

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

Check for Samples: [TS3A226AE](#)

FEATURES

- Ground FET Switches (60mΩ 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-μA Typical
- ±8kV Contract 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 (60mΩ 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.

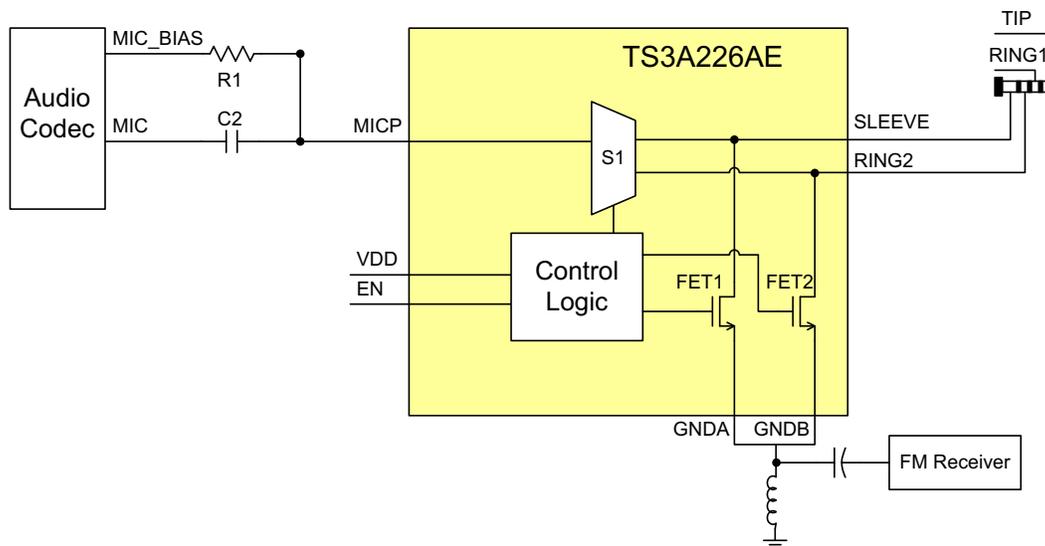


Figure 1. Typical Application Diagram

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



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TS3A226AE

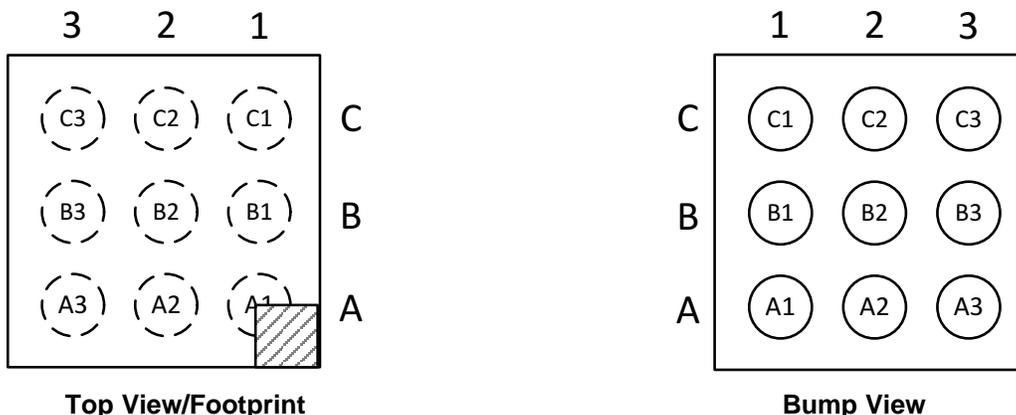
SCDS346A – JUNE 2013 – REVISED JULY 2013

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



Die Size: 1.2mm x 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

NUMBER	PIN		DESCRIPTION
	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

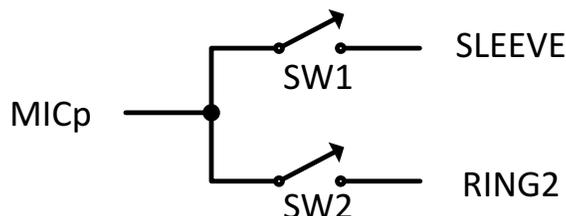


Figure 2. S1 Mux Detail

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 = Ground	On	On	On	On
1	TRRS 4-pole Headphone	TIP = Audio Left Ring1 = Audio Right Ring2 = Ground Sleeve = Microphone	On	High Z	High Z	On
1	TRRS 4-pole Headphone	TIP = Audio Left Ring1 = Audio Right Ring2 = Microphone Sleeve = Ground	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)⁽¹⁾

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

- 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.
- All voltage values are with respect to network ground terminal.
- 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_{A(max)}] is dependent on the maximum operating junction temperature [T_{J(max)}], the maximum power dissipation of the device in the application [P_{D(max)}], and the junction-to-ambient thermal resistance of the part/package in the application (θ_{JA}), as given by the following equation: T_{A(max)} = T_{J(max)} - (θ_{JA} × P_{D(max)})

RECOMMENDED OPERATING CONDITIONS

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

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

KEY ELECTRICAL CHARACTERISTICS

 Unless otherwise noted the specification applies over the V_{DD} range and operating junction temperature $-40^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$. Typical values are for V_{DD} = 3.3V and T_J = 25°C.

