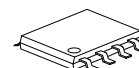


**U74LVC2G66****CMOS IC****DUAL BILATERAL ANALOG SWITCH**■ **DESCRIPTION**

The **U74LVC2G66** 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 5.5 V (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 0.8 ns at 3.3V
- \* High ON-OFF Output Voltage Ratio
- \* High Degree Of Linearity
- \* High Speed, Typically 0.5 ns at  $V_{CC} = 3\text{ V}$ ,  $C_L = 50\text{ pF}$
- \* Rail-to-Rail Input/Output
- \* Low On-State Resistance, Typically  $6\ \Omega$  at  $V_{CC} = 4.5\text{ V}$



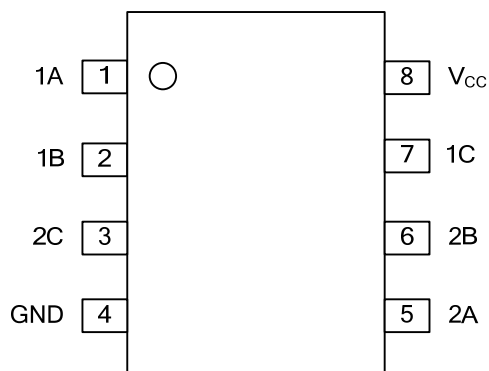
TSSOP-8

■ **ORDERING INFORMATION**

| Ordering Number   |                   | Package | Packing   |
|-------------------|-------------------|---------|-----------|
| Lead Free         | Halogen Free      |         |           |
| U74LVC2G66L-P08-R | U74LVC2G66G-P08-R | TSSOP-8 | Tape Reel |
| U74LVC2G66L-P08-T | U74LVC2G66G-P08-T | TSSOP-8 | Tube      |

|                   |                  |                                   |
|-------------------|------------------|-----------------------------------|
| U74LVC2G66L-P08-R | (1) Packing Type | (1) R: Tape Reel, T: Tube         |
|                   | (2) Package Type | (2) P08: TSSOP-8                  |
|                   | (3) Lead Free    | (3) G: Halogen Free, L: Lead Free |

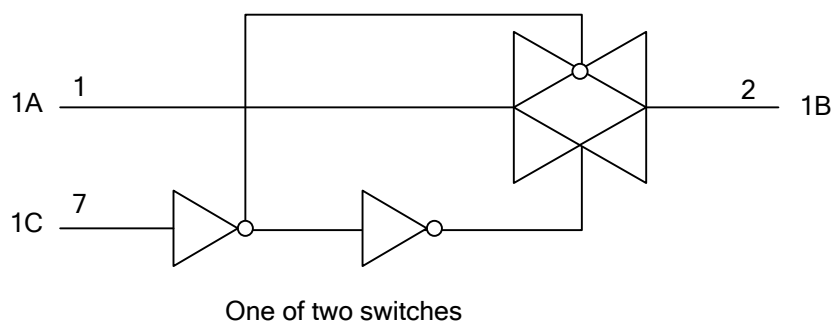
## PIN CONFIGURATION



## FUNCTION TABLE (Each Gate)

| CONTROL INPUT (Y) | SWITCH |
|-------------------|--------|
| L                 | Off    |
| H                 | On     |

## LOGIC DIAGRAM (Positive Logic)



## ■ ABSOLUTE MAXIMUM RATING (Unless otherwise specified)

| PARAMETER                   | SYMBOL    | 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 | $I_{IK}$  | -50                | mA   |
| I/O Port Diode Current      | $I_{I/O}$ | -50                | mA   |
| On-State Switch Current     | $I_{OUT}$ | ±50                | mA   |
| $V_{CC}$ or GND Current     | $I_{CC}$  | ±100               | mA   |
| Storage Temperature         | $T_{STG}$ | -65 ~ +150         | °C   |

