

## 2 X 2 Crosspoint Switch for Audio Applications

Check for Samples: [TS3A26746E](#)

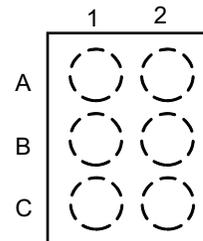
### FEATURES

- Ultra Low  $R_{ON}$  for GND Switch (80-m $\Omega$  typical)
- $R_{ON}$  for MIC Switch <10- $\Omega$
- 3.0V to 3.6V V+ Operation
- Control Input is 1.8-V Logic Compatible
- 6-bump, 0.5mm pitch CSP Package (1.45mm x 0.95mm x 0.5mm)
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 500-V Charged-Device Model (C101)
- ESD Performance (SLEEVE, RING2)
  - $\pm$ 8-kV Contact Discharge (IEC 61000-4-2)

### APPLICATIONS

- Cellular phones
- PDAs
- Portable Instrumentation
- Digital Still Cameras
- Portable Navigation Devices

### PINOUT



### DESCRIPTION

The TS3A26746E is a 2 x 2 cross-point switch that is used to interchange the Ground and MIC connections on a headphone connector. The Ground switch has an ultra low  $R_{ON}$  of <0.1 $\Omega$  to minimize voltage drop across it, preventing undesired increases in headphone ground reference voltage. The switch state is controlled via the SEL input. When SEL=High, GND is connected to RING2 and MIC is connected to SLEEVE. When SEL=Low, GND is connected to SLEEVE and MIC is connected to RING2. An internal 100k pull-up resistor on the SEL input sets the default state of the switch.

