74LVC2G14
Dual Inverter with
5V Tolerant Schmitt Trigger Inputs

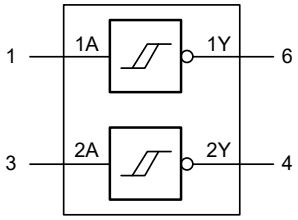
GENERAL DESCRIPTION

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 $Y = \overline{A}$.

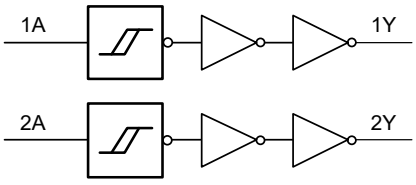
Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device in a mixed 3.3V and 5V environment. Schmitt trigger action at the inputs makes the circuit tolerant of slower input rise and fall times.

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**
- **±24mA Output Drive at V_{CC} = 3.0V**
- **CMOS Low Power Consumption**
- **Direct Interface with TTL Levels**
- **Unlimited Rise and Fall Times**
- **Inputs Accept Voltages up to 5V**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green SC70-6 Package**

FUNCTIONAL TABLE

INPUT	OUTPUT
nA	nY
L	H
H	L

$Y = \overline{A}$

H = High Voltage Level

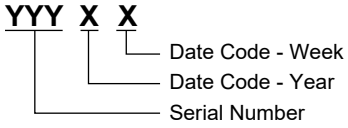
L = Low Voltage Level

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
74LVC2G14	SC70-6	-40℃ to +125℃	74LVC2G14XC6G/TR	R55XX	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)
Active Mode .....-0.5V to V_{CC} + 0.5V
Power-Down Mode, V_{CC} = 0V ..... -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 (3) .....+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. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

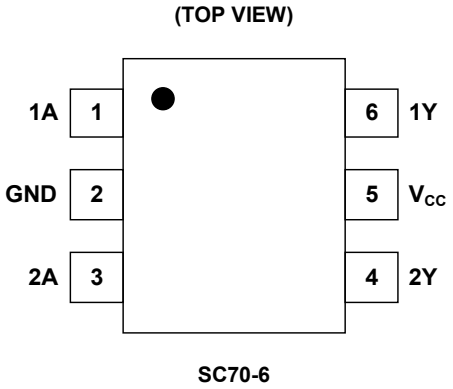
ESD SENSITIVITY CAUTION

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 maximum V_{CC} and T_A = +25℃, 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 = -100μA, V_{CC} = 1.65V to 5.5V	Full	V_{CC} - 0.05	V_{CC} - 0.01		V
			I_O = -4mA, V_{CC} = 1.65V	Full	1.43	1.55		
			I_O = -8mA, V_{CC} = 2.3V	Full	2.02	2.18		
			I_O = -12mA, V_{CC} = 2.7V	Full	2.38	2.56		
			I_O = -24mA, V_{CC} = 3V	Full	2.52	2.74		
			I_O = -32mA, V_{CC} = 4.5V	Full	4	4.22		
Low-Level Output Voltage	V_{OL}	$V_I = V_{T+}$ or V_{T-}	I_O = 100μA, V_{CC} = 1.65V to 5.5V	Full		0.01	0.05	V
			I_O = 4mA, V_{CC} = 1.65V	Full		0.1	0.22	
			I_O = 8mA, V_{CC} = 2.3V	Full		0.12	0.28	
			I_O = 12mA, V_{CC} = 2.7V	Full		0.16	0.34	
			I_O = 24mA, V_{CC} = 3V	Full		0.3	0.56	
			I_O = 32mA, V_{CC} = 4.5V	Full		0.32	0.6	
Input Leakage Current	I_I	V_I = 5.5V or GND, V_{CC} = 0V to 5.5V		Full		±0.01	±1	μA
Power-Off Leakage Current	I_{OFF}	V_I or V_O = 5.5V, V_{CC} = 0V		Full		±0.01	±1	μA
Supply Current	I_{CC}	V_I = 5.5V or GND, V_{CC} = 1.65V to 5.5V, I_O = 0A		Full		0.01	1	μA
Additional Supply Current (1)	ΔI_{CC}	$V_I = V_{CC}$ - 0.6V, I_O = 0A, V_{CC} = 2.3V to 5.5V		Full		0.05	10	μA
Input Capacitance	C_I	V_{CC} = 3.3V, V_I = GND to V_{CC}		+25℃		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℃ to +125℃, all typical values are measured at T_A = +25℃ and V_{CC} = 1.8V, 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} = 1.65V to 1.95V	Full	0.5	10.1	23.0	ns
			V_{CC} = 2.3V to 2.7V	Full	0.5	5.6	11.0	
			V_{CC} = 2.7V	Full	0.5	5.2	10.0	
			V_{CC} = 3V to 3.6V	Full	0.5	5.2	8.5	
			V_{CC} = 4.5V to 5.5V	Full	0.5	4.4	6.5	
Power Dissipation Capacitance (3)	C_{PD}	V_I = GND to V_{CC}, V_{CC} = 3.3V		+25℃		40		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.

