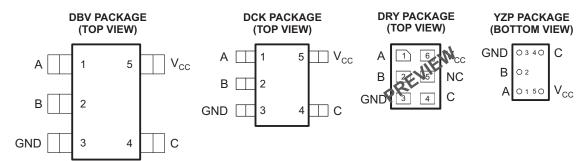
www.ti.com

### SINGLE BILATERAL ANALOG SWITCH

#### **FEATURES**

- Available in the Texas Instruments NanoFree<sup>™</sup> Package
- Wide V<sub>CC</sub> Range of 0.8 V to 2.7 V
- Sub-1-V Operable
- Low Power Consumption, 10-μA Max I<sub>CC</sub>
- High On-Off Output Voltage Ratio
- High Degree of Linearity
- High Speed Max 0.2 ns (V<sub>CC</sub> = 1.8 V, C<sub>L</sub> = 15 pF)

- Low On-State Impedance Typically 9 Ω (V<sub>CC</sub> = 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<sup>™</sup> 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.

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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.



#### ORDERING INFORMATION

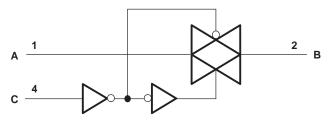
T <sub>A</sub>	PACKAGE <sup>(1)(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
	NanoFree™ WCSP (DSBGA) – YZP (Pb-free)	Reel of 3000	SN74AUC1G66YZPR	U6_
-40°C to 85°C	SON - DRY	Reel of 5000	SN74AUC1G66DRYR	PREVIEW
	SOT (SOT-23) – DBV	Reel of 3000	SN74AUC1G66DBVR	U66_
	SOT (SC-70) – DCK	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
Н	ON

#### **LOGIC DIAGRAM (POSITIVE LOGIC)**



#### Absolute Maximum Ratings(1)

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

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range		-0.5	3.6	V
VI	Input voltage range (2)		-0.5	3.6	V
V <sub>I/O</sub>	Switch I/O voltage range <sup>(2)(3)</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	$V_{I/O} < 0$ or $V_{I/O} > V_{CC}$		±50	mA
I <sub>T</sub>	On-state switch current	$V_{I/O} = 0$ to $V_{CC}$		±50	mA
	Continuous current through $V_{CC}$ or GND			±100	mA
		DBV package		206	
0	Package thermal impedance (4)	DCK package		252	°C /\/\
$\theta_{JA}$	Package thermal impedance	DRY package		°C/W	
		YZP package		123	
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 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.

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### Recommended Operating Conditions<sup>(1)</sup>

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage		0.8	2.7	V
		V <sub>CC</sub> = 0.8 V	V <sub>CC</sub>		
$V_{IH}$	High-level input voltage	$V_{CC} = 1.1 \text{ V to } 1.95 \text{ V}$	0.65 × V <sub>CC</sub>		V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7		
		V <sub>CC</sub> = 0.8 V		0	
$V_{IL}$	Low-level input voltage	$V_{CC} = 1.1 \text{ V to } 1.95 \text{ V}$		0.35 × V <sub>CC</sub>	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.7	
V <sub>I/O</sub>	I/O port voltage		0	$V_{CC}$	V
VI	Control input voltage		0	3.6	V
Δt/Δν	Input transition rise or fall rate			20	ns/V
T <sub>A</sub>	Operating free-air temperature		-40	85	°C

<sup>(1)</sup> 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.

