

Description

The 74LVCE1G04 is a single inverter gate with a standard totem pole output. The device is designed for operation with a power supply range of 1.4V to 5.5V. The inputs are tolerant to 5.5V allowing this device to be used in a mixed voltage environment. The device is fully specified for partial power down applications using I_{OFF}. The I_{OFF} circuitry disables the output preventing damaging current backflow when the device is powered down.

The gate performs the positive Boolean function:

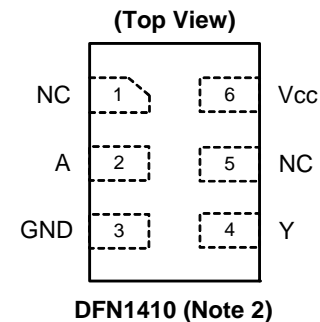
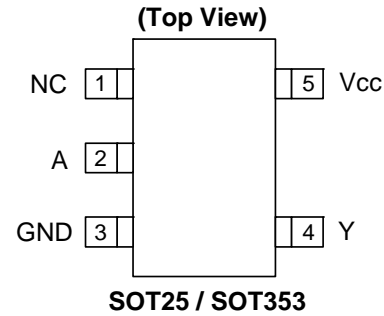
$$Y = \bar{A}$$

Features

- Extended Supply Voltage Range from 1.4 to 5.5V
- Switching speed characterized for operation at 1.5V
- Offers 30% speed improvement over LVC at 1.8V.
- ± 24mA Output Drive at 3.3V
- CMOS low power consumption
- IOFF Supports Partial-Power-Down Mode Operation
- Input accepts up to 5.5V
- ESD Protection Tested per JESD 22
Exceeds 200-V Machine Model (A115-A)
Exceeds 2000-V Human Body Model (A114-A)
- Latch-Up Exceeds 100mA per JESD 78, Class II
- Range of Package Options
- Direct Interface with TTL Levels
- SOT25, SOT353, and DFN1410: Assembled with "Green" Molding Compound (no Br, Sb)
- Lead Free Finish/ RoHS Compliant (Note 1)

- 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.
2. Pin 2 and pin 5 of the DFN1410 package are internally connected.

Pin Assignments



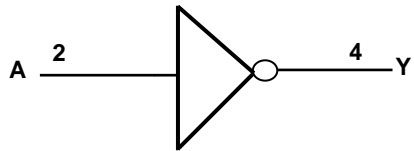
Applications

- Voltage Level Shifting
- 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
 - Cell Phones, Personal Navigation / GPS
 - MP3 players ,Cameras, Video Recorders

Pin Descriptions

| Pin Name | Description |
|----------|----------------|
| NC | No connection |
| A | Data Input |
| GND | Ground |
| Y | Data Output |
| Vcc | Supply Voltage |

Logic Diagram



Function Table

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

Absolute Maximum Ratings (Note 3)

| 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 impedance or I_{OFF} state | -0.5 to 6.5 | V |
| V_o | Voltage applied to output in high or low state | -0.3 to $V_{CC} + 0.5$ | V |
| I_{IK} | Input Clamp Current $V_I < 0$ | -50 | mA |
| I_{OK} | Output Clamp Current | -50 | mA |
| I_o | Continuous output current | ± 50 | mA |
| | Continuous current through Vdd or GND | ± 100 | mA |
| T_J | Operating Junction Temperature | -40 to 150 | $^{\circ}C$ |
| T_{STG} | Storage Temperature | -65 to 150 | $^{\circ}C$ |

Note: 3. 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 4)

