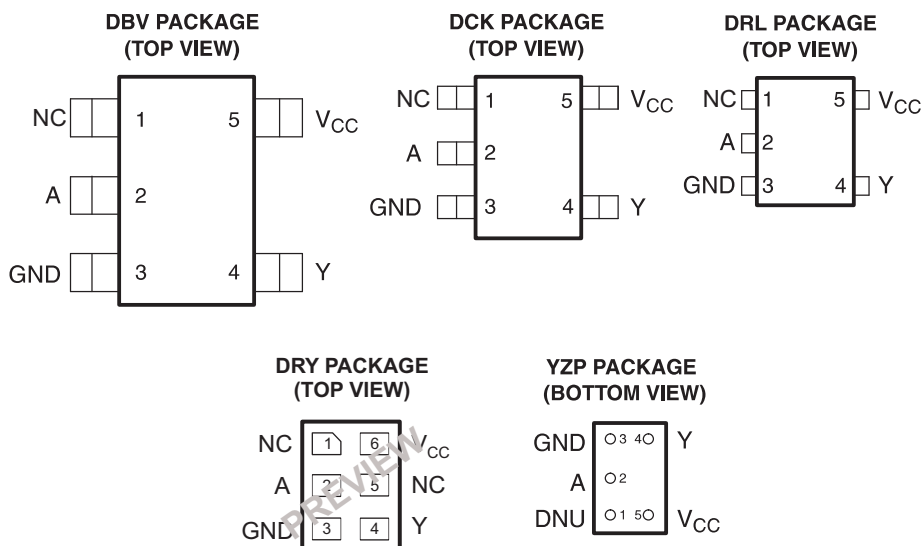


FEATURES

- 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
- I_{off} Supports Partial-Power-Down Mode Operation
- Sub-1-V Operable
- Max t_{pd} of 2.2 ns at 1.8 V
- Low Power Consumption, 10- μ A Max I_{CC}
- ± 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)



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 SN74AUC1G04 performs the Boolean function $Y = \bar{A}$.

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 output, preventing damaging current backflow through the device when it is powered down.

For more information about AUC Little Logic devices, please refer to the TI application report, *Applications of Texas Instruments AUC Sub-1-V Little Logic Devices*, literature number SCEA027.



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.

SN74AUC1G04

SINGLE INVERTER GATE

SCES370Q – SEPTEMBER 2001 – REVISED APRIL 2007

ORDERING INFORMATION

T _A	PACKAGE ⁽¹⁾⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING ⁽³⁾
–40°C to 85°C	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Reel of 3000	SN74AUC1G04YZPR	_ _ _ UC _
	SON – DRY	Reel of 5000	SN74AUC1G04DRYR	PREVIEW
	SOT (SOT-23) – DBV	Reel of 3000	SN74AUC1G04DBVR	U04 _
	SOT (SC-70) – DCK	Reel of 3000	SN74AUC1G04DCKR	UC _
	SOT (SOT-553) – DRL	Reel of 4000	SN74AUC1G04DRLR	UC _

- (1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at 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.
- (3) DBV/DCK/DRL/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. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

FUNCTION TABLE

INPUT A	OUTPUT Y
H	L
L	H

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
V _I	Input voltage range ⁽²⁾	–0.5	3.6	V
V _O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	–0.5	3.6	V
	Output voltage range ⁽²⁾	–0.5	V _{CC} + 0.5	
I _{IK}	Input clamp current	V _I < 0		–50 mA
I _{OK}	Output clamp current	V _O < 0		–50 mA
I _O	Continuous output current			±20 mA
	Continuous current through V _{CC} or GND			±100 mA
θ _{JA}	Package thermal impedance ⁽³⁾	DBV package		206
		DCK package		252
		DRL package		142
		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⁽¹⁾

