

74LVC2G14

Dual Inverter with 5V Tolerant Schmitt Trigger Inputs

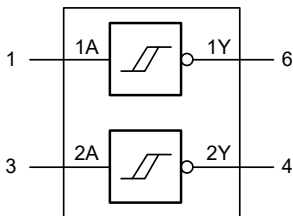
GENERAL DESCRIPTION

The 74LVC2G14 contains two independent inverters each with Schmitt trigger input. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. The 74LVC2G14 is designed for 1.65V to 5.5V V_{CC} operation. The device performs the Boolean function $Y = \bar{A}$.

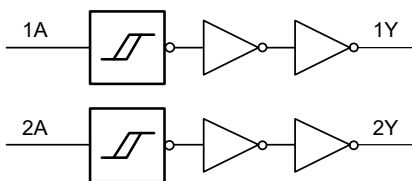
Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device in a mixed 3.3V and 5V environment. Schmitt trigger action at the inputs makes the circuit tolerant of slower input rise and fall times.

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.

LOGIC SYMBOL



LOGIC DIAGRAM



FEATURES

- **Wide Supply Voltage Range: 1.65V to 5.5V**
- **5V Tolerant Inputs for Interfacing with 5V Logic**
- **High Noise Immunity**
- **$\pm 24\text{mA}$ Output Drive at $V_{CC} = 3.0\text{V}$**
- **CMOS Low Power Consumption**
- **Direct Interface with TTL Levels**
- **Unlimited Rise and Fall Times**
- **Inputs Accept Voltages up to 5V**
- **-40°C to $+125^{\circ}\text{C}$ Operating Temperature Range**
- **Available in a Green SC70-6 Package**

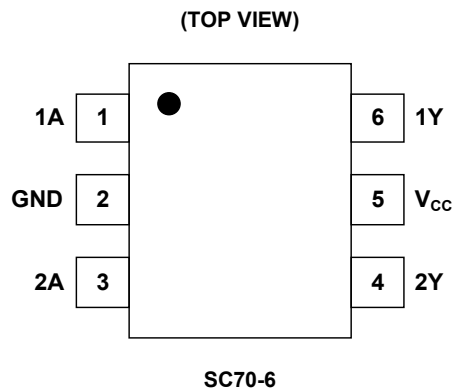
FUNCTIONAL TABLE

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

$$Y = \bar{A}$$

H = High Voltage Level

L = Low Voltage Level

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°C to +125°C. All typical values are measured at maximum V_{CC} and $T_A = +25^\circ\text{C}$, unless stated noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS | |
|--|-----------------|--|--|------|-----------------|-----------------|---------------|---|
| High-Level Output Voltage | V_{OH} | $V_I = V_{T+}$ or V_{T-} | $I_O = -100\mu\text{A}$, $V_{CC} = 1.65\text{V}$ to 5.5V | Full | $V_{CC} - 0.05$ | $V_{CC} - 0.01$ | V | |
| | | | $I_O = -4\text{mA}$, $V_{CC} = 1.65\text{V}$ | Full | 1.43 | 1.55 | | |
| | | | $I_O = -8\text{mA}$, $V_{CC} = 2.3\text{V}$ | Full | 2.02 | 2.18 | | |
| | | | $I_O = -12\text{mA}$, $V_{CC} = 2.7\text{V}$ | Full | 2.38 | 2.56 | | |
| | | | $I_O = -24\text{mA}$, $V_{CC} = 3\text{V}$ | Full | 2.52 | 2.74 | | |
| | | | $I_O = -32\text{mA}$, $V_{CC} = 4.5\text{V}$ | Full | 4 | 4.22 | | |
| Low-Level Output Voltage | V_{OL} | $V_I = V_{T+}$ or V_{T-} | $I_O = 100\mu\text{A}$, $V_{CC} = 1.65\text{V}$ to 5.5V | Full | | 0.01 | 0.05 | V |
| | | | $I_O = 4\text{mA}$, $V_{CC} = 1.65\text{V}$ | Full | | 0.1 | 0.22 | |
| | | | $I_O = 8\text{mA}$, $V_{CC} = 2.3\text{V}$ | Full | | 0.12 | 0.28 | |
| | | | $I_O = 12\text{mA}$, $V_{CC} = 2.7\text{V}$ | Full | | 0.16 | 0.34 | |
| | | | $I_O = 24\text{mA}$, $V_{CC} = 3\text{V}$ | Full | | 0.3 | 0.56 | |
| | | | $I_O = 32\text{mA}$, $V_{CC} = 4.5\text{V}$ | Full | | 0.32 | 0.6 | |
| Input Leakage Current | I_I | $V_I = 5.5\text{V}$ or GND, $V_{CC} = 0\text{V}$ to 5.5V | Full | | ± 0.01 | ± 1 | μA | |
| Power-Off Leakage Current | I_{OFF} | V_I or $V_O = 5.5\text{V}$, $V_{CC} = 0\text{V}$ | Full | | ± 0.01 | ± 1 | μA | |
| Supply Current | I_{CC} | $V_I = 5.5\text{V}$ or GND, $V_{CC} = 1.65\text{V}$ to 5.5V , $I_O = 0\text{A}$ | Full | | 0.01 | 1 | μA | |
| Additional Supply Current ⁽¹⁾ | ΔI_{CC} | $V_I = V_{CC} - 0.6\text{V}$, $I_O = 0\text{A}$, $V_{CC} = 2.3\text{V}$ to 5.5V | Full | | 0.05 | 10 | μA | |
| Input Capacitance | C_I | $V_{CC} = 3.3\text{V}$, $V_I = \text{GND}$ to V_{CC} | +25°C | | 3 | | pF | |