#### **Electrical Characteristics**

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

	PARAMETER	TEST COND	DITIONS	V <sub>cc</sub>	MIN TYP(1)	MAX	UNIT
		$V_I = V_{CC}$ or GND,	I <sub>S</sub> = 4 mA	1.65 V	10	20	_
r <sub>on</sub>	On-state switch resistance	V <sub>C</sub> = V <sub>IH</sub> (see Figure 1)	$I_S = 8 \text{ mA}$	2.3 V	9	15	Ω
		$V_I = V_{CC}$ to GND,	I <sub>S</sub> = 4 mA	1.65 V	32	80	_
r <sub>on(p)</sub>	Peak on resistance	V <sub>C</sub> = V <sub>IH</sub> (see Figure 1)	$I_S = 8 \text{ mA}$	2.3 V	15	20	Ω
I <sub>S(off)</sub>	Off-state switch leakage current	$V_I = V_{CC}$ and $V_O = GN$ $V_I = GND$ and $V_O = V_C$ $V_C = V_{IL}$ (see Figure 2)	CC,	2.7 V		±1 ±0.1 <sup>(1)</sup>	μΑ
I <sub>S(on)</sub>	On-state switch leakage current	$V_I = V_{CC}$ or GND, $V_C = (\text{see Figure 3})$	= V <sub>IH</sub> , V <sub>O</sub> = Open	2.7 V		±1 ±0.1 <sup>(1)</sup>	μΑ
I	Control input current	$V_I = V_{CC}$ or GND		0 to 2.7 V		±5	μΑ
I <sub>CC</sub>	Supply current	$V_I = V_{CC}$ or GND,	I <sub>O</sub> = 0	0.8 V to 2.7 V		10	μΑ
C <sub>ic</sub>	Control input capacitance			2.5 V	2		pF
C <sub>io(off)</sub>	Switch input/output capacitance			2.5 V	3.5		pF
C <sub>io(on)</sub>	Switch input/output capacitance			2.5 V	7		pF

<sup>(1)</sup> All typical values are at  $T_A = 25$ °C.

#### **Switching Characteristics**

over recommended operating free-air temperature range, C<sub>L</sub> = 15 pF (unless otherwise noted) (see Figure 4)

PARAMETER	TER FROM TO (INPUT)		V <sub>CC</sub> = 0.8 V	V <sub>CC</sub> = ± 0.		V <sub>CC</sub> = 1.5 V ± 0.1 V		V <sub>CC</sub> = 1.8 V ± 0.15 V			V <sub>CC</sub> = 2.5 V ± 0.2 V		UNIT
	(INPUT)	(001701)	TYP	MIN	MAX	MIN	MAX	MIN	TYP	MAX	MIN	MAX	
t <sub>pd</sub> <sup>(1)</sup>	A or B	B or A	0.9		0.3		0.2			0.2		0.1	ns
t <sub>en</sub>	С	A or B	4.1	0.5	2.6	0.5	1.7	0.5	0.8	1.1	0.5	1	ns
t <sub>dis</sub>	С	A or B	5	0.7	3.6	0.5	2.6	0.5	1.7	2.9	0.5	2.2	ns

<sup>(1)</sup> 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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#### **Switching Characteristics**

over recommended operating free-air temperature range,  $C_L = 30 \text{ pF}$  (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	
	(INFOT)	(001701)	MIN	TYP	MAX	MIN	MAX	
t <sub>pd</sub> <sup>(1)</sup>	A or B	B or A			0.3		0.3	ns
t <sub>en</sub>	С	A or B	0.5	1.4	2.3	0.8	1.4	ns
t <sub>dis</sub>	С	A or B	0.5	1.7	2.9	0.5	1.5	ns

<sup>(1)</sup> 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**

 $T_A = 25^{\circ}C$ 

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V <sub>CC</sub>	TYP	UNIT
				0.8 V	60	
			$C_L = 50 \text{ pF}, R_L = 600 \Omega,$	1.1 V	60	
			f <sub>in</sub> = sine wave	1.4 V	80	
			(see Figure 5)	1.65 V	1.65 V 120	
Frequency response <sup>(1)</sup>	A or B	B or A		2.3 V	170	MHz
(switch ON)	AOIB	BULK		0.8 V	>500	IVII IZ
			$C_L = 5 \text{ pF}, R_L = 50 \Omega,$	1.1 V	>500	
			f <sub>in</sub> = sine wave	1.4 V	>500	
			(see Figure 5)	1.65 V	>500	
				2.3 V	>500	
				0.8 V	9	
O			$C_L = 50 \text{ pF}, R_L = 600 \Omega,$	1.1 V	14	mV
Crosstalk (control input to signal output)	С	A or B	f <sub>in</sub> = 1 MHz (square wave)	1.4 V	15	
			(see Figure 6)	1.65 V	16	
				2.3 V	20	
				0.8 V	-60	
			$C_L = 50 \text{ pF}, R_L = 600 \Omega,$	1.1 V	-60	
		f <sub>in</sub> = 1 MHz (sine wave) (see Figure 7)	f <sub>in</sub> = 1 MHz (sine wave)	1.4 V	-60	dB
			(see Figure 7)	1.65 V	-60	
Feedthrough attenuation (2)	A or B			2.3 V	-60	
(switch OFF)	7(0) 5	20.70		0.8 V	<b>–</b> 55	
			$C_L = 5 \text{ pF}, R_L = 50 \Omega,$	1.1 V	<b>–</b> 55	
			f <sub>in</sub> = 1 MHz (sine wave)	1.4 V	<b>–</b> 55	
			(see Figure 7)	1.65 V	<b>–</b> 55	
				2.3 V	<del>-</del> 55	
				0.8 V	7.5	
			$C_L = 50 \text{ pF}, R_L = 10 \text{ k}\Omega,$	1.1 V	0.16	
	A or B	B or A	f <sub>in</sub> = 1 kHz (sine wave)	1.4 V	0.04	
			(see Figure 8)	1.65 V	0.03	
Sine-wave distortion				2.3 V	0.02	%
C Maro diotoritori				0.8 V	4.2	70
			$C_L = 50 \text{ pF}, R_L = 10 \text{ k}\Omega,$	1.1 V	0.2	
	A or B B or A $f_{in} = 10 \text{ kHz (sine wave)}$ 1.4 \(\text{V}\)		1.4 V	0.03		
			(see Figure 8)	1.65 V	0.02	
				2.3 V	0.02	

