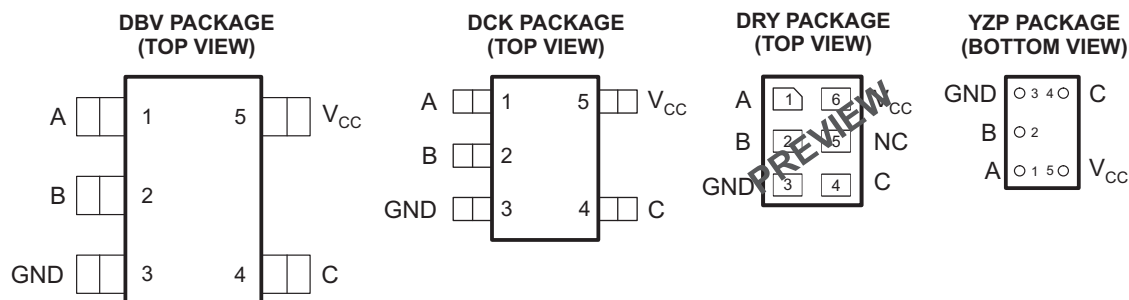


SINGLE BILATERAL ANALOG SWITCH

FEATURES

- Available in the Texas Instruments NanoFree™ Package
- Wide V_{CC} Range of 0.8 V to 2.7 V
- Sub-1-V Operable
- Low Power Consumption, 10- μ A Max I_{CC}
- High On-Off Output Voltage Ratio
- High Degree of Linearity
- High Speed – Max 0.2 ns ($V_{CC} = 1.8$ V, $C_L = 15$ pF)
- Low On-State Impedance – Typically 9 Ω ($V_{CC} = 2.3$ 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)



See mechanical drawings for dimensions.
NC– No internal connection

DESCRIPTION/ORDERING INFORMATION

This single analog switch is operational at 0.8-V to 2.7-V V_{CC} , but is designed specifically for 1.65-V to 1.95-V V_{CC} operation.

The SN74AUC1G66 can handle both analog and digital signals. The combined AC and DC signal has to be between V_{CC} and GND for it to be transmitted in either direction.

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

Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

NanoFree is a trademark of Texas Instruments.

UNLESS OTHERWISE NOTED this document contains PRODUCTION DATA information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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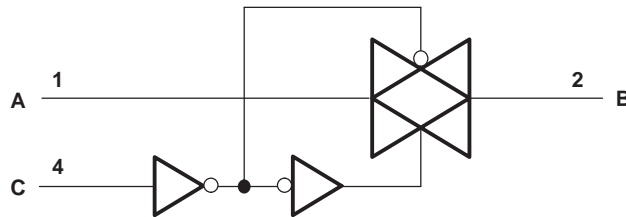
ORDERING INFORMATION

| T _A | PACKAGE ⁽¹⁾⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING ⁽³⁾ |
|----------------|---|--------------|-----------------------|---------------------------------|
| –40°C to 85°C | NanoFree™ WCSP (DSBGA) – YZP (Pb-free) | Reel of 3000 | SN74AUC1G66YZPR | _ _ _U6_ |
| | SON – DRY | Reel of 5000 | SN74AUC1G66DRYR | PREVIEW |
| | SOT (SOT-23) – DBV | Reel of 3000 | SN74AUC1G66DBVR | U66_ |
| | SOT (SC-70) – DCK | Reel of 3000 | SN74AUC1G66DCKR | U6_ |

- (1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
- (3) DBV/DCK/DRY: The actual top-side marking has one additional character that designates the assembly/test site.
YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site.

FUNCTION TABLE

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

LOGIC DIAGRAM (POSITIVE LOGIC)**Absolute Maximum Ratings⁽¹⁾**

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

| | | | MIN | MAX | UNIT |
|---|---|--|------|-----------------------|------|
| V _{CC} | Supply voltage range | | −0.5 | 3.6 | V |
| V _I | Input voltage range ⁽²⁾ | | −0.5 | 3.6 | V |
| V _{I/O} | Switch I/O voltage range ^{(2) (3)} | | −0.5 | V _{CC} + 0.5 | V |
| I _{IK} | Control input clamp current | V _I < 0 | | −50 | mA |
| I _{IOK} | I/O port diode current | V _{I/O} < 0 or V _{I/O} > V _{CC} | | ±50 | mA |
| I _T | On-state switch current | V _{I/O} = 0 to V _{CC} | | ±50 | mA |
| Continuous current through V _{CC} or GND | | | | ±100 | mA |
| θ _{JA} | Package thermal impedance ⁽⁴⁾ | DBV package | | 206 | °C/W |
| | | DCK package | | 252 | |
| | | DRY package | | 234 | |
| | | YZP package | | 123 | |
| 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) All voltages are with respect to ground, unless otherwise specified.
- (3) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾

