

**U74LVC2G66B**

Preliminary

CMOS IC

DUAL BILATERAL ANALOG SWITCH**DESCRIPTION**

The **U74LVC2G66B** is a dual bilateral analog switch which is designed for 1.65V to 5.5V operation. This switch can handle both analog and digital signals and permits signals with amplitudes of up to 5.5V (peak) to be transmitted in either direction. Each switch section has enable-input control (C). If the voltage applied to C is at high-level, the associated switch section is turned on.

FEATURES

- * Wide Supply Voltage Range from 1.65V to 5.5V
- * Up to 5.5V Inputs Accept Voltages
- * Max. t_{PD} of 5ns at 3.3V
- * High ON-OFF Output Voltage Ratio
- * High Degree Of Linearity
- * High Speed, Typically 0.5ns at $V_{CC} = 3V$, $C_L = 50pF$
- * Rail-to-Rail Input/Output
- * Low On-State Resistance, Typically 6Ω at $V_{CC} = 4.5V$

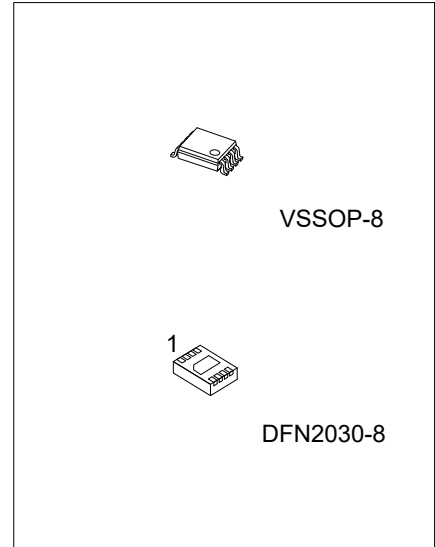
ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74LVC2G66BL-V08-R	U74LVC2G66BG-V08-R	VSSOP-8	Tape Reel
U74LVC2G66BL-K08-2030-R	U74LVC2G66BG-K08-2030-R	DFN2030-8	Tape Reel

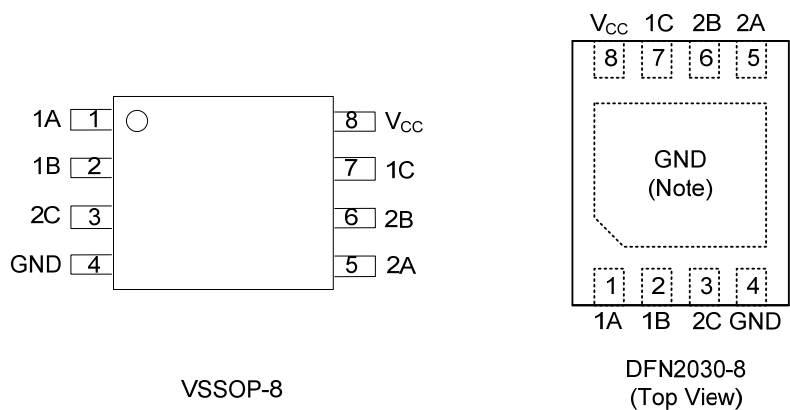
U74LVC2G66BG-V08-R	(1) Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) V08: VSSOP-8, K08-2030: DFN2030-8 (3) G: Halogen Free and Lead Free, L: Lead Free
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MARKING

VSSOP-8	DFN2030-8
8 7 6 5 □ □ □ □ BF6 □ ○ □ □ □ 1 2 3 4 → Date Code → L: Lead Free → G: Halogen Free → Lot Code	L2G 66B □ • □ □ □ → L: Lead Free → G: Halogen Free → Date Code



PIN CONFIGURATION

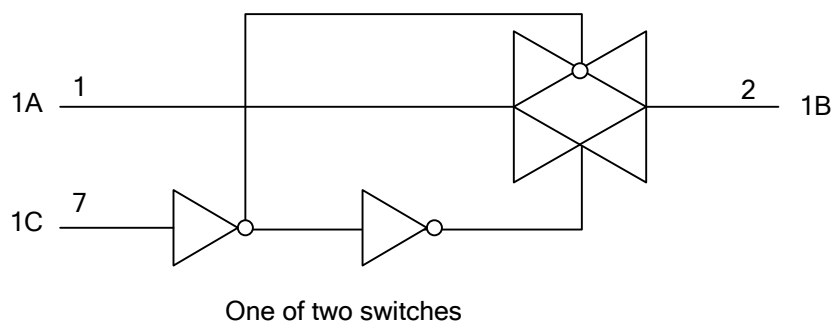


Note: Connect exposed pad to GND

FUNCTION TABLE (Each Gate)

CONTROL INPUT (C)	SWITCH
L	Off
H	On

LOGIC DIAGRAM (Positive Logic)



