

**Features**

- 1.65-V to 5.5-V  $V_{CC}$  Operation
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 0.8 ns at 3.3 V
- High On-Off Output Voltage Ratio
- High Degree of Linearity
- High Speed, Typically 0.5 ns ( $V_{CC} = 3$  V,  $C_L = 50$  pF)
- Low ON-State Resistance, Typically  $\approx 5.5 \Omega$  ( $V_{CC} = 4.5$  V)
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

**Applications**

- Wireless Devices
- Audio and Video Signal Routing
- Portable Computing
- Wearable Devices
- Signal Gating, Chopping, Modulation or Demodulation (Modem)
- Signal Multiplexing for Analog-to-Digital and Digital-to-Analog Conversion Systems

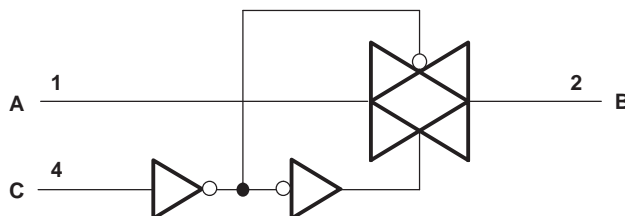
**Description**

This single analog switch is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

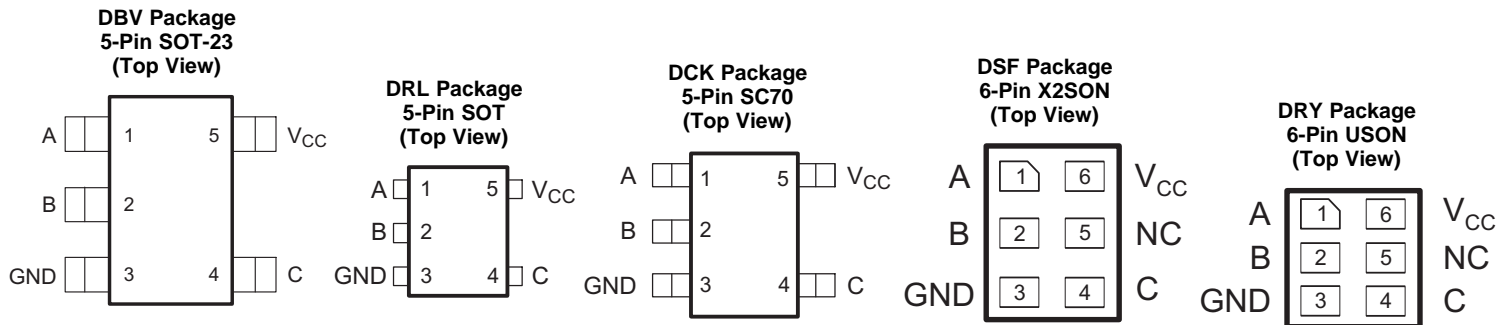
The SN74LVC1G66 device can handle analog and digital signals. The device permits bidirectional transmission of signals with amplitudes of up to 5.5 V (peak).

NanoFree package technology is a major breakthrough in IC packaging concepts, using the die as the package.

**Logic Diagram (Positive Logic)**



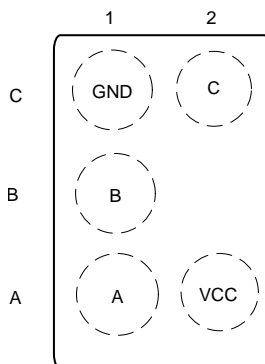
## Pin Configuration and Functions



### Pin Functions

| PIN             |         |                 | I/O | DESCRIPTION                           |
|-----------------|---------|-----------------|-----|---------------------------------------|
| NAME            | SOT NO. | USON, X2SON NO. |     |                                       |
| A               | 1       | 1               | I/O | Bidirectional signal to be switched   |
| B               | 2       | 2               | I/O | Bidirectional signal to be switched   |
| C               | 4       | 4               | I   | Controls the switch (L = OFF, H = ON) |
| GND             | 3       | 3               | —   | Ground pin                            |
| NC              | —       | 5               | —   | Do not connect                        |
| V <sub>CC</sub> | 5       | 6               | —   | Power pin                             |

### YZP Package 5-Pin DSBGA (Bottom View)



### Pin Functions

| PIN             |           | I/O | DESCRIPTION                           |
|-----------------|-----------|-----|---------------------------------------|
| NAME            | DSBGA NO. |     |                                       |
| A               | A1        | I/O | Bidirectional signal to be switched   |
| B               | B1        | I/O | Bidirectional signal to be switched   |
| C               | C2        | I   | Controls the switch (L = OFF, H = ON) |
| GND             | C1        | —   | Ground pin                            |
| V <sub>CC</sub> | A2        | —   | Power pin                             |

## Specifications

### Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                  |   | MIN  | MAX                   | UNIT |
|------------------|---|--|-----------------------|------|
| V <sub>CC</sub>  | Supply voltage <sup>(2)</sup>                     | -0.5   | 6.5                   | V    |
| V <sub>I</sub>   | Input voltage <sup>(2)(3)</sup>                   | -0.5   | 6.5                   | V    |
| V <sub>I/O</sub> | Switch I/O voltage <sup>(2)(3)(4)</sup>           | -0.5   | V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>  | Control input clamp current                       | V <sub>I</sub> < 0   | -50                   | mA   |
| I <sub>IOK</sub> | I/O port diode current                            | V <sub>I/O</sub> < 0 or V <sub>I/O</sub> > V <sub>CC</sub> | ±50                   | mA   |
| I <sub>T</sub>   | ON-state switch current                           | V <sub>I/O</sub> < 0 to V <sub>CC</sub>                    | ±50                   | mA   |
|                  | Continuous current through V <sub>CC</sub> or GND |  | ±100                  | mA   |
| T <sub>stg</sub> | Storage Temperature                               | -65  | 150                   | °C   |
| T <sub>j</sub>   | Junction Temperature                              |  | 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) All voltages are with respect to ground, unless otherwise specified.

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

(4) This value is limited to 5.5 V maximum.

### ESD Ratings

|                    |                         | VALUE  | UNIT  |
|--------------------|-------------------------|--|-------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | +2000 |
|                    |                         | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | +1000 |

(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.

### Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                  |   | MIN                                | MAX                    | UNIT |
|------------------|---|------------------------------------|------------------------|------|
| V <sub>CC</sub>  | Supply voltage                              | 1.65                               | 5.5                    | V    |
| V <sub>I/O</sub> | I/O port voltage.                           | 0                                  | V <sub>CC</sub>        | V    |
| V <sub>IH</sub>  | High-level input voltage, control input     | V <sub>CC</sub> = 1.65 V to 1.95 V | V <sub>CC</sub> × 0.65 | V    |
|                  |   | V <sub>CC</sub> = 2.3 V to 2.7 V   | V <sub>CC</sub> × 0.7  |      |
|                  |   | V <sub>CC</sub> = 3 V to 3.6 V     | V <sub>CC</sub> × 0.7  |      |
|                  |   | V <sub>CC</sub> = 4.5 V to 5.5 V   | V <sub>CC</sub> × 0.7  |      |
| V <sub>IL</sub>  | Low-level input voltage, control input      | V <sub>CC</sub> = 1.65 V to 1.95 V | V <sub>CC</sub> × 0.35 | V    |
|                  |   | V <sub>CC</sub> = 2.3 V to 2.7 V   | V <sub>CC</sub> × 0.3  |      |
|                  |   | V <sub>CC</sub> = 3 V to 3.6 V     | V <sub>CC</sub> × 0.3  |      |
|                  |   | V <sub>CC</sub> = 4.5 V to 5.5 V   | V <sub>CC</sub> × 0.3  |      |
| V <sub>I</sub>   | Control input voltage                       | 0                                  | 5.5                    | V    |
| Δt/Δv            | Control input transition rise and fall time | V <sub>CC</sub> = 1.65 V to 1.95 V | 20                     | ns/V |
|                  |   | V <sub>CC</sub> = 2.3 V to 2.7 V   | 20                     |      |
|                  |   | V <sub>CC</sub> = 3 V to 3.6 V     | 10                     |      |
|                  |   | V <sub>CC</sub> = 4.5 V to 5.5 V   | 10                     |      |
| T <sub>A</sub>   | Operating free-air temperature              | -40                                | 85                     | °C   |

(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.

