

ESDS452 采用 SOT-23 封装的 5.5V 双向 TVS 二极管

1 特性

- IEC 61000-4-5 浪涌保护：
 - 18A (8/20 μ s)
- IEC 61000-4-2 ESD 保护：
 - ± 30 kV 接触放电
 - ± 30 kV 气隙放电
- 5.5V 工作电压
- 超低漏电流：
 - 1nA (典型值)
- I/O 电容：
 - 3pF (典型值)
- 双向极性，支持正负电压摆幅
- 双通道器件通过单个元件提供全面的 ESD/浪涌保护
- 小型引线式 SOT-23 可实现低成本的自动光学检测 (AOI)

2 应用

- 终端设备：
 - 工厂自动化和控制
 - 楼宇自动化
 - 电网基础设施
 - HVAC 系统
 - 储能系统

3 说明

ESDS452 是一款双向 ESD 和 TVS 二极管。ESDS452 的额定 ESD 冲击消散值超出了 IEC 61000-4-2 国际标准所规定的最高水平 (± 30 kV 接触放电, ± 30 kV 气隙放电)。根据 IEC 61000-4-5 标准, 该器件可以钳制峰值脉冲电流高达 18A 的 8/20 μ s 浪涌。此外, 二极管的正负低钳位电压有助于防止下游电路在 ESD 或浪涌事件期间暴露于高电压和大电流中。这种保护对于对稳健性和可靠性要求很高的工业系统至关重要。

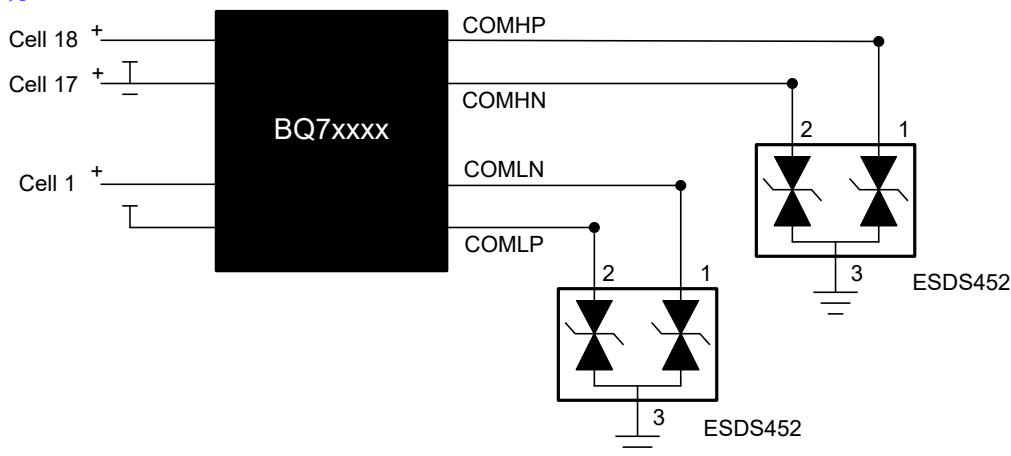
ESDS452 采用小型引线式 SOT-23 (DBZ) 封装。

封装信息

器件型号	封装 ⁽¹⁾	封装尺寸 ⁽²⁾
ESDS452	DBZ (SOT-23, 3)	2.92mm $\times$ 2.37mm

(1) 有关更多信息, 请参阅节 9。

(2) 封装尺寸 (长 $\times$ 宽) 为标称值, 并包括引脚 (如适用)。



BMS 的典型应用



Table of Contents

1 特性.....	1	6 Application and Implementation.....	6
2 应用.....	1	6.1 Application Information.....	6
3 说明.....	1	7 Device and Documentation Support.....	7
4 Pin Configuration and Functions.....	2	7.1 Documentation Support.....	7
5 Specifications.....	3	7.2 接收文档更新通知.....	7
5.1 Absolute Maximum Ratings.....	3	7.3 支持资源.....	7
5.2 ESD Ratings -JEDEC Specifications.....	3	7.4 Trademarks.....	7
5.3 ESD Ratings - IEC Specifications.....	3	7.5 静电放电警告.....	7
5.4 Recommended Operating Conditions.....	3	7.6 术语表.....	7
5.5 Thermal Information.....	3	8 Revision History.....	7
5.6 Electrical Characteristics.....	4	9 Mechanical, Packaging, and Orderable Information....	7
5.7 Typical Characteristics.....	5		

