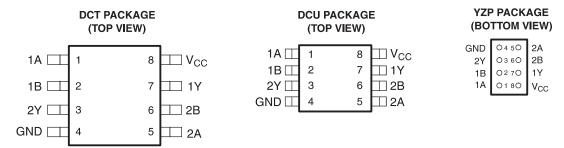
SCES441C-MAY 2003-REVISED JANUARY 2007

#### **FEATURES**

- Available in the Texas Instruments
   NanoFree<sup>™</sup> Package
- Optimized for 1.8-V Operation and Is 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operation
- I<sub>off</sub> Supports Partial Power-Down-Mode Operation
- Sub-1-V Operable
- Max t<sub>pd</sub> of 1.8 ns at 1.8 V

- Low Power Consumption, 10 μA at 1.8 V
- ±8-mA Output Drive at 1.8 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.

#### **DESCRIPTION/ORDERING INFORMATION**

This dual 2-input positive-NOR gate 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 SN74AUC2G02 performs the Boolean function  $Y = \overline{A + B}$  or  $Y = \overline{A} \bullet \overline{B}$  in positive logic.

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

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

#### ORDERING INFORMATION

T <sub>A</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING(2)
-40°C to 85°C	NanoFree <sup>™</sup> – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Reel of 3000	SN74AUC2G02YZPR	UB_
	SSOP - DCT	Reel of 3000	SN74AUC2G02DCTR	U02_
	VSSOP - DCU	Reel of 3000	SN74AUC2G02DCUR	U02_

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



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NanoFree is a trademark of Texas Instruments.

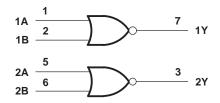
<sup>(2)</sup> DCT: The actual top-side marking has three additional characters that designate the year, month, and assembly/test site. DCU: The actual top-side marking has one additional character that designates the assembly/test site. YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site.



# FUNCTION TABLE (each gate)

INP	UTS	OUTPUT
Α	В	Y
Н	Χ	L
Х	Н	L
L	L	Н

### **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
VI	Input voltage range <sup>(2)</sup>		-0.5	3.6	V
Vo	Voltage range applied to any output in the high-i	impedance or power-off state (2)	-0.5	3.6	V
Vo	Output voltage range (2)		-0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0		-50	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0		-50	mA
Io	Continuous output current			±20	mA
	Continuous current through V <sub>CC</sub> or GND			±100	mA
		DCT package		220	
$\theta_{JA}$	Package thermal impedance (3)	DCU package		227	°C/W
		YZP package		102	
T <sub>stg</sub>	Storage temperature range		-65	150	°C

<sup>(1)</sup> 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.

<sup>(2)</sup> The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

<sup>(3)</sup> The package thermal impedance is calculated in accordance with JESD 51-7.



# SCES441C-MAY 2003-REVISED JANUARY 2007

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

			MIN	MAX	UNIT	
$V_{CC}$	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 <sub>CC</sub> = 1.1 V to 1.95 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 <sub>CC</sub> = 1.1 V to 1.95 V		$0.35 \times V_{CC}$	V	
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.7		
VI	Input voltage		0	3.6	V	
Vo	Output voltage		0	V <sub>CC</sub>	V	
		V <sub>CC</sub> = 0.8 V		-0.7		
		V <sub>CC</sub> = 1.1 V		-3		
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 1.4 V		<b>-</b> 5	mA	
		V <sub>CC</sub> = 1.65 V	-8			
		$V_{CC} = 2.3 \text{ V}$		6		
		V <sub>CC</sub> = 0.8 V		0.7		
		V <sub>CC</sub> = 1.1 V		3		
$I_{OL}$	Low-level output current	V <sub>CC</sub> = 1.4 V		5	mA	
		V <sub>CC</sub> = 1.65 V		8		
		V <sub>CC</sub> = 2.3 V		9		
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 CONDITIONS	V <sub>cc</sub>	MIN TYP(1) M	AX UNIT
	$I_{OH} = -100 \mu A$	0.8 V to 2.7 V	V <sub>CC</sub> - 0.1	
	$I_{OH} = -0.7 \text{ mA}$	0.8 V	0.55	
V	$I_{OH} = -3 \text{ mA}$	1.1 V	0.8	V
V <sub>OH</sub>	$I_{OH} = -5 \text{ mA}$	1.4 V	1	V
	$I_{OH} = -8 \text{ mA}$	1.65 V	1.2	
	$I_{OH} = -9 \text{ mA}$	2.3 V	1.8	
	I <sub>OL</sub> = 100 μA	0.8 V to 2.7 V		0.2
	$I_{OL} = 0.7 \text{ mA}$	0.8 V	0.25	
	I <sub>OL</sub> = 3 mA	1.1 V		0.3 V
V <sub>OL</sub>	$I_{OL} = 5 \text{ mA}$	1.4 V		0.4
	I <sub>OL</sub> = 8 mA	1.65 V	0	45
	I <sub>OL</sub> = 9 mA	2.3 V		0.6
I <sub>I</sub> A or B inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	0 to 2.7 V		±5 μA
I <sub>off</sub>	$V_I \text{ or } V_O = 2.7 \text{ V}$	0	±	:10 μΑ
I <sub>CC</sub>	$V_I = V_{CC}$ or GND, $I_O = 0$	0.8 V to 2.7 V		10 μΑ
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	2.5 V	2.5	pF

