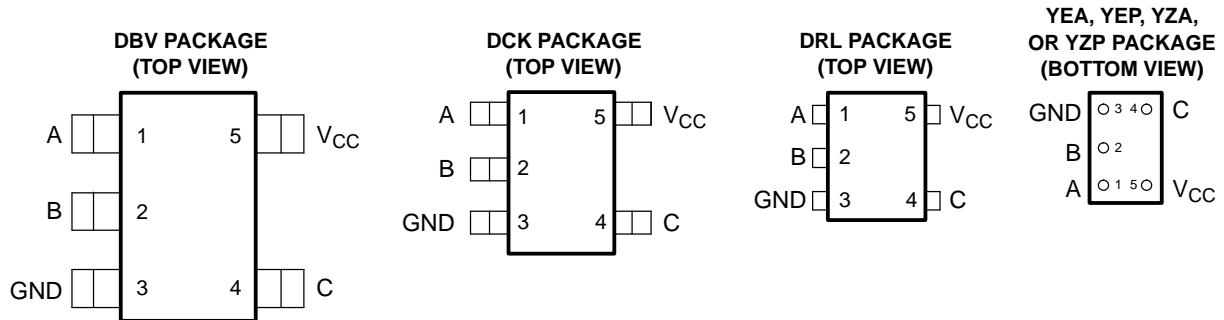


FEATURES

- Available in the Texas Instruments NanoStar™ and NanoFree™ Packages
- 1.65-V to 5.5-V V_{CC} Operation
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 0.8 ns at 3.3 V
- High On-Off Output Voltage Ratio
- High Degree of Linearity
- High Speed, Typically 0.5 ns ($V_{CC} = 3\text{ V}$, $C_L = 50\text{ pF}$)
- Low On-State Resistance, Typically $\approx 5.5\ \Omega$ ($V_{CC} = 4.5\text{ V}$)
- 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)



See mechanical drawings for dimensions.

DESCRIPTION/ORDERING INFORMATION

This single analog switch is designed for 1.65-V to 5.5-V V_{CC} operation.

ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING ⁽²⁾
–40°C to 85°C	NanoStar™ – WCSP (DSBGA) 0.17-mm Small Bump – YEA	Reel of 3000	SN74LVC1G66YEAR	---C6_
	NanoFree™ – WCSP (DSBGA) 0.17-mm Small Bump – YZA (Pb-free)		SN74LVC1G66YZAR	
	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YEP		SN74LVC1G66YEPR	
	NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)		SN74LVC1G66YZPR	
	SOT (SOT-23) – DBV	Reel of 3000	SN74LVC1G66DBVR	C66_
		Reel of 250	SN74LVC1G66DBVT	
	SOT (SC-70) – DCK	Reel of 3000	SN74LVC1G66DCKR	C6_
	Reel of 250	SN74LVC1G66DCKT		
	SOT (SOT-553) – DRL	Reel of 4000	SN74LVC1G66DRLR	

- (1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
- (2) 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).



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, NanoFree are trademarks of Texas Instruments.

SN74LVC1G66

SINGLE BILATERAL ANALOG SWITCH

SCES323K–JUNE 2001–REVISED NOVEMBER 2005

DESCRIPTION/ORDERING INFORMATION (CONTINUED)

The SN74LVC1G66 can handle both analog and digital signals. The device permits signals with amplitudes of up to 5.5 V (peak) to be transmitted in either direction.

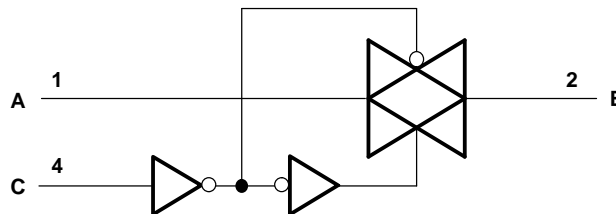
NanoStar™ and NanoFree™ package technology is a major breakthrough in IC packaging concepts, using the die as the package.

Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

FUNCTION TABLE

CONTROL INPUT (C)	SWITCH
L	OFF
H	ON

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 ⁽²⁾	-0.5	6.5	V
V_I	Input voltage range ⁽²⁾⁽³⁾	-0.5	6.5	V
$V_{I/O}$	Switch I/O voltage range ⁽²⁾⁽³⁾⁽⁴⁾	-0.5	$V_{CC} + 0.5$	V
I_{IK}	Control input clamp current	$V_I < 0$	-50	mA
I_{IOK}	I/O port diode current	$V_{I/O} < 0$ or $V_{I/O} > V_{CC}$	±50	mA
I_T	On-state switch current	$V_{I/O} < 0$ to V_{CC}	±50	mA
	Continuous current through V_{CC} or GND		±100	mA
θ_{JA}	Package thermal impedance ⁽⁵⁾	DBV package	206	°C/W
		DCK package	252	
		DRL package	142	
		YEA/YZA package	154	
		YEP/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) All voltages are with respect to ground, unless otherwise specified.
- (3) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (4) This value is limited to 5.5 V maximum.
- (5) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾

		MIN	MAX	UNIT
V _{CC}	Supply voltage	1.65	5.5	V
V _{I/O}	I/O port voltage	0	V _{CC}	V
V _{IH}	High-level input voltage, control input	V _{CC} = 1.65 V to 1.95 V	V _{CC} × 0.65	V
		V _{CC} = 2.3 V to 2.7 V	V _{CC} × 0.7	
		V _{CC} = 3 V to 3.6 V	V _{CC} × 0.7	
		V _{CC} = 4.5 V to 5.5 V	V _{CC} × 0.7	
V _{IL}	Low-level input voltage, control input	V _{CC} = 1.65 V to 1.95 V	V _{CC} × 0.35	V
		V _{CC} = 2.3 V to 2.7 V	V _{CC} × 0.3	
		V _{CC} = 3 V to 3.6 V	V _{CC} × 0.3	
		V _{CC} = 4.5 V to 5.5 V	V _{CC} × 0.3	
V _I	Control input voltage	0	5.5	V
Δt/Δv	Input transition rise/fall time	V _{CC} = 1.65 V to 1.95 V	20	ns/V
		V _{CC} = 2.3 V to 2.7 V	20	
		V _{CC} = 3 V to 3.6 V	10	
		V _{CC} = 4.5 V to 5.5 V	10	
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
r _{on}	On-state switch resistance V _I = V _{CC} or GND, V _C = V _{IH} (see Figure 1 and Figure 2)	I _S = 4 mA	1.65 V	12	30	Ω
		I _S = 8 mA	2.3 V	9	20	
		I _S = 24 mA	3 V	7.5	15	
		I _S = 32 mA	4.5 V	5.5	10	
r _{on(p)}	Peak on resistance V _I = V _{CC} or GND, V _C = V _{IH} (see Figure 1 and Figure 2)	I _S = 4 mA	1.65 V	74.5	120	Ω
		I _S = 8 mA	2.3 V	20	30	
		I _S = 24 mA	3 V	11.5	20	
		I _S = 32 mA	4.5 V	7.5	15	
I _{S(off)}	Off-state switch leakage current V _I = V _{CC} and V _O = GND or V _I = GND and V _O = V _{CC} , V _C = V _{IL} (see Figure 3)	5.5 V		±1	±0.1 ⁽¹⁾	μA
I _{S(on)}	On-state switch leakage current V _I = V _{CC} or GND, V _C = V _{IH} , V _O = Open (see Figure 4)	5.5 V		±1	±0.1 ⁽¹⁾	μA
I _I	Control input current V _C = V _{CC} or GND	5.5 V		±1	±0.1 ⁽¹⁾	μA
I _{CC}	Supply current V _C = V _{CC} or GND	5.5 V		10	1 ⁽¹⁾	μA
ΔI _{CC}	Supply current change V _C = V _{CC} – 0.6 V	5.5 V			500	μA
C _{ic}	Control input capacitance	5 V		2		pF
C _{io(off)}	Switch input/output capacitance	5 V		6		pF
C _{io(on)}	Switch input/output capacitance	5 V		13		pF

