# 74HC1G00-Q100; 74HCT1G00-Q100

2-input NAND gate

Rev. 1 — 16 September 2013

**Product data sheet** 

### 1. General description

The 74HC1G00-Q100; 74HCT1G00-Q100 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  $V_{\rm CC}$ .

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 6.0 V
- Input levels:
  - ◆ For 74HC1G00-Q100: CMOS level
  - ◆ For 74HCT1G00-Q100: TTL level
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ♦ HBM JESD22-A114F exceeds 2000 V
  - ♦ MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
- Multiple package options

# 3. Ordering information

Table 1. Ordering information

Type number	Package	ackage					
	Temperature range	Name	Description	Version			
74HC1G00GW-Q100	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads;	SOT353-1			
74HCT1G00GW-Q100			body width 1.25 mm				
74HC1G00GV-Q100	–40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753			
74HCT1G00GV-Q100							



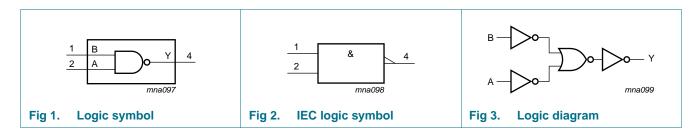
# 4. Marking

Table 2. Marking codes

Type number	Marking[1]
74HC1G00GW-Q100	НА
74HCT1G00GW-Q100	TA
74HC1G00GV-Q100	H00
74HCT1G00GV-Q100	T00

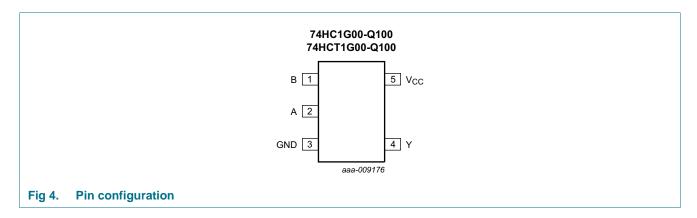
<sup>[1]</sup> The pin 1 indicator is located on the lower left corner of the device, below the marking code.

# 5. Functional diagram



# 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3. Pin description

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

74HC\_HCT1G00\_Q100

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# 7. Functional description

Table 4. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level$ 

Input		Output
Α	В	Υ
L	L	Н
L	Н	Н
Н	L	Н
Н	Н	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
$V_{CC}$	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	$V_I < -0.5 \text{ V or } V_I > V_{CC} + 0.5 \text{ V}$	-	±20	mA
I <sub>OK</sub>	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$	-	±20	mA
Io	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$	-	±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	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	[2] _	200	mW

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

# 9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter		74HC1	G00-Q1	00	74HC	T1G00-Q	100	Unit
			Min	Тур	Max	Min	Тур	Max	
$V_{CC}$	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
Vo	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise	$V_{CC} = 2.0 \text{ V}$	-	-	625	-	-	-	ns/V
	and fall rate	$V_{CC} = 4.5 \text{ V}$	-	-	139	-	-	139	ns/V
		$V_{CC} = 6.0 \text{ V}$	-	-	83	-	-	-	ns/V

<sup>[2]</sup> Above 55 °C, the value of  $P_{tot}$  derates linearly with 2.5 mW/K.

# 10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	-40	°C to +	85 °C	-40 °C	to +125 °C	Unit
			Min	Тур	Max	Min	Max	
For type	74HC1G00-Q100							
$V_{IH}$	HIGH-level input	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	V
	voltage	V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level input	V <sub>CC</sub> = 2.0 V	-	8.0	0.5	-	0.5	V
	voltage	V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-level output	$V_I = V_{IH}$ or $V_{IL}$						
	voltage	$I_{O} = -20 \mu A$ ; $V_{CC} = 2.0 \text{ V}$	1.9	2.0	-	1.9	-	V
		$I_{O} = -20 \mu A$ ; $V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	V
		$I_O = -20 \mu A$ ; $V_{CC} = 6.0 \text{ V}$	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 <sub>OL</sub>	LOW-level output	$V_I = V_{IH}$ or $V_{IL}$						
	voltage	$I_O = 20 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 6.0 \text{ V}$	-	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 <sub>I</sub>	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	1.0	-	1.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$	-	-	10	-	20	μА
Cı	input capacitance		-	1.5	-	-	-	pF
For type	74HCT1G00-Q100							
$V_{IH}$	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	8.0	-	0.8	V
V <sub>OH</sub>	HIGH-level output	$V_I = V_{IH}$ or $V_{IL}$						
	voltage	$I_{O} = -20 \mu A; V_{CC} = 4.5 V$	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 <sub>OL</sub>	LOW-level output	$V_I = V_{IH}$ or $V_{IL}$						
	voltage	$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	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
l <sub>l</sub>	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	1.0	μΑ

 Table 7.
 Static characteristics ...continued

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

Symbol Parameter		Conditions	-40	–40 °C to +85 °C			-40 °C to +125 °C		
			Min	Тур	Max	Min	Max		
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	10	-	20	μΑ	
$\Delta I_{CC}$	additional supply current	per input; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V};$ $V_I = V_{CC} - 2.1 \text{ V};$ $I_O = 0 \text{ A}$	-	-	500	-	850	μΑ	
C <sub>I</sub>	input capacitance		-	1.5	-	-	-	pF	

# 11. Dynamic characteristics

### Table 8. Dynamic characteristics

GND = 0 V;  $t_r = t_f \le 6.0$  ns; All typical values are measured at  $T_{amb} = 25$  °C. For test circuit, see <u>Figure 6</u>

