Inverter

Rev. 9 — 10 March 2015

## 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	Name	Description	Version						
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 $\times$ 1.45 $\times$ 0.5 mm							



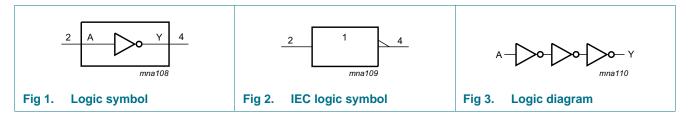
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## 4. Marking

Table 2.   Marking codes	
Type number	Marking <sup>[1]</sup>
74AHC1G04GW	AC
74AHC1G04GV	A04
74AHC1G04GM	AC
74AHCT1G04GW	CC
74AHCT1G04GV	C04
74AHCT1G04GM	CC

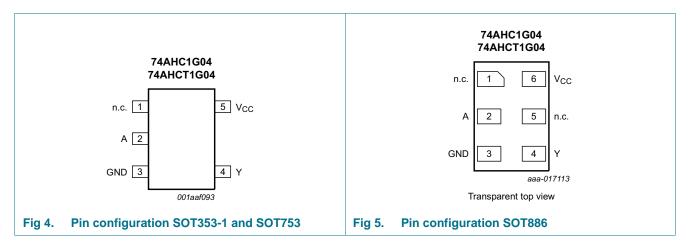
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

# 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning



## 6.2 Pin description

Symbol	Pin		Description	
	SOT353-1 and SOT753	SOT886		
n.c.	1	1	not connected	
А	2	2	data input	
GND	3	3	ground (0 V)	
Y	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	Y
L	Н
Н	L

## 8. Limiting values

#### Table 5. Limiting values

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

Symbol	Parameter	Conditions		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	$V_{\rm O}$ < –0.5 V or $V_{\rm O}$ > $V_{\rm CC}$ + 0.5 V	<u>[1]</u>	-	±20	mA
I <sub>O</sub>	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			-75	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40 \ ^{\circ}C \ to +125 \ ^{\circ}C$	[2]	-	250	mW

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

[2] For both TSSOP5 and SC-74A packages: above 87.5  $^\circ$ C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K.

For XSON6 package: above 118 °C the value of  $P_{tot}$  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	04	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 and fall rate	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	-	-	100	-	-	-	ns/V
		$V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	-	-	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 to +125 °C		Unit
			Min	Тур	Max	Min	Мах	Min	Мах	-
74AHC1	G04	1		1		1		1	1	
V <sub>IH</sub>	HIGH-level	V <sub>CC</sub> = 2.0 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 <sub>IL</sub>	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	V
V <sub>OH</sub>	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
outpu	output voltage	$I_0 = -50 \ \mu\text{A}; \ V_{CC} = 2.0 \ \text{V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_{O} = -50 \ \mu\text{A}; \ V_{CC} = 3.0 \ \text{V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_0 = -50 \ \mu\text{A}; \ V_{CC} = 4.5 \ \text{V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_0 = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_{O} = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	V
V <sub>OL</sub>	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	$I_0 = 50 \ \mu A; \ V_{CC} = 2.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 50 \ \mu A; \ V_{CC} = 3.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 50 \ \mu A; V_{CC} = 4.5 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
		$I_0 = 8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
I	input leakage current	$V_I = 5.5 V \text{ or GND};$ $V_{CC} = 0 V \text{ to } 5.5 V$	-	-	0.1	-	1.0	-	2.0	μA
I <sub>CC</sub>	supply current		-	-	1.0	-	10	-	40	μA
CI	input capacitance		-	1.5	10	-	10	-	10	pF

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## Table 7. Static characteristics ...continued

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

Symbol	mbol Parameter Conditions			25 °C			–40 °C to +85 °C		–40 °C to +125 °C	
			Min	Тур	Max	Min	Max	Min	Max	-
74AHCT	1G04	1	-1		•			1		-
V <sub>IH</sub>	HIGH-level input voltage	$V_{CC}$ = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	$V_{CC} = 4.5 V \text{ to } 5.5 V$	-	-	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
output voltag	output voltage	I <sub>O</sub> = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V <sub>OL</sub>	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
	output voltage	I <sub>O</sub> = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		l <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
lı	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
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
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; $I_O = 0 A$ ; V <sub>CC</sub> = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
CI	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 Figure 7.