4 Pin Configuration and Functions

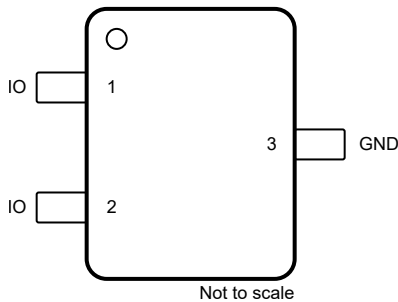


图 4-1. ESDS452 DBZ Package, 3-Pin SOT-23 (Top View)

表 4-1. Pin Functions for ESDS452

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	NO.		
IO	1, 2	I/O	Surge and ESD protected IO
GND	3	GND	Ground. Connect to ground

(1) I = Input, O = Output, I/O = Input or Output, GND = ground

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

Parameter		MIN	MAX	UNIT
P _{PPM}	IEC 61000-4-5 Surge (t _p = 8/20μs) Peak Pulse Power at 25 °C		172	W
I _{PPM}	IEC 61000-4-5 Surge (t _p = 8/20μs) Peak Pulse Current at 25 °C		18	A
T _A	Operating free-air temperature	- 40	125	°C
T _{stg}	Storage temperature	- 65	155	°C

- (1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. Absolute maximum ratings do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*. If briefly operating outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, the device may not sustain damage, but it may not be fully functional. Operating the device in this manner may affect device reliability, functionality, performance, and shorten the device lifetime.

5.2 ESD Ratings -JEDEC Specifications

Parameter		Test Conditions	VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins ⁽¹⁾	±2500	V
		Charged device model (CDM), per JEDEC specification JS-002, all pins ⁽²⁾	±1000	

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 ESD Ratings - IEC Specifications

Parameter		Test Conditions	VALUE	UNIT
V _(ESD)	Electrostatic discharge	IEC 61000-4-2 Contact Discharge, all pins	±30000	V
		IEC 61000-4-2 Air Discharge, all pins	±30000	

5.4 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
V _{IN}	Input voltage	- 5.5		5.5	V
T _A	Operating Free Air Temperature	- 40		125	°C

5.5 Thermal Information

THERMAL METRIC ⁽¹⁾		ESDS452	UNIT
		DBZ (SOT-23)	
		3 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	309.5	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	162.4	°C/W
R _{θJB}	Junction-to-board thermal resistance	149.0	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	41.0	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	147.9	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	°C/W

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

5.6 Electrical Characteristics

At TA = 25°C unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _{RWM}	Reverse stand-off voltage	I _{IO} < 50nA	-5.5		5.5	V
I _{LEAK}	Leakage current at V _{RWM}	V _{IO} = ±5.5 V, I/O to GND and GND to I/O		1	50	nA
V _{BR}	Breakdown voltage, I/O to GND ⁽¹⁾	I _{IO} = ±1mA	7	8	9	V
V _{CLAMP}	Surge clamping voltage, t _p = 8/20 μs ⁽²⁾	I _{PP} = ±1 A, I/O to GND		7.5	10	V
V _{CLAMP}	Surge clamping voltage, t _p = 8/20 μs ⁽²⁾	I _{PP} = ±15 A, I/O to GND		11.5	14	V
V _{CLAMP}	TLP clamping voltage, t _p = 100ns ⁽³⁾	I _{PP} = ±16 A, I/O to GND		9.6		V
R _{DYN}	Dynamic resistance ⁽⁴⁾	I/O to GND		0.29		Ω
		GND to I/O		0.29		
C _{LINE}	Line capacitance, IO to GND	V _{IO} = 0 V, f = 1 MHz		3	5	pF

(1) V_{BR} is defined as the voltage when ±1mA is applied in the positive or negative direction respectively.

(2) Device stressed with 8/20 μs exponential decay waveform according to IEC 61000-4-5

(3) Non-repetitive square wave current pulse, Transmission Line Pulse (TLP); ANSI / ESD STM5.5.1-2008