(1) T_A = 25°C

SN74LVC1G66

SINGLE BILATERAL ANALOG SWITCH

SCES323K–JUNE 2001–REVISED NOVEMBER 2005

Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 5)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$		$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}^{(1)}$	A or B	B or A	2		1.2		0.8		0.6		ns
$t_{en}^{(2)}$	C	A or B	2.5	12	1.9	6.5	1.8	5	1.5	4.2	ns
$t_{dis}^{(3)}$	C	A or B	2.2	10	1.4	6.9	2	6.5	1.4	5	ns

- (1) t_{PLH} and t_{PHL} are the same as t_{pd} . The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).
- (2) t_{PZL} and t_{PZH} are the same as t_{en} .
- (3) t_{PLZ} and t_{PHZ} are the same as t_{dis} .

Analog Switch Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CC}	TYP	UNIT
Frequency response ⁽¹⁾ (switch ON)	A or B	B or A	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = \text{sine wave}$ (see Figure 6)	1.65 V	35	MHz
				2.3 V	120	
				3 V	175	
				4.5 V	195	
			$C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $f_{in} = \text{sine wave}$ (see Figure 6)	1.65 V	>300	
				2.3 V	>300	
				3 V	>300	
				4.5 V	>300	
Crosstalk (control input to signal output)	C	A or B	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (square wave) (see Figure 7)	1.65 V	35	mV
				2.3 V	50	
				3 V	70	
				4.5 V	100	
Feedthrough attenuation ⁽²⁾ (switch OFF)	A or B	B or A	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (sine wave) (see Figure 8)	1.65 V	-58	dB
				2.3 V	-58	
				3 V	-58	
				4.5 V	-58	
			$C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $f_{in} = 1\text{ MHz}$ (sine wave) (see Figure 8)	1.65 V	-42	
				2.3 V	-42	
				3 V	-42	
				4.5 V	-42	
Sine-wave distortion	A or B	B or A	$C_L = 50\text{ pF}$, $R_L = 10\text{ k}\Omega$, $f_{in} = 1\text{ kHz}$ (sine wave) (see Figure 9)	1.65 V	0.1	%
				2.3 V	0.025	
				3 V	0.015	
				4.5 V	0.01	
			$C_L = 50\text{ pF}$, $R_L = 10\text{ k}\Omega$, $f_{in} = 10\text{ kHz}$ (sine wave) (see Figure 9)	1.65 V	0.15	
				2.3 V	0.025	
				3 V	0.015	
				4.5 V	0.01	

- (1) Adjust f_{in} voltage to obtain 0 dBm at output. Increase f_{in} frequency until dB meter reads -3 dB.
- (2) Adjust f_{in} voltage to obtain 0 dBm at input.

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	$f = 10\text{ MHz}$	8	9	9	11	pF

PARAMETER MEASUREMENT INFORMATION

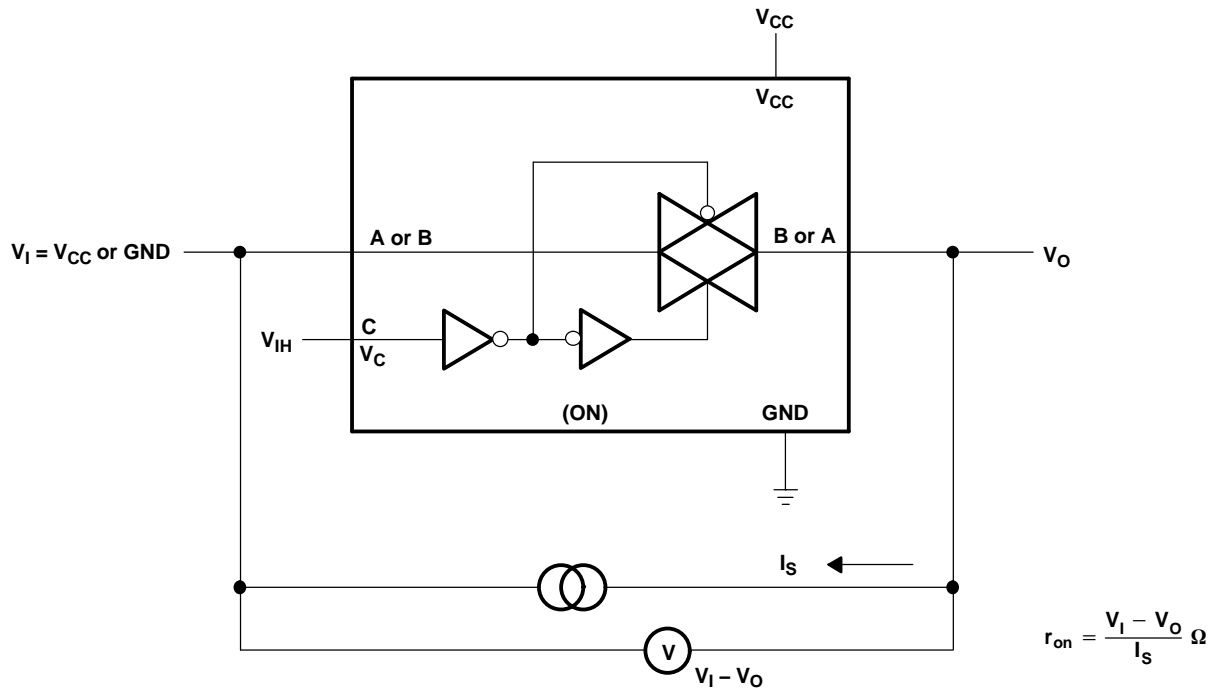


Figure 1. On-State Resistance Test Circuit

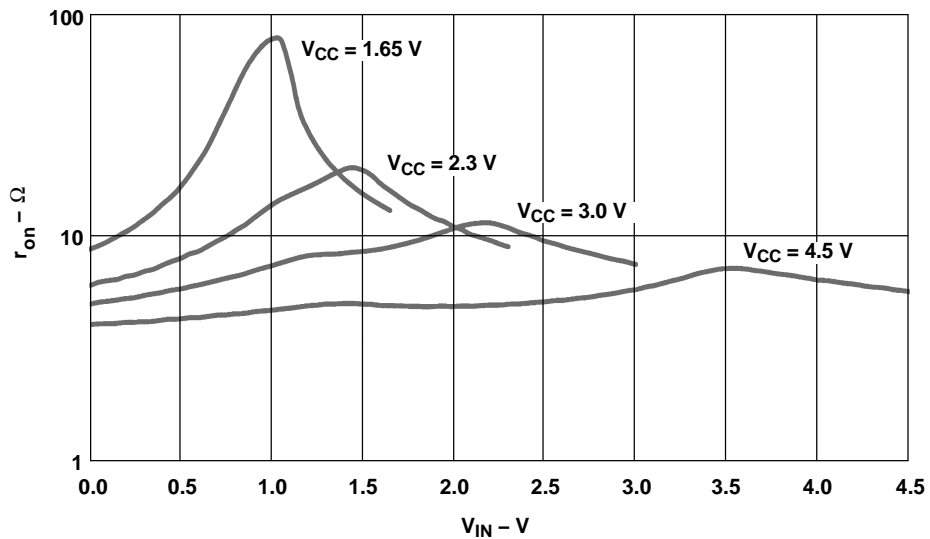


Figure 2. Typical r_{on} as a Function of Input Voltage (V_I) for $V_I = 0$ to V_{CC}

