

# Autonomous Audio Headset Switch with Reduced GND Switch $R_{ON}$ and FM Capability

Check for Samples: [TS3A226AE](#)

## FEATURES

- Ground FET Switches (60m $\Omega$  typical)
- Autonomous Detection of Headset Types: 3-Poles or 4-Poles (with MIC on SLEEVE or RING2)
- Microphone Line Switches
- Supports FM Signal Transmission Through the Ground FETs
- Reduction of Click/Pop Noise
- VDD Range: 2.6 V – 4.7 V
- THD (Mic): 0.002% Typical
- Low Current Consumption: 6.5- $\mu$ A Typical
- $\pm$ 8kV Contact Discharge (IEC 61000-4-2) ESD Performance on SLEEVE and RING2 Pins

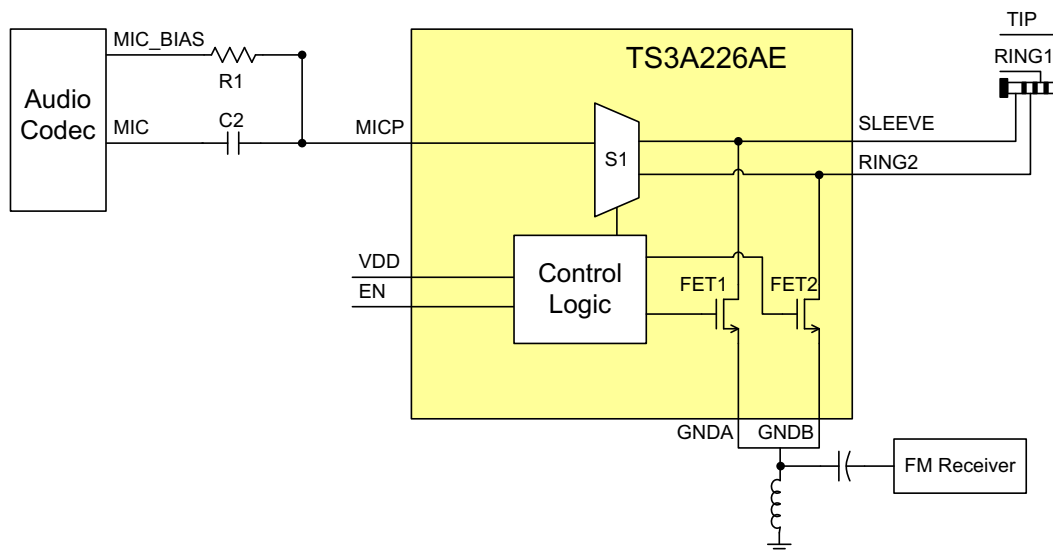
## APPLICATIONS

- Mobile Phones / Tablet PCs
- Notebook/Ultrabook Computers

## DESCRIPTION

The TS3A226AE is an audio headset switch that detects 3- or 4-pole 3.5mm accessories. For a 4-pole accessory with a microphone, the TS3A226AE also detects the MIC location and routes the microphone and ground signals automatically. The ground signal is routed through a pair of low-impedance ground FETs (60m $\Omega$  typical), resulting minimal impact on audio cross-talk performance. The autonomous detection feature allows end users to plug in accessories with different audio pole configurations into the mobile device and have them operate properly with no added software control and complexity. The ground FETs of the device are designed to allow FM signal pass-through, making it possible to use the ground line of the headset as an FM antenna in mobile audio application.

The TS3A226AE is packaged within a 1.2mm x 1.2mm WCSP package, making it suitable for use in mobile application.



**Figure 1. Typical Application Diagram**

## ORDERING INFORMATION

For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com)



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.

