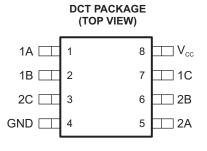
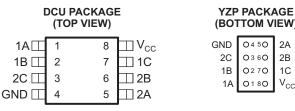


## FEATURES

- Available in the Texas Instruments NanoFree<sup>™</sup> Package
- 1.65-V to 5.5-V V<sub>CC</sub> Operation
- Inputs Accept Voltages to 5.5 V •
- Max t<sub>nd</sub> of 0.8 ns at 3.3 V
- High On-Off Output Voltage Ratio
- **High Degree of Linearity**



- High Speed, Typically 0.5 ns  $(V_{CC} = 3 V, C_{L} = 50 pF)$
- **Rail-to-Rail Input/Output**
- Low On-State Resistance, Typically  $\approx$ 6  $\Omega$  $(V_{CC} = 4.5 V)$
- Latch-Up Performance Exceeds 100 mA Per JESD 78. Class II



BOI	TOM V	IEW
ND	O4 50	2A
2C	O360	2B
1B	0270	1C
1A	0180	V <sub>cc</sub>

See mechanical drawings for dimensions.

## DESCRIPTION/ORDERING INFORMATION

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

The SN74LVC2G66 can handle both analog and digital signals. The device permits signals with amplitudes of up to 5.5 V (peak) to be transmitted in either direction.

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

Each switch section has its own enable-input control (C). A high-level voltage applied to C turns on the associated switch section.

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

T <sub>A</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(2)</sup>	
	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Reel of 3000	SN74LVC2G66YZPR	C6_	
-40°C to 85°C	SSOP – DCT	Reel of 3000	SN74LVC2G66DCTR	C66	
	VSSOP - DCU	Reel of 3000	SN74LVC2G66DCUR	066	
		Reel of 250	SN74LVC2G66DCUT	- C66_	

#### **ORDERING INFORMATION**

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

DCT: The actual top-side marking has three additional characters that designate the year, month, and assembly/test site. (2) DCU: 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. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

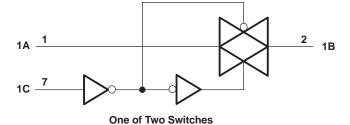


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet. NanoFree is a trademark of Texas Instruments.

#### FUNCTION TABLE (EACH SECTION)

CONTROL INPUT (C)	SWITCH
L	Off
Н	On

### LOGIC DIAGRAM, EACH SWITCH (POSITIVE LOGIC)



### Absolute Maximum Ratings<sup>(1)</sup>

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

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage range <sup>(2)</sup>		-0.5	6.5	V
VI	Input voltage range <sup>(2)(3)</sup>		-0.5	6.5	V
Vo	Switch I/O voltage range <sup>(2)(3)(4)</sup>		-0.5	$V_{CC} + 0.5$	V
I <sub>IK</sub>	Control input clamp current	V <sub>1</sub> < 0		-50	mA
I <sub>I/OK</sub>	I/O port diode current	$V_{I/O}$ < 0 or $V_{I/O}$ > $V_{CC}$		-50	mA
IT	On-state switch current	$V_{I/O} = 0$ to $V_{CC}$		±50	mA
	Continuous current through $V_{CC}$ or GND			±100	mA
		DCT package		220	
$\theta_{JA}$	Package thermal impedance <sup>(5)</sup>	DCU package		227	°C/W
		YZP package		102	
T <sub>stg</sub>	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 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.

(5) The package thermal impedance is calculated in accordance with JESD 51-7.

