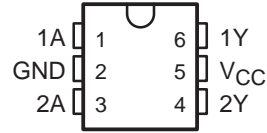


SN74LVC2G06 DUAL INVERTER BUFFER/DRIVER WITH OPEN-DRAIN OUTPUTS

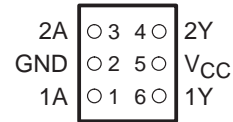
SCES307E – AUGUST 2001 – REVISED SEPTEMBER 2003

- Available in the Texas Instruments NanoStar™ and NanoFree™ Packages
- Supports 5-V V_{CC} Operation
- Max t_{pd} of 3.4 ns at 3.3 V
- Low Power Consumption, 10- μ A Max I_{CC}
- ± 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, $T_A = 25^\circ\text{C}$
- Inputs and Open-Drain Outputs Accept Voltages up to 5.5 V
- I_{off} 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)

DBV OR DCK PACKAGE
(TOP VIEW)



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



description/ordering information

This dual inverter buffer/driver is designed for 1.65-V to 5.5-V V_{CC} operation.

The output of the SN74LVC2G06 device is open drain and can be connected to other open-drain outputs to implement active-low wired-OR or active-high wired-AND functions. The maximum sink current is 32 mA.

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	Tape and reel	SN74LVC2G06YEAR	_ _ _ CT _
	NanoFree™ – WCSP (DSBGA) 0.17-mm Small Bump – YZA (Pb-free)		SN74LVC2G06YZAR	
	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YEP		SN74LVC2G06YEPR	
	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)		SN74LVC2G06YZPR	
-40°C to 85°C	SOT (SOT-23) – DBV	Tape and reel	SN74LVC2G06DBVR	C06 _
	SOT (SC-70) – DCK	Tape and reel	SN74LVC2G06DCKR	CT _

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

‡ DBV/DCK: 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).



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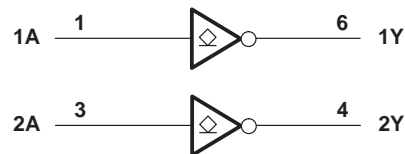
description/ordering information (continued)

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.

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

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_{CC}	–0.5 V to 6.5 V
Input voltage range, V_I (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_O (see Note 1)	–0.5 V to 6.5 V
Voltage range applied to any output in the high or low state, V_O (see Notes 1 and 2)	–0.5 V to 6.5 V
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Continuous output current, I_O	±50 mA
Continuous current through V_{CC} or GND	±100 mA
Package thermal impedance, θ_{JA} (see Note 3): DBV package	165°C/W
DCK package	259°C/W
YEA/YZA package	143°C/W
YEP/YZP package	123°C/W
Storage temperature range, T_{stg}	–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_{CC} 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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DUAL INVERTER BUFFER/DRIVER
WITH OPEN-DRAIN OUTPUTS

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recommended operating conditions (see Note 4)

		MIN	MAX	UNIT
V_{CC}	Supply voltage	Operating	1.65	5.5
		Data retention only	1.5	
V_{IH}	High-level input voltage	$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	$0.65 \times V_{CC}$	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7	
		$V_{CC} = 3\text{ V to }3.6\text{ V}$	2	
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.7 \times V_{CC}$	
V_{IL}	Low-level input voltage	$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.7	
		$V_{CC} = 3\text{ V to }3.6\text{ V}$	0.8	
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.3 \times V_{CC}$	
V_I	Input voltage	0	5.5	V
V_O	Output voltage	0	5.5	V
I_{OL}	Low-level output current	$V_{CC} = 1.65\text{ V}$	4	mA
		$V_{CC} = 2.3\text{ V}$	8	
		$V_{CC} = 3\text{ V}$	16	
			24	
		$V_{CC} = 4.5\text{ V}$	32	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}, 2.5\text{ V} \pm 0.2\text{ V}$	20	ns/V
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	10	
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	5	
T_A	Operating free-air temperature	-40	85	°C

