–	V	4.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; –I <sub>O</sub> = 20 μA
V <sub>OH</sub>	HIGH-level output voltage; standard outputs	4.13	4.32	–	3.7	–	V	4.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; –I <sub>O</sub> = 2.0 mA
V <sub>OL</sub>	LOW-level output voltage; all outputs	–	0	0.1	–	0.1	V	4.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 20 μA
V <sub>OL</sub>	LOW-level output voltage; standard outputs	–	0.15	0.33	–	0.4	V	4.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 2.0 mA
I <sub>I</sub>	input leakage current	–	–	1.0	–	1.0	μA	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND
I <sub>CC</sub>	quiescent supply current	–	–	10.0	–	20	μA	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0
ΔI <sub>CC</sub>	additional supply current per input	–	–	500	–	850	μA	4.5 to 5.5	V <sub>I</sub> = V <sub>CC</sub> – 2.1; I <sub>O</sub> = 0

**Note**1. All typical values are measured at T<sub>amb</sub> = 25 °C.

## 2-input NAND gate

## 74HC1G00; 74HCT1G00

**AC CHARACTERISTICS FOR 74HC1G00**GND = 0 V;  $t_r = t_f \leq 6.0$  ns;  $C_L = 50$  pF.

SYMBOL	PARAMETER	$T_{amb}$ (°C)					UNIT	TEST CONDITIONS	
		-40 to +85			-40 to +125			$V_{CC}$ (V)	WAVEFORMS
		MIN.	TYP. <sup>(1)</sup>	MAX.	MIN.	MAX.			
$t_{PHL}/t_{PLH}$	propagation delay inA, inB to outY	-	25	115	-	135	ns	2.0	see Figs 5 and 6
		-	9	23	-	27		4.5	
		-	8	20	-	23		6.0	

**Note**

1. All typical values are measured at  $T_{amb} = 25$  °C.

**AC CHARACTERISTICS FOR 74HCT1G00**GND = 0 V;  $t_r = t_f \leq 6.0$  ns;  $C_L = 50$  pF.

SYMBOL	PARAMETER	$T_{amb}$ (°C)					UNIT	TEST CONDITIONS	
		-40 to +85			-40 to +125			$V_{CC}$ (V)	WAVEFORMS
		MIN.	TYP. <sup>(1)</sup>	MAX.	MIN.	MAX.			
$t_{PHL}/t_{PLH}$	propagation delay inA, inB to outY	-	12	24	-	27	ns	4.5	see Figs 5 and 6

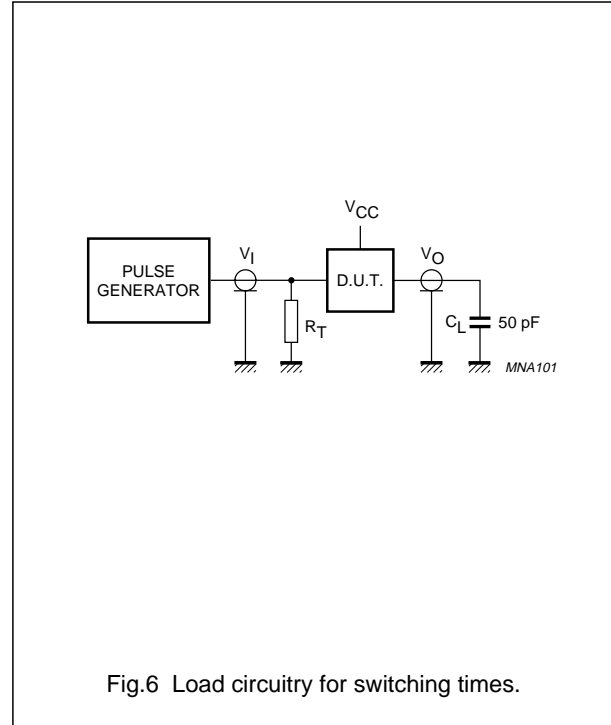
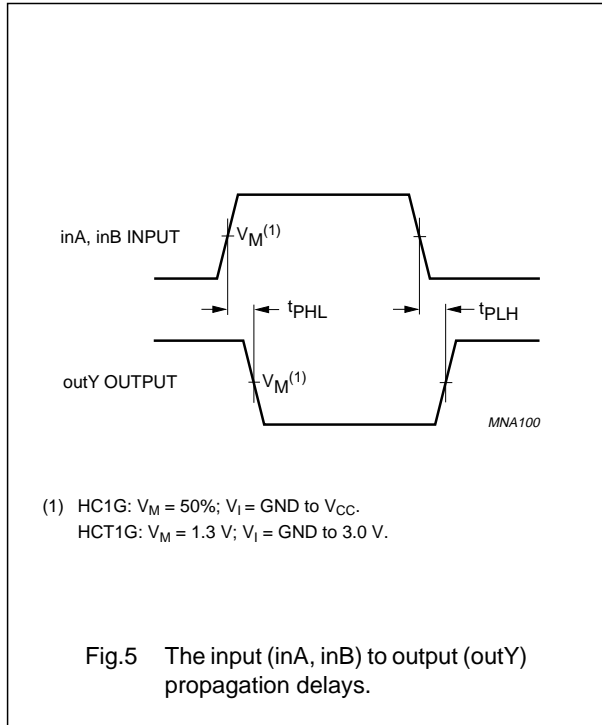
**Note**

