

## Description

The 74AHC1G04Q is an automotive compliant single inverter gate with a standard push-pull output. The device is designed for operation with a power supply range of 2.0V to 5.5V. The gate performs the positive Boolean function:

$$Y = \overline{A}$$

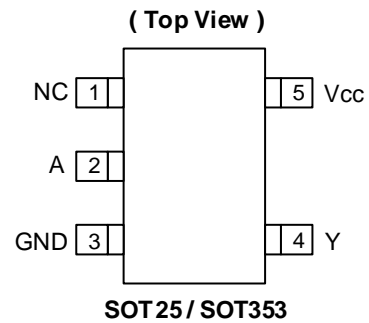
## Features

- Grade 1 Ambient Temperature Operation: -40°C to +125°C
- Supply Voltage Range from 2.0V to 5.5V
- ±8mA Output Drive at 4.5V
- CMOS Low-Power Consumption
- High Noise Immunity
- Inputs Not Limited by V<sub>CC</sub>
- Balanced Propagation Delays
- Balanced Drive Capability
- ESD Protection Tested per AEC-Q100
- Exceeds 2000V Human Body Model (AEC-Q100-002)
- Exceeds 1000V Charged Device Model (AEC-Q100-011)
- Latch-Up Exceeds 100mA (AEC-Q100-004)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The 74AHC1G04Q is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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



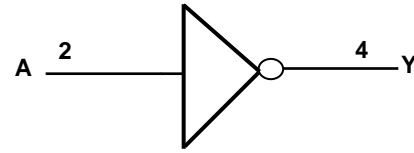
## Applications

- General purpose logics
- Wide array of products, such as:
  - Automotive applications within grade 1 temperature range
  - Industrial computing/controls/automations
  - High reliability networking/communications
  - Industrial/Agricultural equipment

## Pin Descriptions

Pin Name	Description
NC	No Connection
A	Data Input
GND	Ground
Y	Data Output
V <sub>CC</sub>	Supply Voltage

## Logic Diagram



## Function Table

Input	Output
A	Y
H	L
L	H

## Absolute Maximum Ratings (Notes 4 & 5)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD CDM	Charged Device Model ESD Protection	1	kV
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>	75	mA
I <sub>GND</sub>	Continuous Current Through GND	-75	mA
T <sub>J</sub>	Operating Junction Temperature	-40 to +150	°C
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C
P <sub>D</sub>	Total Power Dissipation (Note 6)	250	mW

- Notes:
- Stresses beyond the absolute maximum can result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.
  - Forcing the maximum allowed voltage can cause a condition exceeding the maximum current or conversely forcing the maximum current can cause a condition exceeding the maximum voltage. The ratings of both current and voltage must be maintained within the controlled range.
  - This will need to be derated at higher operating temperatures to prevent exceeding maximum T<sub>J</sub>. Refer to package thermal characteristics section.

### Recommended Operating Conditions (Note 7)

Symbol	Parameter	Min	Max	Unit	
V <sub>CC</sub>	Operating Voltage	—	2	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	V <sub>CC</sub>	V	
I <sub>OH</sub>	High-Level Output Current	V <sub>CC</sub> = 2V	—	-50	μA
		V <sub>CC</sub> = 3.3V ± 0.3V	—	-4	mA
		V <sub>CC</sub> = 5V ± 0.5V	—	-8	
I <sub>OL</sub>	Low-Level Output Current	V <sub>CC</sub> = 2V	—	50	μA
		V <sub>CC</sub> = 3.3V ± 0.3V	—	4	mA
		V <sub>CC</sub> = 5V ± 0.5V	—	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>	Ambient Temperature	—	-40	+125	°C

Note: 7. Unused inputs should be held at V<sub>CC</sub> or Ground.

**Electrical Characteristics** (All typical values are at  $V_{CC} = 3.3V$ ,  $T_A = +25^{\circ}C$ .)

Symbol	Parameter	Test Conditions	Vcc	+25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V <sub>OH</sub>	High Level Output Voltage	V <sub>I</sub> = V <sub>IL</sub> I <sub>OH</sub> = -50μA	2V	1.9	2	—	1.9	—	1.9	—	V
			3V	2.9	3	—	2.9	—	2.9	—	
			4.5V	4.4	4.5	—	4.4	—	4.4	—	
V <sub>OH</sub>	High Level Output Voltage	V <sub>I</sub> = V <sub>IL</sub> I <sub>OH</sub> = -4mA	3V	2.58	—	—	2.48	—	2.40	—	V
			4.5V	3.94	—	—	3.80	—	3.70	—	
			4.5V	3.94	—	—	3.80	—	3.70	—	
V <sub>OL</sub>	Low Level Output Voltage	V <sub>I</sub> = V <sub>IH</sub> 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	
V <sub>OL</sub>	Low Level Output Voltage	V <sub>I</sub> = V <sub>IH</sub> I <sub>OL</sub> = 4mA	3V	—	—	0.36	—	0.44	—	0.55	V
			4.5V	—	—	0.36	—	0.44	—	0.55	
I <sub>I</sub>	Input Current	V <sub>I</sub> = 5.5V or GND	0V to 5.5V	—	—	±0.1	—	±1	—	±2	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	—	1.5	10	—	10	—	10	pF