Note: 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 | $\theta_{JA}$ | 190     | °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,<br>Control Input | $V_{IH}$    | $V_{CC} = 1.65V$ to $1.95V$ | $0.65 \cdot V_{CC}$ |     |                     | V    |
|                                            |             | $V_{CC} = 2.3V$ to $2.7V$   | $0.7 \cdot V_{CC}$  |     |                     |      |
|                                            |             | $V_{CC} = 3V$ to $3.6V$     | $0.7 \cdot V_{CC}$  |     |                     |      |
|                                            |             | $V_{CC} = 4.5V$ to $5.5V$   | $0.7 \cdot V_{CC}$  |     |                     |      |
| Low-Level Input Voltage,<br>Control Input  | $V_{IL}$    | $V_{CC} = 1.65V$ to $1.95V$ |                     |     | $0.35 \cdot V_{CC}$ | V    |
|                                            |             | $V_{CC} = 2.3V$ to $2.7V$   |                     |     | $0.3 \cdot V_{CC}$  |      |
|                                            |             | $V_{CC} = 3V$ to $3.6V$     |                     |     | $0.3 \cdot V_{CC}$  |      |
|                                            |             | $V_{CC} = 4.5V$ to $5.5V$   |                     |     | $0.3 \cdot V_{CC}$  |      |
| Control Input Voltage                      | $V_{IN}$    |                             | 0                   |     | 5.5                 | V    |
| Input Transition Rise or Fall Rate         | $t_R / t_F$ | $V_{CC} = 1.65V$ to $1.95V$ |                     |     | 20                  | ns/V |
|                                            |             | $V_{CC} = 2.3V$ to $2.7V$   |                     |     | 20                  |      |
|                                            |             | $V_{CC} = 3V$ to $3.6V$     |                     |     | 10                  |      |
|                                            |             | $V_{CC} = 4.5V$ to $5.5V$   |                     |     | 10                  |      |
| Operating Temperature                      | $T_{OPR}$   |                             | -40                 |     | 85                  | °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,<br>$V_C = V_{IH}$ ,<br>(see Fig.1) | $I_S = 4\text{mA}$ , $V_{CC} = 1.65\text{V}$ |     | 12.5 | $\Omega$ |
|                                                       |                 |                                                              | $I_S = 8\text{mA}$ , $V_{CC} = 2.3\text{V}$  |     | 9    |          |
|                                                       |                 |                                                              | $I_S = 24\text{mA}$ , $V_{CC} = 3\text{V}$   |     | 7.5  |          |
|                                                       |                 |                                                              | $I_S = 32\text{mA}$ , $V_{CC} = 4.5\text{V}$ |     | 6    |          |
| Peak On-State Resistance                              | $r_{ON(P)}$     | $V_{IN} = V_{CC}$ to GND,<br>$V_C = V_{IH}$ ,<br>(see Fig.1) | $I_S = 4\text{mA}$ , $V_{CC} = 1.65\text{V}$ |     | 85   | $\Omega$ |
|                                                       |                 |                                                              | $I_S = 8\text{mA}$ , $V_{CC} = 2.3\text{V}$  |     | 22   |          |
|                                                       |                 |                                                              | $I_S = 24\text{mA}$ , $V_{CC} = 3\text{V}$   |     | 12   |          |
|                                                       |                 |                                                              | $I_S = 32\text{mA}$ , $V_{CC} = 4.5\text{V}$ |     | 7.5  |          |
| Difference of On-State<br>Resistance Between Switches | $\Delta r_{ON}$ | $V_{IN} = V_{CC}$ to GND,<br>$V_C = V_{IH}$ ,<br>(see Fig.1) | $I_S = 4\text{mA}$ , $V_{CC} = 1.65\text{V}$ |     | 7    | $\Omega$ |
|                                                       |                 |                                                              | $I_S = 8\text{mA}$ , $V_{CC} = 2.3\text{V}$  |     | 5    |          |
|                                                       |                 |                                                              | $I_S = 24\text{mA}$ , $V_{CC} = 3\text{V}$   |     | 3    |          |
|                                                       |                 |                                                              | $I_S = 32\text{mA}$ , $V_{CC} = 4.5\text{V}$ |     | 2    |          |

### ■ ELECTRICAL CHARACTERISTICS (Cont.)

| PARAMETER                           | SYMBOL        | TEST CONDITIONS                                                                                                                           | MIN | TYP | MAX       | UNIT    |
|-------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----------|---------|
| Off-State Switch Leakage Current    | $I_{S(OFF)}$  | $V_{IN} = V_{CC}$ and $V_{OUT} = GND$ or<br>$V_{IN} = GND$ and $V_{OUT} = V_{CC}$ ,<br>$V_C = V_{IL}$ , $V_{CC} = 5.5V$<br>(see Figure 2) |     |     | $\pm 0.1$ | $\mu A$ |
| On-State Switch Leakage Current     | $I_{S(ON)}$   | $V_{IN} = V_{CC}$ or $GND$ , $V_C = V_{IH}$ ,<br>$V_{OUT} = Open$ , $V_{CC} = 5.5V$<br>(see Figure 3)                                     |     |     | $\pm 0.1$ | $\mu A$ |
| Control Input Current               | $I_{IN}$      | $V_C = V_{CC}$ or $GND$ , $V_{CC} = 5.5V$                                                                                                 |     |     | $\pm 0.1$ | $\mu A$ |
| Quiescent Supply Current            | $I_Q$         | $V_C = V_{CC}$ or $GND$ , $V_{CC} = 5.5V$                                                                                                 |     |     | 1         | $\mu A$ |
| Additional Quiescent Supply Current | $\Delta I_Q$  | One input at $V_{CC} - 0.6V$ ; $V_{CC} = 5.5V$ ;<br>other inputs at $V_{CC}$ or $GND$                                                     |     |     | 500       | $\mu A$ |
| Control Input Capacitance           | $C_{IN}$      | $V_{CC} = 5.0V$                                                                                                                           |     | 3.5 |           | pF      |
| Switch Input/Output Capacitance     | $C_{IO(OFF)}$ | $V_{CC} = 5.0V$                                                                                                                           |     | 6   |           | pF      |
| Switch Input/Output Capacitance     | $C_{IO(ON)}$  | $V_{CC} = 5.0V$                                                                                                                           |     | 14  |           | pF      |