			MIN	MAX	UNIT
V _{CC}	Supply voltage		0.8	2.7	V
V _{IH}	High-level input voltage	V _{CC} = 0.8 V	V _{CC}		V
		V _{CC} = 1.1 V to 1.95 V	0.65 × V _{CC}		
		V _{CC} = 2.3 V to 2.7 V	1.7		
V _{IL}	Low-level input voltage	V _{CC} = 0.8 V	0		V
		V _{CC} = 1.1 V to 1.95 V	0.35 × V _{CC}		
		V _{CC} = 2.3 V to 2.7 V	0.7		
V _I	Input voltage		0	3.6	V
V _O	Output voltage		0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 0.8 V	−0.7		mA
		V _{CC} = 1.1 V	−3		
		V _{CC} = 1.4 V	−5		
		V _{CC} = 1.65 V	−8		
		V _{CC} = 2.3 V	−9		
I _{OL}	Low-level output current	V _{CC} = 0.8 V	0.7		mA
		V _{CC} = 1.1 V	3		
		V _{CC} = 1.4 V	5		
		V _{CC} = 1.65 V	8		
		V _{CC} = 2.3 V	9		
Δt/Δv	Input transition rise or fall rate			20	ns/V
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 CONDITIONS	V _{CC}	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{OH}		I _{OH} = −100 μA	0.8 V to 2.7 V	V _{CC} − 0.1			V
		I _{OH} = −0.7 mA	0.8 V	0.55			
		I _{OH} = −3 mA	1.1 V	0.8			
		I _{OH} = −5 mA	1.4 V	1			
		I _{OH} = −8 mA	1.65 V	1.2			
		I _{OH} = −9 mA	2.3 V	1.8			
V _{OL}		I _{OL} = 100 μA	0.8 V to 2.7 V			0.2	V
		I _{OL} = 0.7 mA	0.8 V	0.25			
		I _{OL} = 3 mA	1.1 V			0.3	
		I _{OL} = 5 mA	1.4 V			0.4	
		I _{OL} = 8 mA	1.65 V			0.45	
		I _{OL} = 9 mA	2.3 V			0.6	
I _I	A input	V _I = V _{CC} or GND	0 to 2.7 V			±5	μA
I _{off}		V _I = V _O or 2.7 V	0			±10	μA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	0.8 V to 2.7 V			10	μA
C _i		V _I = V _{CC} or GND	2.5 V	3			pF

(1) All typical values are at T_A = 25°C.

SN74AUC1G04

SINGLE INVERTER GATE

SCES370Q – SEPTEMBER 2001 – REVISED APRIL 2007

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 ± 0.1 V		$V_{CC} = 1.5$ V ± 0.1 V		$V_{CC} = 1.8$ V ± 0.15 V			$V_{CC} = 2.5$ V ± 0.2 V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	TYP	MAX	MIN	MAX	
t_{pd}	A	Y	4.4	0.8	3	0.5	2	0.5	1	2.1	0.5	1.6	ns

Switching Characteristics

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

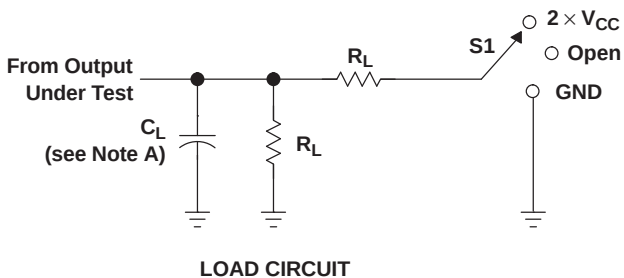
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8$ V ± 0.15 V			$V_{CC} = 2.5$ V ± 0.2 V		UNIT
			MIN	TYP	MAX	MIN	MAX	
t_{pd}	A	Y	0.6	1.2	2.2	0.5	1.9	ns

Operating Characteristics

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

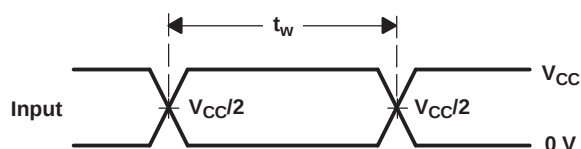
PARAMETER		TEST CONDITIONS	$V_{CC} = 0.8$ V	$V_{CC} = 1.2$ V	$V_{CC} = 1.5$ V	$V_{CC} = 1.8$ V	$V_{CC} = 2.5$ V	UNIT
			TYP	TYP	TYP	TYP	TYP	
C_{pd}	Power dissipation capacitance	$f = 10$ MHz	14	14	14	14	19	pF