TRANSFER CHARACTERISTICS

(Full = -40℃ to +125℃. All typical values are measured at T_A = +25℃, 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} = 1.8V	Full	0.7	1.1	1.7	V
			V_{CC} = 2.3V	Full	1	1.4	2	
			V_{CC} = 3V, see Figure 3	Full	1.3	1.76	2.4	
			V_{CC} = 4.5V	Full	1.9	2.47	3.3	
			V_{CC} = 5.5V	Full	2.2	2.91	3.8	
Negative-Going Threshold Voltage	V_{T-}	See Figure 1 and Figure 2	V_{CC} = 1.8V	Full	0.25	0.61	1.1	V
			V_{CC} = 2.3V	Full	0.4	0.8	1.35	
			V_{CC} = 3V, see Figure 3	Full	0.6	1.04	1.7	
			V_{CC} = 4.5V	Full	1	1.55	2.2	
			V_{CC} = 5.5V	Full	1.2	1.86	2.5	
Hysteresis Voltage	V_H	(V_{T+} - V_{T-}), See Figure 1 and Figure 2	V_{CC} = 1.8V	Full	0.15	0.49	1.2	V
			V_{CC} = 2.3V	Full	0.25	0.6	1.3	
			V_{CC} = 3V, see Figure 3	Full	0.4	0.73	1.4	
			V_{CC} = 4.5V	Full	0.6	0.92	1.7	
			V_{CC} = 5.5V	Full	0.7	1.02	1.9	