### ■ SWITCHING CHARACTERISTICS ( $T_A = 25^\circ C$ )

| PARAMETER                                                | SYMBOL                              | TEST CONDITIONS                                             | MIN | TYP | MAX  | UNIT |
|----------------------------------------------------------|-------------------------------------|-------------------------------------------------------------|-----|-----|------|------|
| Propagation Delay From Input (A or B) to Output (B or A) | $t_{PLH} / t_{PHL}$<br>( $t_{PD}$ ) | $V_{CC} = 1.8 \pm 0.15V$ , $R_L = 1K\Omega$<br>$C_L = 30pF$ |     |     | 2    | ns   |
|                                                          |                                     | $V_{CC} = 2.5 \pm 0.2V$ , $R_L = 500\Omega$                 |     |     | 1.2  |      |
|                                                          |                                     | $V_{CC} = 3.3 \pm 0.3V$ , $R_L = 500\Omega$<br>$C_L = 50pF$ |     |     | 0.8  |      |
|                                                          |                                     | $V_{CC} = 5.0 \pm 0.5V$ , $R_L = 500\Omega$                 |     |     | 0.6  |      |
| Propagation Delay From Input (C) to Output (A or B)      | $t_{PZL} / t_{PZH}$<br>( $t_{EN}$ ) | $V_{CC} = 1.8 \pm 0.15V$ , $R_L = 1K\Omega$<br>$C_L = 30pF$ | 2.3 |     | 10   | ns   |
|                                                          |                                     | $V_{CC} = 2.5 \pm 0.2V$ , $R_L = 500\Omega$                 | 1.6 |     | 5.6  |      |
|                                                          |                                     | $V_{CC} = 3.3 \pm 0.3V$ , $R_L = 500\Omega$<br>$C_L = 50pF$ | 1.5 |     | 4.4  |      |
|                                                          |                                     | $V_{CC} = 5.0 \pm 0.5V$ , $R_L = 500\Omega$                 | 1.3 |     | 3.9  |      |
| Propagation Delay From Input (C) to Output (A or B)      | $t_{PLZ} / t_{PHZ}$ ( $t_{DIS}$ )   | $V_{CC} = 1.8 \pm 0.15V$ , $R_L = 1K\Omega$<br>$C_L = 30pF$ | 2.5 |     | 10.5 | ns   |
|                                                          |                                     | $V_{CC} = 2.5 \pm 0.2V$ , $R_L = 500\Omega$                 | 1.2 |     | 6.9  |      |
|                                                          |                                     | $V_{CC} = 3.3 \pm 0.3V$ , $R_L = 500\Omega$<br>$C_L = 50pF$ | 2   |     | 7.2  |      |
|                                                          |                                     | $V_{CC} = 5.0 \pm 0.5V$ , $R_L = 500\Omega$                 | 1.1 |     | 6.3  |      |

### ■ ANALOG SWITCHING CHARACTERISTICS ( $T_A = 25^\circ C$ ) (Note)

| PARAMETER                                                                        | SYMBOL | TEST CONDITIONS                                                                             | MIN               | TYP  | MAX | UNIT |
|----------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------|-------------------|------|-----|------|
| Frequency Response (Switch On)<br>From Input (A or B) to Output (B or A)         |        | $C_L = 50 pF$ , $R_L = 600 \Omega$ ,<br>$f_{IN} = \text{sine wave}$<br>(see Fig.4)          | $V_{CC} = 1.65 V$ | 35   |     | ns   |
|                                                                                  |        |                                                                                             | $V_{CC} = 2.3 V$  | 120  |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 3 V$    | 175  |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 4.5 V$  | 195  |     |      |
|                                                                                  |        | $C_L = 5 pF$ , $R_L = 50 \Omega$ ,<br>$f_{IN} = \text{sine wave}$<br>(see Fig.4)            | $V_{CC} = 1.65 V$ | >300 |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 2.3 V$  | >300 |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 3 V$    | >300 |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 4.5 V$  | >300 |     |      |
| Crosstalk (Note)<br>(Between Switches)<br>From Input (A or B) to Output (B or A) |        | $C_L = 50 pF$ , $R_L = 600 \Omega$ ,<br>$f_{IN} = 1 \text{ MHz (sine wave)}$<br>(see Fig.6) | $V_{CC} = 1.65 V$ | -58  |     | dB   |
|                                                                                  |        |                                                                                             | $V_{CC} = 2.3 V$  | -58  |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 3 V$    | -58  |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 4.5 V$  | -58  |     |      |
|                                                                                  |        | $C_L = 5 pF$ , $R_L = 50 \Omega$ ,<br>$f_{IN} = 1 \text{ MHz (sine wave)}$<br>(see Fig.6)   | $V_{CC} = 1.65 V$ | -42  |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 2.3 V$  | -42  |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 3 V$    | -42  |     |      |
|                                                                                  |        |                                                                                             | $V_{CC} = 4.5 V$  | -42  |     |      |

