# 具有减少的接地 (GND) 开关 $R_{导通}$和调频 (FM) 功能的自主音频头戴式耳机开关

查询样品: TS3A226AE

## 特性

- 接地场效应晶体管 **(FET)** 开关（典型值 **60mΩ**）
- 耳机类型的自主检测：
  **3** 极或 **4** 极（**SLEEVE** 或 **RING2** 上有麦克风 **(MIC)**）
- 麦克风线路开关
- 支持通过接地 **FET** 传输 **FM** 信号
- 减少卡嗒/爆裂噪音
- **VDD** 范围：**2.6V – 4.7V**
- 总谐波失真 **(THD) (Mic)**：典型值 **0.002%**
- 低流耗：典型值 **6.5μA**
- **±8kV** 接触放电 **(IEC 61000-4-2)** 静电放电 **(ESD)** **SLEEVE** 和 **RING2** 引脚的性能

## 应用范围

- 移动电话 / 平板个人电脑
- 笔记本计算机/超级本计算机

## 说明

TS3A226AE 是一款音频头戴式耳机开关，此开关可检测 3 极或 4 极 3.5mm 配件。 对于带有麦克风的 4 极配件，TS3A226AE 还能够检测麦克风位置，并自动发送麦克风以及接地信号。 此接地信号通过一对低阻抗接地 FET（典型值 60mΩ）发送，所以大大降低了对音频串扰性能的影响。 自主检测特性使得最终用户能够将具有不同音频极配置的配件插入移动器件中，并使得它们运转正常，而无需增加软件控制，并且不会增加复杂度。 器件的接地 FET 被设计成可让 FM 信号通过，这样的话，可将头戴式耳机的接地线用作移动音频应用中的 FM 天线。