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

TYPICAL CHARACTERISTICS

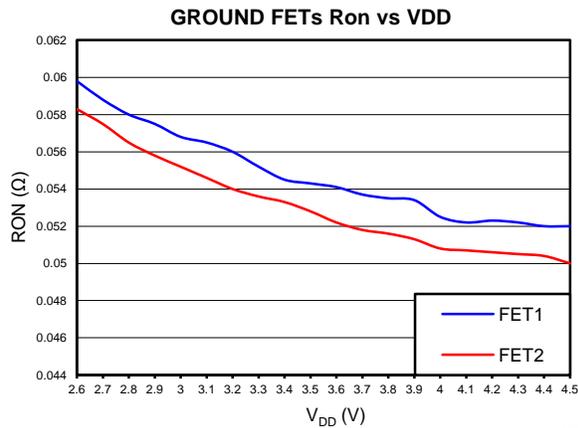


Figure 3.

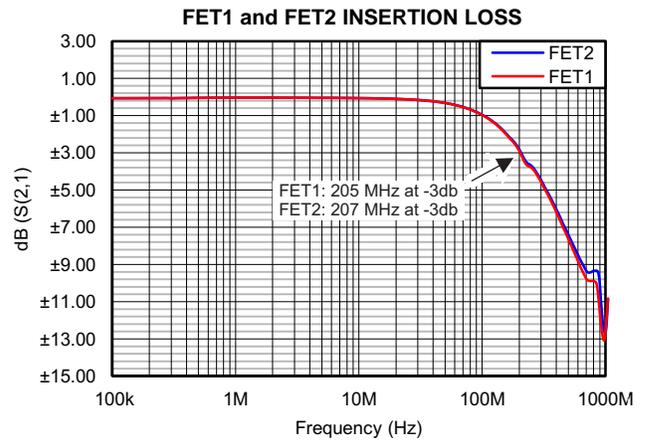


Figure 4.

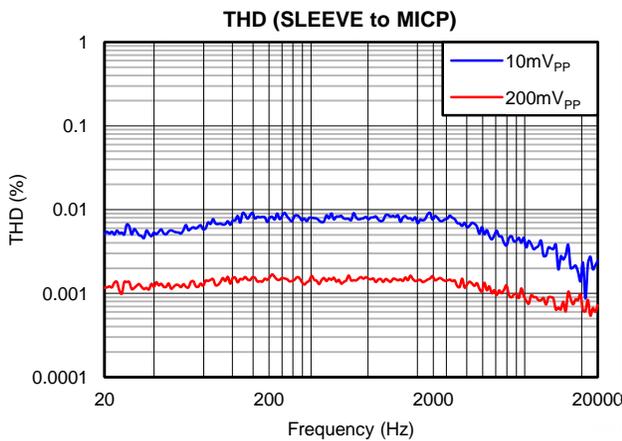


Figure 5.

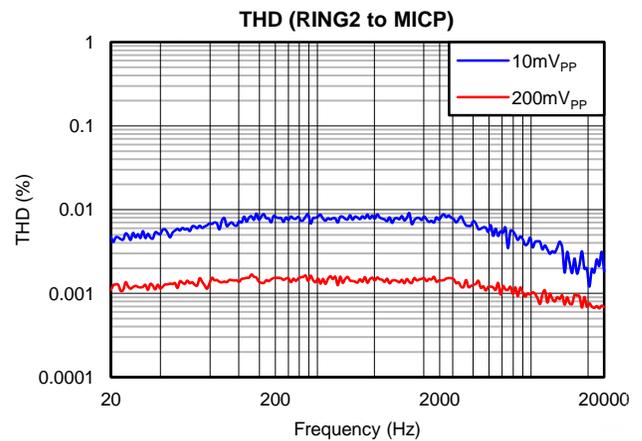


Figure 6.

