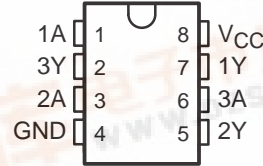


# SN74LVC3G14 TRIPLE SCHMITT-TRIGGER INVERTER

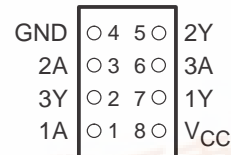
SCES367G – AUGUST 2001 – REVISED SEPTEMBER 2003

- Available in the Texas Instruments NanoStar™ and NanoFree™ Packages
- Supports 5-V  $V_{CC}$  Operation
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 5.4 ns at 3.3 V
- Low Power Consumption, 10- $\mu$ A Max  $I_{CC}$
- $\pm 24$ -mA Output Drive at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $< 0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  $> 2$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- $I_{off}$  Feature Supports Partial-Power-Down Mode Operation
- 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)

DCT OR DCU PACKAGE  
(TOP VIEW)



YEA, YEP, YZA, OR YZP PACKAGE  
(BOTTOM VIEW)



## description/ordering information

This triple Schmitt-trigger inverter is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

The SN74LVC3G14 contains three inverters and performs the Boolean function  $Y = \bar{A}$ . The device functions as three independent inverters but, because of Schmitt action, it may have different input threshold levels for positive-going ( $V_{T+}$ ) and negative-going ( $V_{T-}$ ) signals.

## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING‡
-40°C to 85°C	NanoStar™ – WCSP (DSBGA) 0.17-mm Small Bump – YEA	Reel of 3000	SN74LVC3G14YEAR	---CF_
	NanoFree™ – WCSP (DSBGA) 0.17-mm Small Bump – YZA (Pb-free)		SN74LVC3G14YZAR	
	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YEP		SN74LVC3G14YEPR	
	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)		SN74LVC3G14YZPR	
	SSOP – DCT	Reel of 3000	SN74LVC3G14DCTR	C14_
	VSSOP – DCU	Reel of 3000	SN74LVC3G14DCUR	C14_
		Reel of 250	SN74LVC3G14DCUT	

† 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).

‡ 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.

YEA/YZA, YEP/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).

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.

NanoStar and NanoFree are trademarks of Texas Instruments.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

# SN74LVC3G14

## TRIPLE SCHMITT-TRIGGER INVERTER

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### description/ordering information (continued)

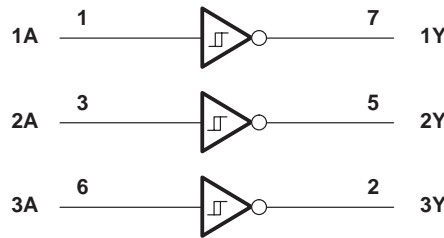
NanoStar™ and NanoFree™ package technology is a major breakthrough in IC packaging concepts, using the die as the package.

This device is fully specified for partial-power-down applications using I<sub>off</sub>. The I<sub>off</sub> circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

FUNCTION TABLE  
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

### logic diagram (positive logic)



### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V <sub>CC</sub>	–0.5 V to 6.5 V
Input voltage range, V <sub>I</sub> (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high-impedance or power-off state, V <sub>O</sub> (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high or low state, V <sub>O</sub> (see Notes 1 and 2)	–0.5 V to V <sub>CC</sub> + 0.5 V
Input clamp current, I <sub>IK</sub> (V <sub>I</sub> < 0)	–50 mA
Output clamp current, I <sub>OK</sub> (V <sub>O</sub> < 0)	–50 mA
Continuous output current, I <sub>O</sub>	±50 mA
Continuous current through V <sub>CC</sub> or GND	±100 mA
Package thermal impedance, θ <sub>JA</sub> (see Note 3):	
DCT package	220°C/W
DCU package	227°C/W
YEA/YZA package	140°C/W
YEP/YZP package	102°C/W
Storage temperature range, T <sub>stg</sub>	–65°C to 150°C

† 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.

- NOTES:
1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
  2. The value of V<sub>CC</sub> is provided in the recommended operating conditions table.
  3. The package thermal impedance is calculated in accordance with JESD 51-7.

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## TRIPLE SCHMITT-TRIGGER INVERTER

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### recommended operating conditions (see Note 4)

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage	Operating	1.65	5.5	V
		Data retention only	1.5		
V <sub>I</sub>	Input voltage	0	5.5	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> = 1.65 V		-4	mA
		V <sub>CC</sub> = 2.3 V		-8	
		V <sub>CC</sub> = 3 V		-16	
				-24	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 1.65 V		4	mA
		V <sub>CC</sub> = 2.3 V		8	
		V <sub>CC</sub> = 3 V		16	
				24	
T <sub>A</sub>	Operating free-air temperature		-40	85	°C

NOTE 4: 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.