**Package Characteristics**

Symbol	Parameter	Package	Test Conditions	Min	Typ	Max	Unit
θ <sub>JA</sub>	Thermal Resistance Junction-to-Ambient	SOT25	Note 8	—	184	—	°C/W
		SOT353		—	385	—	
θ <sub>JC</sub>	Thermal Resistance Junction-to-Case	SOT25	Note 8	—	62	—	°C/W
		SOT353		—	164	—	

Note: 8. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

**Switching Characteristics**
 $V_{CC} = 3.3V \pm 0.3V$  (See Figure 1)

Parameter	From (Input)	To (Output)	Test Conditions	+25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>PD</sub>	A	Y	C <sub>L</sub> = 15pF	1.0	4.3	7.1	1.0	8.5	1.0	11.0	ns
			C <sub>L</sub> = 50pF	1.0	6.1	10.6	1.0	12.0	1.0	14.5	ns

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

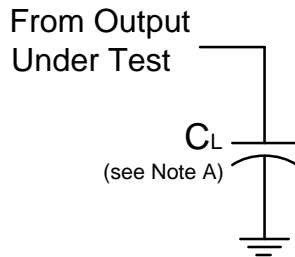
Parameter	From (Input)	To (Output)	Test Conditions	+25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>PD</sub>	A	Y	C <sub>L</sub> = 15pF	1.0	3.1	5.5	1.0	6.5	1.0	7.0	ns
			C <sub>L</sub> = 50pF	1.0	4.5	7.5	1.0	8.5	1.0	9.5	ns

**Operating Characteristics**

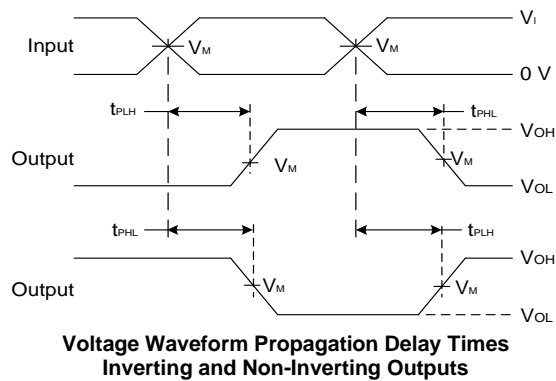
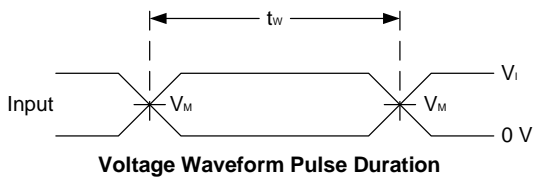
T<sub>A</sub> = +25°C

Parameter		Test Conditions	Typ	Unit
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>CC</sub> = 5.0V, f = 1MHz C <sub>L</sub> = 50pF V <sub>I</sub> = GND to V <sub>CC</sub>	15	pF

**Measurement Information**



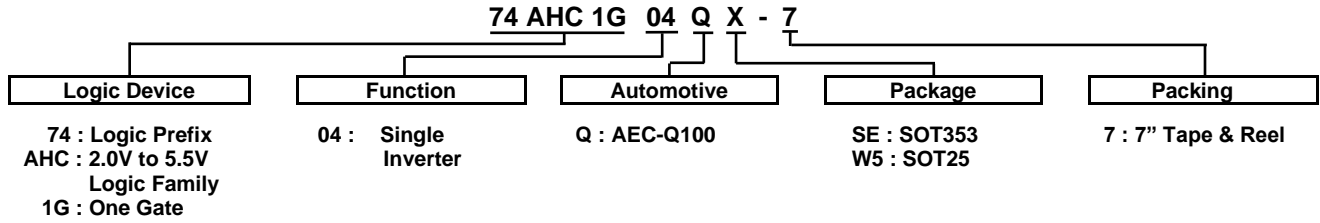
V <sub>CC</sub>	Inputs		V <sub>M</sub>	C <sub>L</sub>
	V <sub>I</sub>	t <sub>R</sub> /t <sub>F</sub>		
3.3V±0.3V	V <sub>CC</sub>	≤3ns	V <sub>CC</sub> /2	15pF
5V±0.5V	V <sub>CC</sub>	≤3ns	V <sub>CC</sub> /2	15pF
3.3V±0.3V	V <sub>CC</sub>	≤3ns	V <sub>CC</sub> /2	50pF
5V±0.5V	V <sub>CC</sub>	≤3ns	V <sub>CC</sub> /2	50pF



**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 ≤ 1MHz.
  - C. Inputs are measured separately one transition per measurement.