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# Recommended Operating Conditions<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>CC</sub> = 1.65 V to 1.95 V	V <sub>CC</sub> × 0.65		
V	Llick lovel input veltage, control input	$V_{CC}$ = 2.3 V to 2.7 V	$V_{CC} \times 0.7$		V
VIH	High-level input voltage, control input	$V_{CC} = 3 V \text{ to } 3.6 V$	$V_{CC} \times 0.7$		v
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	$V_{\rm CC} \times 0.7$		
		V <sub>CC</sub> = 1.65 V to 1.95 V		$V_{CC} \times 0.35$	
V	Low-level input voltage, control input	$V_{CC}$ = 2.3 V to 2.7 V		$V_{CC} \times 0.3$	V
V <sub>IL</sub>	Low-level input voltage, control input	$V_{CC} = 3 \text{ V to } 3.6 \text{ V}$			
		$V_{CC}$ = 4.5 V to 5.5 V		$V_{CC} \times 0.3$	
VI	Control input voltage		0	5.5	V
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		20	
Δt/Δv	Input transition rise fall time	$V_{CC}$ = 2.3 V to 2.7 V		20	ns/V
ΔVΔV	Input transition rise/fall time	$V_{CC} = 3 \text{ V to } 3.6 \text{ V}$		10	115/ V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		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. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.

# SN74LVC2G66 DUAL BILATERAL ANALOG SWITCH

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### TEXAS **STRUMENTS** www.ti.com

### **Electrical Characteristics**

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

	PARAMETER	TEST CONDITION	ONS	V <sub>cc</sub>	MIN TYP <sup>(1)</sup>	MAX	UNIT		
			$I_{S} = 4 \text{ mA}$	1.65 V	12.5	30			
	On-state switch resistance	$V_{I} = V_{CC}$ or GND,	$I_S = 8 \text{ mA}$	2.3 V	9	20	Ω		
r <sub>on</sub>	On-state switch resistance	$V_{C} = V_{IH}$ (see Figure 1 and Figure 2)	I <sub>S</sub> = 24 mA	3 V	7.5	15	52		
			I <sub>S</sub> = 32 mA	4.5 V	6	10			
			$I_{S} = 4 \text{ mA}$	1.65 V	85	120 <sup>(1)</sup>			
	Peak on-state resistance	$V_I = V_{CC}$ to GND, $V_C = V_{IH}$	$I_{S} = 8 \text{ mA}$	2.3 V	22	30 <sup>(1)</sup>	Ω		
r <sub>on(p)</sub>	Fear on-state resistance	(see Figure 1 and Figure 2)	I <sub>S</sub> = 24 mA	3 V	12	20	52		
			I <sub>S</sub> = 32 mA	4.5 V	7.5	15			
			$I_S = 4 \text{ mA}$	1.65 V		7			
٨٢	$\Delta r_{on}$ Difference of on-state resistance between switches	$V_I = V_{CC}$ to GND, $V_C = V_{IH}$	$I_S = 8 \text{ mA}$	2.3 V		5	Ω		
an		(see Figure 1 and Figure 2)	3 V		3	22			
		I <sub>S</sub> = 32 mA		4.5 V		2			
		$V_I = V_{CC}$ and $V_O = GND$ or				±1			
I <sub>S(off)</sub>	Off-state switch leakage current	$V_I = GND \text{ and } V_O = V_{CC},$ $V_C = V_{IL} \text{ (see Figure 3)}$		5.5 V		±0.1 <sup>(1)</sup>	μA		
I <sub>S(on)</sub>	On-state switch leakage current	$V_{I} = V_{CC}$ or GND, $V_{C} = V_{IH}$ , $V_{O}$	= Open	5.5 V		±1	μA		
•S(on)		(see Figure 4)		0.0 1		$\pm 0.1^{(1)}$	μι		
l <sub>l</sub>	Control input current	$V_{\rm C} = V_{\rm CC}$ or GND		5.5 V		±1	μA		
"				0.0 V	±0.1 <sup>(1)</sup>		μι		
امم	Supply current			y current $V_{\rm C} = V_{\rm CC}$ or GND		5.5 V		10	μA
I <sub>CC</sub>				0.0 V	1 <sup>(1)</sup>		μΑ		
$\Delta I_{CC}$	Supply-current change	$V_{\rm C} = V_{\rm CC} - 0.6 \ V$		5.5 V		500	μΑ		
C <sub>ic</sub>	Control input capacitance			5 V	3.5		pF		
C <sub>io(off)</sub>	Switch input/output capacitance			5 V	6		pF		
C <sub>io(on)</sub>	Switch input/output capacitance			5 V	14		pF		