| | | | MIN | MAX | UNIT |
|------------------|------------------------------------|-----------------------------------|------------------------|-----------------|------|
| V _{CC} | Supply voltage | | 0.8 | 2.7 | V |
| V _{IH} | High-level input voltage | V _{CC} = 0.8 V | V _{CC} | | V |
| | | V _{CC} = 1.1 V to 1.95 V | 0.65 × V _{CC} | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | | |
| V _{IL} | Low-level input voltage | V _{CC} = 0.8 V | 0 | | V |
| | | V _{CC} = 1.1 V to 1.95 V | 0.35 × V _{CC} | | |
| | | V _{CC} = 2.3 V to 2.7 V | 0.7 | | |
| V _{I/O} | I/O port voltage | | 0 | V _{CC} | V |
| V _I | Control input voltage | | 0 | 3.6 | V |
| Δt/Δv | Input transition rise or fall rate | | | 20 | ns/V |
| T _A | Operating free-air temperature | | −40 | 85 | °C |

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS | V _{CC} | MIN | TYP ⁽¹⁾ | MAX | UNIT |
|----------------------|---|-----------------------|--------|---------------------------|-----|------|
| r _{on} | On-state switch resistance V _I = V _{CC} or GND, V _C = V _{IH} (see Figure 1) | I _S = 4 mA | 1.65 V | 10 | 20 | Ω |
| | | I _S = 8 mA | 2.3 V | 9 | 15 | |
| r _{on(p)} | Peak on resistance V _I = V _{CC} to GND, V _C = V _{IH} (see Figure 1) | I _S = 4 mA | 1.65 V | 32 | 80 | Ω |
| | | I _S = 8 mA | 2.3 V | 15 | 20 | |
| I _{S(off)} | Off-state switch leakage current V _I = V _{CC} and V _O = GND, or V _I = GND and V _O = V _{CC} , V _C = V _{IL} (see Figure 2) | 2.7 V | | ±1 ±0.1 ⁽¹⁾ | | μA |
| I _{S(on)} | On-state switch leakage current V _I = V _{CC} or GND, V _C = V _{IH} , V _O = Open (see Figure 3) | 2.7 V | | ±1 ±0.1 ⁽¹⁾ | | μA |
| I _I | Control input current V _I = V _{CC} or GND | 0 to 2.7 V | | ±5 | | μA |
| I _{CC} | Supply current V _I = V _{CC} or GND, I _O = 0 | 0.8 V to 2.7 V | | | 10 | μA |
| C _{ic} | Control input capacitance | 2.5 V | | 2 | | pF |
| C _{io(off)} | Switch input/output capacitance | 2.5 V | | 3.5 | | pF |
| C _{io(on)} | Switch input/output capacitance | 2.5 V | | 7 | | pF |

(1) All typical values are at T_A = 25°C.

Switching Characteristics

over recommended operating free-air temperature range, C_L = 15 pF (unless otherwise noted) (see Figure 4)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 0.8 V | V _{CC} = 1.2 V ± 0.1 V | V _{CC} = 1.5 V ± 0.1 V | V _{CC} = 1.8 V ± 0.15 V | V _{CC} = 2.5 V ± 0.2 V | UNIT |
|--------------------------------|-----------------|----------------|-------------------------|------------------------------------|------------------------------------|-------------------------------------|------------------------------------|------|
| | | | TYP | MIN MAX | MIN MAX | MIN TYP MAX | MIN MAX | |
| t _{pd} ⁽¹⁾ | A or B | B or A | 0.9 | 0.3 | 0.2 | 0.2 | 0.1 | ns |
| t _{en} | C | A or B | 4.1 | 0.5 2.6 | 0.5 1.7 | 0.5 0.8 1.1 | 0.5 1 | ns |
| t _{dis} | C | A or B | 5 | 0.7 3.6 | 0.5 2.6 | 0.5 1.7 2.9 | 0.5 2.2 | ns |

(1) 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).

Switching Characteristics

over recommended operating free-air temperature range, $C_L = 30$ pF (unless otherwise noted) (see [Figure 4](#))

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$ | | | $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ | | UNIT |
|----------------|-----------------|----------------|---|-----|-----|--|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | |
| $t_{pd}^{(1)}$ | A or B | B or A | | | 0.3 | | 0.3 | ns |
| t_{en} | C | A or B | 0.5 | 1.4 | 2.3 | 0.8 | 1.4 | ns |
| t_{dis} | C | A or B | 0.5 | 1.7 | 2.9 | 0.5 | 1.5 | ns |

- (1) 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).