NOTE 4: 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†	MAX	UNIT
V_{OL}		$I_{OL} = 100\text{ }\mu\text{A}$	1.65 V to 5.5 V			0.1	V
		$I_{OL} = 4\text{ mA}$	1.65 V			0.45	
		$I_{OL} = 8\text{ mA}$	2.3 V			0.3	
		$I_{OL} = 16\text{ mA}$	3 V			0.4	
		$I_{OL} = 24\text{ mA}$				0.55	
		$I_{OL} = 32\text{ mA}$	4.5 V			0.55	
I_I	A inputs	$V_I = 5.5\text{ V or GND}$	0 to 5.5 V			± 5	μA
I_{off}		$V_I \text{ or } V_O = 5.5\text{ V}$	0			± 10	μA
I_{CC}		$V_I = 5.5\text{ V or GND}, I_O = 0$	1.65 V to 5.5 V			10	μA
ΔI_{CC}		One input at $V_{CC} - 0.6\text{ V}$, Other inputs at V_{CC} or GND	3 V to 5.5 V			500	μA
C_i		$V_I = V_{CC} \text{ or GND}$	3.3 V		3.5		pF

† All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.



SN74LVC2G06

DUAL INVERTER BUFFER/DRIVER WITH OPEN-DRAIN OUTPUTS

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switching characteristics over recommended operating free-air temperature range (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		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t _{pd}	A	Y	1.8	7.2	1	3.9	1	3.4	1	2.9	ns

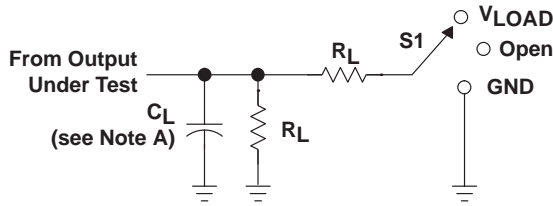
operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	V _{CC} = 1.8 V	V _{CC} = 2.5 V	V _{CC} = 3.3 V	V _{CC} = 5 V	UNIT
			TYP	TYP	TYP	TYP	
C _{pd}	Power dissipation capacitance	f = 10 MHz	2	2	3	4	pF



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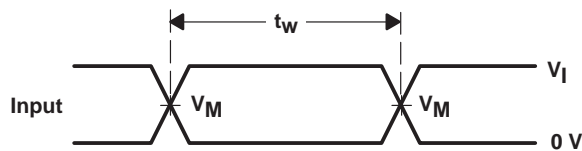
PARAMETER MEASUREMENT INFORMATION (OPEN DRAIN)



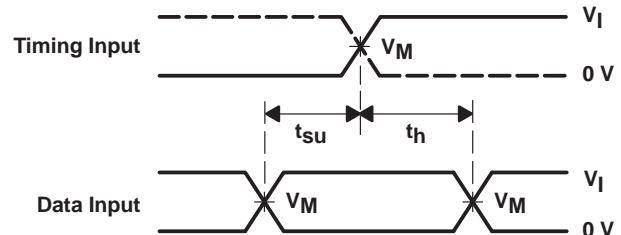
LOAD CIRCUIT

TEST	S1
t_{pZL} (see Notes E and F)	V_{LOAD}
t_{pLZ} (see Notes E and G)	V_{LOAD}
t_{PHZ}/t_{PZH}	V_{LOAD}

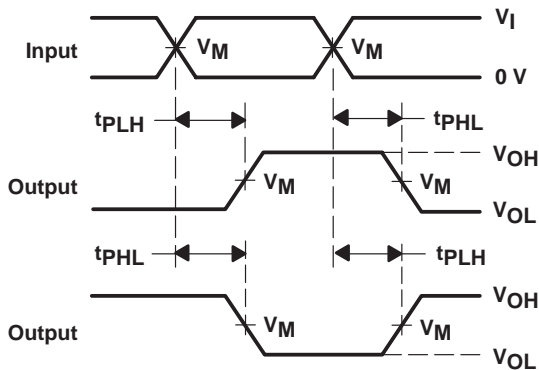
V_{CC}	INPUT		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	t_r/t_f					
$1.8\text{ V} \pm 0.15\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k Ω	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 Ω	0.15 V
$3.3\text{ V} \pm 0.3\text{ V}$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



