

## Description

The 74AHC1G09 is a single 2-input positive AND gate with an open drain output. The device is designed for operation with a power supply range of 2.0V to 5.5V. The open-drain output can be connected to other open drain outputs to implement active-low wired-OR or active-high wired-AND functions. The gate performs the positive Boolean function:

$$Y = A \cdot B \text{ or } Y = \overline{\overline{A} + \overline{B}}$$

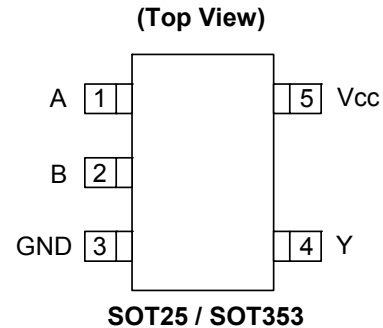
A pull-up resistor is required to achieve a high output state.

## Features

- Supply Voltage Range from 2.0V to 5.5V
- 8mA sink current at 5.0 V
- CMOS low power consumption
- Schmitt Trigger Action at All Inputs Make the Circuit Tolerant for Slower Input Rise and Fall Time.
- ESD Protection per JESD 22
  - Exceeds 200-V Machine Model (A115-A)
  - Exceeds 2000-V Human Body Model (A114-A)
  - Exceeds 1000-V Charged Device Model (C101C)
- Latch-Up Exceeds 100mA per JESD 78, Class II
- SOT25 and SOT353: Assembled with "Green" Molding Compound (no Br, Sb)
  - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
  - **Halogen and Antimony Free. "Green" Device (Note 3)**

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.  
 2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.  
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Assignments



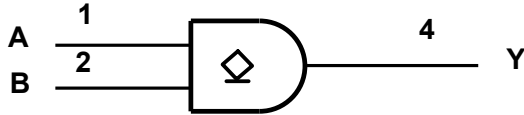
## Applications

- General Purpose Logic
- Wide array of products such as:
  - PCs, networking, notebooks, netbooks, PDAs
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box
  - Personal Navigation / GPS
  - MP3 players, Cameras, Video Recorders

## Pin Descriptions

Pin Name	Pin NO.	Function
A	1	Data Input
B	2	Data Input
GND	3	Ground
Y	4	Data Output
V <sub>CC</sub>	5	Supply Voltage

**Logic Diagram**



**Functional Table**

Inputs		Output
A	B	Y
H	H	Z
L	X	L
X	L	L

**Absolute Maximum Ratings** (Note 4) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	KV
ESD CDM	Charged Device Model ESD Protection	1	KV
ESD MM	Machine Model ESD Protection	200	V
V <sub>CC</sub>	Supply Voltage Range	-0.5 to 6.5	V
V <sub>I</sub>	Input Voltage Range	-0.5 to 6.5	V
V <sub>O</sub>	Voltage applied to output in high or low state	-0.5 to V <sub>CC</sub> +0.5	V
I <sub>IK</sub>	Input Clamp Current V <sub>I</sub> < 0	-20	mA
I <sub>OK</sub>	Output Clamp Current (V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> )	±20	mA
I <sub>O</sub>	Continuous output current (V <sub>O</sub> = 0 to V <sub>CC</sub> )	±25	mA
I <sub>CC</sub>	Continuous current through V <sub>CC</sub>	50	mA
I <sub>GND</sub>	Continuous current through GND	-50	mA
T <sub>J</sub>	Operating Junction Temperature	-40 to +150	°C
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C

