TVS2201 22V 双向平缓钳位浪涌保护器件

1 特性

- 保护特性符合针对工业信号线路的 1kV、42Ω IEC 61000-4-5 浪涌测试要求
- 双向极性可针对双极信号传输或误接线情形提供保护
- 30A、8/20μs 浪涌电流下的钳位电压为 29.6V
- 关断电压：±22V
- 3mm x 3mm^2 小型 SON 封装
- 在 125°C 时，可耐受超过 5,000 次的 30A、8/20μs 浪涌电流的重复冲击
- 强大的浪涌保护
  - IEC 61000-4-5 (8/20μs)：30A
  - IEC61643-321 (10/1000μs)：4A
- 低泄漏电流
  - 27°C 下为 2nA（典型值）
  - 在 85°C 时的最大值为 330nA
- 低电容：62pF
- 集成 4 级 IEC 61000-4-2 ESD 保护

2 应用

- 工业传感器 I/O
- PLC I/O 模块
- 模拟输入
- 电器
- 医疗设备
- USB Type-C V_{BUS} 保护

3 说明

TVS2201 器件可将高达 30A 的 IEC 61000-4-5 故障电流进行分流，以保护系统免受高功率瞬态冲击或雷击。该器件可通过 42Ω 阻抗进行耦合的方式承受 1kV 的 IEC 61000-4-5 开路电压，满足常见的工业信号线路 EMC 要求。TVS2201 使用反馈机制确保在故障期间发挥精确的平缓钳位能力，使系统接触电压始终低于传统 TVS 二极管。精确的电压调节允许设计人员放心地选择具有较低电压容差的系统组件，从而能够在不影响可靠性的情况下降低系统成本和复杂度。TVS2201 具备 ±22V 的工作范围，可在需要反向接线情形防护的系统中运行。

此外，TVS2201 还采用了小型 SON 封装，适用于空间受限 应用，与标准的 SMA 和 SMB 封装相比，尺寸显著缩小。低器件泄露电流和电容确保最大限度地降低了对受保护线路的影响。为了确保在产品的整个寿命期间提供可靠保护，TI 在 125°C 的环境下对 TVS2201 进行了 5000 次重复浪涌冲击测试，但器件性能未发生任何变化。

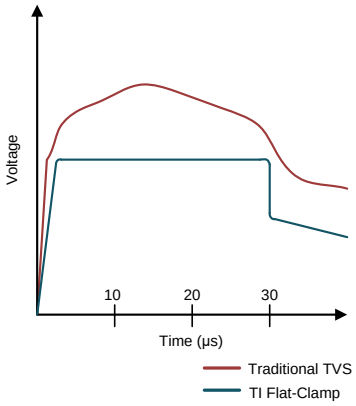
TVS2201 是 TI 的平缓钳位系列浪涌器件中的一款产品。如需深入了解平缓钳位系列，请参阅《*用于高效系统保护的平缓钳位浪涌保护技术*》白皮书。

器件信息(1)

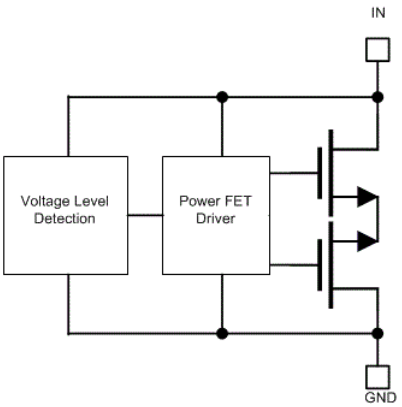
器件型号	封装	封装尺寸（标称值）
TVS2201	SON (8)	3.00mm × 3.00mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。

对 **8/20μs** 浪涌事件的电压钳位响应



功能方框图



本文档旨在为方便起见，提供有关 TI 产品中文版本的信息，以确认产品的概要。 有关适用的官方英文版本的最新信息，请访问 www.ti.com，其内容始终优先。 TI 不保证翻译的准确性和有效性。 在实际设计之前，请务必参考最新版本的英文版本。

目录

1 特性 ... 1
2 应用 ... 1
3 说明 ... 1
4 修订历史记录 ... 2
5 **Device Comparison Table** ... 3
6 **Pin Configuration and Functions** ... 4
7 **Specifications** ... 5
7.1 Absolute Maximum Ratings ... 5
7.2 ESD Ratings - JEDEC ... 5
7.3 ESD Ratings - IEC ... 5
7.4 Recommended Operating Conditions ... 5
7.5 Thermal Information ... 5
7.6 Electrical Characteristics ... 6
7.7 Typical Characteristics ... 7
8 **Detailed Description** ... 8
8.1 Overview ... 8
8.2 Functional Block Diagram ... 8
8.3 Feature Description ... 8
8.4 Device Functional Modes ... 8
9 **Application and Implementation** ... 10
9.1 Application Information ... 10
9.2 Typical Application ... 10
10 **Power Supply Recommendations** ... 11
11 **Layout** ... 12
11.1 Layout Guidelines ... 12
11.2 Layout Example ... 12
12 器件和文档支持 ... 13
12.1 文档支持 ... 13
12.2 接收文档更新通知 ... 13
12.3 社区资源 ... 13
12.4 商标 ... 13
12.5 静电放电警告 ... 13
12.6 术语表 ... 13
13 机械、封装和可订购信息 ... 13