1. All typical values are measured at  $T_{amb} = 25$  °C.

## 2-input NAND gate

## 74HC1G00; 74HCT1G00

## AC WAVEFORMS





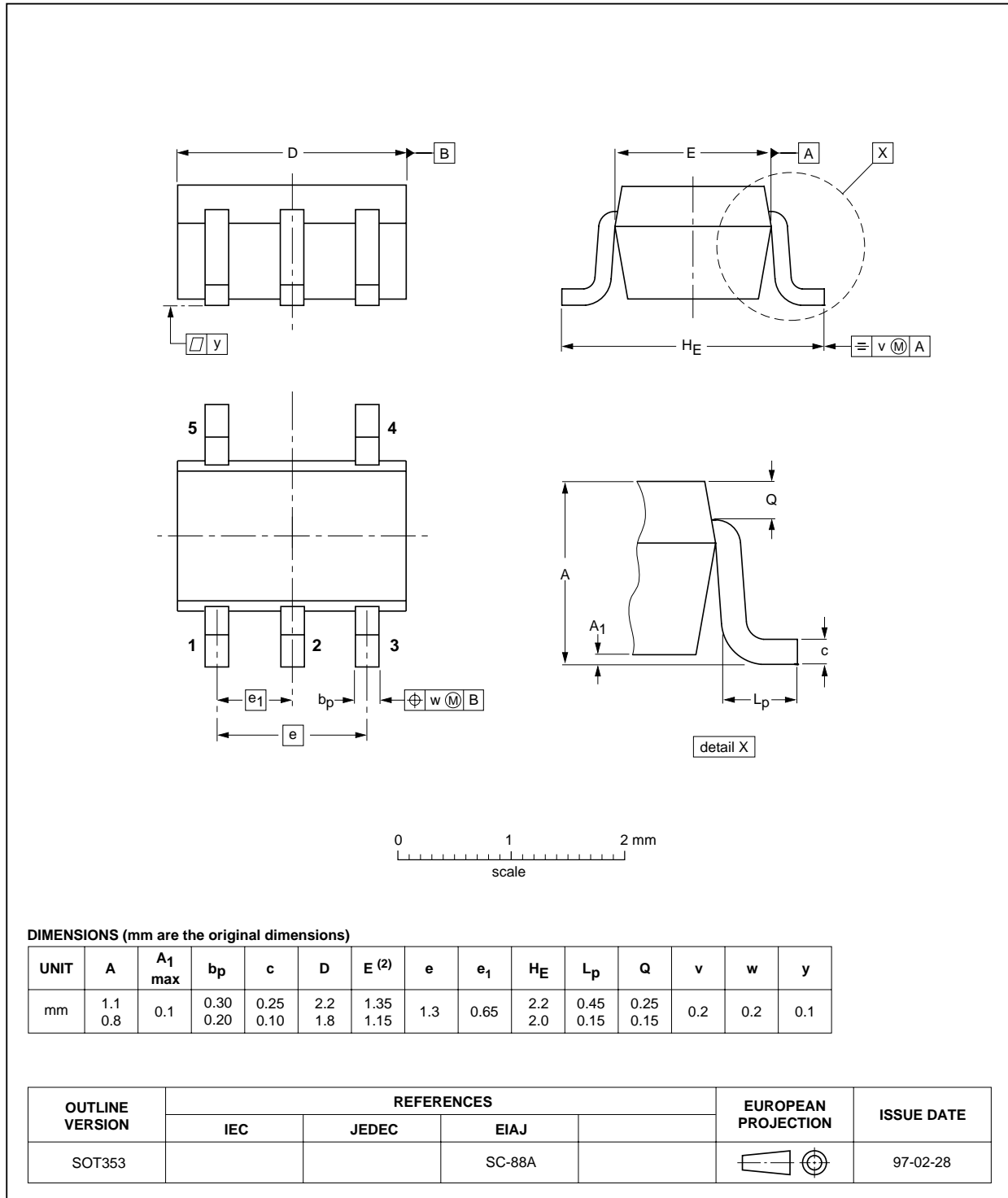
2-input NAND gate

74HC1G00; 74HCT1G00

PACKAGE OUTLINE

Plastic surface mounted package; 5 leads

SOT353



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## 2-input NAND gate

## 74HC1G00; 74HCT1G00

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### SOLDERING

#### Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted IC's, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering IC's can be found in our "*Data Handbook IC26; Integrated Circuit Packages*" (order code 9398 652 90011).

#### Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

#### Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residue in most applications.

#### Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

## 2-input NAND gate

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**DEFINITIONS**

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 160 1010,  
Fax. +43 160 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,  
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

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**Denmark:** Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,  
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**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
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**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,  
Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

**Greece:** No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,  
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**Hungary:** see Austria

**India:** Philips INDIA Ltd, Band Box Building, 2nd floor,  
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,  
Tel. +91 22 493 8541, Fax. +91 22 493 0966

**Indonesia:** PT Philips Development Corporation, Semiconductors Division,  
Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510,  
Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,  
Tel. +353 1 7640 000, Fax. +353 1 7640 200

**Israel:** RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,  
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

**Italy:** PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,  
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku,  
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**Mexico:** 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,  
Tel. +9-5 800 234 7381

**Middle East:** see Italy

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,  
Tel. +31 40 27 82785, Fax. +31 40 27 88399

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,  
Tel. +64 9 849 4160, Fax. +64 9 849 7811

**Norway:** Box 1, Manglerud 0612, OSLO,  
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Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland:** Ul. Lukiska 10, PL 04-123 WARSZAWA,  
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Tel. +7 095 755 6918, Fax. +7 095 755 6919

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 319762,  
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**South America:** Al. Vicente Pinzon, 173, 6th floor,  
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**Turkey:** Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,  
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**Ukraine:** PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,  
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**United Kingdom:** Philips Semiconductors Ltd., 276 Bath Road, Hayes,  
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,  
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