# SN74LVC3G14

## TRIPLE SCHMITT-TRIGGER INVERTER

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

PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	MIN	TYP†	MAX	UNIT
V <sub>T+</sub> Positive-going input threshold voltage			1.65 V	0.7		1.4	V
			2.3 V	1		1.7	
			3 V	1.3		2.2	
			4.5 V	1.9		3.1	
			5.5 V	2.2		3.7	
V <sub>T-</sub> Negative-going input threshold voltage			1.65 V	0.3		0.7	V
			2.3 V	0.4		1	
			3 V	0.6		1.3	
			4.5 V	1.1		2	
			5.5 V	1.4		2.5	
ΔV <sub>T</sub> Hysteresis (V <sub>T+</sub> – V <sub>T-</sub> )			1.65 V	0.3		0.8	V
			2.3 V	0.4		0.9	
			3 V	0.4		1.1	
			4.5 V	0.6		1.3	
			5.5 V	0.7		1.4	
V <sub>OH</sub>	I <sub>OH</sub> = –100 μA	1.65 V to 4.5 V	V <sub>CC</sub> –0.1				V
	I <sub>OH</sub> = –4 mA	1.65 V	1.2				
	I <sub>OH</sub> = –8 mA	2.3 V	1.9				
	I <sub>OH</sub> = –16 mA	3 V	2.4				
	I <sub>OH</sub> = –24 mA	3 V	2.3				
	I <sub>OH</sub> = –32 mA	4.5 V	3.8				
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	1.65 V to 4.5 V				0.1	V
	I <sub>OL</sub> = 4 mA	1.65 V				0.45	
	I <sub>OL</sub> = 8 mA	2.3 V				0.3	
	I <sub>OL</sub> = 16 mA	3 V				0.4	
	I <sub>OL</sub> = 24 mA	3 V				0.55	
	I <sub>OL</sub> = 32 mA	4.5 V				0.55	
I <sub>I</sub>	A inputs	V <sub>I</sub> = 5.5 V or GND	0 to 5.5 V			±5	μA
I <sub>off</sub>		V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0			±10	μA
I <sub>CC</sub>		V <sub>I</sub> = 5.5 V or GND, I <sub>O</sub> = 0	1.65 V to 5.5 V			10	μA
ΔI <sub>CC</sub>		One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND	3 V to 5.5 V			500	μA
C <sub>i</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V		4.5		pF

† All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

switching characteristics over recommended operating free-air temperature range (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> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		V <sub>CC</sub> = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	3.9	9.2	1.9	5.7	2.3	5.4	1.5	4.3	ns

# SN74LVC3G14 TRIPLE SCHMITT-TRIGGER INVERTER

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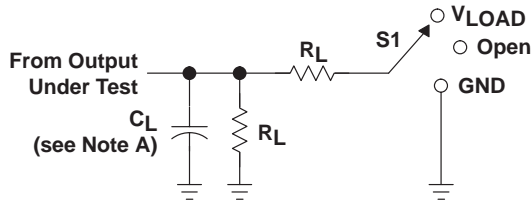
operating characteristics,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	$V_{CC} = 1.8\text{ V}$	$V_{CC} = 2.5\text{ V}$	$V_{CC} = 3.3\text{ V}$	$V_{CC} = 5\text{ V}$	UNIT
		TYP	TYP	TYP	TYP	
$C_{pd}$ Power dissipation capacitance	$f = 10\text{ MHz}$	17	18	19	22	$\mu\text{F}$

