

# LP87745-Q1 用于 AWR 和 IWR 雷达传感器的三个降压转换器和 5V 升压

## 1 特性

- 具有符合 AEC-Q100 标准的下列特性：
  - 器件温度等级 1：-40°C 至 +125°C 环境温度范围
- 符合功能安全标准的器件
  - 专为功能安全应用开发
  - 文档有助于使 ISO 26262 功能安全系统设计满足 ASIL-C/SIL-2 要求
  - 输入电源过压和欠压监控
  - 稳压器输出过压和欠压监控
  - 外部电源轨的欠压和过压监控
  - 问答看门狗
  - 电平或 PWM 错误信号监视器 (ESM)
  - BIST 和 CRC
- 输入电压：3.3V 标称 (3V 至 4V 范围)
- 三个低噪声直流/直流降压转换器：
  - 输出电压：0.9V 至 1.9V、0.8V (BUCK3)、0.82V (BUCK3)
  - 最大输出电流：3A/3A/3A
  - 开关频率：4.4MHz、8.8MHz 和 17.6MHz
- 5V 升压转换器
  - 最大输出电流：350mA
- 150mA 低压降稳压器 (LDO)
  - 输出电压 1.8V 或 3.3V
- 输出短路和过载保护
- 输入过压保护 (OVP) 和欠压锁定 (UVLO)
- 过热警告和保护
- 串行外设接口 (SPI)

## 2 应用

- 中距离和短距离角雷达
- 远距离前置雷达
- 超短距离雷达
- 低纹波、低噪声应用

## 3 说明

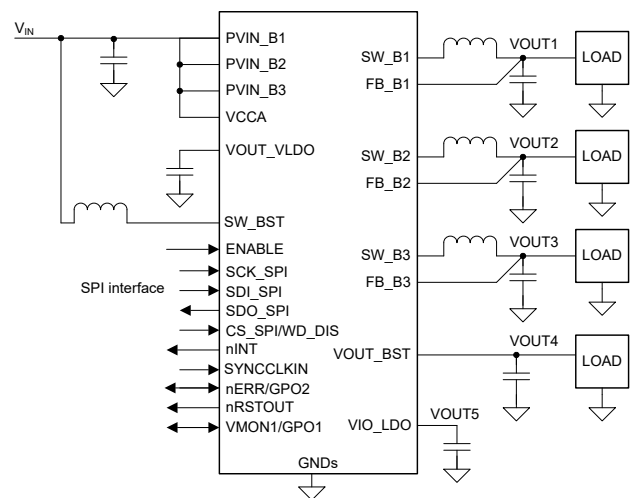
LP87745-Q1 器件旨在满足各种汽车和工业雷达应用中 AWR 和 IWR MMIC 电源管理要求。该器件包含三个直流/直流降压转换器、一个 5V 升压转换器以及一个 1.8V/3.3V LDO。LDO 由升压转换器供电，用于 xWR I/O 电源。SPI 串行接口和使能信号控制器件。

直流/直流降压转换器支持 4.4MHz、8.8MHz 或 17.6MHz 的可编程开关频率。该器件在宽频率范围内具有高开关频率和低噪声，从而可实现无 LDO 电源解决方案，且仅需少量或无需无源滤波。这改善了 MMIC 射频轨的散热和瞬态稳定。该器件会强制开关时钟进入 PWM 模式以获得出色的射频性能，并且还可以与外部时钟同步。该器件支持远程电压检测，可补偿稳压器输出与负载点 (POL) 之间的 IR 压降，从而提高输出电压的精度。

### 器件信息

器件型号 <sup>(1)</sup>	封装	封装尺寸 (标称值)
LP87745-Q1	VQFN-HR (28)	4.50 mm × 5.00 mm

(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。



简化版应用



## Table of Contents

<b>1 特性</b> .....	<b>1</b>	7.2 接收文档更新通知.....	<b>6</b>
<b>2 应用</b> .....	<b>1</b>	7.3 支持资源.....	<b>6</b>
<b>3 说明</b> .....	<b>1</b>	7.4 Trademarks.....	<b>6</b>
<b>4 Revision History</b> .....	<b>2</b>	7.5 Electrostatic Discharge Caution.....	<b>6</b>
<b>5 说明 (续)</b> .....	<b>3</b>	7.6 术语表.....	<b>6</b>
<b>6 Pin Configuration and Functions</b> .....	<b>4</b>	<b>8 Mechanical, Packaging, and Orderable Information</b> ....	<b>6</b>
<b>7 Device and Documentation Support</b> .....	<b>6</b>	8.1 Packaging Option Addendum.....	<b>7</b>
7.1 Documentation Support.....	<b>6</b>	8.2 Tape and Reel Information.....	<b>8</b>