## Thermal Information

| THERMAL METRIC  | SN74LVC1G66  |            |           |            |             |             | UNIT |
|---|--------------|------------|-----------|------------|-------------|-------------|------|
|   | DBV (SOT-23) | DCK (SC70) | DRL (SOT) | DRY (USON) | DSF (X2SON) | YZP (DSBGA) |      |
|   | 5 PINS       | 5 PINS     | 5 PINS    | 6 PINS     | 6 PINS      | 5 PINS      |      |
| R <sub>θJA</sub> Junction-to-ambient thermal resistance | 206          | 252        | 142       | —          | —           | 132         | °C/W |

## Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS  | V <sub>CC</sub>        | MIN    | TYP <sup>(1)</sup> | MAX        | UNIT |
|--|--|------------------------|--------|--------------------|------------|------|
| r <sub>on</sub> ON-state switch resistance               | V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>C</sub> = V <sub>IH</sub> (see Figure 2 and Figure 1)  | I <sub>S</sub> = 4 mA  | 1.65 V | 12                 | 30         | Ω    |
|  |  | I <sub>S</sub> = 8 mA  | 2.3 V  | 9                  | 20         |      |
|  |  | I <sub>S</sub> = 24 mA | 3 V    | 7.5                | 15         |      |
|  |  | I <sub>S</sub> = 32 mA | 4.5 V  | 5.5                | 10         |      |
| r <sub>on(p)</sub> Peak on resistance                    | V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>C</sub> = V <sub>IH</sub> (see Figure 2 and Figure 1)  | I <sub>S</sub> = 4 mA  | 1.65 V | 74.5               | 120        | Ω    |
|  |  | I <sub>S</sub> = 8 mA  | 2.3 V  | 20                 | 30         |      |
|  |  | I <sub>S</sub> = 24 mA | 3 V    | 11.5               | 20         |      |
|  |  | I <sub>S</sub> = 32 mA | 4.5 V  | 7.5                | 15         |      |
| I <sub>S(off)</sub> OFF-state switch leakage current     | V <sub>I</sub> = V <sub>CC</sub> and V <sub>O</sub> = GND or V <sub>I</sub> = GND and V <sub>O</sub> = V <sub>CC</sub> , V <sub>C</sub> = V <sub>IL</sub> (see Figure 3) | T <sub>A</sub> = 25°C  | 5.5 V  |                    | ±1<br>±0.1 | μA   |
| I <sub>S(on)</sub> ON-state switch leakage current       | V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>C</sub> = V <sub>IH</sub> , V <sub>O</sub> = Open (see Figure 4)   | T <sub>A</sub> = 25°C  | 5.5 V  |                    | ±1<br>±0.1 | μA   |
| I <sub>I</sub> Control input current                     | V <sub>C</sub> = V <sub>CC</sub> or GND  | T <sub>A</sub> = 25°C  | 5.5 V  |                    | ±1<br>±0.1 | μA   |
| I <sub>CC</sub> Supply current                           | V <sub>C</sub> = V <sub>CC</sub> or GND  | T <sub>A</sub> = 25°C  | 5.5 V  |                    | 10<br>1    | μA   |
| ΔI <sub>CC</sub> Supply current change                   | V <sub>C</sub> = V <sub>CC</sub> - 0.6 V   |                        | 5.5 V  |                    | 500        | μA   |
| C <sub>ic</sub> Control input capacitance                |  |                        | 5 V    |                    | 2          | pF   |
| C <sub>io(off)</sub> Switch input and output capacitance |  |                        | 5 V    |                    | 6          | pF   |
| C <sub>io(on)</sub> Switch input and output capacitance  |  |                        | 5 V    |                    | 13         | pF   |

(1) T<sub>A</sub> = 25°C

## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER                       | FROM (INPUT) | TO (OUTPUT) | V <sub>CC</sub> = 1.8 V ± 0.15 V |     | V <sub>CC</sub> = 2.5 V ± 0.2 V |     | V <sub>CC</sub> = 3.3 V ± 0.3 V |     | V <sub>CC</sub> = 5 V ± 0.5 V |     | UNIT |
|---------------------------------|--------------|-------------|----------------------------------|-----|---------------------------------|-----|---------------------------------|-----|-------------------------------|-----|------|
|                                 |              |             | MIN                              | MAX | MIN                             | MAX | MIN                             | MAX | MIN                           | MAX |      |
| t <sub>pd</sub> <sup>(1)</sup>  | A or B       | B or A      |                                  | 2   |                                 | 1.2 |                                 | 0.8 |                               | 0.6 | ns   |
| t <sub>en</sub> <sup>(2)</sup>  | C            | A or B      | 2.5                              | 12  | 1.9                             | 6.5 | 1.8                             | 5   | 1.5                           | 4.2 | ns   |
| t <sub>dis</sub> <sup>(3)</sup> | C            | A or B      | 2.2                              | 10  | 1.4                             | 6.9 | 2                               | 6.5 | 1.4                           | 5   | ns   |

(1) t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd</sub>. The propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

(2) t<sub>PZL</sub> and t<sub>PZH</sub> are the same as t<sub>en</sub>.

(3) t<sub>PLZ</sub> and t<sub>PHZ</sub> are the same as t<sub>dis</sub>.

