

## 2 X 2 Crosspoint Switch for Audio Applications

Check for Samples: [TS3A26746E](#)

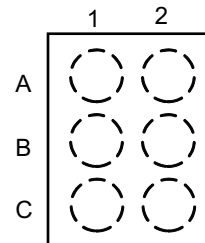
### FEATURES

- 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.

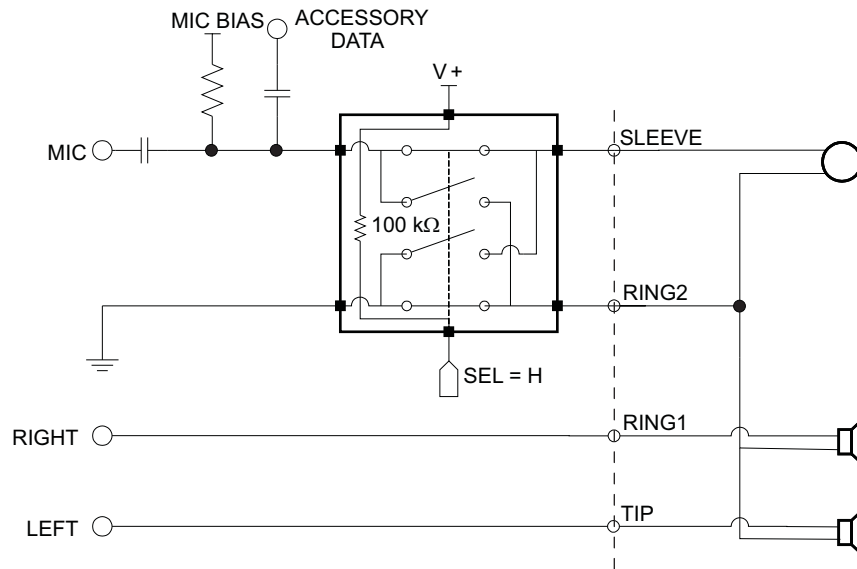


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

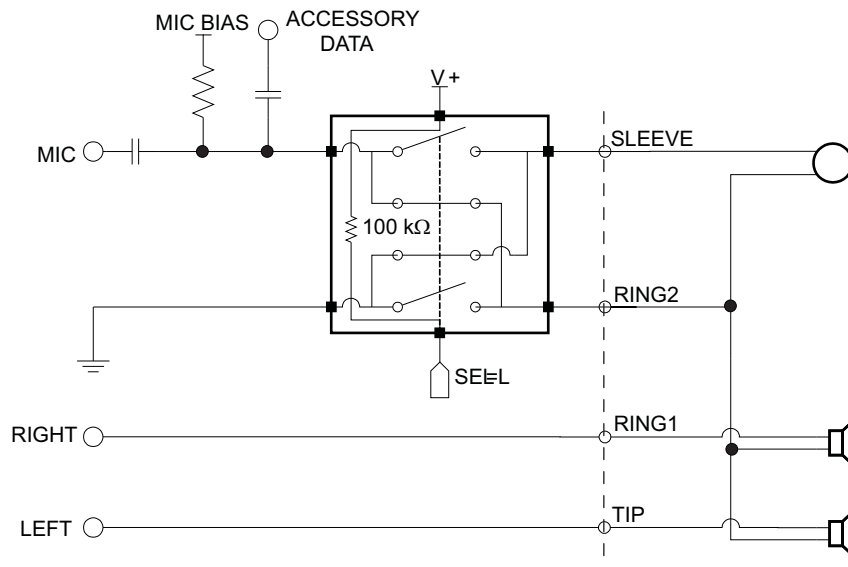


These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

**TYPICAL APPLICATION BLOCK DIAGRAM**

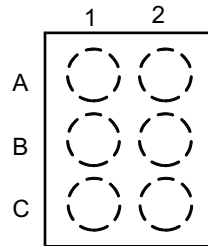


**Figure 1. Standard Headphone Configuration (SEL=H)**



**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

[www.ti.com](http://www.ti.com)
**ABSOLUTE MAXIMUM RATINGS<sup>(1)(2)</sup>**

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

			MIN	MAX	UNIT
V <sub>+</sub>	Supply voltage range <sup>(3)</sup>		-0.3	4.0	V
V <sub>MIC</sub> V <sub>SLEEVE</sub> V <sub>RING2</sub>	Analog voltage range <sup>(3)</sup>		-0.3	4.0	V
I <sub>K</sub>	Analog port diode current	V <sub>MIC</sub> , V <sub>SLEEVE</sub> , V <sub>RING2</sub> < 0 V	-50		mA
V <sub>I</sub>	Digital input voltage range		-0.3	4.0	V
I <sub>IK</sub>	Digital input clamp current <sup>(3)</sup>	V <sub>I</sub> < 0 V	-50		mA
I <sub>+</sub>	Continuous current through V <sub>+</sub>			100	mA
I <sub>GND</sub>	Continuous current through GND		-100		mA
θ <sub>JA</sub>	Package thermal impedance <sup>(4)</sup>	YZP package		102	°C/W
T <sub>stg</sub>	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<sub>+</sub> = 3 V to 3.6 V, T<sub>A</sub> = -40°C to 85°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T <sub>A</sub>	V <sub>+</sub>	MIN	TYP	MAX	UNIT		
<b>MIC SWITCH</b>									
V <sub>MIC</sub> , V <sub>SLEEVE</sub> , V <sub>RING2</sub>	Analog signal range			0		V+	V		
r <sub>on</sub>	ON-state resistance	0 ≤ V <sub>SLEEVE</sub> or V <sub>RING2</sub> ≤ V <sub>+</sub> , I <sub>MIC</sub> = -32 mA	Switch ON	25°C	3 V	5	8	Ω	
				Full			10		