## 4 Revision History

注：以前版本的页码可能与当前版本的页码不同

### Changes from Revision \* (October 2021) to Revision A (November 2022)

Page

• 将文件状态从 <i>预告信息</i> 更改为 <i>量产数据</i> .....	<b>1</b>
--	----------

## 5 说明 (续)

LP87745-Q1 器件支持可编程启动、关断延迟以及时序控制 (与使能信号同步)。这些时序可能还包括用于控制外部稳压器、负载开关和处理器复位的 GPO 信号。器件的默认设置编程到非易失性存储器 (NVM) 中。在启动期间, 该器件会对输出压摆率进行控制, 从而更大限度地减小输出电压过冲和浪涌电流。

## 6 Pin Configuration and Functions

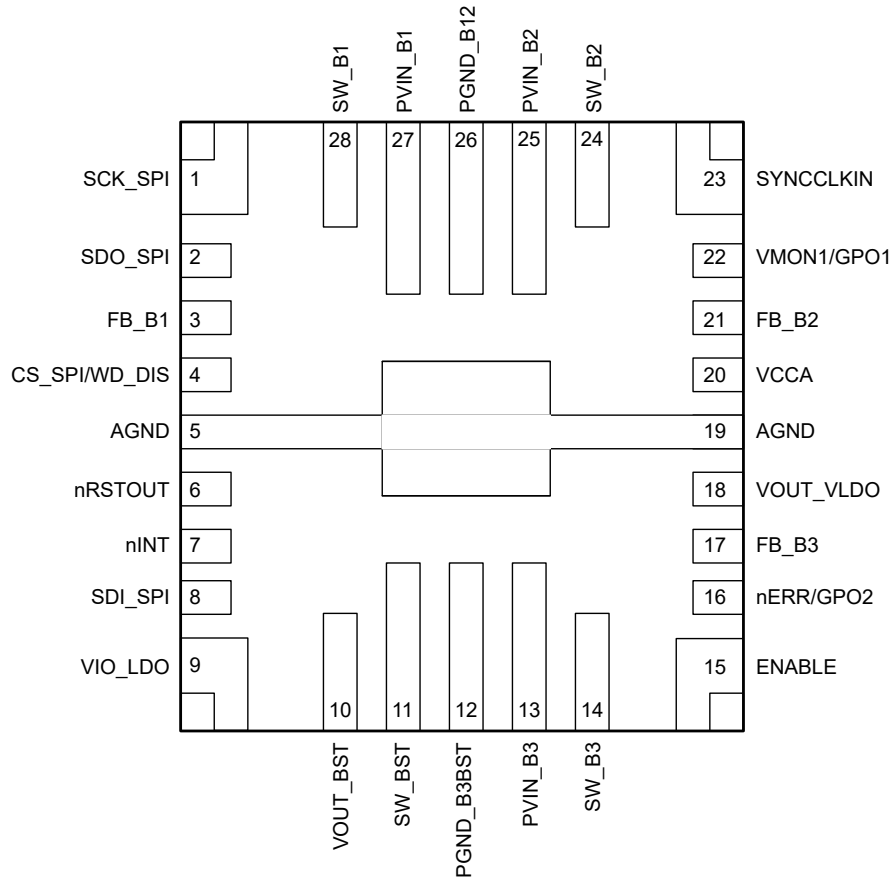


图 6-1. RXV Package, 28-Pin VQFN-HR (Top View)

