



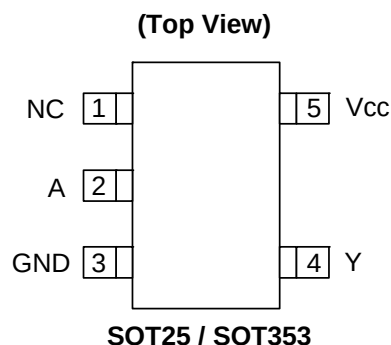
# 74AHC1GU04

## UNBUFFERED SINGLE INVERTER GATE

### Description

The 74AHC1GU04 is a single inverter gate with a standard totem pole output. The device is designed for operation with a power supply range of 2.0V to 5.5V. The inverter can be used in analog circuits such as crystal oscillators.

### Pin Assignments



### Features

- Supply Voltage Range from 2.0V to 5.5V
- $\pm 6$  mA Output Drive at 5.0V
- CMOS low power consumption
- Unbuffered Output
- ESD Protection Exceeds JESD 22
- 200-V Machine Model (A115-A)
- 2000-V Human Body Model (A114-A)
- Latch-Up Exceeds 100mA per JESD 78, Class II
- SOT25 and SOT353: Assembled with "Green" Molding Compound (no Br, Sb)
- Lead Free Finish / RoHS Compliant (Note 1)

### Applications

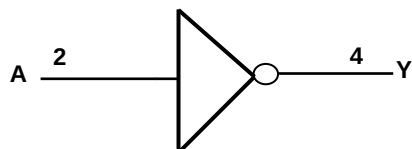
- Crystal Oscillators, Analog Inverters
- Wide array of products such as.
  - o PCs, networking, notebooks, netbooks, PDAs
  - o Computer peripherals, hard drives, CD/DVD ROM
  - o TV, DVD, DVR, set top box
  - o Personal Navigation / GPS
  - o MP3 players, Cameras, Video Recorders

Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at [http://www.diodes.com/products/lead\\_free.html](http://www.diodes.com/products/lead_free.html).

## Pin Descriptions

| Pin Name        | Pin NO. | Description    |
|-----------------|---------|----------------|
| NC              | 1       | No Connection  |
| A               | 2       | Data Input     |
| GND             | 3       | Ground         |
| Y               | 4       | Data Output    |
| V <sub>CC</sub> | 5       | Supply Voltage |

## Logic Diagram



## Function Table

| Inputs | Output |
|--------|--------|
| A      | Y      |
| H      | L      |
| L      | H      |

### Absolute Maximum Ratings (Note 2)

| Symbol    | Description                                          | Rating                 | Unit |
|-----------|------------------------------------------------------|------------------------|------|
| ESD HBM   | Human Body Model ESD Protection                      | 2                      | KV   |
| ESD MM    | Machine Model ESD Protection                         | 200                    | V    |
| $V_{CC}$  | Supply Voltage Range                                 | -0.5 to 6.5            | V    |
| $V_I$     | Input Voltage Range                                  | -0.5 to 6.5            | V    |
| $V_O$     | Voltage applied to output in high or low state       | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IK}$  | Input Clamp Current $V_I < 0$                        | -20                    | mA   |
| $I_{OK}$  | Output Clamp Current ( $V_O < 0$ or $V_O > V_{CC}$ ) | $\pm 20$               | mA   |
| $I_O$     | Continuous output current ( $V_O = 0$ to $V_{CC}$ )  | $\pm 25$               | mA   |
| $I_{CC}$  | Continuous current through $V_{CC}$                  | 50                     | mA   |
| $I_{GND}$ | Continuous current through GND                       | -50                    | mA   |
| $T_J$     | Operating Junction Temperature                       | -40 to 150             | °C   |
| $T_{STG}$ | Storage Temperature                                  | -65 to 150             | °C   |

Notes: 2. 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.

