# 74LVC2G04
# Dual Inverter

## GENERAL DESCRIPTION

The 74LVC2G04 contains two independent inverters and it is designed for 1.65V to 5.5V $V_{CC}$ operation. The device performs the Boolean function Y = $\overline{A}$.

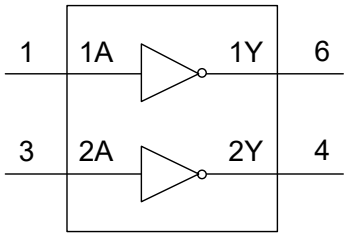
Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V and 5V environment.

This device is fully specified for partial power-down applications using $I_{OFF}$. The $I_{OFF}$ circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

## FEATURES

- **5V Tolerant Inputs for Interfacing with 5V Logic**
- **Wide Supply Voltage Range: 1.65V to 5.5V**
- **High Noise Immunity**
- **±24mA Output Drive at $V_{CC}$ = 3.0V**
- **CMOS Low Power Consumption**
- **Direct Interface with TTL Levels**
- **Inputs Accept Voltages up to 5V**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green SOT-23-6 Package**

## LOGIC SYMBOL



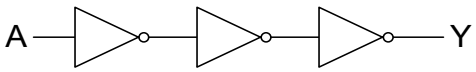

## FUNCTION TABLE

| INPUT | OUTPUT |
|---|---|
| nA | nY |
| L | H |
| H | L |

H = High Voltage Level

L = Low Voltage Level

## LOGIC DIAGRAM

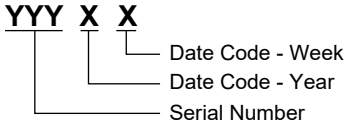


# PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| 74LVC2G04 | SOT-23-6 | -40℃ to +125℃ | 74LVC2G04XN6G/TR | R53XX | Tape and Reel, 3000 |

## MARKING INFORMATION

NOTE: XX = Date Code.




Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

## ABSOLUTE MAXIMUM RATINGS (1)

Supply Voltage, $V_{CC}$ ..... -0.5V to 6.5V
Input Voltage, $V_I$ (2) ..... -0.5V to 6.5V
Output Voltage, $V_O$ (2) (3)
Active Mode ..... -0.5V to $V_{CC}$ + 0.5V
Power-Down Mode ..... -0.5V to 6.5V
Input Clamping Current, $I_{IK}$ ($V_I$ < 0V) ..... -50mA
Output Clamping Current, $I_{OK}$ ($V_O$ > $V_{CC}$ or $V_O$ < 0V) ..... ±50mA
Output Current, $I_O$ ($V_O$ = 0V to $V_{CC}$) ..... ±50mA
Supply Current, $I_{CC}$ ..... 100mA
Ground Current, $I_{GND}$ ..... -100mA
Junction Temperature (4) ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM ..... 8000V
CDM ..... 1000V

## RECOMMENDED OPERATING CONDITIONS

Supply Voltage, $V_{CC}$ ..... 1.65V to 5.5V
Input Voltage, $V_I$ ..... 0V to 5.5V
Output Voltage, $V_O$
Active Mode ..... 0V to $V_{CC}$
Power-Down Mode, $V_{CC}$ = 0V ..... 0V to 5.5V
Input Transition Rise and Fall Rate, Δt/ΔV
$V_{CC}$ = 1.65V to 2.7V ..... 20ns/V (MAX)
$V_{CC}$ = 2.7V to 5.5V ..... 10ns/V (MAX)
Operating Temperature Range ..... -40℃ to +125℃

## OVERSTRESS CAUTION

1. Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

2. The input and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.

3. When $V_{CC}$ = 0V (power-down mode), the output voltage can be 5.5V in normal operation.

4. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

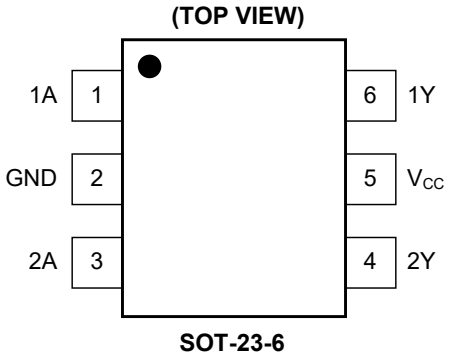
## ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

## DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

## PIN CONFIGURATION




## PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|---|---|---|
| 1, 3 | 1A, 2A | Data Inputs. |
| 2 | GND | Ground. |
| 4, 6 | 2Y, 1Y | Data Outputs. |
| 5 | $V_{CC}$ | Supply Voltage. |

# ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at $V_{CC}$ = 3.3V and $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | $V_{CC}$ = 1.65V to 1.95V | | Full | 0.65 × $V_{CC}$ | | | V |
| | | $V_{CC}$ = 2.3V to 2.7V | | Full | 1.7 | | | |
| | | $V_{CC}$ = 2.7V to 3.6V | | Full | 2 | | | |
| | | $V_{CC}$ = 4.5V to 5.5V | | Full | 0.7 × $V_{CC}$ | | | |
| Low-Level Input Voltage | $V_{IL}$ | $V_{CC}$ = 1.65V to 1.95V | | Full | | | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3V to 2.7V | | Full | | | 0.7 | |
| | | $V_{CC}$ = 2.7V to 3.6V | | Full | | | 0.8 | |
| | | $V_{CC}$ = 4.5V to 5.5V | | Full | | | 0.3 × $V_{CC}$ | |
| High-Level Output Voltage | $V_{OH}$ | $V_I$ = $V_{IH}$ or $V_{IL}$ | $V_{CC}$ = 1.65V to 5.5V, $I_O$ = -100μA | Full | $V_{CC}$ - 0.05 | $V_{CC}$ - 0.01 | | V |
| | | | $V_{CC}$ = 1.65V, $I_O$ = -4mA | Full | 1.43 | 1.55 | | |
| | | | $V_{CC}$ = 2.3V, $I_O$ = -8mA | Full | 2.02 | 2.18 | | |
| | | | $V_{CC}$ = 2.7V, $I_O$ = -12mA | Full | 2.38 | 2.56 | | |
| | | | $V_{CC}$ = 3.0V, $I_O$ = -24mA | Full | 2.52 | 2.74 | | |
| | | | $V_{CC}$ = 4.5V, $I_O$ = -32mA | Full | 4 | 4.22 | | |
| Low-Level Output Voltage | $V_{OL}$ | $V_I$ = $V_{IH}$ or $V_{IL}$ | $V_{CC}$ = 1.65V to 5.5V, $I_O$ = 100μA | Full | | 0.01 | 0.05 | V |
| | | | $V_{CC}$ = 1.65V, $I_O$ = 4mA | Full | | 0.1 | 0.22 | |
| | | | $V_{CC}$ = 2.3V, $I_O$ = 8mA | Full | | 0.12 | 0.28 | |
| | | | $V_{CC}$ = 2.7V, $I_O$ = 12mA | Full | | 0.16 | 0.34 | |
| | | | $V_{CC}$ = 3.0V, $I_O$ = 24mA | Full | | 0.3 | 0.56 | |
| | | | $V_{CC}$ = 4.5V, $I_O$ = 32mA | Full | | 0.32 | 0.6 | |
| Input Leakage Current | $I_I$ | $V_{CC}$ = 0V to 5.5V, $V_I$ = 5.5V or GND | | Full | | ±0.01 | ±1 | μA |
| Power-Off Leakage Current | $I_{OFF}$ | $V_{CC}$ = 0V, $V_I$ or $V_O$ = 5.5V | | Full | | ±0.01 | ±1 | μA |
| Supply Current | $I_{CC}$ | $V_{CC}$ = 1.65V to 5.5V, $V_I$ = 5.5V or GND, $I_O$ = 0A | | Full | | 0.01 | 1 | μA |
| Additional Supply Current | $\Delta I_{CC}$ | Per pin, $V_{CC}$ = 2.3V to 5.5V, $V_I$ = $V_{CC}$ - 0.6V, $I_O$ = 0A | | Full | | 0.05 | 10 | μA |
| Input Capacitance | $C_I$ | $V_{CC}$ = 3.3V, $V_I$ = GND to $V_{CC}$ | | +25℃ | | 3.5 | | pF |