表 6-1. Pin Functions

PIN		I/O	TYPE	DESCRIPTION	CONNECTION IF NOT USED
NO.	NAME				
1	SCK_SPI	I	Digital	Clock signal for SPI interface.	Ground
2	SDO_SPI	O	Digital	Output data signal for SPI interface.	Floating
3	FB_B1	—	Analog	Output voltage feedback (positive) for BUCK1.	Ground
4	CS_SPI/ WD_DIS	I	Digital	Primary function: Chip select signal for SPI interface.	VCCA
		I	Digital	Alternative programmable function: Watchdog Disable Input.	Not applicable
5	AGND	—	Ground	Ground.	Ground
6	NRSTOUT	O	Digital	Reset output.	Floating
7	nINT	O	Digital	Interrupt output and CAN PHY control or both.	Floating
8	SDI_SPI	I	Digital	Input data signal for SPI interface.	Ground
9	VIO_LDO	—	Analog	IO supply from the internal LDO or from external source. LDO enabled: regulator filter node. LDO disabled: input for connecting to an external IO supply source, with input filtering capacitor placed.	Not applicable
10	VOUT_BST	—	Analog	BOOST enabled: BOOST output (internally connected as VIO_LDO input). BOOST disabled and VIO_LDO disabled: short with VIO_LDO. BOOST disabled and VIO_LDO enabled: input for connecting to an external supply used as VIO_LDO input.	External supply
11	SW_BST	—	Analog	When BOOST enabled: BOOST input. When BOOST disabled: short with VOUT_BST.	VOUT_BST

**表 6-1. Pin Functions (continued)**

PIN		I/O	TYPE	DESCRIPTION	CONNECTION IF NOT USED
NO.	NAME				
12	PGND_B3BS T	—	Ground	Power ground for BUCK3 and BOOST.	Ground
13	PVIN_B3	—	Power	Power input for BUCK3. The separate power pins PVIN_Bxx are not connected together internally - PVIN_Bxx and VCCA pins must be connected together in the application and be locally bypassed.	System supply
14	SW_B3	—	Analog	BUCK3 switch node.	Floating
15	ENABLE	I	Digital	Programmable ENABLE signal.	Not applicable
16	nERR/GPO2	I	Digital	Primary function: System MCU Error Monitoring Input.	Ground
		O	Digital	Alternative programmable function: General Purpose Output signal (GPO2).	Floating
		O	Digital	Alternative programmable function: Fault Communication Output signal (FAULT2).	Floating
17	FB_B3	—	Analog	Output voltage feedback (positive) for BUCK3.	Ground
18	VOUT_VLDO	—	Power	LDO regulator filter node. LDO is used for internal purposes. No external load allowed.	-
19	AGND	—	Ground	Ground.	Ground
20	VCCA	—	Power	Supply voltage for internal LDO. VCCA and PVIN_Bxx pins must be connected together in the application and be locally bypassed.	System supply
21	FB_B2	—	Analog	Output voltage feedback (positive) for BUCK2.	Ground
22	VMON1/ GPO1	—	Analog	Voltage monitoring input.	Ground
		O	Digital	Alternative programmable function: General Purpose Output signal (GPO1).	Floating
		O	Digital	Alternative programmable function: Fault Communication Output signal (FAULT1).	Floating
		O	Digital	Alternative programmable function: CAN PHY control (CAN_DIS).	Floating
23	SYNCCLKIN	I	Digital	External clock input.	Ground
24	SW_B2	—	Analog	BUCK2 switch node.	Floating
25	PVIN_B2	—	Power	Power input for BUCK2. The separate power pins PVIN_Bxx are not connected together internally - PVIN_Bxx and VCCA pins must be connected together in the application and be locally bypassed.	System supply
26	PGND_B12	—	Ground	Power ground for BUCK1 and BUCK2.	Ground
27	PVIN_B1	—	Power	Power input for BUCK1. The separate power pins PVIN_Bxx are not connected together internally - PVIN_Bxx and VCCA pins must be connected together in the application and be locally bypassed.	System supply
28	SW_B1	—	Analog	BUCK1 switch node.	Floating

## 7 Device and Documentation Support

### 7.1 Documentation Support

#### 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 [订阅更新](#) 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™ 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](#)》。