PARAMETER MEASUREMENT INFORMATION

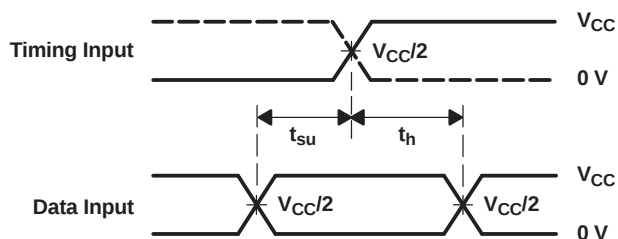


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND

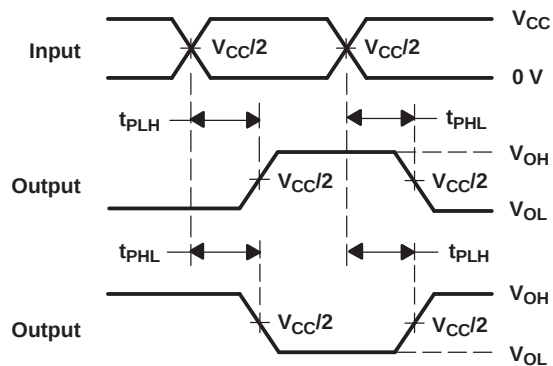
V_{CC}	C_L	R_L	V_{Δ}
0.8 V	15 pF	2 k Ω	0.1 V
$1.2 \text{ V} \pm 0.1 \text{ V}$	15 pF	2 k Ω	0.1 V
$1.5 \text{ V} \pm 0.1 \text{ V}$	15 pF	2 k Ω	0.1 V
$1.8 \text{ V} \pm 0.15 \text{ V}$	15 pF	2 k Ω	0.15 V
$2.5 \text{ V} \pm 0.2 \text{ V}$	15 pF	2 k Ω	0.15 V
$1.8 \text{ V} \pm 0.15 \text{ V}$	30 pF	1 k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



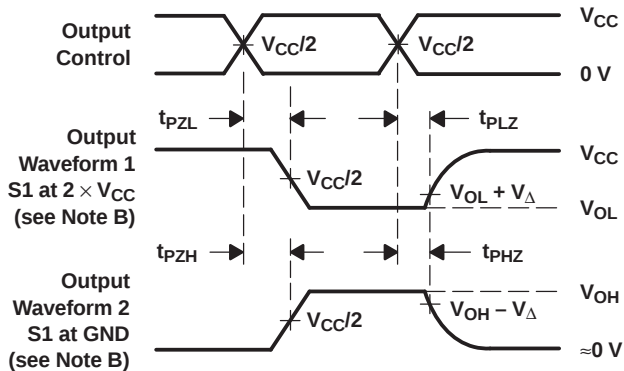
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- 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 $\leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, slew rate $\geq 1 \text{ V/ns}$.
 - 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 ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74AUC1G04DBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04DBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04DBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04DCKRE4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04DRLR	ACTIVE	SOT	DRL	5	4000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04DRLRG4	ACTIVE	SOT	DRL	5	4000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUC1G04YZPR	ACTIVE	DSBGA	YZP	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM

⁽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⁾ 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.