# DYNAMIC CHARACTERISTICS

(For test circuit, see Figure 1. Full = -40℃ to +125℃, all typical values are measured at $T_A$ = +25℃ and $V_{CC}$ = 1.8V, 2.5V, 2.7V, 3.3V and 5.0V respectively, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN (1) | TYP | MAX (1) | UNITS |
|---|---|---|---|---|---|---|---|---|
| Propagation Delay (2) | $t_{PD}$ | nA to nY, see Figure 2 | $V_{CC}$ = 1.65V to 1.95V | Full | 0.5 | 6.0 | 14.0 | ns |
| | | | $V_{CC}$ = 2.3V to 2.7V | Full | 0.5 | 3.2 | 7.0 | |
| | | | $V_{CC}$ = 2.7V | Full | 0.5 | 3.1 | 7.5 | |
| | | | $V_{CC}$ = 3.0V to 3.6V | Full | 0.1 | 3.5 | 6.0 | |
| | | | $V_{CC}$ = 4.5V to 5.5V | Full | 0.1 | 3.1 | 5.5 | |
| Power Dissipation Capacitance (3) | $C_{PD}$ | $V_{CC}$ = 3.3V, $V_I$ = GND to $V_{CC}$ | | +25℃ | | 30.5 | | pF |

NOTES:

1. Specified by design and characterization; not production tested.
2. $t_{PD}$ is the same as $t_{PLH}$ and $t_{PHL}$.
3. $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).

   $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$

   where:

   $f_i$ = Input frequency in MHz.

   $f_o$ = Output frequency in MHz.

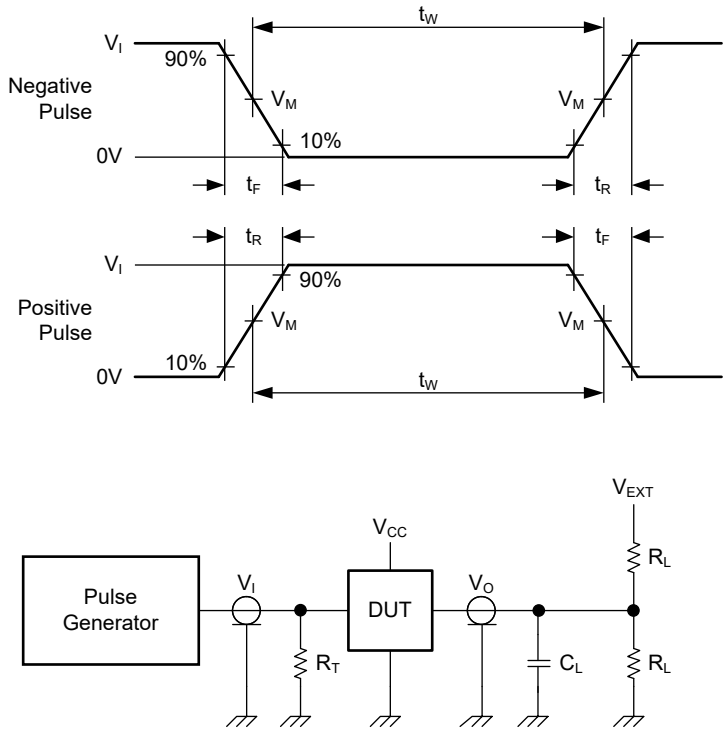
   $C_L$ = Output load capacitance in pF.

   $V_{CC}$ = Supply voltage in Volts.

   N = Number of inputs switching.

   $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = Sum of outputs.

## TEST CIRCUIT




Test conditions are given in Table 1.

Definitions for test circuit:

$R_L$ = Load resistance.

$C_L$ = Load capacitance including jig and probe capacitance.

$R_T$ = Termination resistance should be equal to the output impedance $Z_O$ of the pulse generator.

