

General Description

This single 2-input positive- NOR gate is designed for 1.65-V to 5.5-V V_{CC} operation.

The SN74LVC1G02 performs the Boolean function. $Y = A + B$ or $Y = \overline{A} \times \overline{B}$ in positive logic. The CMOS device has high output drive while maintaining low static power dissipation over a broad V_{CC} operating range.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry prevents damaging current backflow through the device when the gate is

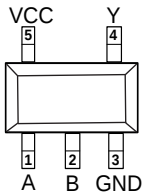
Features

- Operate from 1.65 V to 5.5 V
- Supports 5-V V_{CC} operation
- Specified from -20°C to 85°
- Provides down translation to V_{CC}
- Max tpd of 4 ns at 3.3 V
- ± 24 -mA output drive at 3.3 V

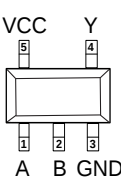
Applications

- Personal digital assistant devices
- AV receiver
- MP3 player/recorder
- Solid state drive (SSD): client and enterprise
- Power: telecom/server AC/DC supply
- TV: LCD/digital and high-definition (HDTV)

Reference News

Pinning and Package	Marking
	

SOT23-5

Pinning and Package	Marking
	

SC70-5

Pin Functions

Pin		Type	Description
Name	SOT23-5/SC70-5		
A	1	I	Data Input
B	2	I	Data Input
GND	3	-	Ground
Y	4	O	Data Output
V_{CC}	5	-	Supply Voltage

Order information

Orderable Device	Package	Packing Option
SN74LVC1G02DBVR	SOT23-5	3000PCS
SN74LVC1G02DCKR	SC70-5	3000PCS

Absolute Maximum Ratings

Parameters			Min	Max.	Unit
V _{CC}	Supply voltage range		-0.5	6.5	V
V _I	Input voltage range		-0.5	6.5	V
V _O	Voltage range applied to any output in the high-impedance or power-off state		-0.5	6.5	V
V _O	Voltage range applied to any output in the high or low state		-0.5	V _{CC} +0.5	V
I _{IK}	Input clamp current	V _I <0		-50	mA
I _{OK}	Output clamp current	V _O <0		-50	mA
I _O	Continuous output current			±50	mA
Continuous current through V _{CC} or GND				±100	mA
T _J	Junction temperature under bias			85	°C
T _{stg}	Storage temperature range		-65	150	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

Functional Block Diagram



ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic Discharge	Human-Body Model (HBM) ⁽¹⁾	8 K	V
		Charged-Device Model (CDM) ⁽²⁾	1.5 K	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOT23-5	250	81	°C/W
SC70-5	400	150	°C/W

Recommended Operating Conditions

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

Symbol	Parameter		Min	Max	Units
V _{CC}	Supply Voltage	Operating	1.65	5.5	V
V _{IH}	High-Level Input Voltage	V _{CC} =1.65V to 1.95V	0.65×V _{CC}		V
		V _{CC} =2.3V to 2.7V	1.7		
		V _{CC} =3V to 3.6V	2		
		V _{CC} =4.5V to 5.5V	0.7×V _{CC}		
V _{IL}	Low-Level Input Voltage	V _{CC} =1.65V to 1.95V		0.35×V _{CC}	V
		V _{CC} =2.3V to 2.7V		0.7	
		V _{CC} =3V to 3.6V		0.8	
		V _{CC} =4.5V to 5.5V		0.3×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} =1.65V		-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	
TA	Operating Free-air Temperature	All Other Packages	-40	125	°C

(1) All unused digital inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

Electrical Characteristics

$V_{CC}=1.65V$ to $5.5V$, FULL= $-20^{\circ}C$ to $+85^{\circ}C$. Typical values are at $T_A=+25^{\circ}C$ (unless otherwise noted)

