

SN74LVC2G66 Dual Bilateral Analog Switch

Check for Samples: SN74LVC2G66

FEATURES

- **Available in the Texas Instruments** NanoFree™ Package
- 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 $(V_{CC} = 3 V, C_{L} = 50 pF)$
- Rail-to-Rail Input/Output
- Low On-State Resistance, Typically ≉6 Ω $(V_{CC} = 4.5 V)$
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II

DCT PACKAGE (TOP VIEW) $\neg V_{cc}$ 1A [1 8 2 7 1B _ 1C 2C [6 □ 2B GND 5 □ 2A

See mechanical drawings for dimensions.

DESCRIPTION

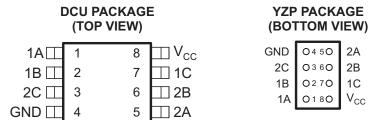
This dual bilateral analog switch is designed for 1.65-V to 5.5-V V_{CC} operation.

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

NanoFree™ 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.

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



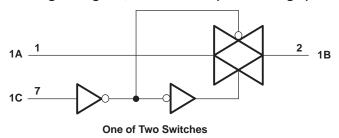
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Function Table (Each Section)

CONTROL INPUT (C)	SWITCH
L	Off
Н	On

Logic Diagram, Each Switch (Positive logic)



Absolute Maximum Ratings(1)

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range (2)		-0.5	6.5	V
V_{I}	Input voltage range (2)(3)	-0.5	6.5	V	
Vo	Switch I/O voltage range ⁽²⁾⁽³⁾⁽⁴⁾		-0.5	$V_{CC} + 0.5$	V
I_{IK}	Control input clamp current	V _I < 0		- 50	mA
I _{I/OK}	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
		DCT package		220	
θ_{JA}	Package thermal impedance (5)	DCU package		227	
		YZP package		102	
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 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⁽¹⁾