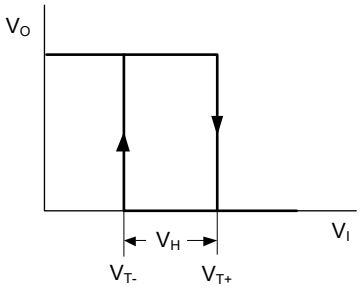


Figure 1. Transfer Characteristic

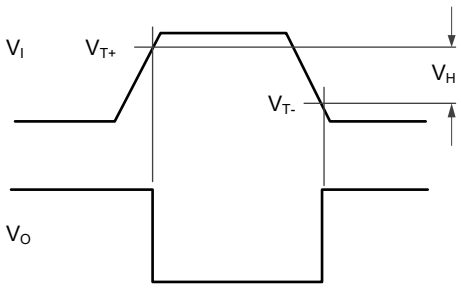


Figure 2. Definition of V_{T+}, V_{T-} and V_H

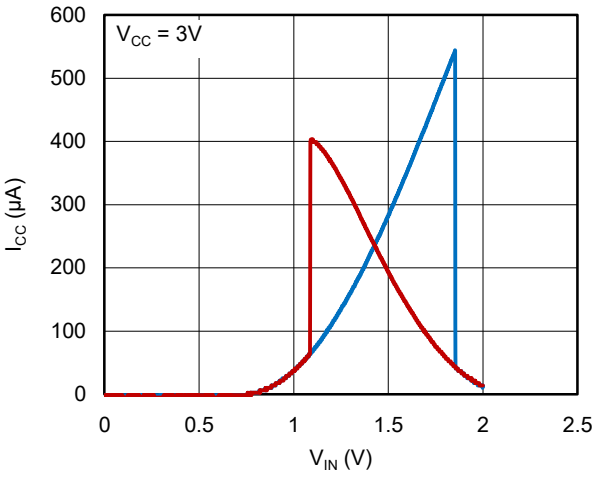
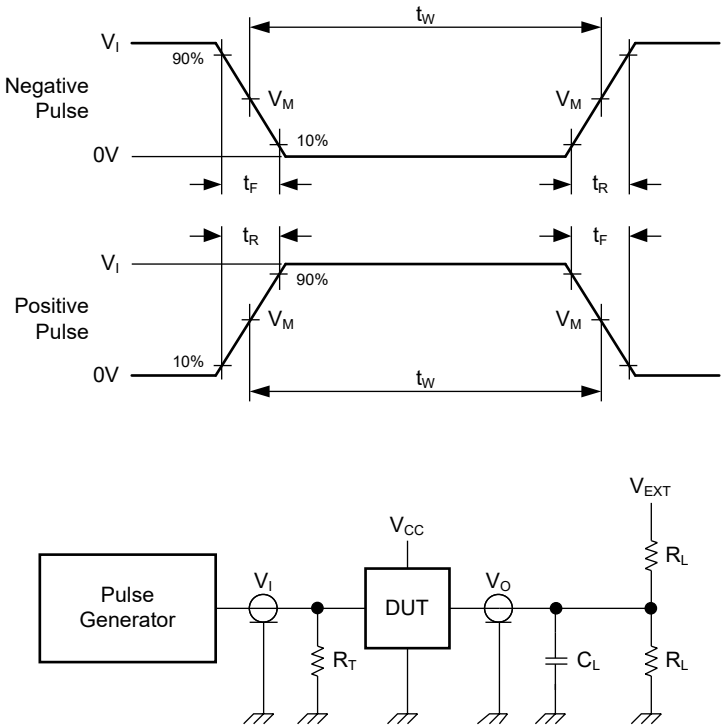


Figure 3. Typical Transfer Characteristics

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 Zo of the pulse generator.

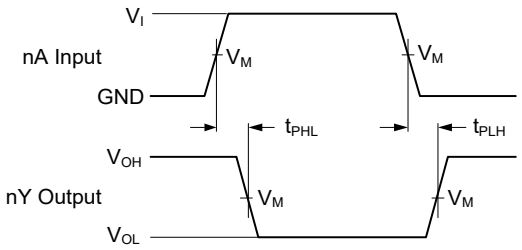
V_{EXT} = External voltage for measuring switching times.

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}	≤ 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 5. The Data Input (nA) to Output (nY) Propagation Delays

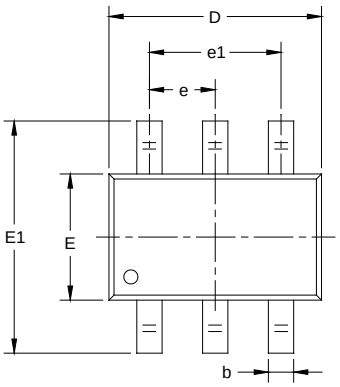
Table 2. Measurement Points

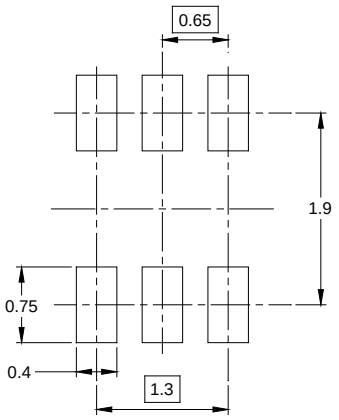
SUPPLY VOLTAGE	INPUT	OUTPUT
V_{CC}	V_M (1)	V_M
1.65V to 1.95V	0.5 × V_{CC}	0.5 × V_{CC}
2.3V to 2.7V	0.5 × V_{CC}	0.5 × V_{CC}
2.7V	1.5V	1.5V
3.0V to 3.6V	1.5V	1.5V
4.5V to 5.5V	0.5 × V_{CC}	0.5 × V_{CC}