#### 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 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.

#### 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 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.

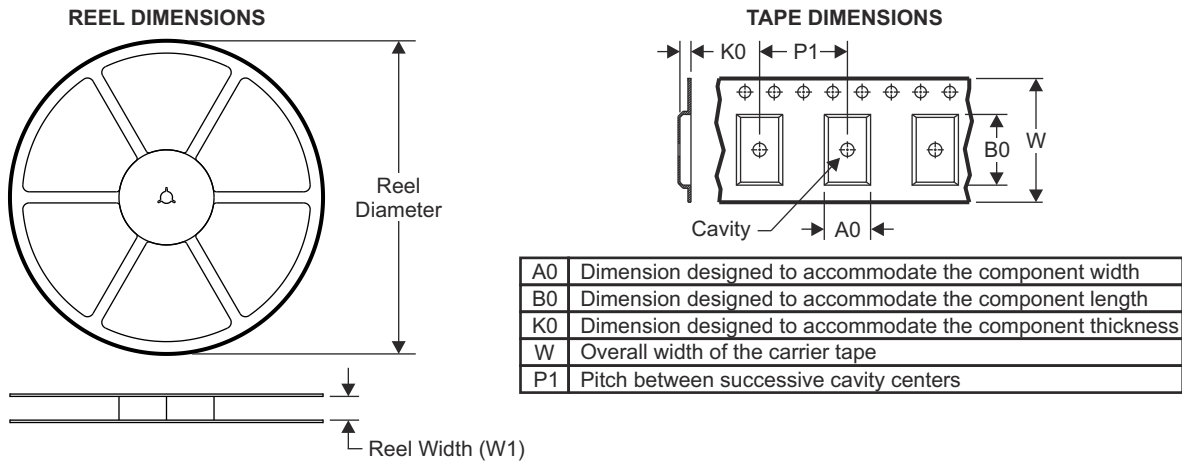
## 8.1 Packaging Option Addendum

### Packaging Information

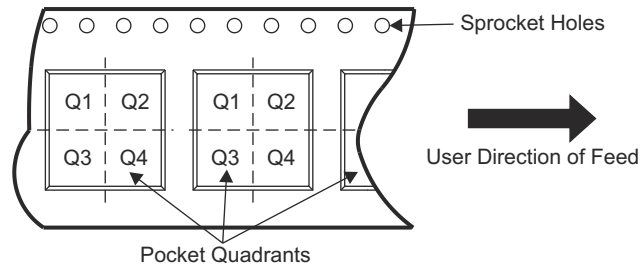
Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish <sup>(4)</sup>	MSL Peak Temp <sup>(3)</sup>	Op Temp (°C)	Device Marking <sup>(5) (6)</sup>
LP877451A1RXVRQ1	ACTIVE	VQFN-HR	RXV	28	3000	Green (RoHS & no Sb/Br)	NIPDAU   SN	Level-2-260C-1 YEAR	-40 to 125	LP8774 51A1-Q1

- (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.  
**PRE\_PROD** Unannounced device, not in production, not available for mass market, nor on the web, samples not available.  
**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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.  
**TBD:** The Pb-Free/Green conversion plan has not been defined.  
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.  
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.  
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)
- (3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.
- (5) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device
- (6) 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.  
**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.

## 8.2 Tape and Reel Information



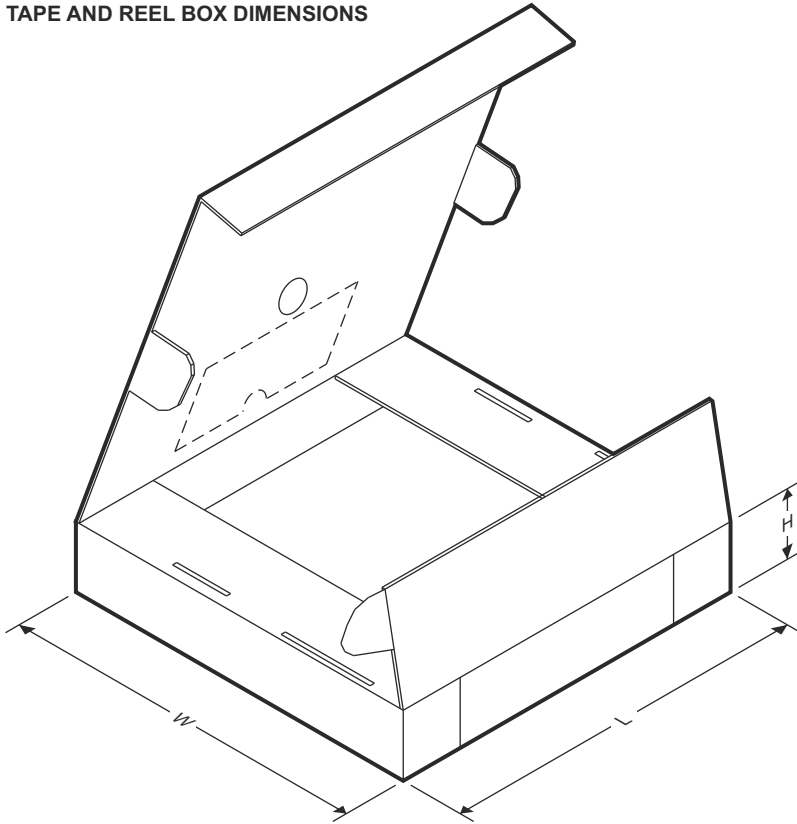
### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