Parameter	Symbol	Test Conditions	V_{CC}	T_A	Min	Typ	Max	Units
Output								
Output High Voltage	V_{OH}	$I_{OH}=-100\mu A$	1.65V to 5.5V	FULL	$V_{CC}-0.1$			V
		$I_{OH}=-4mA$	1.65V	FULL	1.2			V
		$I_{OH}=-8mA$	2.3V	FULL	1.9			V
		$I_{OH}=-16mA$	3V	FULL	2.4			V
		$I_{OH}=-24mA$		FULL	2.3			V
		$I_{OH}=-32mA$	4.5V	FULL	3.8			V
Output Low Voltage	V_{OL}	$I_{OL}=100\mu A$	1.65V to 5.5V	FULL			0.1	V
		$I_{OL}=4mA$	1.65V	FULL			0.45	V
		$I_{OL}=8mA$	2.3V	FULL			0.3	V
		$I_{OL}=16mA$	3V	FULL			0.4	V
		$I_{OL}=24mA$		FULL			0.55	V
		$I_{OL}=32mA$	4.5V	FULL			0.55	V
Off-State Current	I_{off}	V_I or $V_O=5.5V$	0V	FULL			± 10	μA
Input								
Input Leakage Current	I_i	$V_i=5.5V$ or GND	0V to 5.5V	FULL			± 5	μA
Input Capacitance	C_i	$V_i=V_{CC}$ or GND	3.3V	FULL		4		pF
Power Supply								
Power Supply Range	V_{CC}		1.65V to 5.5V	FULL	1.65		5.5	V
Power Supply Current	I_{CC}	$V_i=V_{CC}$ or GND, $I_O=0$	5.5V	FULL			10	μA
Delta Power Current	ΔI_{CC}	One Input at $V_{CC}-0.6V$, Other Inputs at V_{CC} or GND	3V to 5.5V	FULL			500	μA

(1) All unused digital inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

Switching Characteristics

Over recommended operating free-air temperature range, $C_L=30pF$ or $50pF$ (unless otherwise noted)

Parameter	From(Input)	To(Output)	−20°C to +85°C								Units
			V _{CC} =1.8V±0.15V		V _{CC} =2.5V±0.2V		V _{CC} =3.3V±0.3V		V _{CC} =5V±0.5V		
			Min	Max	Min	Max	Min	Max	Min	Max	
t _{pd}	A or B	Y	1	9	1	3.8	1	4	1	3.3	ns