### ■ ANALOG SWITCHING CHARACTERISTICS (Cont.)

| PARAMETER                                                                          | SYMBOL | TEST CONDITIONS                                                                                            | MIN                       | TYP   | MAX | UNIT |
|------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------|---------------------------|-------|-----|------|
| Crosstalk<br>(Control Input To Signal Output)<br>From Input (C) to Output (B or A) |        | $C_L = 50 \text{ pF}$ , $R_L = 600 \Omega$ ,<br>$f_{IN} = 1\text{MHz}$ (sine wave)<br>(see Fig.7)          | $V_{CC} = 1.65 \text{ V}$ | 35    |     | mV   |
|                                                                                    |        |                                                                                                            | $V_{CC} = 2.3 \text{ V}$  | 50    |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 3 \text{ V}$    | 70    |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 4.5 \text{ V}$  | 100   |     |      |
| Feedthrough Attenuation<br>(Switch Off)<br>From Input (A or B) to Output (B or A)  |        | $C_L = 50 \text{ pF}$ , $R_L = 600 \Omega$ ,<br>$f_{IN} = 1\text{MHz}$ (sine wave)<br>(see Fig.8)          | $V_{CC} = 1.65 \text{ V}$ | -58   |     | dB   |
|                                                                                    |        |                                                                                                            | $V_{CC} = 2.3 \text{ V}$  | -58   |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 3 \text{ V}$    | -58   |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 4.5 \text{ V}$  | -58   |     |      |
|                                                                                    |        | $C_L = 5 \text{ pF}$ , $R_L = 50 \Omega$ ,<br>$f_{IN} = 1\text{MHz}$ (sine wave)<br>(see Fig.8)            | $V_{CC} = 1.65 \text{ V}$ | -42   |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 2.3 \text{ V}$  | -42   |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 3 \text{ V}$    | -42   |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 4.5 \text{ V}$  | -42   |     |      |
| Sine-Wave Distortion<br>From Input (A or B) to Output (B or A)                     |        | $C_L = 50 \text{ pF}$ , $R_L = 10 \text{ k}\Omega$ ,<br>$f_{IN} = 1\text{kHz}$ (sine wave)<br>(see Fig.9)  | $V_{CC} = 1.65 \text{ V}$ | 0.1   |     | %    |
|                                                                                    |        |                                                                                                            | $V_{CC} = 2.3 \text{ V}$  | 0.025 |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 3 \text{ V}$    | 0.015 |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 4.5 \text{ V}$  | 0.01  |     |      |
|                                                                                    |        | $C_L = 50 \text{ pF}$ , $R_L = 10 \text{ k}\Omega$ ,<br>$f_{IN} = 10\text{kHz}$ (sine wave)<br>(see Fig.9) | $V_{CC} = 1.65 \text{ V}$ | 0.15  |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 2.3 \text{ V}$  | 0.025 |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 3 \text{ V}$    | 0.015 |     |      |
|                                                                                    |        |                                                                                                            | $V_{CC} = 4.5 \text{ V}$  | 0.01  |     |      |

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

### ■ OPERATING CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

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

## ■ PARAMETER MEASUREMENT

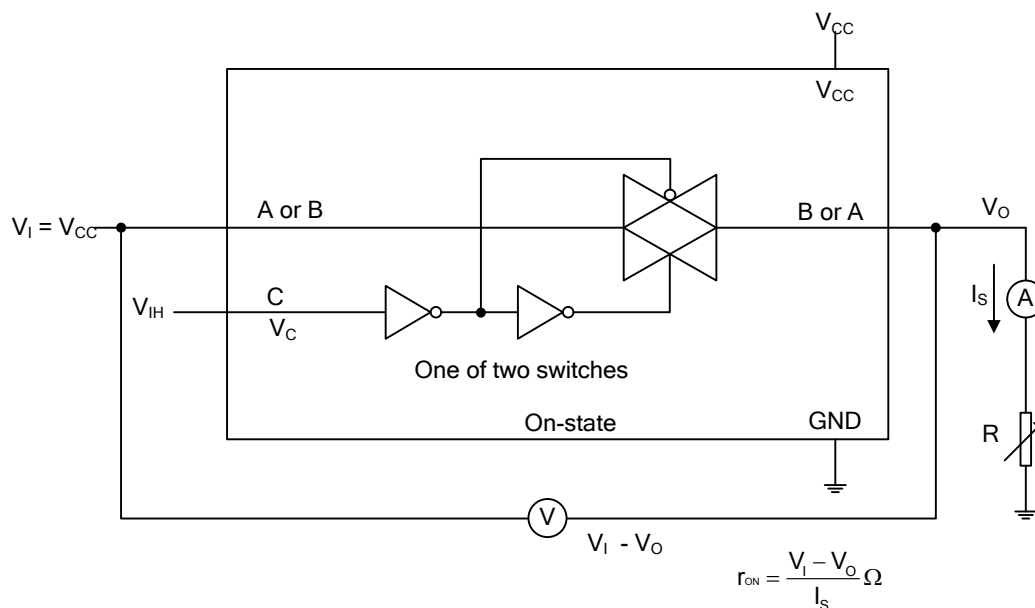
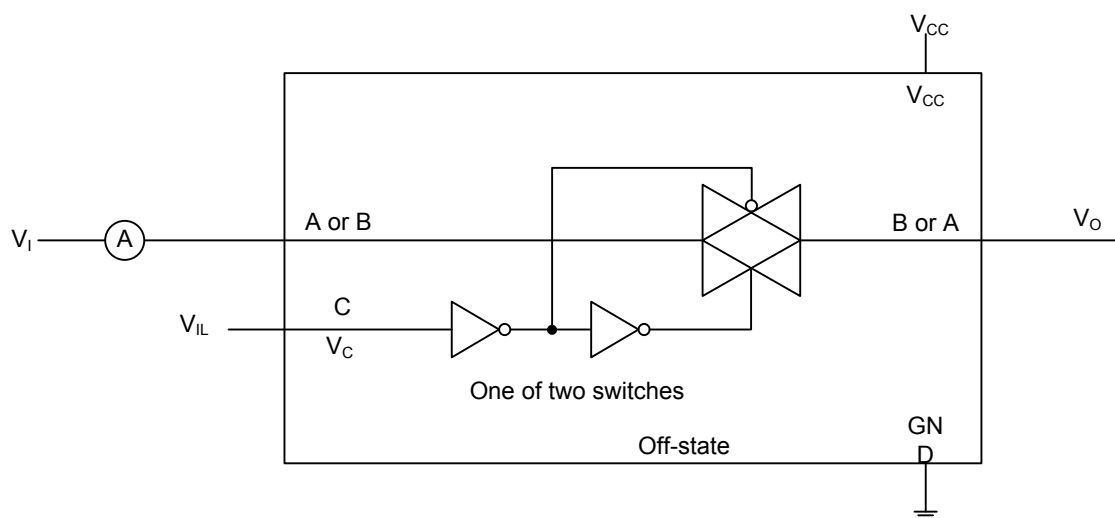