Analog Switch Characteristics

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | V_{CC} | TYP | UNIT |
|--|-----------------|----------------|--|----------|------|------|
| Frequency response ⁽¹⁾ (switch ON) | A or B | B or A | $C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = \text{sine wave}$ (see Figure 5) | 0.8 V | 60 | MHz |
| | | | | 1.1 V | 60 | |
| | | | | 1.4 V | 80 | |
| | | | | 1.65 V | 120 | |
| | | | | 2.3 V | 170 | |
| | | | $C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $f_{in} = \text{sine wave}$ (see Figure 5) | 0.8 V | >500 | |
| | | | | 1.1 V | >500 | |
| | | | | 1.4 V | >500 | |
| | | | | 1.65 V | >500 | |
| | | | | 2.3 V | >500 | |
| Crosstalk (control input to signal output) | C | A or B | $C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (square wave) (see Figure 6) | 0.8 V | 9 | mV |
| | | | | 1.1 V | 14 | |
| | | | | 1.4 V | 15 | |
| | | | | 1.65 V | 16 | |
| | | | | 2.3 V | 20 | |
| Feedthrough attenuation ⁽²⁾ (switch OFF) | A or B | B or A | $C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (sine wave) (see Figure 7) | 0.8 V | –60 | dB |
| | | | | 1.1 V | –60 | |
| | | | | 1.4 V | –60 | |
| | | | | 1.65 V | –60 | |
| | | | | 2.3 V | –60 | |
| | | | $C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $f_{in} = 1\text{ MHz}$ (sine wave) (see Figure 7) | 0.8 V | –55 | |
| | | | | 1.1 V | –55 | |
| | | | | 1.4 V | –55 | |
| | | | | 1.65 V | –55 | |
| | | | | 2.3 V | –55 | |
| Sine-wave distortion | A or B | B or A | $C_L = 50\text{ pF}$, $R_L = 10\text{ k}\Omega$, $f_{in} = 1\text{ kHz}$ (sine wave) (see Figure 8) | 0.8 V | 7.5 | % |
| | | | | 1.1 V | 0.16 | |
| | | | | 1.4 V | 0.04 | |
| | | | | 1.65 V | 0.03 | |
| | | | | 2.3 V | 0.02 | |
| | A or B | B or A | $C_L = 50\text{ pF}$, $R_L = 10\text{ k}\Omega$, $f_{in} = 10\text{ kHz}$ (sine wave) (see Figure 8) | 0.8 V | 4.2 | |
| | | | | 1.1 V | 0.2 | |
| | | | | 1.4 V | 0.03 | |
| | | | | 1.65 V | 0.02 | |
| | | | | 2.3 V | 0.02 | |

(1) Adjust f_{in} voltage to obtain 0 dBm at output. Increase f_{in} frequency until dB meter reads –3 dB.

(2) Adjust f_{in} voltage to obtain 0 dBm at input.

Operating Characteristics

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

| PARAMETER | TEST CONDITIONS | $V_{CC} = 0.8\text{ V}$ | $V_{CC} = 1.2\text{ V}$ | $V_{CC} = 1.5\text{ V}$ | $V_{CC} = 1.8\text{ V}$ | $V_{CC} = 2.5\text{ V}$ | UNIT |
|--|---------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------|
| | | TYP | TYP | TYP | TYP | TYP | |
| C_{pd} Power dissipation capacitance | $f = 10\text{ MHz}$ | 3 | 3 | 3 | 3 | 3 | pF |