PARAMETER MEASUREMENT INFORMATION

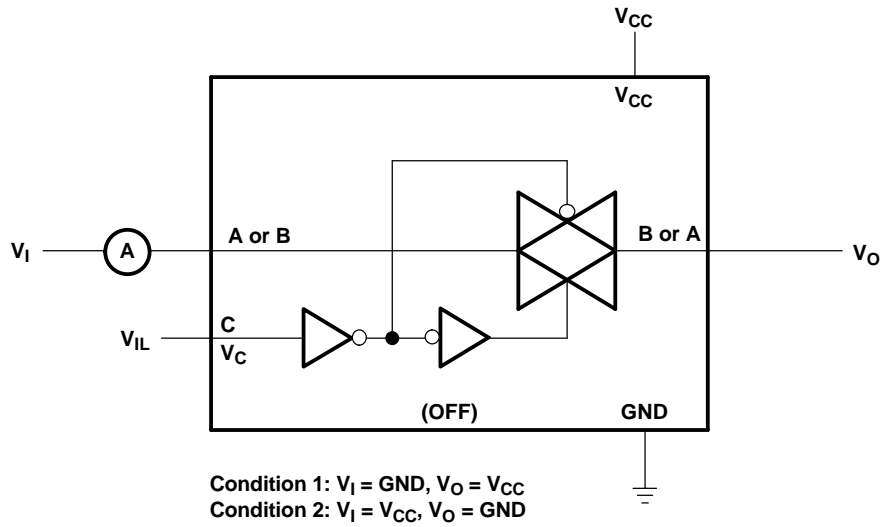


Figure 3. Off-State Switch Leakage-Current Test Circuit

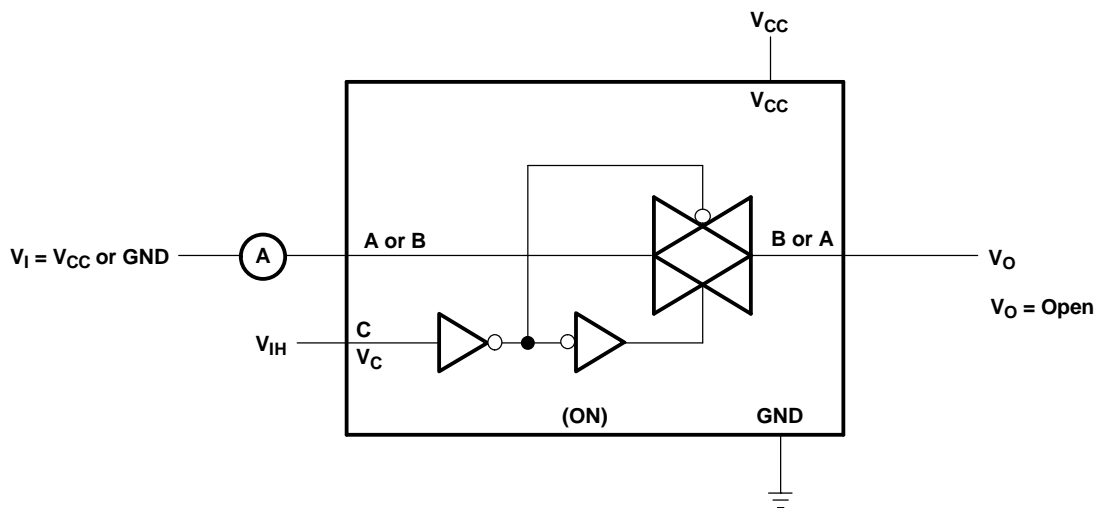
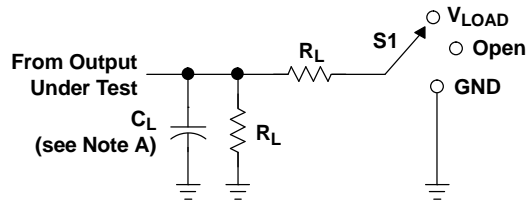


Figure 4. On-State Switch Leakage-Current Test Circuit

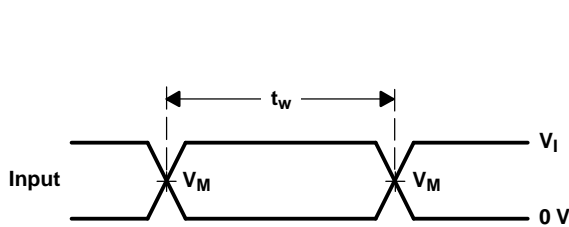
PARAMETER MEASUREMENT INFORMATION



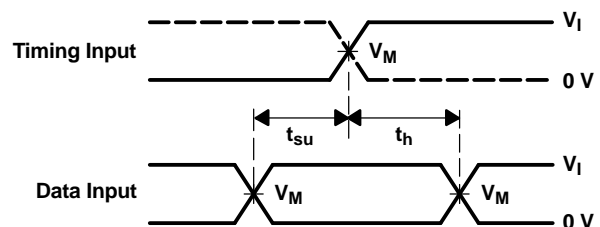
LOAD CIRCUIT

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

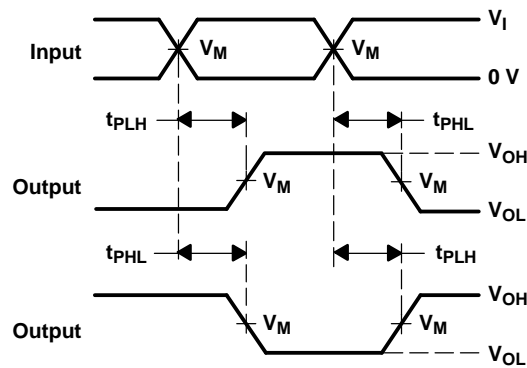
V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	t_r/t_f					
$1.8\text{ V} \pm 0.15\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k Ω	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 Ω	0.15 V
$3.3\text{ V} \pm 0.3\text{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



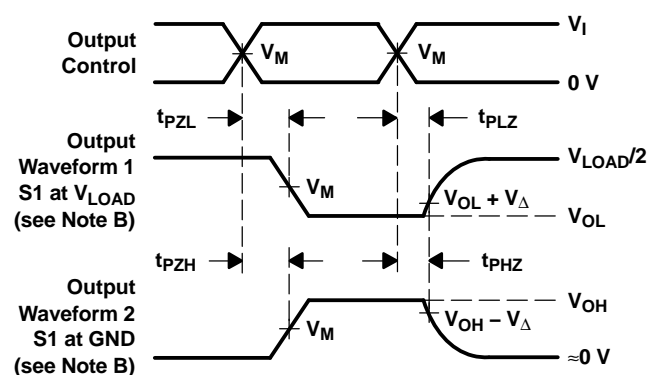
VOLTAGE WAVEFORMS
PULSE DURATION



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 MHz, $Z_O = 50\ \Omega$.
 - D. The outputs are measured one at a time, with one transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PLH} and t_{PHL} are the same as t_{pd} .
 - H. All parameters and waveforms are not applicable to all devices.