■ **ABSOLUTE MAXIMUM RATING** ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNIT
Supply Voltage	V_{CC}		-0.5 ~ 6.5	V
Input Voltage	V_{IN}		-0.5 ~ 6.5	V
Switch I/O Voltage	V_{OUT}		-0.5 ~ $V_{CC}+0.5$	V
Control Input Clamp Current	I_{IK}	$V_{IN} < 0$ or $V_{IN} > V_{CC}$	-50	mA
I/O Port Diode Current	$I_{I/O}$		-50	mA
On-State Switch Current	I_{OUT}	$V_{OUT} = 0$ to V_{CC}	± 50	mA
V_{CC} or GND Current	I_{CC}		± 100	mA
Junction Temperature	T_J		+150	$^{\circ}\text{C}$
Storage Temperature	T_{STG}		-65 ~ +150	$^{\circ}\text{C}$

Notes: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

2. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ **THERMAL DATA**

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	VSSOP-8	230	$^{\circ}\text{C/W}$
	DFN2030-8	59	$^{\circ}\text{C/W}$

■ **RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{CC}	Operating	1.65		5.5	V
I/O Port Voltage	$V_{I/O}$		0		V_{CC}	V
High-Level Input Voltage, Control Input	V_{IH}	$V_{CC} = 1.65\text{V to }1.95\text{V}$	$0.65 \times V_{CC}$			V
		$V_{CC} = 2.3\text{V to }2.7\text{V}$	$0.7 \times V_{CC}$			V
		$V_{CC} = 3\text{V to }3.6\text{V}$	$0.7 \times V_{CC}$			V
		$V_{CC} = 4.5\text{V to }5.5\text{V}$	$0.7 \times V_{CC}$			V
Low-Level Input Voltage, Control Input	V_{IL}	$V_{CC} = 1.65\text{V to }1.95\text{V}$			$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3\text{V to }2.7\text{V}$			$0.3 \times V_{CC}$	V
		$V_{CC} = 3\text{V to }3.6\text{V}$			$0.3 \times V_{CC}$	V
		$V_{CC} = 4.5\text{V to }5.5\text{V}$			$0.3 \times V_{CC}$	V
Control Input Voltage	V_{IN}		0		5.5	V
Input Transition Rise or Fall Rate	t_R / t_F	$V_{CC} = 1.65\text{V to }1.95\text{V}$			20	ns/V
		$V_{CC} = 2.3\text{V to }2.7\text{V}$			20	ns/V
		$V_{CC} = 3\text{V to }3.6\text{V}$			10	ns/V
		$V_{CC} = 4.5\text{V to }5.5\text{V}$			10	ns/V
Operating Temperature	T_A		-40		+125	$^{\circ}\text{C}$

■ **ELECTRICAL CHARACTERISTICS** ($T_A=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
On-State Switch Resistance	r_{ON}	$V_{IN}=V_{CC}$ or GND, $V_C=V_{IH}$, (see Fig.1)	$I_S=4\text{mA}$, $V_{CC}=1.65\text{V}$		16.5	$30\ \Omega$
			$I_S=8\text{mA}$, $V_{CC}=2.3\text{V}$		9	$20\ \Omega$
			$I_S=24\text{mA}$, $V_{CC}=3\text{V}$		7.5	$15\ \Omega$
			$I_S=32\text{mA}$, $V_{CC}=4.5\text{V}$		6	$10\ \Omega$
Peak On-State Resistance	$r_{ON(P)}$	$V_{IN}=V_{CC}$ to GND, $V_C=V_{IH}$, (see Fig.1)	$I_S=4\text{mA}$, $V_{CC}=1.65\text{V}$		200	Ω
			$I_S=8\text{mA}$, $V_{CC}=2.3\text{V}$		80	Ω
			$I_S=24\text{mA}$, $V_{CC}=3\text{V}$		30	Ω
			$I_S=32\text{mA}$, $V_{CC}=4.5\text{V}$		15	Ω
Difference of On-State Resistance Between Switches	Δr_{ON}	$V_{IN}=V_{CC}$ to GND, $V_C=V_{IH}$, (see Fig.1)	$I_S=4\text{mA}$, $V_{CC}=1.65\text{V}$		26	Ω
			$I_S=8\text{mA}$, $V_{CC}=2.3\text{V}$		5	Ω
			$I_S=24\text{mA}$, $V_{CC}=3\text{V}$		3	Ω
			$I_S=32\text{mA}$, $V_{CC}=4.5\text{V}$		2	Ω
Off-State Switch Leakage Current	$I_{S(OFF)}$	$V_{IN}=V_{CC}$ and $V_{OUT}=\text{GND}$ or $V_{IN}=\text{GND}$ and $V_{OUT}=V_{CC}$, $V_C=V_{IL}$, $V_{CC}=5.5\text{V}$ (see Figure 2)			± 1	μA
On-State Switch Leakage Current	$I_{S(ON)}$	$V_{IN}=V_{CC}$ or GND, $V_C=V_{IH}$, $V_{OUT}=\text{Open}$, $V_{CC}=5.5\text{V}$ (see Figure 3)			± 1	μA
Control Input Current	I_{IN}	$V_C=V_{CC}$ or GND, $V_{CC}=5.5\text{V}$			± 1	μA
Quiescent Supply Current	I_Q	$V_C=V_{CC}$ or GND, $V_{CC}=5.5\text{V}$			10	μA
Additional Quiescent Supply Current	ΔI_Q	One input at $V_{CC}-0.6\text{V}$; $V_{CC}=5.5\text{V}$; other inputs at V_{CC} or GND			500	μA
Control Input Capacitance	C_{IN}	$V_{CC}=5.0\text{V}$		5.5		pF
Switch Input/Output Capacitance	$C_{IO(OFF)}$	$V_{CC}=5.0\text{V}$		6		pF
Switch Input/Output Capacitance	$C_{IO(ON)}$	$V_{CC}=5.0\text{V}$		14		pF