PARAMETER MEASUREMENT INFORMATION

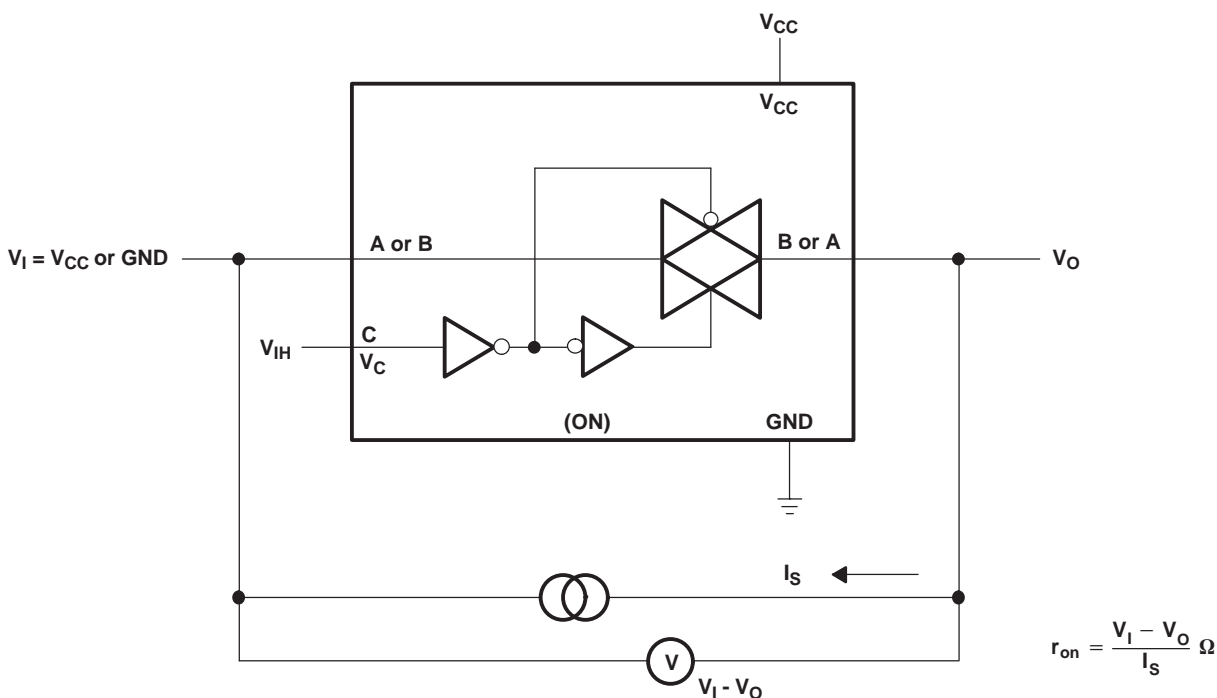


Figure 1. On-State Resistance Test Circuit

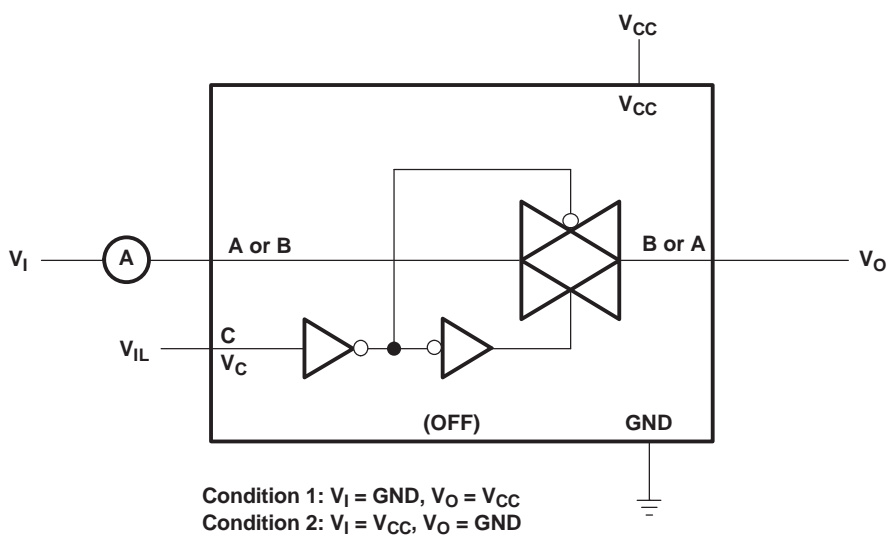


Figure 2. Off-State Switch Leakage-Current Test Circuit

PARAMETER MEASUREMENT INFORMATION (Continued)

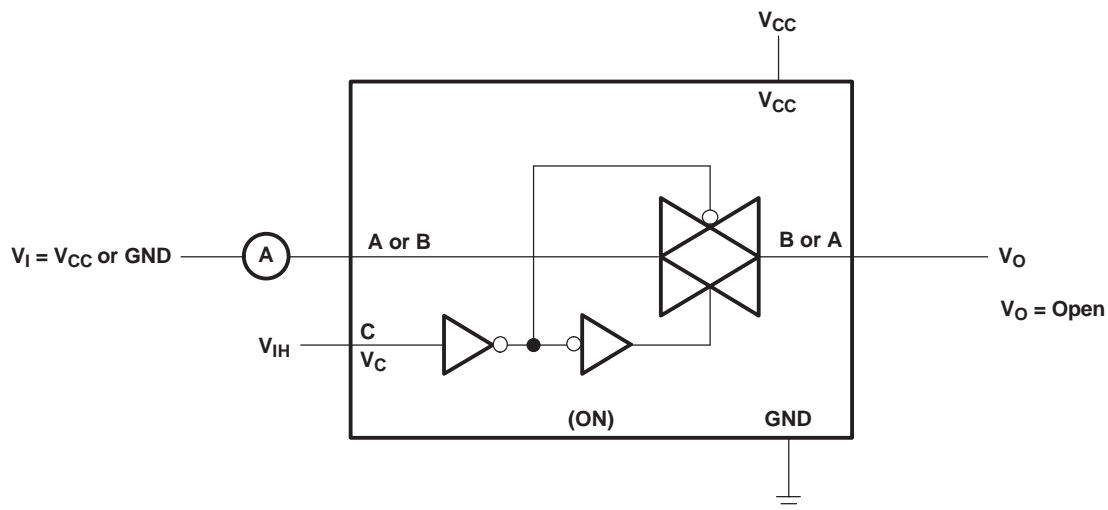
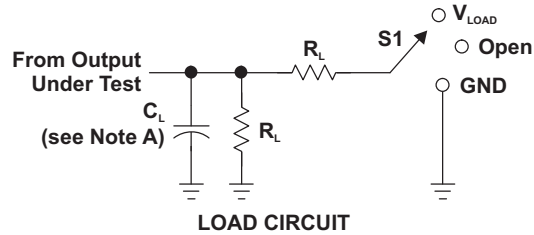


