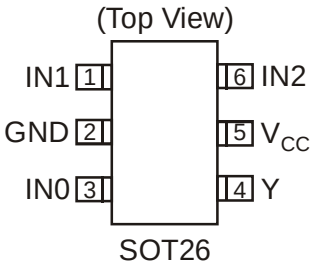
# 74LVC1G97

## CONFIGURABLE MULTIPLE-FUNCTION GATE

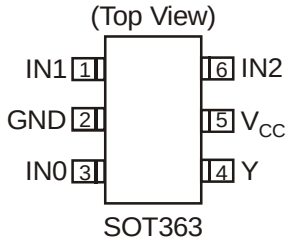
## Description

The 74LVC1G97 is a single 3-input positive configurable multiple function gate with a standard push-pull output. The output state is determined by eight patterns of 3-bit input. The user can chose the logic functions MUX, AND, OR, NAND, NOR, inverter or non-inverting buffer. All inputs can be connected to ground or Vcc as required. The device is designed for operation with a power supply range of 1.65V 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 IOFF. The IOFF circuitry disables the output preventing damaging current backflow when the device is powered down. The user is reminded that the device can simulate several types of logic gates but may respond differently due to the Schmitt action at the inputs.

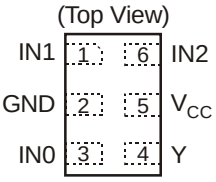
## Pin Assignments



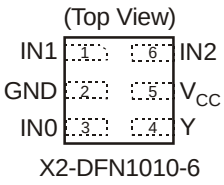
SOT26



SOT363



X2-DFN1410-6



X2-DFN1010-6

## Features

- Wide Supply Voltage Range from 1.65V to 5.5V
- ± 24mA Output Drive at 3.3V
- CMOS low power consumption
- IOFF Supports Partial-Power-Down Mode Operation
- Inputs accept up to 5.5V
- 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
- Range of Package Options
- SOT26, SOT363, X2-DFN1410-6, and X2-DFN1010-6: Available in “Green” Molding Compound (no Br, Sb)
  - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
  - **Halogen and Antimony Free. “Green” Device (Note 3)**

## Applications

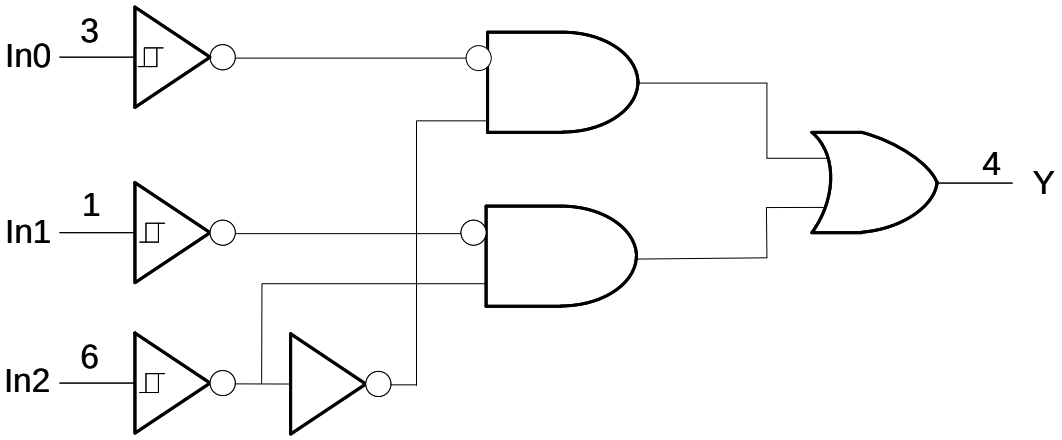
- Voltage Level Shifting
- General Purpose Logic
- Power Down Signal Isolation
- Wide array of products such as:
  - PCs, networking, notebooks, netbooks, PDAs
  - Computer peripherals, hard drives, CD/DVD ROM
  - TV, DVD, DVR, set top box
  - Cell Phones, Personal Navigation / GPS
  - MP3 players ,Cameras,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