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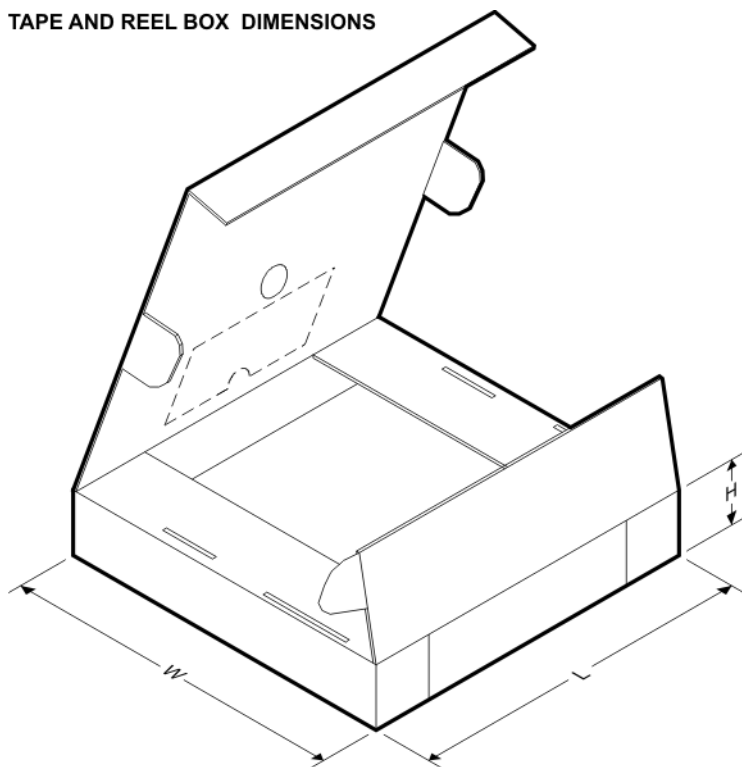
TAPE AND REEL INFORMATION



*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
SN74AUC1G04DBVR	SOT-23	DBV	5	3000	180.0	9.2	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUC1G04DCKR	SC70	DCK	5	3000	180.0	9.2	2.24	2.34	1.22	4.0	8.0	Q3
SN74AUC1G04DRLR	SOT	DRL	5	4000	180.0	9.2	1.78	1.78	0.69	4.0	8.0	Q3
SN74AUC1G04YZPR	DSBGA	YZP	5	3000	180.0	8.4	1.02	1.52	0.66	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS

