# 74AHC1G04; 74AHCT1G04

#### Inverter

Rev. 9 — 10 March 2015

**Product data sheet** 

## 1. General description

74AHC1G04 and 74AHCT1G04 are high-speed Si-gate CMOS devices. They provide an inverting buffer.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

#### 2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- ESD protection:
  - ◆ HBM JESD22-A114E: exceeds 2000 V
  - ◆ MM JESD22-A115-A: exceeds 200 V
  - ◆ CDM JESD22-C101C: exceeds 1000 V
- Specified from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

Type number	Package										
	Temperature range	Temperature range Name Description									
74AHC1G04GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package;	SOT353-1							
74AHCT1G04GW			5 leads; body width 1.25 mm								
74AHC1G04GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753							
74AHCT1G04GV											
74AHC1G04GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package;	SOT886							
74AHCT1G04GM			no leads; 6 terminals; body 1 × 1.45 × 0.5 mm								



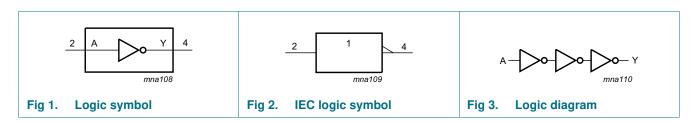
## 4. Marking

#### Table 2. Marking codes

Type number	Marking[1]
74AHC1G04GW	AC
74AHC1G04GV	A04
74AHC1G04GM	AC
74AHCT1G04GW	CC
74AHCT1G04GV	C04
74AHCT1G04GM	CC

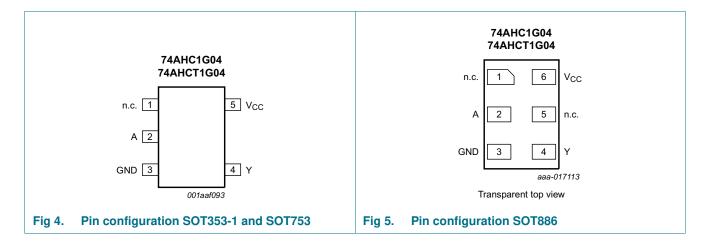
<sup>[1]</sup> The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 5. Functional diagram



## 6. Pinning information

#### 6.1 Pinning



## 6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT353-1 and SOT753	SOT886	
n.c.	1	1	not connected
Α	2	2	data input
GND	3	3	ground (0 V)
Υ	4	4	data output
n.c.	-	5	not connected
V <sub>CC</sub>	5	6	supply voltage

## 7. Functional description

#### Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input	Output
Α	Υ
L	Н
Н	L

## 8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	I	Min	Max	Unit
V <sub>CC</sub>	supply voltage			-0.5	+7.0	V
VI	input voltage			-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V		-20	-	mA
I <sub>OK</sub>	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$	[1]	-	±20	mA
Io	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$		-	±25	mA
I <sub>CC</sub>	supply current			-	75	mA
I <sub>GND</sub>	ground current			<b>-75</b>	-	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]	-	250	mW

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

<sup>[2]</sup> For both TSSOP5 and SC-74A packages: above 87.5 °C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K. For XSON6 package: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

## 9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	74	AHC1G	)4	74	Unit		
			Min	Тур	Max	Min	Тур	Max	
V <sub>CC</sub>	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 <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise	$V_{CC}$ = 3.3 V $\pm$ 0.3 V	-	-	100	-	-	-	ns/V
	and fall rate	$V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	-	-	20	-	-	20	ns/V