TS3A226AE 采用 1.2mm x 1.2mm 晶圆级芯片 (WCSP) 封装，这使得它适合在移动应用中使用。

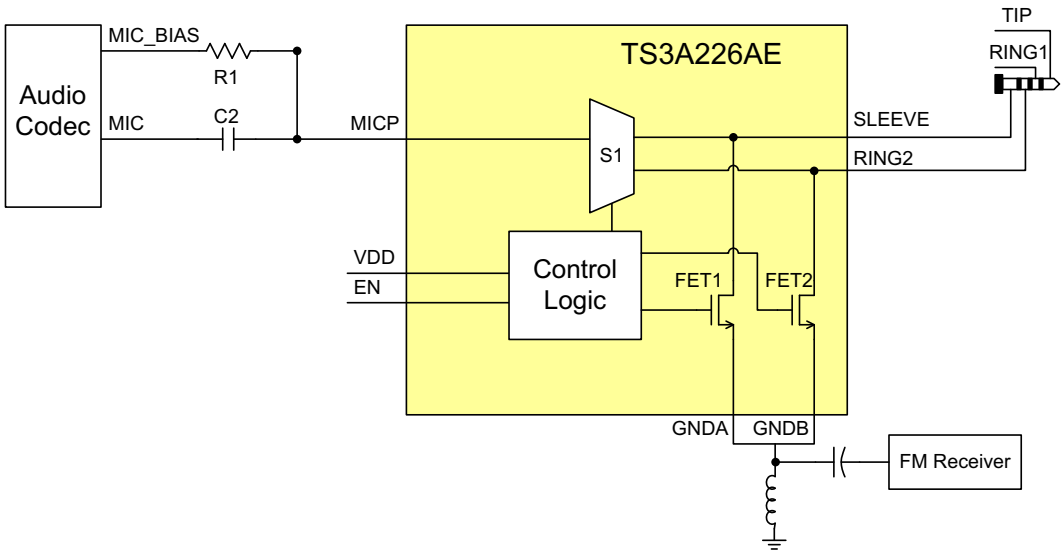


图 **1.** 典型应用图

### 订购信息

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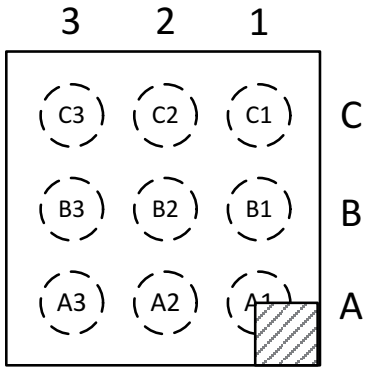
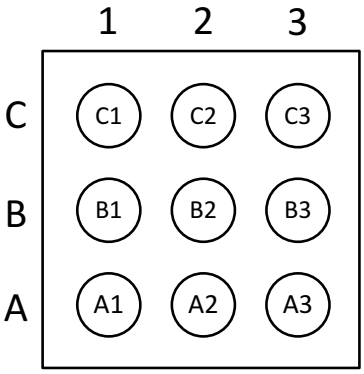
These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## 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. |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## S1 MUX DETAIL

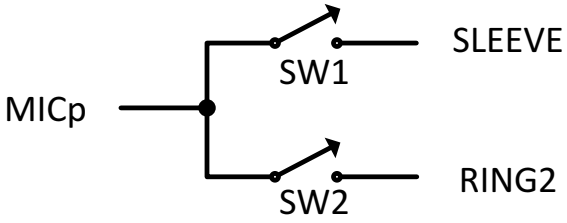


**Figure 2. S1 Mux Detail**

## 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<br>Ring = Audio Right<br>Sleeve = **Ground** | On | On | On | On |
| 1 | TRRS 4-pole Headphone | TIP = Audio Left<br>Ring1 = Audio Right<br>Ring2 = **Ground**<br>Sleeve = **Microphone** | On | High Z | High Z | On |
| 1 | TRRS 4-pole Headphone | TIP = Audio Left<br>Ring1 = Audio Right<br>Ring2 = **Microphone**<br>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 (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 [$T_{A(max)}$] 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 ($\theta_{JA}$), as given by the following equation: $T_{A(max)} = T_{J(max)} - (\theta_{JA} \times P_{D(max)})$

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## 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 | VDD = 2.6 V | 1.16 | $V_{DD}$ | V |
| | | VDD = 3.3 V | 1.24 | $V_{DD}$ | |
| | | VDD = 4.5 V | 1.48 | $V_{DD}$ | |
| $V_{IL}$ | Input Logic Low for EN | VDD = 2.6 V | 0 | 0.19 | V |
| | | VDD = 3.3 V | 0 | 0.3 | |
| | | VDD = 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°C ≤ $T_A$ ≤ 70°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 |