Fig.1 On-state resistance test circuit



Condition 1:  $V_I = \text{GND}$ ,  $V_O = V_{CC}$

Condition 2:  $V_I = V_{CC}$ ,  $V_O = \text{GND}$

Fig.2 Off-state switch leakage-current test circuit

## ■ PARAMETER MEASUREMENT (Cont.)

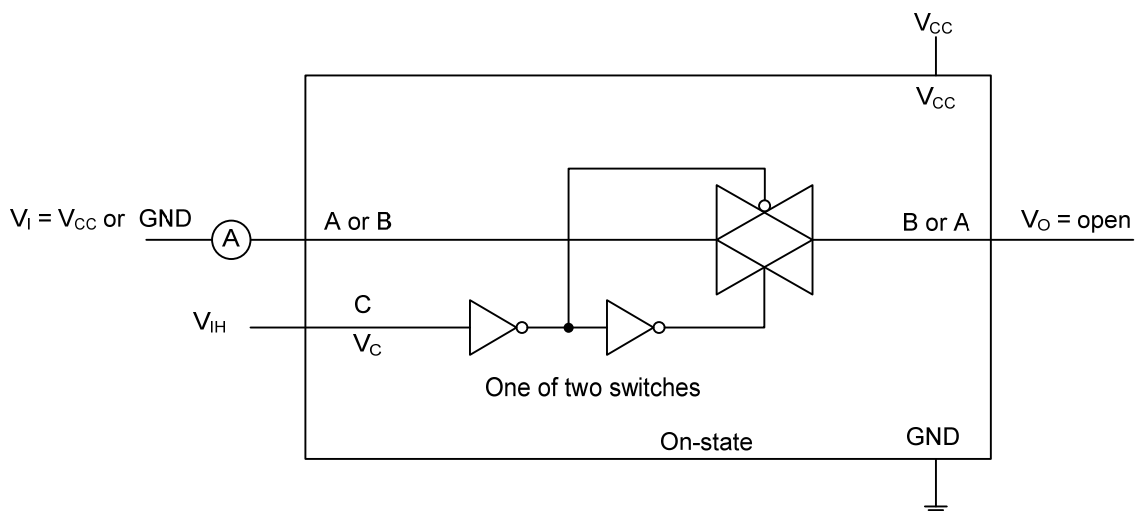


Fig.3 On-state leakage-current test circuit

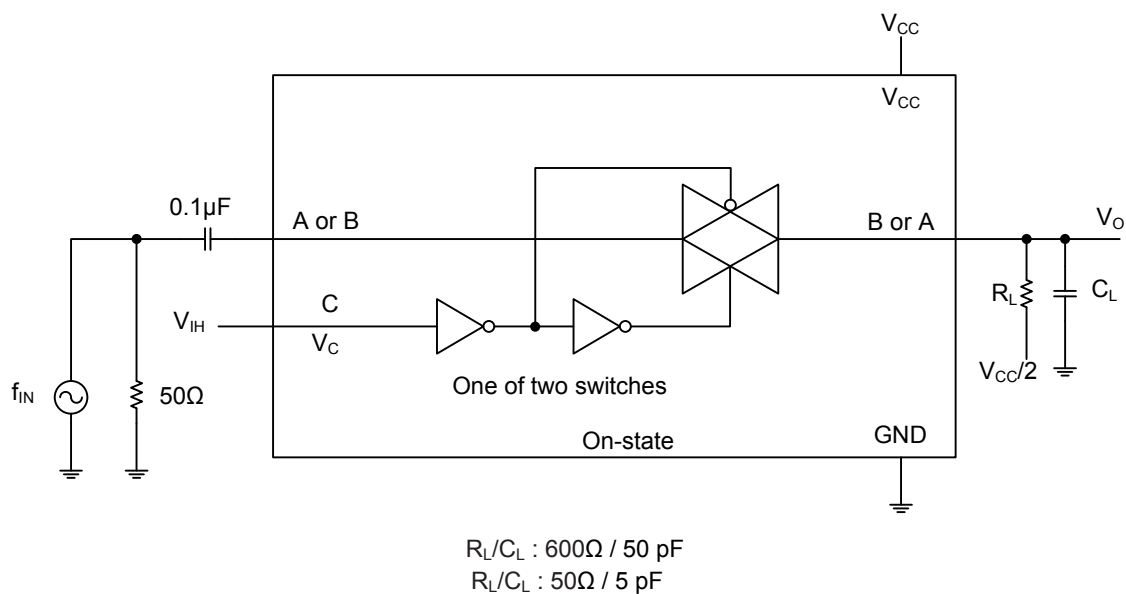
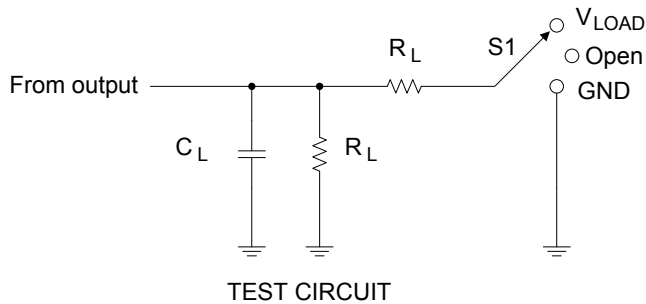