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
LP877451A1RXVRQ1	VQFN-HR	RXV	28	3000	330	12.4	4.80	5.30	1.10	8.0	12.0	Q1



**TAPE AND REEL BOX DIMENSIONS**

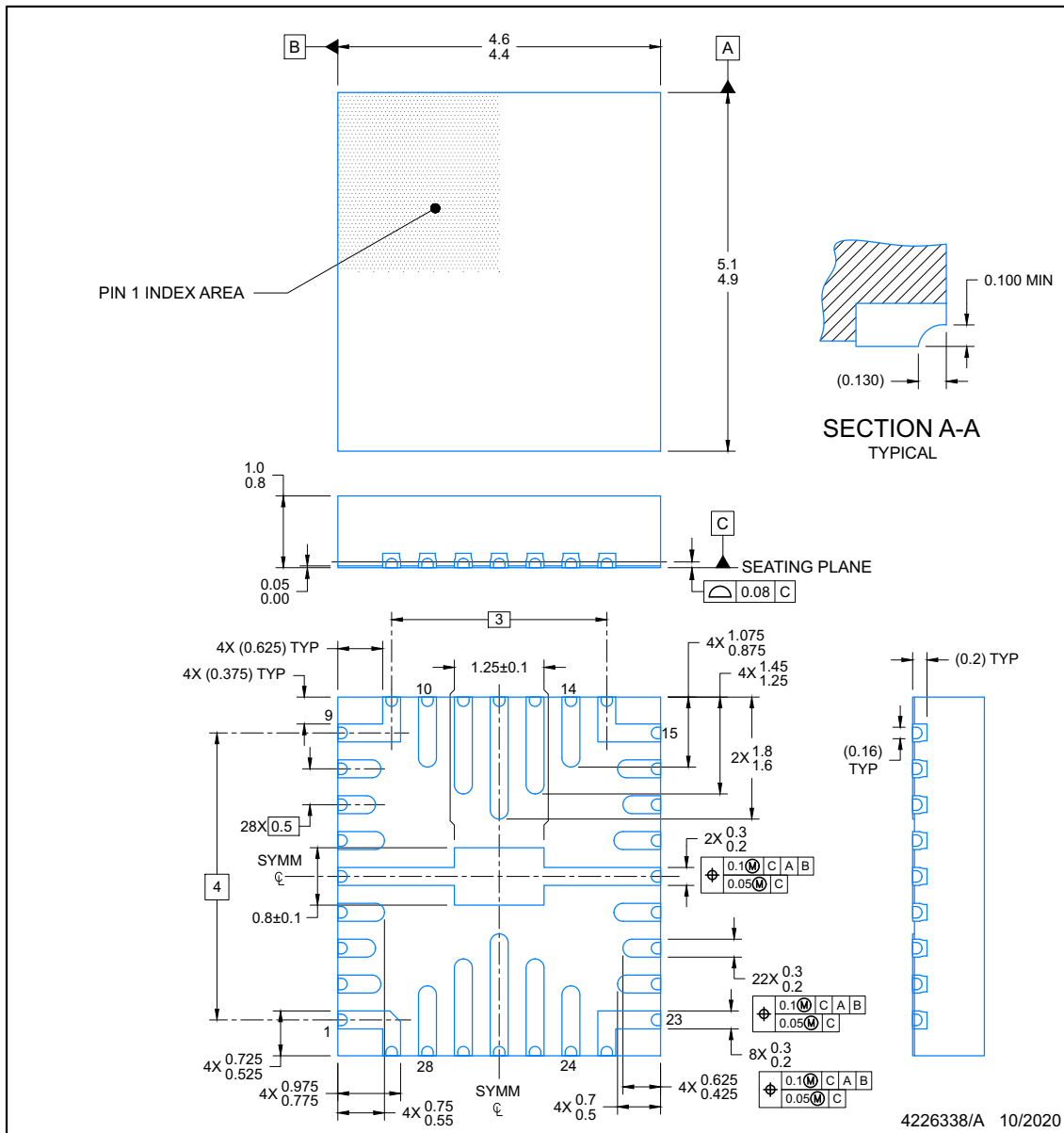


Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LP877451A1RXVRQ1	VQFN-HR	RXV	28	3000	367	367	38