## Analog Switch Characteristics

T<sub>A</sub> = 25°C

| PARAMETER  | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS  | V <sub>CC</sub> | TYP    | UNIT |
|--|--------------|-------------|--|-----------------|--------|------|
| Frequency response <sup>(1)</sup><br>(switch ON)       | A or B       | B or A      | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 600 Ω,<br>f <sub>in</sub> = sine wave           | 1.65 V          | 35     | MHz  |
|  |              |             |  | 2.3 V           | 120    |      |
|  |              |             |  | 3 V             | 175    |      |
|  |              |             |  | 4.5 V           | 195    |      |
|  |              |             | C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω,<br>f <sub>in</sub> = sine wave             | 1.65 V          | >300   |      |
|  |              |             |  | 2.3 V           | >300   |      |
|  |              |             |  | 3 V             | >300   |      |
|  |              |             |  | 4.5 V           | >300   |      |
| Crosstalk<br>(control input to signal output)          | C            | A or B      | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 600 Ω,<br>f <sub>in</sub> = 1 MHz (square wave) | 1.65 V          | 35     | mV   |
|  |              |             |  | 2.3 V           | 50     |      |
|  |              |             |  | 3 V             | 70     |      |
|  |              |             |  | 4.5 V           | 100    |      |
| Feedthrough attenuation <sup>(2)</sup><br>(switch OFF) | A or B       | B or A      | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 600 Ω,<br>f <sub>in</sub> = 1 MHz (sine wave)   | 1.65 V          | -58    | dB   |
|  |              |             |  | 2.3 V           | -58    |      |
|  |              |             |  | 3 V             | -58    |      |
|  |              |             |  | 4.5 V           | -58    |      |
|  |              |             | C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω,<br>f <sub>in</sub> = 1 MHz (sine wave)     | 1.65 V          | -42    |      |
|  |              |             |  | 2.3 V           | -42    |      |
|  |              |             |  | 3 V             | -42    |      |
|  |              |             |  | 4.5 V           | -42    |      |
| Sine-wave distortion                                   | A or B       | B or A      | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 10 kΩ,<br>f <sub>in</sub> = 1 kHz (sine wave)   | 1.65 V          | 0.1%   |      |
|  |              |             |  | 2.3 V           | 0.025% |      |
|  |              |             |  | 3 V             | 0.015% |      |
|  |              |             |  | 4.5 V           | 0.01%  |      |
|  |              |             | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 10 kΩ,<br>f <sub>in</sub> = 10 kHz (sine wave)  | 1.65 V          | 0.15%  |      |
|  |              |             |  | 2.3 V           | 0.025% |      |
|  |              |             |  | 3 V             | 0.015% |      |
|  |              |             |  | 4.5 V           | 0.01%  |      |

(1) Adjust f<sub>in</sub> voltage to obtain 0 dBm at output. Increase f<sub>in</sub> frequency until dB meter reads -3 dB.

(2) Adjust f<sub>in</sub> voltage to obtain 0 dBm at input.

## Operating Characteristics

T<sub>A</sub> = 25°C

| PARAMETER                                     | TEST CONDITIONS | V <sub>CC</sub> = 1.8 V | V <sub>CC</sub> = 2.5 V | V <sub>CC</sub> = 3.3 V | V <sub>CC</sub> = 5 V | UNIT |
|---|-----------------|-------------------------|-------------------------|-------------------------|-----------------------|------|
|   |                 | TYP                     | TYP                     | TYP                     | TYP                   |      |
| C <sub>pd</sub> Power dissipation capacitance | f = 10 MHz      | 8                       | 9                       | 9                       | 11                    | pF   |

**Typical Characteristics**

$T_A = 25^\circ\text{C}$

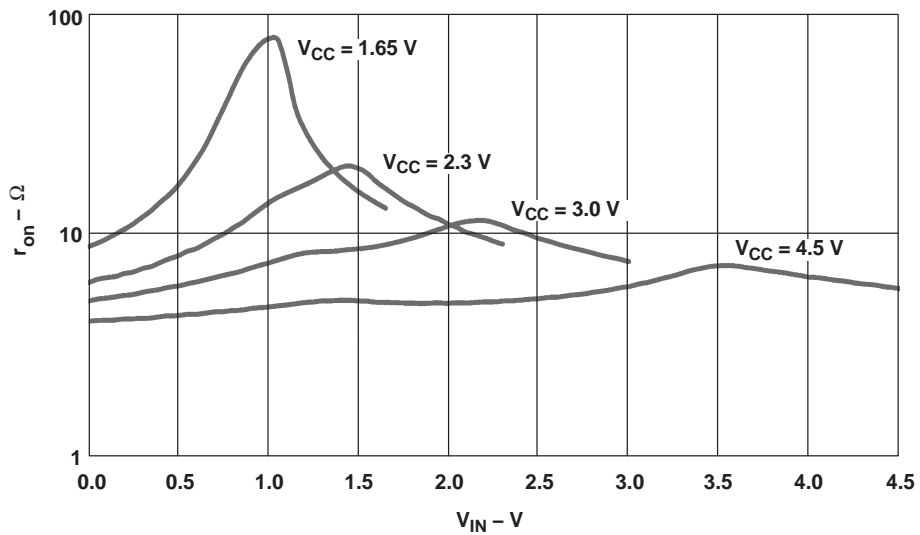
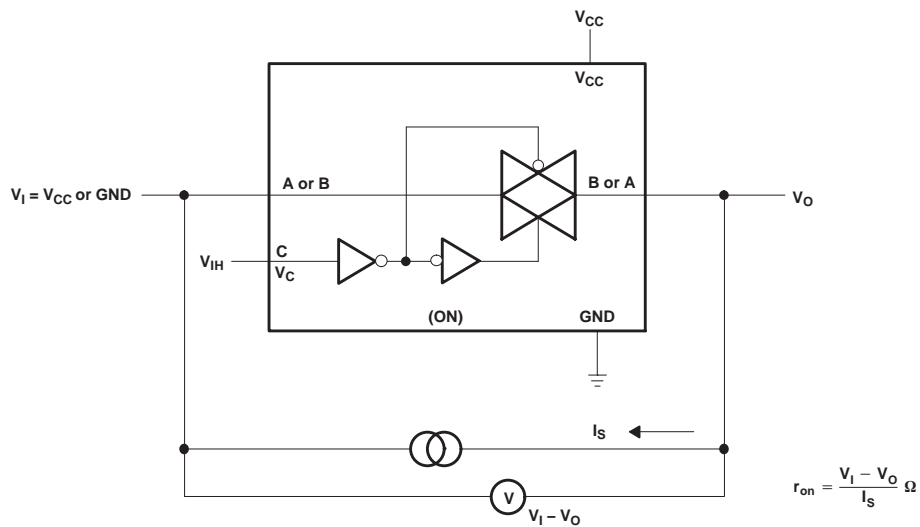
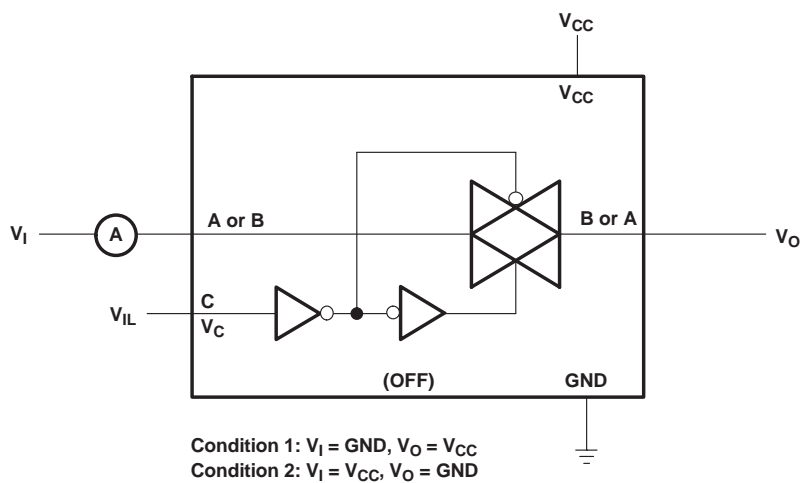


Figure 1. Typical  $r_{on}$  as a Function of Input Voltage ( $V_I$ ) for  $V_I = 0$  to  $V_{CC}$