(1)  $T_A = 25^{\circ}C$ 

## **Switching Characteristics**

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 5)

PARAMETER	FROM (INPUT)	TO (OUTPUT)		V <sub>CC</sub> = 1.8 V ± 0.15 V																								$V_{CC}$ = 3.3 V ± 0.3 V		V <sub>CC</sub> = 5 V ± 0.5 V		UNIT
	(INFUT)	(001201)	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>	С	A or B	2.3	10	1.6	5.6	1.5	4.4	1.3	3.9	ns																					
t <sub>dis</sub> <sup>(3)</sup>	С	A or B	2.5	10.5	1.2	6.9	2	7.2	1.1	6.3	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)  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ . (3)  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

## Analog Switch Characteristics

 $T_A = 25^{\circ}C$ 

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V <sub>cc</sub>	ТҮР	UNIT							
				1.65 V	35								
			$C_{L} = 50 \text{ pF}, R_{L} = 600 \Omega,$	2.3 V	120								
			f <sub>in</sub> = sine wave (see Figure 6)	3 V	175								
Frequency response	A or B	B or A		4.5 V	195	MHz							
(switch on)	AUB	BUIA		1.65 V	>300								
			$C_L = 5 \text{ pF}, R_L = 50 \Omega,$ $f_{in} = \text{sine wave}$	2.3 V	>300								
			(see Figure 6)	3 V	>300								
				4.5 V	>300								
				1.65 V	-58								
			$C_{L} = 50 \text{ pF}, R_{L} = 600 \Omega,$	2.3 V	-58								
			f <sub>in</sub> = 1 MHz (sine wave) (see Figure 7)	3 V	-58								
Crosstalk <sup>(1)</sup>	A or D	D or A		4.5 V	-58	٩D							
(between switches)	A or B	B or A		1.65 V	-42	dB							
		f <sub>in</sub> = 1 MHz (sine wave)			$C_{L} =$	$C_L = 5 \text{ pF}, R_L = 50 \Omega,$	2.3 V	-42					
			3 V	-42									
				4.5 V	-42								
		A co D	A or P	A or P		1.65 V	35						
Crosstalk	<u> </u>				A or B	$C_{L} = 50 \text{ pF}, R_{L} = 600 \Omega,$	2.3 V	50	mV				
(control input to signal output)	С	A OF B	f <sub>in</sub> = 1 MHz (square wave) (see Figure 8)	3 V	70	mv							
				4.5 V	100								
		B or A	B or A	Durch	DerA	DerA	D -= 4		1.65 V	-58			
										$C_{L} = 50 \text{ pF}, R_{L} = 600 \Omega,$	2.3 V	-58	
								f <sub>in</sub> = 1 MHz (sine wave) (see Figure 9)	3 V	-58			
Feedthrough attenuation	1 D								4.5 V	-58			
(switch off)	A or B				1.65 V	-42	dB						
			$C_L = 5 \text{ pF}, \text{ R}_L = 50 \Omega,$	2.3 V	-42								
			f <sub>in</sub> = 1 MHz (sine wave) (see Figure 9)	3 V	-42								
				4.5 V	-42								
				1.65 V	0.1								
			$C_{L} = 50 \text{ pF}, R_{L} = 10 \text{ k}\Omega,$	2.3 V	0.025								
			f <sub>in</sub> = 1 kHz (sine wave) (see Figure 10)	3 V	0.015								
<b>0</b>				4.5 V	0.01								
Sine-wave distortion	A or B	B or A		1.65 V	0.15	%							
				$C_{L} = 50 \text{ pF}, R_{L} = 10 \text{ k}\Omega,$	2.3 V	0.025							
			$f_{in} = 10 \text{ kHz} (sine wave)$ (see Figure 10) 3 V	3 V	0.015								
			4.5 V	0.01									