4 修订历史记录

Changes from Original (September 2018) to Revision A **Page**

- 已更改 将“高级信息”更改为“生产数据” ... 1

Copyright © 2018, Texas Instruments Incorporated

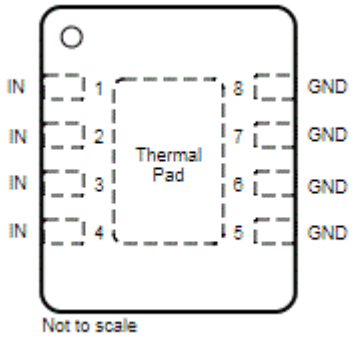
5 Device Comparison Table

DEVICE	V_{rwm}	V_{clamp} at I_{pp}	I_{pp} (8/20 µs)	Leakage at V_{rwm}	POLARITY	Package
TVS0500	5	9.2 V	43 A	0.07 nA	Unidirectional	DRV (SON-6)
TVS0701	7	11 V	30 A	0.25 nA	Bidirectional	DRB (SON-8)
TVS1400	14	18.6 V	43 A	2 nA	Unidirectional	DRV (SON-6)
TVS1401	14	20.5 V	30 A	1.1 nA	Bidirectional	DRB (SON-8)
TVS1800	18	22.8 V	40 A	0.3 nA	Unidirectional	DRV (SON-6)
TVS1801	18	27.4 V	30 A	0.4 nA	Bidirectional	DRB (SON-8)
TVS2200	22	27.7 V	40 A	3.2 nA	Unidirectional	DRV (SON-6)
TVS2201	22	29.6 V	30 A	2 nA	Bidirectional	DRB (SON-8)
TVS2700	27	32.5 V	40 A	1.7 nA	Unidirectional	DRV (SON-6)
TVS2701	27	34 V	27 A	0.8 nA	Bidirectional	DRB (SON-8)
TVS3300	33	38 V	35 A	19 nA	Unidirectional	DRV (SON-6), YZF (WCSP)
TVS3301	33	40 V	27 A	2.5 nA	Bidirectional	DRB (SON-8)

Copyright © 2018, Texas Instruments Incorporated

6 Pin Configuration and Functions

DRB Package
8-Pin SON
Top View



Pin Functions

PIN		TYPE	DESCRIPTION
NAME	DRB		
IN	1, 2, 3, 4	IN	Surge Protected Channel
GND	5, 6, 7, 8	GND	Ground
FLOAT	Exposed Thermal Pad	NC	Exposed Thermal Pad Must Be Floating

Copyright © 2018, Texas Instruments Incorporated

7 Specifications

7.1 Absolute Maximum Ratings

T_A = 27°C (unless otherwise noted)(1)

		MIN	MAX	UNIT
Maximum Surge	IEC 61000-4-5 Current (8/20 µs), T_A < 125°C		±30	A
	IEC 61000-4-5 Power (8/20 µs)		850	W
	IEC 61643-321 Current (10/1000 µs)		±4	A
	IEC 61643-321 Power (10/1000 µs)		120	W
EFT	IEC 61000-4-4 EFT Protection		±80	A
I_{BR}	DC Current		30	mA
T_A	Ambient Operating Temperature	-40	125	°C
T_{stg}	Storage Temperature	-65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Rating* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

7.2 ESD Ratings - JEDEC

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)	±2000	V
		Charged device model (CDM), per JEDEC specificationJESD22-C101, all pins(2)	±500	

(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.

7.3 ESD Ratings - IEC

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	IEC 61000-4-2 contact discharge	±8	kV
		IEC 61000-4-2 air-gap discharge	±15	

7.4 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
V_{RWM}	Reverse Stand-Off Voltage		±22		V

7.5 Thermal Information

THERMAL METRIC(1)		TVS2201 DRB (SON) 8 PINS	UNIT
R_{qJA}	Junction-to-ambient thermal resistance	52	°C/W
$R_{qJC(top)}$	Junction-to-case (top) thermal resistance	56.1	°C/W
R_{qJB}	Junction-to-board thermal resistance	24.9	°C/W
Y_{JT}	Junction-to-top characterization parameter	2.1	°C/W
Y_{JB}	Junction-to-board characterization parameter	24.8	°C/W
$R_{qJC(bot)}$	Junction-to-case (bottom) thermal resistance	9.8	°C/W

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

Copyright © 2018, Texas Instruments Incorporated

7.6 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{LEAK}	Leakage Current	Measured at V_{IN} = ±V_{RWM}, T_A = 27°C		2	27	nA
		Measured at V_{IN} = ±V_{RWM}, T_A = 85°C			330	
V_{BR}	Break-down Voltage	I_{IN} = ±1mA	25.1	26.6		V
V_{CLAMP}	Clamp Voltage	±I_{pp} IEC 61000-4-5 Surge (8/20 µs), V_{IN} = 0 V before surge, T_A = 27°C		29.6	30.7	V
		Max ±I_{PP} IEC 61000-4-5 Surge (8/20 µs), V_{IN} =±V_{RWM} before surge, T_A = 125°C		30.5	32.7	
R_{DYN}	8/20 µs surge dynamic resistance	Calculated from V_{CLAMP} at .5*I_{PP} and I_{PP} surge current, T_A = 25°C		40		mΩ
C_{IN}	Input pin capacitance	V_{IN} = V_{RWM}, f = 1 MHz, 30 mV_{pp}, IO to GND		62		pF
SR	Maximum Slew Rate	0-±V_{RWM} rising edge, sweep rise time and measure slew rate when I_{PEAK} = 1 mA, T_A = 27°C		2.5		V/µs
		0-±V_{RWM} rising edge, sweep rise time and measure slew rate when I_{PEAK} = 1 mA, T_A = 85°C		1.0		

