TPS51633 适用于 VR12.6 V_{CPU} 的三相 D-CAP+™ 降压控制器

1 特性

- Intel® *VR12.6 PWM 规格* 符合串行 VID (SVID) 标准
- 单相、两相或三相运行
- 完整的 VR12.6 移动功能集，包括数字电流监控器、PS3 和 PS4 运行
- 输出电压范围为 0.50V 至 2.30V 的 8 位 DAC
- 优化了轻负载和重负载条件下的效率
- 8 级独立的过冲衰减 (OSR) 和下冲衰减 (USR)
- 无驱动器配置，有助于实现高效的高频开关
- 支持分立式、电源块、功率级或 DrMOS MOSFET 实施
- 精确可调电压定位
- 300kHz 至 800kHz 的频率选择
- 获得专利的 AutoBalance 相位平衡
- 可选 8 级电流限制
- 4.5V 至 28V 转换电压范围
- 小型 4 × 4 32 引脚 QFN PowerPAD™ 集成电路封装

2 应用

- 适配器
- 电池
- NVDC
- 5V 至 12V 电源轨

3 说明

TPS51633 器件是一款完全符合 SVID 通信协议的无驱动降压控制器，符合 Intel VR12.6 规范。高级控制特性（例如 D-CAP+ 架构）借助重叠脉冲支持下冲衰减 (USR) 和过冲衰减 (OSR)，可提供快速瞬态响应、最低输出电容和高效率。TPS51633 器件还支持在 CCM 或 DCM 运行情况下进行单相运行，从而提高轻负载情况下的效率。TPS51633 器件集成了完整的 VR12.6 I/O 功能，包括 VR_READY (PGOOD)、$\overline{\text{ALERT}}$ 和 $\overline{\text{VR_HOT}}$。SVID 接口地址允许在 0 到 7 的时间范围内进行编程。

在 PS4 中，控制器的静态功耗通常为 0.25mW。VCPU 压摆率和电压定位的可调节控制完善了 VR12.6 功能。与新的 TPS51604 FET 栅极驱动器配合使用时，该解决方案可提供超高速度和低开关损耗。TPS51633 器件与选定的 TI Power Stage™ 产品以及 DrMOS 产品一起使用，可实现出色效率。

TPS51633 器件采用节省空间的热增强型 32 引脚 QFN 封装，可在 –40°C 到 105°C 温度下运行。

器件型号(1)	封装	封装尺寸（标称值）
TPS51633	VQFN (32)	4.00mm × 4.00mm

(1) 要了解所有可用封装，请参阅文档末尾的可订购产品附录。

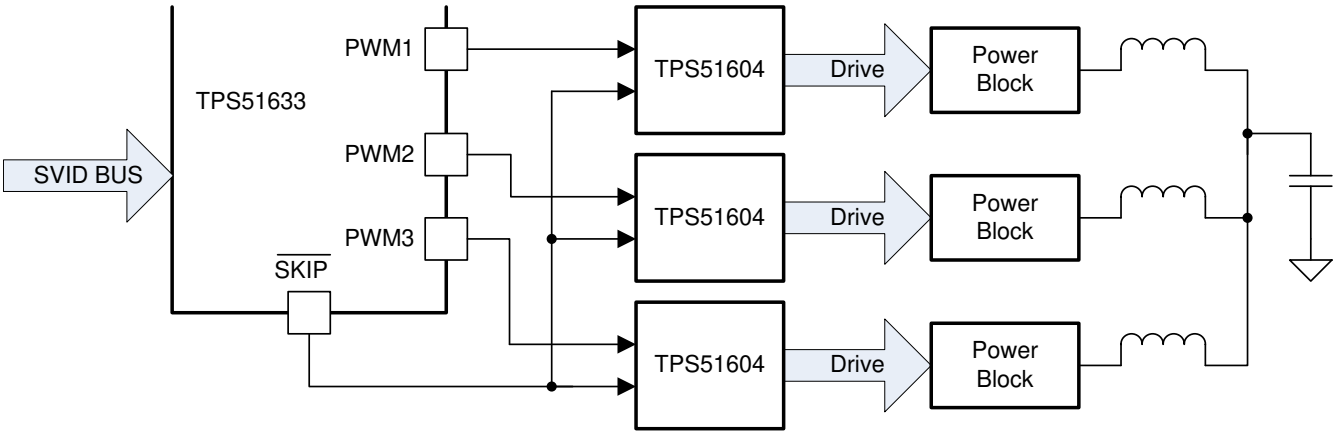


图 3-1. 简化原理图

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4 Revision History

DATE	REVISION	NOTES
June 2022	*	Initial release.