# SN74LVC3G14 TRIPLE SCHMITT-TRIGGER INVERTER

SCES367G – AUGUST 2001 – REVISED SEPTEMBER 2003

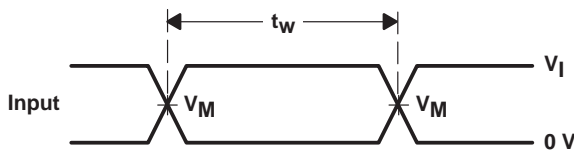
## PARAMETER MEASUREMENT INFORMATION



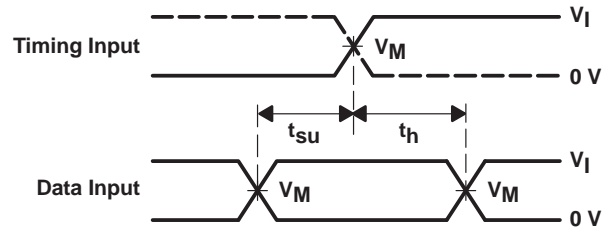
LOAD CIRCUIT

TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

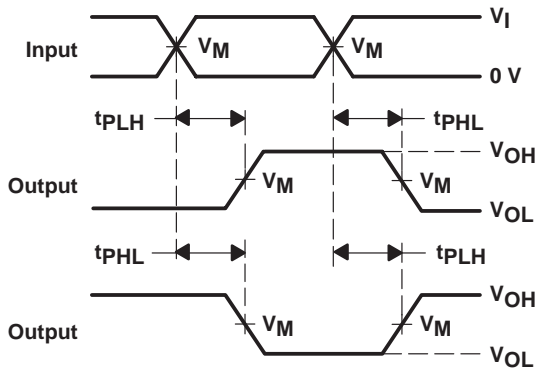
$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$1.8 V \pm 0.15 V$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
$2.5 V \pm 0.2 V$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
$3.3 V \pm 0.3 V$	3 V	$\leq 2.5 \text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
$5 V \pm 0.5 V$	$V_{CC}$	$\leq 2.5 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 $\Omega$	0.3 V



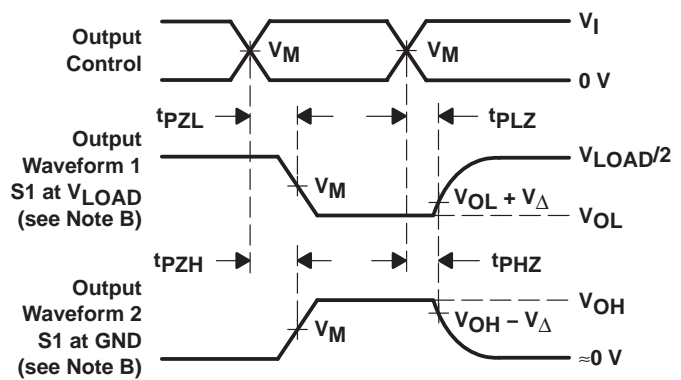
VOLTAGE WAVEFORMS  
PULSE DURATION



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:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ .
  - 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.

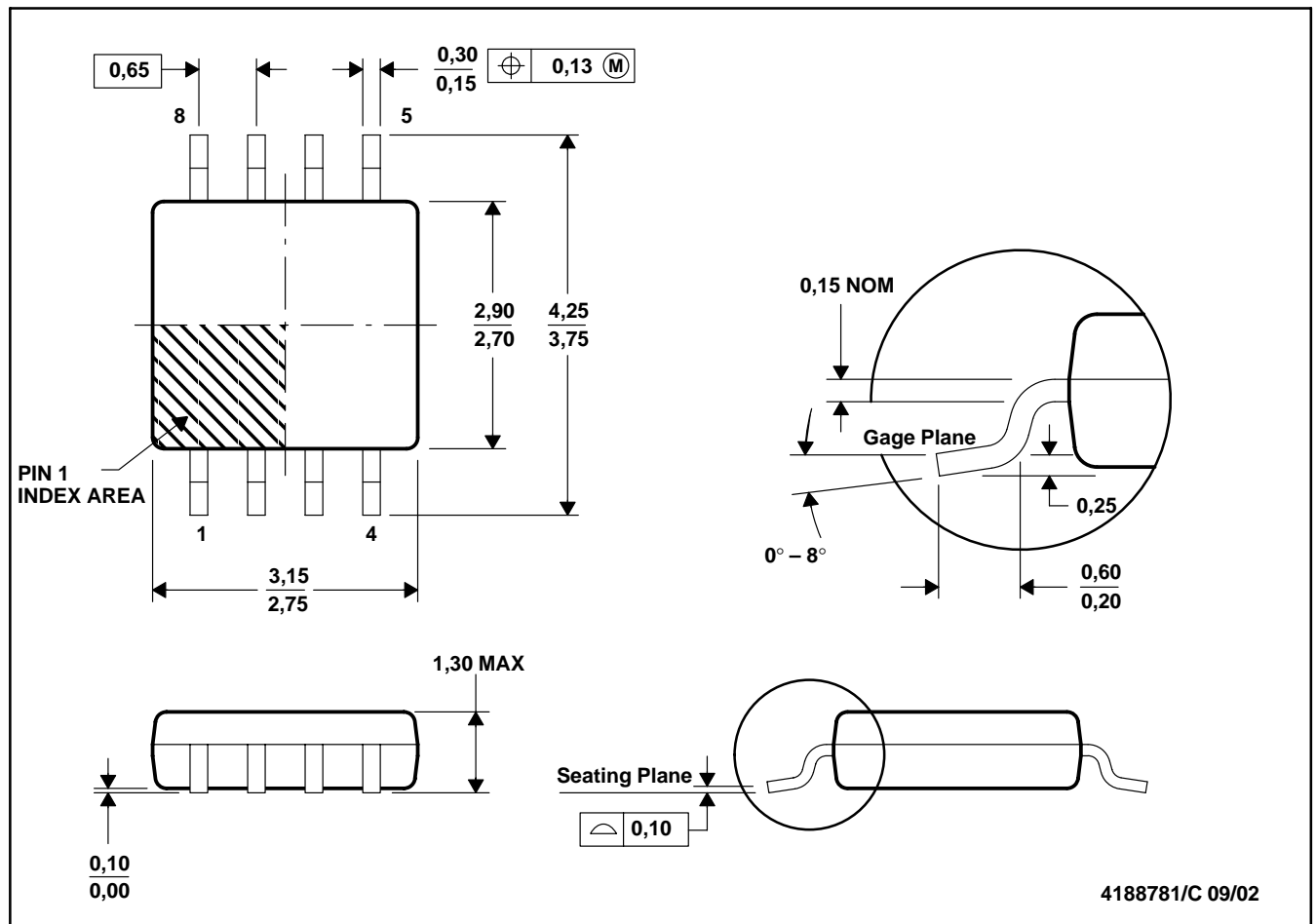
Figure 1. Load Circuit and Voltage Waveforms