r <sub>on(flat)</sub>	ON-state resistance flatness	0 ≤ V <sub>SLEEVE</sub> or V <sub>RING2</sub> ≤ V <sub>+</sub> , I <sub>MIC</sub> = -32 mA	Switch ON	25°C	3 V	1	2.3	Ω	
				Full			2.5		
I <sub>SLEEVE(OFF)</sub> , I <sub>RING2(OFF)</sub>	SLEEVE, RING2 OFF leakage current	V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 1 V, V <sub>MIC</sub> = 3 V, or V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 3 V, V <sub>MIC</sub> = 1 V	Switch OFF	25°C	3.6 V	-0.5	0.05	0.5	μA
				Full		-2		2	
I <sub>MIC(OFF)</sub>	MIC OFF leakage current	V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 3 V, V <sub>MIC</sub> = 1 V, or V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 1 V, V <sub>MIC</sub> = 3 V	Switch OFF	25°C	3.6 V	-1	0.1	1	μA
				Full		-2		2	
I <sub>SLEEVE(ON)</sub> , I <sub>RING2(ON)</sub>	SLEEVE, RING2 ON leakage current	V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 1 V, V <sub>MIC</sub> = Open, or V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 3 V, V <sub>MIC</sub> = Open	Switch ON	25°C	3.6 V	-2	0.5	2	μA
				Full		-2		2	
I <sub>MIC(ON)</sub>	MIC ON leakage current	V <sub>SLEEVE</sub> or V <sub>RING2</sub> = Open V, V <sub>MIC</sub> = 1 V, or V <sub>SLEEVE</sub> or V <sub>RING2</sub> = Open, V <sub>MIC</sub> = 3 V	Switch ON	25°C	3.6 V	-2	0.5	2	μA
				Full		-2		2	
<b>GND SWITCH</b>									
r <sub>on</sub>	ON-state resistance	I <sub>SLEEVE</sub> or I <sub>RING2</sub> = +32 mA, V <sub>GND</sub> = 0 V, I <sub>GND</sub> = -32 mA	Switch ON	25°C	3 V	0.08	0.09	Ω	
				Full					0.11
I <sub>SLEEVE(OFF)</sub> , I <sub>RING2(OFF)</sub>	SLEEVE, RING2 OFF leakage current	V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 3V and V <sub>GND</sub> = 0 V	Switch OFF	25°C	3.6 V	-0.5	0.05	0.5	μA
						Full	-1		
I <sub>SLEEVE(PWROFF)</sub> , I <sub>RING2(PWROFF)</sub>	SLEEVE, RING2 OFF leakage current	V <sub>SLEEVE</sub> or V <sub>RING2</sub> = 0 to 3.6 V and V <sub>GND</sub> = 0 V	Switch OFF	25°C	0 V	-1	0.5	1	μA
						Full	-10		