■ **SWITCHING CHARACTERISTICS** ($T_A=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay From Input (A or B) to Output (B or A)	t_{PLH} / t_{PHL} (t_{PD})	$C_L=30\text{pF}$	$V_{CC}=1.8\pm 0.15\text{V}$, $R_L=1\text{K}\Omega$		8	ns
			$V_{CC}=2.5\pm 0.2\text{V}$, $R_L=500\Omega$		7	ns
		$C_L=50\text{pF}$	$V_{CC}=3.3\pm 0.3\text{V}$, $R_L=500\Omega$		5	ns
			$V_{CC}=5.0\pm 0.5\text{V}$, $R_L=500\Omega$		3	ns
Propagation Delay From Input (C) to Output (A or B)	t_{PZL} / t_{PZH} (t_{EN})	$C_L=30\text{pF}$	$V_{CC}=1.8\pm 0.15\text{V}$, $R_L=1\text{K}\Omega$	1	17	ns
			$V_{CC}=2.5\pm 0.2\text{V}$, $R_L=500\Omega$	1	14	ns
		$C_L=50\text{pF}$	$V_{CC}=3.3\pm 0.3\text{V}$, $R_L=500\Omega$	1	11	ns
			$V_{CC}=5.0\pm 0.5\text{V}$, $R_L=500\Omega$	1	8	ns
Propagation Delay From Input (C) to Output (A or B)	t_{PLZ} / t_{PHZ} (t_{DIS})	$C_L=30\text{pF}$	$V_{CC}=1.8\pm 0.15\text{V}$, $R_L=1\text{K}\Omega$	1	28	ns
			$V_{CC}=2.5\pm 0.2\text{V}$, $R_L=500\Omega$	1	24	ns
		$C_L=50\text{pF}$	$V_{CC}=3.3\pm 0.3\text{V}$, $R_L=500\Omega$	1	20	ns
			$V_{CC}=5.0\pm 0.5\text{V}$, $R_L=500\Omega$	1	15	ns

■ **ANALOG SWITCHING CHARACTERISTICS** ($T_A=25^\circ\text{C}$, unless otherwise specified) (Note)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Response (Switch On) From Input (A or B) to Output (B or A)	f_{MAX}	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{\text{IN}} = \text{sine wave}$ (see Fig.4)	$V_{\text{CC}} = 1.65\text{ V}$	30		MHz
			$V_{\text{CC}} = 2.3\text{ V}$	100		MHz
			$V_{\text{CC}} = 3\text{ V}$	130		MHz
			$V_{\text{CC}} = 4.5\text{ V}$	150		MHz
		$C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $f_{\text{IN}} = \text{sine wave}$ (see Fig.4)	$V_{\text{CC}} = 1.65\text{ V}$	>200		MHz
			$V_{\text{CC}} = 2.3\text{ V}$	>200		MHz
			$V_{\text{CC}} = 3\text{ V}$	>200		MHz
			$V_{\text{CC}} = 4.5\text{ V}$	>200		MHz
Crosstalk (Note) (Between Switches) From Input (A or B) to Output (B or A)	V_{CT} (S_W , S_W)	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{\text{IN}} = 1\text{ MHz}$ (sine wave) (see Fig.6)	$V_{\text{CC}} = 1.65\text{ V}$	-45		dB
			$V_{\text{CC}} = 2.3\text{ V}$	-45		dB
			$V_{\text{CC}} = 3\text{ V}$	-45		dB
			$V_{\text{CC}} = 4.5\text{ V}$	-45		dB
		$C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $f_{\text{IN}} = 1\text{ MHz}$ (sine wave) (see Fig.6)	$V_{\text{CC}} = 1.65\text{ V}$	-30		dB
			$V_{\text{CC}} = 2.3\text{ V}$	-30		dB
			$V_{\text{CC}} = 3\text{ V}$	-30		dB
			$V_{\text{CC}} = 4.5\text{ V}$	-30		dB
Crosstalk (Control Input to Signal Output) From Input (C) to Output (B or A)	V_{OT} (C_{ti} , S_W)	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{\text{IN}} = 1\text{ MHz}$ (sine wave) (see Fig.7)	$V_{\text{CC}} = 1.65\text{ V}$	-75		mV
			$V_{\text{CC}} = 2.3\text{ V}$	90		mV
			$V_{\text{CC}} = 3\text{ V}$	110		mV
			$V_{\text{CC}} = 4.5\text{ V}$	210		mV
Feedthrough Attenuation (Switch Off) From Input (A or B) to Output (B or A)	$\alpha_{\text{off(FT)}}$	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{\text{IN}} = 1\text{ MHz}$ (sine wave) (see Fig.8)	$V_{\text{CC}} = 1.65\text{ V}$	-50		dB
			$V_{\text{CC}} = 2.3\text{ V}$	-50		dB
			$V_{\text{CC}} = 3\text{ V}$	-50		dB
			$V_{\text{CC}} = 4.5\text{ V}$	-50		dB
		$C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $f_{\text{IN}} = 1\text{ MHz}$ (sine wave) (see Fig.8)	$V_{\text{CC}} = 1.65\text{ V}$	-35		dB
			$V_{\text{CC}} = 2.3\text{ V}$	-35		dB
			$V_{\text{CC}} = 3\text{ V}$	-35		dB
			$V_{\text{CC}} = 4.5\text{ V}$	-35		dB
Sine-Wave Distortion From Input (A or B) to Output (B or A)	D_{SIN}	$C_L = 50\text{ pF}$, $R_L = 10\text{ k}\Omega$, $f_{\text{IN}} = 1\text{ kHz}$ (sine wave) (see Fig.9)	$V_{\text{CC}} = 1.65\text{ V}$	0.1		%
			$V_{\text{CC}} = 2.3\text{ V}$	0.025		%
			$V_{\text{CC}} = 3\text{ V}$	0.015		%
			$V_{\text{CC}} = 4.5\text{ V}$	0.01		%
		$C_L = 50\text{ pF}$, $R_L = 10\text{ k}\Omega$, $f_{\text{IN}} = 10\text{ kHz}$ (sine wave) (see Fig.9)	$V_{\text{CC}} = 1.65\text{ V}$	0.15		%
			$V_{\text{CC}} = 2.3\text{ V}$	0.025		%
			$V_{\text{CC}} = 3\text{ V}$	0.015		%
			$V_{\text{CC}} = 4.5\text{ V}$	0.01		%