NOTE:

1. This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.**DYNAMIC CHARACTERISTICS**(For test circuit, see Figure 4. Full = -40°C to +125°C, all typical values are measured at $T_A = +25^\circ\text{C}$ and $V_{CC} = 1.8\text{V}$, 2.5V , 2.7V , 3.3V and 5V respectively, unless stated noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN ⁽¹⁾ | TYP | MAX ⁽¹⁾ | UNITS | |
|--|----------|---|---|--------------------|-----|--------------------|-------|----|
| Propagation Delay ⁽²⁾ | t_{PD} | nA to nY, see Figure 5 | $V_{CC} = 1.65\text{V}$ to 1.95V | Full | 0.5 | 10.1 | 23.0 | ns |
| | | | $V_{CC} = 2.3\text{V}$ to 2.7V | Full | 0.5 | 5.6 | 11.0 | |
| | | | $V_{CC} = 2.7\text{V}$ | Full | 0.5 | 5.2 | 10.0 | |
| | | | $V_{CC} = 3\text{V}$ to 3.6V | Full | 0.5 | 5.2 | 8.5 | |
| | | | $V_{CC} = 4.5\text{V}$ to 5.5V | Full | 0.5 | 4.4 | 6.5 | |
| Power Dissipation Capacitance ⁽³⁾ | C_{PD} | $V_I = \text{GND}$ to V_{CC} , $V_{CC} = 3.3\text{V}$ | +25°C | | 40 | | pF | |

NOTES:

- Specified by design and characterization; not production tested.
- t_{PD} is the same as t_{PLH} and t_{PHL} .
- 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.

TRANSFER CHARACTERISTICS

(Full = -40°C to +125°C. All typical values are measured at $T_A = +25^\circ\text{C}$, unless stated noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS | |
|----------------------------------|----------|--|-------------------------------------|------|------|------|-------|---|
| Positive-Going Threshold Voltage | V_{T+} | See Figure 1 and Figure 2 | $V_{CC} = 1.8\text{V}$ | Full | 0.7 | 1.1 | 1.7 | V |
| | | | $V_{CC} = 2.3\text{V}$ | Full | 1 | 1.4 | 2 | |
| | | | $V_{CC} = 3\text{V}$, see Figure 3 | Full | 1.3 | 1.76 | 2.4 | |
| | | | $V_{CC} = 4.5\text{V}$ | Full | 1.9 | 2.47 | 3.3 | |
| | | | $V_{CC} = 5.5\text{V}$ | Full | 2.2 | 2.91 | 3.8 | |
| Negative-Going Threshold Voltage | V_{T-} | See Figure 1 and Figure 2 | $V_{CC} = 1.8\text{V}$ | Full | 0.25 | 0.61 | 1.1 | V |
| | | | $V_{CC} = 2.3\text{V}$ | Full | 0.4 | 0.8 | 1.35 | |
| | | | $V_{CC} = 3\text{V}$, see Figure 3 | Full | 0.6 | 1.04 | 1.7 | |
| | | | $V_{CC} = 4.5\text{V}$ | Full | 1 | 1.55 | 2.2 | |
| | | | $V_{CC} = 5.5\text{V}$ | Full | 1.2 | 1.86 | 2.5 | |
| Hysteresis Voltage | V_H | $(V_{T+} - V_{T-})$, See Figure 1 and Figure 2 | $V_{CC} = 1.8\text{V}$ | Full | 0.15 | 0.49 | 1.2 | V |
| | | | $V_{CC} = 2.3\text{V}$ | Full | 0.25 | 0.6 | 1.3 | |
| | | | $V_{CC} = 3\text{V}$, see Figure 3 | Full | 0.4 | 0.73 | 1.4 | |
| | | | $V_{CC} = 4.5\text{V}$ | Full | 0.6 | 0.92 | 1.7 | |
| | | | $V_{CC} = 5.5\text{V}$ | Full | 0.7 | 1.02 | 1.9 | |