版权 © 2018, Texas Instruments Incorporated

7.7 Typical Characteristics

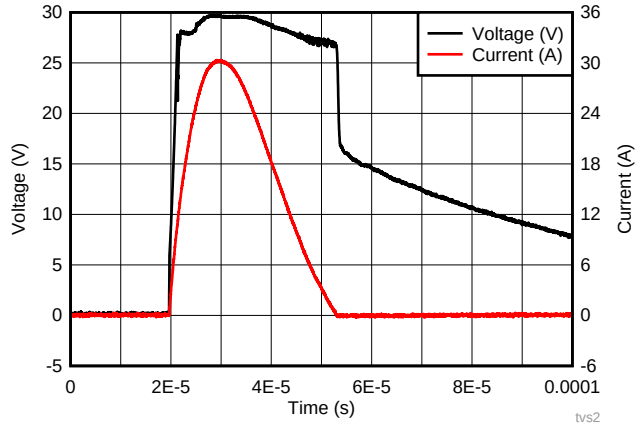


图 1. 8/20 µs Surge Response at 30 A

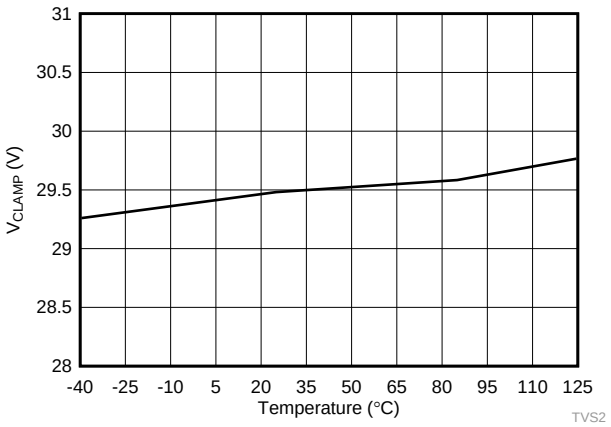
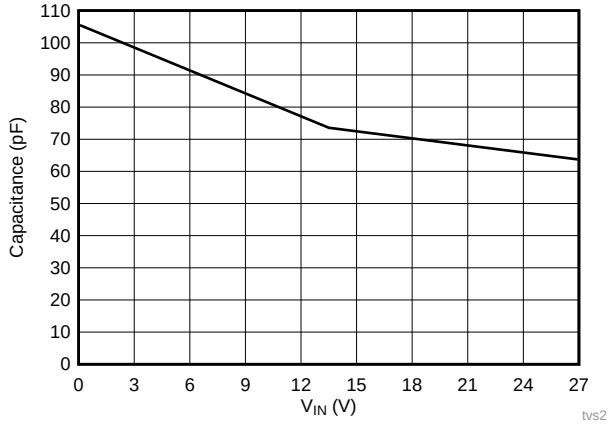


图 2. 8/20 µs Surge Clamping Response at 30 A



f = 1 MHz, 30 mVpp, IO to GND

图 3. Capacitance vs Voltage Bias

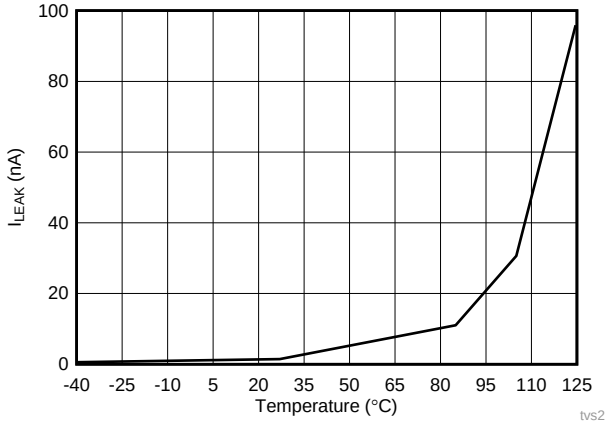


图 4. Leakage Current vs Temperature at 22 V

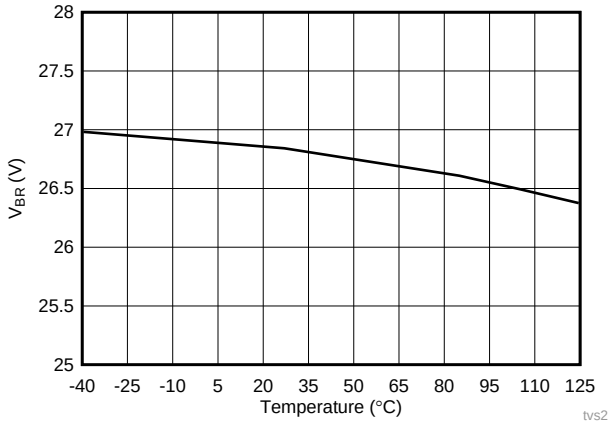


图 5. Breakdown Voltage (1 mA) vs Temperature

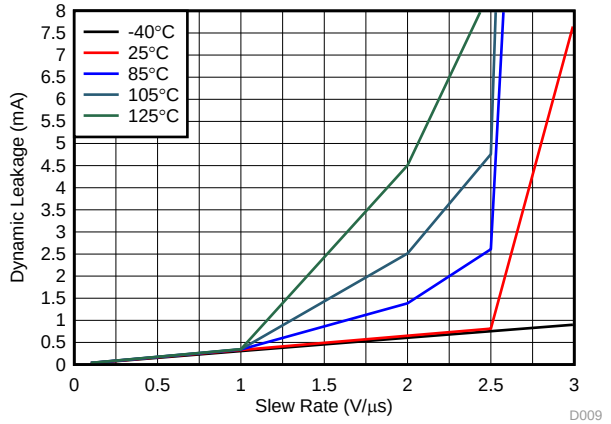


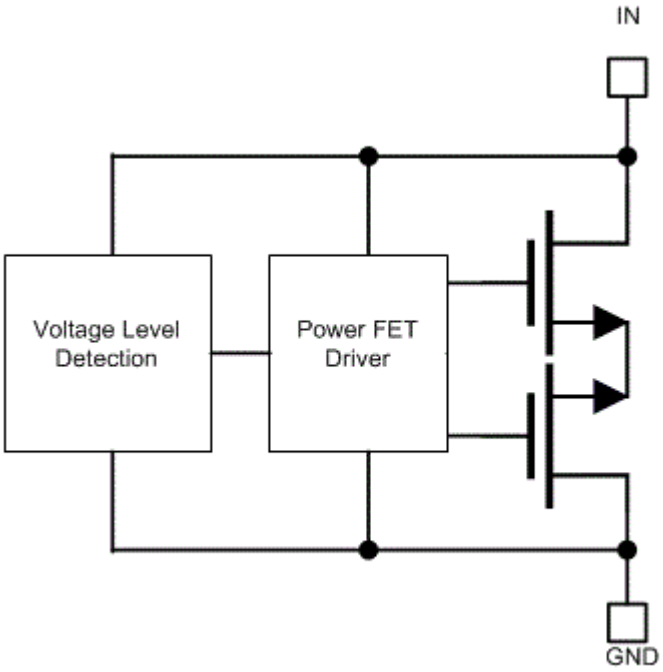
图 6. Dynamic Leakage vs Signal Slew Rate across Temperature

8 Detailed Description

8.1 Overview

The TVS2201 is a bidirectional precision clamp with two integrated FETs driven by a feedback loop to tightly regulate the input voltage during an overvoltage event. This feedback loop leads to a very low dynamic resistance, giving a flat clamping voltage during transient overvoltage events like a surge.