- (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		
$C_{SLEEVE}$	SLEEVE / RING2 capacitance	SEL=High	25°C	3.3 V		100	140	pF	
		SEL=Low	25°C	3.3 V		100	140		
$C_I$	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**

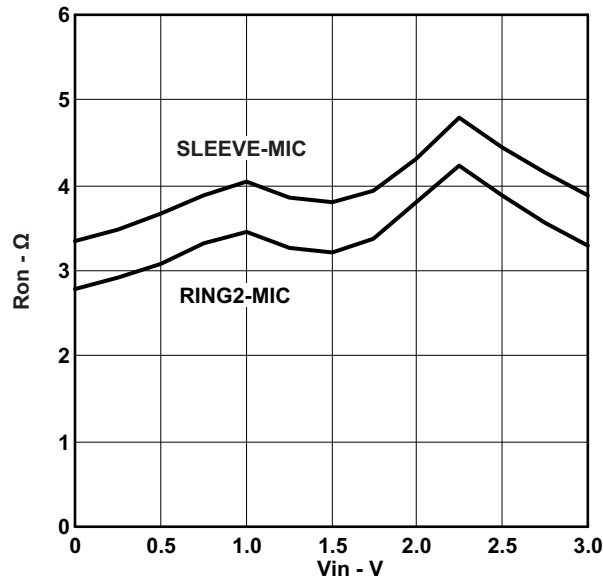
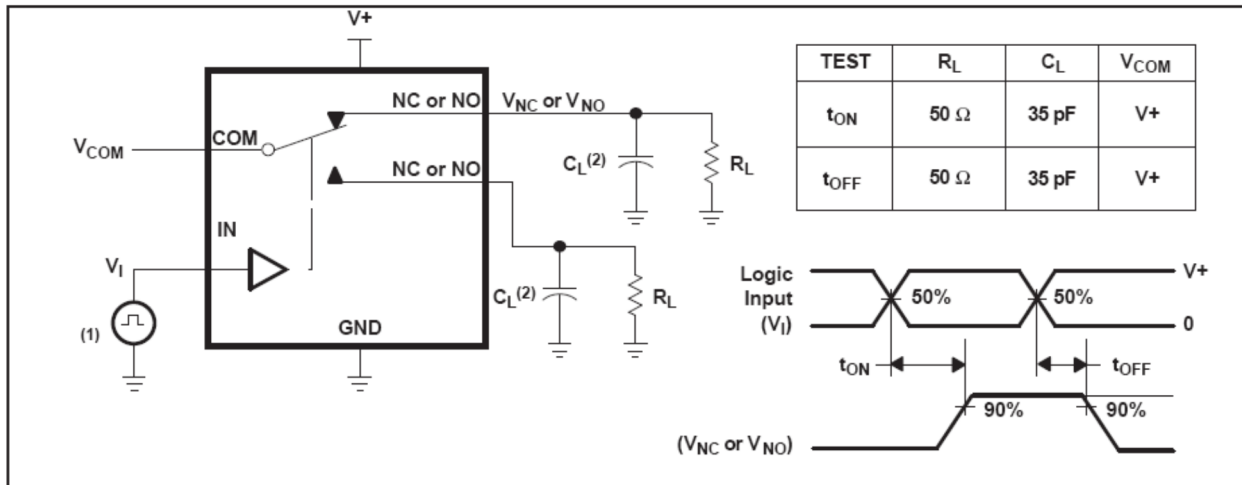


Figure 3. RON vs VIN (MIC Switch)