Note: Adjust f_{IN} voltage to obtain 0dBm at input.

■ **OPERATING CHARACTERISTICS** ($f=10\text{ MHz}$, $T_A=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	C_{PD}	$V_{\text{CC}} = 1.8\text{ V}$		8		pF
		$V_{\text{CC}} = 2.5\text{ V}$		9		pF
		$V_{\text{CC}} = 3.3\text{ V}$		9.5		pF
		$V_{\text{CC}} = 5\text{ V}$		11		pF

■ PARAMETER MEASUREMENT

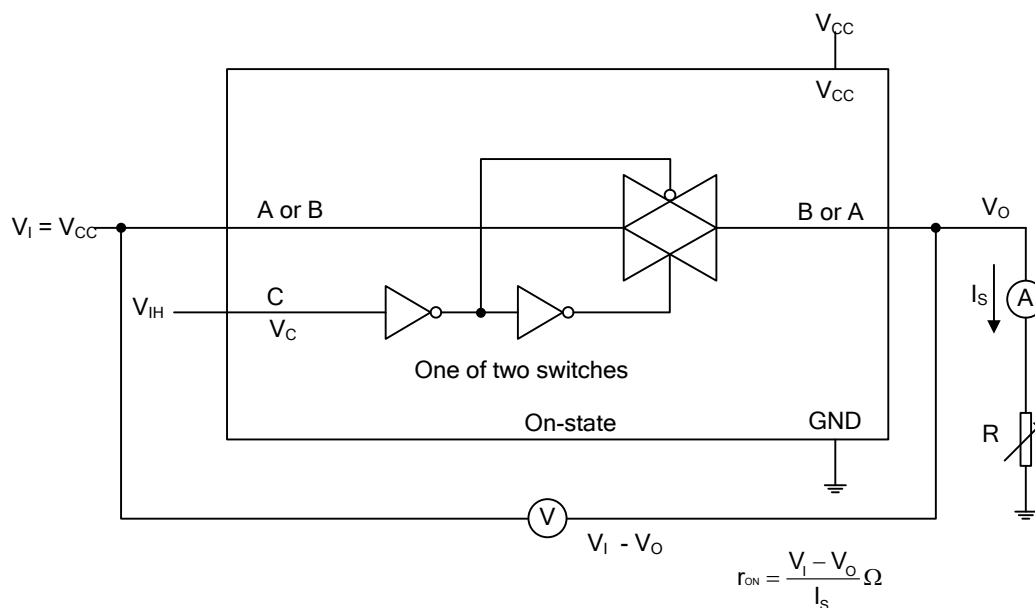


Fig.1 On-State Resistance Test Circuit

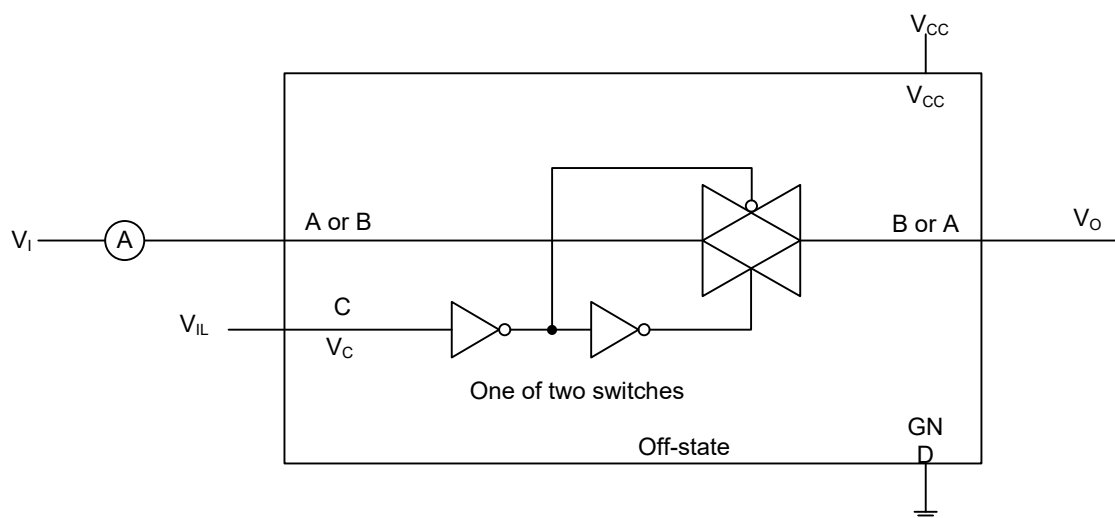


Fig.2 Off-State switch Leakage-Current Test Circuit

■ PARAMETER MEASUREMENT (Cont.)

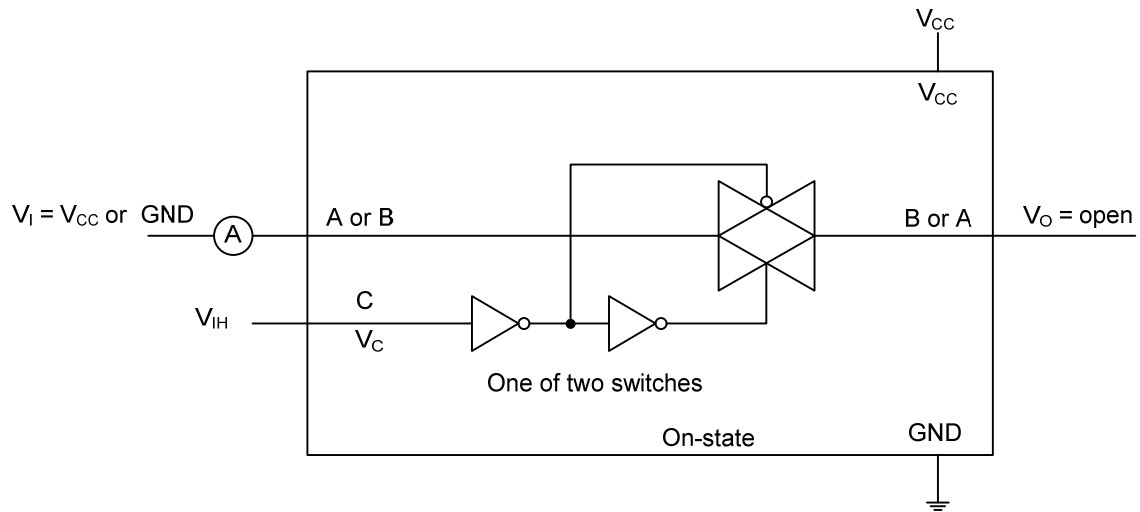
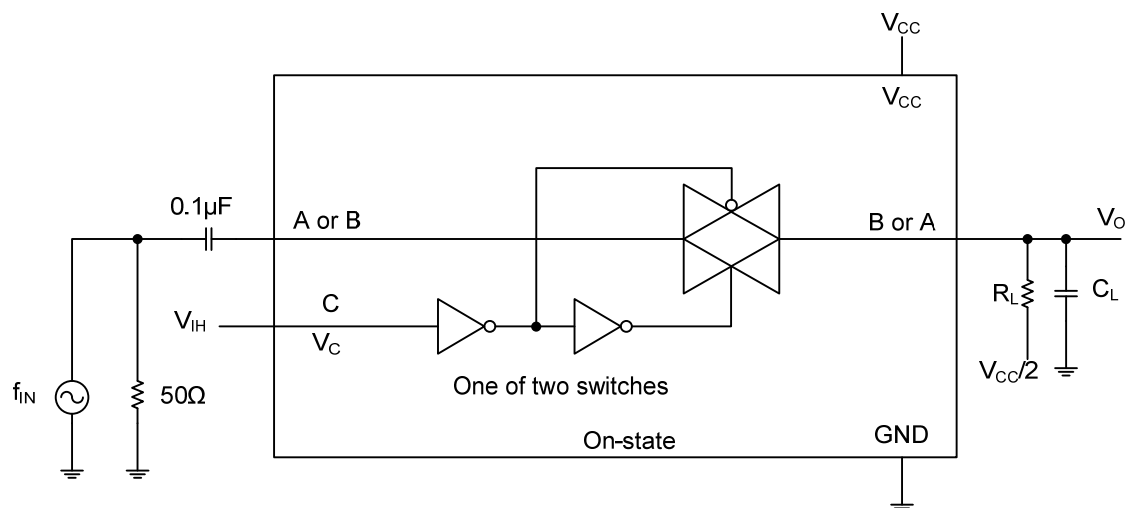