8.2 Functional Block Diagram



8.3 Feature Description

The TVS2201 is a precision clamp that handles 30 A of IEC 61000-4-5 8/20 µs surge pulse. The flat clamping feature helps keep the clamping voltage very low to keep the downstream circuits from being stressed. The flat clamping feature can also help end-equipment designers save cost by opening up the possibility to use lower-cost, lower voltage tolerant downstream ICs. This device provides a bidirectional operating range, with a symmetrical V_{RWM} of ±22 V, designed for applications that have bipolar input signals or that must withstand reverse wiring conditions. The TVS2201 has minimal leakage at V_{RWM}, designed for applications where low leakage and power dissipation is a necessity. Built in IEC 61000-4-2 and IEC 61000-4-4 ratings make it a robust protection solution for ESD and EFT events and the TVS2201 wide ambient temperature range of –40°C to +125°C enables usage in harsh industrial environments.

8.4 Device Functional Modes

8.4.1 Protection Specifications

The TVS2201 is specified according to both the IEC 61000-4-5 and IEC 61643-321 standards. This enables usage in systems regardless of which standard is required by relevant product standards or best matches measured fault conditions. The IEC 61000-4-5 standard requires protection against a pulse with a rise time of 8 µs and a half-length of 20 µs, while the IEC 61643-321 standard requires protection against a much longer pulse with a rise time of 10 µs and a half-length of 1000 µs.

版权 © 2018, Texas Instruments Incorporated

Device Functional Modes (接下页)

The positive and negative surges are imposed to the TVS2201 by a combination wave generator (CWG) with a 2-Ω coupling resistor at different peak voltage levels. For powered-on transient tests that need power supply bias, inductances are used to decouple the transient stress and protect the power supply. The TVS2201 is post-tested by assuring that there is no shift in device breakdown or leakage at V_{RWM}.

In addition, the TVS2201 has been tested according to IEC 61000-4-5 to pass a ±1-kV surge test through a 42-Ω coupling resistor and a 0.5-µF capacitor. This test is a common test requirement for industrial signal I/O lines and the TVS2201 precision clamp can be used in applications that have that requirement.

The TVS2201 integrates IEC 61000-4-2 level 4 ESD Protection and 80 A of IEC 61000-4-4 EFT Protection. These combine to ensure that the device can protect against most common transient test requirements.

For more information on TI's test methods for Surge, ESD, and EFT testing, refer to the *IEC 61000-4-x Tests for TI's Protection Devices* application report.

8.4.2 Reliability Testing

To ensure device reliability, the TVS2201 is characterized against 5000 repetitive pulses of 25-A IEC 61000-4-5 8/20-µs surge pulses at 125°C. The test is performed with less than 10 seconds between each pulse at high temperature to simulate worst-case scenarios for fault regulation. After each surge pulse, the TVS2201 clamping voltage, breakdown voltage, and leakage are recorded to ensure that there is no variation or performance degradation. By ensuring robust, reliable, high temperature protection, the TVS2201 enables fault protection in applications that must withstand years of continuous operation with no performance change.

8.4.3 Zero Derating

Unlike traditional diodes, the TVS2201 has zero derating of maximum power dissipation and ensures robust performance up to 125°C. Traditional TVS diodes lose up to 50% of their current carrying capability when at high temperatures, so a surge pulse above 85°C ambient can cause failures that are not seen at room temperature. The TVS2201 prevents this so the designer can see the surge protection regardless of temperature. Because of this, Flat-Clamp devices can provide robust protection against surge pulses that occur at high ambient temperatures, as shown in TI's *TVS Surge Protection in High-Temperature Environments* application report.

8.4.4 Bidirectional Operation

The TVS2201 is a bidirectional TVS with a symmetrical operating region. This allows for operation with positive and negative voltages, rather than just positive voltages like the unidirectional TVS2200. This allows for single chip protection for applications where the signal is expected to operate below 0 V or where there is a need to withstand a large common-mode voltage. In addition, there is a system requirement to be able to withstand reverse wiring conditions, in many cases where a high voltage signal is accidentally applied to the system ground and a ground is accidentally applied to the input terminal. This causes a large reverse voltage on the TVS diode that the device must be able to withstand. The TVS2201 is designed to not break down or see failures under reverse wiring conditions, for applications that must withstand these miswiring issues.

注

If the applied signal is not expected to go below 0 V, a unidirectional device will clamp much lower in the reverse direction and should be used. In this case, the recommended device would be the TVS2200.

8.4.5 Transient Performance

During large transient swings, the TVS2201 will begin clamping the input signal to protect downstream conditions. While this prevents damage during fault conditions, it can cause leakage when the intended input signal has a fast slew rate. To keep power dissipation low and remove the chance of signal distortion, TI recommendeds that the designer keep the slew rate of any input signal on the TVS2201 below 2.5 V/µs at room temperature and below 1.0 V/µs at 85°C shown in 图 6. Faster slew rates will cause the device to clamp the input signal and draw current through the device for a few microseconds, increasing the rise time of the signal. This will not cause any harm to the system or to the device, however it can cause device overheating if the fast input voltage swings occur regularly.

版权 © 2018, Texas Instruments Incorporated

9 Application and Implementation

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. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The TVS2201 can be used to protect any power, analog, or digital signal from transient fault conditions caused by the environment or other electrical components.