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5 Device and Documentation Support

5.1 接收文档更新通知

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5.2 支持资源

TI E2E™ 支持论坛是工程师的重要参考资料，可直接从专家获得快速、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可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》。

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5.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

5.5 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。

6 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.

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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)
TPS51633RSMR	Active	Production	VQFN (RSM) | 32	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	TPS 51633
TPS51633RSMR.A	Active	Production	VQFN (RSM) | 32	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	TPS 51633
TPS51633RSMT	Active	Production	VQFN (RSM) | 32	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	TPS 51633
TPS51633RSMT.A	Active	Production	VQFN (RSM) | 32	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	TPS 51633

(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.

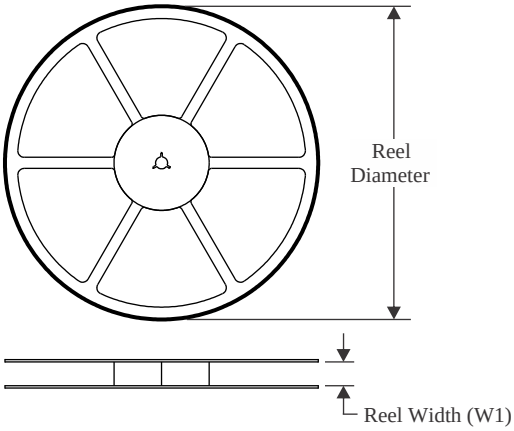
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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.

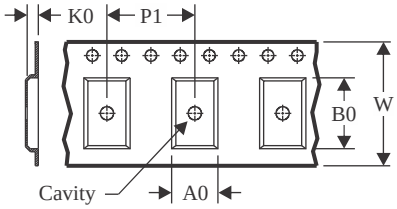
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

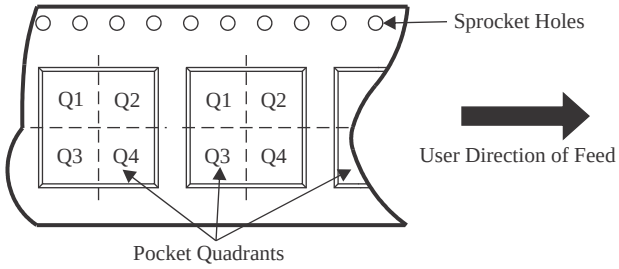


TAPE DIMENSIONS



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

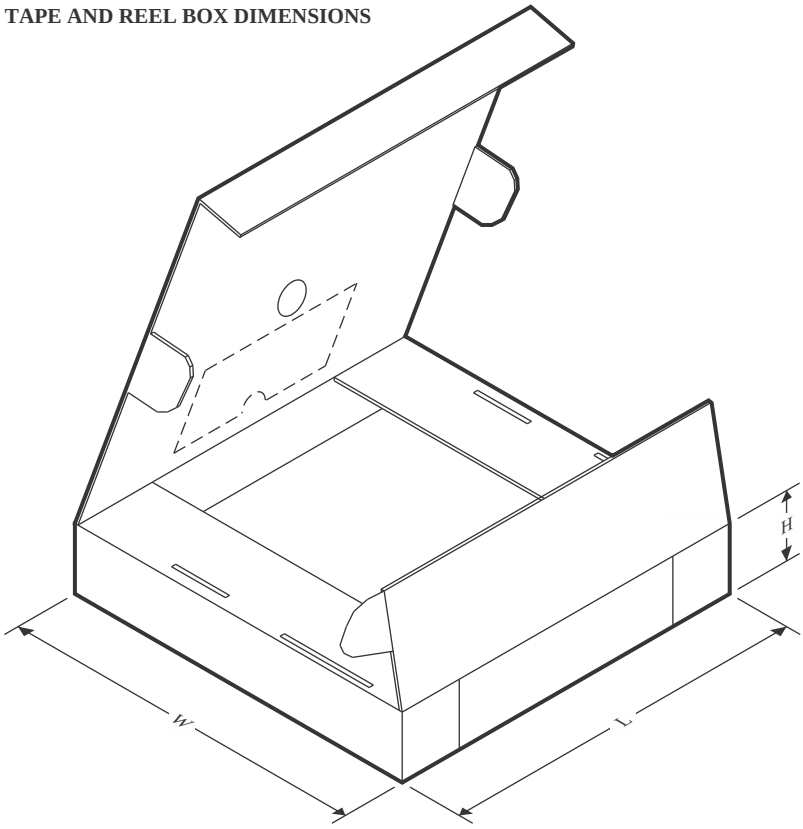
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPS51633RSMR	VQFN	RSM	32	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
TPS51633RSMT	VQFN	RSM	32	250	180.0	12.4	4.25	4.25	1.15	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)
TPS51633RSMR	VQFN	RSM	32	3000	346.0	346.0	33.0
TPS51633RSMT	VQFN	RSM	32	250	182.0	182.0	20.0