### 10. Static characteristics

#### Table 7. Static characteristics

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

Symbol Parameter		Conditions		25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC1	G04									
V <sub>IH</sub>	HIGH-level	$V_{CC} = 2.0 \text{ V}$	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V <sub>CC</sub> = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V <sub>CC</sub> = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
$V_{IL}$	LOW-level	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V <sub>CC</sub> = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V <sub>CC</sub> = 5.5 V	-	-	1.65	-	1.65	-	1.65	٧
$V_{OH}$	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$								
	output voltage	$I_O = -50 \mu A; V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	٧
		$I_O = -50 \mu A; V_{CC} = 3.0 V$	2.9	3.0	-	2.9	-	2.9	-	٧
		$I_O = -50 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	٧
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	٧
		$I_{O} = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	٧
$V_{OL}$	LOW-level	$V_I = V_{IH}$ or $V_{IL}$								
	output voltage	$I_O = 50 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	٧
		$I_O = 50 \mu A; V_{CC} = 3.0 \text{ V}$	-	0	0.1	-	0.1	-	0.1	٧
		$I_O = 50 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	٧
		$I_O = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	٧
		$I_O = 8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	٧
l <sub>l</sub>	input leakage current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	0.1	-	1.0	-	2.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	1.0	-	10	-	40	μΑ
Cı	input capacitance		-	1.5	10	-	10	-	10	pF

**Table 7. Static characteristics** ...continued Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		-40 °C t	to +85 °C	–40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHCT	1G04									
V <sub>IH</sub>	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	$I_{O} = -50 \ \mu A$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -8.0 \text{ mA}$	3.94	-	-	3.8	-	3.70	-	V
$V_{OL}$	LOW-level	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I <sub>O</sub> = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
II	input leakage current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	0.1	-	1.0	-	2.0	μА
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μА
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = 3.4 \text{ V}$ ; other inputs at $V_{CC}$ or GND; $I_O = 0 \text{ A}$ ; $V_{CC} = 5.5 \text{ V}$	-	-	1.35	-	1.5	-	1.5	mA
Cı	input capacitance		-	1.5	10	-	10	-	10	pF

## 11. Dynamic characteristics

#### Table 8. Dynamic characteristics

GND = 0 V;  $t_r = t_f = \le 3.0$  ns. For test circuit see <u>Figure 7</u>.

Symbol	Parameter	Conditions			25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
74AHC10	G04										
t <sub>pd</sub>	propagation	A to Y; see Figure 6	[1]								
	delay	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C <sub>L</sub> = 15 pF		-	4.3	7.1	1.0	8.5	1.0	11.0	ns
		C <sub>L</sub> = 50 pF		-	6.1	10.6	1.0	12	1.0	14.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	[3]								
		C <sub>L</sub> = 15 pF		-	3.1	5.5	1.0	6.5	1.0	7.0	ns
		C <sub>L</sub> = 50 pF		-	4.5	7.5	1.0	8.5	1.0	9.5	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$ ; $f = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$	[4]	-	15	-	-	-	-	-	pF
74AHCT	1G04	<del>'</del>					<del>'</del>			-	-
t <sub>pd</sub>	propagation	A to Y; see Figure 6	<u>[1]</u>								
	delay	V <sub>CC</sub> = 4.5 V to 5.5 V	[3]								
		C <sub>L</sub> = 15 pF		-	3.4	6.7	1.0	7.5	1.0	8.5	ns
		C <sub>L</sub> = 50 pF		-	4.9	7.7	1.0	8.5	1.0	10.0	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$ ; $f = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$	<u>[4]</u>	-	16	-	-	-	-	-	pF

- [1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
- [2] Typical values are measured at  $V_{CC} = 3.3 \text{ V}$ .
- [3] Typical values are measured at  $V_{CC} = 5.0 \text{ V}$ .
- [4]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu W$ ).

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

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

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

V<sub>CC</sub> = supply voltage in Volts;

N = total load switching outputs;

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

## 12. Waveforms

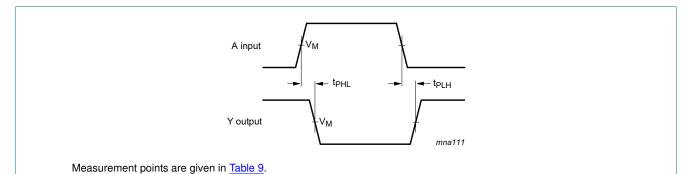
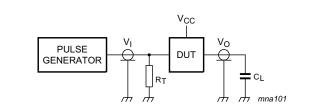