# MECHANICAL DATA

MPDS049B – MAY 1999 – REVISED OCTOBER 2002

DCT (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

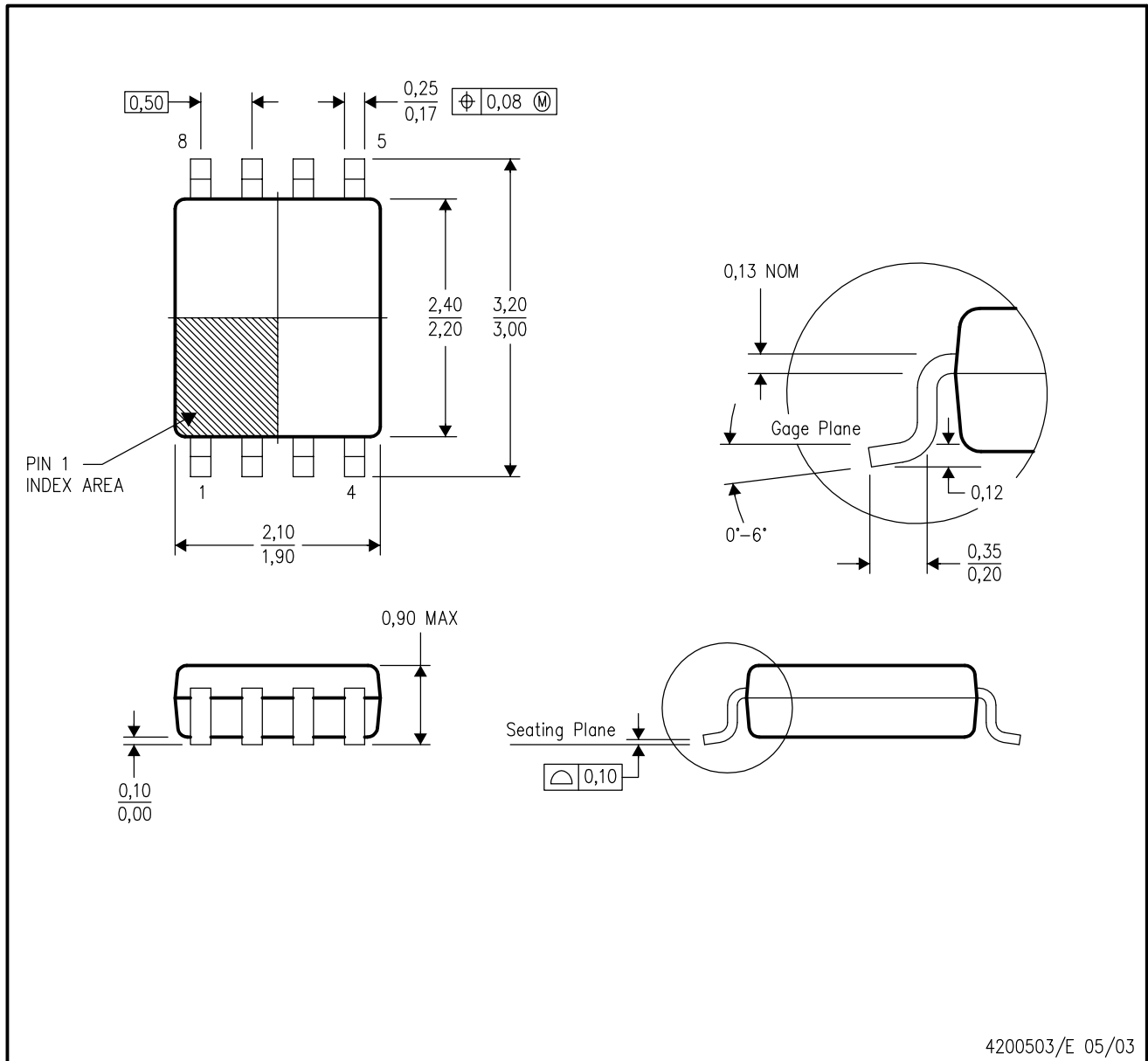


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion
  - D. Falls within JEDEC MO-187 variation DA.