### Recommended Operating Conditions (Note 3)

| Symbol   | Parameter                      |                          | Min | Max      | Unit |
|----------|--------------------------------|--------------------------|-----|----------|------|
| $V_{CC}$ | Operating Voltage              |                          | 2   | 5.5      | V    |
| $V_{IH}$ | High-level Input Voltage       | $V_{CC} = 2V$            | 1.7 |          | V    |
|          |                                | $V_{CC} = 3V$            | 2.4 |          |      |
|          |                                | $V_{CC} = 5.5V$          | 4.4 |          |      |
| $V_{IL}$ | Low-level input voltage        | $V_{CC} = 2V$            |     | 0.3      | V    |
|          |                                | $V_{CC} = 3V$            |     | 0.6      |      |
|          |                                | $V_{CC} = 5.5V$          |     | 1.1      |      |
| $V_I$    | Input Voltage                  |                          | 0   | 5.5      | V    |
| $V_O$    | Output Voltage                 |                          | 0   | $V_{CC}$ | V    |
| $I_{OH}$ | High-level output current      | $V_{CC} = 2V$            |     | -50      | uA   |
|          |                                | $V_{CC} = 3.3V \pm 0.3V$ |     | -3       | mA   |
|          |                                | $V_{CC} = 5V \pm 0.5V$   |     | -6       |      |
| $I_{OL}$ | Low-level output current       | $V_{CC} = 2V$            |     | 50       | uA   |
|          |                                | $V_{CC} = 5V \pm 0.5V$   |     | 3        | mA   |
|          |                                | $V_{CC} = 3V$            |     | 6        |      |
| $T_A$    | Operating free-air temperature |                          | -40 | 85       | °C   |

Notes: 3. Unused inputs should be held at  $V_{CC}$  or Ground.

### Electrical Characteristics

| 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>OH</sub> | High Level Output Voltage              | I <sub>OH</sub> = -50µA                           | 2V              | 1.8  | 2    |       | 1.75          |      | 1.75           |      | V    |
|                 |                                        |                                                   | 3V              | 2.7  | 3    |       | 2.65          |      | 2.65           |      |      |
|                 |                                        |                                                   | 4.5V            | 4.0  | 4.5  |       | 3.9           |      | 3.9            |      |      |
|                 |                                        | I <sub>OH</sub> = -3mA                            | 3V              | 2.58 |      |       | 2.5           |      | 2.5            |      |      |
|                 |                                        | I <sub>OH</sub> = -6mA                            | 4.5V            | 3.94 |      |       | 3.8           |      | 3.8            |      |      |
| V <sub>OL</sub> | Low Level Output Voltage               | I <sub>OL</sub> = 50µA                            | 2V              |      |      | 0.2   |               | 0.2  |                | 0.2  | V    |
|                 |                                        |                                                   | 3V              |      |      | 0.3   |               | 0.3  |                | 0.3  |      |
|                 |                                        |                                                   | 4.5V            |      |      | 0.5   |               | 0.5  |                | 0.5  |      |
|                 |                                        | I <sub>OL</sub> = 3mA                             | 3V              |      |      | 0.36  |               | 0.44 |                | 0.55 |      |
|                 |                                        | I <sub>OL</sub> = 6mA                             | 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>CC</sub> | Supply Current                         | V <sub>I</sub> = 5.5V or GND<br>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 4)        |      | 195  |       |               |      |                |      | °C/W |
|                 |                                        | SOT353                                            |                 |      | 430  |       |               |      |                |      |      |
| θ <sub>JC</sub> | Thermal Resistance Junction-to-Case    | SOT25                                             | (Note 4)        |      | 58   |       |               |      |                |      | °C/W |
|                 |                                        | SOT353                                            |                 |      | 155  |       |               |      |                |      |      |

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

### Switching Characteristics

V<sub>CC</sub> = 3.3V ± 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 <sub>pd</sub> | A            | Y           | C <sub>L</sub> =15pF | 0.6  | 3.4  | 7.1  | 0.6           | 8.5  | 0.6            | 10.0 | ns   |
|                 |              |             | C <sub>L</sub> =50pF | 0.6  | 4.9  | 10.6 | 0.6           | 12.0 | 0.6            | 13.0 | ns   |

V<sub>CC</sub> = 5V ± 0.5V (see Figure 1)