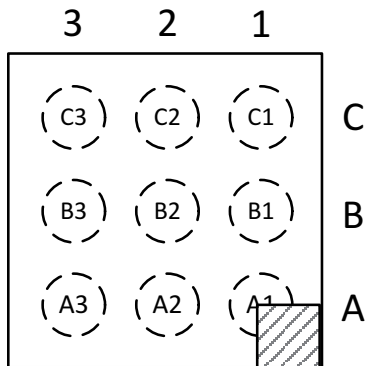
# TS3A226AE

SCDS346A – JUNE 2013 – REVISED JULY 2013

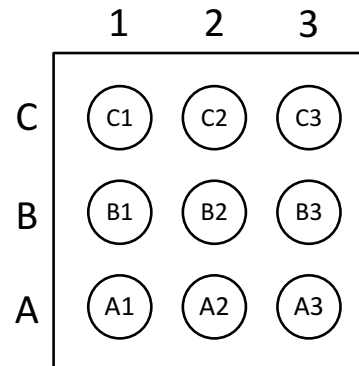
[www.ti.com](http://www.ti.com)


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.

## PACKAGE; YFF-WCSP



Top View/Footprint



Bump View

Die Size: 1.2mm × 1.2mm

Bump Size: 0.25mm

Bump Pitch: 0.4mm

### TS3A226AE Pin Mapping (Top View)

	3	2	1
C	GND	TIP	EN
B	SLEEVE	GNDA	MICp
A	RING2	GNDB	VDD

### PIN FUNCTIONS

PIN			DESCRIPTION
NUMBER	NAME	TYPE	
A1	VDD	Supply	Power supply for the chip.
A2	GNDB	Ground	FET2 ground reference.
A3	RING2	I/O	Connected to the RING2 segment of the jack. The pin will be routed automatically by TS3A226AE to either MICp or GNDB depending on the type of accessory.
B1	MICp	I/O	Microphone signal connection to codec. Microphone bias should be fed into this pin.
B2	GNDA	Ground	FET1 ground reference.
B3	SLEEVE	I/O	Connected to the SLEEVE segment of the jack. The pin will be routed automatically by TS3A226AE to either MICp or GNDA depending on the type of accessory.
C1	EN	Input	A rising edge triggers the detection sequence. This pin can be connected to the headset jack to allow automatic pull-up to supply after headset insertion.
C2	TIP	I/O	Connected to the TIP segment of the headphone jack.
C3	GND	Ground	Chip ground reference.

## S1 MUX DETAIL

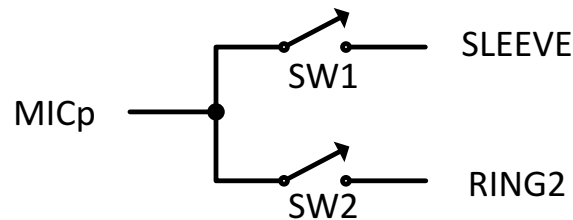


Figure 2. S1 Mux Detail

## FUNCTIONAL TABLES: INTERNAL SWITCHES

EN	Accessory Type	Accessory Configuration	SW1	SW2	FET1	FET2
0	N/A	—	High Z	High Z	High Z	High Z
1	TRS 3-pole Headphone or Speaker	TIP = Audio Left Ring = Audio Right Sleeve = <b>Ground</b>	On	On	On	On
1	TRRS 4-pole Headphone	TIP = Audio Left Ring1 = Audio Right Ring2 = <b>Ground</b> Sleeve = <b>Microphone</b>	On	High Z	High Z	On
1	TRRS 4-pole Headphone	TIP = Audio Left Ring1 = Audio Right Ring2 = <b>Microphone</b> Sleeve = <b>Ground</b>	High Z	On	On	High Z
1	N/A	—	On	On	On	On