<sup>(1)</sup> 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**

 $T_A = 25$ °C

	PARAMETER	TEST CONDITIONS	V <sub>CC</sub> = 0.8 V	V <sub>CC</sub> = 1.2 V				UNIT
		CONDITIONS	TYP	TYP	TYP	TYP	TYP	
C <sub>pd</sub>	Power dissipation capacitance	f = 10 MHz	3	3	3	3	3	pF



#### PARAMETER MEASUREMENT INFORMATION

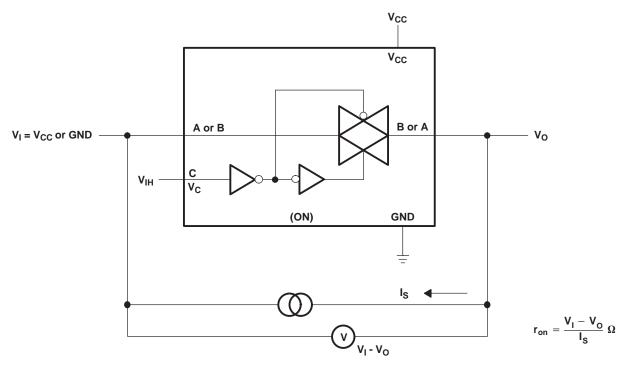


Figure 1. On-State Resistance Test Circuit

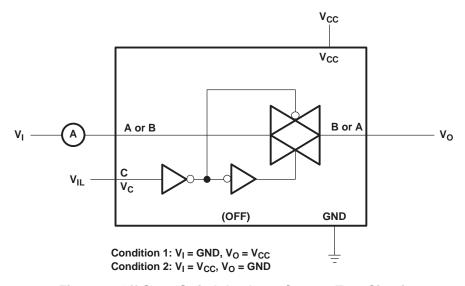


Figure 2. Off-State Switch Leakage-Current Test Circuit



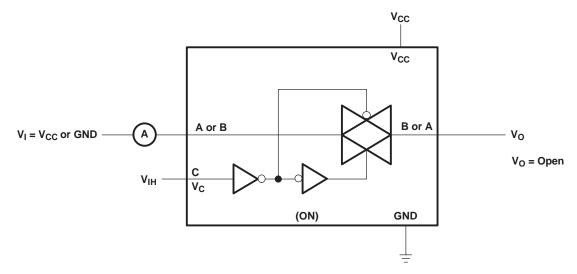
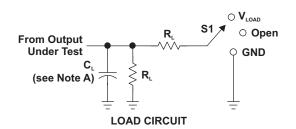