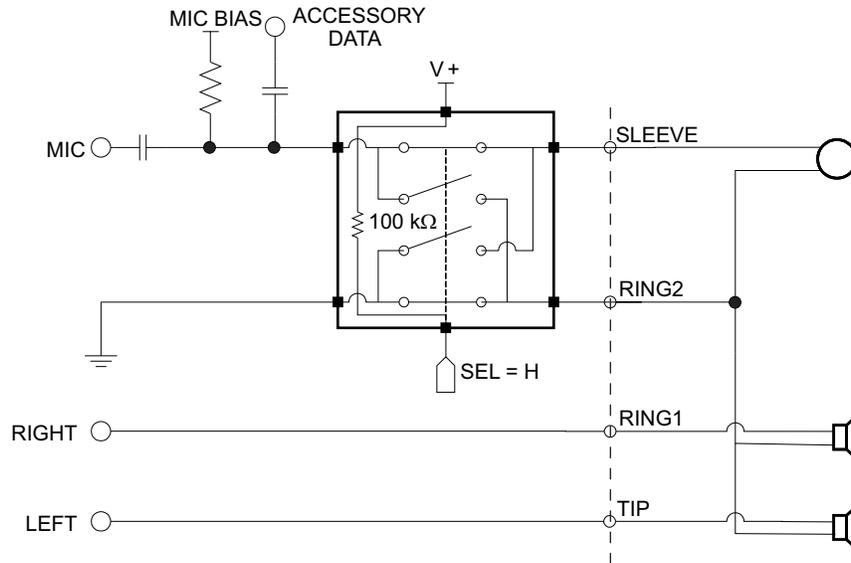


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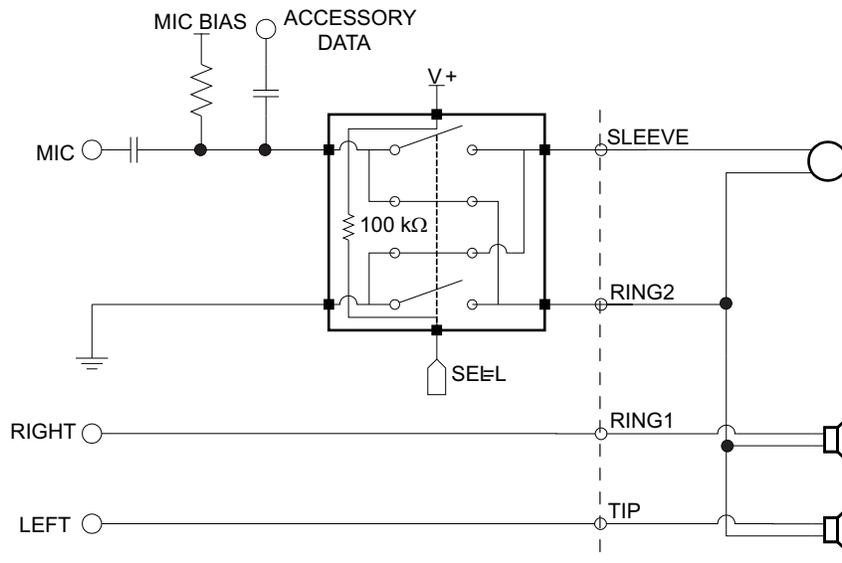


These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

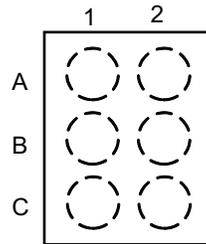
**TYPICAL APPLICATION BLOCK DIAGRAM**



**Figure 1. Standard Headphone Configuration (SEL=H)**



**Figure 2. Alternate Headphone Configuration (SEL=L)**

**PINOUT**

**TERMINAL ASSIGNMENTS**

	1	2
<b>A</b>	SEL	V+
<b>B</b>	MIC	SLEEVE
<b>C</b>	GND	RING2

**PIN FUNCTIONS**

BALL #	PIN		DESCRIPTION
	NAME	TYPE	
A1	SEL	Input	Control Input
A2	V+	Power	Supply Voltage
B1	MIC	I/O	MIC
B2	SLEEVE	I/O	Sleeve Connection on Headphone Jack
C1	GND	Ground	Ground
C2	RING2	I/O	2 <sup>nd</sup> Ring Connection on Headphone Jack

**Table 1. FUNCTION TABLE**

SEL	MIC to SLEEVE, GND to RING2	MIC to RING2, GND to SLEEVE
L	OFF	ON
H	ON	OFF

# TS3A26746E

SCDS313C – FEBRUARY 2011 – REVISED MAY 2013

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## ABSOLUTE MAXIMUM RATINGS<sup>(1)(2)</sup>

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

			MIN	MAX	UNIT
$V_+$	Supply voltage range <sup>(3)</sup>		-0.3	4.0	V
$V_{MIC}$ $V_{SLEEVE}$ $V_{RING2}$	Analog voltage range <sup>(3)</sup>		-0.3	4.0	V
$I_K$	Analog port diode current	$V_{MIC}, V_{SLEEVE}, V_{RING2} < 0\text{ V}$	-50		mA
$V_I$	Digital input voltage range		-0.3	4.0	V
$I_{IK}$	Digital input clamp current <sup>(3)</sup>	$V_I < 0\text{ V}$	-50		mA
$I_+$	Continuous current through $V_+$			100	mA
$I_{GND}$	Continuous current through GND		-100		mA
$\theta_{JA}$	Package thermal impedance <sup>(4)</sup>	YZP package		102	°C/W
$T_{stg}$	Storage temperature range		-65	150	°C

- (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.
- (2) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum.
- (3) All voltages are with respect to ground, unless otherwise specified.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