Figure 5. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION

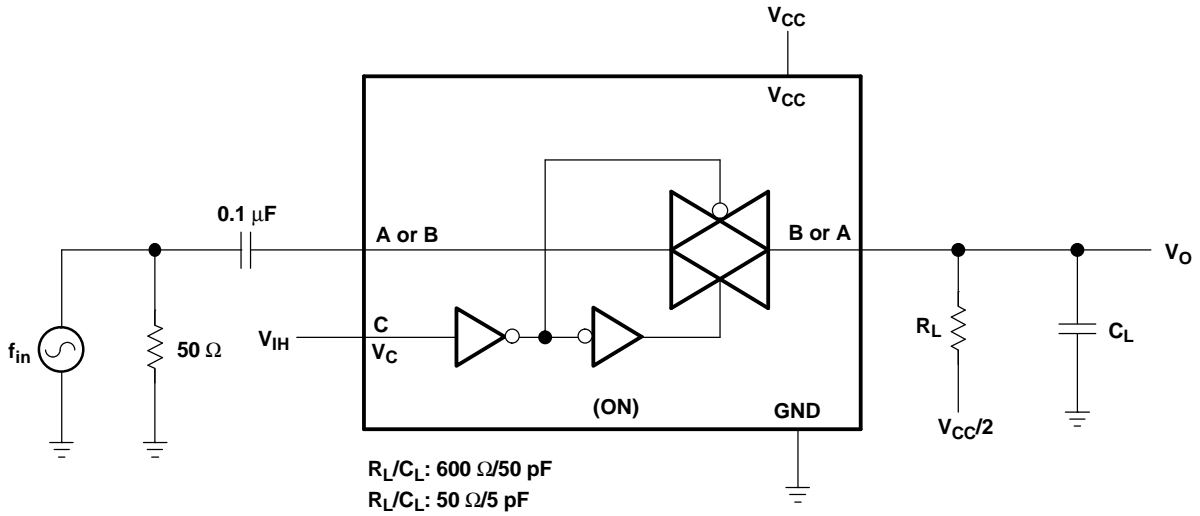


Figure 6. Frequency Response (Switch ON)

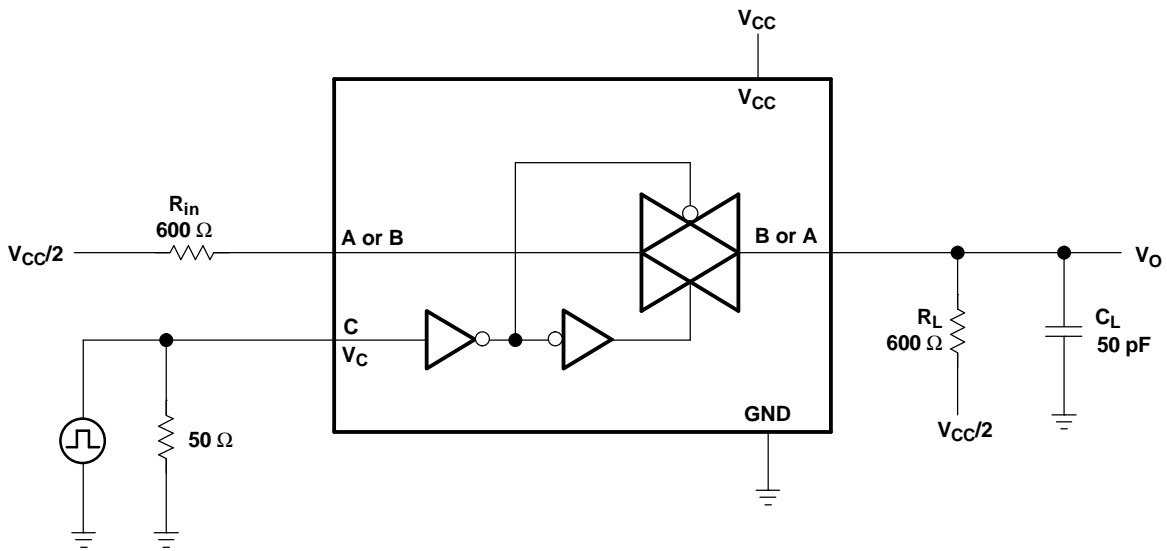


Figure 7. Crosstalk (Control Input – Switch Output)

PARAMETER MEASUREMENT INFORMATION

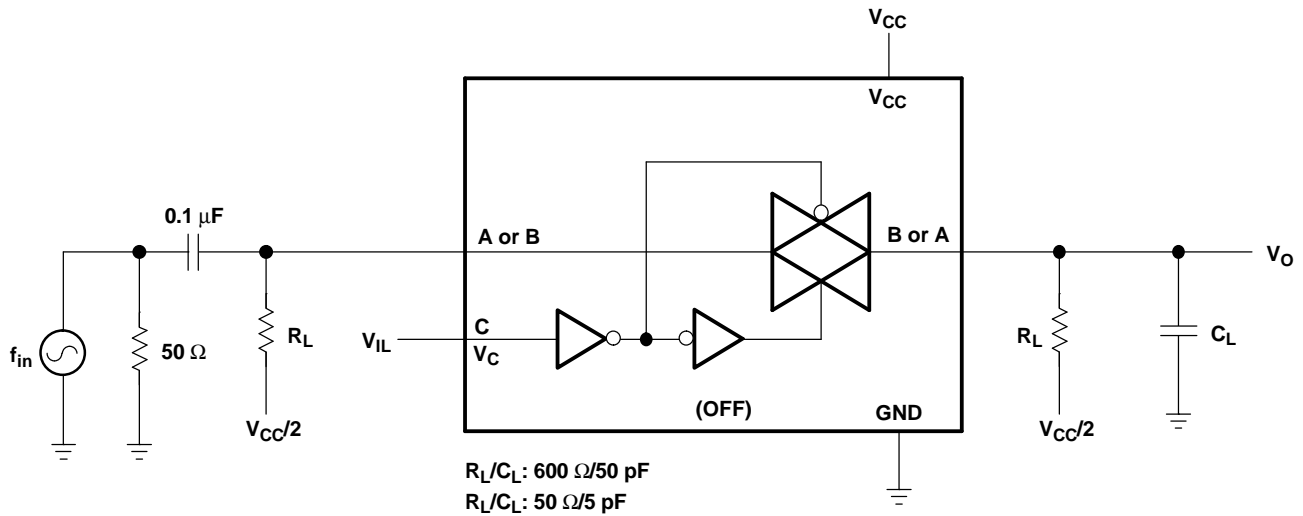


Figure 8. Feedthrough (Switch OFF)

