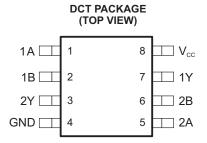


## FEATURES

- 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
- Ioff Supports Partial-Power-Down Mode Operation
- Sub-1-V Operable
- Max  $t_{pd}$  of 1.7 ns at 1.8 V



- Low Power Consumption, 10-µA Max I<sub>cc</sub>
- ±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)

1		ACKAGE VIEW)		PACK/		
1A 🖂	1	8		GND	O4 50	2A
1B □	2	7	∏ 1Y	2Y	O 3 6 O	2B
2Y □	3	6	⊡ 2B	1B	0270	1Y
GND 🗆	4	5	⊥ 2B ⊥ 2A	1A	0180	V <sub>CC</sub>

See mechanical drawings for dimensions.

## DESCRIPTION/ORDERING INFORMATION

This dual 2-input exclusive-OR gate is operational at 0.8-V to 2.7-V V<sub>CC</sub>, but is designed specifically for 1.65-V to 1.95-V V<sub>CC</sub> operation.

The SN74AUC2G86 performs the Boolean function  $Y = A \oplus B$  or  $Y = \overline{AB} + A\overline{B}$  in positive logic.

A common application is as a true/complement element. If the input is low, the other input is reproduced in true form at the output. If the input is high, the signal on the other input is reproduced inverted at the output.

NanoFree<sup>™</sup> 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<sub>off</sub>. The I<sub>off</sub> circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

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	SN74AUC2G86YZPR	UH_
–40°C to 85°C	SSOP – DCT	Reel of 3000	SN74AUC2G86DCTR	U86
	VSSOP – DCU	Reel of 3000	SN74AUC2G86DCUR	U86_

#### **ORDERING INFORMATION**

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

(2) 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.



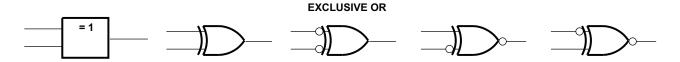
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet. NanoFree is a trademark of Texas Instruments.

### FUNCTION TABLE (each gate)

INPU	JTS	OUTPUT
Α	В	Y
L	L	L
L	Н	н
Н	L	н
Н	Н	L

## **EXCLUSIVE-OR LOGIC**

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.



These are five equivalent exclusive-OR symbols valid for an SN74AUC2G86 gate in positive logic; negation may be shown at any two ports.

#### 

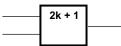
The output is active (low) if all inputs stand at the same logic level (i.e., A = B).





The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

#### ODD-PARITY ELEMENT



The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

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

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 h	nigh-impedance or power-off state <sup>(2)</sup>	-0.5	3.6	V
Vo	Output voltage range <sup>(2)</sup>		-0.5	$V_{CC} + 0.5$	V
I <sub>IK</sub>	Input clamp current	V <sub>1</sub> < 0		-50	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0		-50	mA
I <sub>O</sub>	Continuous output current			±20	mA
	Continuous current through $V_{CC}$ or GND			±100	mA
		DCT package		220	
$\theta_{JA}$	Package thermal impedance <sup>(3)</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) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

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

# 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 <sub>IH</sub>	High-level input voltage	$V_{CC} = 1.1 \text{ V to } 1.95 \text{ V}$	$0.65  imes V_{CC}$		V
		$V_{CC}$ = 2.3 V to 2.7 V	1.7		
		$V_{CC} = 0.8 V$		0	
V <sub>IL</sub>	Low-level input voltage	$V_{CC} = 1.1 \text{ V to } 1.95 \text{ V}$		$0.35 \times V_{CC}$	V
		$V_{CC}$ = 2.3 V to 2.7 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		-5	mA
		V <sub>CC</sub> = 1.65 V		-8	
		$V_{CC} = 2.3 V$		-9	
		$V_{CC} = 0.8 V$		0.7	
		V <sub>CC</sub> = 1.1 V		3	
I <sub>OL</sub>	Low-level output current	$V_{CC} = 1.4 V$		5	mA
		V <sub>CC</sub> = 1.65 V		8	
		V <sub>CC</sub> = 2.3 V		9	
$\Delta t / \Delta v$	Input transition rise or fall rate			20	ns/V
T <sub>A</sub>	Operating free-air temperature		-40	85	°C