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## TYPICAL CHARACTERISTICS

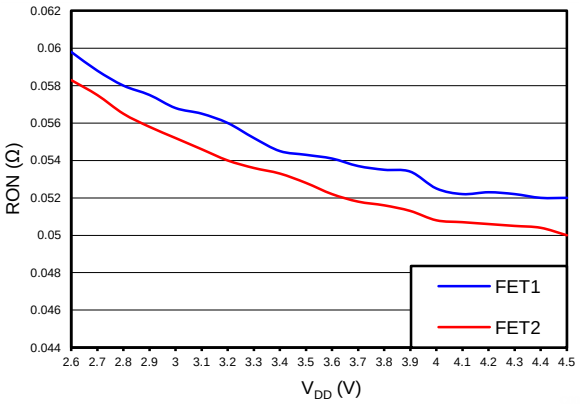


**Figure 3.**

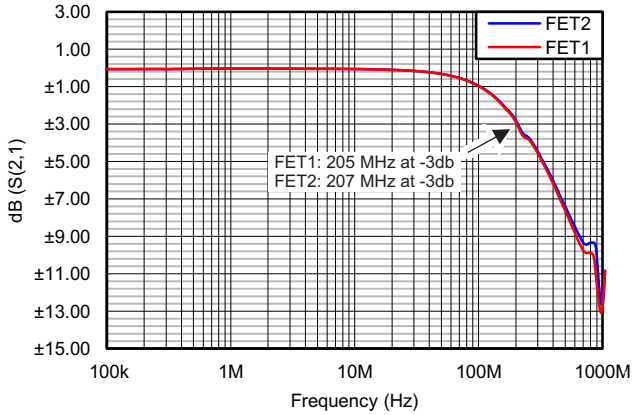


**Figure 4.**

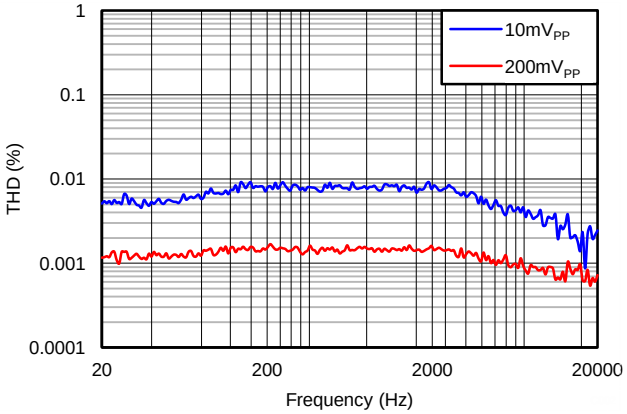


**Figure 5.**

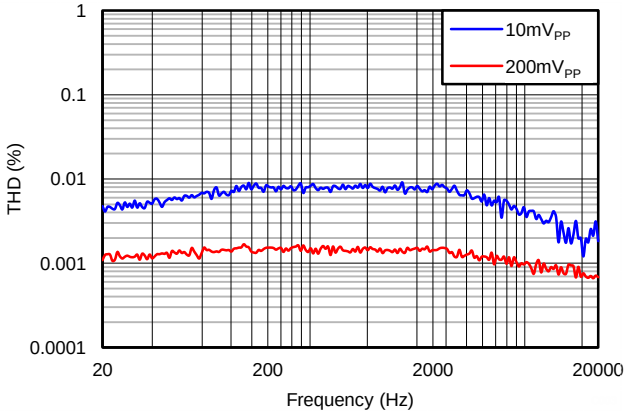


**Figure 6.**

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## 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


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## 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<br>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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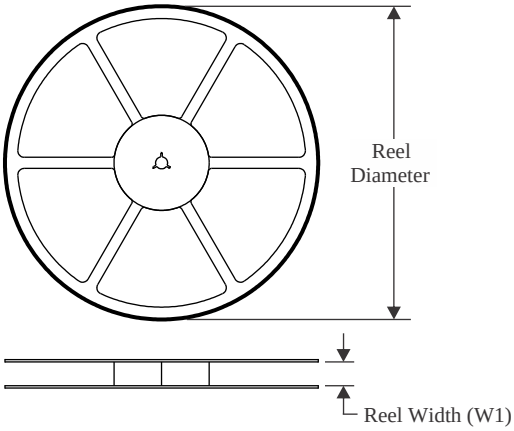
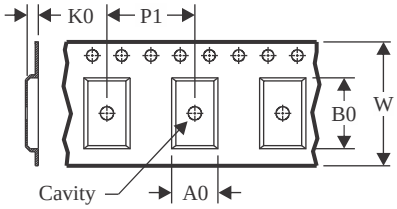
## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