| Symbol | Parameter | Min | Max | Unit | |
|-----------------|------------------------------------|-----------------------------------|------------------------|------------------------|------|
| V _{CC} | Operating Voltage | Operating | 1.4 | 5.5 | V |
| | | Data retention only | 1.2 | | V |
| V _{IH} | High-level Input Voltage | V _{CC} = 1.4 V to 1.95 V | 0.65 X V _{CC} | | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | | |
| | | V _{CC} = 3 V to 3.6 V | 2 | | |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7 X V _{CC} | | |
| V _{IL} | Low-level input voltage | V _{CC} = 1.4 V to 1.95 V | | 0.35 X V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | | 0.7 | |
| | | V _{CC} = 3 V to 3.6 V | | 0.8 | |
| | | V _{CC} = 4.5 V to 5.5 V | | 0.3 X V _{CC} | |
| V _I | Input Voltage | 0 | 5.5 | V | |
| V _O | Output Voltage | 0 | V _{CC} | V | |
| I _{OH} | High-level output current | V _{CC} =1.4 V | | -3 | mA |
| | | V _{CC} = 1.65 V | | -4 | |
| | | V _{CC} = 2.3 V | | -8 | |
| | | V _{CC} = 3 V | | -16 | |
| | | V _{CC} = 4.5 V | | -24 | |
| I _{OL} | Low-level output current | V _{CC} =1.4 V | | 3 | mA |
| | | V _{CC} = 1.65 V | | 4 | |
| | | V _{CC} = 2.3 V | | 8 | |
| | | V _{CC} = 3 V | | 16 | |
| | | V _{CC} = 4.5 V | | 24 | |
| Δt/ΔV | Input transition rise or fall rate | V _{CC} = 1.4 to 3V | | 20 | ns/V |
| | | V _{CC} = 3.3 V ± 0.3 V | | 10 | |
| | | V _{CC} = 5 V ± 0.5 V | | 5 | |
| T _A | Operating free-air temperature | -40 | 85 | °C | |

Note: 4. Unused inputs should be held at V_{CC} or Ground.

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

Over recommended free-air temperature range (unless otherwise noted)

| Symbol | Parameter | Test Conditions | Vcc | Min | Typ. | Max | Unit |
|---------------|--|----------------------------------|---------------|----------------|------|----------|--------------|
| V_{OH} | High Level Output Voltage | $I_{OH} = -100\mu A$ | 1.4 V to 5.5V | $V_{CC} - 0.1$ | | | V |
| | | $I_{OH} = -3mA$ | 1.4 V | 1.05 | | | |
| | | $I_{OH} = -4mA$ | 1.65 V | 1.2 | | | |
| | | $I_{OH} = -8mA$ | 2.3V | 1.9 | | | |
| | | $I_{OH} = -16mA$ | 3 V | 2.4 | | | |
| | | $I_{OH} = -24mA$ | | 2.3 | | | |
| | | $I_{OH} = -32mA$ | 4.5 V | 3.8 | | | |
| V_{OL} | High-level Input Voltage | $I_{OL} = 100\mu A$ | 1.4 V to 5.5V | | | 0.1 | V |
| | | $I_{OL} = 3mA$ | 1.4V | | | .4 | |
| | | $I_{OL} = 4mA$ | 1.65 V | | | 0.45 | |
| | | $I_{OL} = 8mA$ | 2.3V | | | 0.3 | |
| | | $I_{OL} = 16mA$ | 3 V | | | 0.4 | |
| | | $I_{OL} = 24mA$ | | | | 0.55 | |
| | | $I_{OL} = 32mA$ | 4.5 | | | 0.55 | |
| I_I | Input Current | $V_I = 5.5 V$ or GND | 0 to 5.5 V | | | ± 5 | μA |
| I_{OFF} | Power Down Leakage Current | V_I or $V_O = 5.5V$ | 0 | | | ± 10 | μA |
| I_{CC} | Supply Current | $V_I = 5.5V$ of GND $I_O = 0$ | 1.4 V to 5.5V | | | 10 | μA |
| C_i | Input Capacitance | $V_i = V_{CC} -$ or GND | 3.3 | | 3.5 | | pF |
| θ_{JA} | Thermal Resistance Junction-to-Ambient | SOT25 | (Note 5) | | 204 | | $^\circ C/W$ |
| | | SOT353 | (Note 5) | | 371 | | |
| | | DFN1410 | (Note 5) | | 430 | | |
| θ_{JC} | Thermal Resistance Junction-to-Case | SOT25 | (Note 5) | | 52 | | $^\circ C/W$ |
| | | SOT353 | (Note 5) | | 143 | | |
| | | DFN1410 | (Note 5) | | 190 | | |

Note: 5. Test condition for SOT25, SOT353, and DFN1410: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

Switching Characteristics

Over recommended free-air temperature range, CL = 15pF (see Figure 1)

| Parameter | From (Input) | TO (OUTPUT) | Vcc = 1.5 V ± 0.1V | | Vcc = 1.8 V ± 0.15V | | Vcc = 2.5 V ± 0.2V | | Vcc = 3.3 V ± 0.3V | | Vcc = 5 V ± 0.5V | | Unit |
|-----------------|--------------|-------------|--------------------|-----|---------------------|-----|--------------------|-----|--------------------|-----|------------------|-----|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | |
| t _{pd} | A | Y | 2 | 6.4 | 1.4 | 4.4 | 0.8 | 3.3 | 0.5 | 2.7 | 0.5 | 2.7 | ns |