GENERIC PACKAGE VIEW

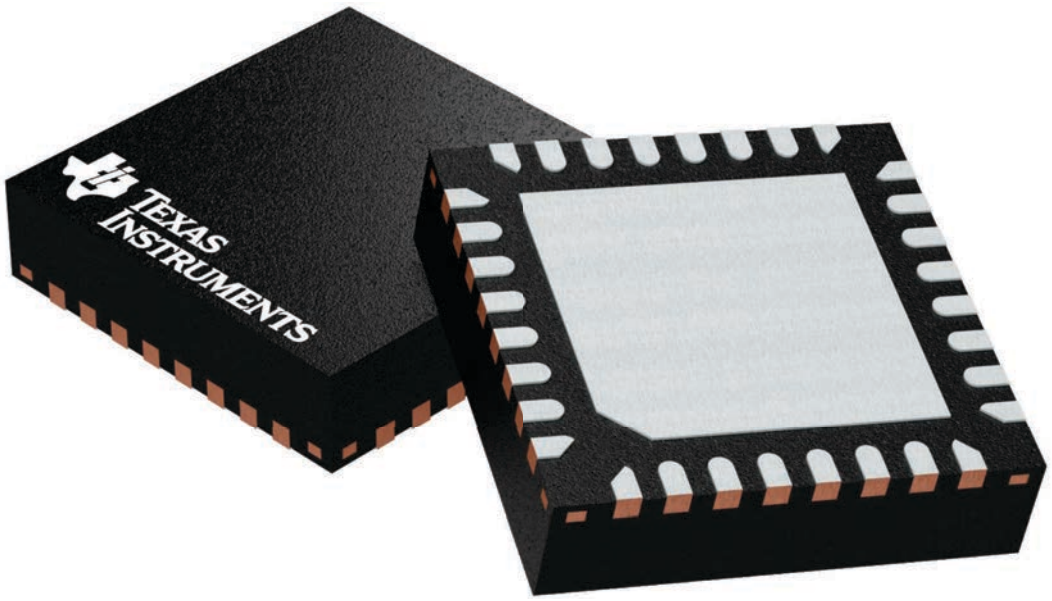
RSM 32

VQFN - 1 mm max height

4 x 4, 0.4 mm pitch

PLASTIC QUAD FLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