# MECHANICAL DATA

DCU (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



4200503/E 05/03

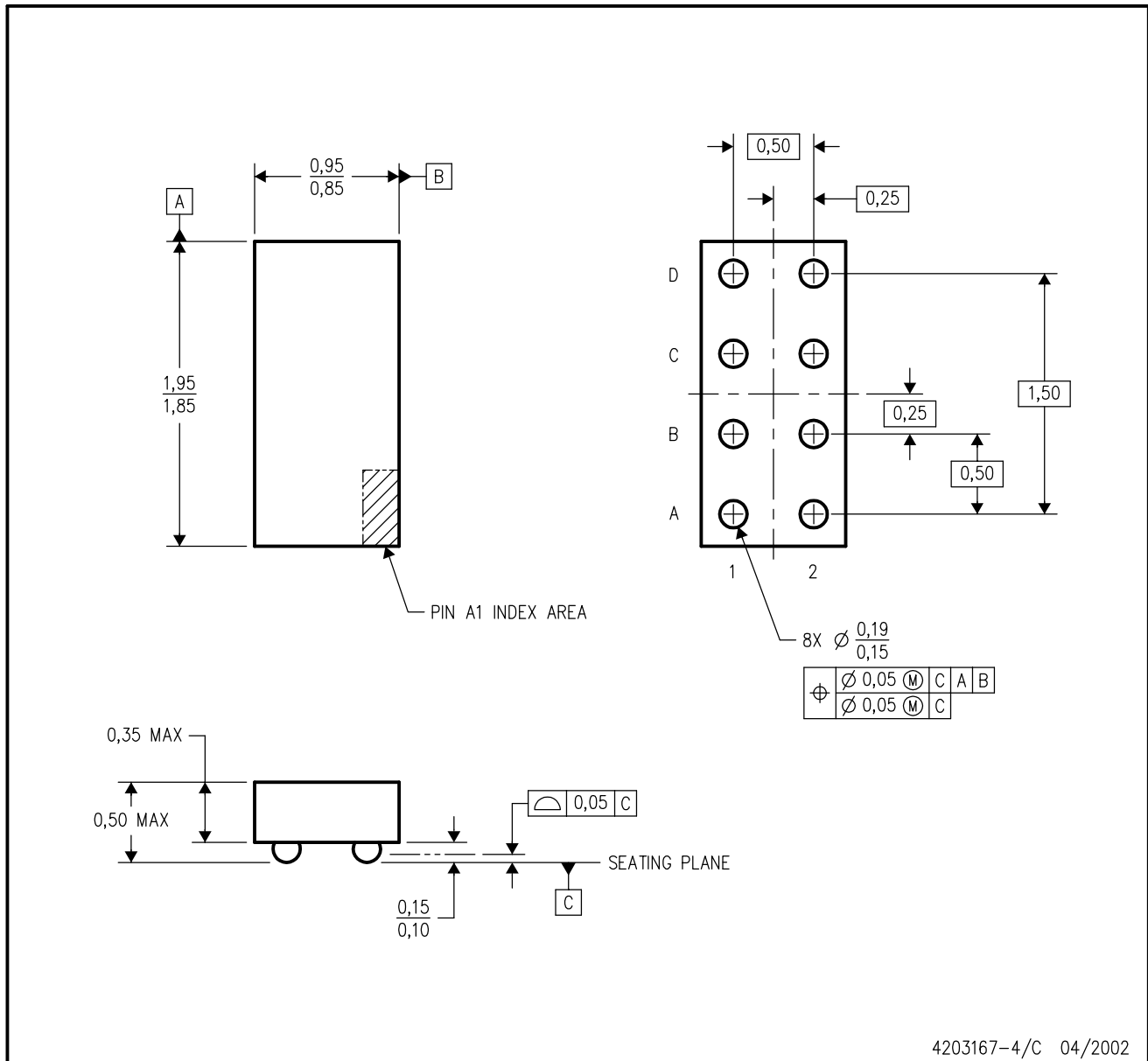
- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion.
  - Falls within JEDEC MO-187 variation CA.