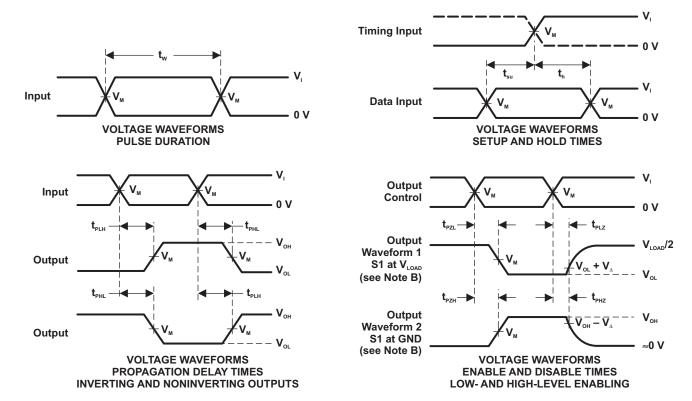
Figure 3. On-State Leakage-Current Test Circuit





TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PLZ</sub> /t <sub>PZL</sub>	<b>V</b> <sub>LOAD</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND

V	INPUTS		V	V	•	В	V
V <sub>cc</sub>	V,	t,/t,	V <sub>M</sub>	<b>V</b> <sub>LOAD</sub>	C <sub>∟</sub>	$R_{\scriptscriptstyle L}$	V <sub>A</sub>
0.8 V	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	<b>2</b> kΩ	0.1 V
1.2 V $\pm$ 0.1 V	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	<b>2 k</b> Ω	0.1 V
1.5 V ± 0.1 V	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	<b>2 k</b> Ω	0.1 V
$1.8 \ V \pm 0.15 \ V$	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	<b>2 k</b> Ω	0.15 V
$2.5~\textrm{V}~\pm~0.2~\textrm{V}$	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	15 pF	<b>2 k</b> Ω	0.15 V
1.8 V ± 0.15 V	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	30 pF	<b>1 k</b> Ω	0.15 V
2.5 V ± 0.2 V	V <sub>cc</sub>	≤2 ns	V <sub>cc</sub> /2	2 × V <sub>cc</sub>	30 pF	<b>500</b> Ω	0.15 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 having the following characteristics: PRR  $\leq$  10 MHz,  $Z_{\circ}$  = 50  $\Omega$ , Slew rate  $\geq$  1 V/ns.
- 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.  $t_{\mbox{\tiny PLH}}$  and  $t_{\mbox{\tiny PHL}}$  are the same as  $t_{\mbox{\tiny pd}}$

Figure 4. Load Circuit and Voltage Waveforms



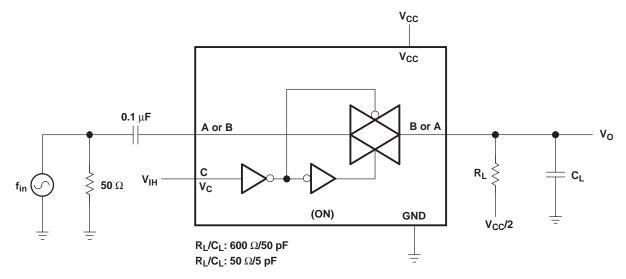


Figure 5. Frequency Response (Switch ON)

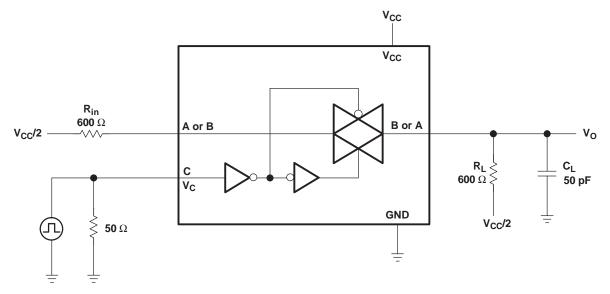


Figure 6. Crosstalk (Control Input – Switch Output)



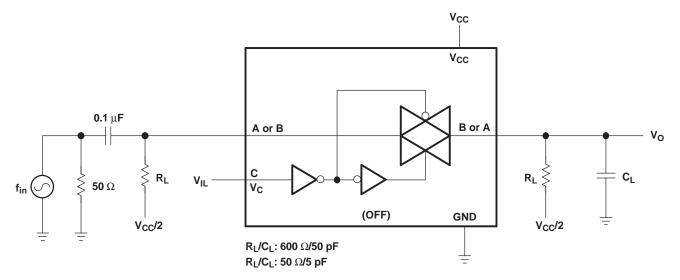


Figure 7. Feedthrough (Switch OFF)