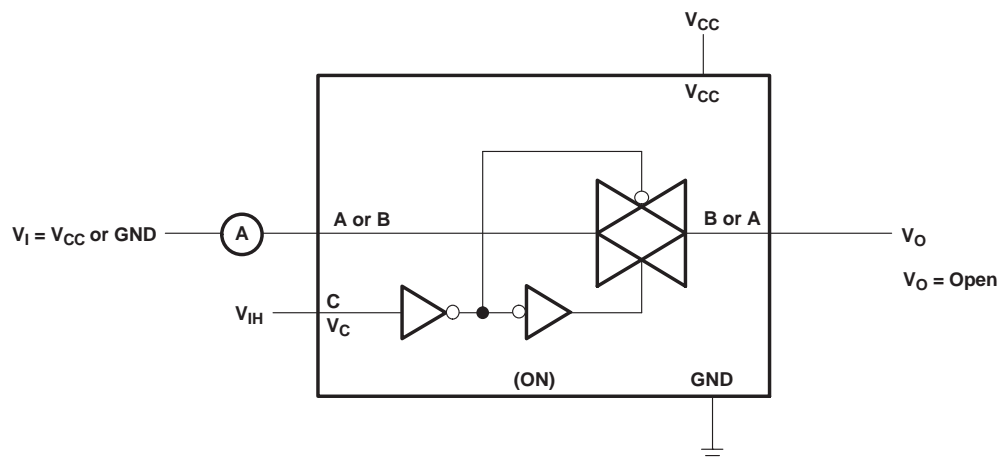
**Parameter Measurement Information**



**Figure 2. ON-State Resistance Test Circuit**

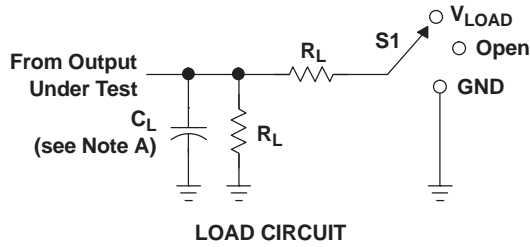


**Figure 3. OFF-State Switch Leakage-Current Test Circuit**



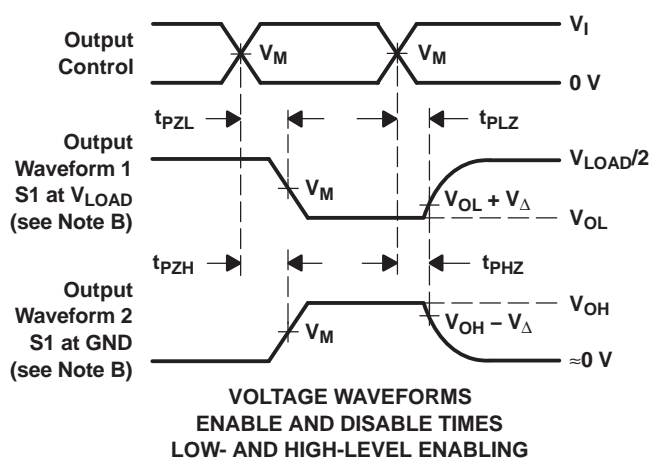
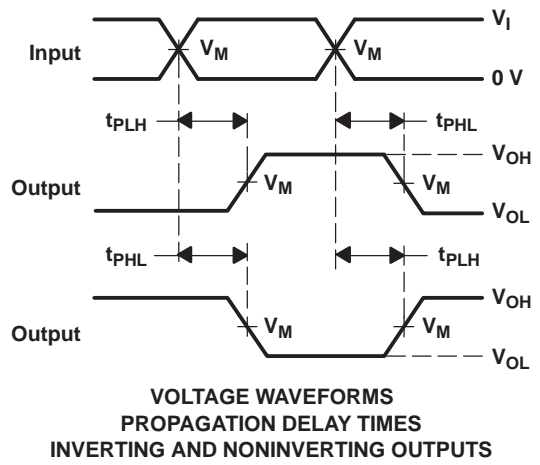
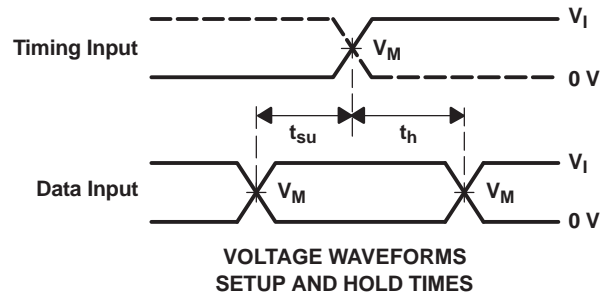
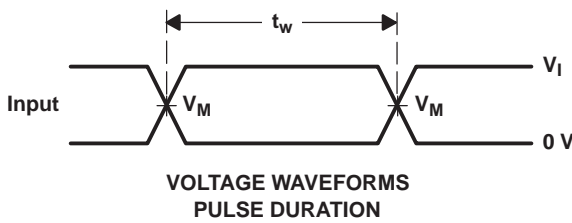
**Figure 4. ON-State Switch Leakage-Current Test Circuit**

**Parameter Measurement Information (continued)**



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

| $V_{CC}$                         | INPUTS   |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_{\Delta}$ |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
|                                  | $V_I$    | $t_r/t_f$            |            |                   |       |              |              |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k $\Omega$ | 0.15 V       |
| $2.5\text{ V} \pm 0.2\text{ V}$  | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 $\Omega$ | 0.15 V       |
| $3.3\text{ V} \pm 0.3\text{ V}$  | $V_{CC}$ | $\leq 2.5\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 50 pF | 500 $\Omega$ | 0.3 V        |
| $5\text{ V} \pm 0.5\text{ V}$    | $V_{CC}$ | $\leq 2.5\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 50 pF | 500 $\Omega$ | 0.3 V        |

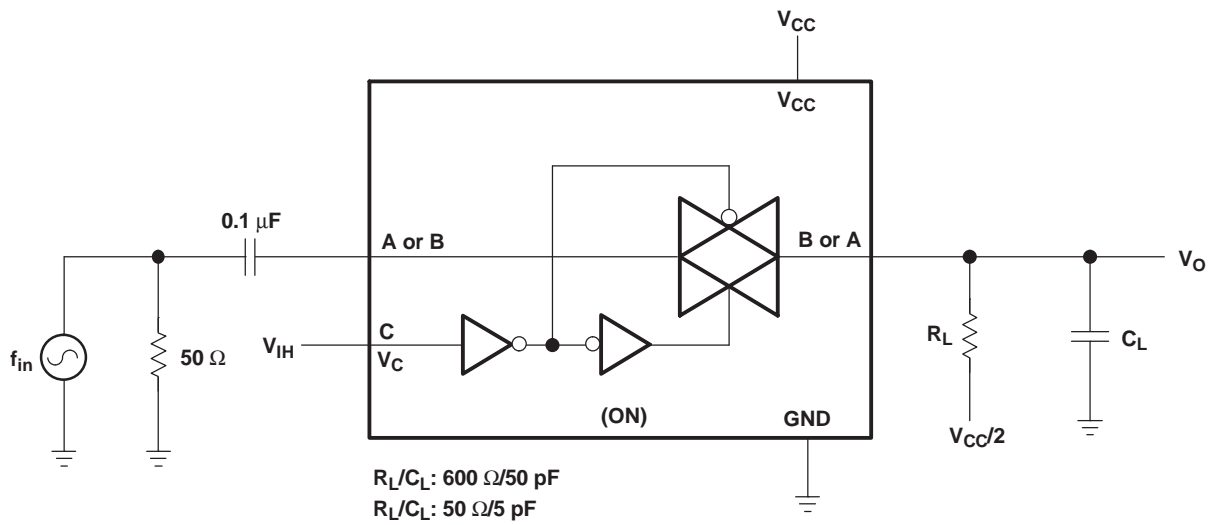


- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ .
  - 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 devices.

