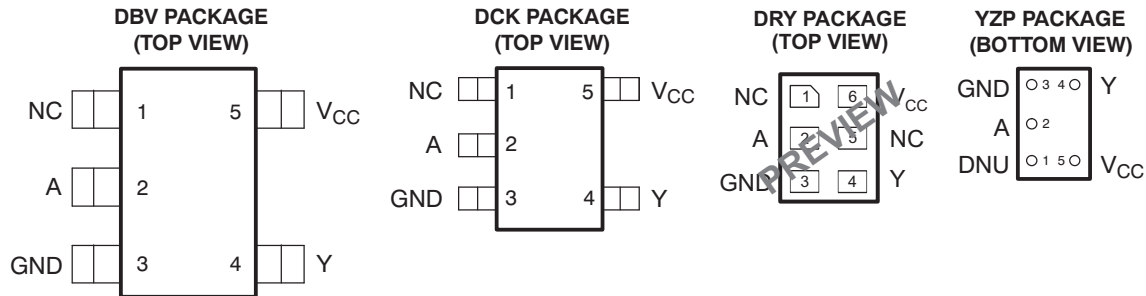


## FEATURES

- Available in the Texas Instruments NanoFree™ Package
- Optimized for 1.8-V Operation and Is 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operation
- Sub-1-V Operable
- Max  $t_{pd}$  of 2.4 ns at 1.8 V
- Low Power Consumption, 10- $\mu$ A Max  $I_{CC}$
- $\pm 8$ -mA Output Drive at 1.8 V
- Unbuffered Output
- 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)



DNU – Do not use  
NC – No internal connection  
See mechanical drawings for dimensions.

## DESCRIPTION/ORDERING INFORMATION

This single inverter 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 SN74AUC1GU04 contains one inverter with an unbuffered output and performs the Boolean function  $Y = \bar{A}$ .

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

## ORDERING INFORMATION

$T_A$	PACKAGE <sup>(1)(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
–40°C to 85°C	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Reel of 3000	SN74AUC1GU04YZPR	___UD_
	SON – DRY	Reel of 5000	SN74AUC1GU04DRYR	PREVIEW
	SOT (SOT-23) – DBV	Reel of 300	SN74AUC1GU04DBVR	UU4_
	SOT (SC-70) – DCK	Reel of 300	SN74AUC1GU04DCKR	UD_

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



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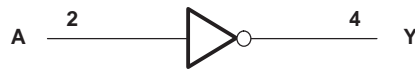
# SN74AUC1GU04 SINGLE INVERTER GATE

SCES371L – SEPTEMBER 2001 – REVISED APRIL 2007

## FUNCTION TABLE

INPUT A	OUTPUT Y
H	L
L	H

## LOGIC DIAGRAM (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	-0.5	3.6	V
$V_I$	Input voltage range <sup>(2)</sup>	-0.5	3.6	V
$V_O$	Output voltage range <sup>(2)</sup>	-0.5	$V_{CC} + 0.5$	V
$I_{IK}$	Input clamp current		-50	mA
$I_{OK}$	Output clamp current		-50	mA
$I_O$	Continuous output current		±20	mA
	Continuous current through $V_{CC}$ or GND		±100	mA
$\theta_{JA}$	Package thermal impedance <sup>(3)</sup>	DBV package	206	°C/W
		DCK package	252	
		DRY package	234	
		YZP package	132	
$T_{stg}$	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) 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>IH</sub>	High-level input voltage	I <sub>O</sub> = -100 μA	0.65 × V <sub>CC</sub>		V
V <sub>IL</sub>	Low-level input voltage	I <sub>O</sub> = 100 μA		0.35 × V <sub>CC</sub>	V
V <sub>I</sub>	Input voltage		0	3.6	V
V <sub>O</sub>	Output voltage		0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 0.8 V		-0.7	mA
		V <sub>CC</sub> = 1.1 V		-3	
		V <sub>CC</sub> = 1.4 V		-5	
		V <sub>CC</sub> = 1.65 V		-8	
		V <sub>CC</sub> = 2.3 V		-9	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 0.8 V		0.7	mA
		V <sub>CC</sub> = 1.1 V		3	
		V <sub>CC</sub> = 1.4 V		5	
		V <sub>CC</sub> = 1.65 V		8	
		V <sub>CC</sub> = 2.3 V		9	
Δt/Δv	Input transition rise or fall rate			20	ns/V
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.