Fig.3 On-State Leakage-Current Test Circuit

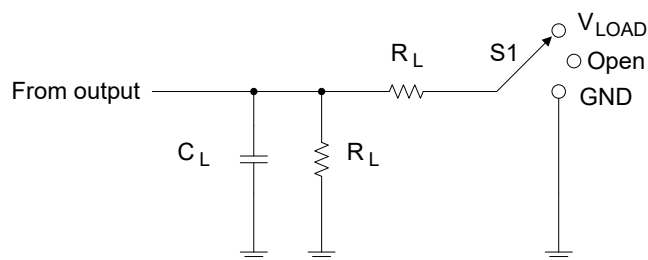


$R_L/C_L : 600\Omega / 50 \text{ pF}$

$R_L/C_L : 50\Omega / 5 \text{ pF}$

Fig.4 Frequency Response (switch on)

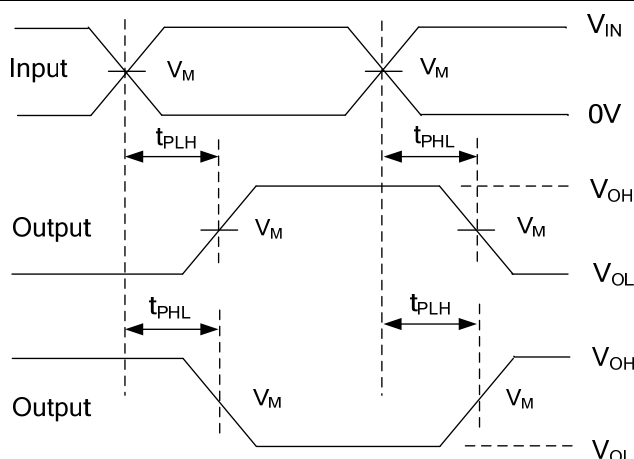
■ PARAMETER MEASUREMENT (Cont.)



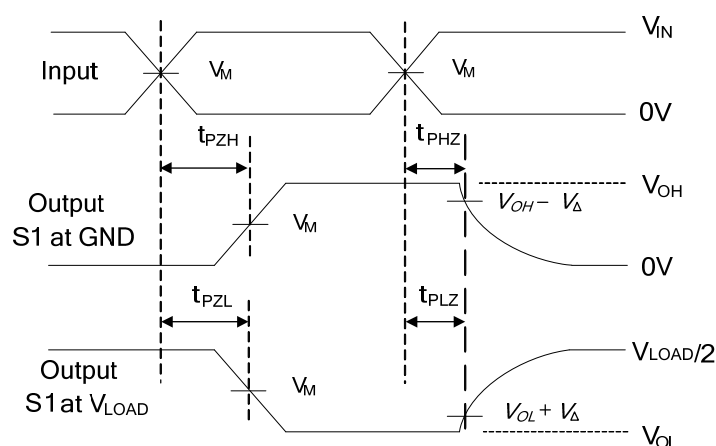
TEST CIRCUIT

TEST	S1
t_{PLH} / t_{PHL}	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_{IN}	t_R, t_F					
$1.8V \pm 0.15V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	1K Ω	0.15V
$2.5V \pm 0.2V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	500 Ω	0.15V
$3.3V \pm 0.3V$	V_{CC}	$\leq 2.5ns$	$V_{CC}/2$	$2 \times V_{CC}$	50pF	500 Ω	0.3V
$5V \pm 0.5V$	V_{CC}	$\leq 2.5ns$	$V_{CC}/2$	$2 \times V_{CC}$	50pF	500 Ω	0.3V



PROPAGATION DELAY TIMES



Enable and disable times
Low and high level enabling

Notes: 1. C_L includes probe and jig capacitance.

2. All input pulses are supplied by generators having the following characteristics: $P_{RR} \leq 10MHz$, $Z_0 = 50\Omega$.

Fig.5 Load circuit and voltage waveforms

■ PARAMETER MEASUREMENT (Cont.)