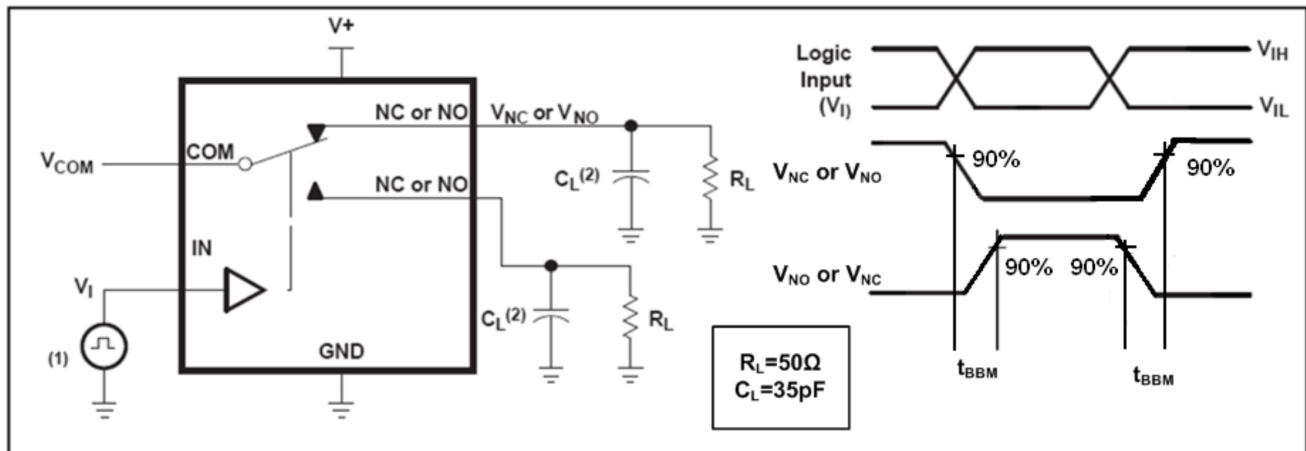
**PARAMETER MEASUREMENT INFORMATION**



- A. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, ZO = 50 Ω, tr < 5 ns, tf < 5 ns.
- B. CL includes probe and jig capacitance.

Figure 4. Turn-On (tON) and Turn-Off Time (tOFF)

PARAMETER MEASUREMENT INFORMATION (continued)



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

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

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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 part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TS3A26746EYZPR</a>	Active	Production	DSBGA (YZP)   6	3000   LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	7N
TS3A26746EYZPR.B	Active	Production	DSBGA (YZP)   6	3000   LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	7N

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

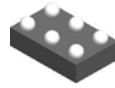
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS3A26746EYZPR	DSBGA	YZP	6	3000	180.0	8.4	1.02	1.52	0.63	4.0	8.0	Q1

**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	20.0

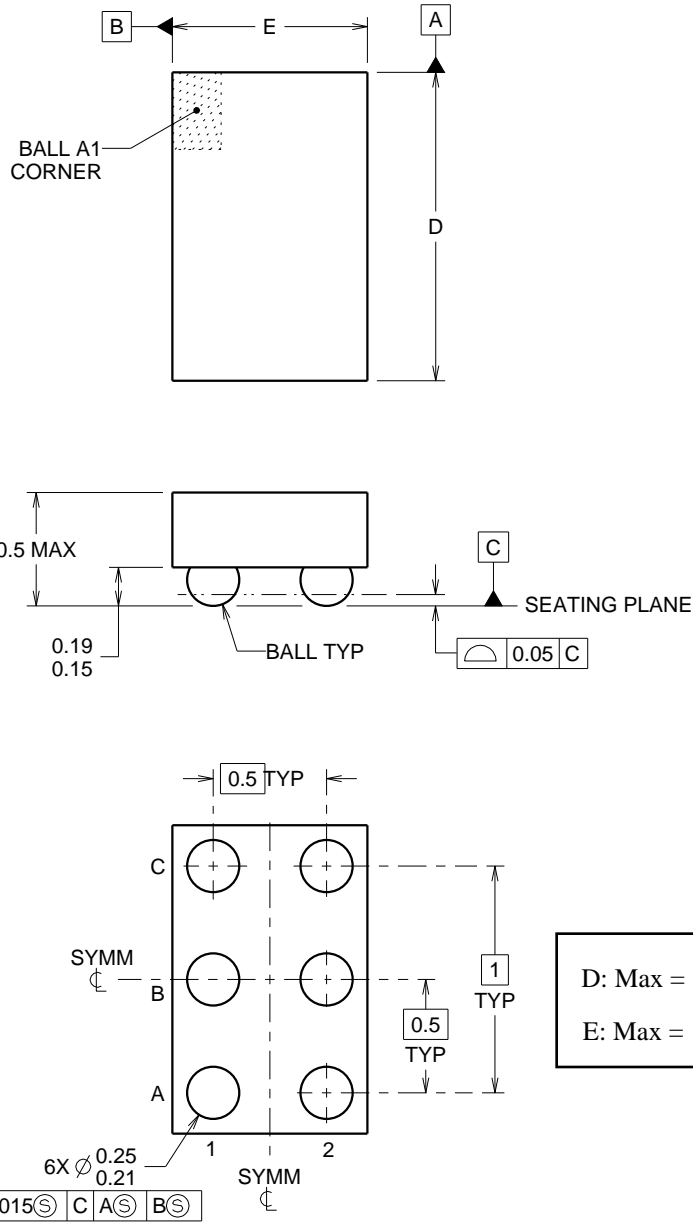
YZP0006



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4219524/A 06/2014

NOTES:

NanoFree Is a trademark of Texas Instruments.