(4) 8/20 μs (IEC 61000-4-5) dynamic resistance

5.7 Typical Characteristics

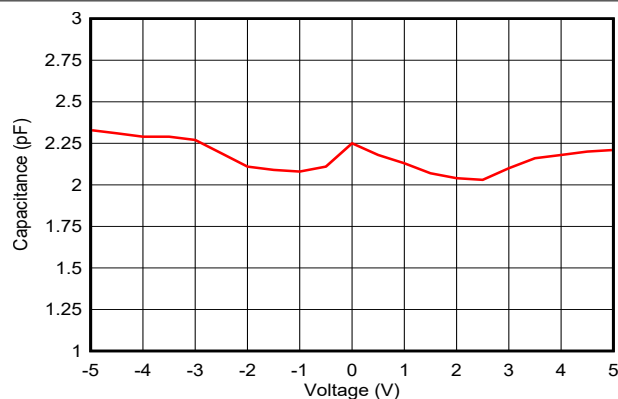


图 5-1. Capacitance vs. Bias Voltage

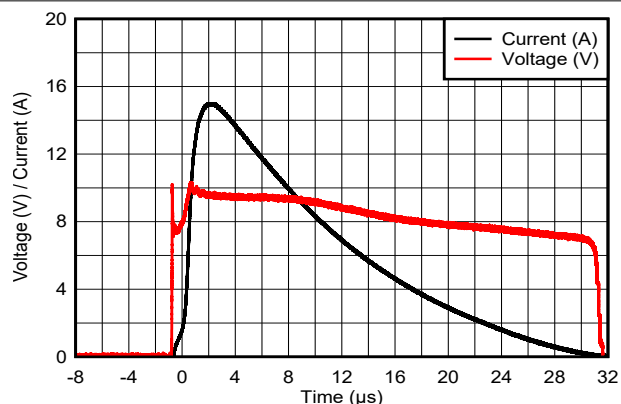


图 5-2. 8/20 μ s Surge Response

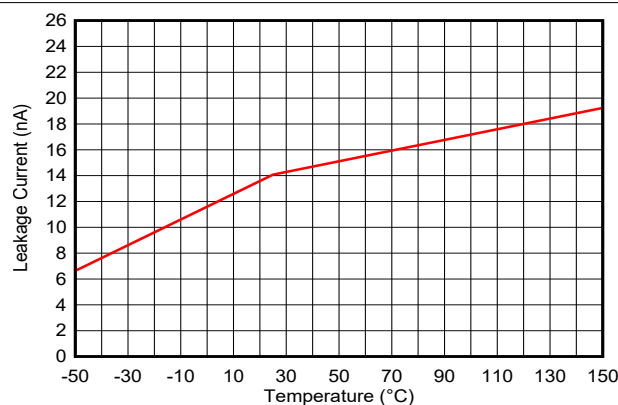


图 5-3. Leakage Current vs. Temperature

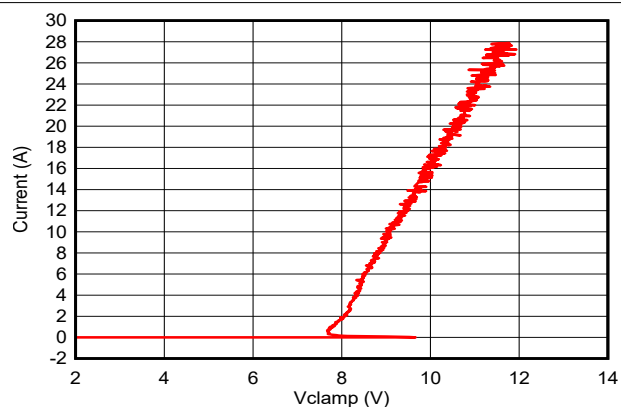


图 5-4. Positive TLP Curve

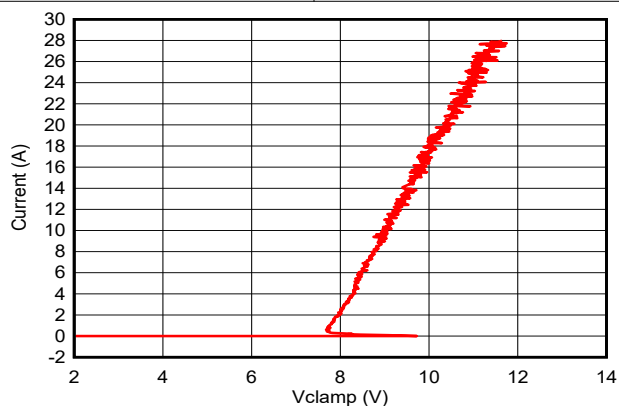


图 5-5. Negative TLP Curve

6 Application and Implementation

备注

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

6.1 Application Information

The ESDS452 is a diode type TVS which provides a path to ground for dissipating transient voltage spikes, such as ESD or surge, on signal lines and power lines. Connect the device in parallel to the down stream circuitry for protection. As the current from the transient passes through the device, only a small voltage drop is present across the diode. This is the voltage presented to the protected IC. The low R_{DYN} of the triggered TVS holds this voltage (V_{CLAMP}) to a safe level for the protected IC. For more information on how to properly use this device, refer to the [ESD Packaging and Layout Guide](#).