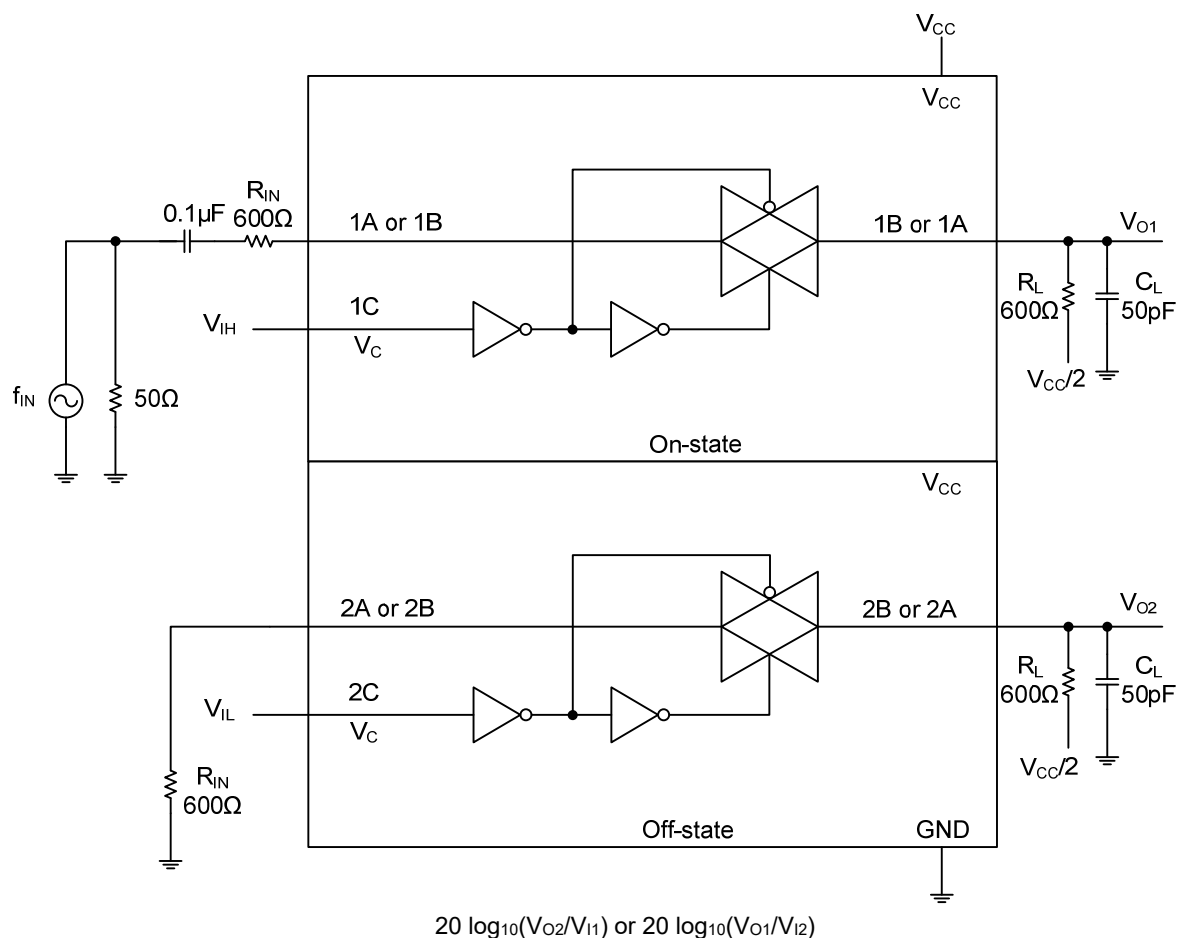


Fig.6 Crosstalk (between switches)

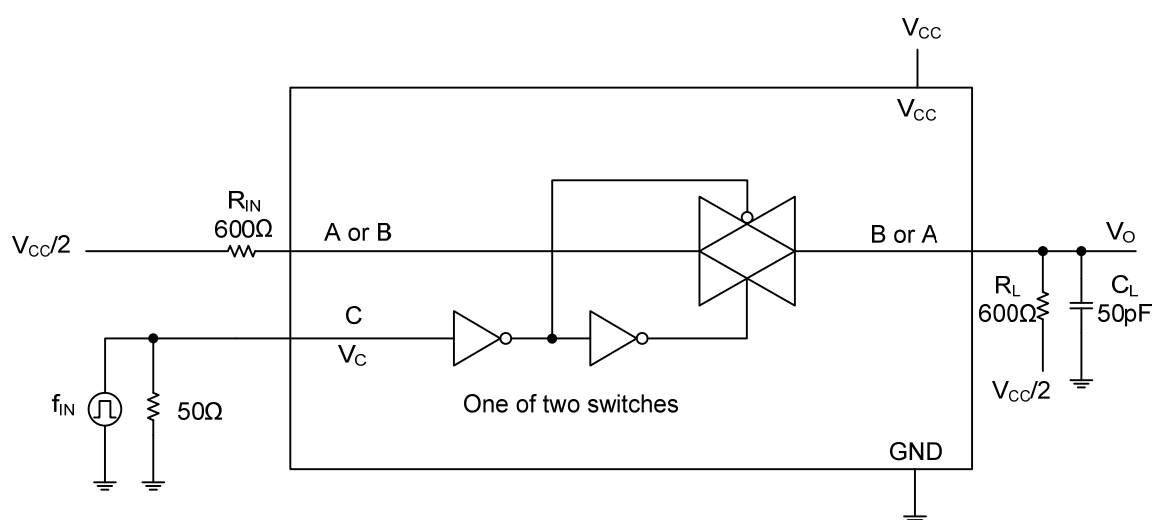


Fig.7 Crosstalk (control input, switch output)

■ PARAMETER MEASUREMENT (Cont.)