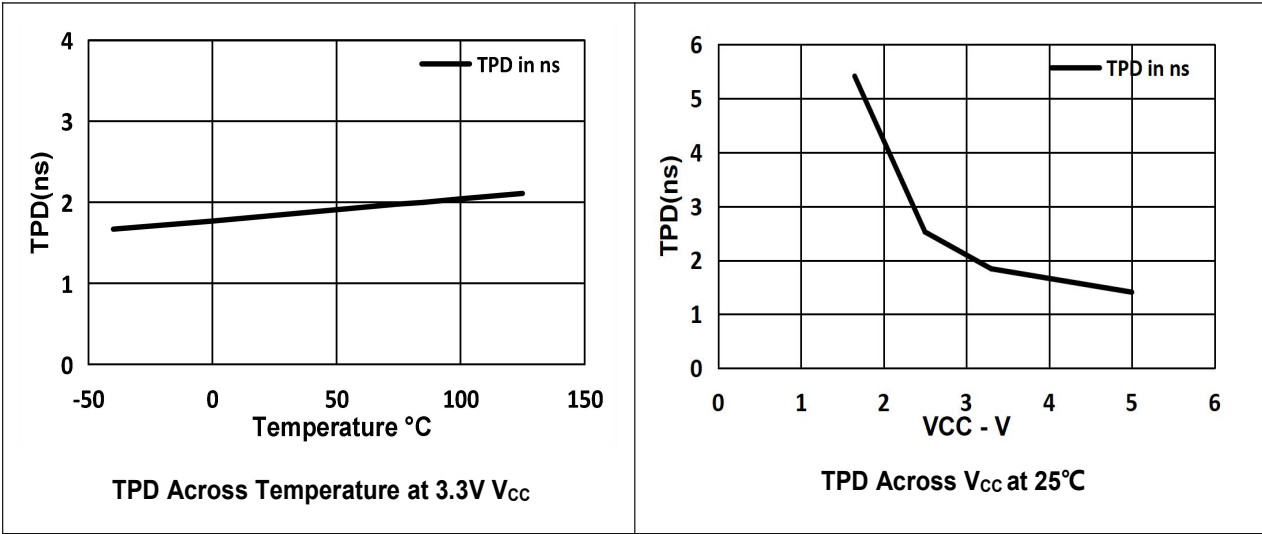
Operating Characteristics

$T_A=-20^{\circ}C$ to $+85^{\circ}C$

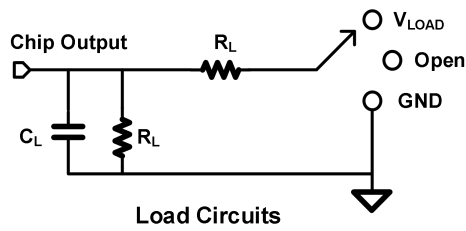
Parameter		Test Conditions	$V_{CC}=1.8V$	$V_{CC}=2.5V$	$V_{CC}=3.3V$	$V_{CC}=5V$	Units
			Typ	Typ	Typ	Typ	
C_{pd}	Power Dissipation Capacitance	$f=10MHz$	23	23	23	31	pF

Typical Characteristics

$V_{CC}=1.65V$ or $5.5V$, FULL= $-20^{\circ}C$ to $+85^{\circ}C$. Typical values are at $T_A=+25^{\circ}C$ (unless otherwise noted)



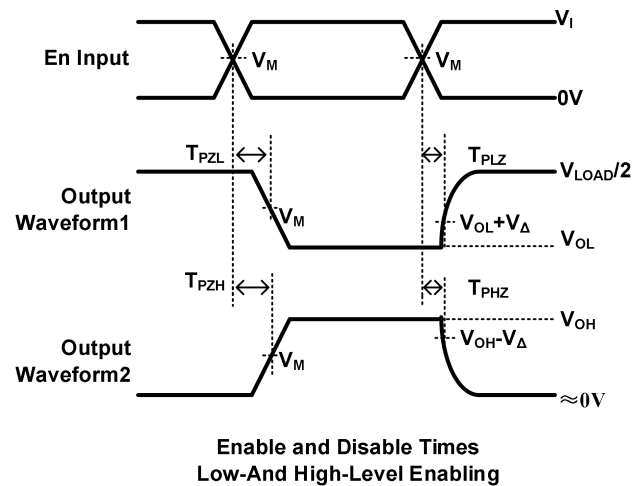
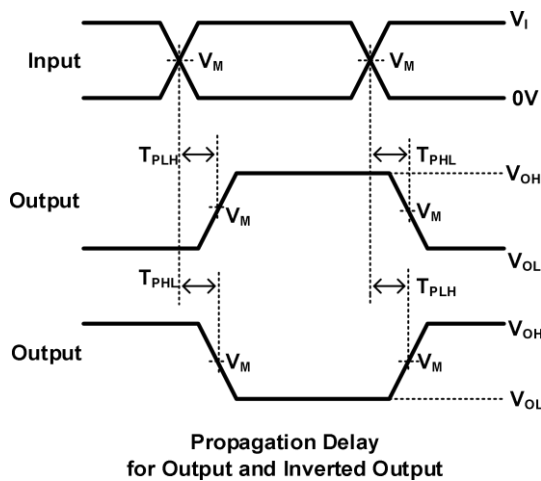
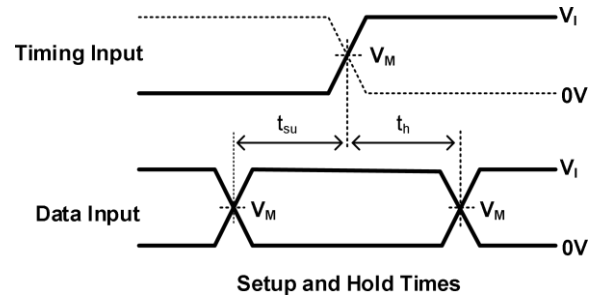
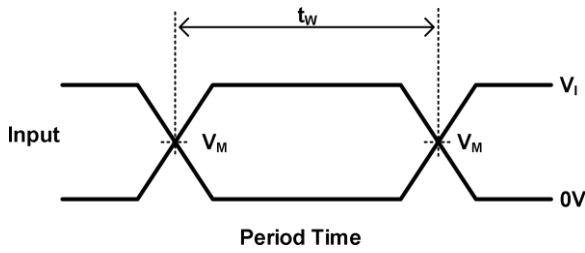
Parameter Measurement Information