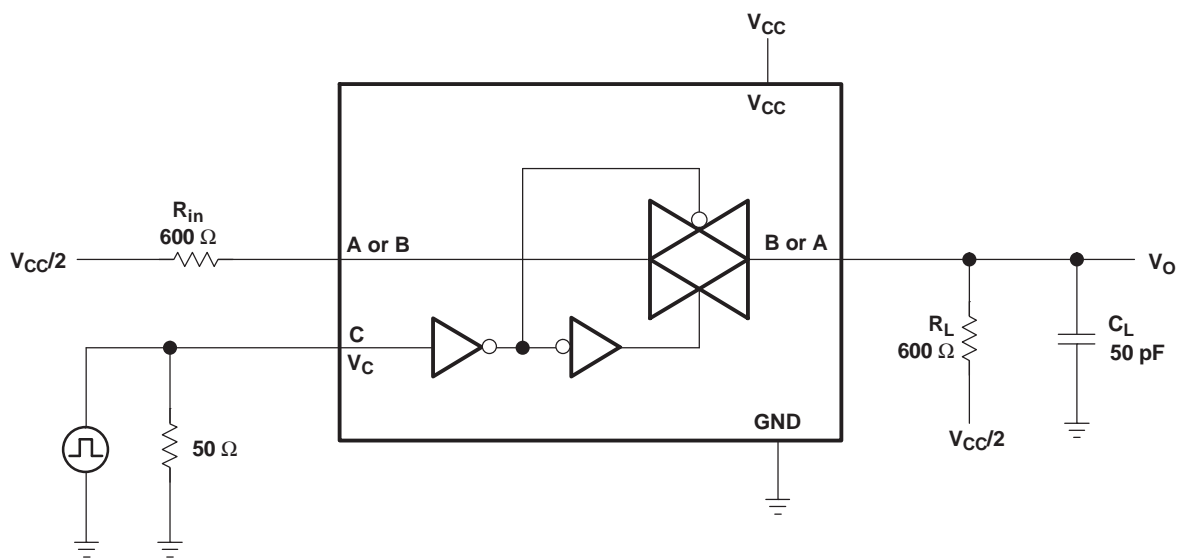
**Figure 5. Load Circuit and Voltage Waveforms**



**Parameter Measurement Information (continued)**

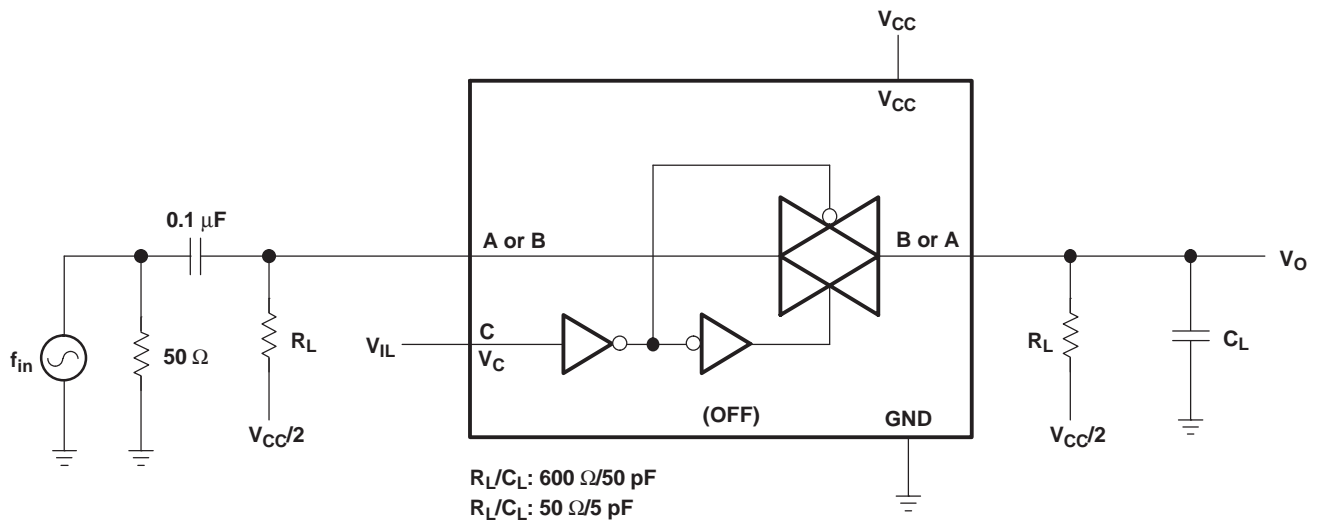


**Figure 6. Frequency Response (Switch ON)**

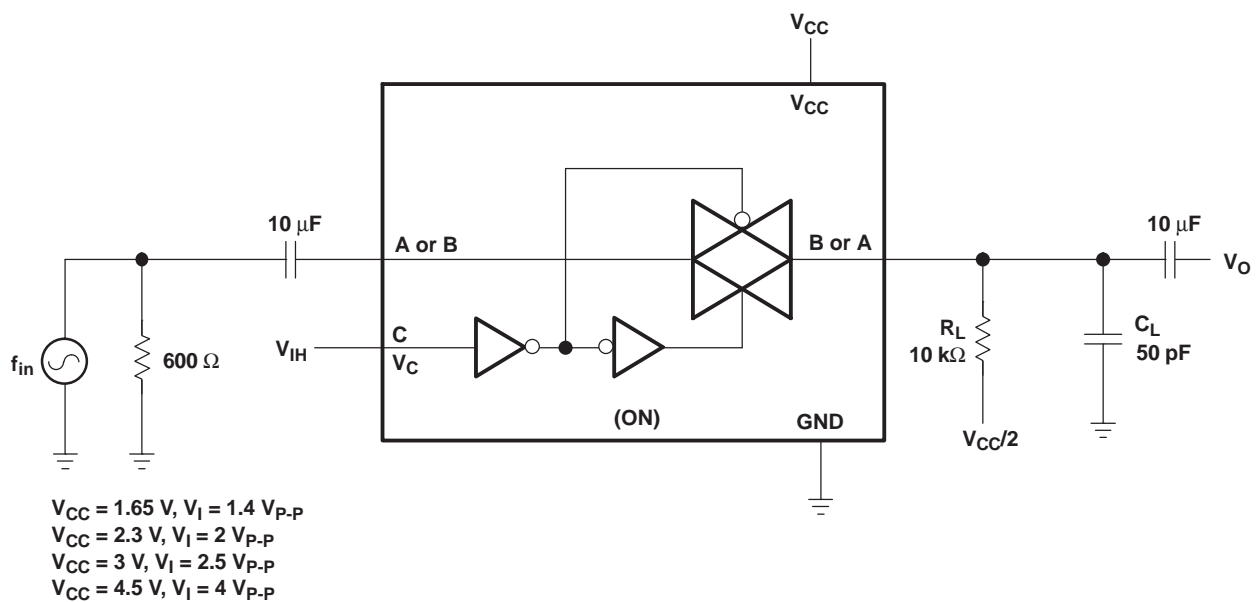


**Figure 7. Crosstalk (Control Input – Switch Output)**

**Parameter Measurement Information (continued)**



**Figure 8. Feedthrough (Switch OFF)**



**Figure 9. Sine-Wave Distortion**

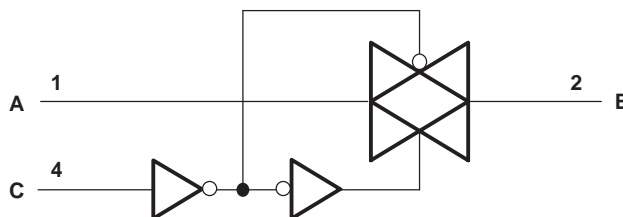
## Detailed Description

### Overview

This single analog switch is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