 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 <sup>(1)</sup>	MAX	UNIT
	I <sub>OH</sub> = -100 μA	0.8 V to 2.7 V	V <sub>CC</sub> - 0.1			
	$I_{OH} = -0.7 \text{ mA}$	0.8 V		0.55		
M	$I_{OH} = -3 \text{ mA}$	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 <sub>OL</sub> = 0.7 mA	0.8 V		0.25		
	I <sub>OL</sub> = 3 mA	1.1 V			0.3	V
V <sub>OL</sub>	I <sub>OL</sub> = 5 mA	1.4 V			0.4	V
	I <sub>OL</sub> = 8 mA	1.65 V			0.45	
	I <sub>OL</sub> = 9 mA	2.3 V			0.6	
II A or B inputs	$V_{I} = V_{CC} \text{ or } GND$	0 to 2.7 V			±5	μA
l <sub>off</sub>	$V_1 \text{ or } V_0 = 2.7 \text{ V}$	0			±10	μA
I <sub>CC</sub>	$V_{I} = V_{CC} \text{ or } GND, \qquad I_{O} = 0$	0.8 V to 2.7 V			10	μA
C <sub>i</sub>	$V_{I} = V_{CC} \text{ or } GND$	2.5 V		2.5		pF

(1) All typical values are at  $T_A = 25^{\circ}C$ .

# SN74AUC2G86 DUAL 2-INPUT EXCLUSIVE-OR GATE

SCES479B-AUGUST 2003-REVISED JANUARY 2007

## TEXAS INSTRUMENTS www.ti.com

#### **Switching Characteristics**

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

PARAMETER	FROM TO (INPUT) (OUTPUT)		V <sub>CC</sub> = 0.8 V	$\begin{array}{c} \textbf{V}_{\text{CC}} = \textbf{1.2} \ \textbf{V} \\ \pm \ \textbf{0.1} \ \textbf{V} \end{array}$		$V_{CC}$ = 1.5 V ± 0.1 V		V <sub>CC</sub> = 1.8 V ± 0.15 V			$V_{CC}$ = 2.5 V $\pm$ 0.2 V		UNIT
	(INFOT)	(001-01)	TYP	MIN	MAX	MIN	MAX	MIN	TYP	MAX	MIN	MAX	
t <sub>pd</sub>	A or B	Y	5.3	0.8	3.8	0.5	2.6	0.4	1	1.7	0.3	1.3	ns

### **Switching Characteristics**

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

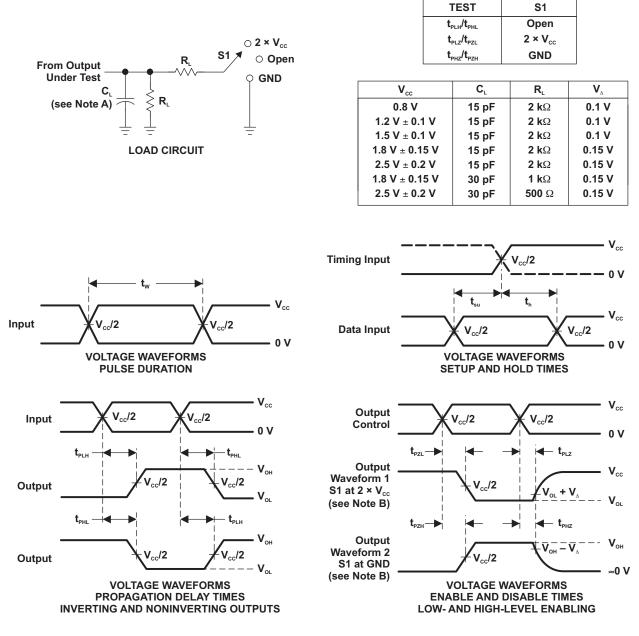
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 1.8 V ± 0.15 V			V <sub>CC</sub> = 2 ± 0.2	UNIT	
		(001201)	MIN	TYP	MAX	MIN	MAX	
t <sub>pd</sub>	A or B	Y	0.8	1.5	2.6	0.7	2	ns

