74AHC1G09

2-input AND gate with open-drain output

Rev. 02 — 18 December 2007 Product data sheet

1. General description

The 74AHC1G09 is a high-speed Si-gate CMOS device.

The 74AHC1G09 provides the 2-input AND function with open-drain output.

The output of the 74AHC1G09 is an open drain and can be connected to other open-drain outputs to implement active-LOW, wired-OR or active-HIGH wired-AND functions. For digital operation this device must have a pull-up resistor to establish a logic HIGH level.

2. Features

- High noise immunity
- Low power dissipation
- SOT353-1 and SOT753 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 +85 °C and from –40 °C to +125 °C.

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC1G09GW	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHC1G09GV	–40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753

4. Marking

Table 2. Marking

Type number	Marking code
74AHC1G09GW	A9
74AHC1G09GV	A09

5. Functional diagram

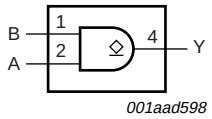


Fig 1. Logic symbol

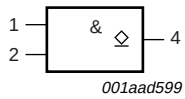


Fig 2. IEC logic symbol

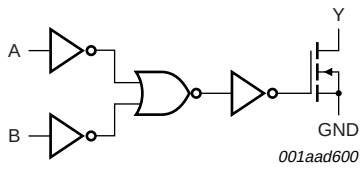


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

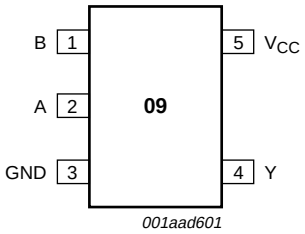


Fig 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
B	1	data input B
A	2	data input A
GND	3	ground (0 V)
Y	4	data output Y
V_{CC}	5	supply voltage

7. Functional description

Table 4. Function table[1]

Input		Output
A	**B**	**Y**
L	L	L
L	H	L
H	L	L
H	H	Z

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

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).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			–0.5	+7.0	V
V_I	input voltage		[1]	–0.5	+7.0	V
V_O	output voltage	active mode	[1]	–0.5	+7.0	V
		high-impedance mode	[1]	–0.5	+7.0	V
I_{IK}	input clamping current	$V_I < –0.5$ V	[1]	-	–20	mA
I_{OK}	output clamping current	$V_O < –0.5$ V	[1]	-	±20	mA
I_O	output current	$V_O > –0.5$ V		-	25	mA
I_{CC}	supply current			-	±75	mA
I_{GND}	GND current			-	±75	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation	T_{amb} = –40 °C to +125 °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 TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating operations

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		2.0	5.0	5.5	V
V_I	input voltage		0	-	5.5	V
V_O	output voltage	active mode	0	-	V_{CC}	V
		high-impedance mode	0	-	6.0	V
T_{amb}	ambient temperature		–40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 3.0 V to 3.6 V	-	-	100	ns/V
		V_{CC} = 4.5 V to 5.5 V	-	-	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	Typ	Max	Min	Max	Min	Max	
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		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 input voltage	V_{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V_{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V_{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V

Table 7. Static characteristics *…continued*
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	Typ	Max	Min	Max	Min	Max	
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		I_O = 50 µA; V_{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 µA; V_{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 µA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 4.0 mA; V_{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I_O = 8.0 mA; V_{CC} = 4.5 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	µA
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL}; $V_O = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	±0.25		±2.5		±10.0	µA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	1.0	-	10	-	20	µA
C_I	input capacitance		-	1.5	10	-	10	-	10	pF

11. Dynamic characteristics

Table 8. Dynamic characteristics
GND = 0 V; for test circuit see Figure 6.

Symbol	Parameter	Conditions		25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{pd}	propagation delay	A and B to Y; see Figure 5	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 15 pF		-	4.6	7.5	1.0	8.5	1.0	9.0	ns
		C_L = 50 pF		-	6.5	11.0	1.5	12.0	1.5	12.5	ns
		V_{CC} = 4.5 V to 5.5 V	[3]								
		C_L = 15 pF		-	3.2	5.5	1.0	6.5	1.0	7.0	ns
		C_L = 50 pF		-	4.6	7.5	1.5	8.0	1.5	8.5	ns
C_{PD}	power dissipation capacitance	C_L = 50 pF; f_i = 1 MHz; V_I = GND to V_{CC}	[4]	-	5	-	-	-	-	-	pF

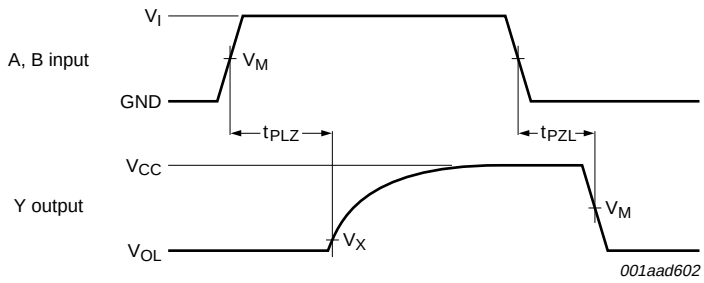
[1] t_{pd} is the same as t_{PZL} and t_{PLZ}.