Symbol	Parameter	Conditions		25 °C		–40 °C to +85 °C		–40 °C to +125 °C		Unit	
				Min	Тур	Max	Min	Max	Min	Max	-
74AHC1	G04										_
t <sub>pd</sub>	propagation	A to Y; see Figure 6	<u>[1]</u>								
	delay	$V_{CC}$ = 3.0 V to 3.6 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
		$V_{CC}$ = 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; $C_L = 50 \text{ pF}; \text{ f} = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	<u>[4]</u>	-	15	-	-	-	-	-	pF
74AHCT	1G04					1	-!				+
t <sub>pd</sub>	propagation	A to Y; see Figure 6	<u>[1]</u>								
	delay	$V_{CC}$ = 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; $C_L = 50 \text{ pF}; \text{ f} = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	[4]	-	16	-	-	-	-	-	pF

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

[2] Typical values are measured at  $V_{CC}$  = 3.3 V.

[3] Typical values are measured at  $V_{CC} = 5.0$  V.

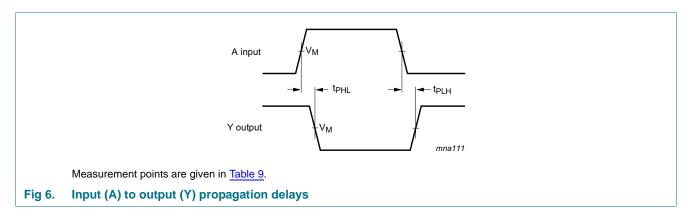
V<sub>CC</sub> = supply voltage in Volts;

N = total load switching outputs;

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

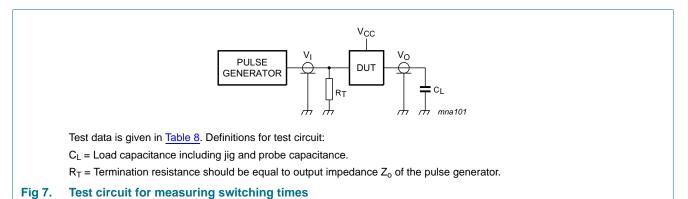
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## 12. Waveforms