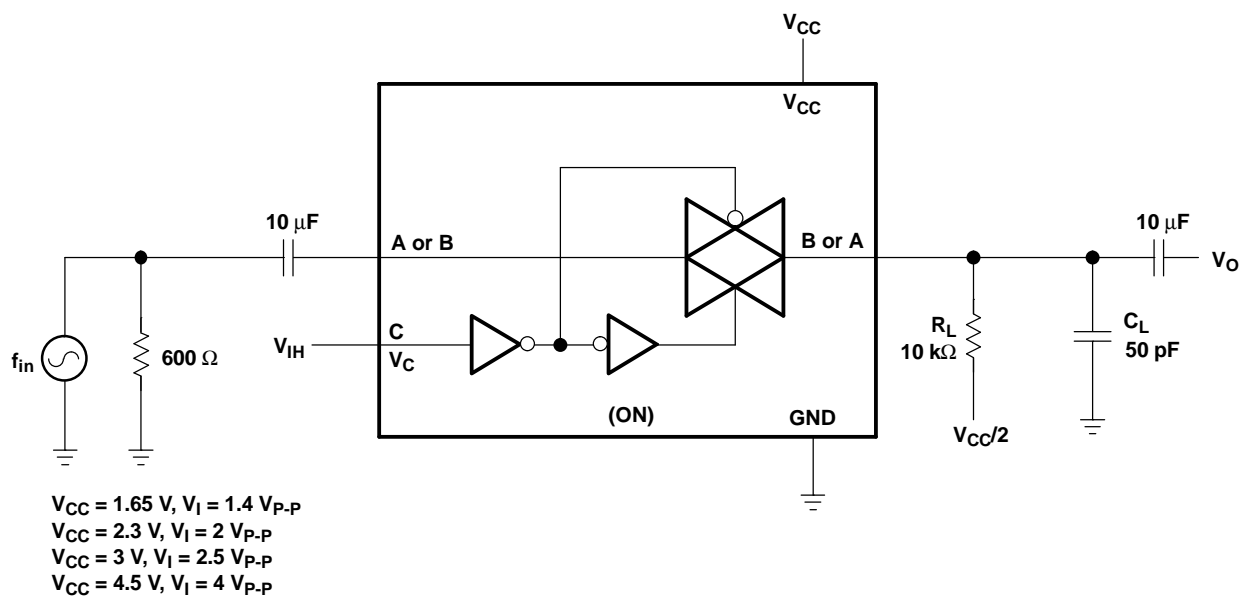


Figure 9. Sine-Wave Distortion

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74LVC1G66DBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DCKRE4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DCKTE4	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DRLR	ACTIVE	SOP	DRL	5	4000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66DRLRG4	ACTIVE	SOP	DRL	5	4000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC1G66YEAR	NRND	WCSP	YEA	5	3000	TBD	SNPB	Level-1-260C-UNLIM
SN74LVC1G66YEPR	NRND	WCSP	YEP	5	3000	TBD	SNPB	Level-1-260C-UNLIM
SN74LVC1G66YZAR	NRND	WCSP	YZA	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM
SN74LVC1G66YZPR	ACTIVE	WCSP	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)

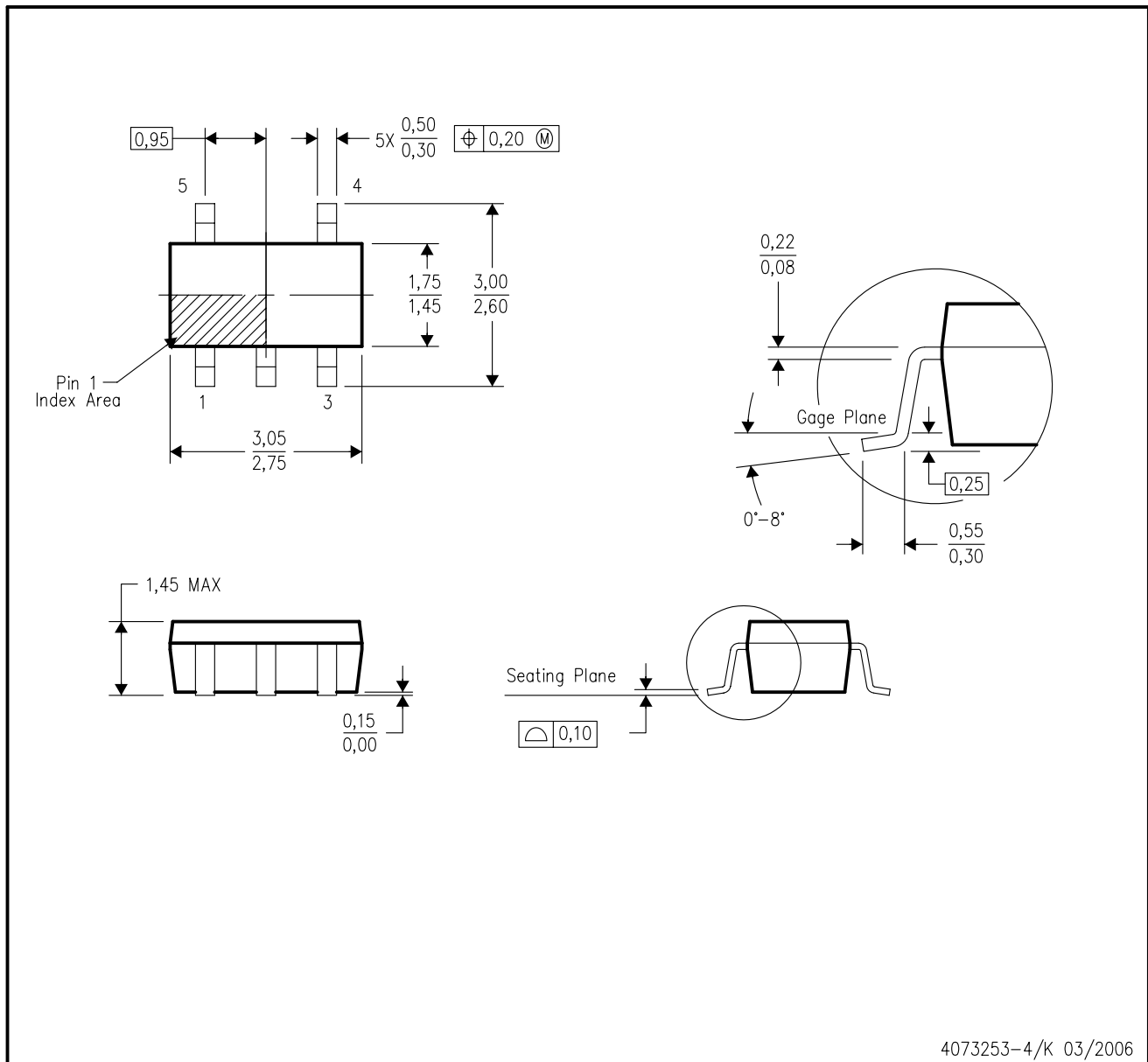
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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DBV (R-PDSO-G5)