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

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

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + (C_L \times V_{CC}^2 \times f_o)$ 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 V;
N = number of inputs switching;
$(C_L \times V_{CC}^2 \times f_o)$ = dissipation due to the output if the combination of the pull up voltage and resistance results in V_{CC} at the output.

12. Waveforms



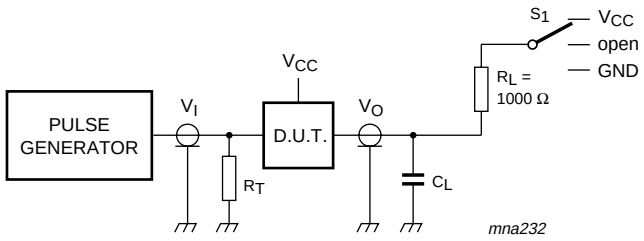
Measurement points are given in Table 9.

V_{OL} is the typical voltage output level that occur with the output load.

Fig 5. The data input (A, B) to output (Y) propagation delays

Table 9. Measurement points

Input	Output	
V_M	V_M	V_X
$0.5V_{CC}$	$0.5V_{CC}$	V_{OL} + 0.3 V



Test data is given in Table 10.

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.

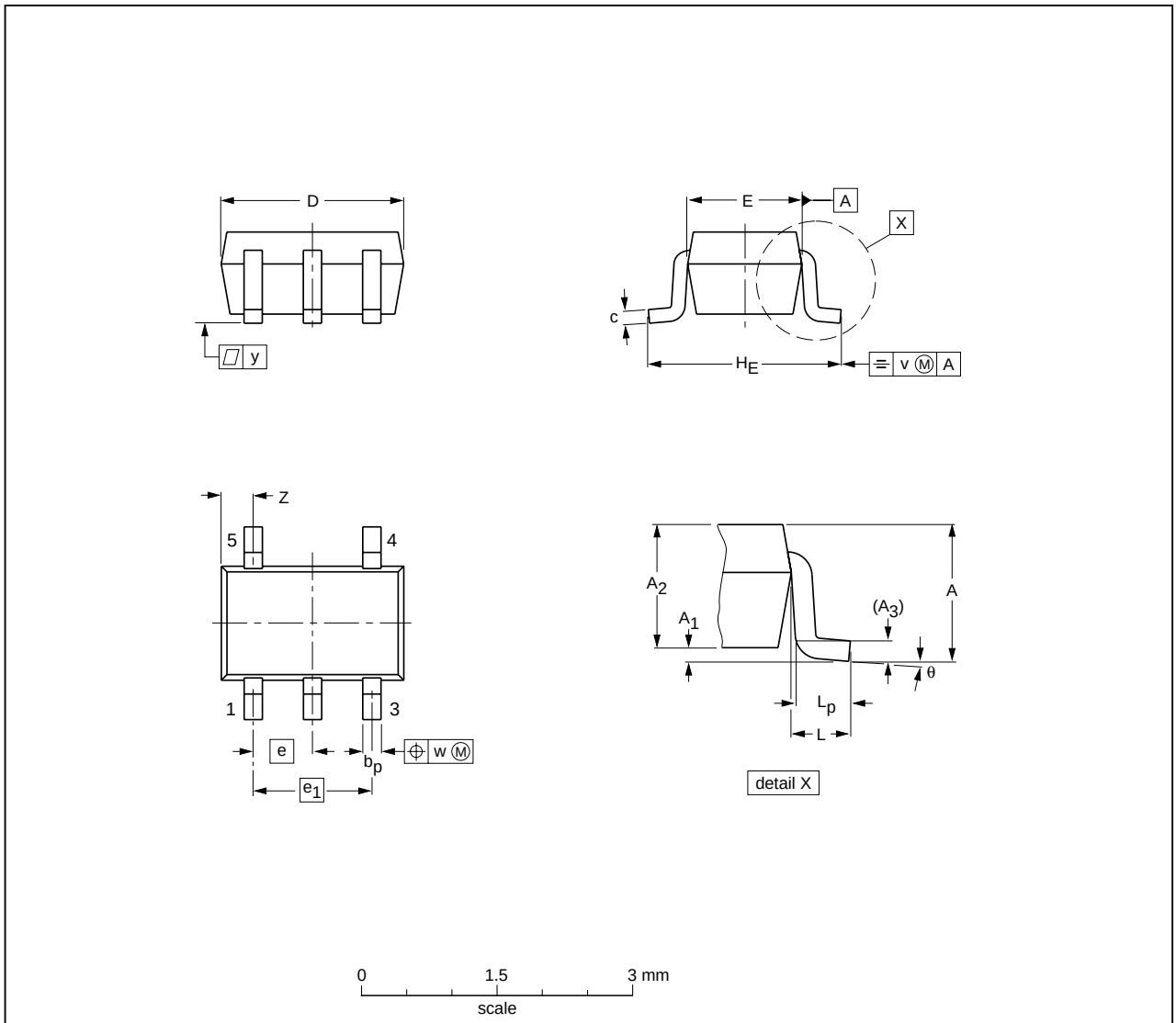
Fig 6. Load circuit for switching times

Table 10. Test data

Input		Load		S_1		
V_I	t_r, t_f	R_L	C_L	t_{PHZ}, t_{PZH}	t_{PLZ}, t_{PZL}	t_{PLH}, t_{PHL}
GND to V_{CC}	≤ 3.0 ns	1000 Ω	15 pF	GND	V_{CC}	open
GND to V_{CC}	≤ 3.0 ns	1000 Ω	50 pF	GND	V_{CC}	open