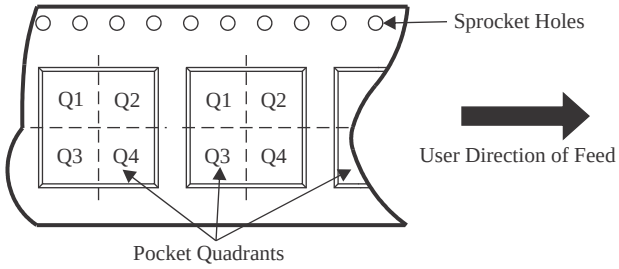



**TAPE DIMENSIONS**




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

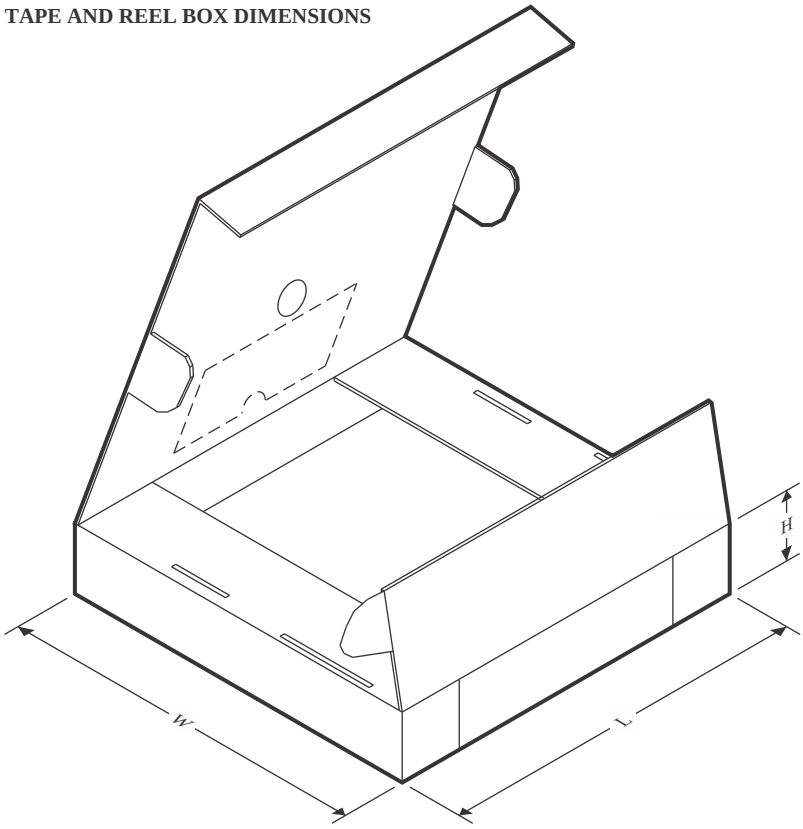
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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

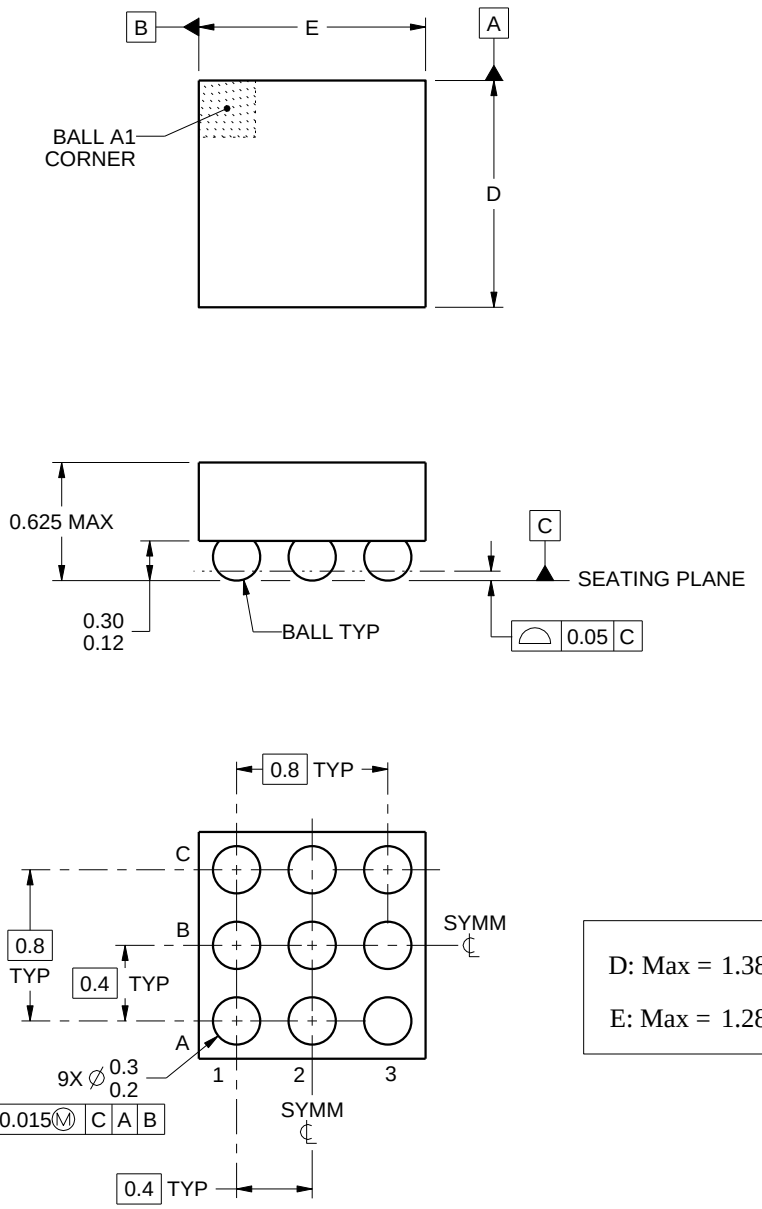
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TS3A226AEYFFR | DSBGA | YFF | 9 | 3000 | 182.0 | 182.0 | 20.0 |