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

## SN74AUC2G02 DUAL 2-INPUT POSITIVE-NOR GATE





#### **Switching Characteristics**

over recommended operating free-air temperature range,  $C_L = 15 \text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 0.8 V	V <sub>CC</sub> = ± 0.		V <sub>CC</sub> = ± 0.		$ m V_{CC}$ = 1.8 V $\pm$ 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>	A or B	Y	8	0.8	3.5	0.6	2.2	0.5	1	1.8	0.5	1.3	ns

### **Switching Characteristics**

over recommended operating free-air temperature range,  $C_L = 30 \text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)		<sub>C</sub> = 1.8 : 0.15 \		V <sub>CC</sub> = 2.5 V ± 0.2 V		UNIT	
	(INFOT)	(OUTPUT)	MIN	TYP	MAX	MIN	MAX	
t <sub>pd</sub>	A or B	Υ	1	1.6	2.4	0.8	1.9	ns

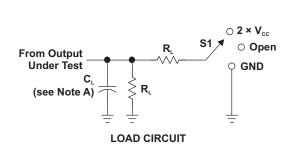
## **Operating Characteristics**

 $T_A = 25^{\circ}C$ 

PARAMETER TEST CONDITION		TEST CONDITIONS	V <sub>CC</sub> = 0.8 V TYP	V <sub>CC</sub> = 1.2 V TYP	V <sub>CC</sub> = 1.5 V TYP	V <sub>CC</sub> = 1.8 V TYP	V <sub>CC</sub> = 2.5 V TYP	UNIT
$C_{pd}$	Power dissipation capacitance	f = 10 MHz	13	13	14	14	14	pF

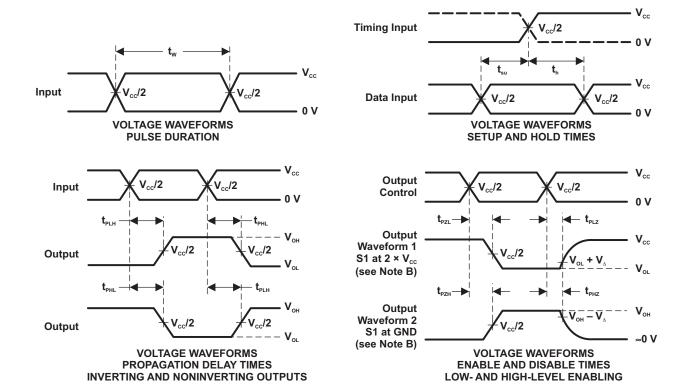


#### PARAMETER MEASUREMENT INFORMATION



TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PLZ</sub> /t <sub>PZL</sub>	2 × V <sub>cc</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND

C <sub>∟</sub>	R <sub>L</sub>	V <sub>Δ</sub>
15 pF	<b>2 k</b> Ω	0.1 V
15 pF	<b>2 k</b> Ω	0.1 V
15 pF	<b>2 k</b> Ω	0.1 V
15 pF	<b>2 k</b> Ω	0.15 V
15 pF	<b>2 k</b> Ω	0.15 V
30 pF	<b>1 k</b> Ω	0.15 V
30 pF	500 Ω	0.15 V
	15 pF 15 pF 15 pF 15 pF 15 pF 30 pF	15 pF 2 kΩ 15 pF 2 kΩ 15 pF 2 kΩ 15 pF 2 kΩ 15 pF 2 kΩ 30 pF 1 kΩ



NOTES: A. C<sub>L</sub> 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,  $Z_o$  = 50  $\Omega$ , slew rate  $\geq$  1 V/ns.
- D. The outputs are measured one at a time, with one transition per measurement.
- E.  $t_{\text{\tiny PLZ}}$  and  $t_{\text{\tiny PHZ}}$  are the same as  $t_{\text{\tiny dis}}$ .
- F.  $t_{\mbox{\tiny PZL}}$  and  $t_{\mbox{\tiny PZH}}$  are the same as  $t_{\mbox{\tiny en}}.$
- G.  $t_{Pl\,H}$  and  $t_{PHl}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms



### PACKAGE OPTION ADDENDUM

16-Jun-2017

#### **PACKAGING INFORMATION**

www.ti.com

Orderable Device	Status	Package Type	_	Pins	_	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
SN74AUC2G02DCTR	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	U02 (R ~ Z)	Samples
SN74AUC2G02DCUR	ACTIVE	VSSOP	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	-40 to 85	(U02Q ~ U02R) UR	Samples
SN74AUC2G02YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	UBN	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.