## **Operating Characteristics**

 $T_A = 25^{\circ}C$ 

	PARAMETER	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 <sub>pd</sub>	Power dissipation capacitance	f = 10 MHz	15	15	16	19	27	pF

#### PARAMETER MEASUREMENT INFORMATION



NOTES: A.  $C_{L}$  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<sub>o</sub> = 50 Ω,
- slew rate  $\geq$  1 V/ns.
- D. The outputs are measured one at a time, with one transition per measurement.
- E.  $t_{_{PLZ}}$  and  $\dot{t}_{_{PHZ}}$  are the same as  $t_{_{dis}}$ .
- F.  $t_{\mbox{\tiny PZL}}$  and  $t_{\mbox{\tiny PZH}}$  are the same as  $t_{\mbox{\tiny en}}.$
- G.  $t_{PIH}$  and  $t_{PHI}$  are the same as  $t_{od}$ .

#### Figure 1. Load Circuit and Voltage Waveforms



11-Apr-2013

## PACKAGING INFORMATION

Orderable Device	Status	Package Type	•		-	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Top-Side Markings	Samples
	(1)		Drawing		Qty	(2)		(3)		(4)	
SN74AUC2G86DCTR	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	U86 Z	Samples
SN74AUC2G86DCTRE4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	U86 Z	Samples
SN74AUC2G86DCTRG4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	U86 Z	Samples
SN74AUC2G86DCUR	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	U86R	Samples
SN74AUC2G86DCURE4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	U86R	Samples
SN74AUC2G86DCURG4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	U86R	Samples
SN74AUC2G86YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(UH7 ~ UHN)	Samples

<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)

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

<sup>(4)</sup> Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.



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11-Apr-2013

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# PACKAGE MATERIALS INFORMATION

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## TAPE AND REEL INFORMATION





## 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
SN74AUC2G86DCUR	US8	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
SN74AUC2G86YZPR	DSBGA	YZP	8	3000	178.0	9.2	1.02	2.02	0.63	4.0	8.0	Q1

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# PACKAGE MATERIALS INFORMATION

26-Jan-2013



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUC2G86DCUR	US8	DCU	8	3000	202.0	201.0	28.0
SN74AUC2G86YZPR	DSBGA	YZP	8	3000	220.0	220.0	35.0

## **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.



DCT (R-PDSO-G8) PLASTIC SMALL OUTLINE Example Board Layout Example Stencil Design (Note C,E) (Note D) - 6x0,65 - 6x0,65 8x0,25-8x1,55 3,40 3,40 Non Solder Mask Defined Pad Example Pad Geometry -0,30 (Note C) 1,60 Example -0,07 Non-solder Mask Opening All Around (Note E) 4212201/A 10/11

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.



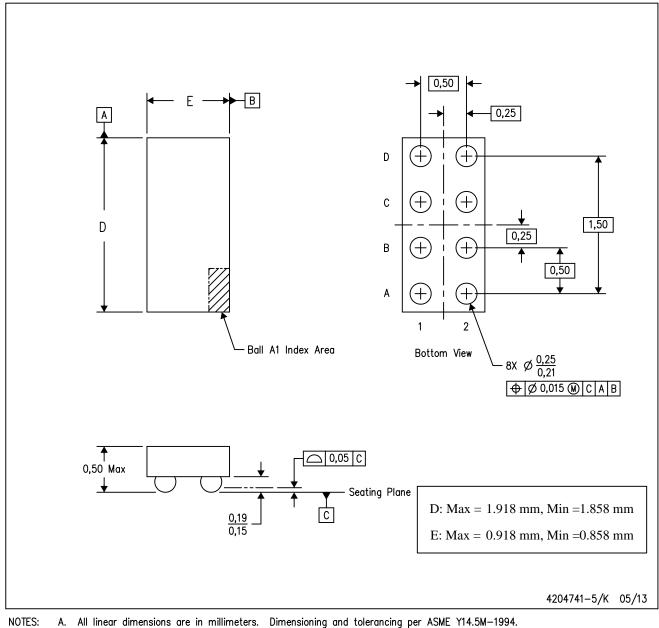


- NOTES: A. All linear dimensions are in millimeters. В. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should 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



- A. All linear dimensions are in millimeters. Dimension B. This drawing is subject to change without notice.
- C. NanoFree™ package configuration.

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