## ELECTRICAL CHARACTERISTICS FOR 3.3 V SUPPLY<sup>(1)</sup>

 $V_+ = 3\text{ V to }3.6\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>MIC SWITCH</b>							
$V_{MIC}, V_{SLEEVE}, V_{RING2}$	Analog signal range			0		$V_+$	V
$r_{on}$	ON-state resistance	$0 \leq V_{SLEEVE}$ or $V_{RING2} \leq V_+$ , $I_{MIC} = -32\text{ mA}$	Switch ON	25°C	3 V	5 8	Ω
				Full		10	
$r_{on(Flat)}$	ON-state resistance flatness	$0 \leq V_{SLEEVE}$ or $V_{RING2} \leq V_+$ , $I_{MIC} = -32\text{ mA}$	Switch ON	25°C	3 V	1 2.3	Ω
				Full		2.5	
$I_{SLEEVE(OFF)}, I_{RING2(OFF)}$	SLEEVE, RING2 OFF leakage current	$V_{SLEEVE}$ or $V_{RING2} = 1\text{ V}$ , $V_{MIC} = 3\text{ V}$ , or $V_{SLEEVE}$ or $V_{RING2} = 3\text{ V}$ , $V_{MIC} = 1\text{ V}$	Switch OFF	25°C	3.6 V	-0.5 0.05 0.5	μA
				Full		-2 2	
$I_{MIC(OFF)}$	MIC OFF leakage current	$V_{SLEEVE}$ or $V_{RING2} = 3\text{ V}$ , $V_{MIC} = 1\text{ V}$ , or $V_{SLEEVE}$ or $V_{RING2} = 1\text{ V}$ , $V_{MIC} = 3\text{ V}$	Switch OFF	25°C	3.6 V	-1 0.1 1	μA
				Full		-2 2	
$I_{SLEEVE(ON)}, I_{RING2(ON)}$	SLEEVE, RING2 ON leakage current	$V_{SLEEVE}$ or $V_{RING2} = 1\text{ V}$ , $V_{MIC} = \text{Open}$ , or $V_{SLEEVE}$ or $V_{RING2} = 3\text{ V}$ , $V_{MIC} = \text{Open}$	Switch ON	25°C	3.6 V	-2 0.5 2	μA
				Full		-2 2	
$I_{MIC(ON)}$	MIC ON leakage current	$V_{SLEEVE}$ or $V_{RING2} = \text{Open V}$ , $V_{MIC} = 1\text{ V}$ , or $V_{SLEEVE}$ or $V_{RING2} = \text{Open}$ , $V_{MIC} = 3\text{ V}$	Switch ON	25°C	3.6 V	-2 0.5 2	μA
				Full		-2 2	
<b>GND SWITCH</b>							
$r_{on}$	ON-state resistance	$I_{SLEEVE}$ or $I_{RING2} = +32\text{ mA}$ , $V_{GND} = 0\text{ V}$ , $I_{GND} = -32\text{ mA}$	Switch ON	25°C	3 V	0.08 0.09	Ω
				Full		0.11	
$I_{SLEEVE(OFF)}, I_{RING2(OFF)}$	SLEEVE, RING2 OFF leakage current	$V_{SLEEVE}$ or $V_{RING2} = 3\text{ V}$ and $V_{GND} = 0\text{ V}$	Switch OFF	25°C	3.6 V	-0.5 0.05 0.5	μA
						Full	
$I_{SLEEVE(PWROFF)}, I_{RING2(PWROFF)}$	SLEEVE, RING2 OFF leakage current	$V_{SLEEVE}$ or $V_{RING2} = 0\text{ to }3.6\text{ V}$ and $V_{GND} = 0\text{ V}$	Switch OFF	25°C	0 V	-1 0.5 1	μA
						Full	

- (1) The algebraic convention, whereby the most negative value is a minimum and the most positive value is a maximum