### 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
V <sub>OH</sub>	I <sub>OH</sub> = -100 μA	0.8 V to 2.7 V	V <sub>CC</sub> - 0.1			V
	I <sub>OH</sub> = -0.7 mA	0.8 V	0.55			
	I <sub>OH</sub> = -3 mA	1.1 V	0.8			
	I <sub>OH</sub> = -5 mA	1.4 V	1			
	I <sub>OH</sub> = -8 mA	1.65 V	1.2			
	I <sub>OH</sub> = -9 mA	2.3 V	1.8			
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	0.8 V to 2.7 V			0.2	V
	I <sub>OL</sub> = 0.7 mA	0.8 V		0.25		
	I <sub>OL</sub> = 3 mA	1.1 V			0.3	
	I <sub>OL</sub> = 5 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 input V <sub>I</sub> = V <sub>CC</sub> or GND		0 to 2.7 V		±5	μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0		0.8 V to 2.7 V		10	μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		2.5 V		3	pF

(1) All typical values are at T<sub>A</sub> = 25°C.

# SN74AUC1GU04

## SINGLE INVERTER GATE

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### Switching Characteristics

over recommended operating free-air temperature range,  $C_L = 15$  pF (unless otherwise noted) (see [Figure 1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 0.8$ V	$V_{CC} = 1.2$ V $\pm 0.1$ V		$V_{CC} = 1.5$ V $\pm 0.1$ V		$V_{CC} = 1.8$ V $\pm 0.15$ V			$V_{CC} = 2.5$ V $\pm 0.2$ V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	TYP	MAX	MIN	MAX	
$t_{pd}$	A	Y	1.9	0.6	2.5	0.6	1.7	0.3	1.1	2.3	0.2	2	ns

### Switching Characteristics

over recommended operating free-air temperature range,  $C_L = 30$  pF (unless otherwise noted) (see [Figure 1](#))

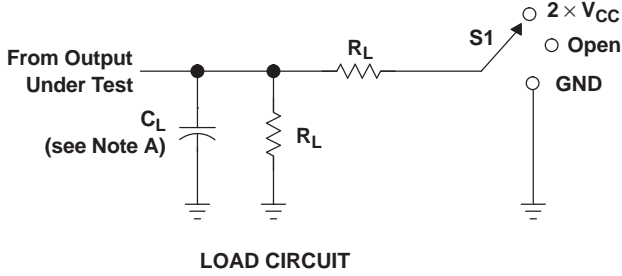
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8$ V $\pm 0.15$ V			$V_{CC} = 2.5$ V $\pm 0.2$ V		UNIT
			MIN	TYP	MAX	MIN	MAX	
$t_{pd}$	A	Y	0.6	1.1	2.4	0.5	2.1	ns