TEST	S1
T_{PHL}/T_{PLH}	OPEN
T_{PLZ}/T_{PZL}	V_{LOAD}
T_{PHZ}/T_{PZH}	GND

V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	T_r/T_f					
$1.8V \pm 0.15V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	500 Ω	0.15V
$2.5V \pm 0.15V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	500 Ω	0.15V
$3.3V \pm 0.15V$	3V	$\leq 2.5ns$	1.5V	6V	30pF	500 Ω	0.3V
$5V \pm 0.15V$	V_{CC}	$\leq 2.5ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	500 Ω	0.3V

Parameter Measurement Information(Continued)



Notes: A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.

Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.

C. All input pulses are supplied by generators having the following characteristics: PRR 10 MHz, $Z = 50$.

D. The outputs are measured one at a time, with one transition per measurement.

E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .

F. t_{PZL} and t_{PZH} are the same as t_{en} .

G. t_{PLH} and t_{PHL} are the same as t_{pd} .

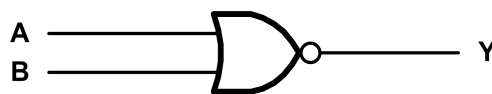
H. All parameters and waveforms are not applicable to all device.

Detailed Descript

ion Overview

The SN74LVC1G02 device contains one 2 -input positive - NOR gate device and performs the Boolean function $Y = \overline{A+B}$ or $Y = \overline{A} \times \overline{B}$. This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current back flow through the device when it is powered down. The I_{off} feature allows voltages on the inputs and outputs, when V_{CC} is 0 V.

Functional Block Diagram



Feature Description

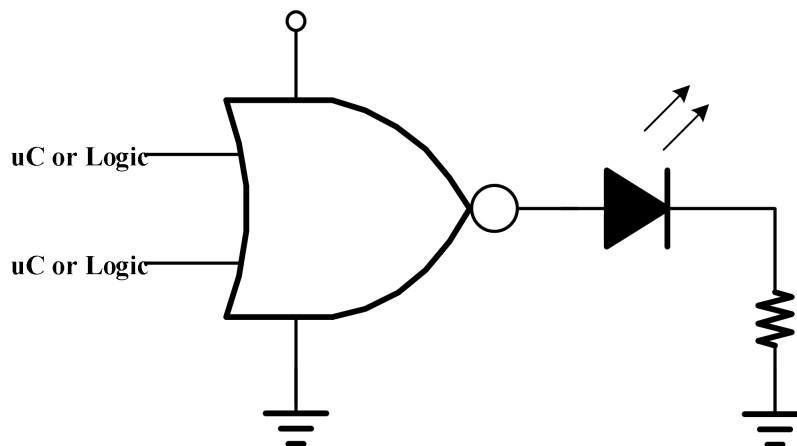
- Wide operating voltage range.
- Operates from 1.65 V to 5.5 V.
- Allows down voltage translation.
- Inputs accept voltages to 5.5 V.
- I_{off} feature allows voltages on the inputs and outputs, when V_{CC} is 0 V.