9.2 Typical Application

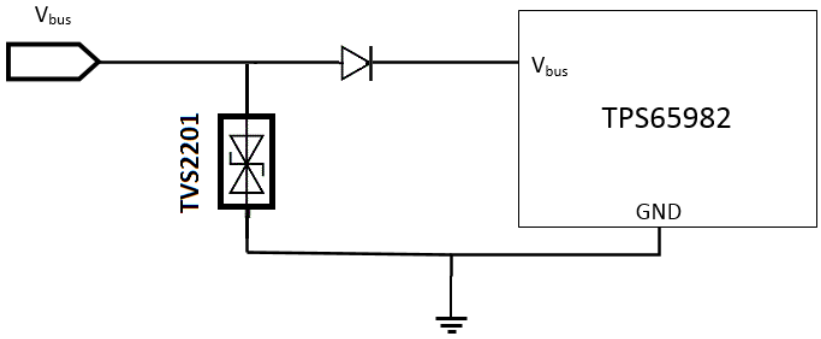


图 7. TVS2201 Application Schematic

9.2.1 Design Requirements

A typical operation for the TVS2201 would be protecting a USB Type-C V_{BUS} input, with a nominal input voltage of 20 V and a required withstand of 22 V, shown in 图 7. In this example, a TVS2201 is protecting the input to a TPS65982 Type-C Port Controller. Without any input protection, this input voltage will rise to hundreds of volts for multiple microseconds, and violate the absolute maximum input voltage and harm the device if a surge event is caused by lightning, coupling, hot-swap ringing, or any other fault condition. This customer is adding additional surge protection on the V_{BUS} line because they are worried about faulty connectors causing power spikes, and in addition wants to have protection against mechanical shorts in the connector that could possibly apply –20 V to the V_{BUS} line.

9.2.2 Detailed Design Procedure

If the TVS2201 is in place to protect the device, the voltage will rise to the breakdown of the diode at 26.6 V, during a surge event. The TVS2201 will then turn on to shunt the surge current to ground. With the low dynamic resistance of the TVS2201, even large amounts of surge current will have minimal impact on the clamping voltage. The dynamic resistance of the TVS2201 is around 40 mΩ, which means a 25-A surge current will cause a voltage raise of 25 A × 40 mΩ = 1 V. Because the device turns on at 26.6 V, this means the input will be exposed to a maximum of 26.6 V + 1 V = 27.6 V during surge pulses, robustly protecting the USB Type-C port.

In addition, the TVS2201 provides protection against reverse voltage application that could accidentally be caused by shorts between pins. If –20 V is applied to the VBUS pin, the TPS65982 will not be harmed because the series diode will prevent the voltage from being applied to the input, and the TVS2201 will not shunt current because the reverse working voltage is –22 V. If the TVS2200 or a unidirectional device is used in this case, a –20-V short would cause the device to shunt current until it fails.

版权 © 2018, Texas Instruments Incorporated

Typical Application (接下页)

Finally, the small size of the device also improves fault protection by lowering the effect of fault current coupling onto neighboring traces. The small form factor of the TVS2201 allows the device to be placed extremely close to the input connector, which lowers the length of the path fault current going through the system compared to larger protection solutions.

9.2.3 Application Curves

When a surge is applied to the system with the TVS2201, the device will clamp the overvoltage as shown in 图 8.

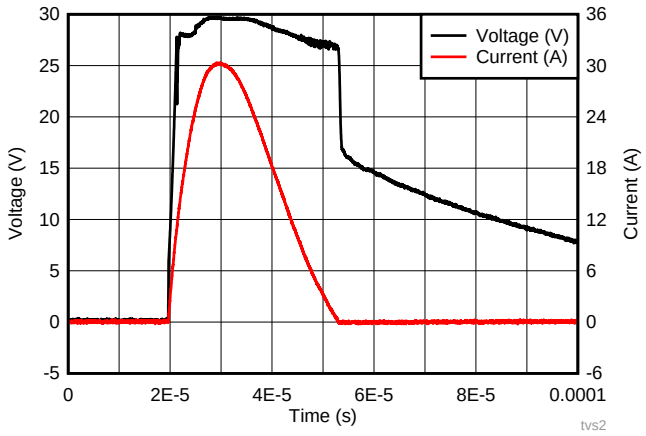


图 8. TVS2201 Surge Clamping at 30 A

10 Power Supply Recommendations

The TVS2201 is a clamping device so there is no need to power it. To ensure the device functions properly do not violate the recommended V_{IN} voltage range (–22 V to 22 V) .

11 Layout

11.1 Layout Guidelines

The optimum placement is close to the connector. EMI during an ESD event can couple from the tested trace to other nearby unprotected traces, which could result in system failures. The PCB designer must minimize the possibility of EMI coupling by keeping all unprotected traces away from protected traces between the TVS and the connector. Route the protected traces straight. Use rounded corners with the largest radii possible to eliminate any sharp corners on the protected traces between the TVS2201 and the connector. Electric fields tend to build up on corners, which could increase EMI coupling.

Ensure that the thermal pad on the layout is floating rather than grounded. Grounding the thermal pad will impede the operating range of the TVS2201, and can cause failures when the applied voltage is negative. A floating thermal pad allows the maximum operating range without sacrificing any transient performance.

11.2 Layout Example

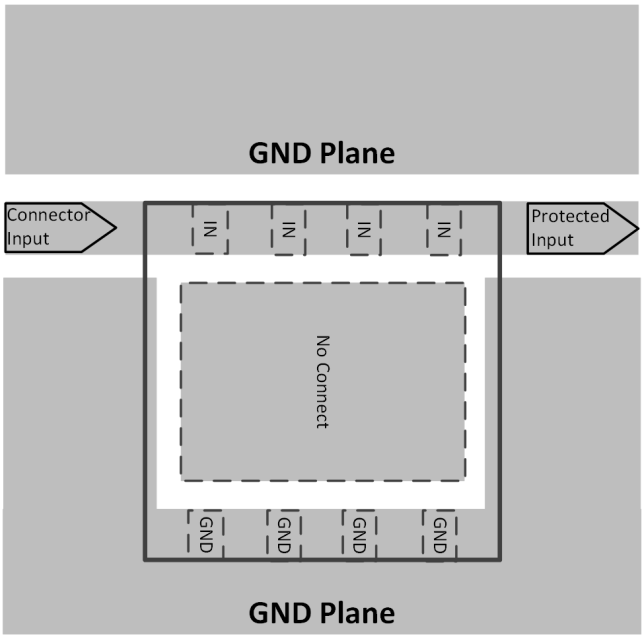


图 9. TVS2201 Layout

版权 © 2018, Texas Instruments Incorporated

12 器件和文档支持

12.1 文档支持

12.1.1 相关文档

请参阅如下相关文档：

- *用于高效系统保护的平缓钳位浪涌保护技术*
- *用于 TI 保护器件的 IEC 61000-4-x 测试*
- *用于高温环境的 TVS 浪涌保护*

12.2 接收文档更新通知

要接收文档更新通知，请导航至 TI.com.cn 上的器件产品文件夹。单击右上角的*通知我* 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。