### Operating Characteristics

$T_A = 25^\circ\text{C}$

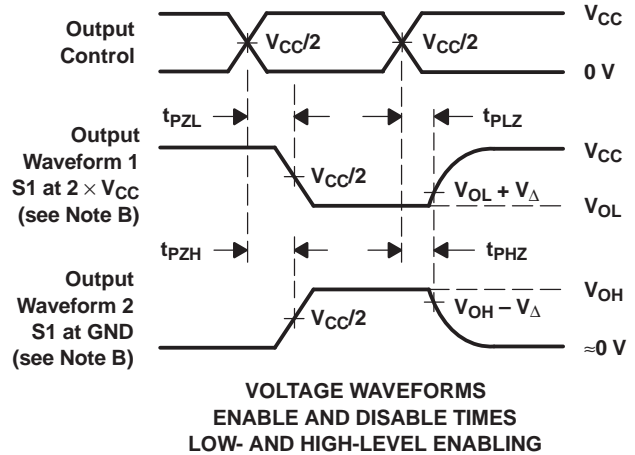
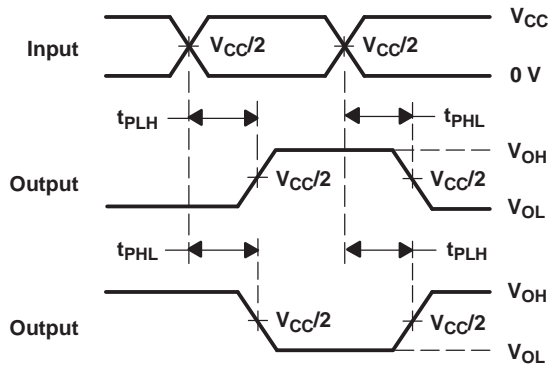
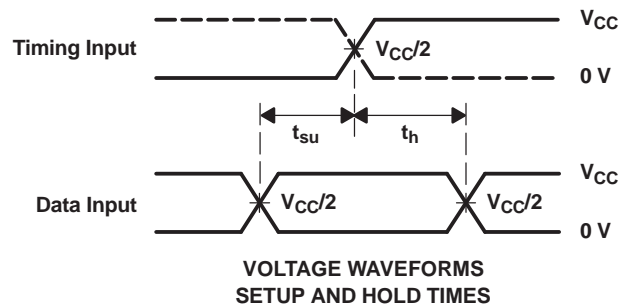
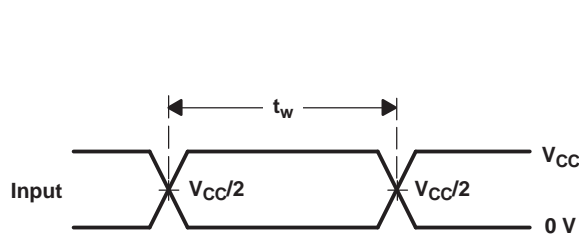
PARAMETER	TEST CONDITIONS	$V_{CC} = 0.8$ V	$V_{CC} = 1.2$ V	$V_{CC} = 1.5$ V	$V_{CC} = 1.8$ V	$V_{CC} = 2.5$ V	UNIT
		TYP	TYP	TYP	TYP	TYP	
$C_{pd}$ Power dissipation capacitance	$f = 10$ MHz	4	4	4	4	5	pF

PARAMETER MEASUREMENT INFORMATION



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$C_L$	$R_L$	$V_{\Delta}$
0.8 V	15 pF	2 k $\Omega$	0.1 V
$1.2 \text{ V} \pm 0.1 \text{ V}$	15 pF	2 k $\Omega$	0.1 V
$1.5 \text{ V} \pm 0.1 \text{ V}$	15 pF	2 k $\Omega$	0.1 V
$1.8 \text{ V} \pm 0.15 \text{ V}$	15 pF	2 k $\Omega$	0.15 V
$2.5 \text{ V} \pm 0.2 \text{ V}$	15 pF	2 k $\Omega$	0.15 V
$1.8 \text{ V} \pm 0.15 \text{ V}$	30 pF	1 k $\Omega$	0.15 V
$2.5 \text{ V} \pm 0.2 \text{ V}$	30 pF	500 $\Omega$	0.15 V



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - 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.
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**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>
74AUC1GU04DBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74AUC1GU04DBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74AUC1GU04DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1GU04DBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1GU04DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1GU04DCKRE4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1GU04YZPR	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.

**OBSELETE:** 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

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AUC1GU04DBVR	SOT-23	DBV	5	3000	180.0	9.2	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUC1GU04DCKR	SC70	DCK	5	3000	180.0	9.2	2.24	2.34	1.22	4.0	8.0	Q3
SN74AUC1GU04YZPR	DSBGA	YZP	5	3000	178.0	9.2	1.02	1.52	0.63	4.0	8.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