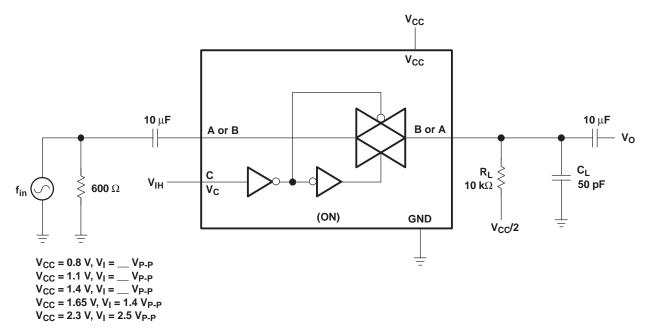


Figure 8. Sine-Wave Distortion

#### PACKAGE OPTION ADDENDUM

www.ti.com 3-Aug-2009

#### **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>
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

<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.

(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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

### PACKAGE MATERIALS INFORMATION

www.ti.com 27-Apr-2011

#### TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
B0	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	Package Type	Package Drawing		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	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUC1G66DCKR	SC70	DCK	5	3000	180.0	8.4	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

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\*All dimensions are nominal

ń								
	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

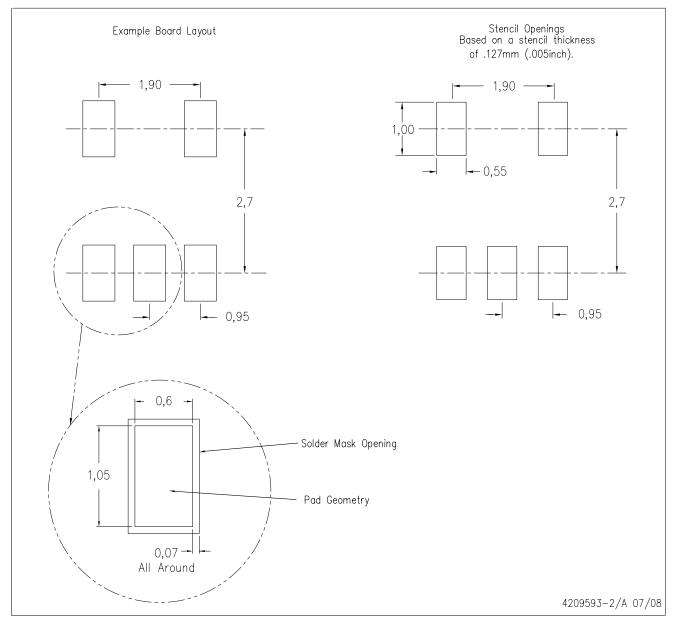


NOTES:

- 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-178 Variation AA.



# DBV (R-PDSO-G5)



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.



## DCK (R-PDSO-G5)

## PLASTIC SMALL-OUTLINE PACKAGE



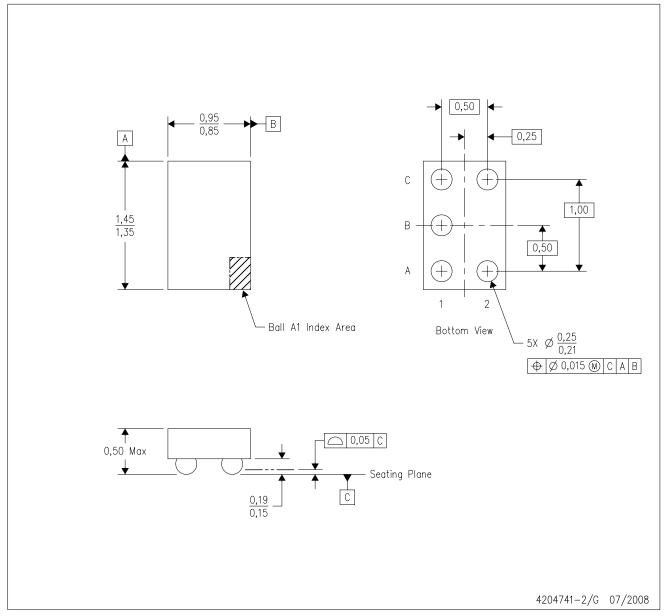
NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. 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  $^{\text{TM}}$  package configuration.
- D. This package is lead-free. Refer to the 5 YEP package (drawing 4204725) for tin-lead (SnPb).

NanoFree is a trademark of Texas Instruments.



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