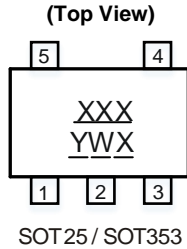
**Ordering Information** (Note 9)



Orderable Part Number	Package Code	Package (Notes 10 & 11)	Package Size	Packing	
				Qty.	Carrier
74AHC1G04QSE-7	SE	SOT353	2.15mm × 2.1mm × 1.1mm 0.65mm Lead Pitch	3000	7" Tape and Reel
74AHC1G04QW5-7	W5	SOT25	3.0mm × 2.8mm × 1.2mm 0.95mm Lead Pitch	3000	7" Tape and Reel

Notes: 9. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.  
 10. Pad layout as shown in Diodes Incorporated's package outline PDFs, which can be found on our website at <http://www.diodes.com/package-outlines.html>.  
 11. The taping orientation is located on our website at <https://www.diodes.com/assets/Packaging-Support-Docs/ap02007.pdf>.

**Marking Information**



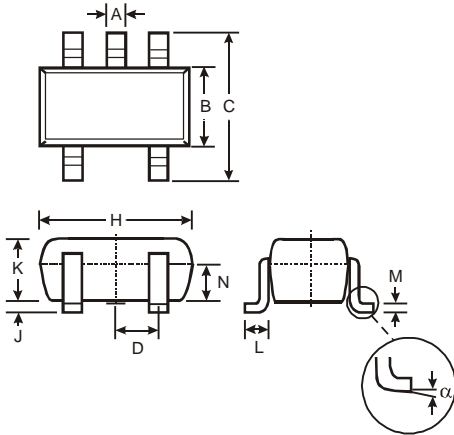
XXX : Identification Code  
Y : Year 0 to 9  
W : Week: A to Z: 1 to 26 Week  
           a to z: 27 to 52 Week  
           z Represents Week 52 and 53  
X : A to Z: Internal Code

Orderable Part Number	Package	Identification Code
74AHC1G04QW5-7	SOT25	YTQ
74AHC1G04QSE-7	SOT353	YTQ

## Package Outline Dimensions

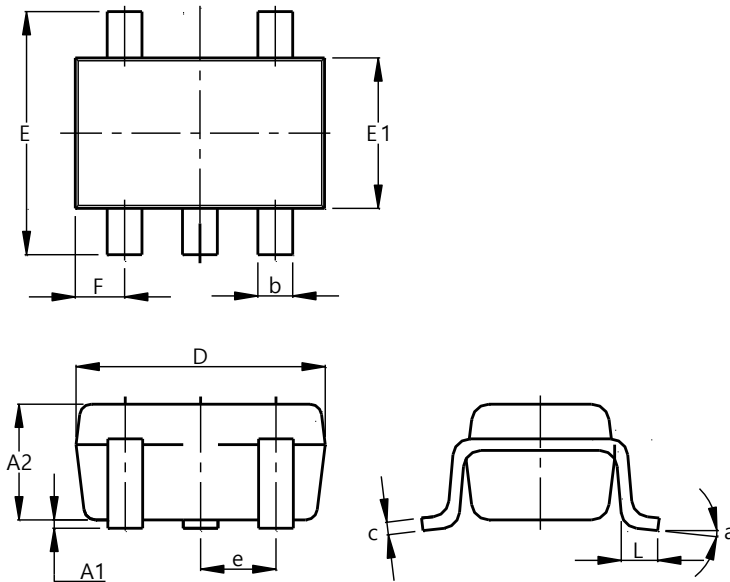
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (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
$\alpha$	0°	8°	-
All Dimensions in mm			

### (2) Package Type: SOT353

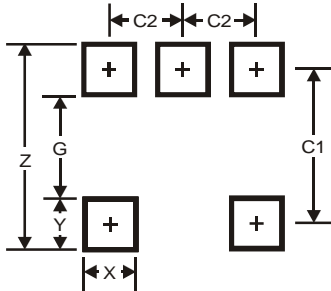


SOT353			
Dim	Min	Max	Typ
A1	0.00	0.10	0.05
A2	0.90	1.00	0.95
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
All Dimensions in mm			

## Suggested Pad Layout

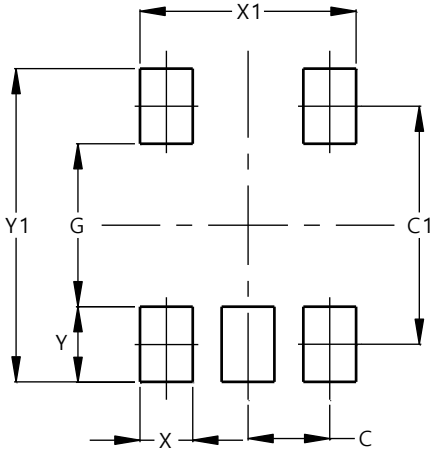
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (1) Package Type: SOT25



Dimensions	Value
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)
C	0.650
C1	1.900
G	1.300
X	0.420
X1	1.720
Y	0.600
Y1	2.500

## Mechanical Data

### SOT25

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208@3
- Weight: 0.0158 grams (Approximate)

### SOT353

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208@3
- Weight: 0.0064 grams (Approximate)



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