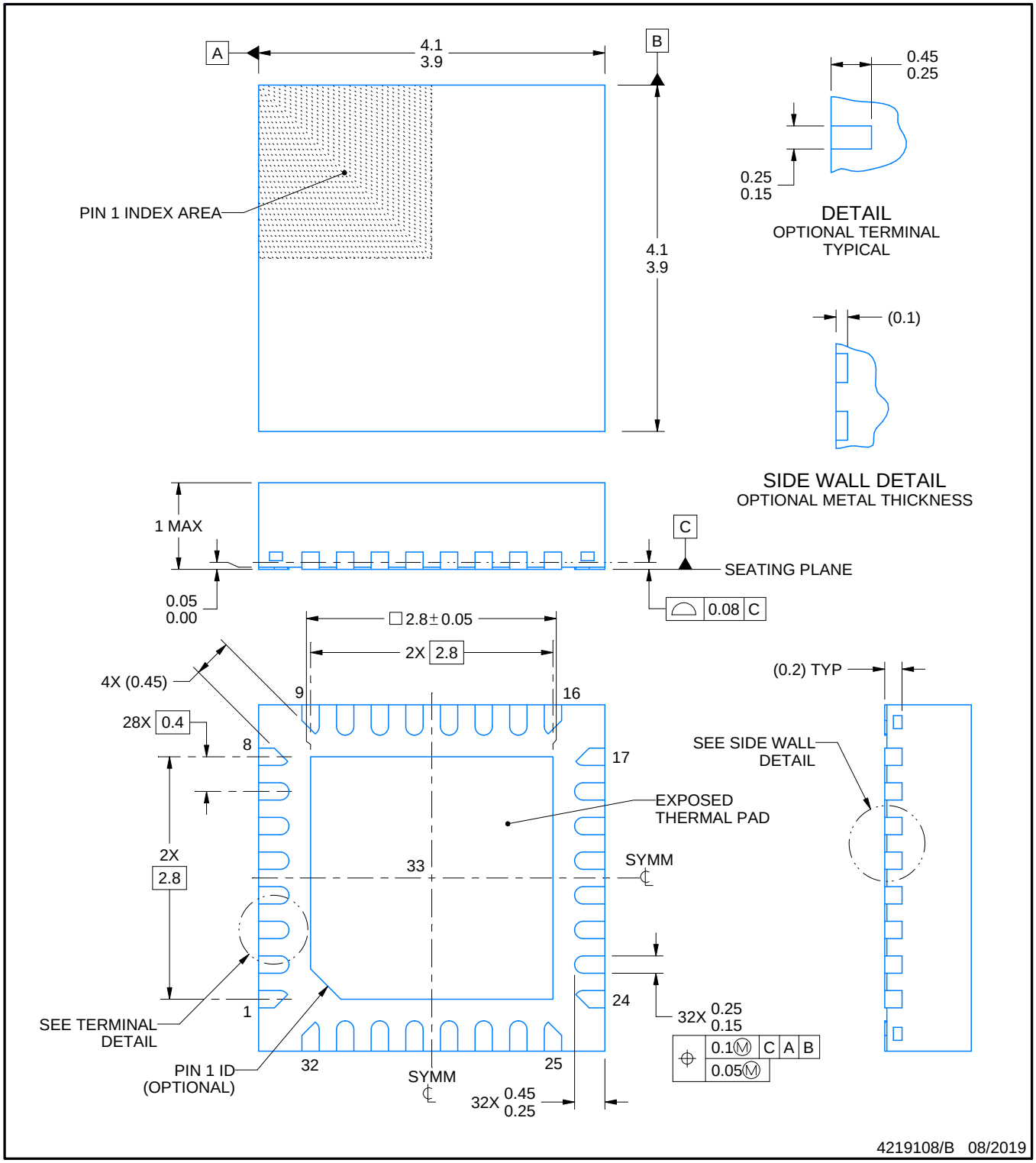
4224982/A

PACKAGE OUTLINE

RSM0032B

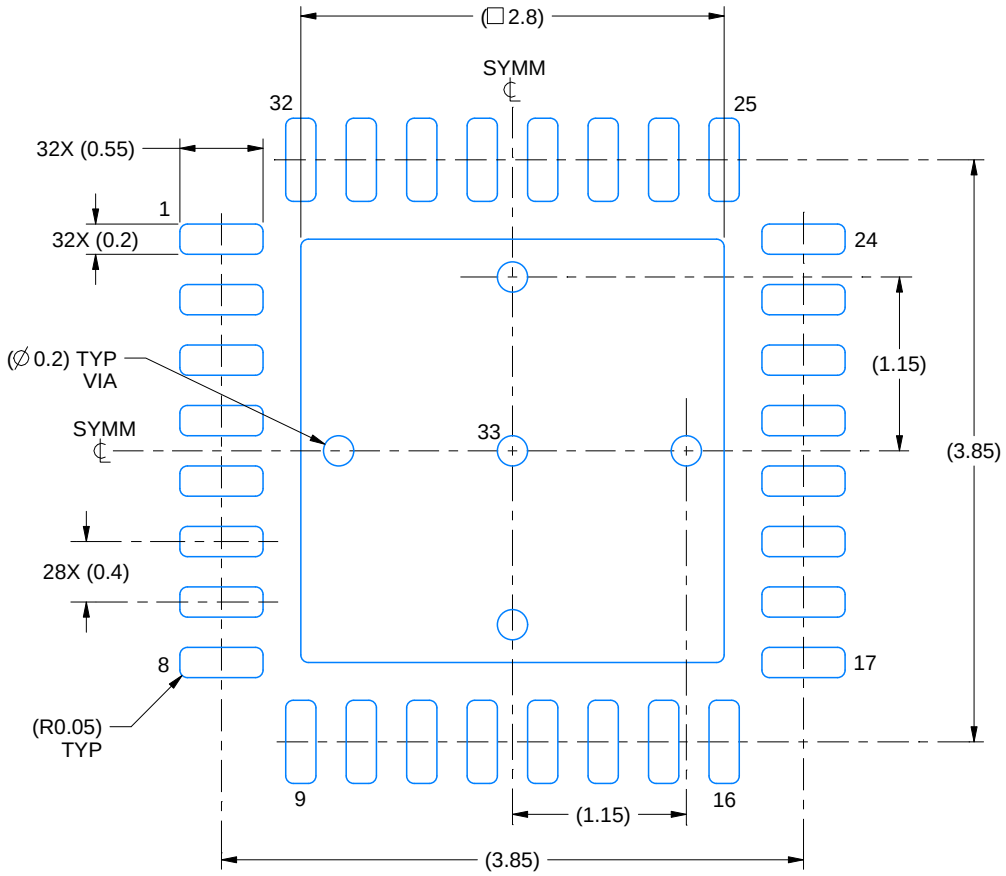
VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