Symbol	Parameter	Conditions		-40	0 °C to +8	35 °C	-40 °C	to +125 °C	Unit
				Min	Тур	Max	Min	Max	
For type	74HC1G00-Q100							'	
t <sub>pd</sub> propagation del		A and B to Y; see Figure 5	[1]						
		$V_{CC} = 2.0 \text{ V}; C_L = 50 \text{ pF}$		-	25	115	-	135	ns
		$V_{CC} = 4.5 \text{ V}; C_L = 50 \text{ pF}$		-	9	23	-	27	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	7	-	-	-	ns
		$V_{CC} = 6.0 \text{ V}; C_L = 50 \text{ pF}$		-	8	20	-	23	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND \text{ to } V_{CC}$	[2]	-	19	-	-	-	pF
For type	74HCT1G00-Q100								
t <sub>pd</sub>	propagation delay	A and B to Y; see Figure 5	<u>[1]</u>						
		$V_{CC} = 4.5 \text{ V}; C_L = 50 \text{ pF}$		-	12	24	-	27	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	10	-	-	-	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND \text{ to } V_{CC} - 1.5 \text{ V}$	<u>[2]</u>	-	21	-	-	-	pF

<sup>[1]</sup>  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

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

 $f_i$  = input frequency in MHz;  $f_o$  = output frequency in MHz

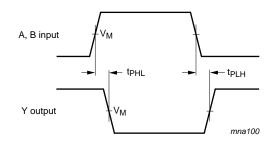
C<sub>L</sub> = output load capacitance in pF

 $V_{CC}$  = supply voltage in Volts

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

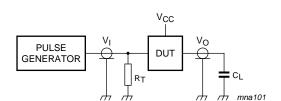
<sup>[2]</sup>  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu W$ ).

### 12. Waveforms



For HC1G:  $V_M$  = 0.5 ×  $V_{CC}$ ;  $V_I$  = GND to  $V_{CC}$ For HCT1G:  $V_M$  = 1.3 V;  $V_I$  = GND to 3.0 V

Fig 5. Input to output propagation delays



Test data is given in Table 8.

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

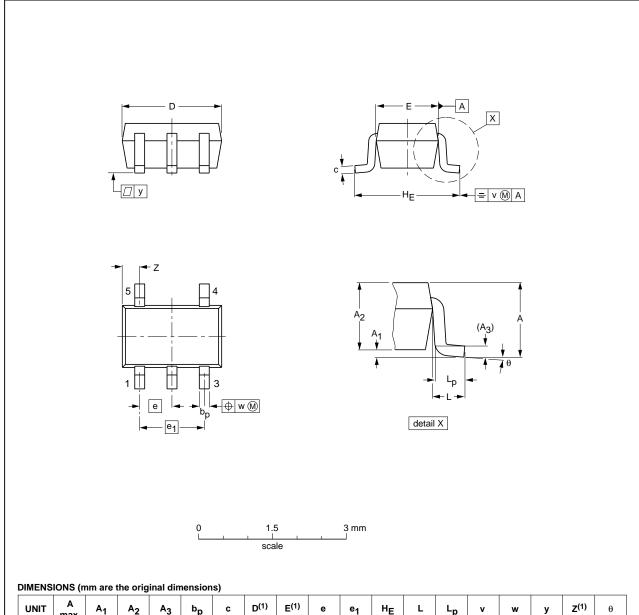
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

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



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	А3	bp	С	D <sup>(1)</sup>	E <sup>(1)</sup>	е	e <sub>1</sub>	HE	L	Lp	v	w	у	Z <sup>(1)</sup>	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

#### Note

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

OUTLINE		REFER	ENCES	EUROPEAN	ISSUE DATE	
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT353-1		MO-203	SC-88A			<del>-00-09-01</del> 03-02-19

Fig 7. Package outline SOT353-1 (TSSOP5)

74HC\_HCT1G00\_Q100

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### Plastic surface-mounted package; 5 leads

#### **SOT753**

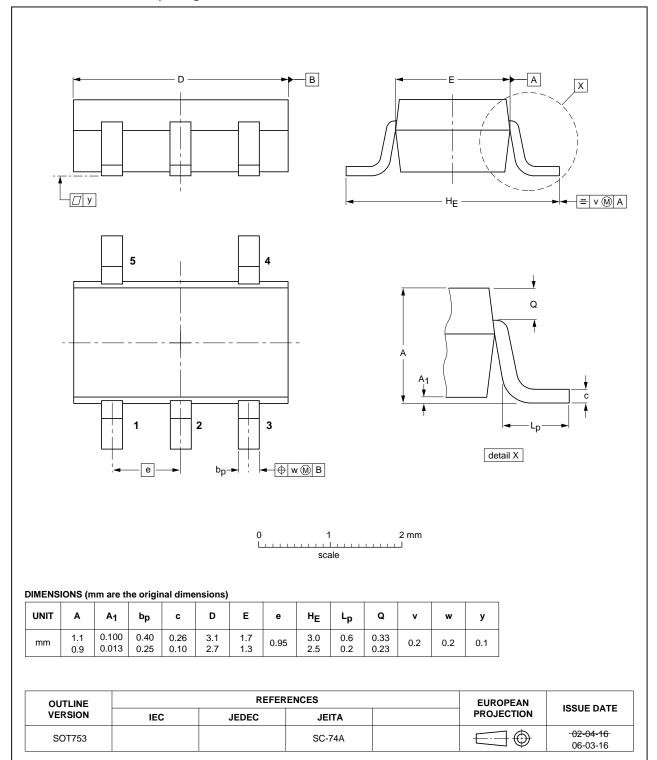


Fig 8. Package outline SOT753 (SC-74A)

# 14. Abbreviations

### Table 9. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MIL	Military
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_Q100 v.1	20130916	Product data sheet	-	-

### 16. Legal information

#### 16.1 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.	
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