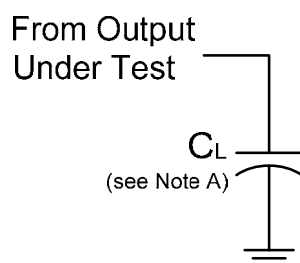
| Parameter       | From (Input) | TO (OUTPUT) |                      | 25°C |      |     | -40°C to 85°C |     | -40°C to 125°C |     | Unit |
|-----------------|--------------|-------------|----------------------|------|------|-----|---------------|-----|----------------|-----|------|
|                 |              |             |                      | Min  | Typ. | Max | Min           | Max | Min            | Max |      |
| t <sub>pd</sub> | A            | Y           | C <sub>L</sub> =15pF | 0.6  | 2.6  | 5.5 | 0.6           | 6.0 | 0.6            | 7.0 | ns   |
|                 |              |             | C <sub>L</sub> =50pF | 0.6  | 3.6  | 7.0 | 0.6           | 8.0 | 0.6            | 9.0 | ns   |

## Operating Characteristics

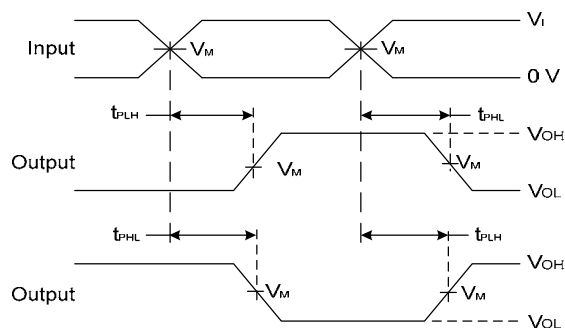
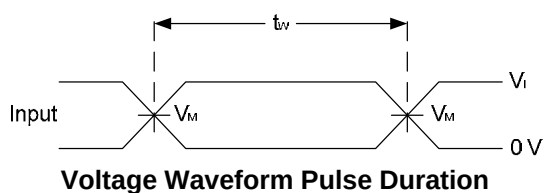
$T_A = 25^\circ\text{C}$

| Parameter |                               | Test Conditions               | $V_{CC} = 5V$ | Unit |
|-----------|-------------------------------|-------------------------------|---------------|------|
|           |                               |                               | Typ.          |      |
| $C_{pd}$  | Power dissipation capacitance | $f = 1\text{ MHz}$<br>No Load | 8             | pF   |

## Parameter Measurement Information



| $V_{CC}$        | Inputs   |                    | $V_M$      | $C_L$ |
|-----------------|----------|--------------------|------------|-------|
|                 | $V_I$    | $t_r/t_f$          |            |       |
| $3.3V \pm 0.3V$ | $V_{CC}$ | $\leq 3\text{ ns}$ | $V_{CC}/2$ | 15pF  |
| $5V \pm 0.5V$   | $V_{CC}$ | $\leq 3\text{ ns}$ | $V_{CC}/2$ | 15pF  |
| $3.3V \pm 0.3V$ | $V_{CC}$ | $\leq 3\text{ ns}$ | $V_{CC}/2$ | 50pF  |
| $5V \pm 0.5V$   | $V_{CC}$ | $\leq 3\text{ ns}$ | $V_{CC}/2$ | 50pF  |

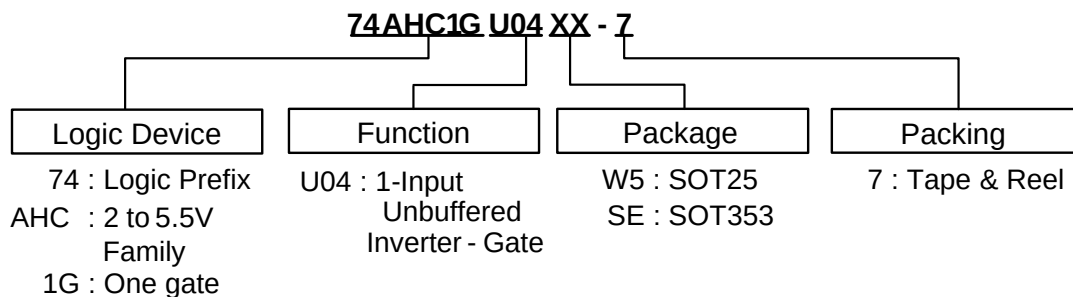


**Voltage Waveform Propagation Delay Times  
Inverting and Non Inverting Outputs**

**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  $\leq 1\text{ MHz}$ .
  - C. Inputs are measured separately one transition per measurement.
  - D.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{PD}$ .