The SN74LVC1G66 device can handle analog and digital signals. The device permits bidirectional transmission of signals with amplitudes of up to 5.5 V (peak). Like all analog switches, the SN74LVC1G66 is bidirectional.

### Functional Block Diagram



**Figure 10. Logic Diagram (Positive Logic)**

### Feature Description

The SN74LVC1G66 has a wide  $V_{CC}$  range, allowing rail-to-rail operation of signals anywhere from a 1.8-V system to a 5-V system. In addition, the control input (C Pin) is 5.5-V tolerant, allowing higher-voltage logic to interface to the switch control system.

### Device Functional Modes

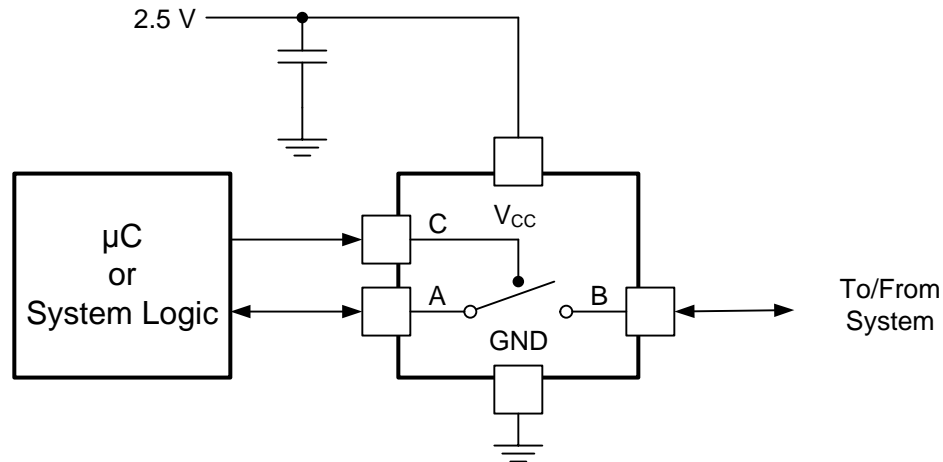
**Table 1. Function Table**

| CONTROL INPUT (C) | SWITCH |
|-------------------|--------|
| L                 | OFF    |
| H                 | ON     |

**Application Information**

The SN74LVC1G66 can be used in any situation where an SPST switch would be used and a solid-state, voltage-controlled version is preferred.

**Typical Application**



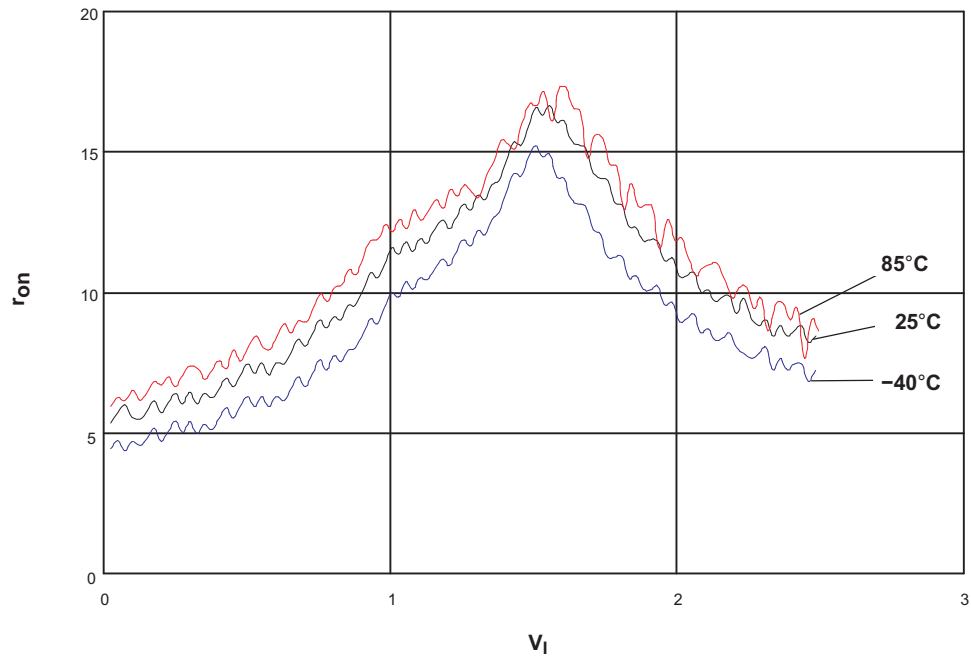
**Figure 11. Typical Application Schematic**

**Design Requirements**

The SN74LVC1G66 allows on and off control of analog and digital signals with a digital control signal. All input signals should remain between 0 V and  $V_{CC}$  for optimal operation.