Note: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

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**Recommended Operating Conditions** (Note 5) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter		Min	Max	Unit
V <sub>CC</sub>	Operating Voltage		2.0	5.5	V
V <sub>IH</sub>	High-Level Input Voltage	V <sub>CC</sub> = 2V	1.5		V
		V <sub>CC</sub> = 3V	2.1		
		V <sub>CC</sub> = 5.5V	3.85		
V <sub>IL</sub>	Low-Level input Voltage	V <sub>CC</sub> = 2V		0.5	V
		V <sub>CC</sub> = 3V		0.9	
		V <sub>CC</sub> = 5.5V		1.65	
V <sub>I</sub>	Input Voltage		0	5.5	V
V <sub>O</sub>	Output Voltage		0	5.5	V
I <sub>OL</sub>	Low-Level Output Current	V <sub>CC</sub> = 2V		50	μA
		V <sub>CC</sub> = 5V ± 0.5V		4	mA
		V <sub>CC</sub> = 3V		8	
Δt/ΔV	Input transition rise or fall rate	V <sub>CC</sub> = 3.3V ± 0.3V		100	ns/V
		V <sub>CC</sub> = 5V ± 0.5V		20	
T <sub>A</sub>	Operating free-air temperature		-40	+125	°C

 Note: 5. Unused inputs should be held at V<sub>CC</sub> or Ground.

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	+25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V <sub>OL</sub>	High-level Input Voltage	I <sub>OL</sub> = 50μA	2V			0.1		0.1		0.1	V
			3V			0.1		0.1		0.1	
			4.5V			0.1		0.1		0.1	
		I <sub>OL</sub> = 4mA	3V			0.36		0.44		0.55	
		I <sub>OL</sub> = 8mA	4.5V			0.36		0.44		0.55	
I <sub>I</sub>	Input Current	V <sub>I</sub> = 5.5V or GND	0 to 5.5V			±0.1		±1		±2	μA
I <sub>oz</sub>	Z-state Output Current	V <sub>I</sub> = 5.5V or GND	0 to 5.5V			±0.25		±2.5		±10	μA
I <sub>CC</sub>	Supply Current	V <sub>I</sub> = 5.5V or GND I <sub>O</sub> = 0	5.5V			1		10		40	μA
C <sub>i</sub>	Input Capacitance	V <sub>I</sub> = V <sub>CC</sub> – or GND	5.5V		2.0	10		10		10	pF
θ <sub>JA</sub>	Thermal Resistance Junction-to-Ambient	SOT25	(Note 6)		204						°C/W
		SOT353			371						
θ <sub>JC</sub>	Thermal Resistance Junction-to-Case	SOT25	(Note 6)		52						°C/W
		SOT353			143						

Note: 6. Test conditions for SOT25, and SOT353: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

## Switching Characteristics

 $V_{CC} = 3.3V \pm 0.3$  (see Figure 1)

Parameter	From (Input)	TO (OUTPUT)		+25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	A or B	Y	$C_L = 15pF$	0.6	4.6	7.5	0.6	8.5	0.6	9.0	ns
			$C_L = 50pF$	0.6	6.5	11.0	0.6	12.0	0.6	12.5	ns

 $V_{CC} = 5V \pm 0.5V$  (see Figure 1)

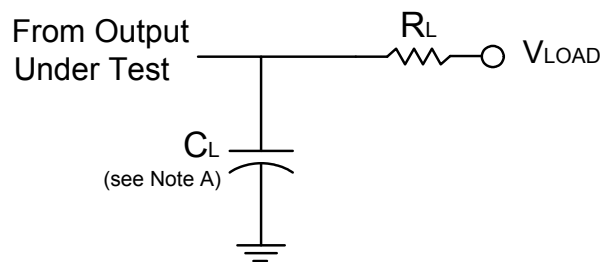
Parameter	From (Input)	TO (OUTPUT)		+25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$t_{pd}$	A or B	Y	$C_L = 15pF$	0.6	3.2	5.5	0.6	6.5	0.6	7.0	ns
			$C_L = 50pF$	0.6	4.6	7.5	0.6	8.0	0.6	8.5	ns

## Operating Characteristics

 $T_A = +25^\circ C$ 

Parameter	Test Conditions	$V_{CC} = 5V$		Unit
		Typ		
$C_{pd}$	f = 1 MHz No Load	5		pF