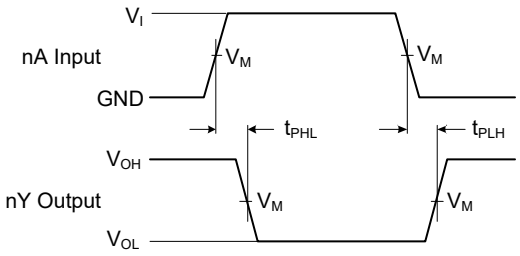
$V_{EXT}$ = External voltage for measuring switching times.

**Figure 1. Test Circuit for Measuring Switching Times**

**Table 1. Test Conditions**

| SUPPLY VOLTAGE | INPUT | | LOAD | | $V_{EXT}$ |
|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $t_R = t_F$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ |
| 1.65V to 1.95V | $V_{CC}$ | ≤ 2.0ns | 30pF | 1kΩ | Open |
| 2.3V to 2.7V | $V_{CC}$ | ≤ 2.0ns | 30pF | 500Ω | Open |
| 2.7V | 2.7V | ≤ 2.5ns | 50pF | 500Ω | Open |
| 3.0V to 3.6V | 2.7V | ≤ 2.5ns | 50pF | 500Ω | Open |
| 4.5V to 5.5V | $V_{CC}$ | ≤ 2.5ns | 50pF | 500Ω | Open |

# WAVEFORMS




Test conditions are given in Table 1.
Measurement points are given in Table 2.
Logic levels: $V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load.

**Figure 2. Input nA to Output nY Propagation Delays**

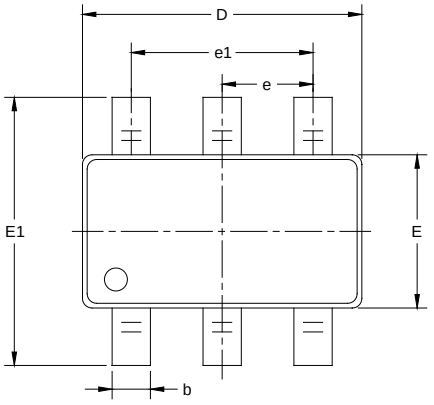
**Table 2. Measurement Points**

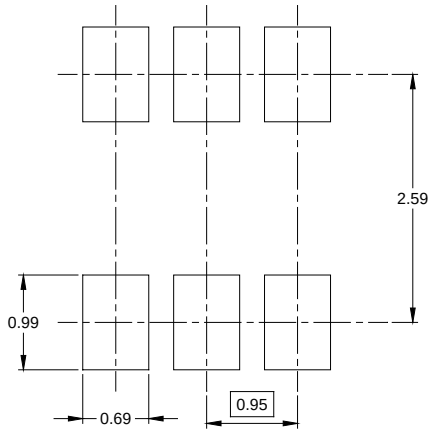
| SUPPLY VOLTAGE | INPUT | OUTPUT |
|---|---|---|
| $V_{CC}$ | $V_M$ (1) | $V_M$ |
| 1.65V to 1.95V | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 2.3V to 2.7V | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 2.7V | 1.5V | 1.5V |
| 3.0V to 3.6V | 1.5V | 1.5V |
| 4.5V to 5.5V | $0.5V_{CC}$ | $0.5V_{CC}$ |

NOTE:
1. The measurement points should be $V_{IH}$ or $V_{IL}$ when the input rising or falling time exceeds 2.5ns.