Over recommended free-air temperature range, CL = 30 or 50pF as noted (see Figure 2)

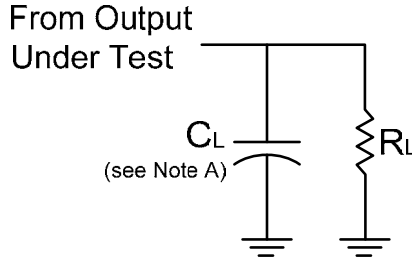
| Parameter | From (Input) | TO (OUTPUT) | Vcc = 1.5 V ± 0.1V | | Vcc = 1.8 V ± 0.15V | | Vcc = 2.5 V ± 0.2V | | Vcc = 3.3 V ± 0.3V | | Vcc = 5 V ± 0.5V | | Unit |
|-----------------|--------------|-------------|--------------------|-----|---------------------|-----|--------------------|-----|--------------------|-----|------------------|-----|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | |
| t _{pd} | A | Y | 3 | 7.5 | 2.1 | 5.2 | 1.1 | 4.1 | 0.8 | 3.4 | 0.9 | 3.3 | ns |

Operating Characteristics

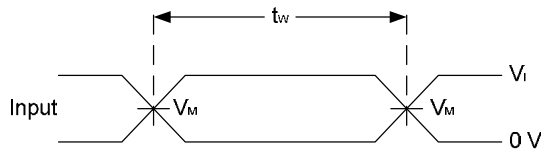
T_A = 25 °C

| Parameter | | Test Conditions | Vcc = 1.5 V | Vcc = 1.8 V | Vcc = 2.5 V | Vcc = 3.3 V | Vcc = 5 V | Unit |
|-----------------|-------------------------------|-----------------|-------------|-------------|-------------|-------------|-----------|------|
| | | | TYP | TYP | TYP | TYP | TYP | |
| C _{pd} | Power dissipation capacitance | f = 10 MHz | 16 | 16 | 18 | 18 | 20 | pF |

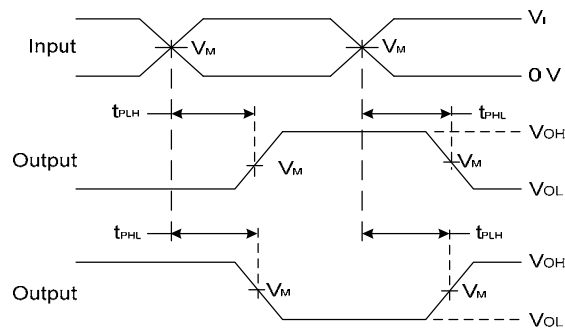
Parameter Measurement Information



| V _{CC} | Inputs | | V _M | C _L | R _L |
|-----------------|-----------------|--------------------------------|--------------------|----------------|----------------|
| | V _I | t _r /t _f | | | |
| 1.5V±0.1V | V _{CC} | ≤2ns | V _{CC} /2 | 15pF | 1MΩ |
| 1.8V±0.15V | V _{CC} | ≤2ns | V _{CC} /2 | 15pF | 1MΩ |
| 2.5V±0.2V | V _{CC} | ≤2ns | V _{CC} /2 | 15pF | 1MΩ |
| 3.3V±0.3V | 3V | ≤2.5ns | 1.5V | 15pF | 1MΩ |
| 5V±0.5V | V _{CC} | ≤2.5ns | V _{CC} /2 | 15pF | 1MΩ |



**Voltage Waveform
Pulse Duration**

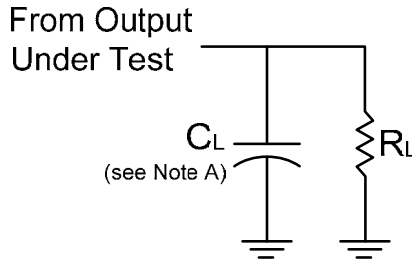


**Voltage Waveform
Propagation Delay Times
Inverting and Non Inverting Outputs**

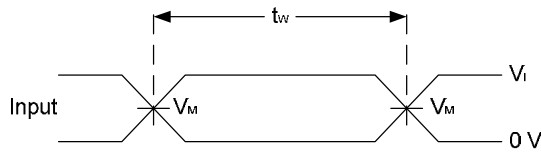
- Notes:
- A. Includes test lead and test apparatus capacitance.
 - B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
 - C. Inputs are measured separately one transition per measurement.
 - D. t_{PLH} and t_{PHL} are the same as t_{PD}.