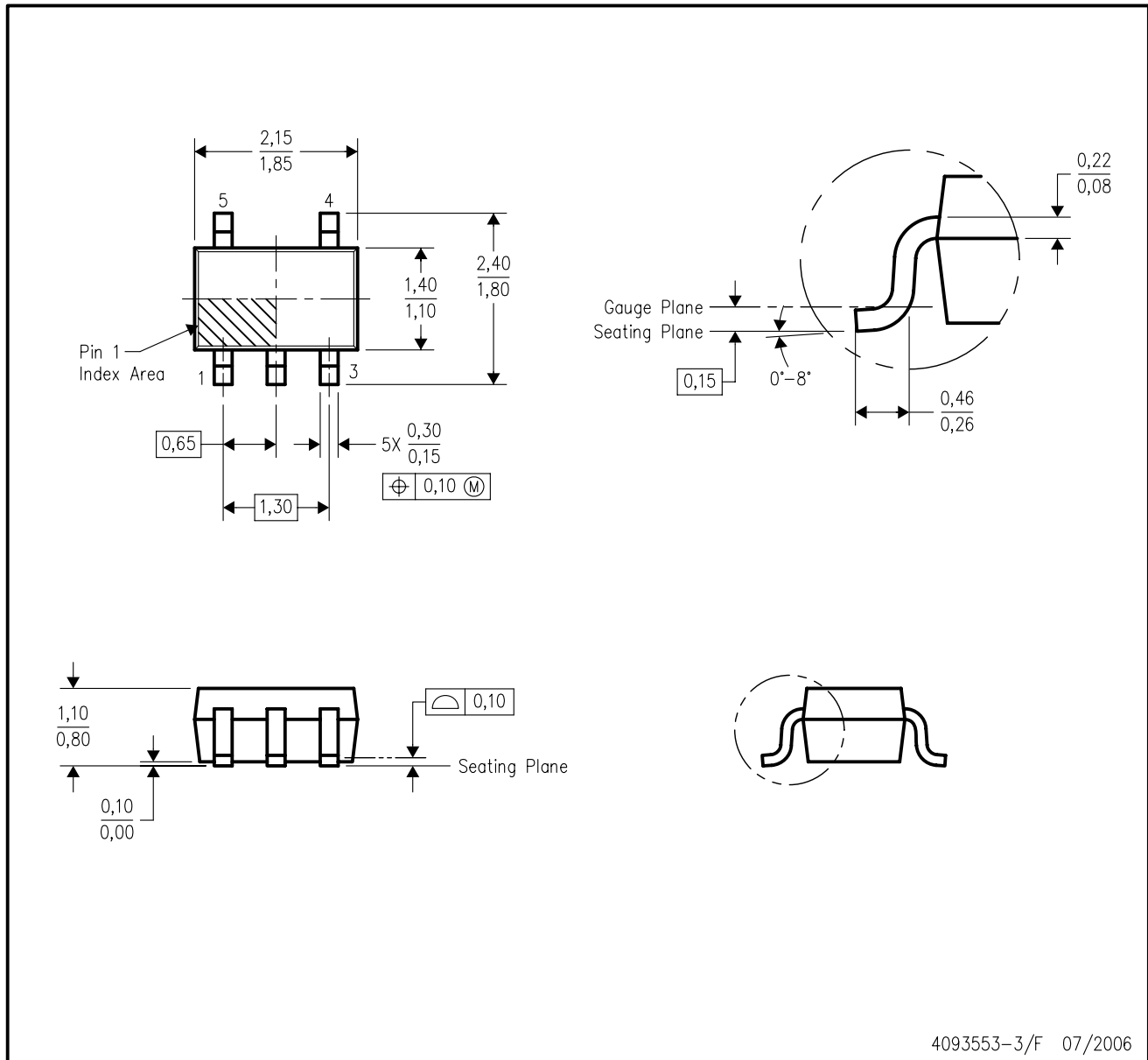
PLASTIC SMALL-OUTLINE PACKAGE



- 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-178 Variation AA.

DCK (R-PDSO-G5)

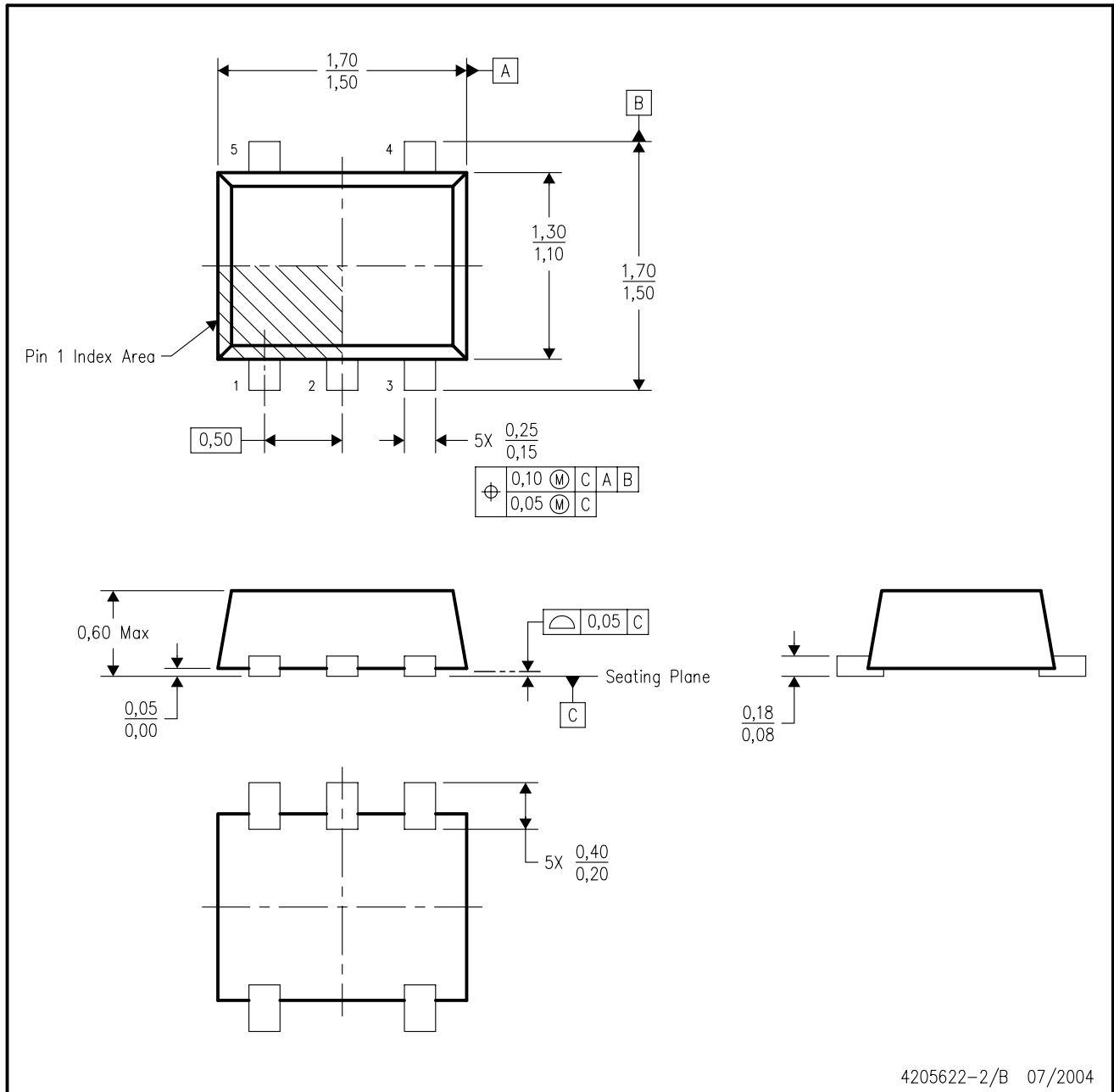
PLASTIC SMALL-OUTLINE PACKAGE



- 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.

DRL (R-PDSO-N5)