			MIN	MAX	UNIT		
V _{CC}	Supply voltage		1.65	5.5	V		
V _{I/O}	I/O port voltage		0	V _{CC}	V		
		V _{CC} = 1.65 V to 1.95 V	V _{CC} × 0.65				
\ /	High-level input voltage, control input	V _{CC} = 2.3 V to 2.7 V	$V_{CC} \times 0.7$).7			
V_{IH}		V _{CC} = 3 V to 3.6 V	$V_{CC} \times 0.7$		V		
		V _{CC} = 4.5 V to 5.5 V	$V_{CC} \times 0.7$				
		V _{CC} = 1.65 V to 1.95 V		$V_{CC} \times 0.35$			
	Low-level input voltage, control input	V _{CC} = 2.3 V to 2.7 V		$V_{CC} \times 0.3$			
V_{IL}		V _{CC} = 3 V to 3.6 V		$V_{CC} \times 0.3$	0.3 V		
		V _{CC} = 4.5 V to 5.5 V		V _{CC} × 0.3			
VI	Control input voltage		0	5.5	V		
		V _{CC} = 1.65 V to 1.95 V		20			
۸4/۸	land the neities wise on fall time	V _{CC} = 2.3 V to 2.7 V		20			
Δt/Δv	Input transition rise or fall time	V _{CC} = 3 V to 3.6 V		10	ns/V		
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		10			
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 CONDITION	ONS	V _{cc}	MIN TYP ⁽¹⁾	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 _{on}	On-state switch resistance	$V_C = V_{IH}$ (see Figure 1 and Figure 2)	$I_S = 24 \text{ mA}$	3 V	7.5	15	12
			$I_S = 32 \text{ mA}$	4.5 V	6	10	
			$I_S = 4 \text{ mA}$	1.65 V	85	120 ⁽¹⁾	
_	Peak on-state resistance	$V_I = V_{CC}$ to GND,	$I_S = 8 \text{ mA}$	2.3 V	22	30 ⁽¹⁾	Ω
r _{on(p)}	reak on-state resistance	V _C = V _{IH} (see Figure 1 and Figure 2)	$I_S = 24 \text{ mA}$	3 V	12	20	12
			4.5 V	7.5	15		
			$I_S = 4 \text{ mA}$	1.65 V		7	
۸	Difference of on-state resistance between switches	$V_I = V_{CC}$ to GND,	$I_S = 8 \text{ mA}$	2.3 V		5	Ω
Δr_{on}		$V_C = V_{IH}$ (see Figure 1 and Figure 2)	I _S = 24 mA	3 V		3	
			$I_S = 32 \text{ mA}$	4.5 V		2	
		$V_I = V_{CC}$ and $V_O = GND$ or				±1	1 .
I _{S(off)}	Off-state switch leakage current	$V_I = GND$ and $V_O = V_{CC}$, $V_C = V_{IL}$ (see Figure 3)		5.5 V		±0.1 ⁽¹⁾	μA
I _{S(on)}	On-state switch leakage current	$V_I = V_{CC}$ or GND, $V_C = V_{IH}$, V_O (see Figure 4)	= Open	5.5 V		±1 ±0.1 ⁽¹⁾	μΑ
						±1	
I _I	Control input current	$V_C = V_{CC}$ or GND		5.5 V		±0.1 ⁽¹⁾	μΑ
				5.5 V		10	
I _{CC}	Supply current	$V_C = V_{CC}$ or GND	$V_C = V_{CC}$ or GND				μΑ
ΔI _{CC}	Supply-current change	$V_{\rm C} = V_{\rm CC} - 0.6 \text{ V}$		5.5 V		500	μΑ
C _{ic}	Control input capacitance			5 V	3.5		pF
C _{io(off)}	Switch input/output capacitance			5 V	6		pF
C _{io(on)}	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 _{CC} = 1 ± 0.1		V _{CC} = 2 ± 0.2		V _{CC} = 3 ± 0.3		V _{CC} = ± 0.5		UNIT
	(INFOT)	(001701)	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t _{pd} ⁽¹⁾	A or B	B or A		2		1.2		8.0		0.6	ns
t _{en} ⁽²⁾	С	A or B	2.3	10	1.6	5.6	1.5	4.4	1.3	3.9	ns
t _{dis} (3)	С	A or B	2.5	10.5	1.2	6.9	2	7.2	1.1	6.3	ns

⁽¹⁾ t_{PLH} and t_{PHL} are the same as t_{pd}. 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).

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 ⁽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

 $T_{\Lambda} = 25^{\circ}C$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V _{cc}	TYP	UNIT
				1.65 V	35	
			$C_L = 50 \text{ pF}, R_L = 600 \Omega,$	2.3 V	120	
			f _{in} = sine wave (see Figure 6)	3 V	175	
Frequency response	A or B	B or A		4.5 V	195	MHz
(switch on)	AUID	BULA		1.65 V	>300	IVITZ
			$C_L = 5 \text{ pF}, R_L = 50 \Omega,$ $f_{in} = \text{sine wave}$	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 _{in} = 1 MHz (sine wave) (see Figure 7)	3 V	-58	
Crosstalk ⁽¹⁾	A or B			4.5 V	-58	dB
(between switches)	7.012			1.65 V	-42	uБ
			$C_L = 5 \text{ pF}, R_L = 50 \Omega,$ $f_{in} = 1 \text{ MHz (sine wave)}$	2.3 V	-42	
			(see Figure 7)	3 V	-42	
				4.5 V	-42	
			0 50 5 B 000 0	1.65 V	35	mV
Crosstalk	С	A or B	$C_L = 50 \text{ pF}, R_L = 600 \Omega,$ $f_{in} = 1 \text{ MHz} \text{ (square wave)}$	2.3 V	50	
(control input to signal output)			(see Figure 8)	3 V	70	
				4.5 V	100	
				1.65 V	-58	
			C_L = 50 pF, R_L = 600 Ω , f_{in} = 1 MHz (sine wave) (see Figure 9)	2.3 V	-58	
				3 V	-58	
Feedthrough attenuation	A or B	B or A		4.5 V	-58	dB
(switch off)	AOID	BOIA		1.65 V	-42	uВ
			$C_L = 5 \text{ pF}, R_L = 50 \Omega,$ $f_{in} = 1 \text{ MHz (sine wave)}$	2.3 V	-42	
			(see Figure 9)	3 V	-42	
				4.5 V	-42	
				1.65 V	0.1	
			$C_L = 50 \text{ pF}, R_L = 10 \text{ k}\Omega,$ $f_{in} = 1 \text{ kHz (sine wave)}$	2.3 V	0.025	
			(see Figure 10)	3 V	0.015	
Sine-wave distortion	A or B	B or A		4.5 V	0.01	%
Sine wave distortion	7.016	2017		1.65 V	0.15	%
			$C_L = 50 \text{ pF}, R_L = 10 \text{ k}\Omega,$ $f_{in} = 10 \text{ kHz} \text{ (sine wave)}$	2.3 V	0.025	
			(see Figure 10)	3 V	0.015	
				4.5 V	0.01	