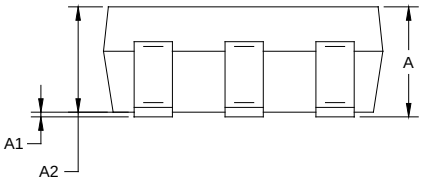
# PACKAGE OUTLINE DIMENSIONS

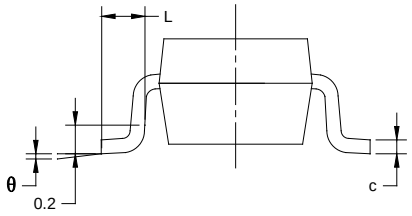
## SOT-23-6




**RECOMMENDED LAND PATTERN** (Unit: mm)

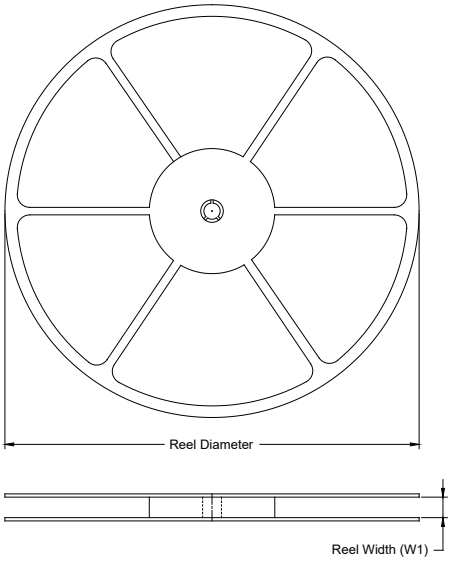


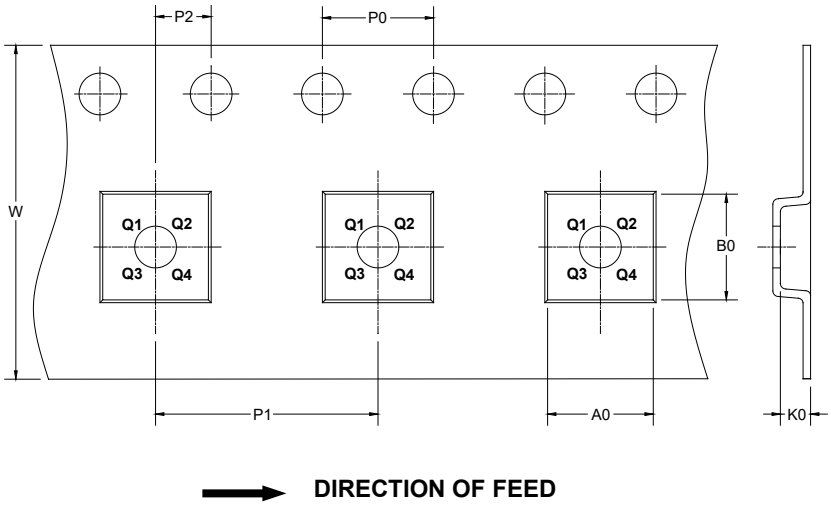

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950 BSC | | 0.037 BSC | |
| e1 | 1.900 BSC | | 0.075 BSC | |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



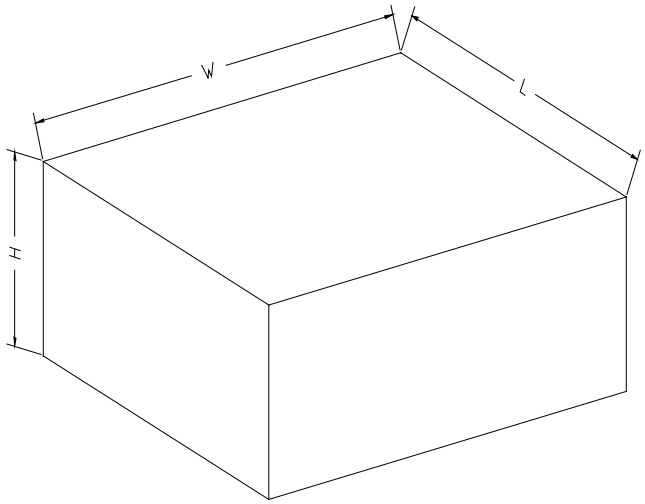

NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| SOT-23-6 | 7″ | 9.5 | 3.17 | 3.23 | 1.37 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |

DD0001

## CARTON BOX DIMENSIONS




NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|---|---|---|---|---|
| 7″ (Option) | 368 | 227 | 224 | 8 |
| 7″ | 442 | 410 | 224 | 18 |

DD0002