Fig 6. Input (A) to output (Y) propagation delays

#### Table 9. Measurement point

Туре	Input	Input	Output
	V <sub>I</sub>	V <sub>M</sub>	V <sub>M</sub>
74AHC1G04	GND to V <sub>CC</sub>	$0.5 \times V_{CC}$	0.5 × V <sub>CC</sub>
74AHCT1G04	GND to 3.0 V	1.5 V	0.5 × V <sub>CC</sub>



Test data is given in  $\underline{\text{Table 8}}.$  Definitions for test circuit:

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

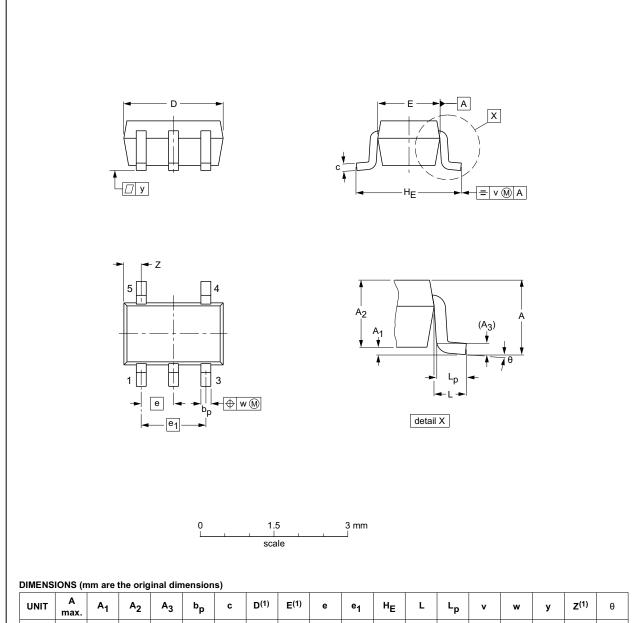
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

Fig 7. Test circuit for measuring 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>	A <sub>3</sub>	bр	C	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°	

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

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

Package outline SOT353-1 (TSSOP5)

74AHC\_AHCT1G04

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SOT753

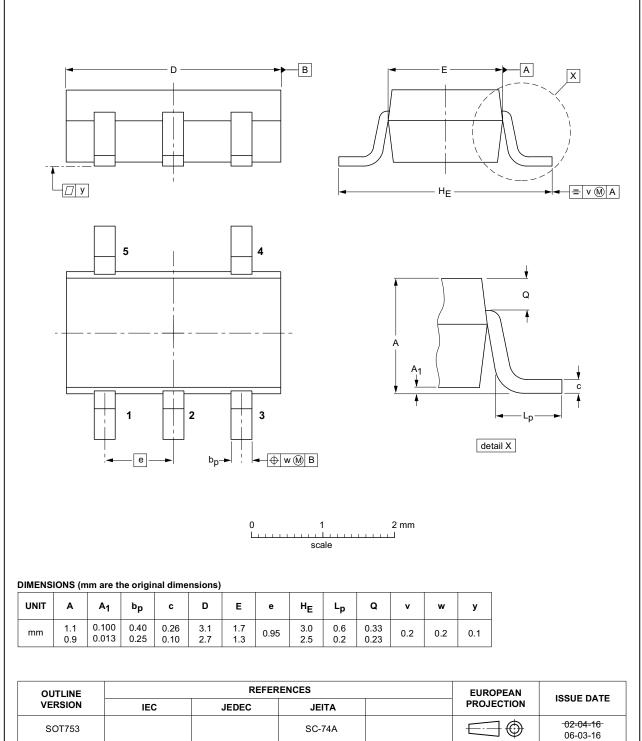


Fig 9. Package outline SOT753 (SC-74A)