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		VALUE	UNIT
V <sub>I</sub>	Voltage range on VDD <sup>(2)</sup>	–0.3 to 5	V
	Voltage range on EN, MICP, RING2, SLEEVE, TIP <sup>(2)</sup>	–0.3 to V <sub>DD</sub> +0.5	V
T <sub>A</sub>	Operating ambient temperature range <sup>(3)</sup>	–40 to 85	°C
T <sub>J (MAX)</sub>	Maximum operating junction temperature	125	°C
T <sub>stg</sub>	Storage temperature range	–65 to 150	°C
ESD rating	Charge device model (JESD 22 C101)	500	V
	Human body model(JESD 22 A114)	2	kV
	Contact discharge on RING2, SLEEVE, TIP (IEC 61000-4-2)	8	kV

- (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 voltage values are with respect to network ground terminal.
- (3) In applications where high power dissipation and/or poor package thermal resistance is present, the maximum ambient temperature may have to be derated. Maximum ambient temperature [T<sub>A(max)</sub>] is dependent on the maximum operating junction temperature [T<sub>J(max)</sub>], the maximum power dissipation of the device in the application [P<sub>D(max)</sub>], and the junction-to-ambient thermal resistance of the part/package in the application (θ<sub>JA</sub>), as given by the following equation: T<sub>A(max)</sub> = T<sub>J(max)</sub> – (θ<sub>JA</sub> × P<sub>D(max)</sub>)

# TS3A226AE

SCDS346A – JUNE 2013 – REVISED JULY 2013

[www.ti.com](http://www.ti.com)

## RECOMMENDED OPERATING CONDITIONS

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

		MIN	MAX	UNIT
V <sub>DD</sub>	Supply voltage range	2.6	4.5	V
V <sub>IO</sub>	Input/Output voltage range (EN, MICP, RING2, SLEEVE, TIP)	0	V <sub>DD</sub>	V
V <sub>IO(TIP)</sub>	Input/Output voltage range for TIP	-2.0	V <sub>DD</sub>	V
V <sub>IH</sub>	Input Logic High for EN	V <sub>DD</sub> = 2.6 V	1.16	V <sub>DD</sub>
		V <sub>DD</sub> = 3.3 V	1.24	V <sub>DD</sub>
		V <sub>DD</sub> = 4.5 V	1.48	V <sub>DD</sub>
V <sub>IL</sub>	Input Logic Low for EN	V <sub>DD</sub> = 2.6 V	0	0.19
		V <sub>DD</sub> = 3.3 V	0	0.3
		V <sub>DD</sub> = 4.5 V	0	0.5
T <sub>A</sub>	Operating temperature range	-40	85	°C