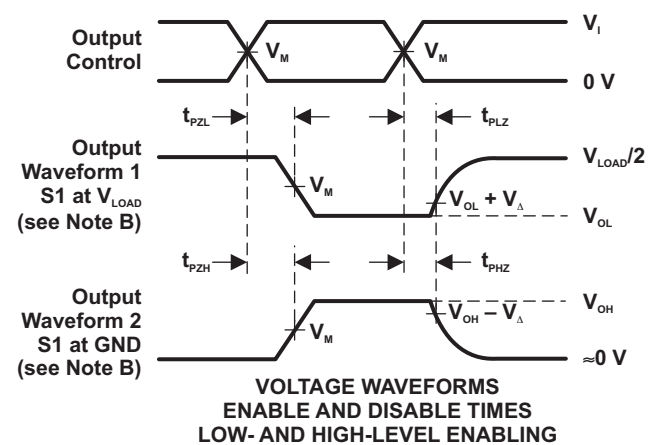
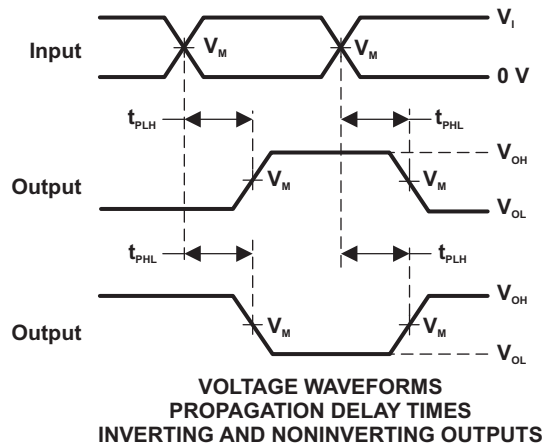
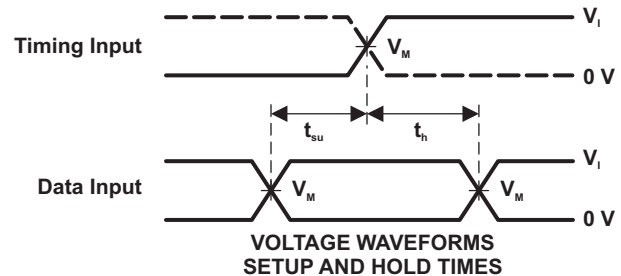
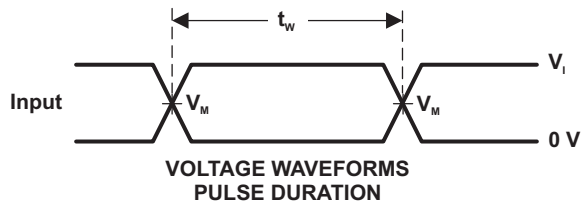
Figure 3. On-State Leakage-Current Test Circuit

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_{Δ} |
|--------------------|----------|-------------|------------|-------------------|-------|--------------|--------------|
| | V_i | t_i/t_f | | | | | |
| 0.8 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 2 k Ω | 0.1 V |
| 1.2 V \pm 0.1 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 2 k Ω | 0.1 V |
| 1.5 V \pm 0.1 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 2 k Ω | 0.1 V |
| 1.8 V \pm 0.15 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 2 k Ω | 0.15 V |
| 2.5 V \pm 0.2 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 2 k Ω | 0.15 V |
| 1.8 V \pm 0.15 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k Ω | 0.15 V |
| 2.5 V \pm 0.2 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |



- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_o = 50 \Omega$, Slew rate \geq 1 V/ns.
 - The outputs are measured one at a time, with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 4. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (Continued)