74AHC\_AHCT1G04

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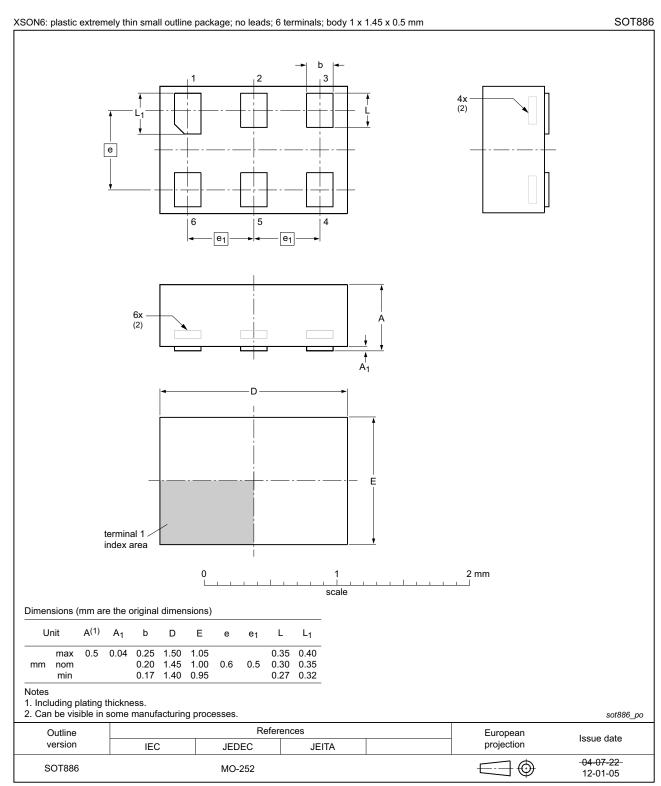


Fig 10. Package outline SOT886 (XSON6)

74AHC\_AHCT1G04

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## 14. Abbreviations

#### Table 10. Abbreviations

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

# 15. Revision history

#### Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74AHC_AHCT1G04 v.9	20150310	Product data sheet	-	74AHC_AHCT1G04 v.8	
Modifications:	Added type numbers 74AHC1G04GM and 74AHCT1G04GM.				
74AHC_AHCT1G04 v.8	20141106	Product data sheet	-	74AHC_AHCT1G04 v.7	
Modifications:	Section 4: table note added.				
74AHC_AHCT1G04 v.7	20070531	Product data sheet	-	74AHC_AHCT1G04 v.6	
Modifications:		t of this data sheet has been re of NXP Semiconductors.	edesigned to comply	with the new identity	
	<ul> <li>Legal texts</li> </ul>	have been adapted to the new	w company name wl	nere appropriate.	
	Package S	OT353 changed to SOT353-1	in Section 3 and Se	ection 13.	
	Quick refer	rence data and Soldering secti	ions removed.		
74AHC_AHCT1G04 v.6	20030904	Product specification	-	74AHC_AHCT1G04 v.5	
74AHC_AHCT1G04 v.5	20020527	Product specification	-	74AHC_AHCT1G04 v.4	
74AHC_AHCT1G04 v.4	20020215	Product specification	-	74AHC_AHCT1G04 v.3	
74AHC_AHCT1G04 v.3	20010131	Product specification	-	74AHC_AHCT1G04 v.2	
74AHC_AHCT1G04 v.2	19990127	Product specification	-	74AHC_AHCT1G04_N v.1	
74AHC_AHCT1G04_N v.1	19981125	Preliminary specification	-	-	

## 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.
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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74AHC\_AHCT1G04

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Inverter

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## 18. Contents

1	General description
2	Features and benefits
3	Ordering information 1
4	Marking 2
5	Functional diagram 2
6	Pinning information 2
6.1	Pinning
6.2	Pin description
7	Functional description 3
8	Limiting values 3
9	Recommended operating conditions 4
10	Static characteristics 4
11	Dynamic characteristics 6
12	Waveforms
13	Package outline 8
14	Abbreviations11
15	Revision history 11
16	Legal information 12
16.1	Data sheet status
16.2	Definitions 12
16.3	Disclaimers
16.4	Trademarks13
17	Contact information
10	Contents 14

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