7 Device and Documentation Support

7.1 Documentation Support

7.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [ESD Packaging and Layout Guide](#)
- Texas Instruments, [TI's IEC 61000-4-x Testing application note](#)
- Texas Instruments, [ESD Layout Guide user's guide](#)
- Texas Instruments, [ESD Protection Diodes EVM user's guide](#)
- Texas Instruments, [Generic ESD Evaluation Module user's guide](#)
- Texas Instruments, [Reading and Understanding an ESD Protection Data Sheet user's guide](#)

7.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.ti.com) 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

7.3 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [使用条款](#)。

7.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

7.5 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

7.6 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

8 Revision History

DATE	REVISION	NOTES
March 2024	*	Initial Release

9 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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)
ESDS452DBZR	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 150	3BO8
ESDS452DBZR.B	Active	Production	SOT-23 (DBZ) 3	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 150	3BO8

⁽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.

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.

OTHER QUALIFIED VERSIONS OF ESDS452 :

- Automotive : [ESDS452-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

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
ESDS452DBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS

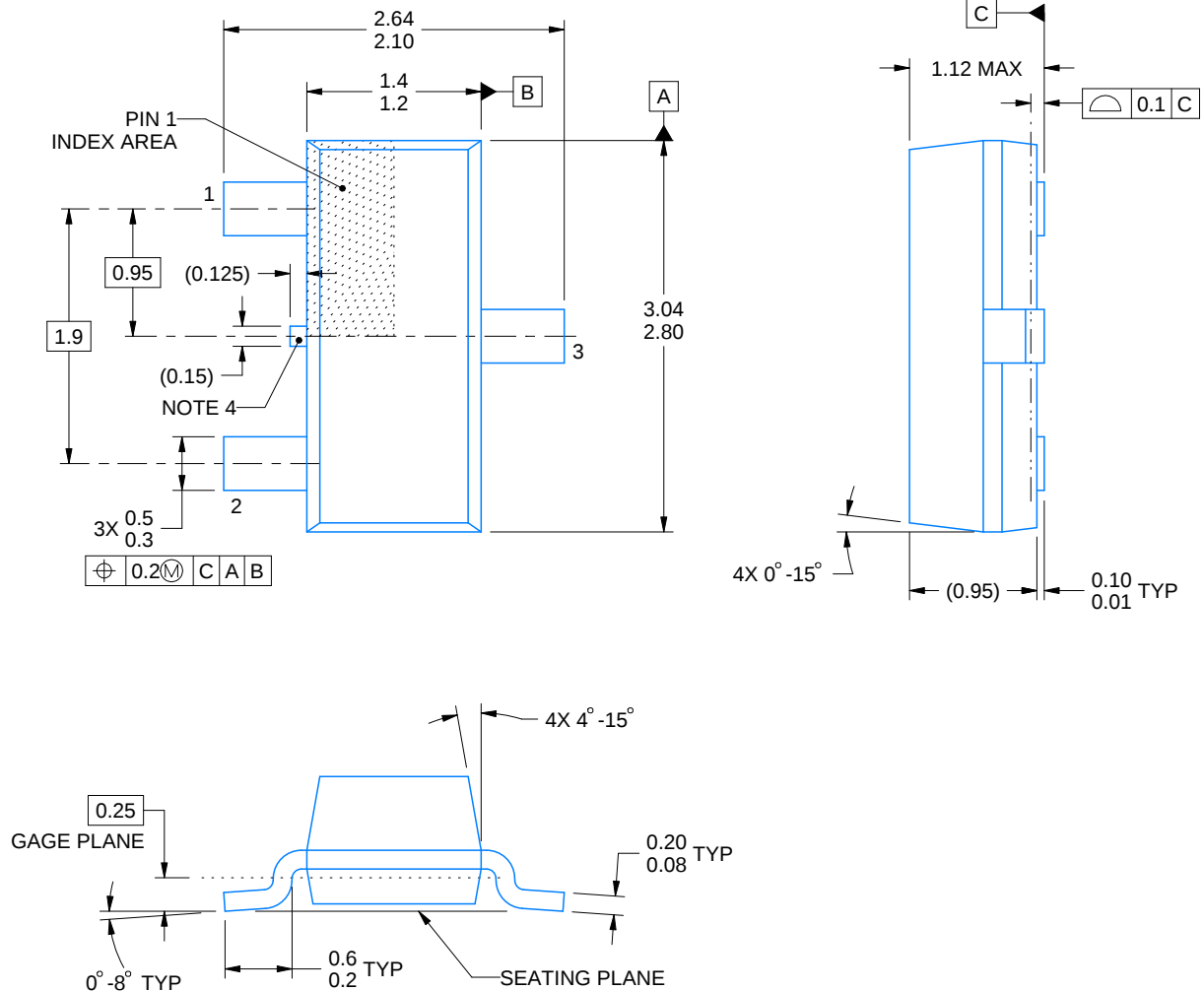


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ESDS452DBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0