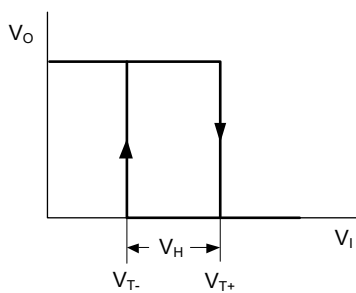


Figure 1. Transfer Characteristic

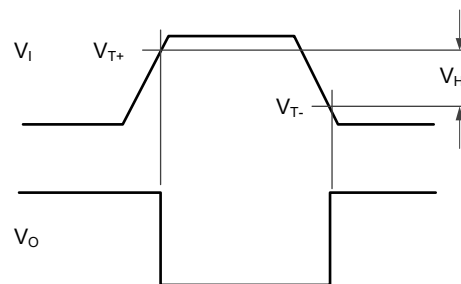


Figure 2. Definition of V_{T+} , V_{T-} , and V_H

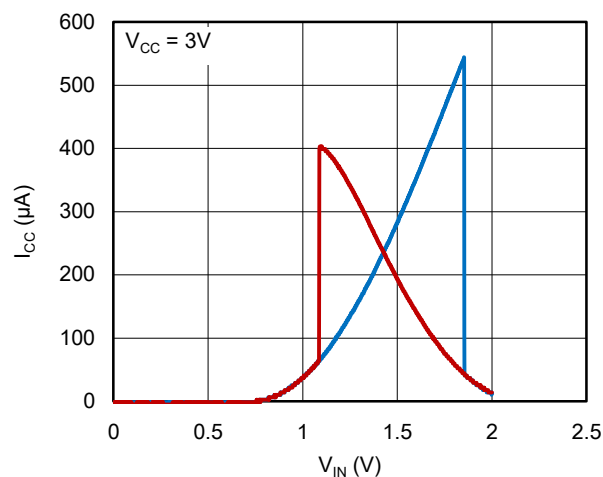
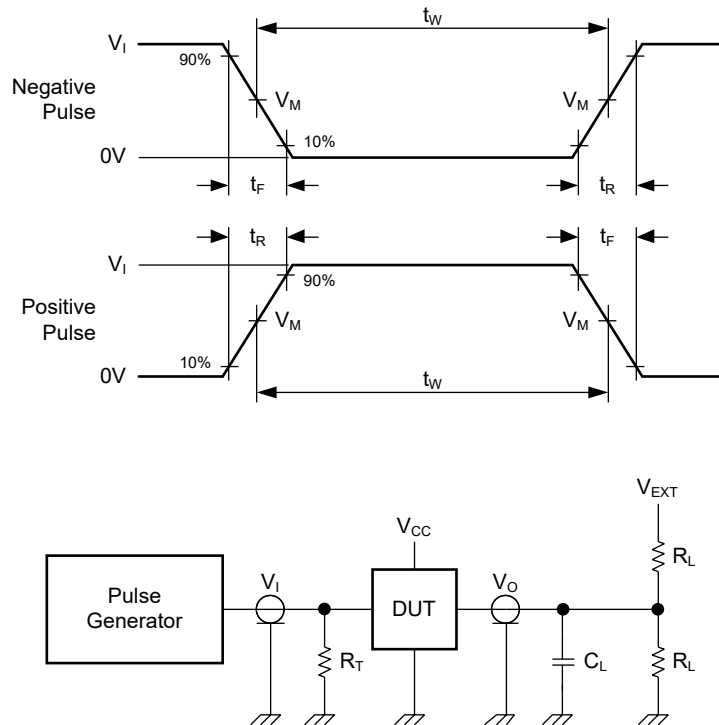


Figure 3. Typical Transfer Characteristics

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.