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 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 Descriptions

| Pin Name | Description |
|---|---|
| IN1 | Data Input |
| GND | Ground |
| IN0 | Data Input |
| Y | Data Output |
| $V_{CC}$ | Supply Voltage |
| IN2 | Data Input |

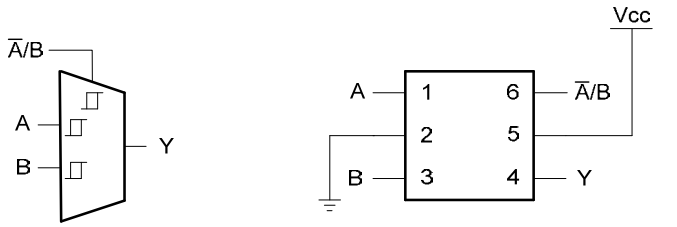
## Logic Diagram



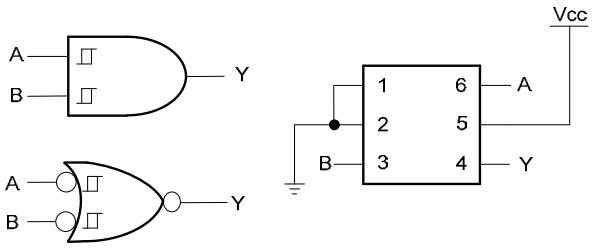

## Function Table

| Inputs | | | Output |
|---|---|---|---|
| IN2 | IN1 | IN0 | Y |
| L | L | L | L |
| L | L | H | L |
| L | H | L | H |
| L | H | H | H |
| H | L | L | L |
| H | L | H | H |
| H | H | L | L |
| H | H | H | H |

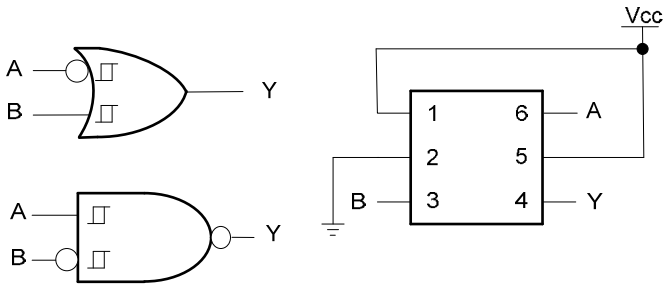
## Logic Configurations



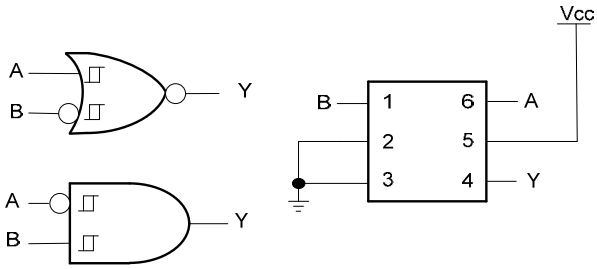

Configuration 1
2 to 1 Data Selector



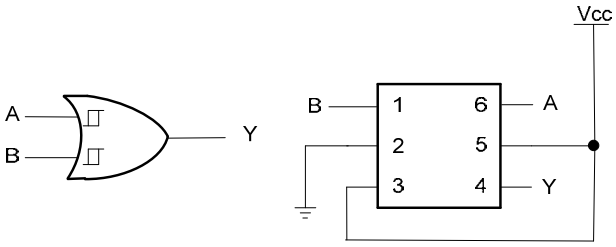

Configuration 2
2-Input AND Gate
2-Input NOR Gate with Both Inputs Inverted



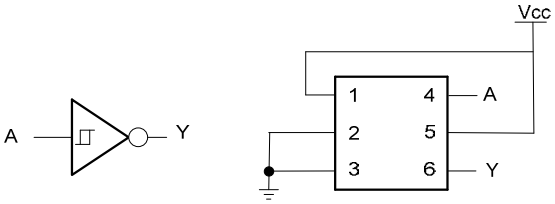

Configuration 3
2-Input NAND Gate with B Input Inverted
2-Input OR Gate with A Input Inverted