12.3 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”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》。

TI E2E™ 在线社区 ***TI 的工程师对工程师 (E2E) 社区。*** **此社区的创建目的在于促进工程师之间的协作。在 e2e.ti.com 中，您可以咨询问题、分享知识、拓展思路并与同行工程师一道帮助解决问题。**

设计支持 ***TI 参考设计支持*** **可帮助您快速查找有帮助的 E2E 论坛、设计支持工具以及技术支持的联系信息。**

12.4 商标

E2E is a trademark of Texas Instruments.

12.5 静电放电警告



ESD 可能会损坏该集成电路。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措施和安装程序，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。

12.6 术语表

SLYZ022 — *TI 术语表*。

这份术语表列出并解释术语、缩写和定义。

13 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

重要声明和免责声明

TI 均以“原样”提供技术性及可靠性数据（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，不保证其中不含任何瑕疵，且不做任何明示或暗示的担保，包括但不限于对适销性、适合某特定用途或不侵犯任何第三方知识产权的暗示担保。

所述资源可供专业开发人员应用TI 产品进行设计使用。您将对以下行为独自承担全部责任：(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、安保或其他要求。所述资源如有变更，恕不另行通知。TI 对您使用所述资源的授权仅限于开发资源所涉及TI 产品的相关应用。除此之外不得复制或展示所述资源，也不提供其它TI或任何第三方的知识产权授权许可。如因使用所述资源而产生任何索赔、赔偿、成本、损失及债务等，TI对此概不负责，并且您须赔偿由此对TI 及其代表造成的损害。

TI 所提供产品均受TI 的销售条款 (http://www.ti.com.cn/zh-cn/legal/termsofsale.html) 以及ti.com.cn上或随附TI产品提供的其他可适用条款的约束。TI提供所述资源并不扩展或以其他方式更改TI 针对TI 产品所发布的可适用的担保范围或担保免责声明。

邮寄地址：上海市浦东新区世纪大道 1568 号中建大厦 32 楼，邮政编码：200122
Copyright © 2019 德州仪器半导体技术（上海）有限公司

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TVS2201DRBR	ACTIVE	SON	DRB	8	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	1PVP	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

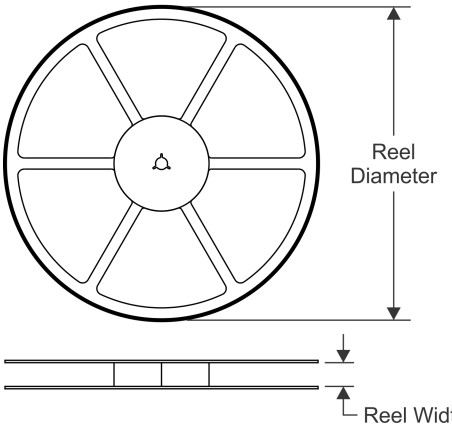
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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.

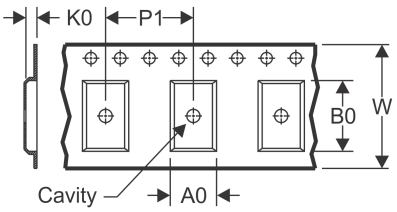
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

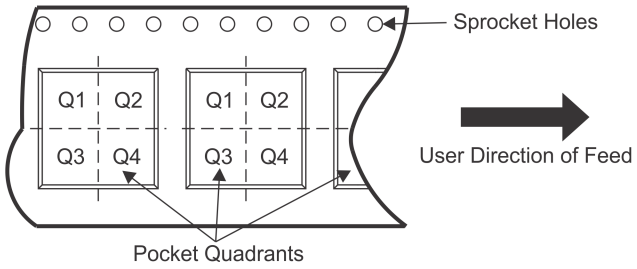


TAPE DIMENSIONS



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

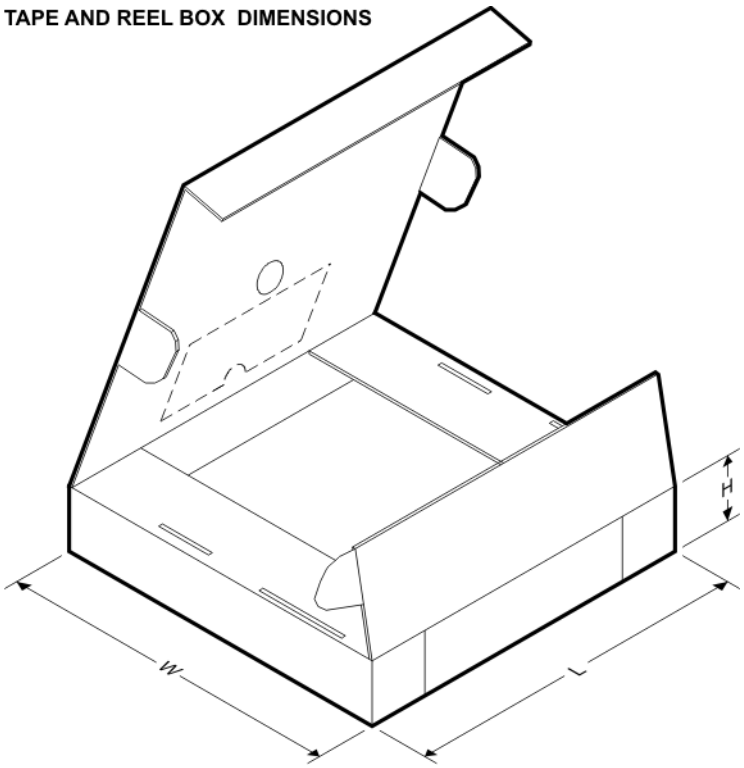
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TVS2201DRBR	SON	DRB	8	3000	330.0	12.4	3.3	3.3	1.1	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TVS2201DRBR	SON	DRB	8	3000	338.0	355.0	50.0