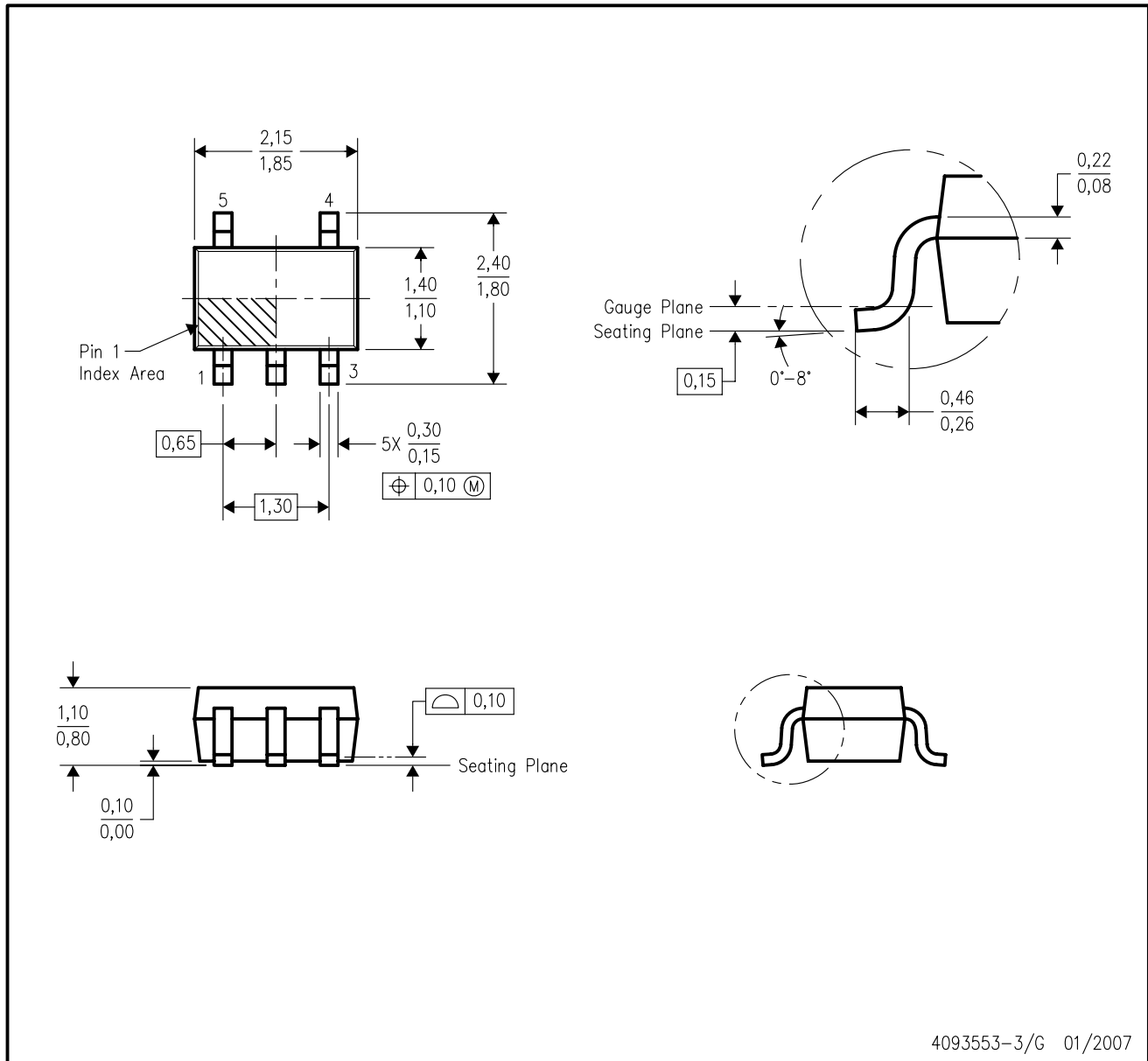
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUC1GU04DBVR	SOT-23	DBV	5	3000	202.0	201.0	28.0
SN74AUC1GU04DCKR	SC70	DCK	5	3000	202.0	201.0	28.0
SN74AUC1GU04YZPR	DSBGA	YZP	5	3000	220.0	220.0	35.0





DCK (R-PDSO-G5)