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

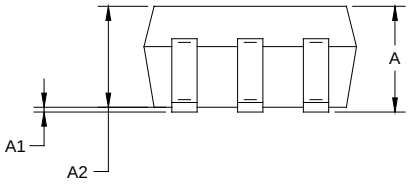
PACKAGE OUTLINE DIMENSIONS

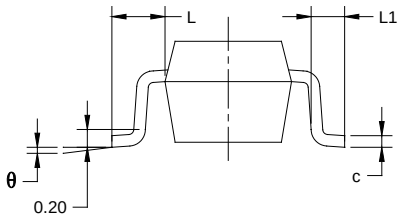
SC70-6





RECOMMENDED LAND PATTERN (Unit: mm)

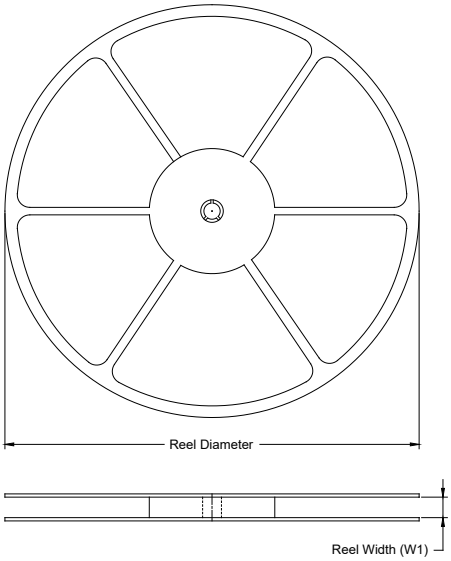




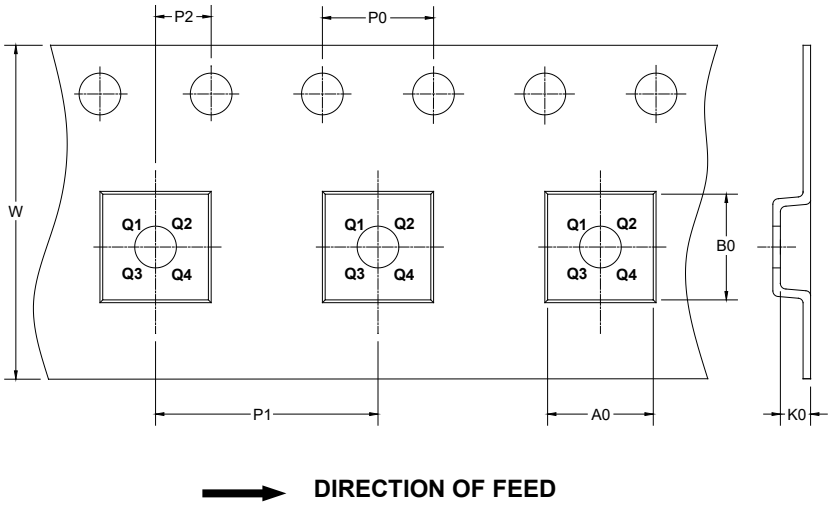
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.800	1.100	0.031	0.043
A1	0.000	0.100	0.000	0.004
A2	0.800	1.000	0.031	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.220	0.003	0.009
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 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°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

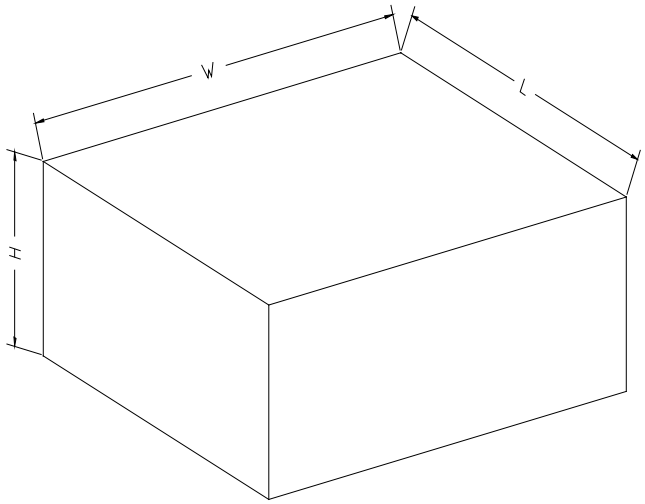
NOTE: The picture is only for reference. Please make the object as the standard.

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

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