Figure 1. Load Circuit and Voltage Waveforms

Parameter Measurement Information (Continued)



| V_{CC} | Inputs | | V_M | C_L | R_L |
|------------------|----------|--------------|------------|-------|--------------|
| | V_I | t_r/t_f | | | |
| $1.5V \pm 0.1V$ | V_{CC} | $\leq 2ns$ | $V_{CC}/2$ | 30pF | 1K Ω |
| $1.8V \pm 0.15V$ | V_{CC} | $\leq 2ns$ | $V_{CC}/2$ | 30pF | 1K Ω |
| $2.5V \pm 0.2V$ | V_{CC} | $\leq 2ns$ | $V_{CC}/2$ | 30pF | 500 Ω |
| $3.3V \pm 0.3V$ | 3V | $\leq 2.5ns$ | 1.5V | 50pF | 500 Ω |
| $5V \pm 0.5V$ | V_{CC} | $\leq 2.5ns$ | $V_{CC}/2$ | 50pF | 500 Ω |



**Voltage Waveform
Pulse Duration**



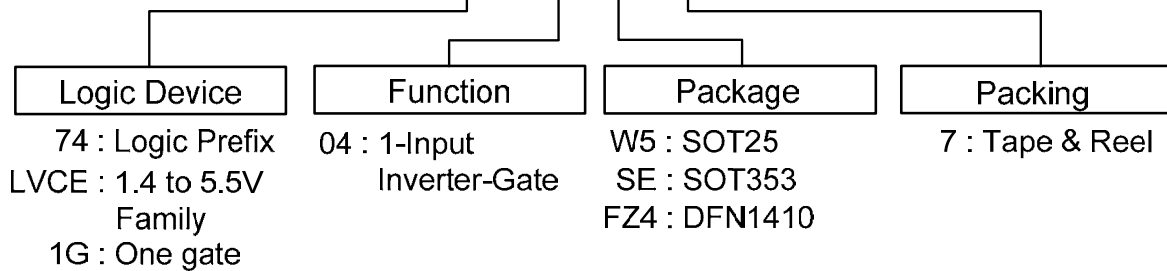
**Voltage Waveform
Propagation Delay Times
Inverting and Non Inverting Outputs**

- Notes: A. Includes test lead and test apparatus capacitance.
 B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
 C. Inputs are measured separately one transition per measurement.
 D. t_{PLH} and t_{PHL} are the same as t_{PD} .

Figure 2. Load Circuit and Voltage Waveforms

Ordering Information

74LVCE1G 04 XXX - 7



| Device | Package Code | Packaging (Note 5) | 7" Tape and Reel | |
|-----------------|--------------|--------------------|------------------|--------------------|
| | | | Quantity | Part Number Suffix |
| 74LVCE1G04W5-7 | W6 | SOT25 | 3000/Tape & Reel | -7 |
| 74LVCE1G04SE-7 | SE | SOT353 | 3000/Tape & Reel | -7 |
| 74LVCE1G04FZ4-7 | FZ4 | DFN1410 | 5000/Tape & Reel | -7 |



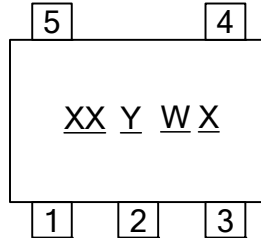
Note: 6. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

NEW PRODUCT

Marking Information

(1) SOT25 and SOT353

(Top View)

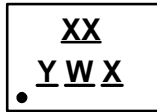


XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents
52 and 53 week
X : A~Z : Internal code

| Part Number | Package | Identification Code |
|--------------|---------|---------------------|
| 74LVCE1G04W5 | SOT25 | PU |
| 74LVCE1G04SE | SOT353 | PV |

(2) DFN1410H4-6

(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 |
|---------------|---------|---------------------|
| 74LVCE1G04FZ4 | DFN1410 | PU |

Package Outline Dimensions (All Dimensions in mm)