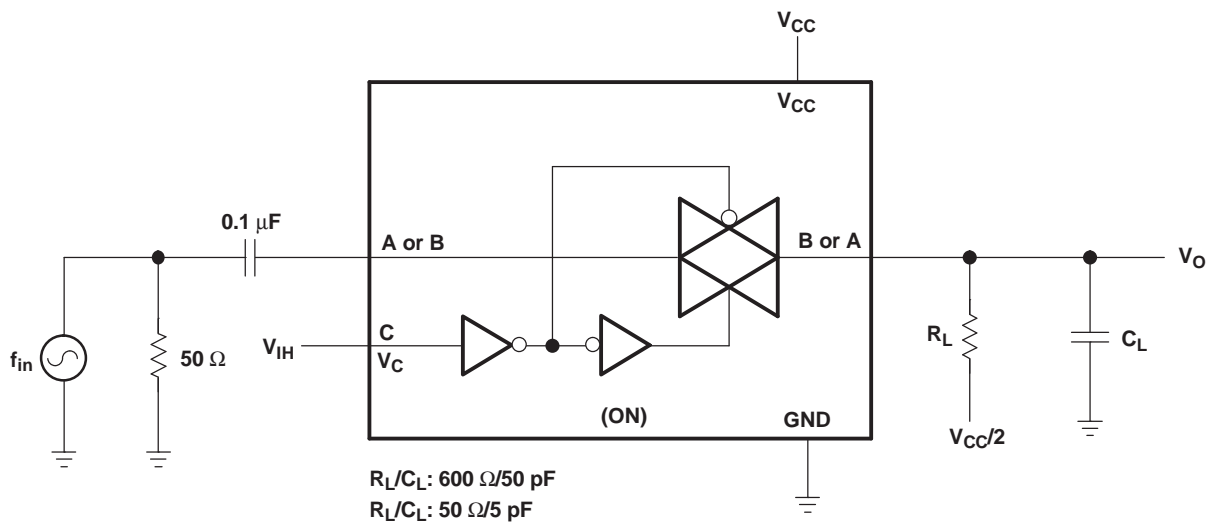


Figure 5. Frequency Response (Switch ON)

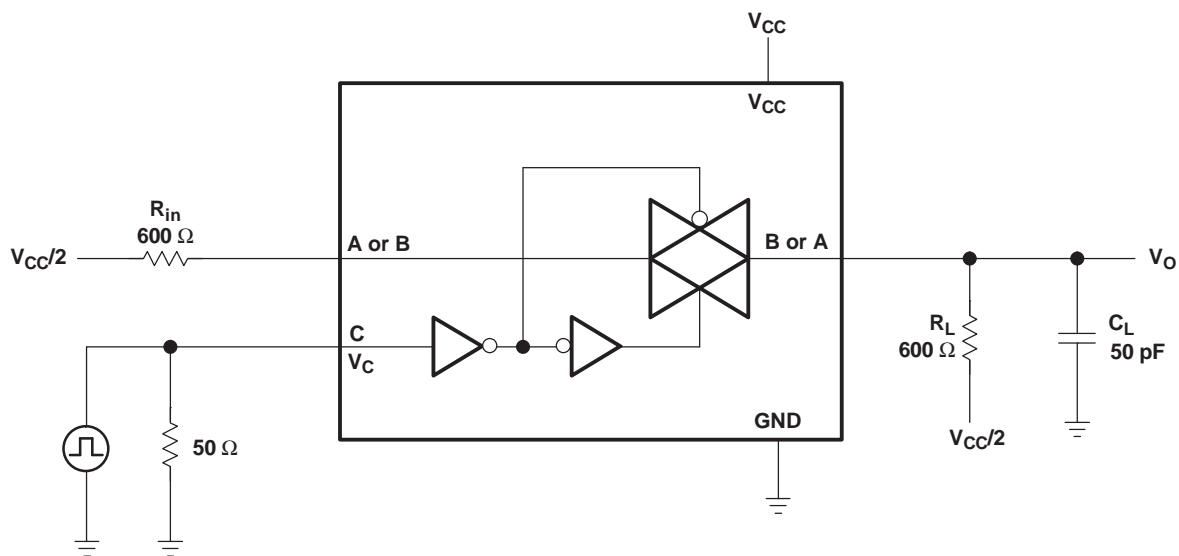


Figure 6. Crosstalk (Control Input – Switch Output)

PARAMETER MEASUREMENT INFORMATION (Continued)