**Typical Application (continued)**

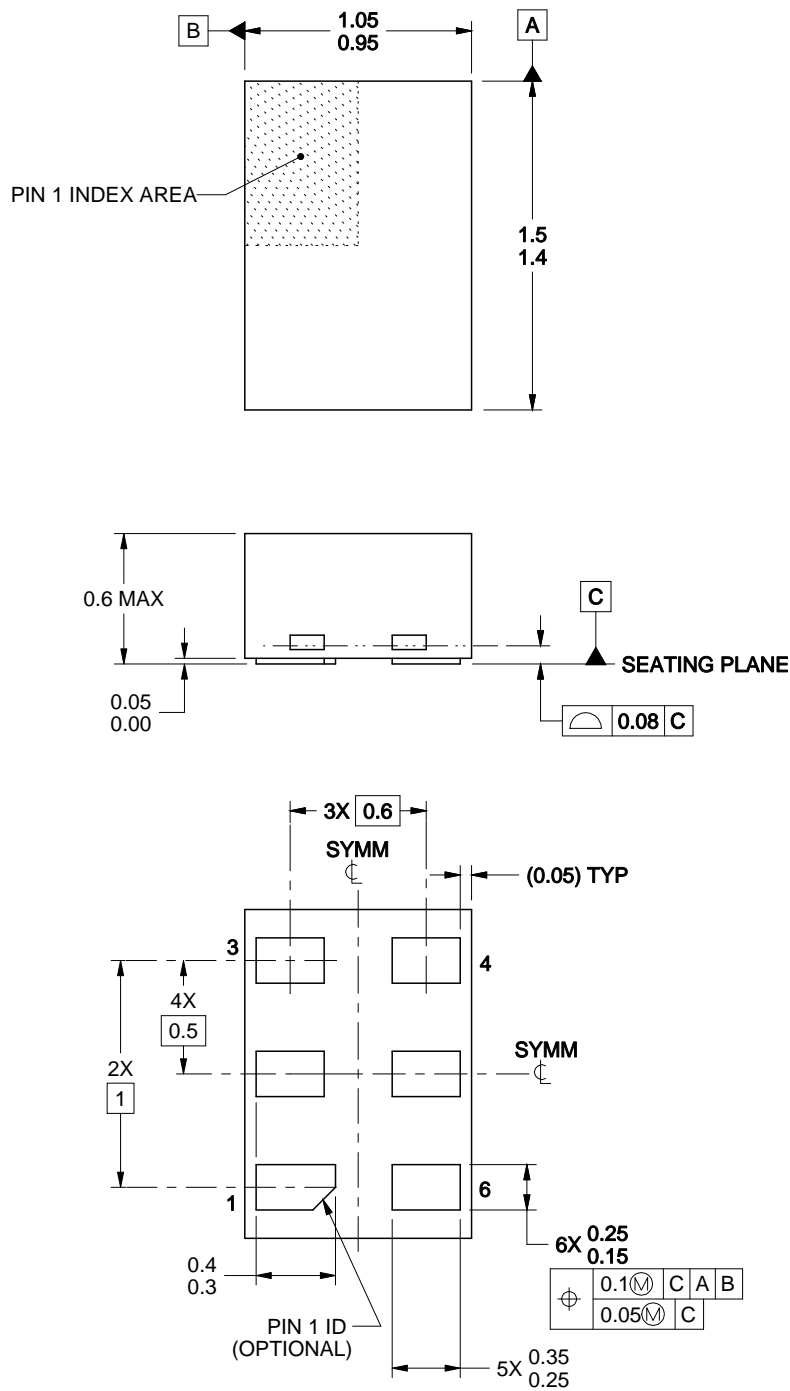
**Application Curve**



**Figure 12.  $r_{on}$  vs  $V_I$ ,  $V_{CC} = 2.5$  V (SN74LVC1G66)**



**DRY (USON-6)**

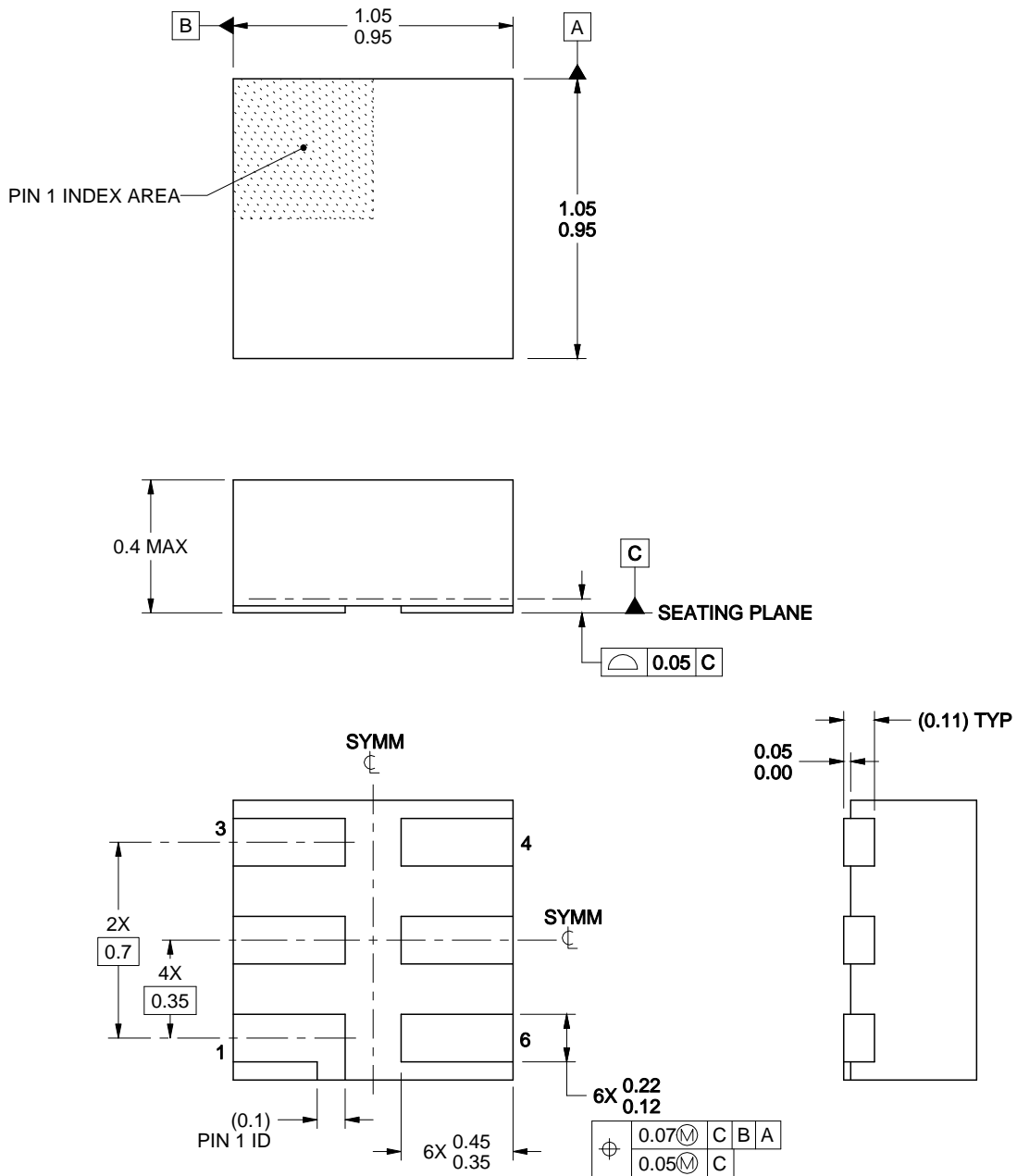


4222894/A 01/2018

**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

**DSF (X2SON-6)**



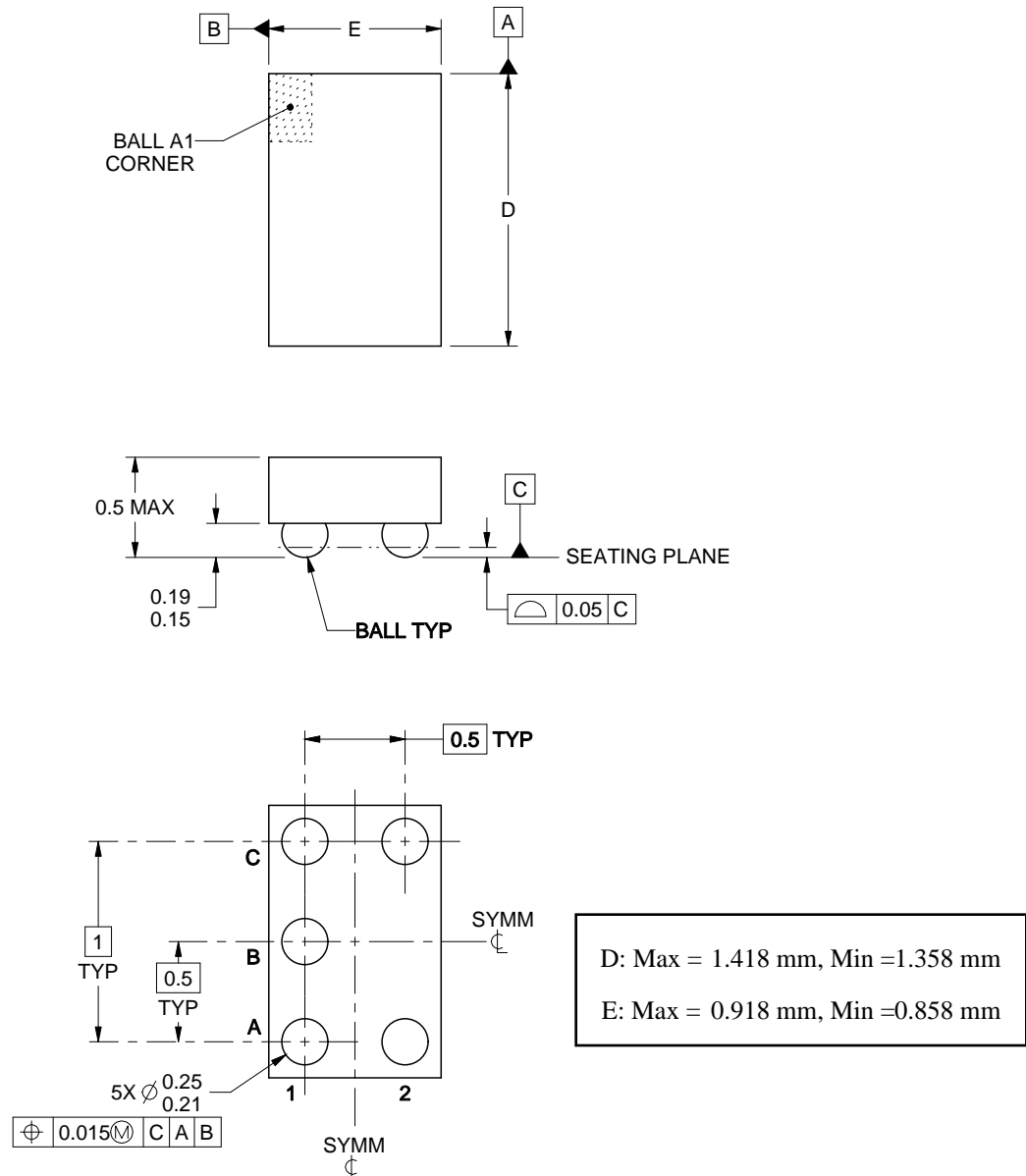
**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration MO-287, variation X2AAF.





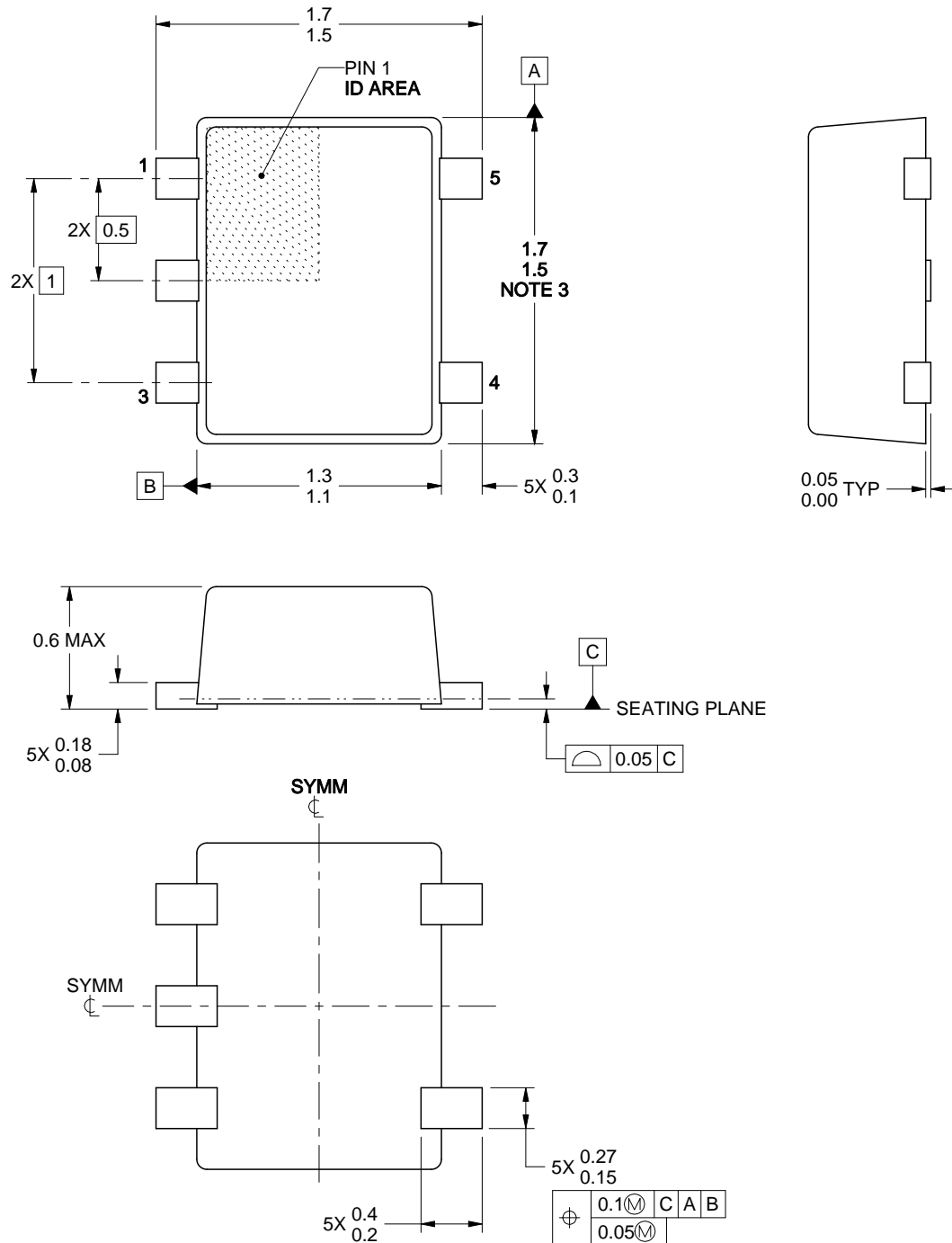
**YZP (DSBGA-5)**



**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

**DRL (SOT-553)**



**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

**Ordering information**

| Order Code      | Marking code | Package | Baseqty | Deliverymode  |
|-----------------|--------------|---------|---------|---------------|
| SN74LVC1G66DBVR | C665         | SOT23-5 | 3000    | Tape and reel |
| SN74LVC1G66DCKR | C65          | SC70-5  | 3000    | Tape and reel |
| SN74LVC1G66DRLR | C6R          | SOT-553 | 3000    | Tape and reel |
| SN74LVC1G66DRYR | C6           | USON-6  | 3000    | Tape and reel |
| SN74LVC1G66DSFR | C6           | X2SON-6 | 3000    | Tape and reel |
| SN74LVC1G66YZPR | C6N          | DSBGA-5 | 3000    | Tape and reel |