(1) Package Type: SOT25

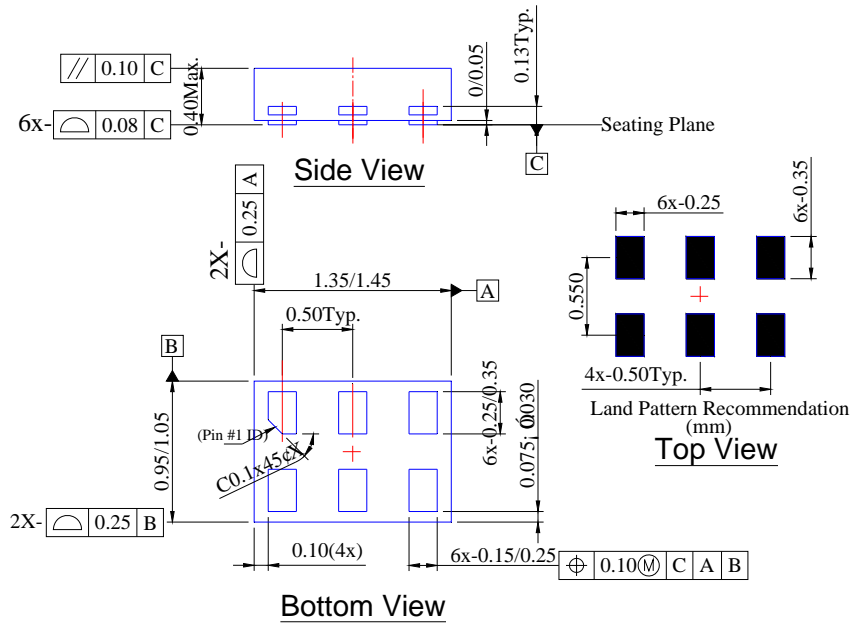


(2) Package Type: SOT353



Package Outline Dimensions (All Dimensions in mm)

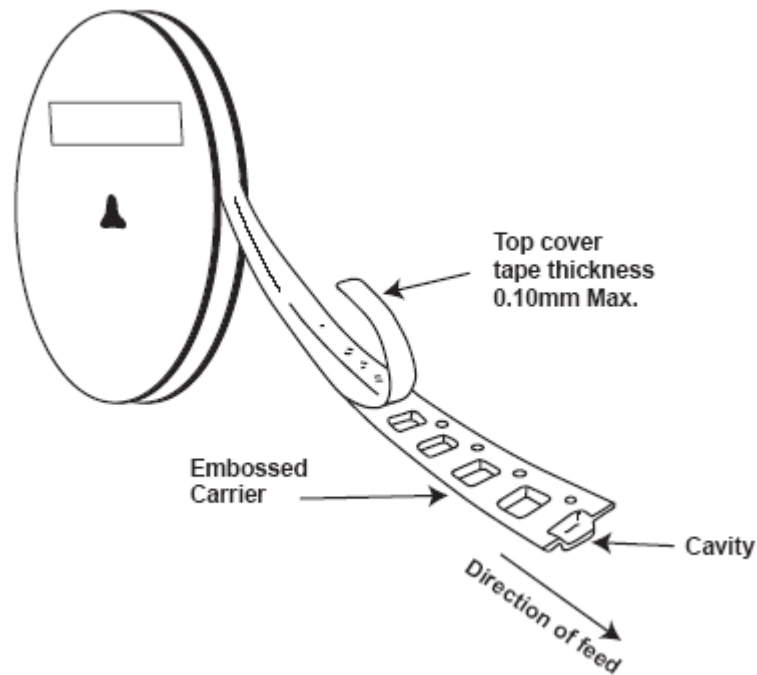
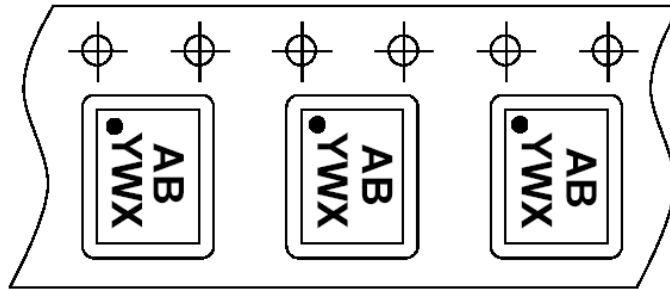
(3) Package Type: DFN1410



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Taping Orientation (Note 7)

For DFN1410



Note: 7. The taping orientation of the other package type can be found on our website at <http://www.diodes.com/datasheets/ap02007.pdf>

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