DBZ0003A**PACKAGE OUTLINE****SOT-23 - 1.12 mm max height**

SMALL OUTLINE TRANSISTOR



4214838/F 08/2024

NOTES:

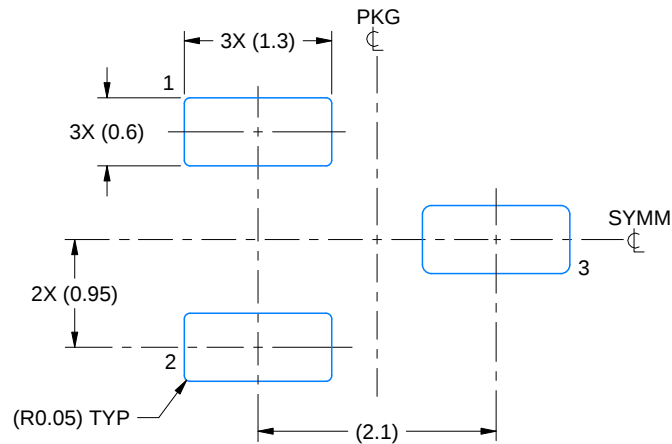
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side

EXAMPLE BOARD LAYOUT

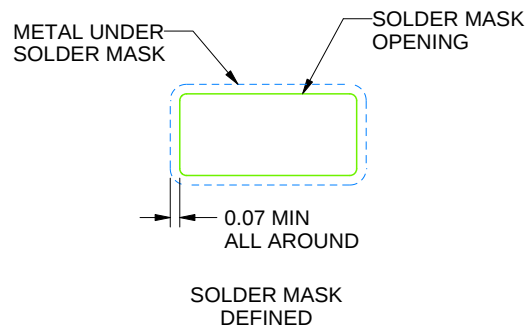
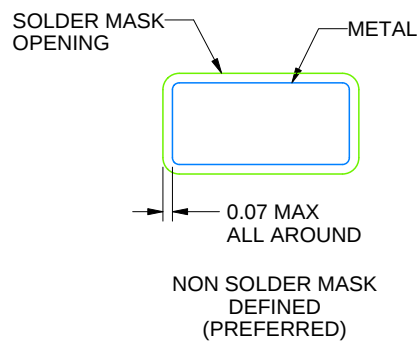
DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
SCALE:15X



SOLDER MASK DETAILS

4214838/F 08/2024

NOTES: (continued)

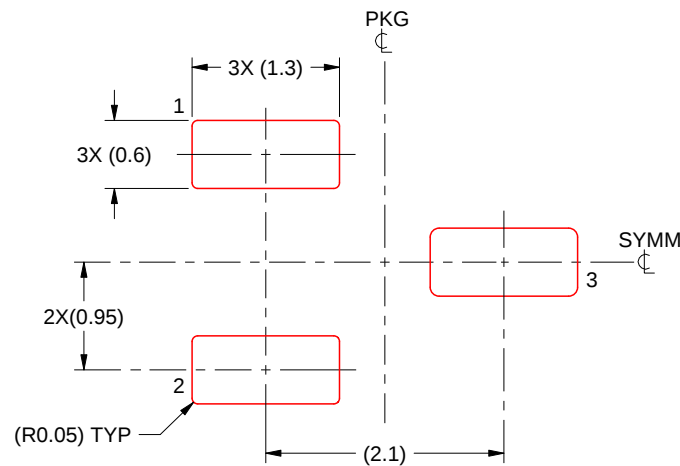
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

4214838/F 08/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

重要通知和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做任何明示或暗示的担保，包括但不限于对适销性、与某特定用途的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他安全、安保法规或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的相关应用。严禁以其他方式对这些资源进行复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。对于因您对这些资源的使用而对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，您将全额赔偿，TI 对此概不负责。

TI 提供的产品受 [TI 销售条款](#)、[TI 通用质量指南](#) 或 [ti.com](#) 上其他适用条款或 TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。除非德州仪器 (TI) 明确将某产品指定为定制产品或客户特定产品，否则其产品均为按确定价格收入目录的标准通用器件。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

版权所有 © 2025，德州仪器 (TI) 公司

最后更新日期：2025 年 10 月