### Ordering Information

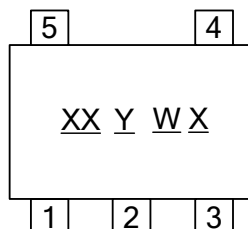


| Device         | Package Code | Packaging (Note 5) | 7" Tape and Reel |                    |
|----------------|--------------|--------------------|------------------|--------------------|
|                |              |                    | Quantity         | Part Number Suffix |
| 74AHC1GU04W5-7 | W5           | SOT25              | 3000/Tape & Reel | -7                 |
| 74AHC1GU04SE-7 | SE           | SOT353             | 3000/Tape & Reel | -7                 |

Notes: 5. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

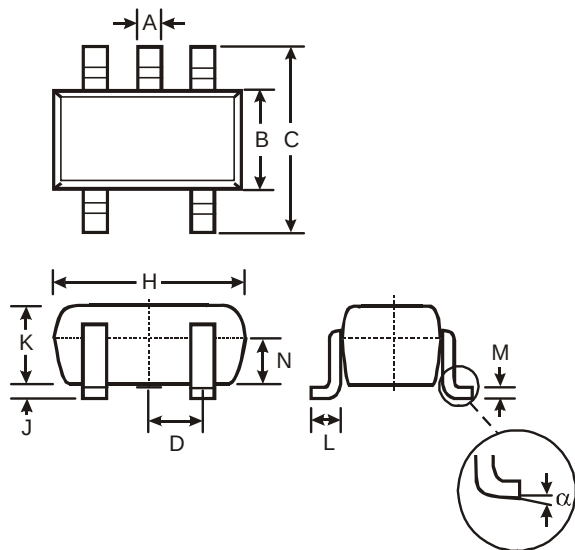
### Marking Information

(Top View)

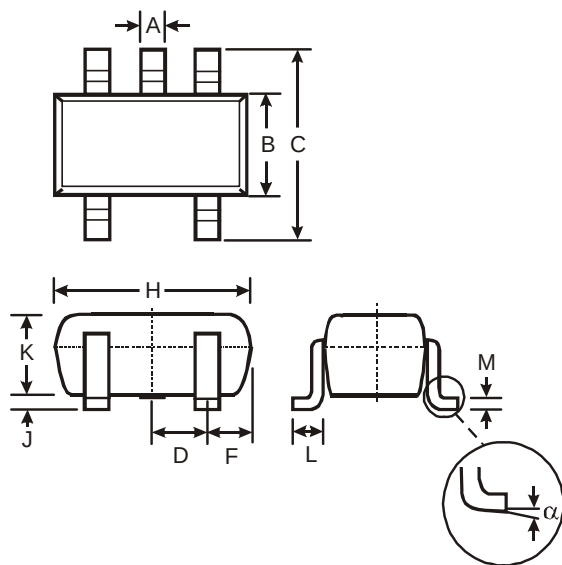


XX : Identification code  
Y : Year 0~9  
W : Week : A~Z : 1~26 week;  
           a~z : 27~52 week; z represents 52 and 53 week  
X : A~Z : Internal code

| Part Number  | Package | Identification Code |
|--------------|---------|---------------------|
| 74AHC1GU04W5 | SOT25   | YP                  |
| 74AHC1GU04SE | SOT353  | YP                  |

**Package Outline Dimensions (All Dimensions in mm)**
**(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  |
| 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 |
| $\alpha$             | 0°       | 8°   |
| All Dimensions in mm |          |      |

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