## KEY ELECTRICAL CHARACTERISTICS

Unless otherwise noted the specification applies over the V<sub>DD</sub> range and operating junction temperature -40°C ≤ T<sub>A</sub> ≤ 70°C. Typical values are for V<sub>DD</sub> = 3.3V and T<sub>J</sub> = 25°C.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V <sub>DD</sub>	Input Voltage Range		2.6	3.3	4.5	V
I <sub>DD</sub>	Quiescent Current	V <sub>DD</sub> = 4.5 V, V <sub>MICp</sub> = 1.8 V to V <sub>DD</sub> , EN=L or EN=H (after detection)		6.5	14	μA
SWITCH RESISTANCE						
R <sub>F1</sub>	FET1 On Resistance	V <sub>DD</sub> = 2.6 V, V <sub>GND</sub> = 0 V, I <sub>GND</sub> = 10 mA		60	85	mΩ
R <sub>F2</sub>	FET2 On Resistance			60	85	
R <sub>SW1</sub>	SW1 On Resistance	V <sub>DD</sub> = 2.6 V, V <sub>SLEEVE/RING2</sub> = 0 V to 2.6 V, I <sub>MIC</sub> = ±10 mA		8.5	10.5	Ω
R <sub>SW2</sub>	SW2 On Resistance			8.5	10.5	
SWITCH LEAKAGE CURRENT						
I <sub>OFF-0.1</sub>	FET1 and FET2 off leakage	V <sub>IN</sub> = 0 V to 2.6 V, V <sub>OUT</sub> = 0 V, V <sub>DD</sub> = 4.5 V			1	μA
I <sub>OFF-10</sub>	SW1, SW2 off leakage				1	
I <sub>ON-10</sub>	SW1, SW2 on leakage				1	
SWITCH DYNAMIC CHARACTERISTICS						
BW <sub>F1</sub>	FET1 Bandwidth	V = 60 mV <sub>PP</sub> , I <sub>bias</sub> = 10 mA		160	200	MHz
BW <sub>F2</sub>	FET2 Bandwidth			160	200	
PSR <sub>217</sub>	Power Supply Rejection, R <sub>L</sub> = 50 Ω	V = 200 mV <sub>PP</sub> , f = 217 Hz		-110		dB
PSR <sub>1k</sub>		V = 200 mV <sub>PP</sub> , f = 1 kHz		-100		dB
PSR <sub>20k</sub>		V = 200 mV <sub>PP</sub> , f = 20 kHz		-85		dB
ISO <sub>S1</sub>	SLEEVE or RING2 to MICP Isolation	V = 200 mV <sub>PP</sub> , f = 20 kHz, R <sub>L</sub> = 50 Ω		-80		dB
SEP <sub>S1</sub>	SLEEVE to RING2 Separation	V = 200 mV <sub>PP</sub> , f = 20 kHz, R <sub>L</sub> = 50 Ω (see <a href="#">Figure 5</a> )		-80		dB
THD <sub>10</sub>	Total Harmonic Distortion	V = 10 mV <sub>PP</sub> , f = 20-20 kHz, R <sub>S</sub> = 600 Ω		0.01%		
THD <sub>200</sub>		V = 200 mV <sub>PP</sub> , f = 20-20 kHz, R <sub>S</sub> = 600 Ω		0.002%		
TIMING CHARACTERISTICS						
t <sub>detect</sub>	Total detection time	From EN=H to S1 switch(es) closing		180		ms

## TYPICAL CHARACTERISTICS

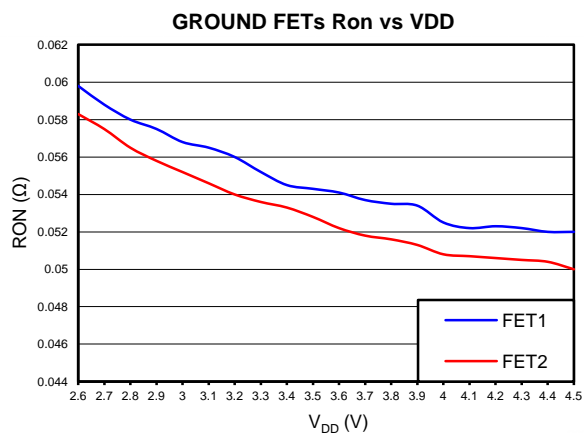


Figure 3.

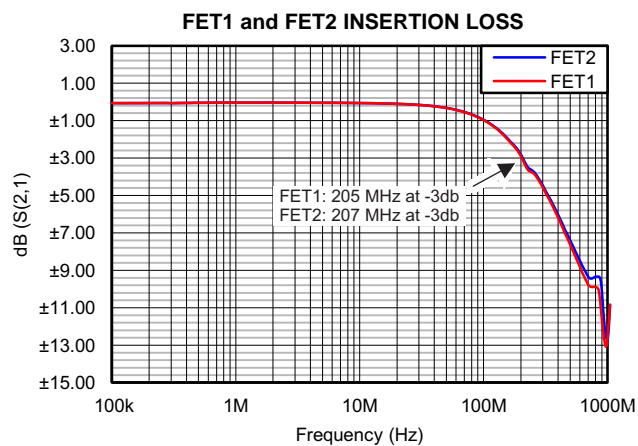


Figure 4.