**ELECTRICAL CHARACTERISTICS FOR 3.3 V SUPPLY<sup>(1)</sup> (continued)**
 $V_+ = 3\text{ V to }3.6\text{ V}$ ,  $T_A = -40^\circ\text{C to }85^\circ\text{C}$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	$T_A$	$V_+$	MIN	TYP	MAX	UNIT
<b>DIGITAL CONTROL INPUTS (SEL)</b>								
$V_{IH}$	Input logic high		Full	3.6 V	1.2		3.6	V
$V_{IL}$	Input logic low		Full	3.6 V	0		0.4	V
$I_{IH}$	Input logic high leakage current	$V_I = V_+$	25°C	3.6 V	-1	0.05	1	$\mu\text{A}$
			Full		-2		2	
$I_{IL}$	Input logic low leakage current	$V_I = 0\text{ V}$	25°C	3.6 V	-38	-36	-34	$\mu\text{A}$
			Full		-45		-30	
<b>DYNAMIC</b>								
$t_{ON}$	Turn-on time	$V_{MIC} = V_+$ , $R_L = 50\ \Omega$	$C_L = 35\ \text{pF}$	25°C	3.3 V		150 200	ns
				Full	3 V to 3.6 V		250	
$t_{OFF}$	Turn-off time	$V_{MIC} = V_+$ , $R_L = 50\ \Omega$	$C_L = 35\ \text{pF}$	25°C	3.3 V		5 10	ns
				Full	3 V to 3.6 V		15	
$t_{BBM}$	Break-before-make time	$V_{MIC} = V_+$	25°C	3.3 V		70	330	ns
			Full	3 V to 3.6 V			330	
$C_{MIC}$	MIC capacitance	SEL=High	25°C	3.3 V		100	140	pF
		SEL=Low	25°C	3.3 V		100	140	pF
$C_{SLEEVE}$	SLEEVE / RING2 capacitance	SEL=High	25°C	3.3 V		100	140	pF
		SEL=Low	25°C	3.3 V		100	140	pF
$C_I$	Digital input capacitance	$V_I = V_+$ or 0 V	25°C	3.3 V		4.0		pF
THD	Total harmonic distortion	$R_L = 1\text{ k}\ \Omega$ , $V = 30\text{ mVPP}$	f = 20 Hz to 20 kHz 25°C	3.3 V		0.01%		
<b>SUPPLY</b>								
$V_+$	Power Supply Voltage				3.0	3.3	3.6	V
$I_+$	Positive supply current	$V_I = V_+$	25°C	3.6 V		0.01	1	$\mu\text{A}$
			Full				5	
		$V_I = 0\text{ V}$	25°C			40	41	$\mu\text{A}$
			Full				50	

**OPERATIONAL CHARACTERISTICS**

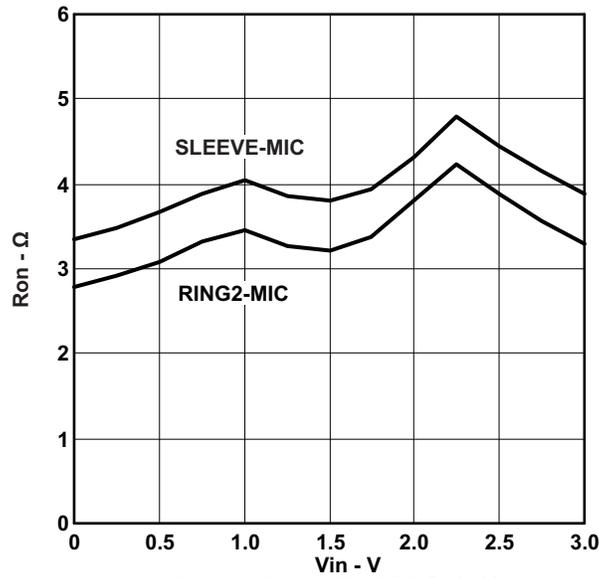
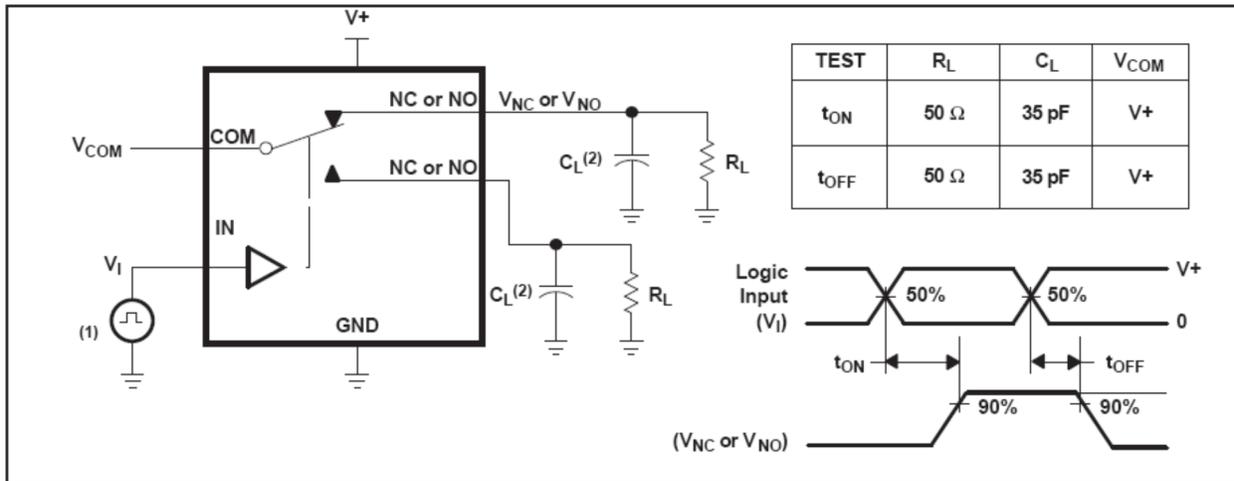