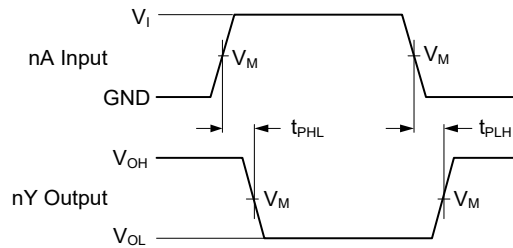
V_{EXT} = External voltage for measuring switching times.

Figure 4. 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} | $\leq 2.0\text{ns}$ | 30pF | 1k Ω | Open |
| 2.3V to 2.7V | V_{CC} | $\leq 2.0\text{ns}$ | 30pF | 500 Ω | Open |
| 2.7V | 2.7V | $\leq 2.5\text{ns}$ | 50pF | 500 Ω | Open |
| 3.0V to 3.6V | 2.7V | $\leq 2.5\text{ns}$ | 50pF | 500 Ω | Open |
| 4.5V to 5.5V | V_{CC} | $\leq 2.5\text{ns}$ | 50pF | 500 Ω | 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 5. The Data 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 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.3V to 2.7V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.7V | 1.5V | 1.5V |
| 3.0V to 3.6V | 1.5V | 1.5V |
| 4.5V to 5.5V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |

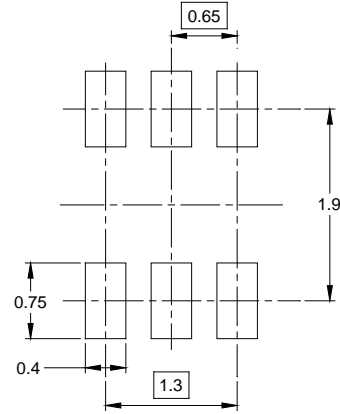
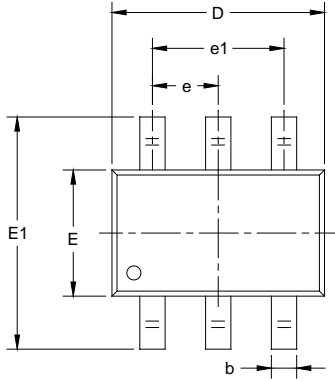
NOTE:

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

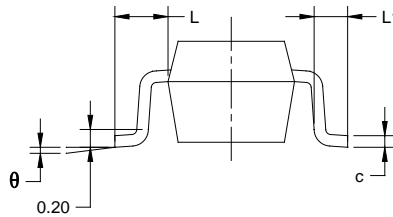
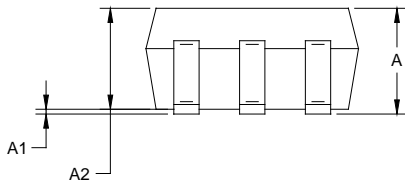
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

SC70-6



RECOMMENDED LAND PATTERN (Unit: mm)



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.800 | 1.100 | 0.031 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.800 | 1.000 | 0.031 | 0.039 |
| b | 0.150 | 0.350 | 0.006 | 0.014 |
| c | 0.080 | 0.220 | 0.003 | 0.009 |
| D | 2.000 | 2.200 | 0.079 | 0.087 |
| E | 1.150 | 1.350 | 0.045 | 0.053 |
| E1 | 2.150 | 2.450 | 0.085 | 0.096 |
| e | 0.65 TYP | | 0.026 TYP | |
| e1 | 1.300 BSC | | 0.051 BSC | |
| L | 0.525 REF | | 0.021 REF | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| θ | 0° | 8° | 0° | 8° |

NOTES:

1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

PACKAGE INFORMATION

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 |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| SC70-6 | 7" | 9.5 | 2.40 | 2.50 | 1.20 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |

DD0001

PACKAGE INFORMATION

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