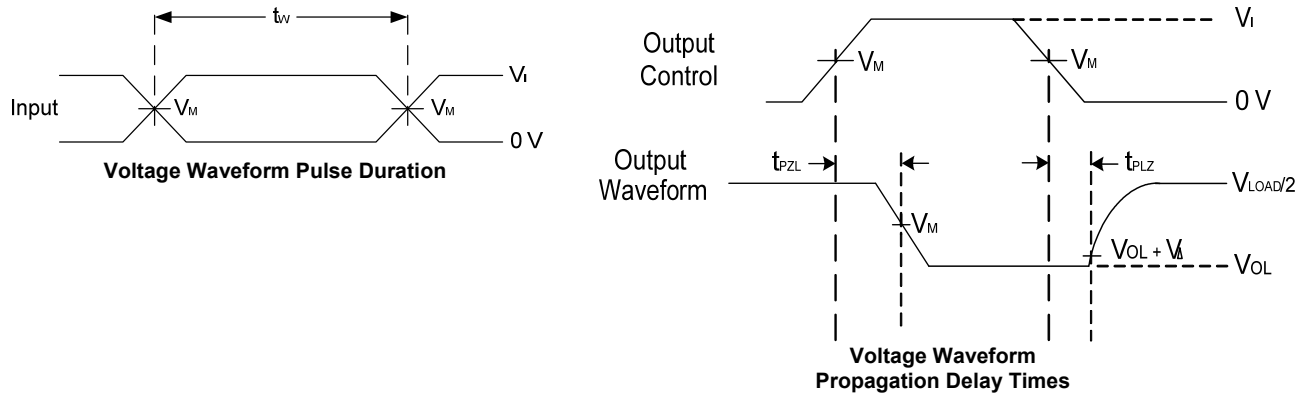
## Parameter Measurement Information



TEST	Condition
$t_{PLZ}$ (see Notes D and E)	$V_{LOAD}$
$t_{PZL}$ (see Notes D and F)	$V_{LOAD}$

$V_{CC}$	Inputs		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$3.3V \pm 0.3V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	$V_{CC}$	15pF	1K $\Omega$	0.3V
$3.3V \pm 0.3V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	$V_{CC}$	50pF	1K $\Omega$	0.3V
$5V \pm 0.5V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	$V_{CC}$	15pF	1K $\Omega$	0.3V
$5V \pm 0.5V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	$V_{CC}$	50pF	1K $\Omega$	0.3V

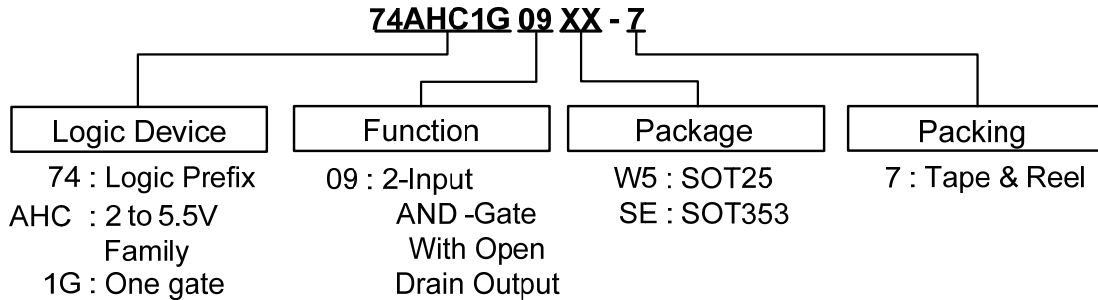
**Parameter Measurement Information** (cont.)



**Figure 1 Load Circuit and Voltage Waveforms**

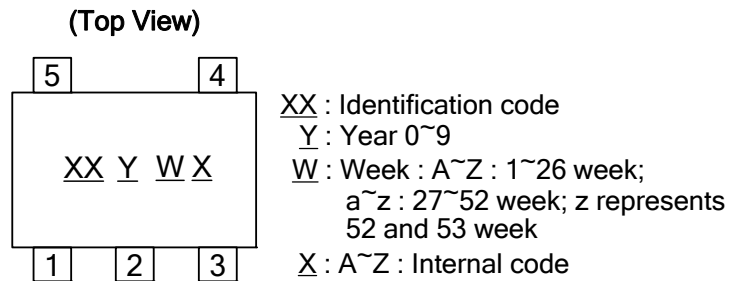
- Notes:
- A. Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate  $\leq 1$  MHz.
  - C. The inputs are measured one at a time with one transition per measurement.
  - D. For the open drain device  $t_{PLZ}$  and  $t_{PZL}$  are the same as  $t_{PD}$ .
  - E.  $t_{PZL}$  is measured at  $V_M$ .
  - F.  $t_{PLZ}$  is measured at  $V_{OL} + V_{\Delta}$ .