# PACKAGE OUTLINE

## YFF0009

## DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



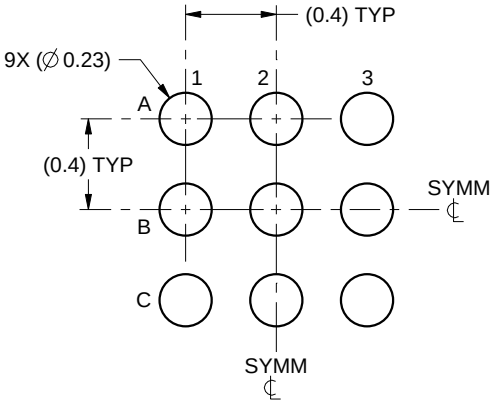

D: Max = 1.386 mm, Min =1.326 mm

E: Max = 1.286 mm, Min =1.226 mm

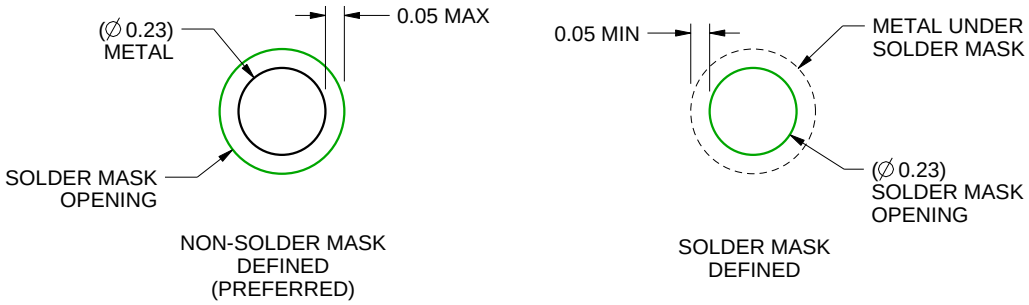
4219552/A 05/2016

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.




LAND PATTERN EXAMPLE
SCALE:30X




SOLDER MASK DETAILS
NOT TO SCALE

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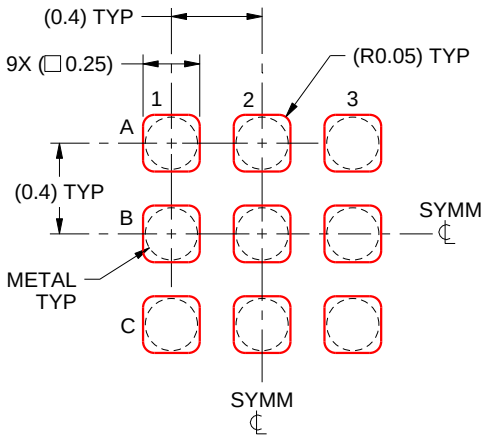
NOTES: (continued)

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).




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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