# MECHANICAL DATA

YEA (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



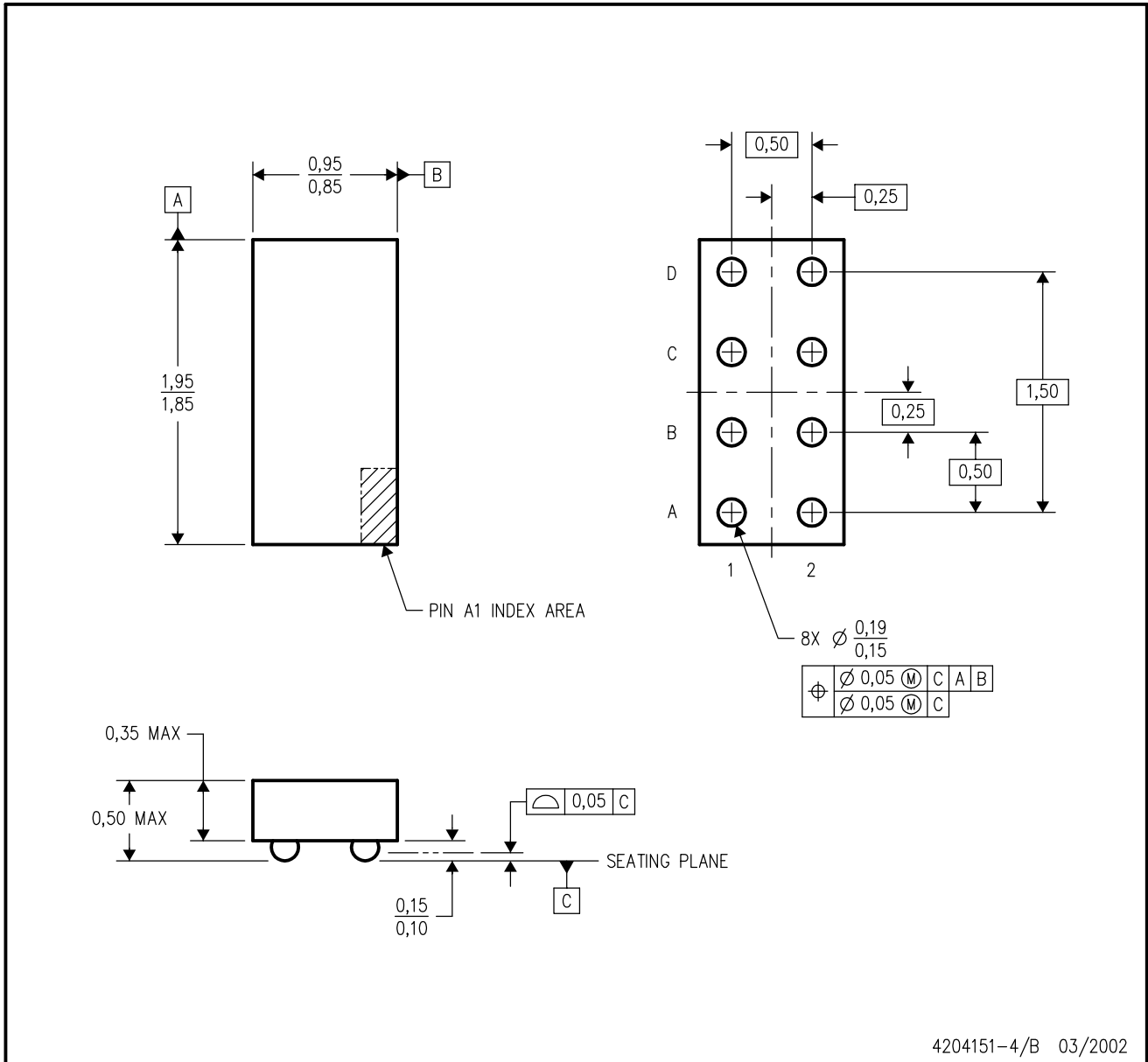
- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - NanoStar™ package configuration.
  - Package complies to JEDEC MO-211 variation EB.
  - This package is tin-lead (SnPb). Refer to the 8 YZA package (drawing 4204151) for lead-free.