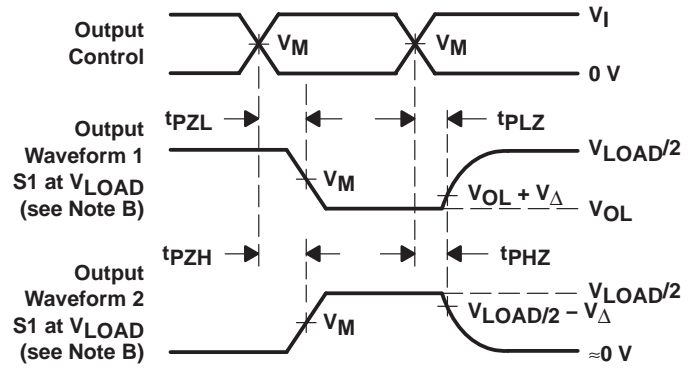
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



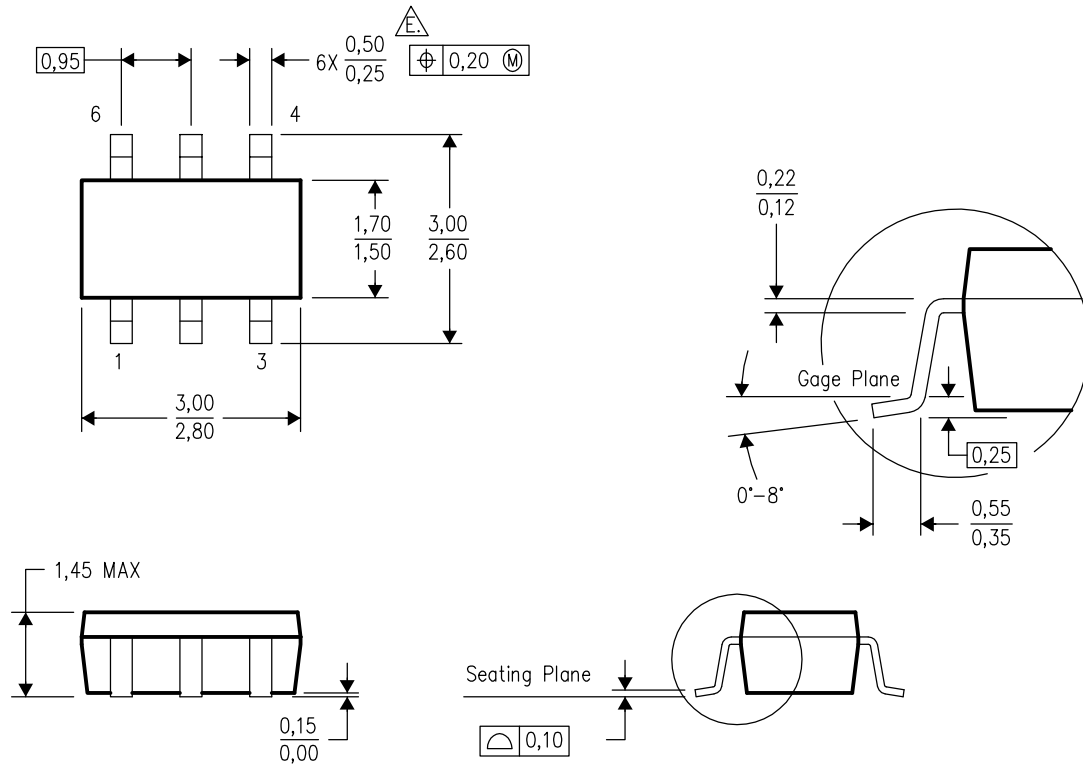
VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- 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 $\leq 10\text{ MHz}$, $Z_O = 50\ \Omega$.
 - D. The outputs are measured one at a time with one transition per measurement.
 - E. Since this device has open-drain outputs, t_{pLZ} and t_{pZL} are the same as t_{pd} .
 - F. t_{pZL} is measured at V_M .
 - G. t_{pLZ} is measured at $V_{OL} + V_{\Delta}$.
 - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE

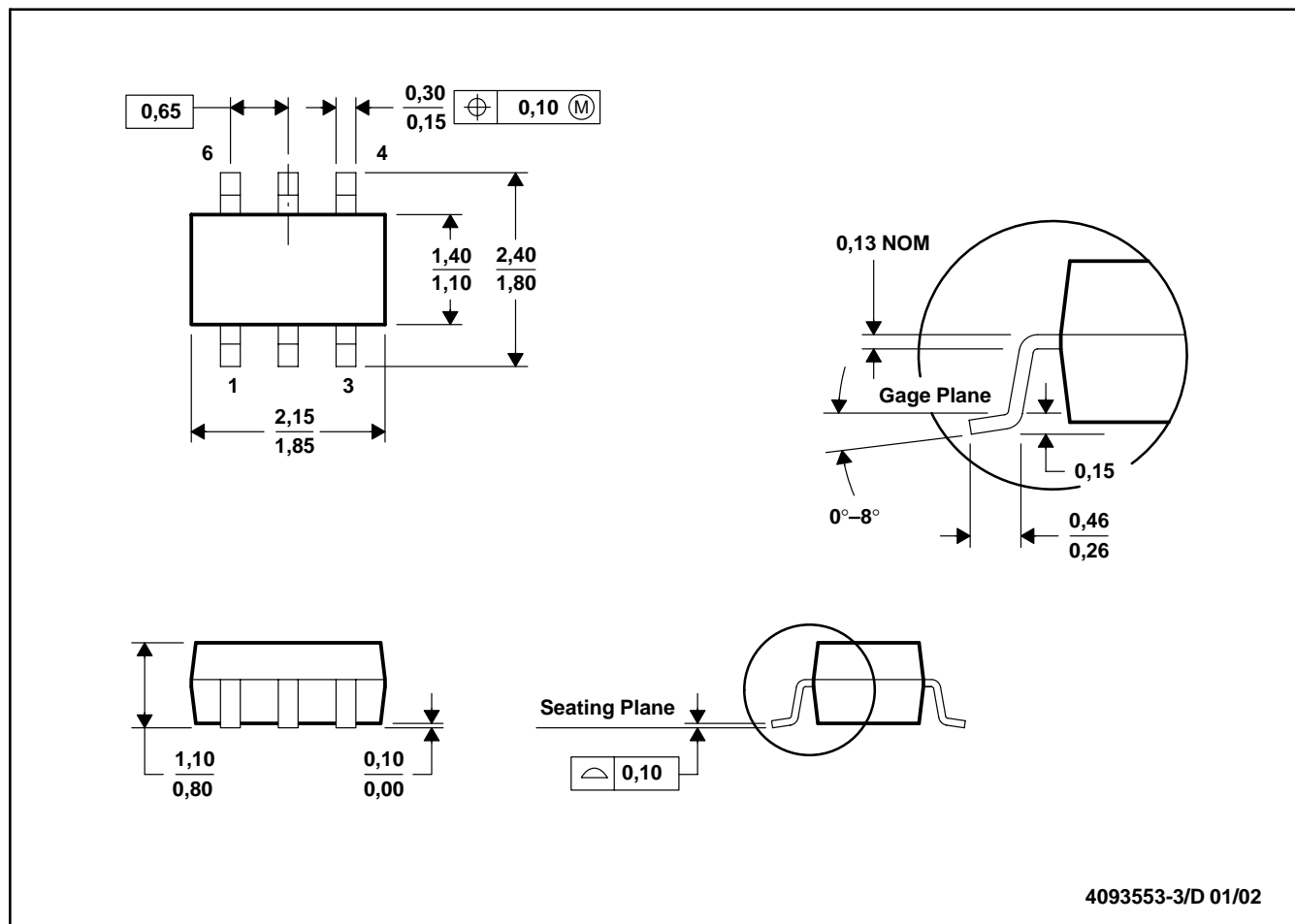


4073253-5/H 10/2003

- 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. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
 - E. Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DCK (R-PDSO-G6)