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

## **Operating Characteristics**

 $T_A = 25^{\circ}C$ 

PARAMETER	TEST CONDITIONS	V <sub>CC</sub> = 1.8 V TYP	V <sub>CC</sub> = 2.5 V TYP	V <sub>CC</sub> = 3.3 V TYP	V <sub>CC</sub> = 5 V TYP	UNIT
C <sub>pd</sub> Power dissipation capacitance	f = 10 MHz	8	9	9.5	11	pF



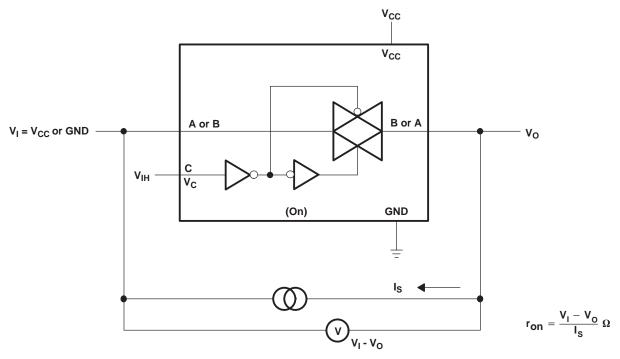


Figure 1. On-State Resistance Test Circuit

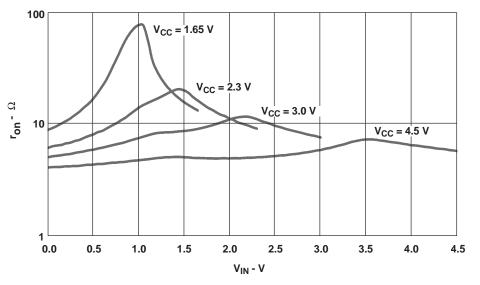


Figure 2. Typical  $r_{on}$  as a Function of Input Voltage (V<sub>I</sub>) for V<sub>I</sub> = 0 to V<sub>CC</sub>

#### PARAMETER MEASUREMENT INFORMATION

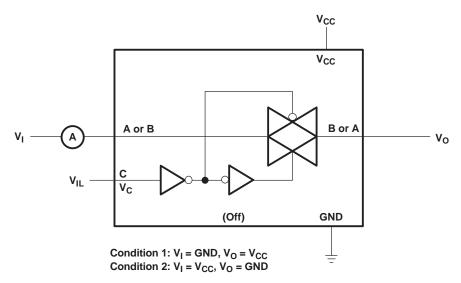


Figure 3. Off-State Switch Leakage-Current Test Circuit

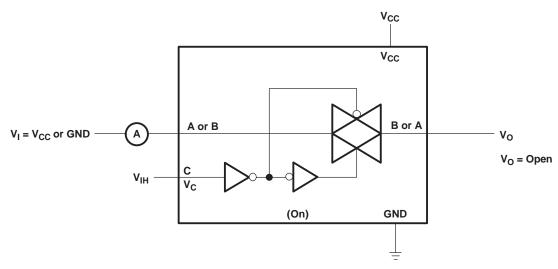


Figure 4. On-State Leakage-Current Test Circuit

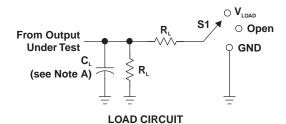
### SN74LVC2G66 DUAL BILATERAL ANALOG SWITCH SCES325J-JULY 2001-REVISED FEBRUARY 2007

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V,

≈0 V

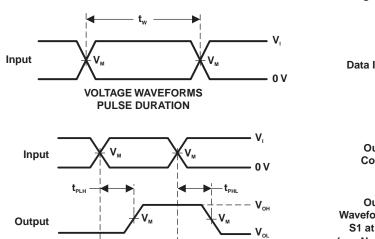
#### PARAMETER MEASUREMENT INFORMATION

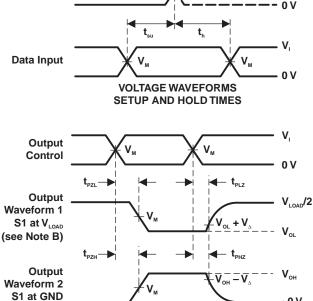


TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
$t_{PLZ}/t_{PZL}$	V <sub>load</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND