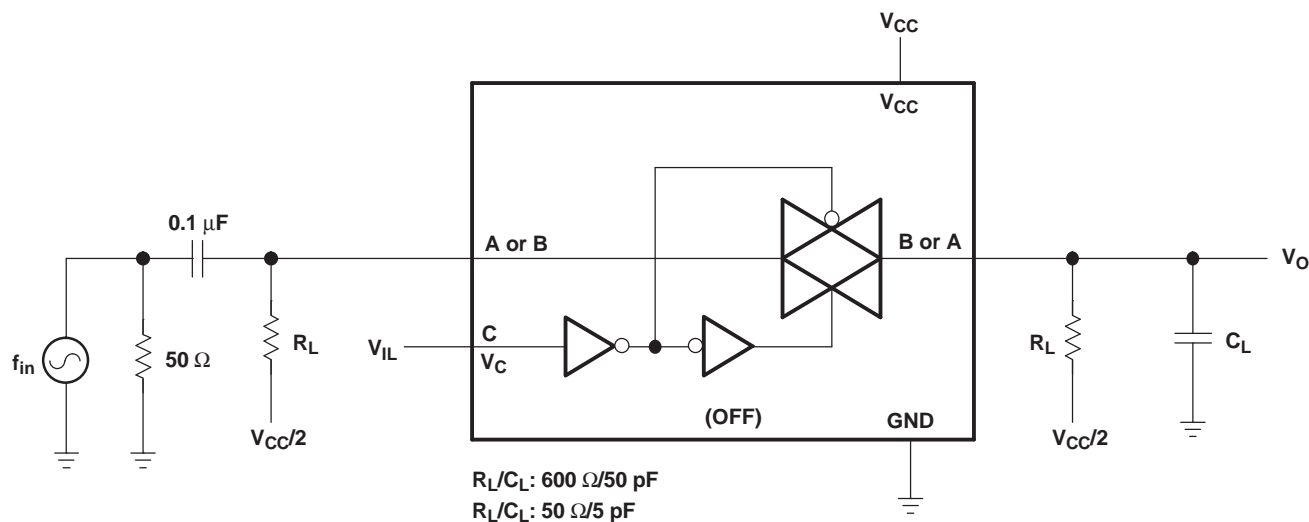


Figure 7. Feedthrough (Switch OFF)

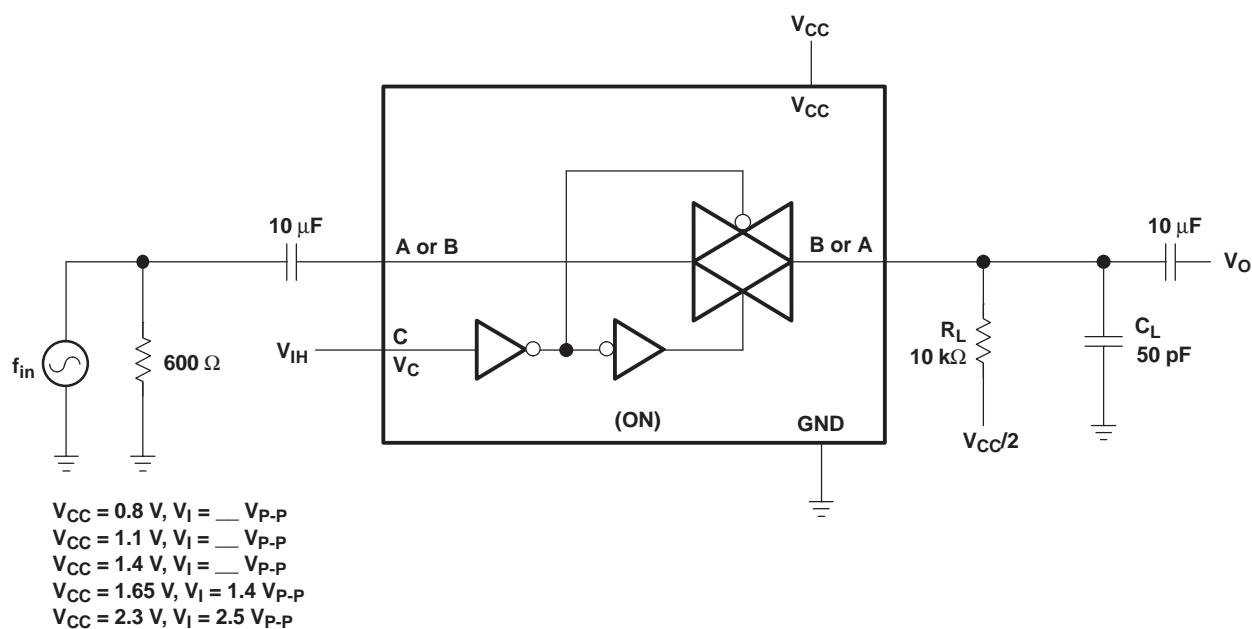


Figure 8. Sine-Wave Distortion

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|-------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74AUC1G66DBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AUC1G66DBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AUC1G66DBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AUC1G66DCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AUC1G66DCKRE4 | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AUC1G66DCKRG4 | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AUC1G66YZPR | ACTIVE | DSBGA | YZP | 5 | 3000 | Green (RoHS & no Sb/Br) | SNAGCU | Level-1-260C-UNLIM |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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TAPE AND REEL INFORMATION


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AUC1G66DBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 9.2 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| SN74AUC1G66DCKR | SC70 | DCK | 5 | 3000 | 180.0 | 9.2 | 2.24 | 2.34 | 1.22 | 4.0 | 8.0 | Q3 |
| SN74AUC1G66YZPR | DSBGA | YZP | 5 | 3000 | 180.0 | 8.4 | 1.02 | 1.52 | 0.63 | 4.0 | 8.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AUC1G66DBVR | SOT-23 | DBV | 5 | 3000 | 202.0 | 201.0 | 28.0 |
| SN74AUC1G66DCKR | SC70 | DCK | 5 | 3000 | 202.0 | 201.0 | 28.0 |
| SN74AUC1G66YZPR | DSBGA | YZP | 5 | 3000 | 220.0 | 220.0 | 34.0 |

DBV (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - Falls within JEDEC MO-178 Variation AA.