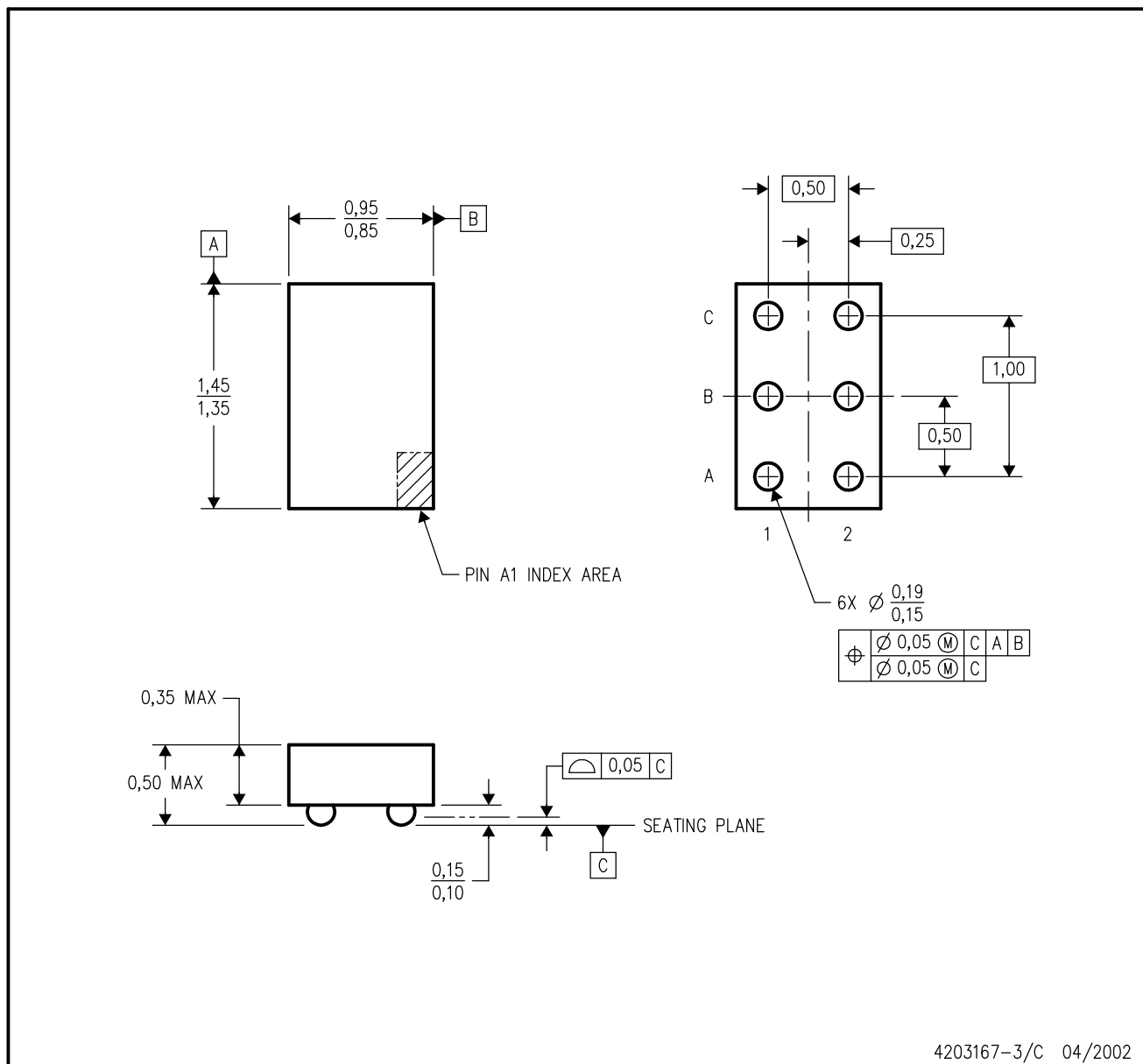
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion.
 - Falls within JEDEC MO-203

YEA (R-XBGA-N6)