NanoStar is a trademark of Texas Instruments.

MECHANICAL DATA

YZA (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY

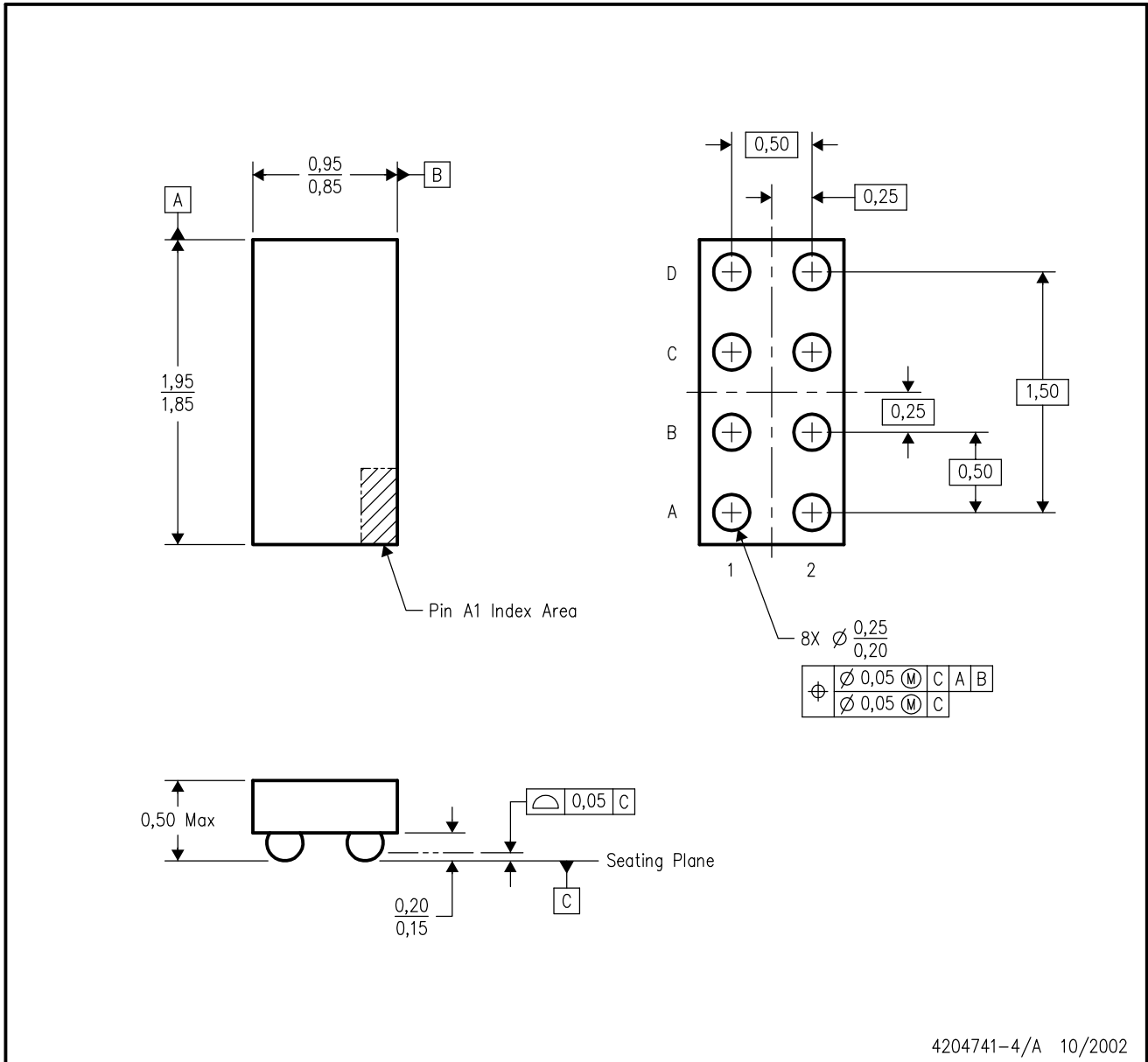


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. NanoFree™ package configuration.
  - D. Package complies to JEDEC MO-211 variation EB.
  - E. This package is lead-free. Refer to the 8 YEA package (drawing 4203167) for tin-lead (SnPb).