⁽¹⁾ Adjust f_{in} voltage to obtain 0 dBm at input.

Operating Characteristics

 $T_A = 25$ °C

PARAMETER		TEST CONDITIONS	V _{CC} = 1.8 V TYP	V _{CC} = 2.5 V TYP	V _{CC} = 3.3 V TYP	V _{CC} = 5 V TYP	UNIT
C _{pd}	Power dissipation capacitance	f = 10 MHz	8	9	9.5	11	pF



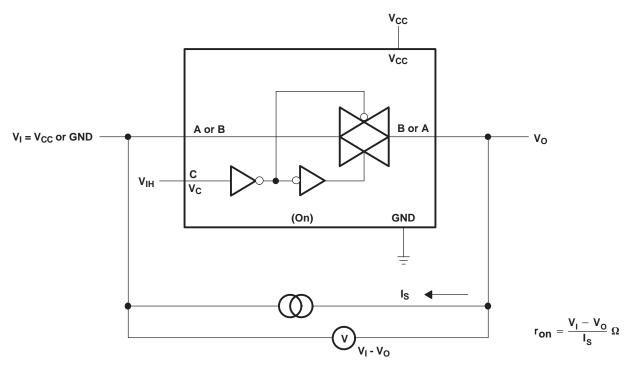


Figure 1. On-State Resistance Test Circuit

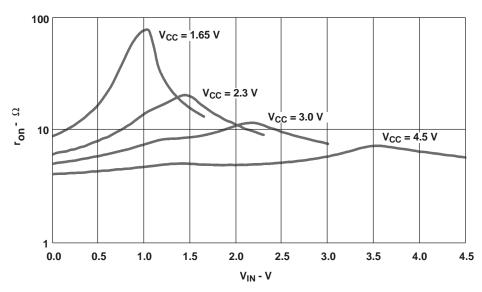


Figure 2. Typical r_{on} as a Function of Input Voltage (V_I) for $V_{I} = 0$ to V_{CC}