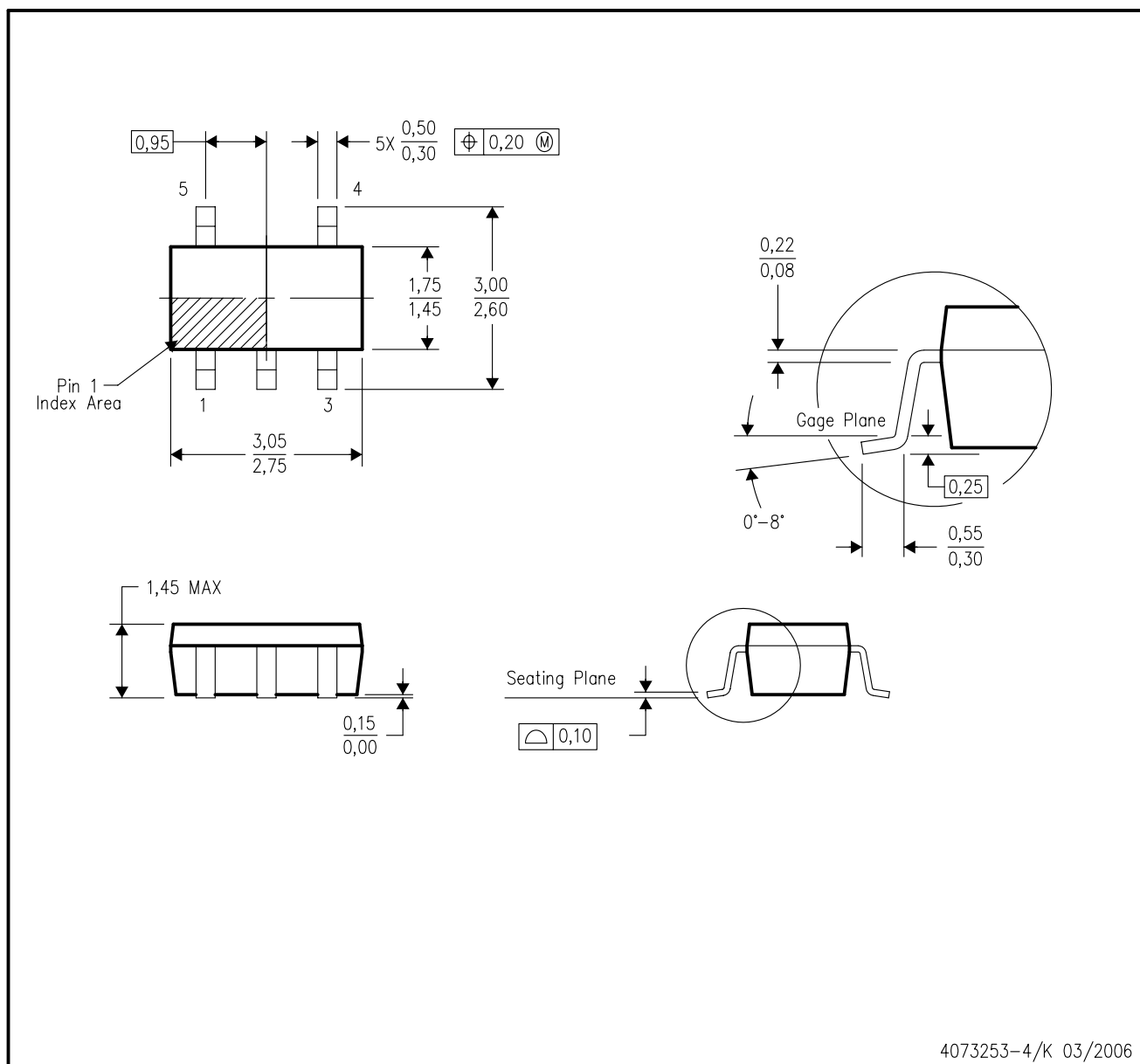


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUC1G04DBVR	SOT-23	DBV	5	3000	202.0	201.0	28.0
SN74AUC1G04DCKR	SC70	DCK	5	3000	202.0	201.0	28.0
SN74AUC1G04DRLR	SOT	DRL	5	4000	202.0	201.0	28.0
SN74AUC1G04YZPR	DSBGA	YZP	5	3000	220.0	220.0	34.0

DBV (R-PDSO-G5)

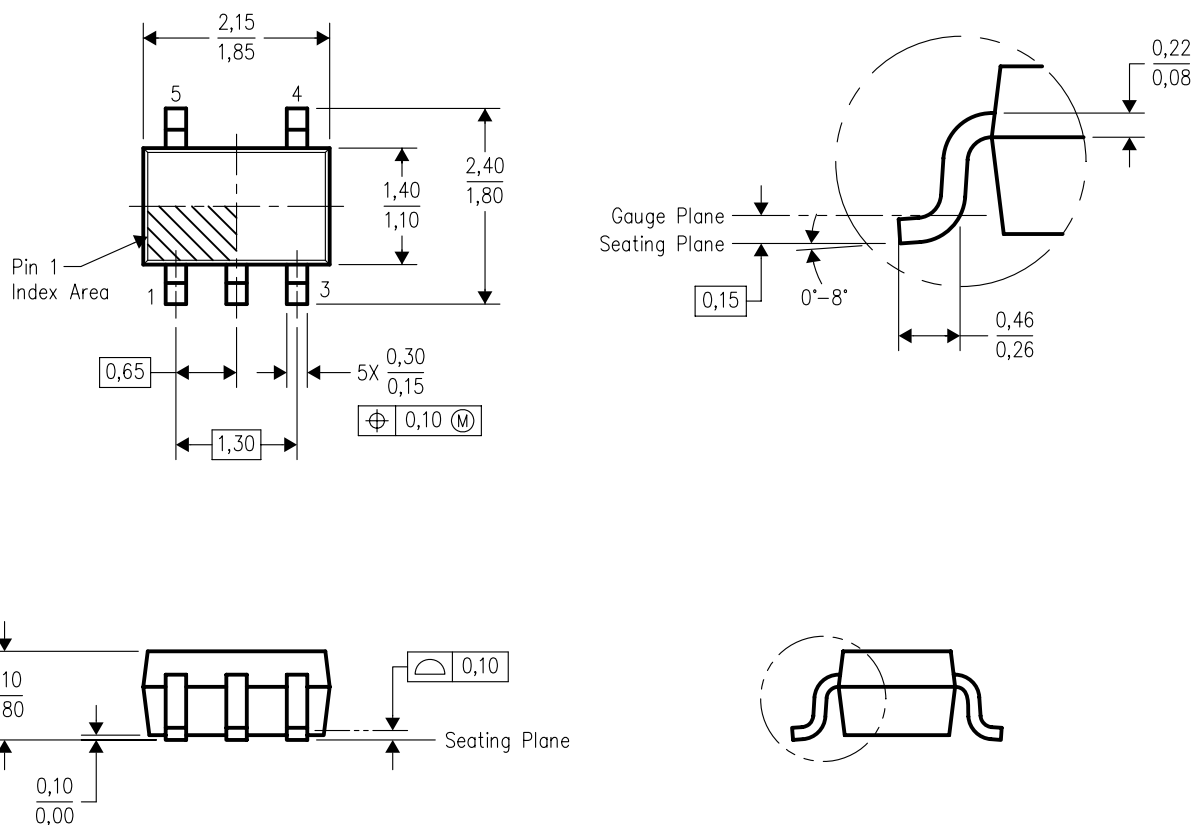
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - Falls within JEDEC MO-178 Variation AA.