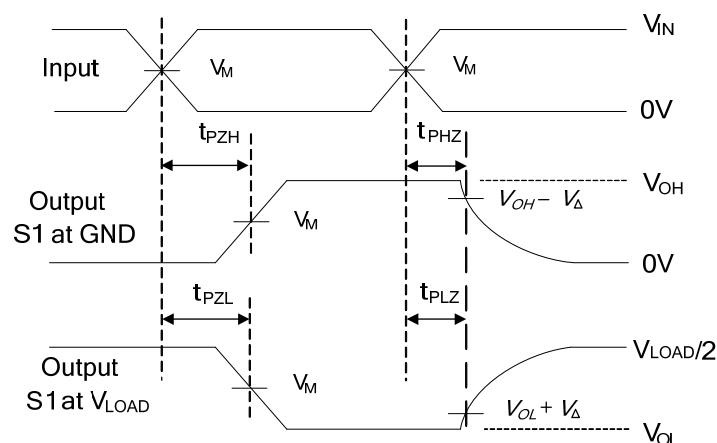
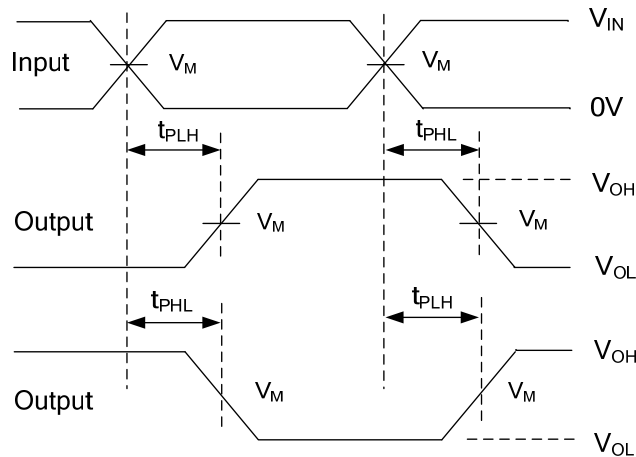
Fig.4 Frequency response (switch on)

## PARAMETER MEASUREMENT (Cont.)



| TEST                | S1         |
|---------------------|------------|
| $t_{PLH} / t_{PHL}$ | Open       |
| $t_{PLZ} / t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ} / t_{PZH}$ | GND        |

| $V_{CC}$         | Inputs   |              | $V_M$      | $V_{LOAD}$       | $C_L$ | $R_L$        | $V_\Delta$ |
|------------------|----------|--------------|------------|------------------|-------|--------------|------------|
|                  | $V_{IN}$ | $t_R, t_F$   |            |                  |       |              |            |
| $1.8V \pm 0.15V$ | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | $2 \cdot V_{CC}$ | 30pF  | 1K $\Omega$  | 0.15V      |
| $2.5V \pm 0.2V$  | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | $2 \cdot V_{CC}$ | 30pF  | 500 $\Omega$ | 0.15V      |
| $3.3V \pm 0.3V$  | $V_{CC}$ | $\leq 2.5ns$ | $V_{CC}/2$ | $2 \cdot V_{CC}$ | 50pF  | 500 $\Omega$ | 0.3V       |
| $5V \pm 0.5V$    | $V_{CC}$ | $\leq 2.5ns$ | $V_{CC}/2$ | $2 \cdot V_{CC}$ | 50pF  | 500 $\Omega$ | 0.3V       |