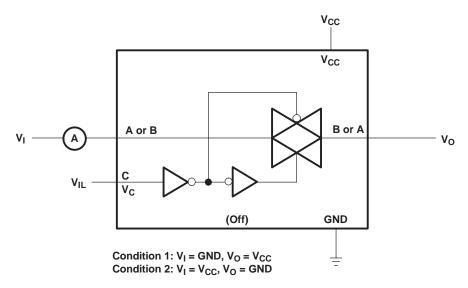


Figure 3. Off-State Switch Leakage-Current Test Circuit

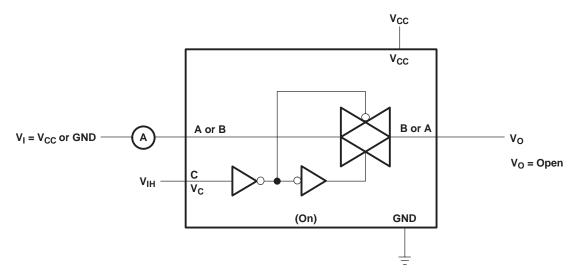
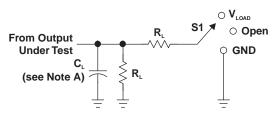


Figure 4. On-State Leakage-Current Test Circuit

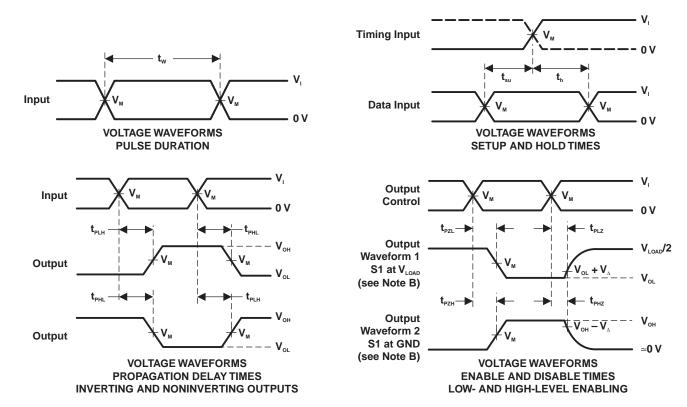




TEST	S1
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	V _{LOAD}
t _{PHZ} /t _{PZH}	GND

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V _{cc}	V,	t,/t, V _{LOAD}		C _∟	R _⊾	V _Δ	
1.8 V ± 0.15 V	V _{cc}	≤2 ns	V _{cc} /2	2 × V _{cc}	30 pF	1 k Ω	0.15 V
$\textbf{2.5 V} \pm \textbf{0.2 V}$	V_{cc}	≤2 ns	V _{cc} /2	2 × V _{cc}	30 pF	500 Ω	0.15 V
3.3 V \pm 0.3 V	V _{cc}	≤2.5 ns	V _{cc} /2	2 × V _{cc}	50 pF	500 Ω	0.3 V
5 V \pm 0.5 V	V _{cc}	≤2.5 ns	V _{cc} /2	2 × V _{cc}	50 pF	500 Ω	0.3 V



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_{o} = 50 Ω .
- D. The outputs are measured one at a time, with one transition per measurement.
- E. $t_{\mbox{\tiny PLZ}}$ and $t_{\mbox{\tiny PHZ}}$ are the same as $t_{\mbox{\tiny dis}}.$
- F. t_{PZL} and t_{PZH} are the same as t_{en} .
- G. $t_{\scriptscriptstyle PLH}$ and $t_{\scriptscriptstyle PHL}$ are the same as $t_{\scriptscriptstyle pd}$.
- H. All parameters and waveforms are not applicable to all devices.

Figure 5. Load Circuit and Voltage Waveforms

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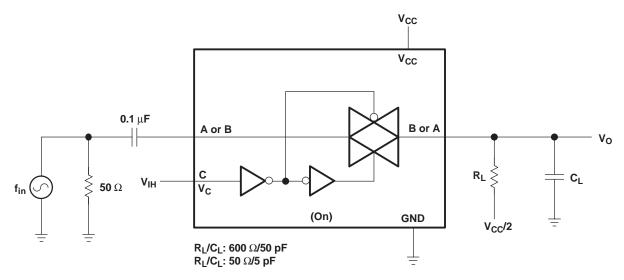


Figure 6. Frequency Response (Switch On)