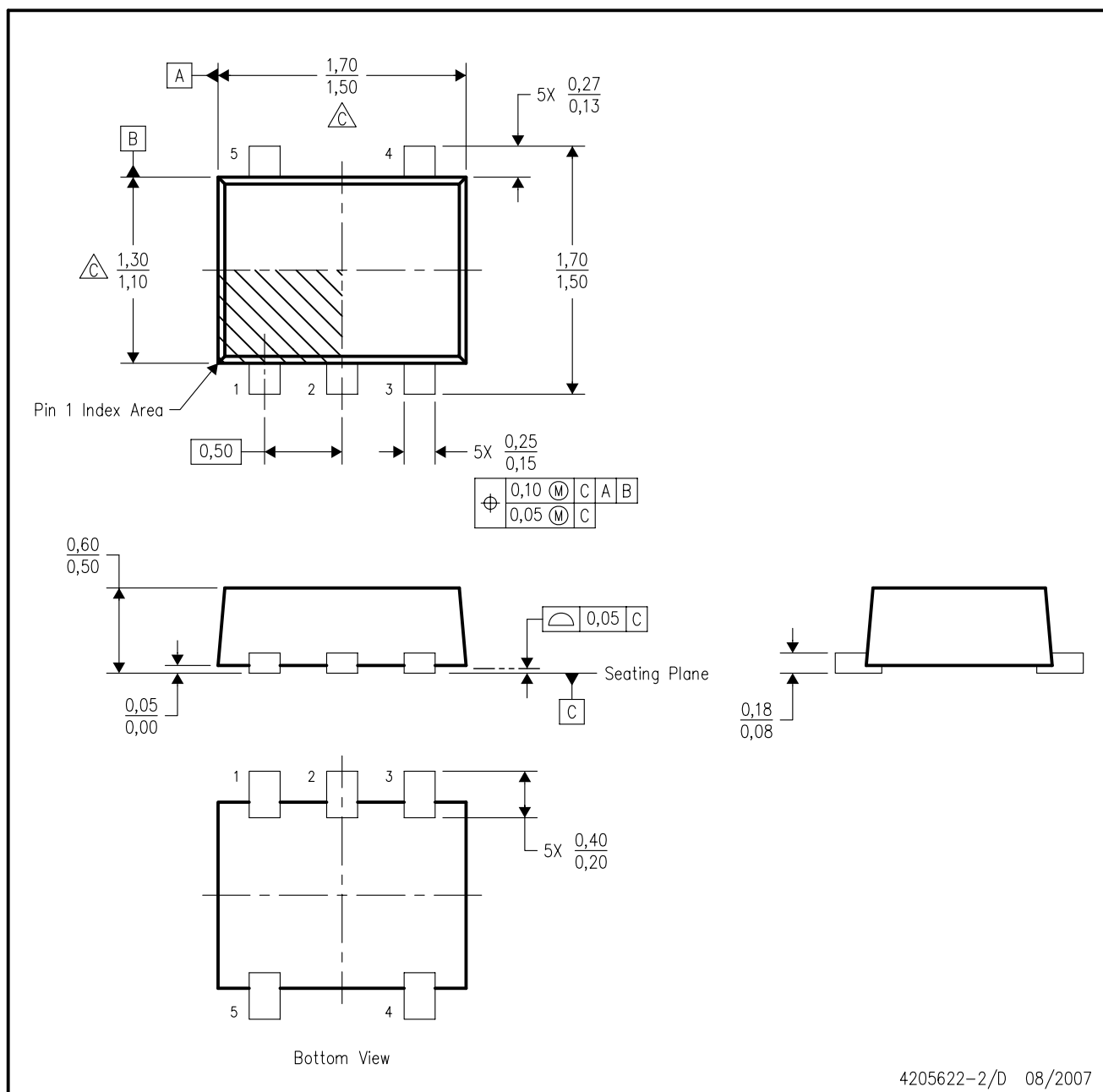
DCK (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE