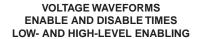
	INF	PUTS			_	-	V
V <sub>cc</sub>	V,	t,/t,	V <sub>M</sub>	VLOAD	C	R	V
$1.8V\pm0.15V$	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	$2 \times V_{cc}$	30 pF	<b>1 k</b> Ω	0.15 V
$\textbf{2.5 V} \pm \textbf{0.2 V}$	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	$2 \times V_{cc}$	30 pF	<b>500</b> Ω	0.15 V
3.3 V $\pm$ 0.3 V	V <sub>cc</sub>	≤2.5 ns	V <sub>cc</sub> /2	$2 \times V_{cc}$	50 pF	<b>500</b> Ω	0.3 V
$5~V\pm0.5~V$	V <sub>cc</sub>	≤2.5 ns	V <sub>cc</sub> /2	$2 \times V_{cc}$	50 pF	<b>500</b> Ω	0.3 V

**Timing Input** 









NOTES: A. C, 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 have the following characteristics: PRR  $\leq$  10 MHz, Z<sub>o</sub> = 50  $\Omega$ .

(see Note B)

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

V,

- E.  $t_{\mbox{\tiny PLZ}}$  and  $t_{\mbox{\tiny PHZ}}$  are the same as  $t_{\mbox{\tiny dis}}.$
- F.  $t_{\text{PZL}}$  and  $t_{\text{PZH}}$  are the same as  $t_{\text{en}}$ .
- 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

Output

## SN74LVC2G66 **DUAL BILATERAL ANALOG SWITCH**

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#### PARAMETER MEASUREMENT INFORMATION

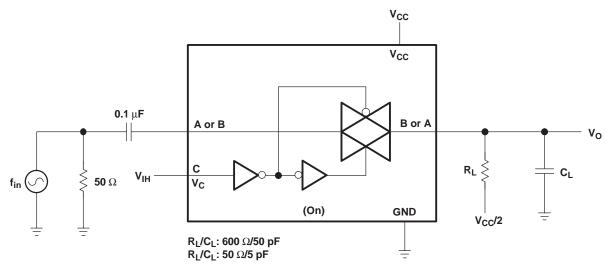


Figure 6. Frequency Response (Switch On)

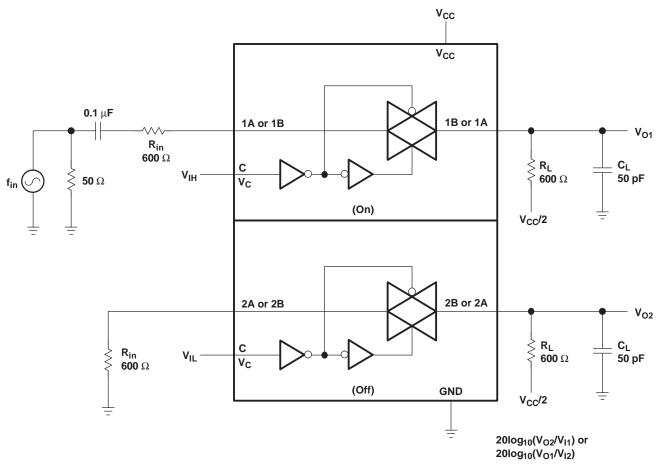


Figure 7. Crosstalk (Between Switches)

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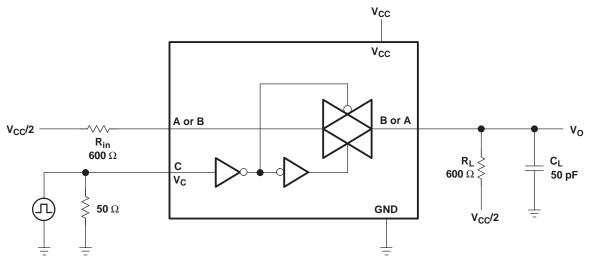


Figure 8. Crosstalk (Control Input, Switch Output)