GENERIC PACKAGE VIEW

DRB 8

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

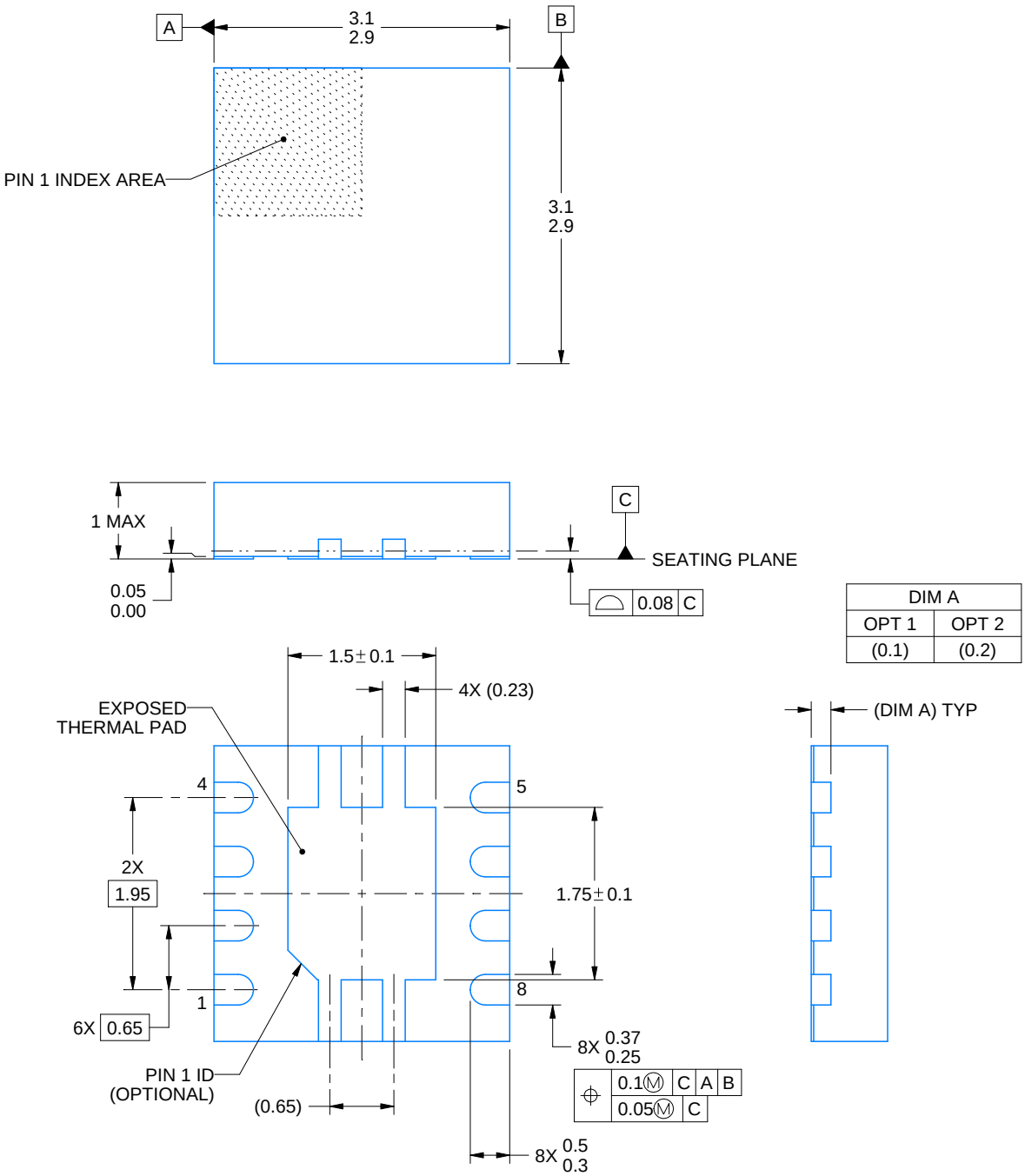
4203482/L

PACKAGE OUTLINE

DRB0008A

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



NOTES:

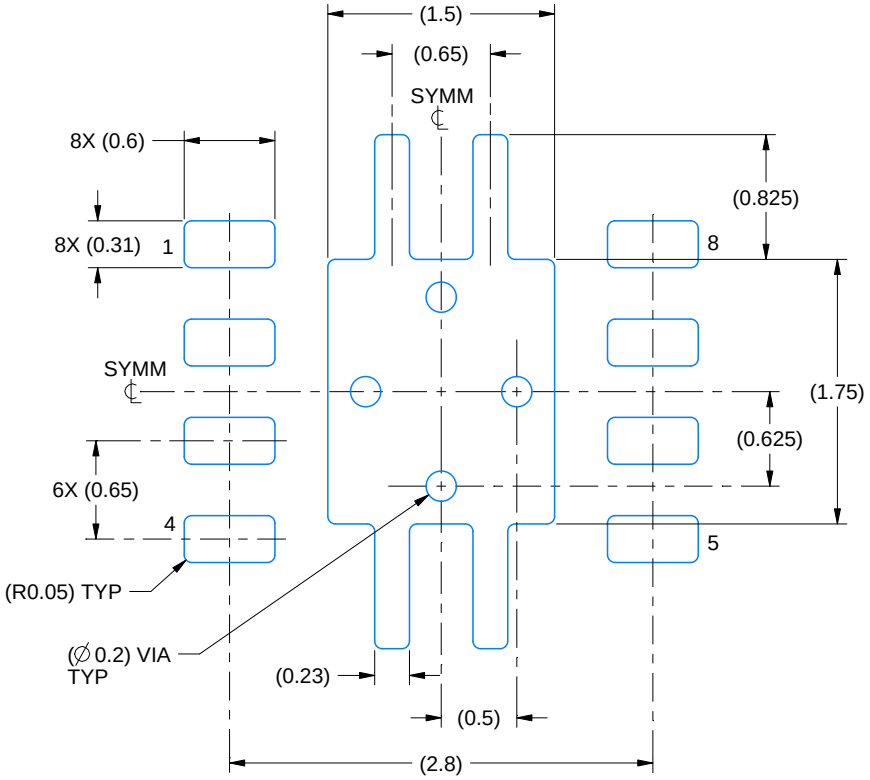
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