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm **SOT353-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L	L_p	v	w	y	$Z^{(1)}$	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°

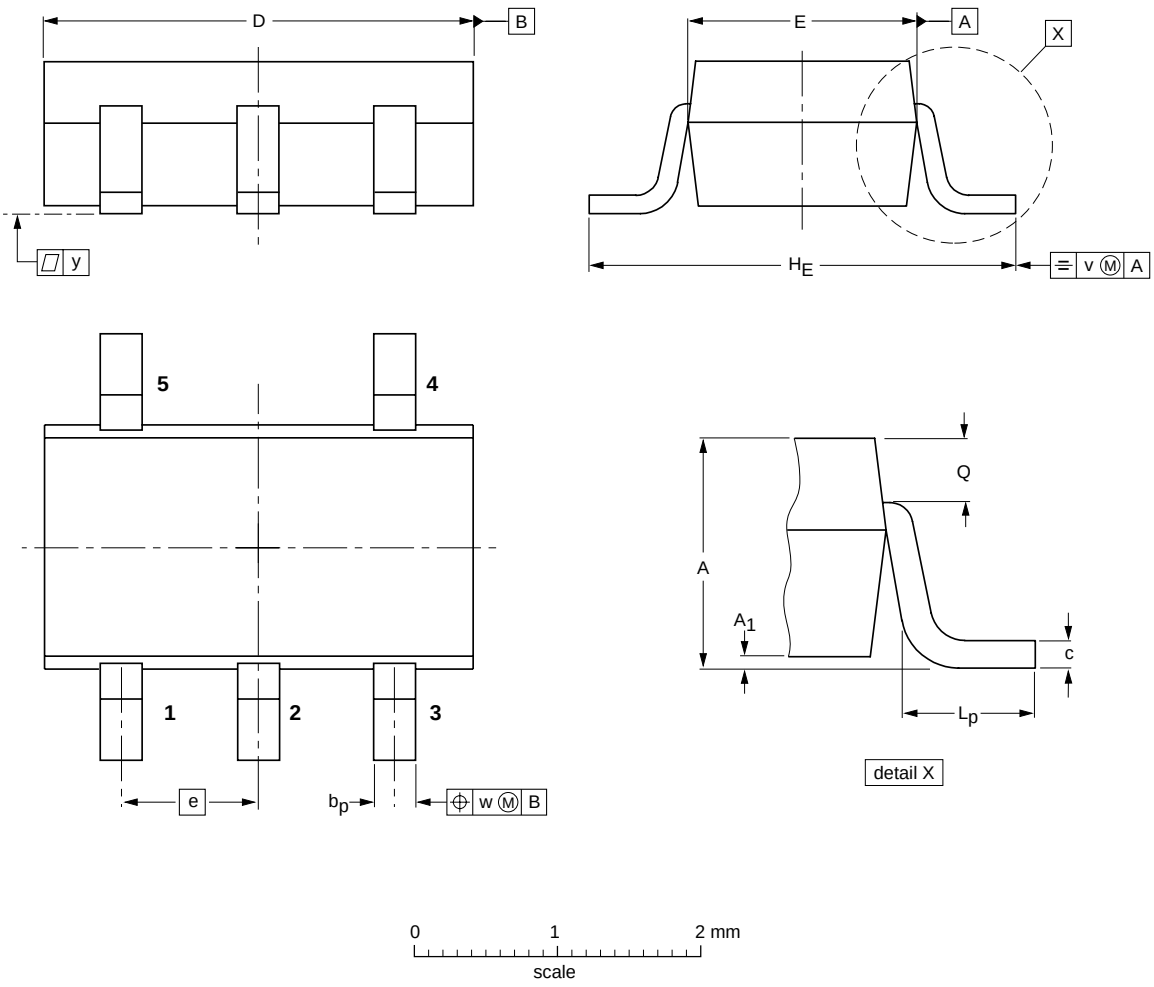
Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~00-09-01~~ 03-02-19

Fig 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads **SOT753**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			~~02-04-16~~ 06-03-16

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

14. Abbreviations

Table 11. Abbreviations

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

15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC1G09_2	20071218	Product data sheet	-	74AHC1G09_1
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Package SOT753 added to Section 3, Section 4 and Section 13. • Quick reference data section removed.			
74AHC1G09_1	20050926	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.
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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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18. Contents

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