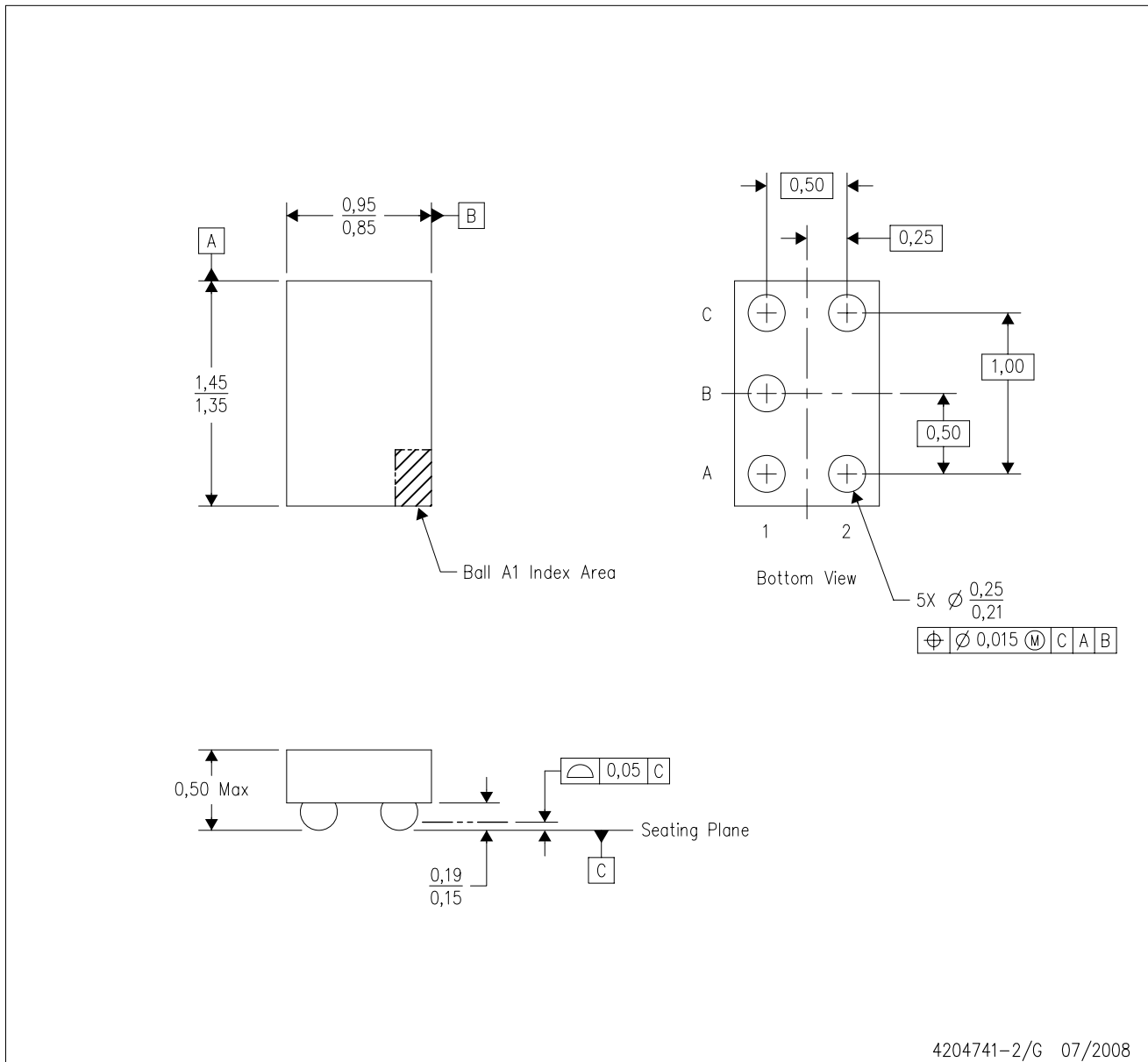
PLASTIC SMALL-OUTLINE PACKAGE



- 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™ package configuration.
  - D. This package is lead-free. Refer to the 5 YEP package (drawing 4204725) for tin-lead (SnPb).

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>	Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>	Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Energy	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Space, Avionics & Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>	Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
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