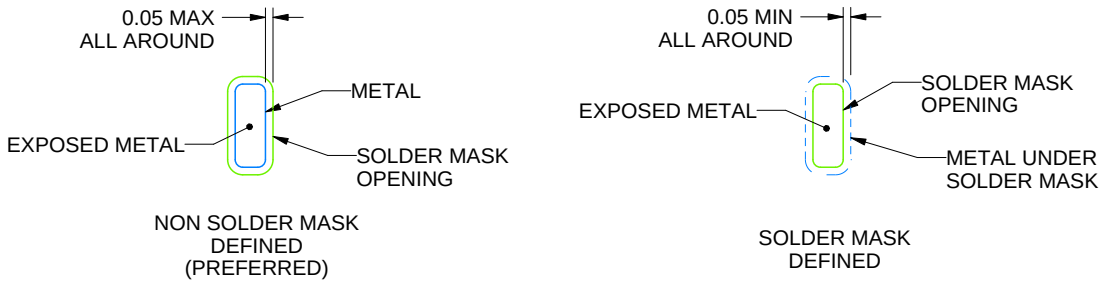


NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:20X

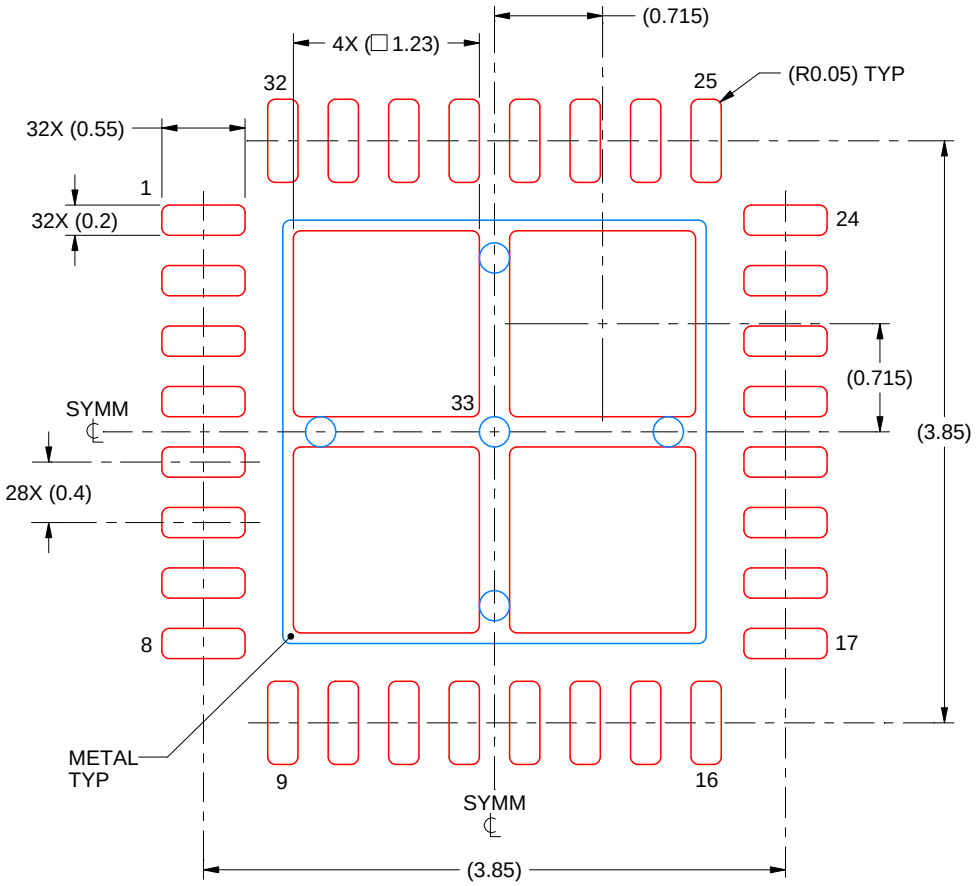


SOLDER MASK DETAILS

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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 0.1 mm THICK STENCIL

EXPOSED PAD 33:
77% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

4219108/B 08/2019

NOTES: (continued)

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

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