(2) RoHS: TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (CI) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

- (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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## **PACKAGE OPTION ADDENDUM**

16-Jun-2017

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## **PACKAGE MATERIALS INFORMATION**

www.ti.com 28-Sep-2017

## TAPE AND REEL INFORMATION





Α0	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

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
SN74AUC2G02DCTR	SM8	DCT	8	3000	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
SN74AUC2G02DCUR	VSSOP	DCU	8	3000	178.0	9.5	2.25	3.35	1.05	4.0	8.0	Q3
SN74AUC2G02DCUR	VSSOP	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
SN74AUC2G02YZPR	DSBGA	YZP	8	3000	178.0	9.2	1.02	2.02	0.63	4.0	8.0	Q1

www.ti.com 28-Sep-2017



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUC2G02DCTR	SM8	DCT	8	3000	182.0	182.0	20.0
SN74AUC2G02DCUR	VSSOP	DCU	8	3000	202.0	201.0	28.0
SN74AUC2G02DCUR	VSSOP	DCU	8	3000	202.0	201.0	28.0
SN74AUC2G02YZPR	DSBGA	YZP	8	3000	220.0	220.0	35.0

# DCU (R-PDSO-G8)

# PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



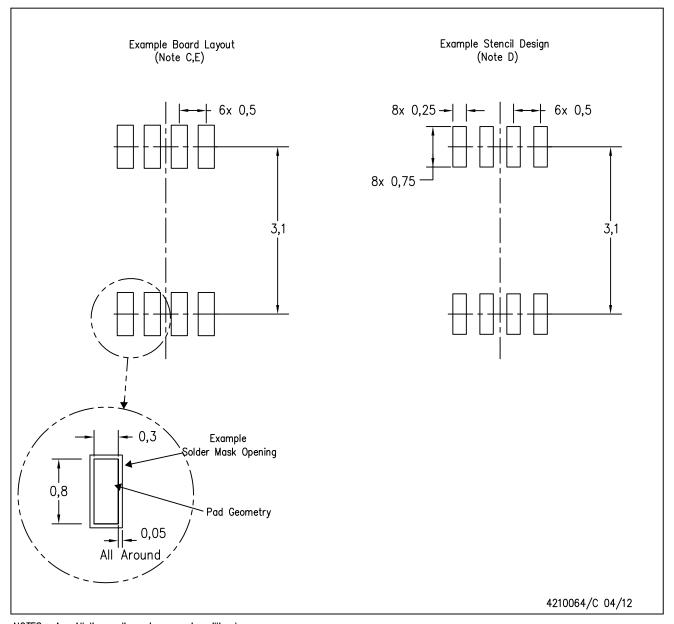
NOTES:

- 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.



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.



### 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



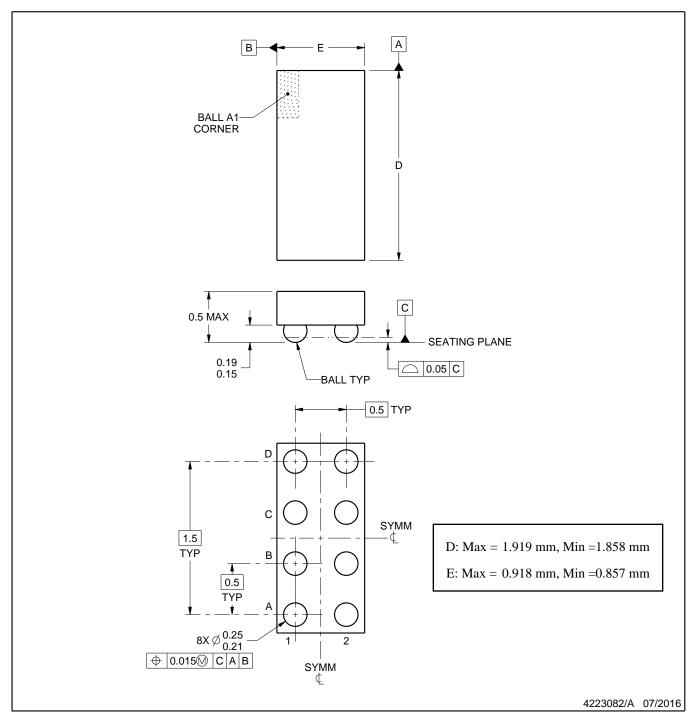
NOTES: A. All linear dimensions are in millimeters.

- 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.





DIE SIZE BALL GRID ARRAY



#### NOTES:

- 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.



DIE SIZE BALL GRID ARRAY



NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).



DIE SIZE BALL GRID ARRAY



NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.



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