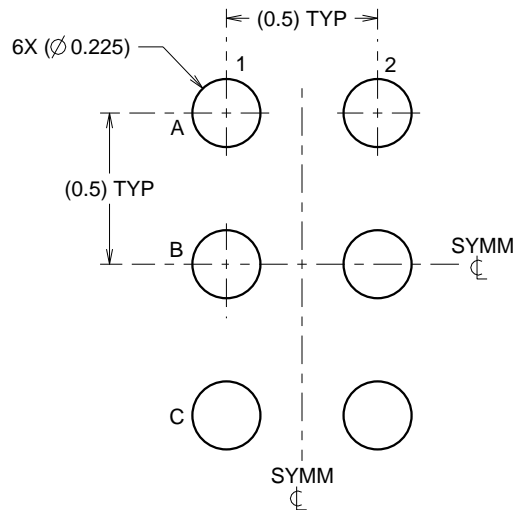
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. NanoFree™ package configuration.

# EXAMPLE BOARD LAYOUT

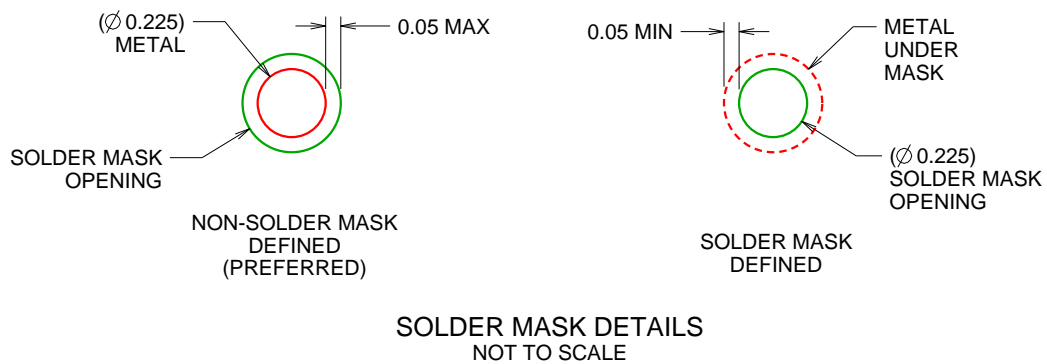
YZP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE  
SCALE:40X



4219524/A 06/2014

NOTES: (continued)

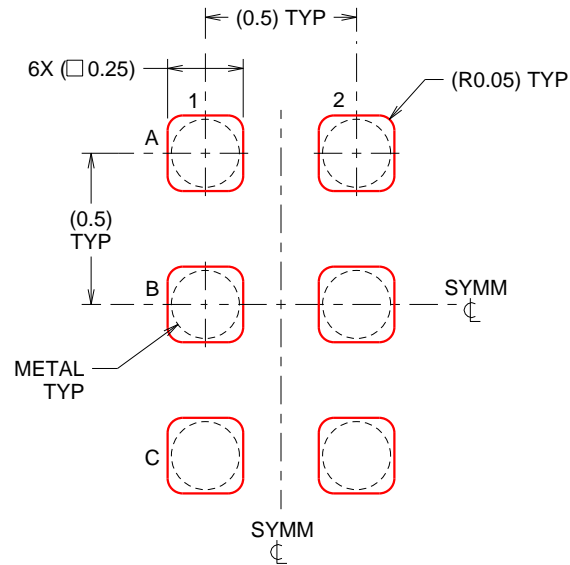
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SBVA017 ([www.ti.com/lit/sbva017](http://www.ti.com/lit/sbva017)).

# EXAMPLE STENCIL DESIGN

YZP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICK STENCIL  
SCALE:40X

4219524/A 06/2014

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

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