Configuration 4
2-Input NOR Gate with One Input Inverted
2-Input AND Gate with One Input Inverted




Configuration 5
2-Input OR Gate




Configuration 6
Inverter

| Function Selection Table | |
|---|---|
| **Logic Function** | **Configuration** |
| 2-to-1 Data Selector | 1 |
| 2-input AND gate | 2 |
| 2-input AND with inverted input | 3, 4 |
| 2-input NOR with inverted input | 3, 4 |
| 2-input OR | 5 |
| 2-input NOR with both inputs inverted | 2 |
| 1-input Inverter | 6 |

## Absolute Maximum Ratings (Note 4)

| 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 | °C |
| $T_{STG}$ | Storage Temperature | -65 to +150 | °C |

Notes: 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.

## Recommended Operating Conditions (Note 5)

| Symbol | Parameter | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Operating Voltage | Operating | 1.65 | 5.5 | V |
| | | Data retention only | 1.5 | | V |
| $V_I$ | Input Voltage | | 0 | 5.5 | V |
| $V_O$ | Output Voltage | | 0 | $V_{CC}$ | V |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 1.65V | | -4 | mA |
| | | $V_{CC}$ = 2.3V | | -8 | |
| | | $V_{CC}$ = 3V | | -16 | |
| | | | | -24 | |
| | | $V_{CC}$ = 4.5V | | -32 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 1.65V | | 4 | mA |
| | | $V_{CC}$ = 2.3V | | 8 | |
| | | $V_{CC}$ = 3V | | 16 | |
| | | | | 24 | |
| | | $V_{CC}$ = 4.5V | | 32 | |
| Δt/ΔV | Input transition rise or fall rate | $V_{CC}$ = 1.8V ± 0.15V, 2.5V ± 0.2V | | 20 | ns/V |
| | | $V_{CC}$ = 3.3V ± 0.3V | | 10 | |
| | | $V_{CC}$ = 5V ± 0.5V | | 5 | |
| $T_A$ | Operating free-air temperature | | -40 | +125 | ºC |

Notes: 5. Unused inputs should be held at $V_{CC}$ or Ground.

## Electrical Characteristics $T_A$ = -40°C to +85°C (All typical values are at $V_{CC}$ = 3.3V, $T_A$ = +25°C)

| Symbol | Parameter | Test Conditions | $V_{CC}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{T+}$ | Positive-going input threshold voltage | | 1.65V | 0.70 | | 1.20 | |
| | | | 2.3V | 1.11 | | 1.60 | |
| | | | 3V | 1.50 | | 2.00 | |
| | | | 4.5V | 2.16 | | 2.74 | |
| | | | 5.5V | 2.61 | | 3.33 | |
| $V_{T-}$ | Negative-going input threshold voltage | | 1.65V | 0.30 | | 0.72 | |
| | | | 2.3V | 0.58 | | 1.00 | |
| | | | 3V | 0.80 | | 1.30 | |
| | | | 4.5V | 1.21 | | 1.95 | |
| | | | 5.5V | 1.45 | | 2.35 | |
| $\Delta V_T$ | Hysteresis ($V_{T+}$ - $V_{T-}$) | | 1.65V | 0.30 | | 0.62 | |
| | | | 2.3V | 0.40 | | 0.80 | |
| | | | 3V | 0.35 | | 1.00 | |
| | | | 4.5V | 0.55 | | 1.10 | |
| | | | 5.5V | 0.60 | | 1.20 | |
| $V_{OH}$ | High Level Output Voltage | $I_{OH}$ = -100µA | 1.65V to 5.5V | $V_{CC}$ – 0.1 | | | V |
| | | $I_{OH}$ = -4mA | 1.65V | 1.2 | | | |
| | | $I_{OH}$ = -8mA | 2.3V | 1.9 | | | |
| | | $I_{OH}$ = -16mA | 3V | 2.4 | | | |
| | | $I_{OH}$ = -24mA | | 2.3 | | | |
| | | $I_{OH}$ = -32mA | 4.5V | 3.8 | | | |
| $V_{OL}$ | High-level Input Voltage | $I_{OL}$ = 100µA | 1.65V to 5.5V | | | 0.1 | V |
| | | $I_{OL}$ = 4mA | 1.65V | | | 0.45 | |
| | | $I_{OL}$ = 8mA | 2.3V | | | 0.3 | |
| | | $I_{OL}$ = 16mA | 3V | | | 0.4 | |
| | | $I_{OL}$ = 24mA | | | | 0.55 | |
| | | $I_{OL}$ = 32mA | 4.5V | | | 0.55 | |
| $I_I$ | Input Current | $V_I$ = 5.5V or GND | 0 to 5.5V | | | ± 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<br>$I_O$=0 | 1.65V to 5.5V | | | 10 | µA |
| $\Delta I_{CC}$ | Additional Supply Current | One input at $V_{CC}$ –0.6V<br>Other inputs at $V_{CC}$ or GND | 3V to 5.5V | | | 500 | µA |