PLASTIC SMALL OUTLINE

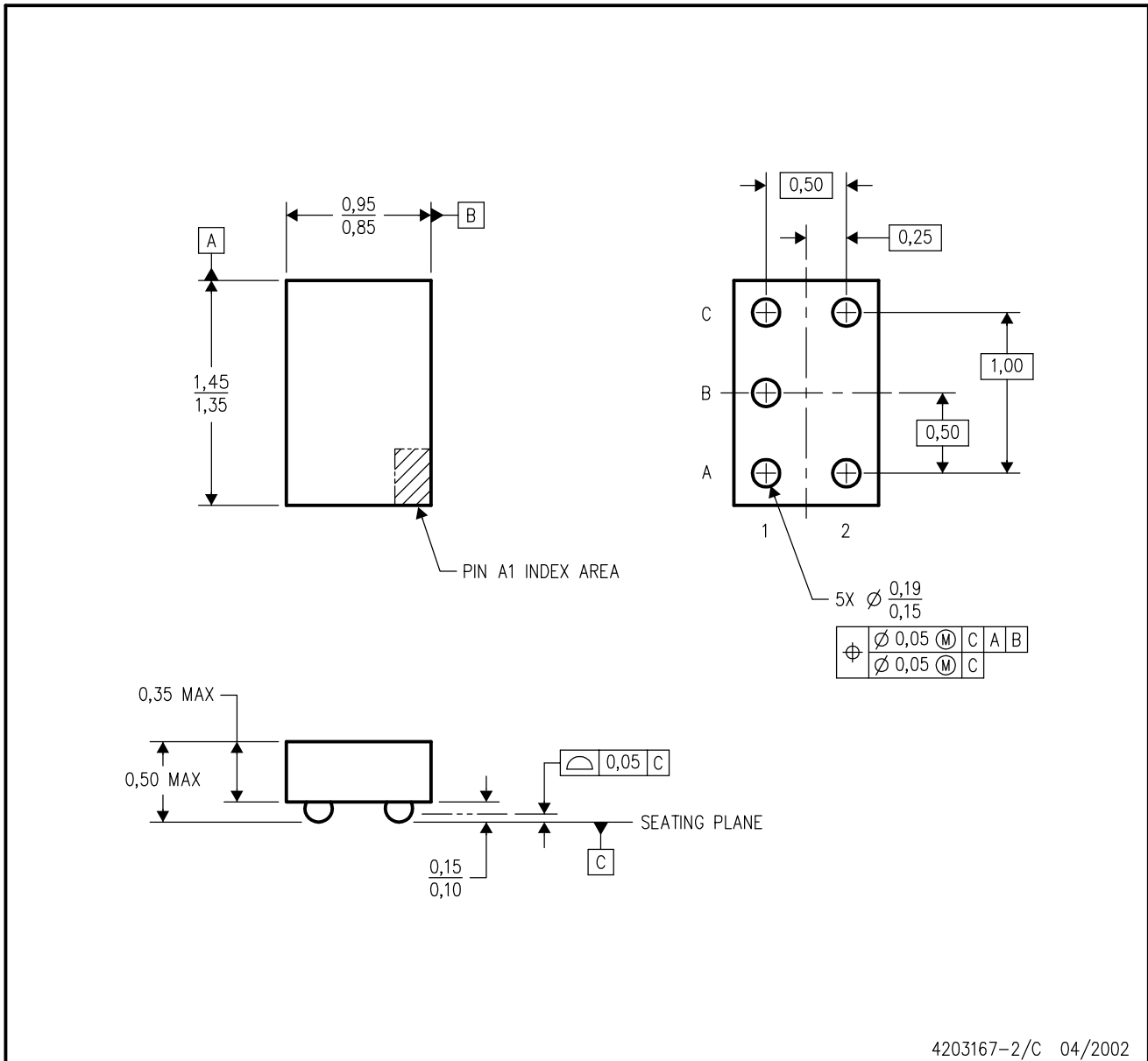


4205622-2/B 07/2004

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. JEDEC package registration is pending.

YEA (R-XBGA-N5)

DIE-SIZE BALL GRID ARRAY

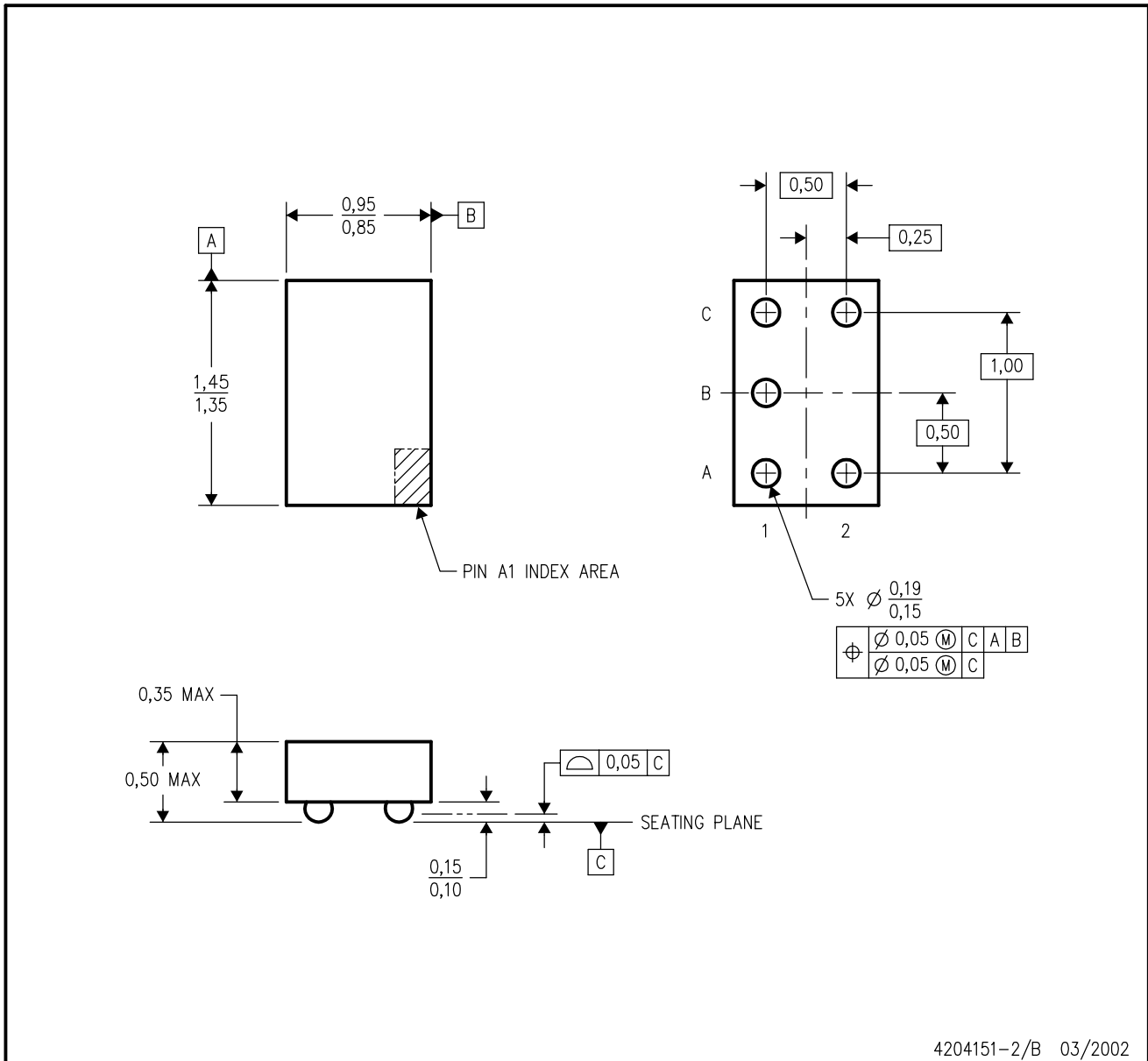


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. NanoStar™ package configuration.
 - D. Package complies to JEDEC MO-211 variation EA.
 - E. This package is tin-lead (SnPb). Refer to the 5 YZA package (drawing 4204151) for lead-free.

NanoStar is a trademark of Texas Instruments.