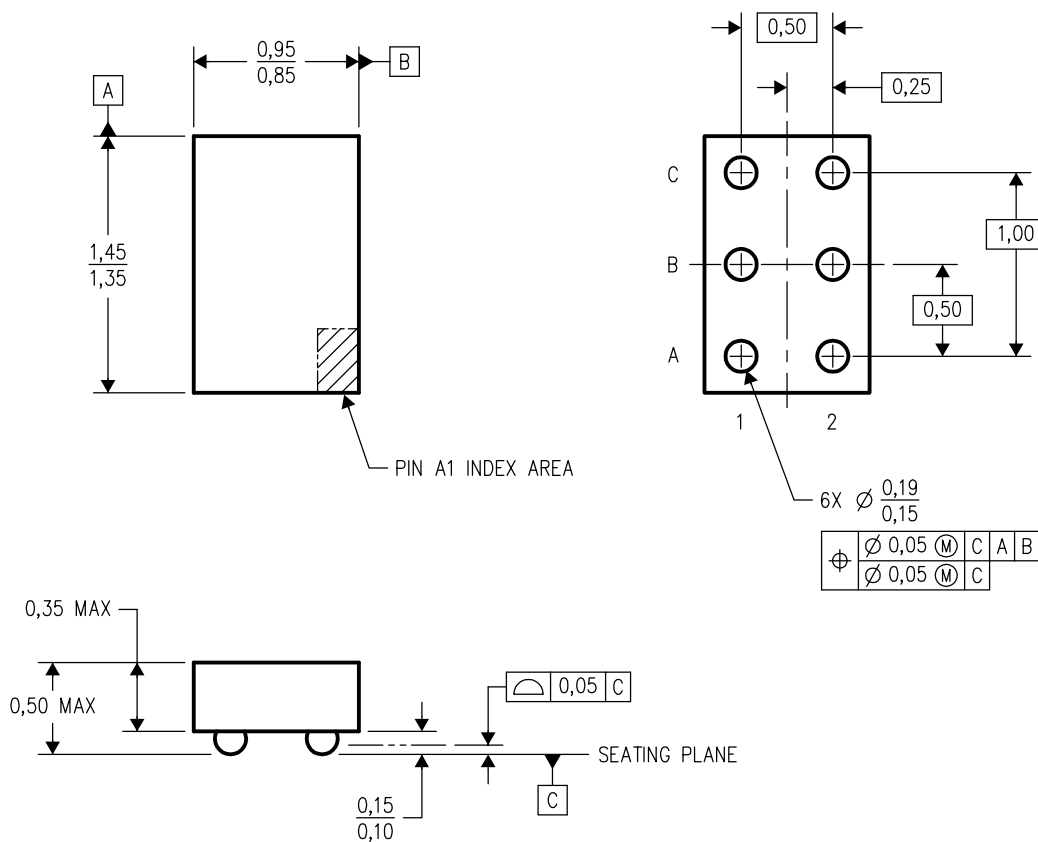
DIE-SIZE BALL GRID ARRAY



- 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 EA.
 - This package is tin-lead (SnPb). Refer to the 6 YZA package (drawing 4204151) for lead-free.