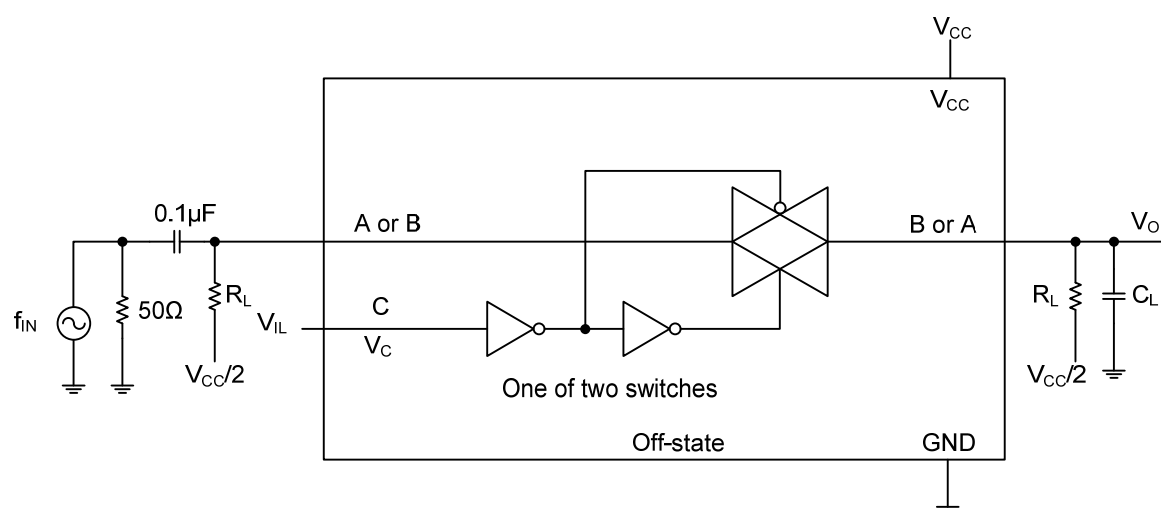

 $R_L/C_L : 600\Omega / 50 \text{ pF}$
 $R_L/C_L : 50\Omega / 5 \text{ pF}$

Fig.8 Feedthrough (switch off)

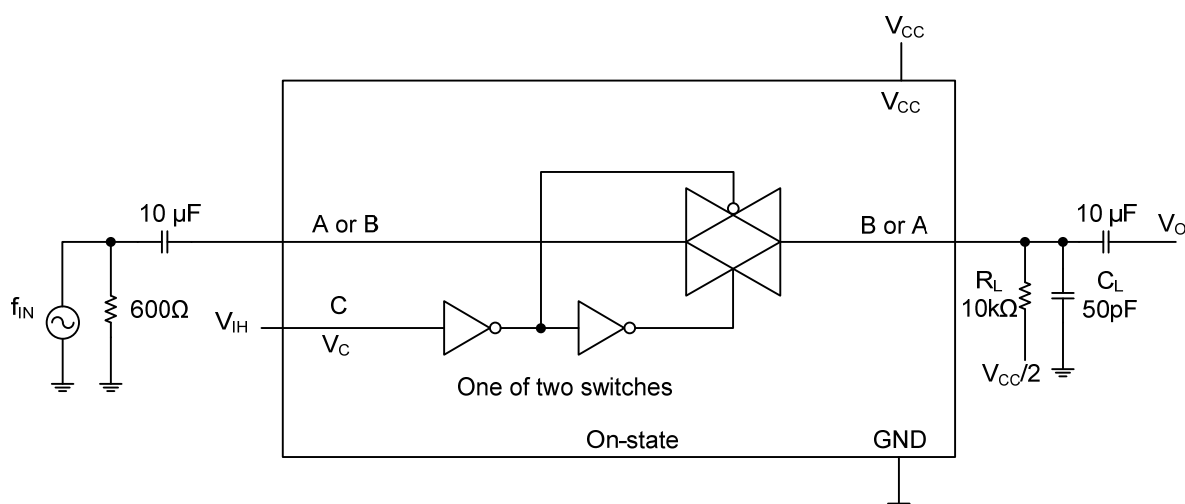

 $V_{CC}=1.65\text{V}, V_I = 1.4 \text{ V}_{P-P}$
 $V_{CC}=2.3\text{V}, V_I = 2 \text{ V}_{P-P}$
 $V_{CC}=3\text{V}, V_I = 2.5 \text{ V}_{P-P}$
 $V_{CC}=4.5\text{V}, V_I = 4 \text{ V}_{P-P}$

Fig.9 Sine-Wave Distortion

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