## Electrical Characteristics $T_A$ = -40°C to +125°C (All typical values are at $V_{CC}$ = 3.3V, $T_A$ = +25°C)

| Symbol | Parameter | Test Conditions | $V_{CC}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{T+}$ | Positive-going input threshold voltage | | 1.65V | 0.70 | | 1.20 | |
| | | | 2.3V | 1.11 | | 1.60 | |
| | | | 3V | 1.50 | | 2.00 | |
| | | | 4.5V | 2.16 | | 2.74 | |
| | | | 5.5V | 2.61 | | 3.33 | |
| $V_{T-}$ | Negative-going input threshold voltage | | 1.65V | 0.30 | | 0.75 | |
| | | | 2.3V | 0.58 | | 1.03 | |
| | | | 3V | 0.80 | | 1.33 | |
| | | | 4.5V | 1.21 | | 1.95 | |
| | | | 5.5V | 1.45 | | 2.35 | |
| $\Delta V_T$ | Hysteresis ($V_{T+}$ - $V_{T-}$) | | 1.65V | 0.30 | | 0.62 | |
| | | | 2.3V | 0.37 | | 0.80 | |
| | | | 3V | 0.32 | | 1.00 | |
| | | | 4.5V | 0.50 | | 1.20 | |
| | | | 5.5V | 0.55 | | 1.40 | |
| $V_{OH}$ | High Level Output Voltage | $I_{OH}$ = -100µA | 1.65V to 5.5V | $V_{CC}$ -0.1 | | | V |
| | | $I_{OH}$ = -4mA | 1.65V | 0.95 | | | |
| | | $I_{OH}$ = -8mA | 2.3V | 1.7 | | | |
| | | $I_{OH}$ = -16mA | 3V | 1.9 | | | |
| | | $I_{OH}$ = -24mA | | 2.0 | | | |
| | | $I_{OH}$ = -32mA | 4.5V | 3.4 | | | |
| $V_{OL}$ | High-level Input Voltage | $I_{OL}$ = 100µA | 1.65V to 5.5V | | | 0.1 | V |
| | | $I_{OL}$ = 4mA | 1.65V | | | 0.7 | |
| | | $I_{OL}$ = 8mA | 2.3V | | | 0.45 | |
| | | $I_{OL}$ = 16mA | 3V | | | 0.6 | |
| | | $I_{OL}$ = 24mA | | | | 0.8 | |
| | | $I_{OL}$ = 32mA | 4.5V | | | 0.8 | |
| $I_I$ | Input Current | $V_I$ = 5.5V or GND | 0 to 5.5V | | | ± 100 | µA |
| $I_{OFF}$ | Power Down Leakage Current | $V_I$ or $V_O$ = 5.5V | 0 | | | ± 200 | µA |
| $I_{CC}$ | Supply Current | $V_I$ = 5.5V of GND<br>$I_O$=0 | 1.65V to 5.5V | | | 200 | µA |
| $\Delta I_{CC}$ | Additional Supply Current | One input at $V_{CC}$ -0.6V<br>Other inputs at $V_{CC}$ or GND | 3V to 5.5V | | | 5000 | µA |