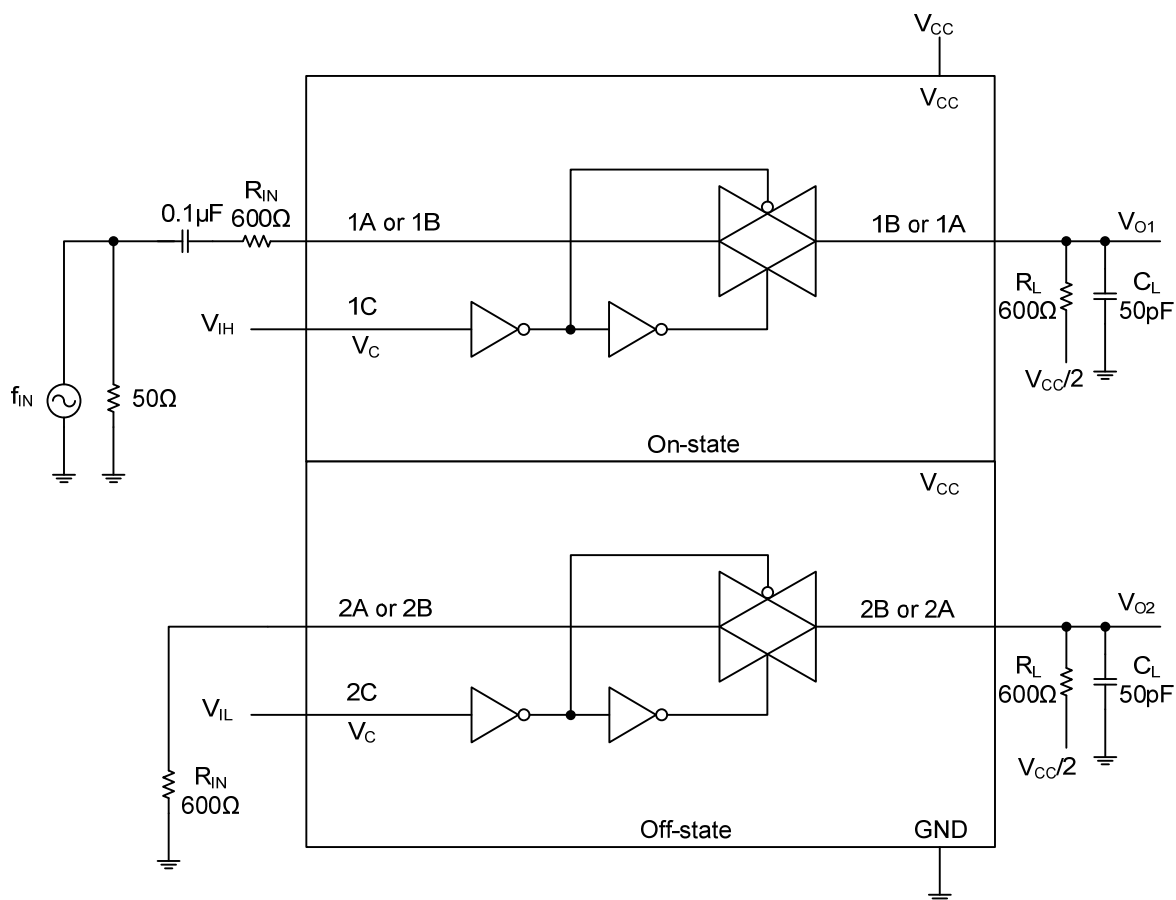
Enable and disable times  
Low and high level enabling

Notes: 1.  $C_L$  includes probe and jig capacitance.

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

Fig.5 Load circuit and voltage waveforms

## ■ PARAMETER MEASUREMENT (Cont.)



20  $\log_{10}(V_{O2}/V_{I1})$  or 20  $\log_{10}(V_{O1}/V_{I2})$   
Fig.6 Crosstalk (between switches)

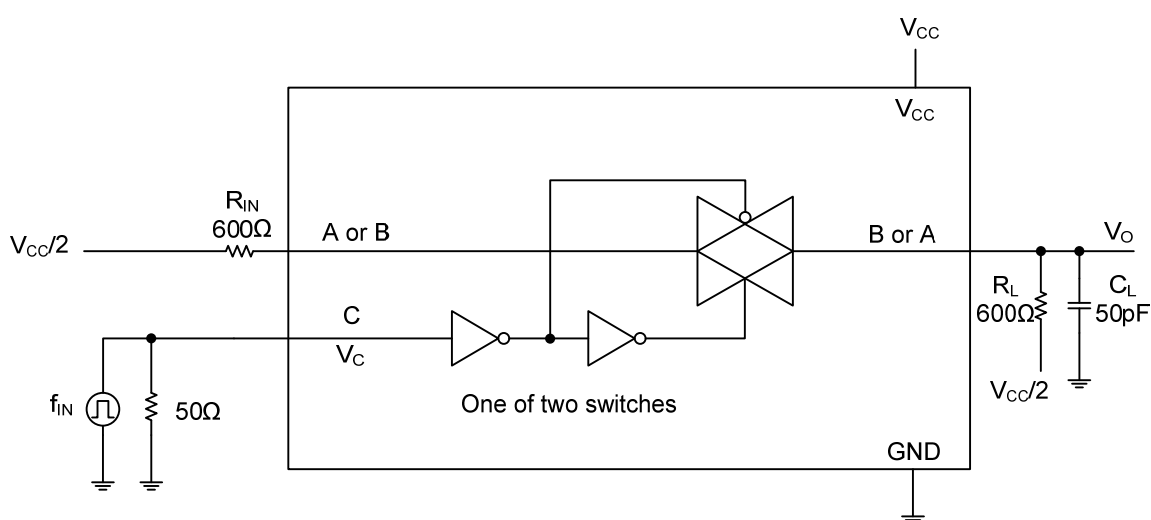


Fig.7 Crosstalk (control input, switch output)