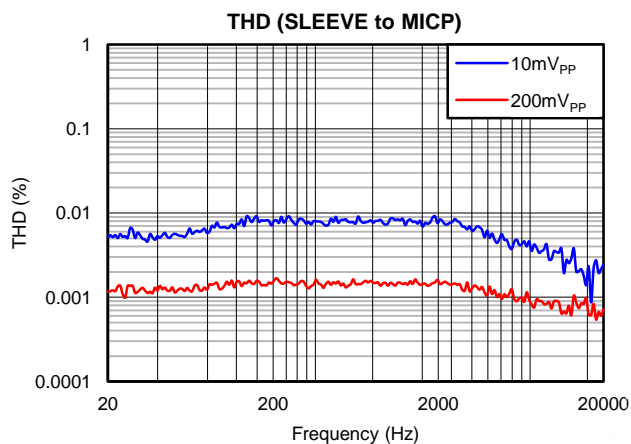


Figure 5.

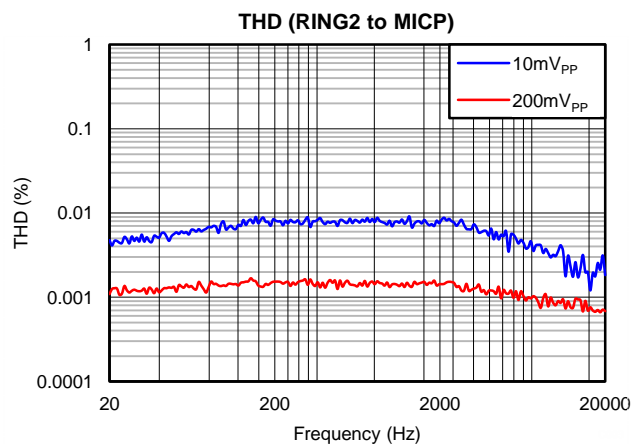


Figure 6.

## REVISION HISTORY

Changes from Original (June 2013) to Revision A	Page
• Removed Machine Model ESD specification. ....	<a href="#">3</a>
• Added EN=L or EN=H (after detection) to I <sub>DD</sub> TEST CONDITIONS. ....	<a href="#">4</a>
• Added typical values to R <sub>SW1</sub> and R <sub>SW2</sub> . ....	<a href="#">4</a>
• Added t <sub>dect</sub> PARAMETER to KEY ELECTRICAL CHARACTERISTICS table. ....	<a href="#">4</a>

## 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="#">TS3A226AEYFFR</a>	Active	Production	DSBGA (YFF)   9	3000   LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	YP2 26AE
TS3A226AEYFFR.A	Active	Production	DSBGA (YFF)   9	3000   LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	YP2 26AE

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

<sup>(2)</sup> **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.

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

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

## TAPE AND REEL INFORMATION



\*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
TS3A226AEYFFR	DSBGA	YFF	9	3000	180.0	8.4	1.46	1.36	0.7	4.0	8.0	Q1



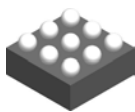
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS3A226AEYFFR	DSBGA	YFF	9	3000	182.0	182.0	20.0

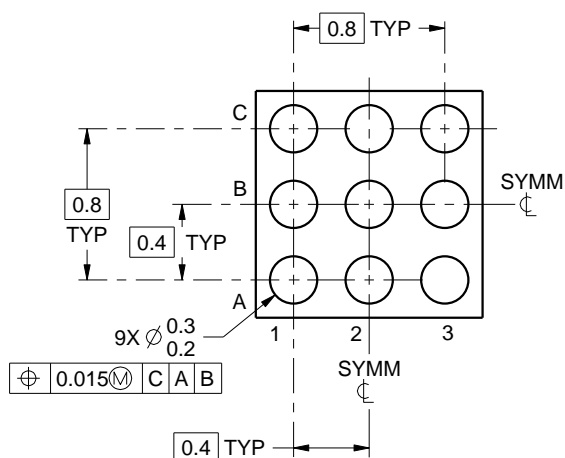
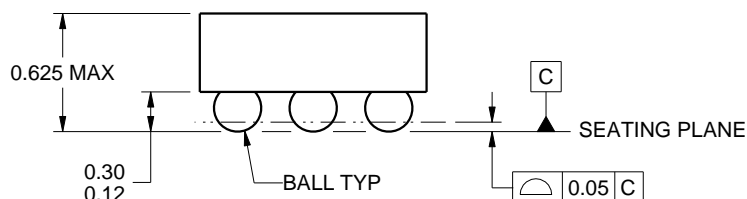
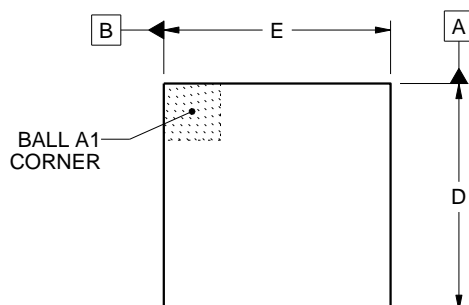
YFF0009