## Electrical Characteristics (All typical values are at $V_{CC}$ = 3.3V, $T_A$ = +25°C)

| Symbol | Parameter | Test Conditions | $V_{CC}$ | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $C_I$ | Input Capacitance | $V_I = V_{CC}$ – or GND | 3.3 | | 3.5 | | pF |
| $\theta_{JA}$ | Thermal Resistance Junction-to-Ambient | SOT26 | (Note 6) | | 204 | | °C/W |
| | | SOT363 | | | 371 | | |
| | | X2-DFN1410-6 | | | 430 | | |
| | | X2-DFN1010-6 | | | 510 | | |
| $\theta_{JC}$ | Thermal Resistance Junction-to-Case | SOT26 | (Note 6) | | 52 | | °C/W |
| | | SOT363 | | | 143 | | |
| | | X2-DFN1410-6 | | | 190 | | |
| | | X2-DFN1010-6 | | | 250 | | |

Notes: 6. Test condition for SOT26, SOT363, X2-DFN1410-6 and X2-DFN1010-6 : Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

## Switching Characteristics

**$T_A$ = -40°C to +85°C**, $C_L$ = 30 or 50pF as noted (see Figure 1)

| Parameter | From (Input) | TO (OUTPUT) | $V_{CC}$ = 1.8V ± 0.15V | | $V_{CC}$ = 2.5V ± 0.2V | | $V_{CC}$ = 3.3V ± 0.3V | | $V_{CC}$ = 5V ± 0.5V | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| $t_{pd}$ | Any | Y | 1.0 | 14.4 | 0.7 | 8.3 | 0.7 | 6.3 | 0.7 | 5.1 | ns |

**$T_A$ = -40°C to +125°C**, $C_L$ = 30 or 50pF as noted (see Figure 1)

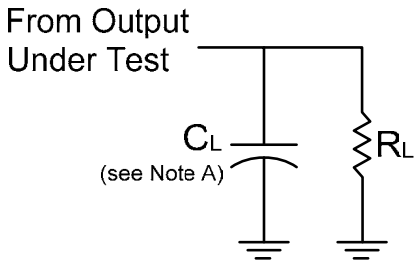
| Parameter | From (Input) | TO (OUTPUT) | $V_{CC}$ = 1.8V ± 0.15V | | $V_{CC}$ = 2.5V ± 0.2V | | $V_{CC}$ = 3.3V ± 0.3V | | $V_{CC}$ = 5V ± 0.5V | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| $t_{pd}$ | Any | Y | 1.0 | 18.0 | 0.7 | 10.4 | 0.7 | 7.9 | 0.7 | 6.4 | ns |

## Operating Characteristics

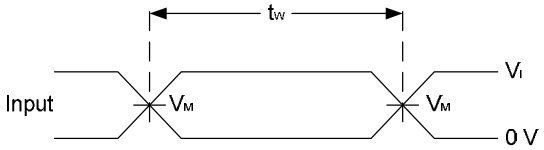
**$T_A$ = +25°C**

| Parameter | | Test Conditions | $V_{CC}$ = 1.8V | $V_{CC}$ = 2.5V | $V_{CC}$ = 3.3V | $V_{CC}$ = 5V | Unit |
|---|---|---|---|---|---|---|---|
| | | | Typ. | Typ. | Typ. | Typ. | |
| $C_{pd}$ | Power dissipation capacitance | f = 10 MHz | 22 | 22 | 23 | 24 | pF |