Figure 3.  $R_{ON}$  vs  $V_{IN}$  (MIC Switch)

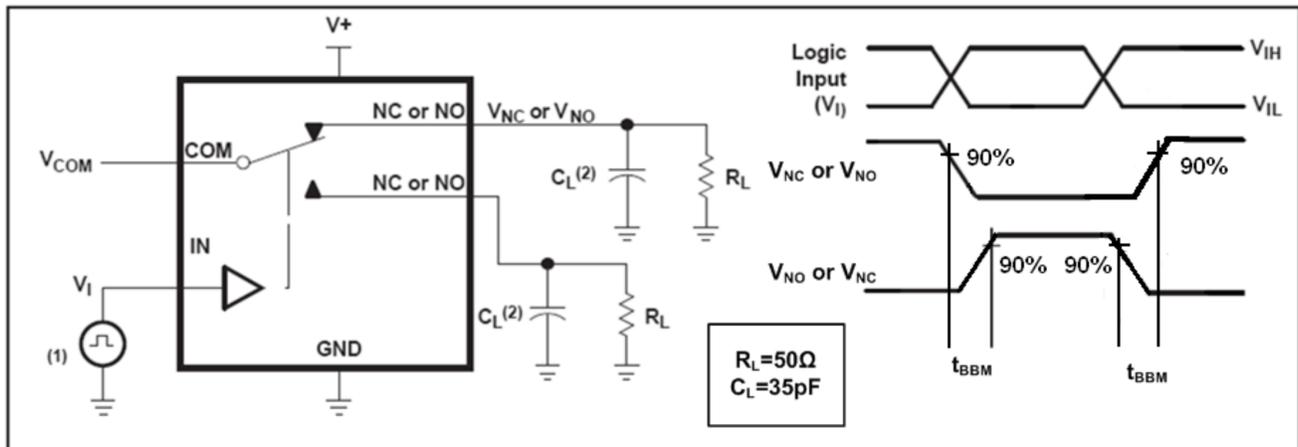
**PARAMETER MEASUREMENT INFORMATION**



- A. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_O = 50 \Omega$ ,  $t_r < 5$  ns,  $t_f < 5$  ns.
- B.  $C_L$  includes probe and jig capacitance.

Figure 4. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )

PARAMETER MEASUREMENT INFORMATION (continued)



- A.  $C_L$  includes probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics:  $\text{PRR} \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r < 5 \text{ ns}$ ,  $t_f < 5 \text{ ns}$ .

Figure 5. Break-Before-Make Time ( $t_{\text{BBM}}$ )

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**REVISION HISTORY**

<b>Changes from Revision B (November 2011) to Revision C</b>	<b>Page</b>
<hr/> <ul style="list-style-type: none"><li>Replaced 1 page preview with full document. ....</li></ul> <hr/>	<hr/> <b>1</b> <hr/>

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS3A26746EYZPR	ACTIVE	DSBGA	YZP	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	7N	Samples

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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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
TS3A26746EYZPR	DSBGA	YZP	6	3000	180.0	8.4	1.02	1.52	0.63	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS