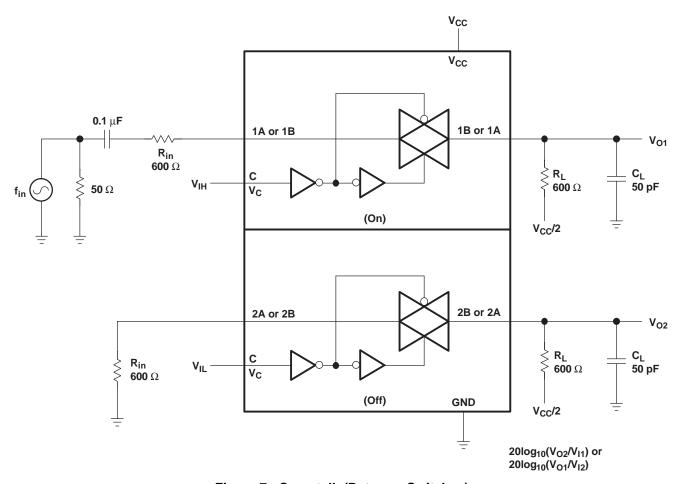


Figure 7. Crosstalk (Between Switches)



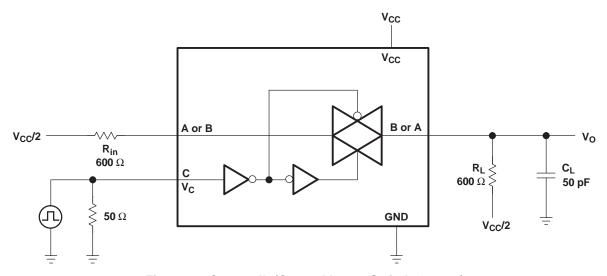


Figure 8. Crosstalk (Control Input, Switch Output)

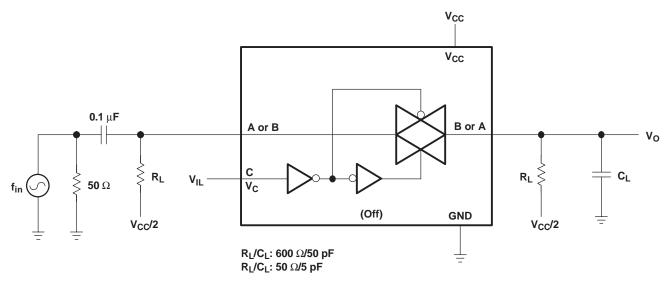


Figure 9. Feedthrough (Switch Off)



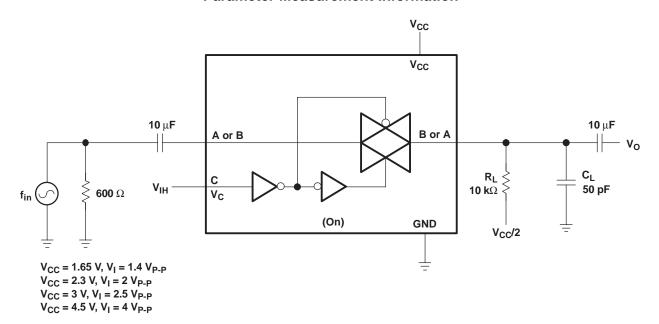


Figure 10. Sine-Wave Distortion



REVISION HISTORY

Cł	Updated document to new TI data sheet formatno specification changes. Removed ordering information					
•	Updated document to new TI data sheet formatno specification changes.	1				
•	Removed ordering information.	1				

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PACKAGING INFORMATION

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVC2G66DCTR	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	C66 Z	Samples
SN74LVC2G66DCTRE4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	C66 Z	Samples
SN74LVC2G66DCTRG4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	C66 Z	Samples
SN74LVC2G66DCUR	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 85	(66 ~ C66Q ~ C66R) CZ	Samples
SN74LVC2G66DCURE4	ACTIVE	US8	DCU	8		TBD	Call TI	Call TI	-40 to 85		Samples
SN74LVC2G66DCURG4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	C66R	Samples
SN74LVC2G66DCUT	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 85	(C66Q ~ C66R)	Samples
SN74LVC2G66DCUTE4	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(C66Q ~ C66R)	Samples
SN74LVC2G66DCUTG4	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(C66Q ~ C66R)	Samples
SN74LVC2G66YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(C62 ~ C67 ~ C6N)	Samples

⁽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.