# PACKAGE OUTLINE

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



D: Max = 1.386 mm, Min = 1.326 mm

E: Max = 1.286 mm, Min = 1.226 mm

4219552/A 05/2016

## NOTES:

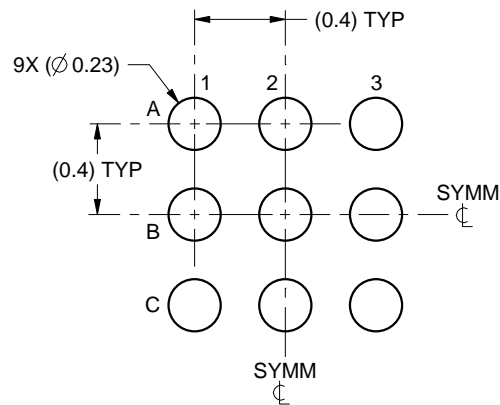
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

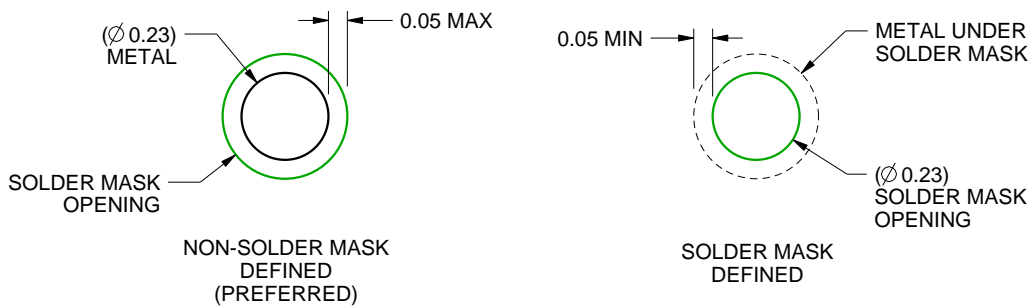
YFF0009

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE  
SCALE:30X



SOLDER MASK DETAILS  
NOT TO SCALE

4219552/A 05/2016

NOTES: (continued)

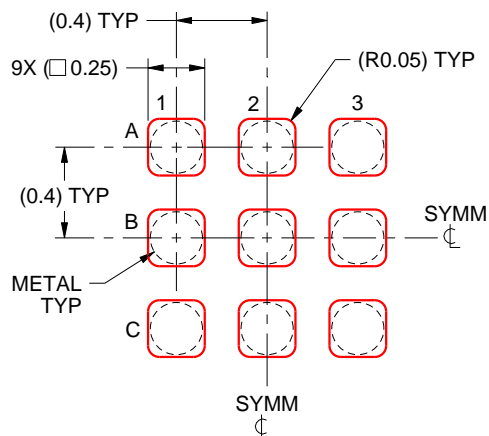
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).

## EXAMPLE STENCIL DESIGN

YFF0009

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICK STENCIL  
SCALE:30X

4219552/A 05/2016

NOTES: (continued)

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

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2025, Texas Instruments Incorporated