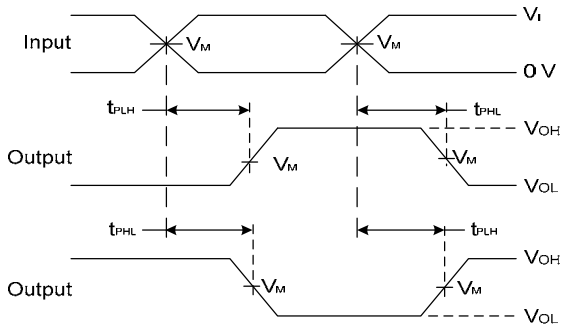
## Parameter Measurement Information




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




**Voltage Waveform**
**Pulse Duration**

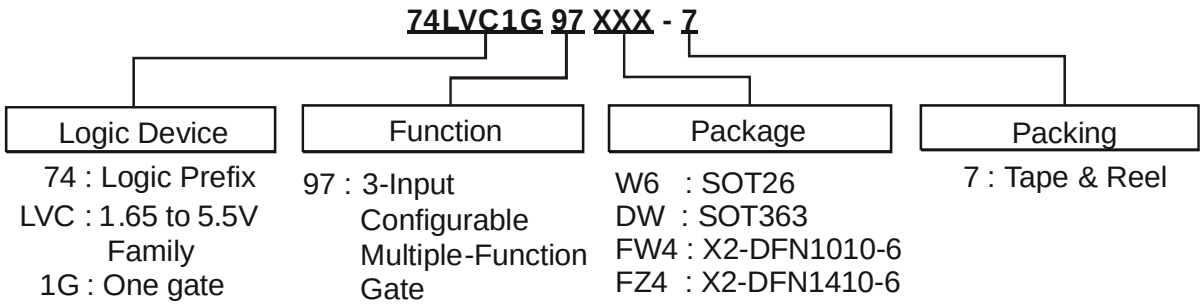



**Voltage Waveform**
**Propagation Delay Times**
**Inverting and Non Inverting Outputs**

**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 ≤ 10 MHz
C. Inputs are measured separately one transition per measurement
D. $t_{PLH}$ and $t_{PHL}$ are the same as $t_{PD}$

## Ordering Information

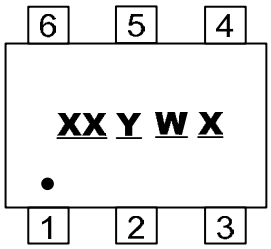



| Device | Package Code | Packaging (Note 7) | 7" Tape and Reel | |
|---|---|---|---|---|
| | | | Quantity | Part Number Suffix |
| 74LVC1G97W6-7 | W6 | SOT26 | 3000/Tape & Reel | -7 |
| 74LVC1G97DW-7 | DW | SOT363 | 3000/Tape & Reel | -7 |
| 74LVC1G97FW4-7 | FW4 | X2-DFN1010-6 | 5000/Tape & Reel | -7 |
| 74LVC1G97FZ4-7 | FZ4 | X2-DFN1410-6 | 5000/Tape & Reel | -7 |

Notes: 7. 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

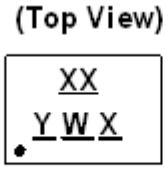
**(1) SOT26, SOT363**




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 |
|---|---|---|
| 74LVC1G97W6 | SOT26 | TY |
| 74LVC1G97DW | SOT363 | TY |

**(2) X2-DFN1010-6, X2-DFN1410-6**

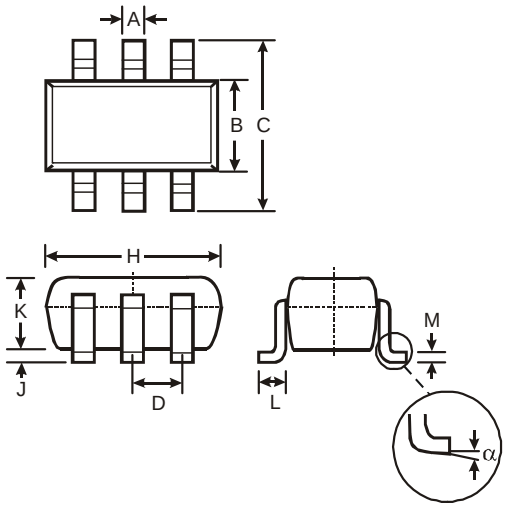



XX : Identification Code
Y : Year : 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents
52 and 53 week
X : A~Z : Internal code

| Part Number | Package | Identification Code |
|---|---|---|
| 74LVC1G97FW4 | X2-DFN1010-6 | TY |
| 74LVC1G97FZ4 | X2-DFN1410-6 | TY |