YZA (R-XBGA-N5)

DIE-SIZE BALL GRID ARRAY

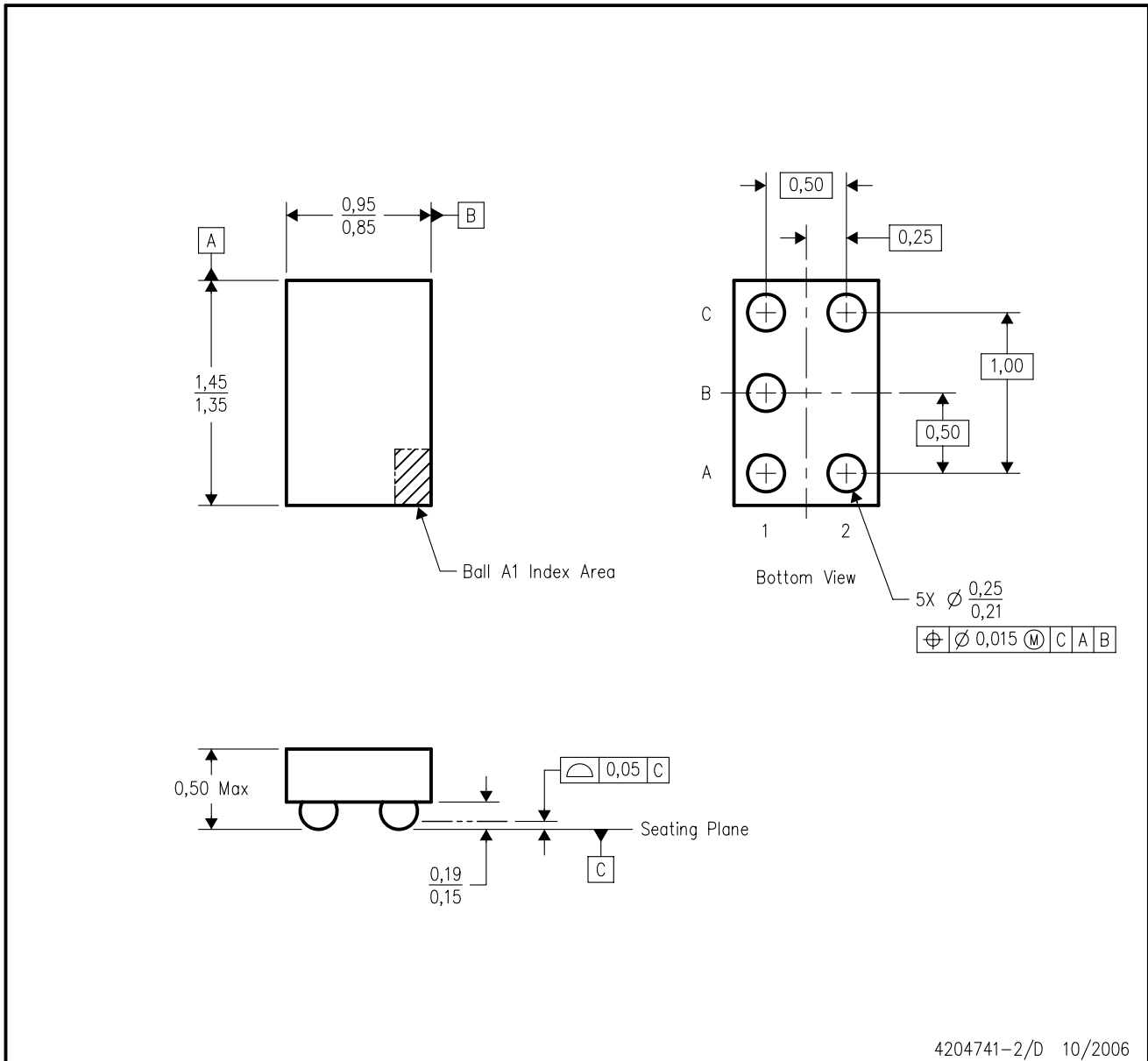


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. NanoFree™ package configuration.
 - D. Package complies to JEDEC MO-211 variation EA.
 - E. This package is lead-free. Refer to the 5 YEA package (drawing 4203167) for tin-lead (SnPb).

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YZP (R-XBGA-N5)

DIE-SIZE BALL GRID ARRAY

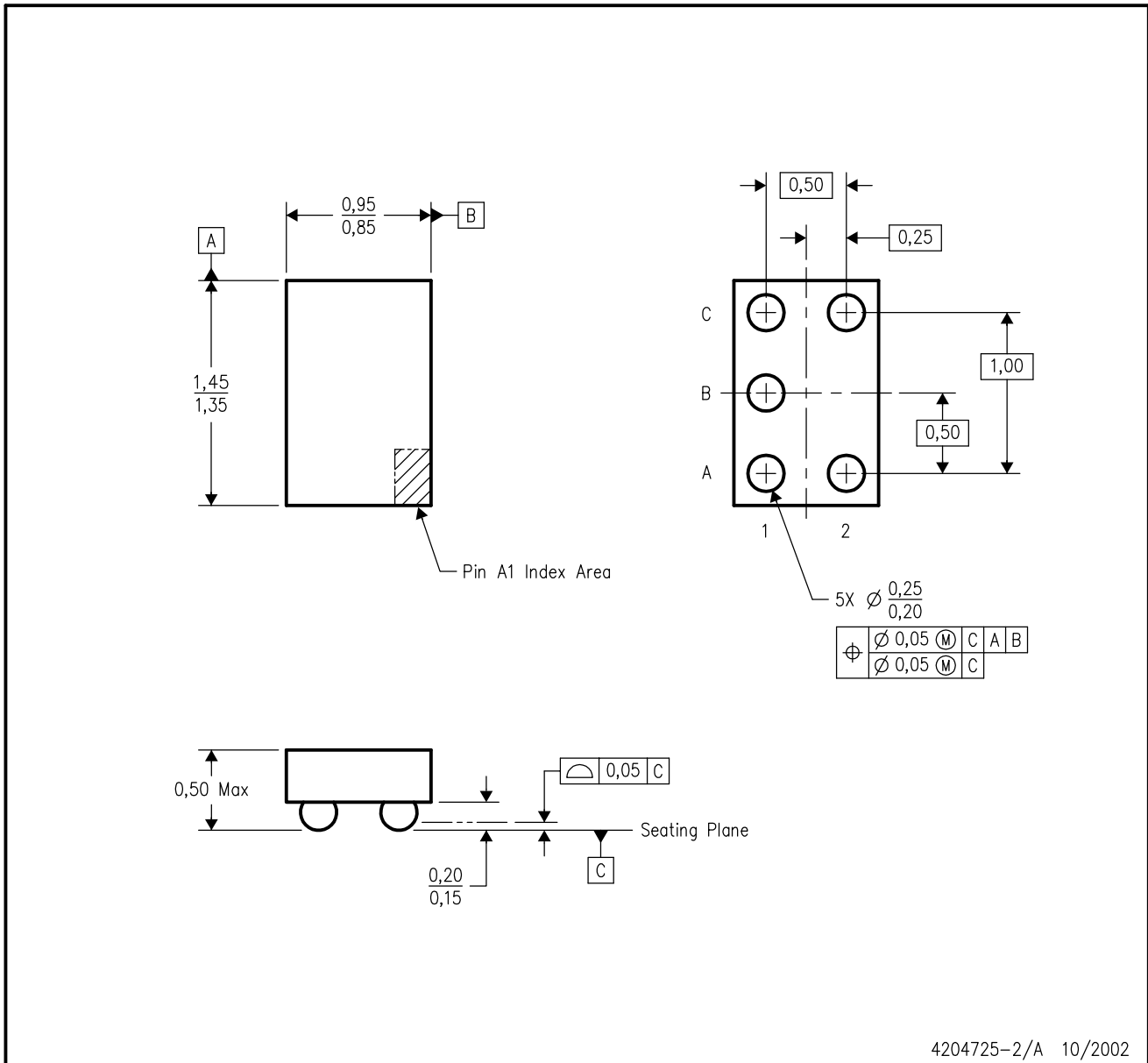


- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. NanoFree™ package configuration.
 - D. This package is lead-free. Refer to the 5 YEP package (drawing 4204725) for tin-lead (SnPb).

NanoFree is a trademark of Texas Instruments.

YEP (R-XBGA-N5)

DIE-SIZE BALL GRID ARRAY



4204725-2/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 5 YZP package (drawing 4204741) for lead-free.

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