4093553-3/G 01/2007

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - Falls within JEDEC MO-203 variation AA.

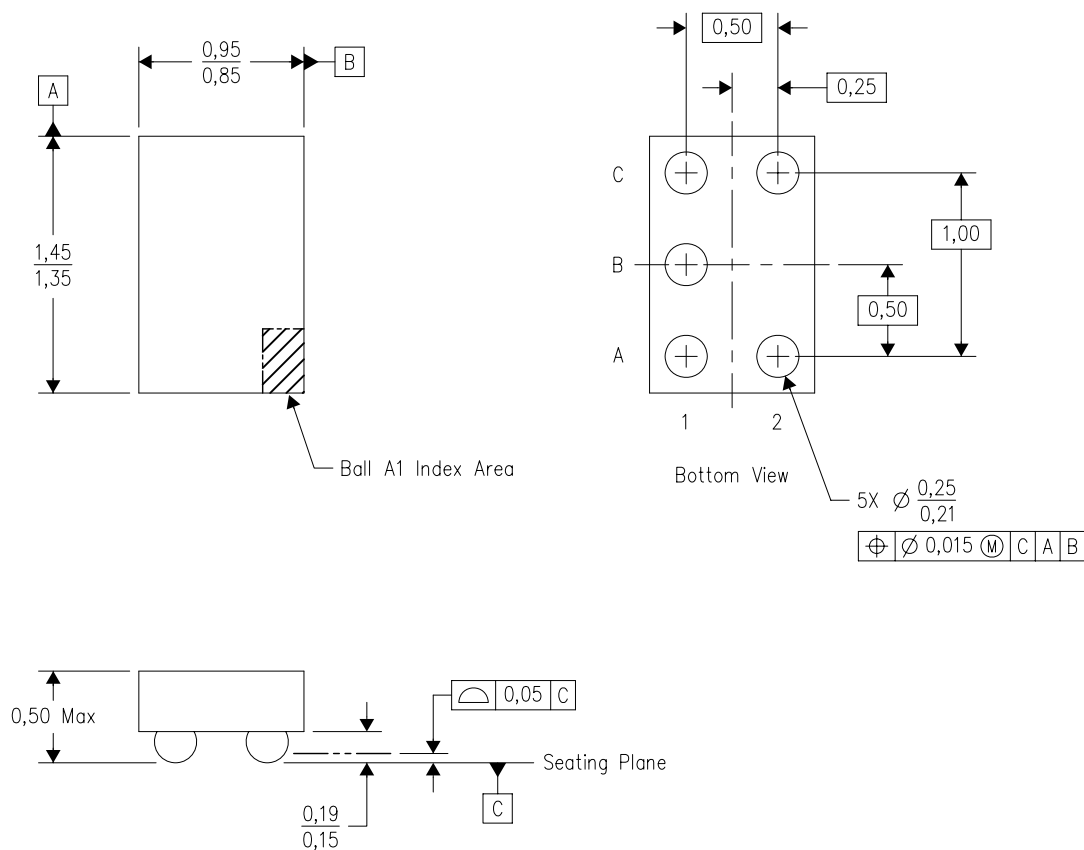


4205622-2/D 08/2007

- 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. Body dimensions do not include mold flash, interlead flash, protrusions, or gate burrs. Mold flash, interlead flash, protrusions, or gate burrs shall not exceed 0,15 per end or side.
 - D. JEDEC package registration is pending.

YZP (R-XBGA-N5)

DIE-SIZE BALL GRID ARRAY



4204741-2/G 07/2008

- 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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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
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