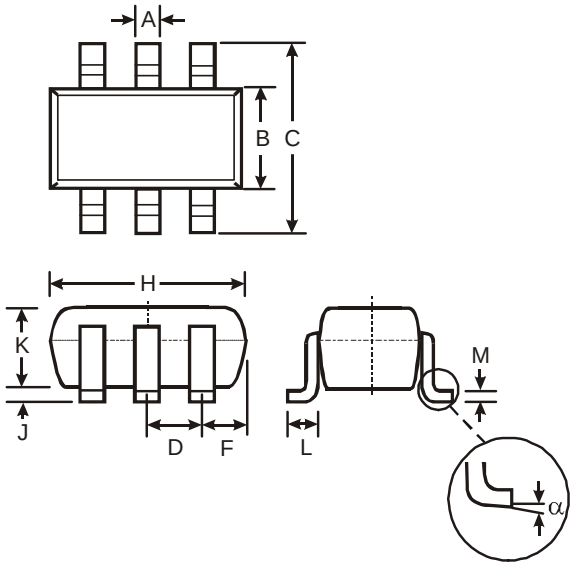
## Package Outline Dimensions (All Dimensions in mm)

### (1) SOT26




| SOT26 | | | |
|---|---|---|---|
| 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 |
| α | 0° | 8° | — |
| All Dimensions in mm | | | |

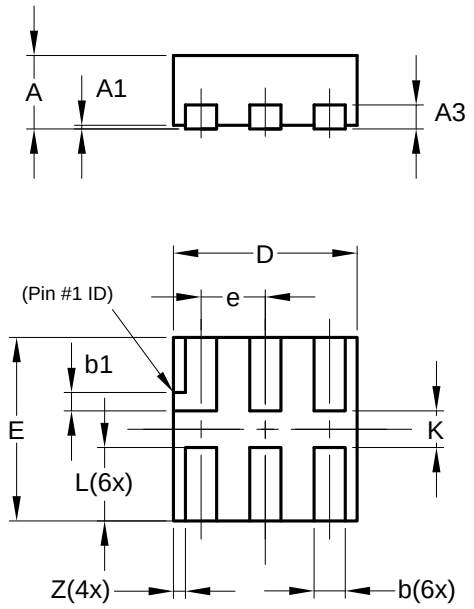
### (2) SOT363




| SOT363 | | |
|---|---|---|
| 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 | | |

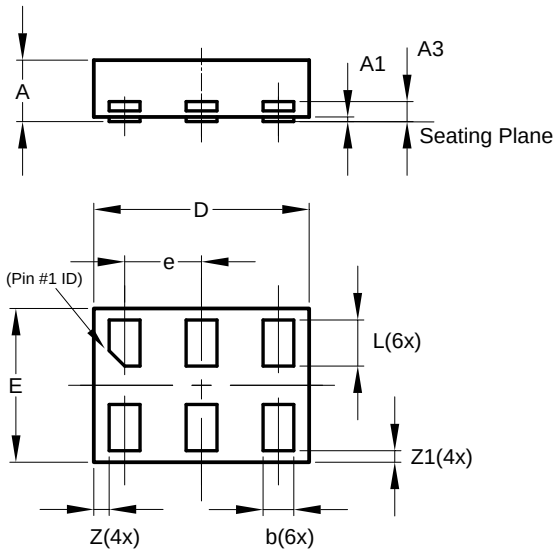
## Package Outline Dimensions (All Dimensions in mm)