MECHANICAL DATA

YZP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



4204741-4/A 10/2002

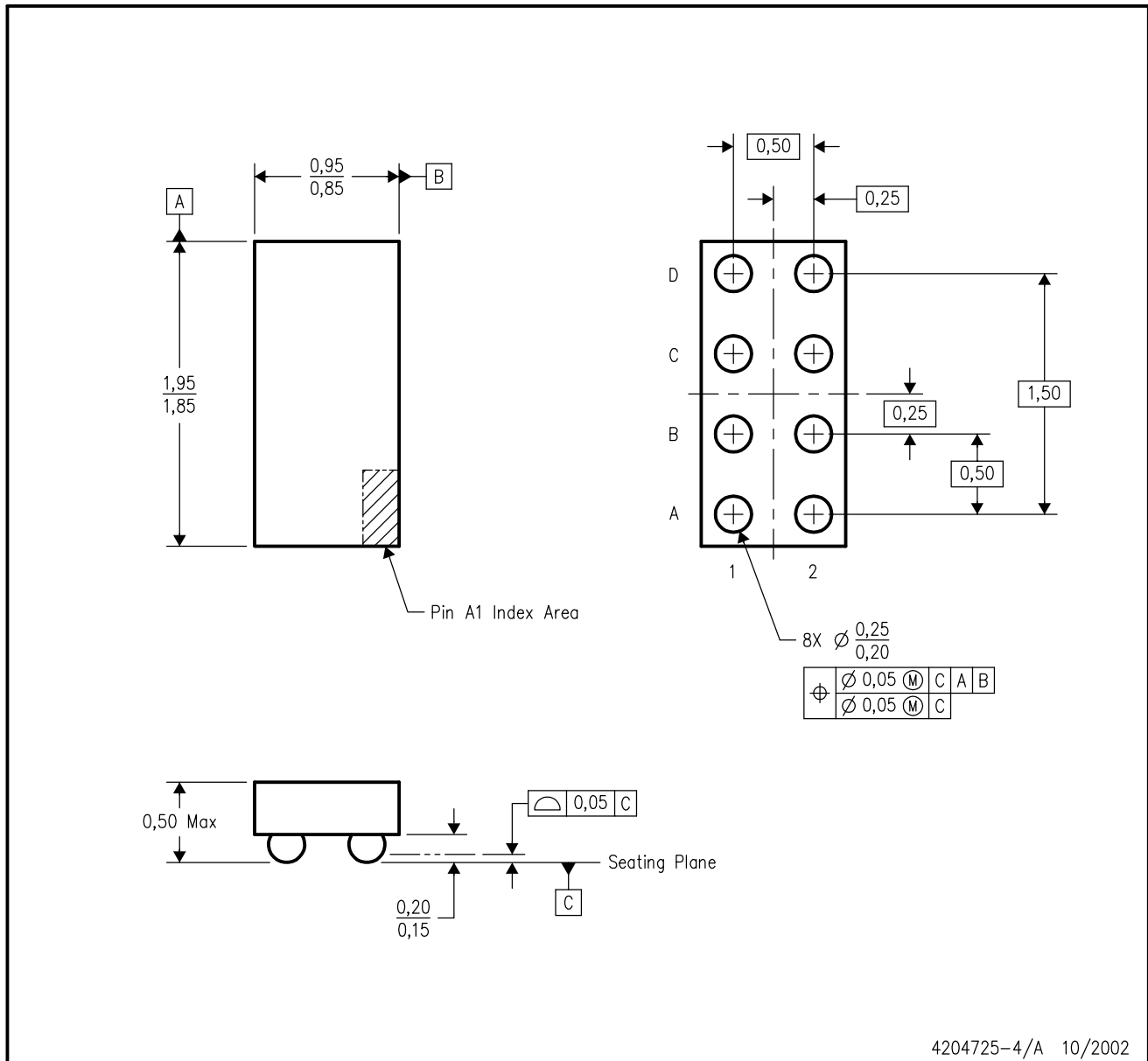
- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. NanoFree™ package configuration.
  - D. This package is lead-free. Refer to the 8 YEP package (drawing 4204725) for tin-lead (SnPb).

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# MECHANICAL DATA

YEP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. NanoStar™ package configuration.
  - D. This package is tin-lead (SnPb). Refer to the 8 YZP package (drawing 4204741) for lead-free.

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		Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
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Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265