YZA (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



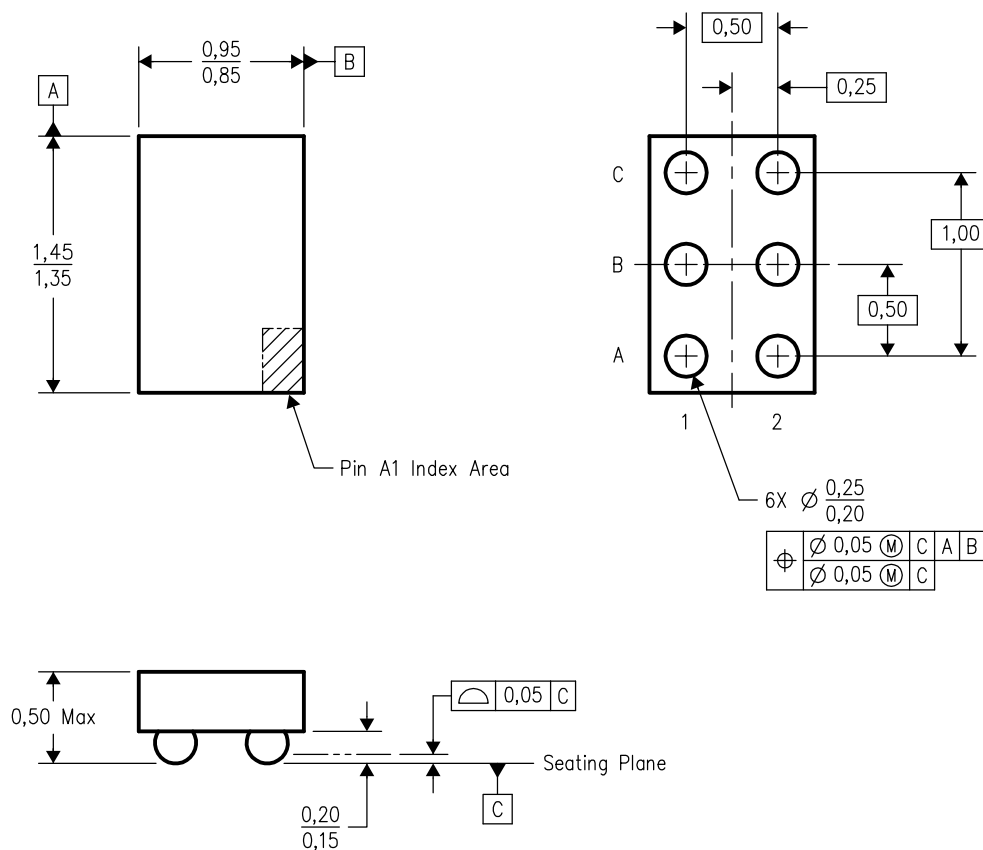
4204151-3/B 03/2002

- 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 EA.
 - E. This package is lead-free. Refer to the 6 YEA package (drawing 4203167) for tin-lead (SnPb).

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YZP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



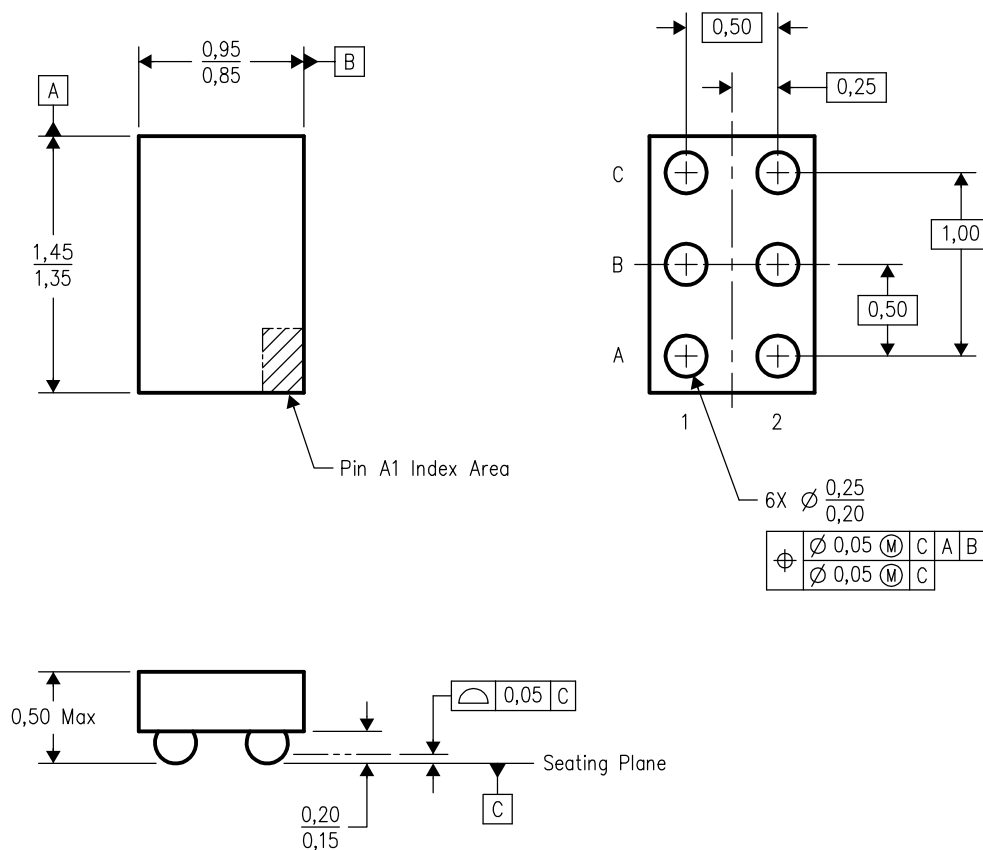
4204741-3/A 10/2002

- 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 6 YEP package (drawing 4204725) for tin-lead (SnPb).

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YEP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



4204725-3/A 10/2002

- 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 6 YZP package (drawing 4204741) for lead-free.

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