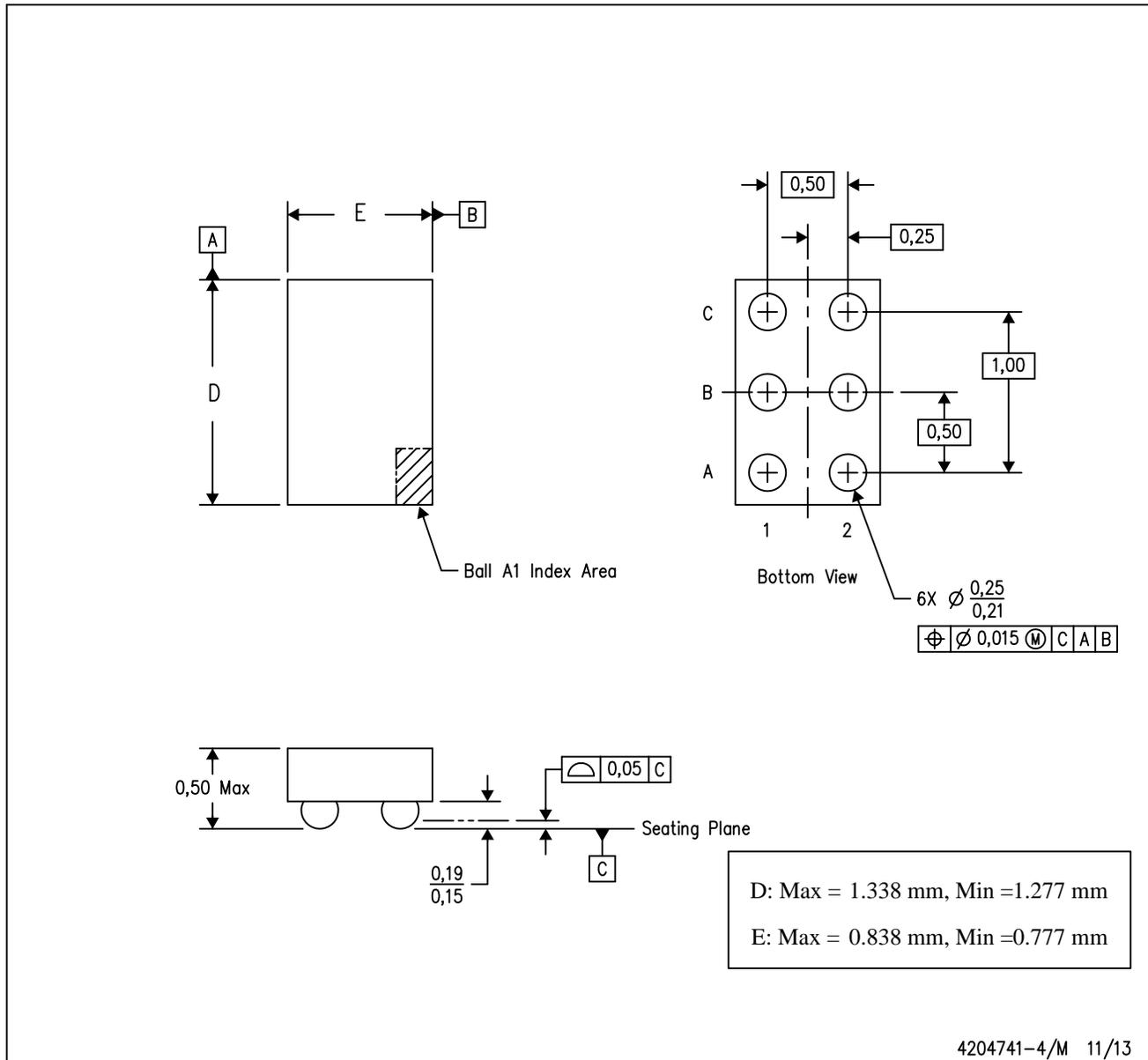


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS3A26746EYZPR	DSBGA	YZP	6	3000	182.0	182.0	17.0

YZP (R-XBGA-N6)

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.

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