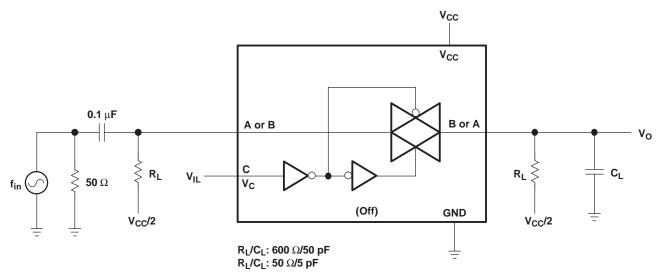
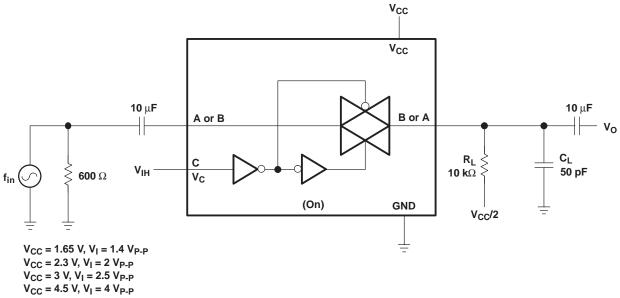


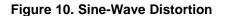
Figure 9. Feedthrough (Switch Off)

## SN74LVC2G66 **DUAL BILATERAL ANALOG SWITCH**

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#### PARAMETER MEASUREMENT INFORMATION





### PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74LVC2G66DCTR	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCTRE4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCTRG4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCUR	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCURE4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCURG4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCUT	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCUTE4	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66DCUTG4	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC2G66YZPR	ACTIVE	DSBGA	YZP	8	3000	TBD	Call TI	Call TI

<sup>(1)</sup> 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.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> 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)

<sup>(3)</sup> 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





## QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal	
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Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVC2G66DCUR	US8	DCU	8	3000	180.0	9.2	2.25	3.35	1.05	4.0	8.0	Q3



## PACKAGE MATERIALS INFORMATION

26-Nov-2008



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC2G66DCUR	US8	DCU	8	3000	202.0	201.0	28.0

DCU (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

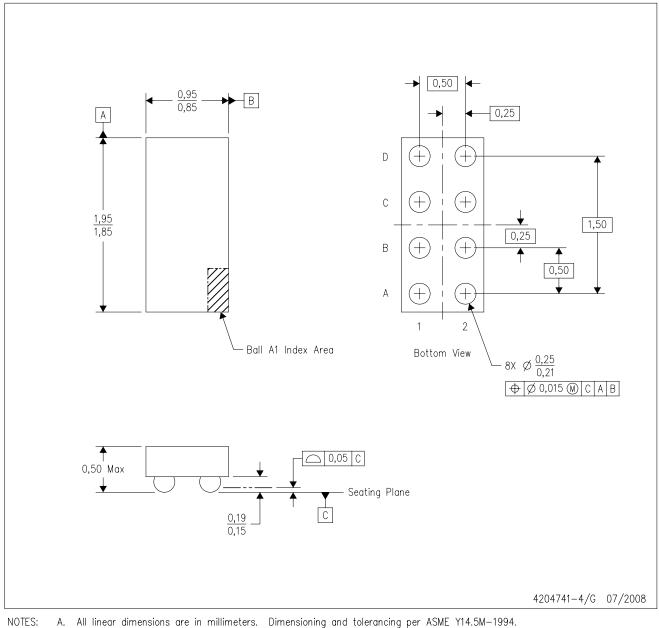
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.

D. Falls within JEDEC MO-187 variation CA.



YZP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



- B. This drawing is subject to change without notice.
- C. NanoFree™ package configuration.
- D. This package is lead-free. Refer to the 8 YEP package (drawing 4204725) for tin-lead (SnPb).

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## **MECHANICAL DATA**

MPDS049B - MAY 1999 - REVISED OCTOBER 2002

#### DCT (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

C. Body dimensions do not include mold flash or protrusion

D. Falls within JEDEC MO-187 variation DA.



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