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	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 × 1.45 × 0.5 mm									



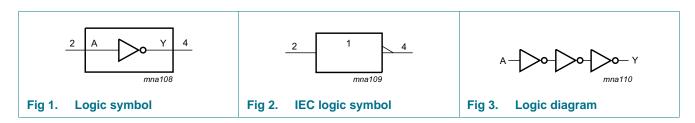
4. Marking

Table 2. Marking codes

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

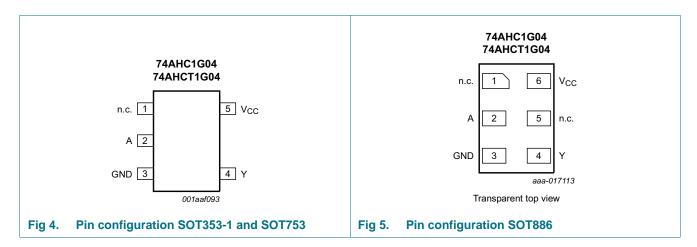
^[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1 Pinning



6.2 Pin description

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 _{CC}	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		Min	Max	Unit
V _{CC}	supply voltage			-0.5	+7.0	V
VI	input voltage			-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V		-20	-	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$	[1]	-	±20	mA
lo	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$		-	±25	mA
I _{CC}	supply current			-	75	mA
GND	ground current			−75	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$	[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_{tot} derates linearly with 4.0 mW/K. For XSON6 package: above 118 $^{\circ}$ 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)4	74	Unit		
			Min	Тур	Max	Min	Тур	Max	
V _{CC}	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 _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	-	-	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		1					-		
V _{IH}	HIGH-level	$V_{CC} = 2.0 \text{ V}$	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V _{CC} = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V_{IL}	LOW-level	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V _{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
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	-	V
		$I_O = -50 \mu A; V_{CC} = 3.0 \text{ V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	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 _{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	V
		$I_O = 50 \mu A; V_{CC} = 3.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
		$I_O = 8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	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 1	to +85 °C	–40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHCT	1G04								1	
V _{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	0.8	-	0.8	-	0.8	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = -50 μA	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 _O = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
l _l	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μА
Δl _{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	
74AHC1	G04	<u>'</u>								1	
t _{pd}	propagation	A to Y; see Figure 6	[1]								
	delay	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C _L = 15 pF		-	4.3	7.1	1.0	8.5	1.0	11.0	ns
		C _L = 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 _L = 15 pF		-	3.1	5.5	1.0	6.5	1.0	7.0	ns
		C _L = 50 pF		-	4.5	7.5	1.0	8.5	1.0	9.5	ns
C _{PD}	power dissipation capacitance	per buffer; [4] C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC}		-	15	-	-	-	-	-	pF
74AHCT	1G04						•				-
t _{pd}	propagation	A to Y; see Figure 6	[1]								
	delay	V _{CC} = 4.5 V to 5.5 V	[3]								
		C _L = 15 pF		-	3.4	6.7	1.0	7.5	1.0	8.5	ns
		C _L = 50 pF		-	4.9	7.7	1.0	8.5	1.0	10.0	ns
C _{PD}	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_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts;

N = total load switching outputs;

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

12. Waveforms

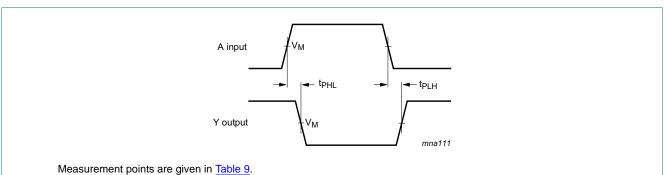
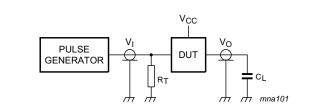


Fig 6. Input (A) to output (Y) propagation delays

Table 9. Measurement point

Туре	Input	Input	Output
	V _I	V _M	V_{M}
74AHC1G04	GND to V _{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74AHCT1G04	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$



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

 C_L = Load capacitance including jig and probe capacitance.

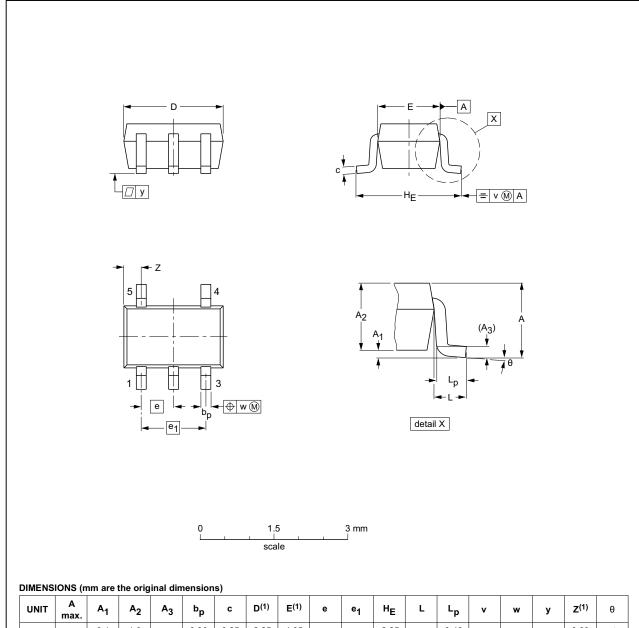
 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