REVISION HISTORY

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

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)
TS3A226AEYFFR	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

(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

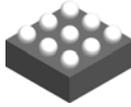
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TS3A226AEYFFR	DSBGA	YFF	9	3000	180.0	8.4	1.46	1.36	0.7	4.0	8.0	Q1

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

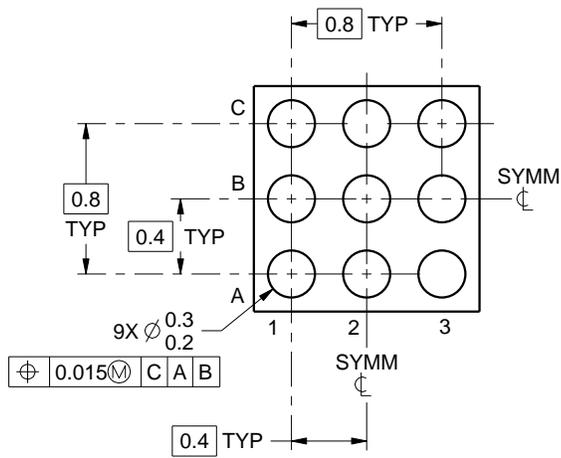
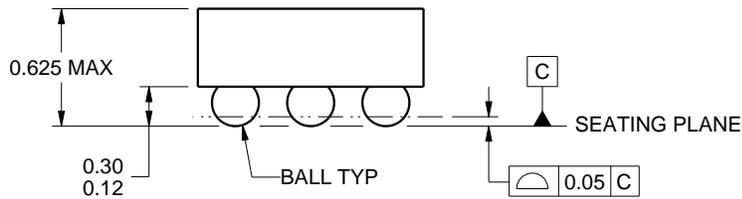
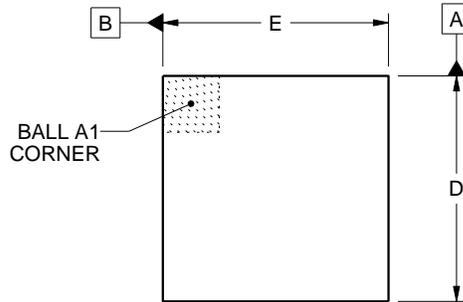
YFF0009



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

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NOTES:

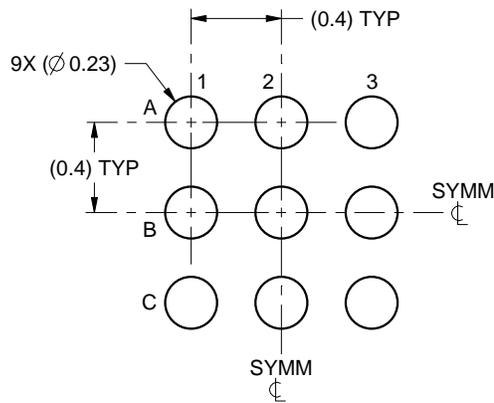
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

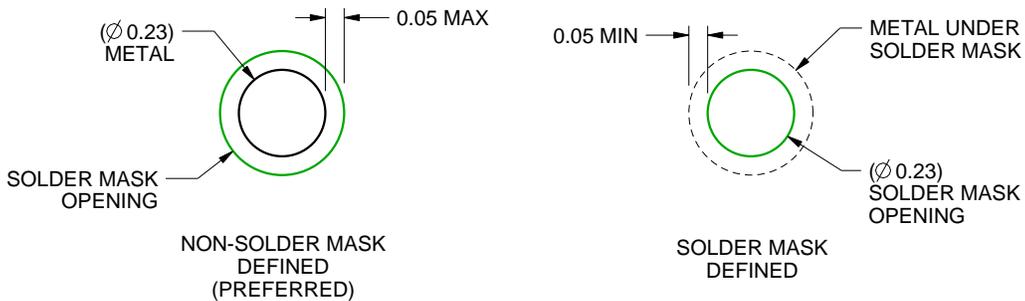
YFF0009

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:30X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

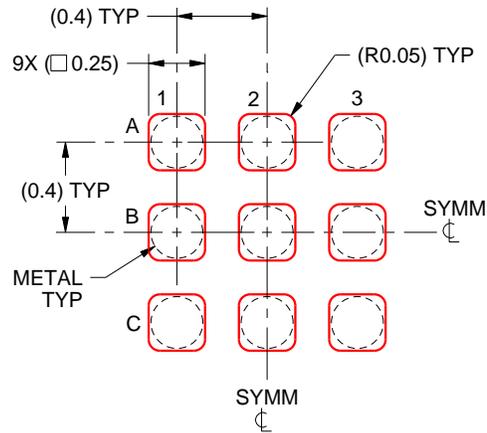
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).

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

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NOTES: (continued)

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

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