### (3) X2-DFN1010-6




| X2-DFN1010-6 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | — | 0.40 | 0.39 |
| **A1** | 0.00 | 0.05 | 0.02 |
| **A3** | — | — | 0.13 |
| **b** | 0.14 | 0.20 | 0.17 |
| **b1** | 0.05 | 0.15 | 0.10 |
| **D** | 0.95 | 1.05 | 1.00 |
| **E** | 0.95 | 1.05 | 1.00 |
| **e** | — | — | 0.35 |
| **L** | 0.35 | 0.45 | 0.40 |
| **K** | 0.15 | — | — |
| **Z** | — | — | 0.065 |
| **All Dimensions in mm** | | | |

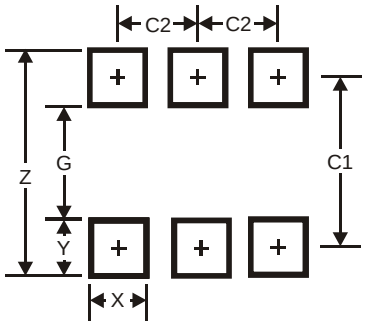
### (4) X2-DFN1410-6




| X2-DFN1410-6 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | — | 0.40 | 0.39 |
| **A1** | 0.00 | 0.05 | 0.02 |
| **A3** | — | — | 0.13 |
| **b** | 0.15 | 0.25 | 0.20 |
| **D** | 1.35 | 1.45 | 1.40 |
| **E** | 0.95 | 1.05 | 1.00 |
| **e** | — | — | 0.50 |
| **L** | 0.25 | 0.35 | 0.30 |
| **Z** | — | — | 0.10 |
| **Z1** | 0.045 | 0.105 | 0.075 |
| **All Dimensions in mm** | | | |

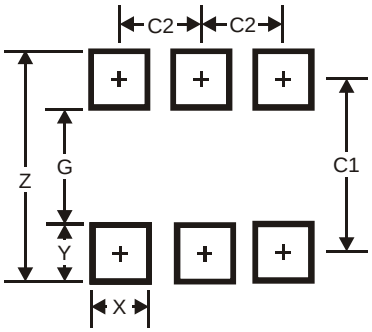
## Suggest Pad Layout

### (1) SOT26



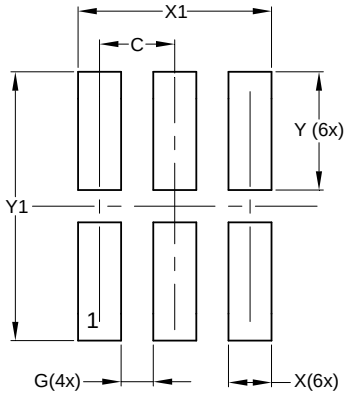

| Dimensions | Value (in mm) |
|---|---|
| Z | 3.20 |
| G | 1.60 |
| X | 0.55 |
| Y | 0.80 |
| C1 | 2.40 |
| C2 | 0.95 |

### (2) SOT363




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

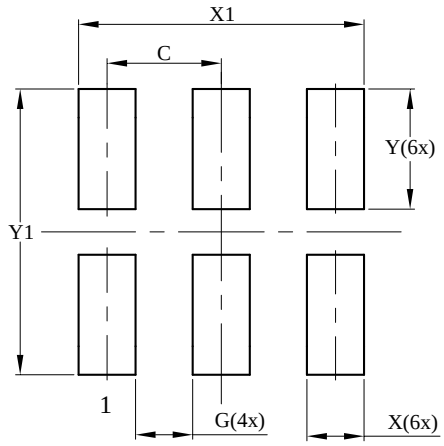
### (3) X2-DFN1010-6




| Dimensions | Value (in mm) |
|---|---|
| C | 0.350 |
| G | 0.150 |
| X | 0.200 |
| X1 | 0.900 |
| Y | 0.550 |
| Y1 | 1.250 |

## Suggest Pad Layout

**(4) X2-DFN1410-6**




| Dimensions | Value (in mm) |
|---|---|
| C | 0.500 |
| G | 0.250 |
| X | 0.250 |
| X1 | 1.250 |
| Y | 0.525 |
| Y1 | 1.250 |

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