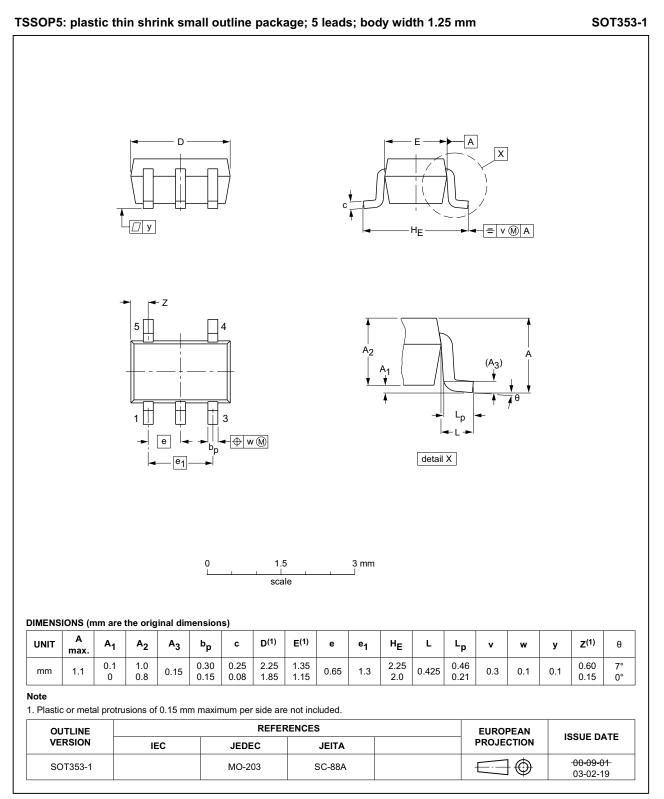
#### Table 9.Measurement point

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



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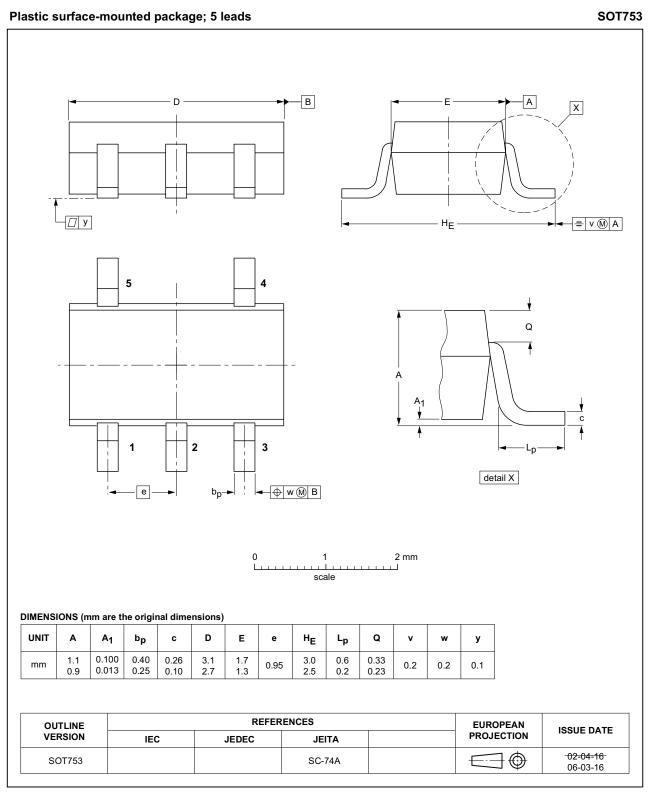
## 13. Package outline



#### Fig 8. Package outline SOT353-1 (TSSOP5)

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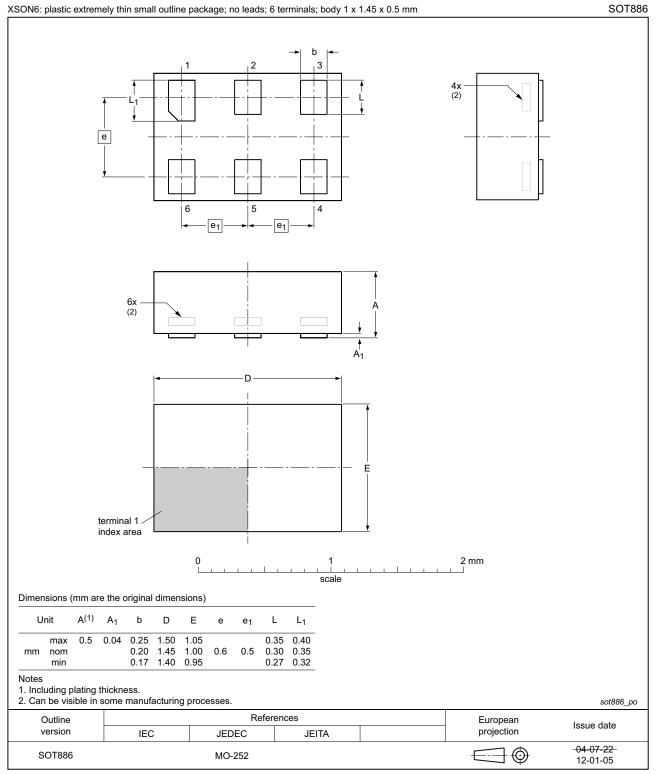


### Fig 9. Package outline SOT753 (SC-74A)

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### Fig 10. Package outline SOT886 (XSON6)

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# 14. Abbreviations

Table 10. Abbreviations						
Acronym	Description					
CDM	Charged Device Model					
DUT	Device Under Test					
ESD	ElectroStatic Discharge					
НВМ	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:	<ul> <li>Added typ</li> </ul>	e numbers 74AHC1G04GM	and 74AHCT1G04G	M.	
74AHC_AHCT1G04 v.8	20141106	Product data sheet	-	74AHC_AHCT1G04 v.7	
Modifications:	<u>Section 4</u> : table note added.				
74AHC_AHCT1G04 v.7	20070531	Product data sheet	-	74AHC_AHCT1G04 v.6	
Modifications:	<ul> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>				
	<ul> <li>Package SOT353 changed to SOT353-1 in <u>Section 3</u> and <u>Section 13</u>.</li> <li>Quick reference data and Soldering sections removed.</li> </ul>				
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	-	-	

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### 16.1 Data sheet status

Document status[1][2]	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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### **NXP Semiconductors**

# 74AHC1G04; 74AHCT1G04

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