## ■ PARAMETER MEASUREMENT (Cont.)

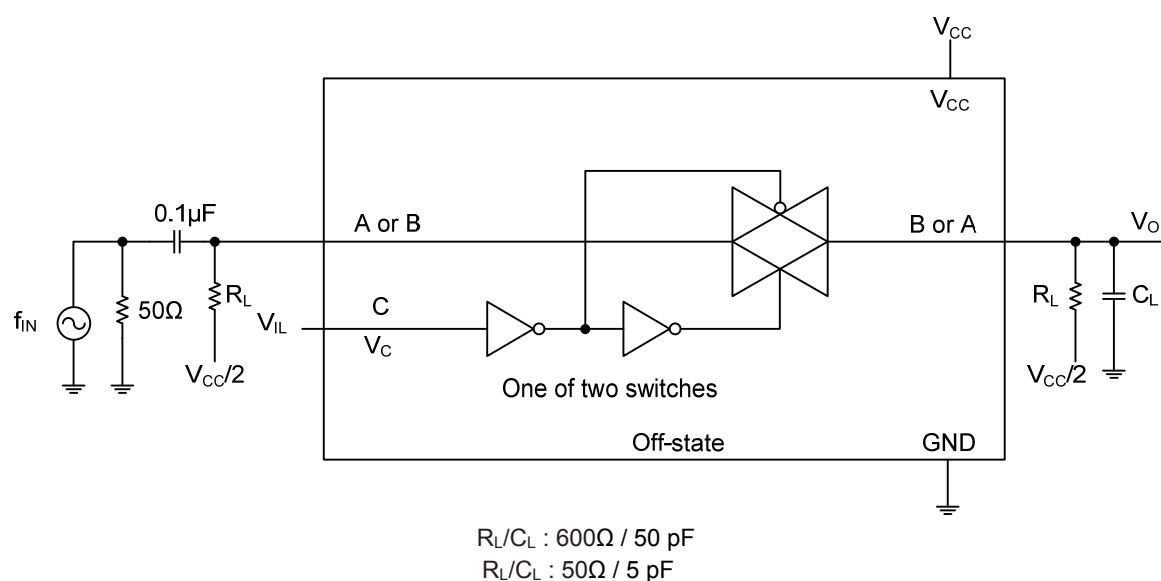


Fig.8 Feedthrough (switch off)

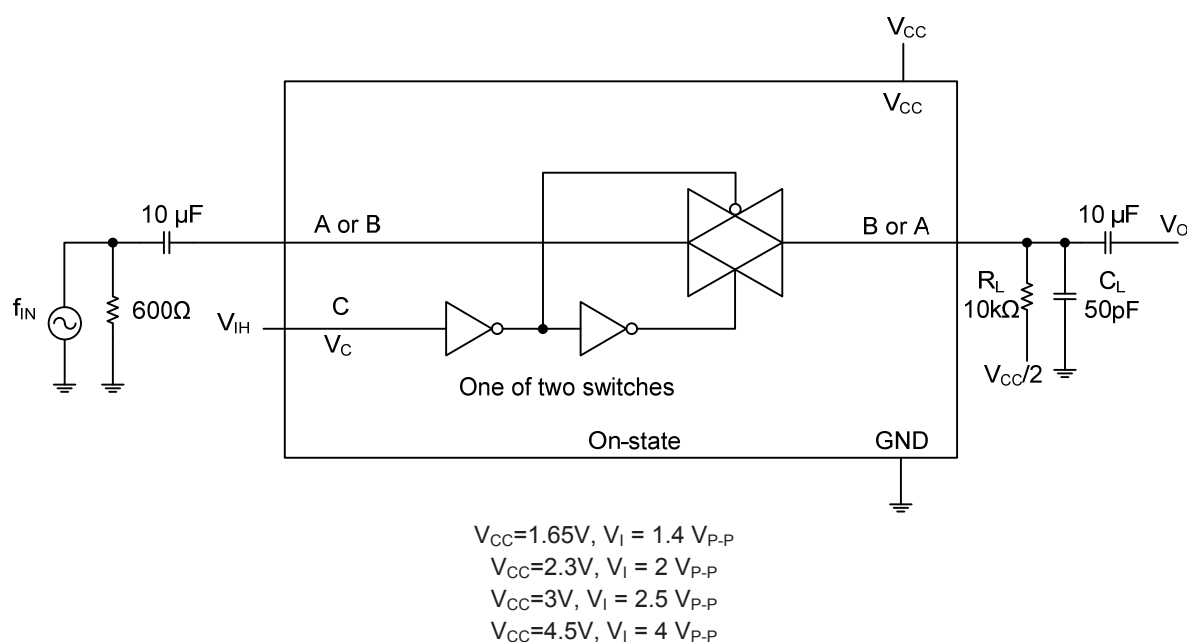


Fig.9 Sine-wave distortion

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