OBSOLETE: TI has discontinued the production of the device.

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)

⁽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.





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- (3) MSL, Peak Temp. The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.
- (5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.
- (6) Lead/Ball Finish Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF SN74LVC2G66:

Automotive: SN74LVC2G66-Q1

NOTE: Qualified Version Definitions:

Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

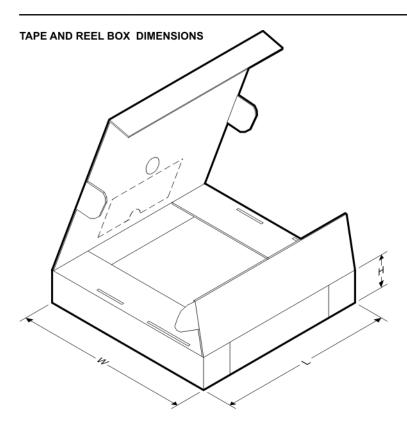


*All dimensions are nominal

Device Device	Package Type	Package Drawing		SPQ	Reel Diameter	Reel Width	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVC2G66DCUR	US8	DCU	8	3000	(mm) 180.0	W1 (mm) 9.0	2.05	3.3	1.0	4.0	8.0	Q3
SN74LVC2G66DCURG4	US8	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
SN74LVC2G66YZPR	DSBGA	YZP	8	3000	178.0	9.2	1.02	2.02	0.63	4.0	8.0	Q1

PACKAGE MATERIALS INFORMATION

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*All dimensions are nominal

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Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)		
SN74LVC2G66DCUR	US8	DCU	8	3000	182.0	182.0	20.0		
SN74LVC2G66DCURG4	US8	DCU	8	3000	202.0	201.0	28.0		
SN74LVC2G66YZPR	DSBGA	YZP	8	3000	220.0	220.0	35.0		

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.

DCT (R-PDSO-G8)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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.



DCU (S-PDSO-G8)

PLASTIC SMALL OUTLINE PACKAGE (DIE DOWN)



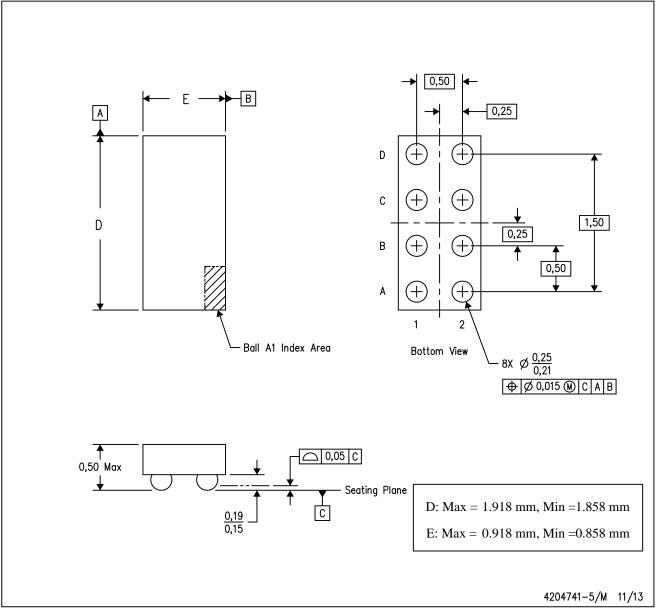
NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



YZP (R-XBGA-N8)

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.

NanoFree is a trademark of Texas Instruments.



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