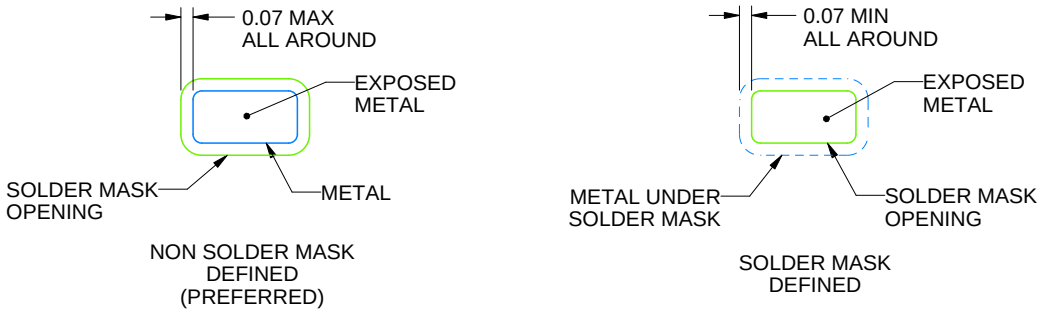
DRB0008A

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:20X

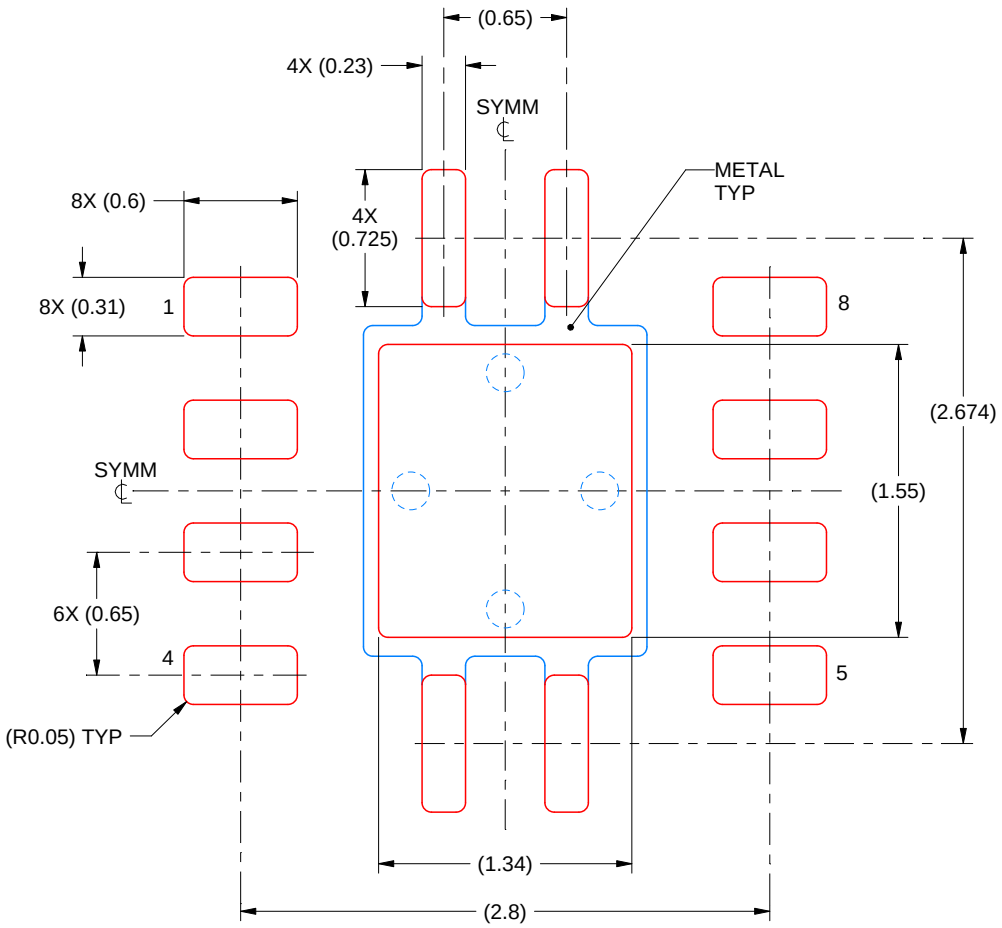


SOLDER MASK DETAILS

4218875/A 01/2018

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
84% PRINTED SOLDER COVERAGE BY AREA
SCALE:25X

4218875/A 01/2018

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

重要声明和免责声明

TI 均以“原样”提供技术性及可靠性数据（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，不保证其中不含任何瑕疵，且不做任何明示或暗示的担保，包括但不限于对适销性、适合某特定用途或不侵犯任何第三方知识产权的暗示担保。

所述资源可供专业开发人员应用TI 产品进行设计使用。您将对以下行为独自承担全部责任：(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、安保或其他要求。所述资源如有变更，恕不另行通知。TI 对您使用所述资源的授权仅限于开发资源所涉及TI 产品的相关应用。除此之外不得复制或展示所述资源，也不提供其它TI或任何第三方的知识产权授权许可。如因使用所述资源而产生任何索赔、赔偿、成本、损失及债务等，TI对此概不负责，并且您须赔偿由此对TI 及其代表造成的损害。

TI 所提供产品均受TI 的销售条款 (http://www.ti.com.cn/zh-cn/legal/termsofsale.html) 以及ti.com.cn上或随附TI产品提供的其他可适用条款的约束。TI提供所述资源并不扩展或以其他方式更改TI 针对TI 产品所发布的可适用的担保范围或担保免责声明。

邮寄地址：上海市浦东新区世纪大道 1568 号中建大厦 32 楼，邮政编码：200122
Copyright © 2020 德州仪器半导体技术（上海）有限公司