Device Functional Modes

Inputs		Output
A	B	Y
H	X	L
X	H	L
L	L	H

Application Note

The SN74LVC1G02 is a high drive CMOS device that can be used for implement NOR logic with a high output drive, such as an LED application. It can produce 24-mA of drive current at 3.3V making it Ideal for driving multiple outputs and good for high speed applications up to 100Mhz. The inputs are 5.5-V tolerant allowing translation down to V_{CC}

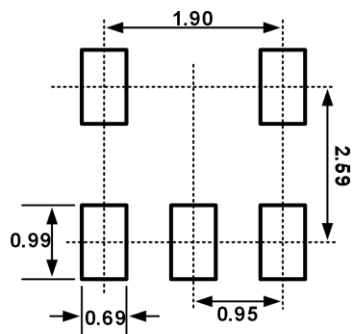
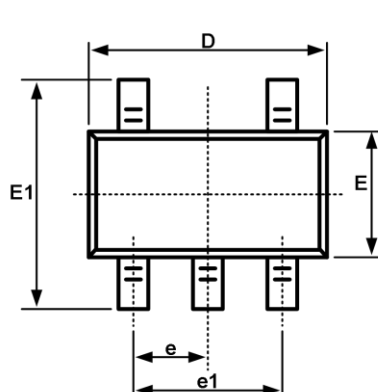


Basic LED Driver

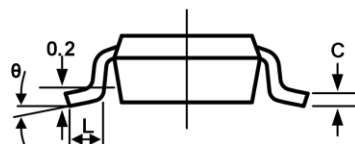
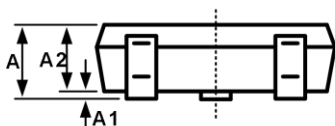
This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads, so routing and load conditions should be considered to prevent ringing.

Each VCC pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1- μ F capacitor is recommended. If there are multiple VCC pins, then a 0.01- μ F or 0.022- μ F capacitor is recommended for each power pin. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. A 0.1- μ F and 1- μ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

Package Outline SOT23-5

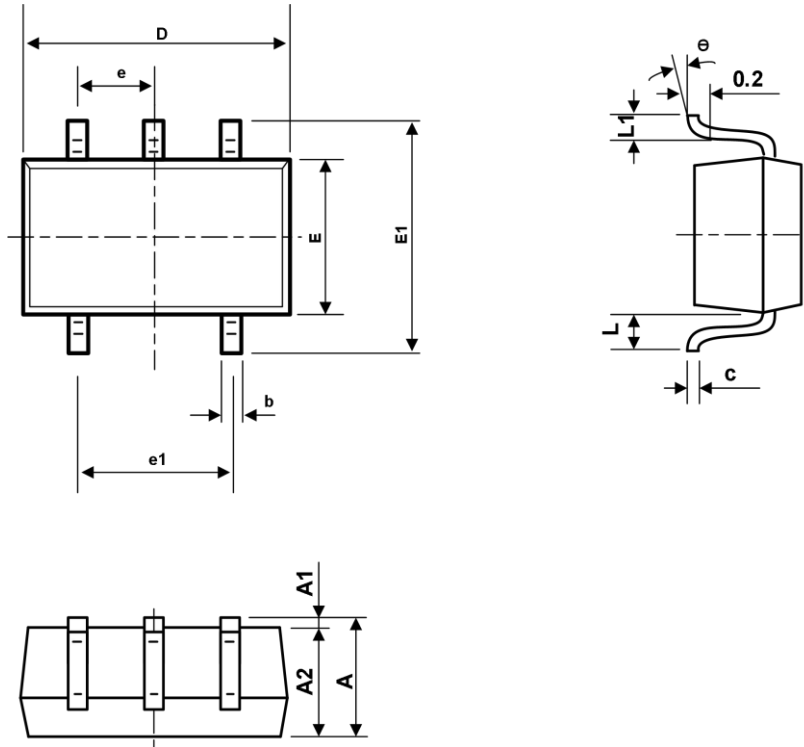


Recommended Land Pattern (Unit: mm)



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	0.950BSC		0.037BSC	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
L1	0.600REF		0.024REF	
θ	0°	8°	0°	8°

Package Outline SC70-5



symbol	Dimension In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.110	0.175	0.004	0.007
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	0.650TYP		0.026TYP	
e1	1.200	1.400	0.047	0.055
L	0.525REF		0.021REF	
L1	0.260	0.460	0.010	0.018
ø	0°	8°	0°	8°