DCK (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE

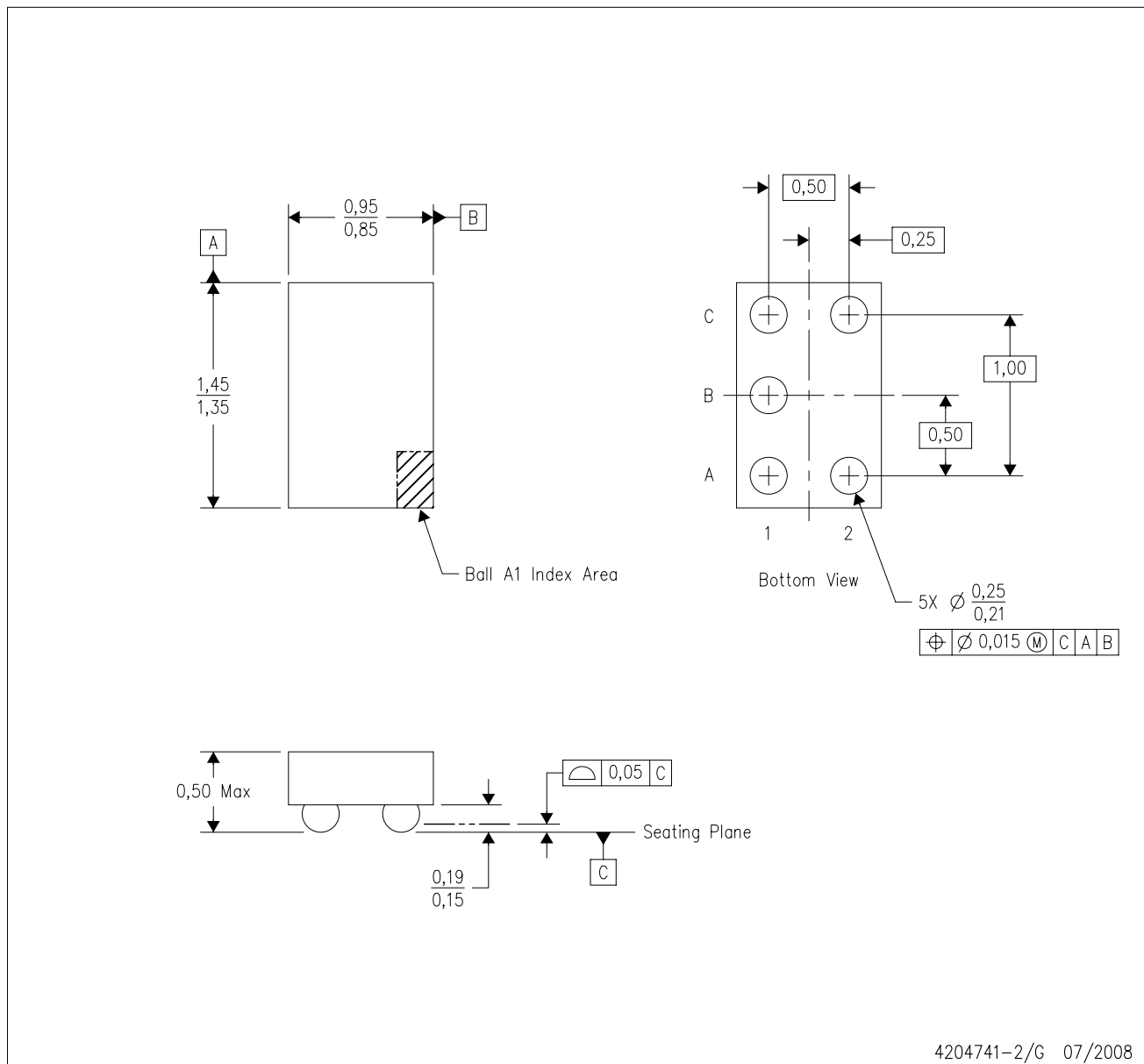


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- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - Falls within JEDEC MO-203 variation AA.

YZP (R-XBGA-N5)

DIE-SIZE BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. NanoFree™ package configuration.
 - D. This package is lead-free. Refer to the 5 YEP package (drawing 4204725) for tin-lead (SnPb).

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