Fig 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 ₁	A ₂	А3	bp	С	D ⁽¹⁾	E(1)	е	e ₁	HE	L	Lp	v	w	у	Z ⁽¹⁾	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		EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA	PROJECTION	ISSUE DATE
SOT353-1		MO-203	SC-88A		-00-09-01 03-02-19

Package outline SOT353-1 (TSSOP5)

74AHC_AHCT1G04

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SOT753

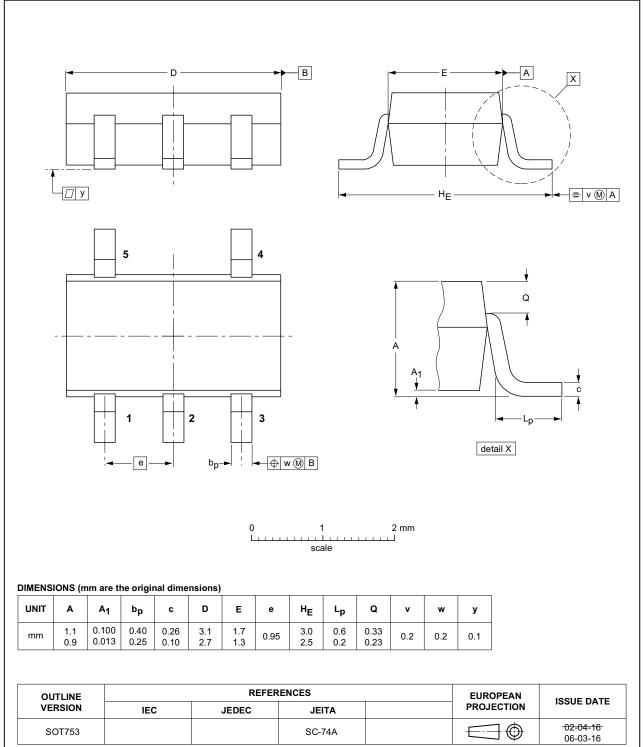


Fig 9. Package outline SOT753 (SC-74A)

74AHC_AHCT1G04

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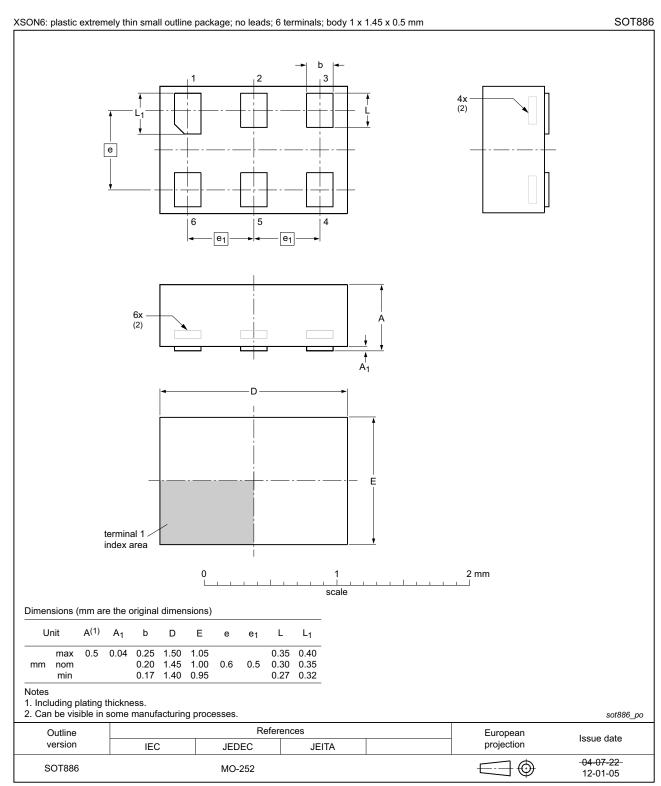


Fig 10. Package outline SOT886 (XSON6)

74AHC_AHCT1G04

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14. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
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:	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:	guidelines	t of this data sheet has been re of NXP Semiconductors.		·	
	 Legal texts 	s have been adapted to the ne	w company name wl	here appropriate.	
	 Package S 	OT353 changed to SOT353-1	in <u>Section 3</u> and <u>Section 3</u>	ection 13.	
	 Quick reference data and Soldering sections 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	-	-	

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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.

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74AHC_AHCT1G04

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