**Ordering Information**



Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
74AHC1G09W5-7	W5	SOT25	3000/Tape & Reel	-7
74AHC1G09SE-7	SE	SOT353	3000/Tape & Reel	-7

**Marking Information**



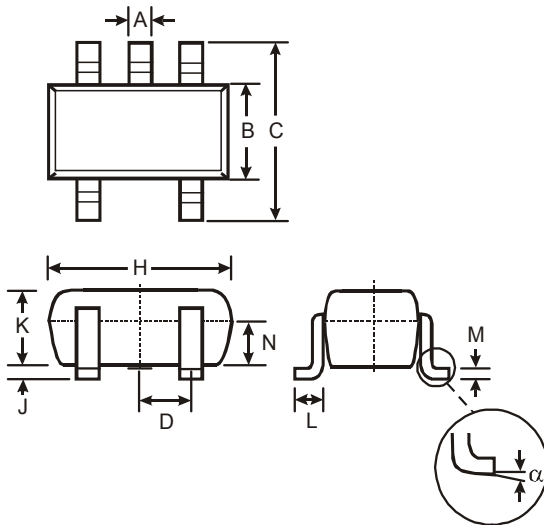
Part Number	Package	Identification Code
74AHC1G09W5	SOT25	YN
74AHC1G09SE	SOT353	YN

**Package Outline Dimensions** (All dimensions in mm.)

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

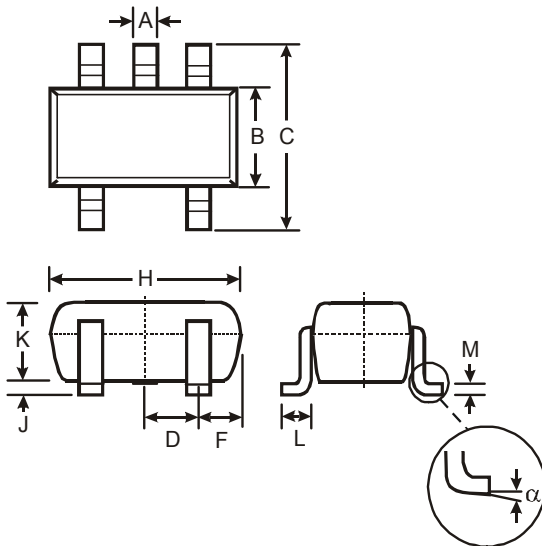
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(1) Package Type: SOT25



SOT25			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	—	—	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	—
All Dimensions in mm			

(2) Package Type: SOT353

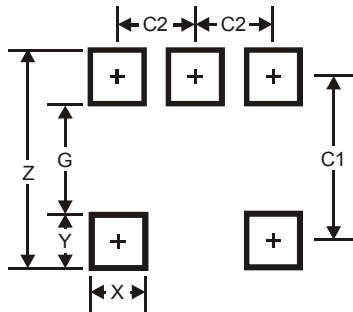


SOT353		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 Typ	
F	0.40	0.45
H	1.80	2.20
J	0	0.10
K	0.90	1.00
L	0.25	0.40
M	0.10	0.22
α	0°	8°
All Dimensions in mm		

## Suggested Pad Layout

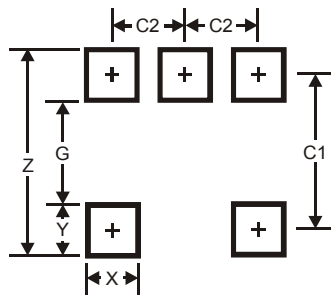
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

### (1) Package Type: SOT25



Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

### (2) Package Type: SOT353



Dimensions	Value (in mm)
Z	2.5
G	1.3
X	0.42
Y	0.6
C1	1.9
C2	0.65



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