**RXV0028A**

**PACKAGE OUTLINE**  
**VQFN-HR - 1 mm max height**

PLASTIC QUAD FLATPACK-NO LEAD



NOTES:

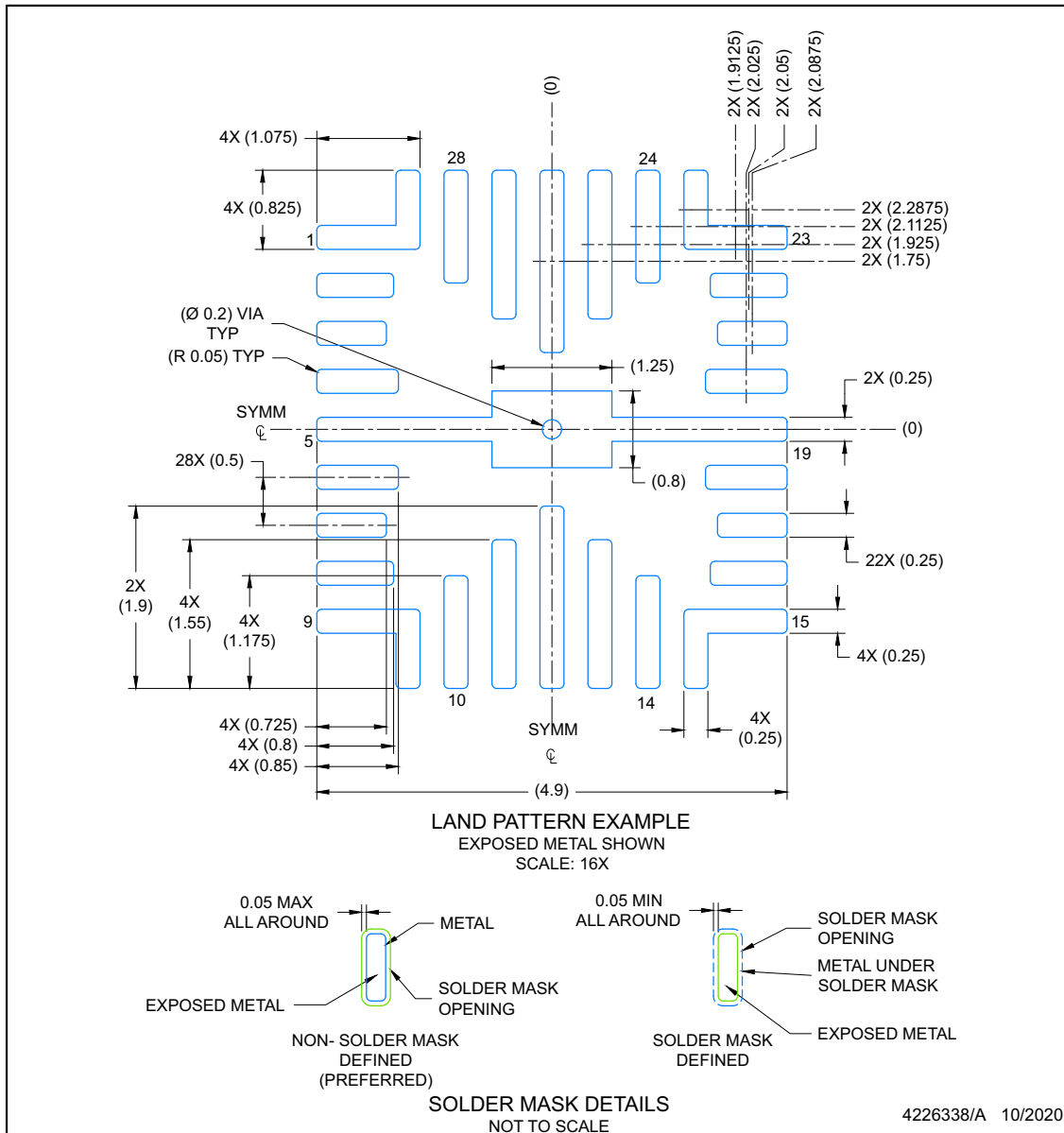
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

**EXAMPLE BOARD LAYOUT**

**RXV0028A**

**VQFN-HR - 1 mm max height**

PLASTIC QUAD FLATPACK-NO LEAD



NOTES: (continued)

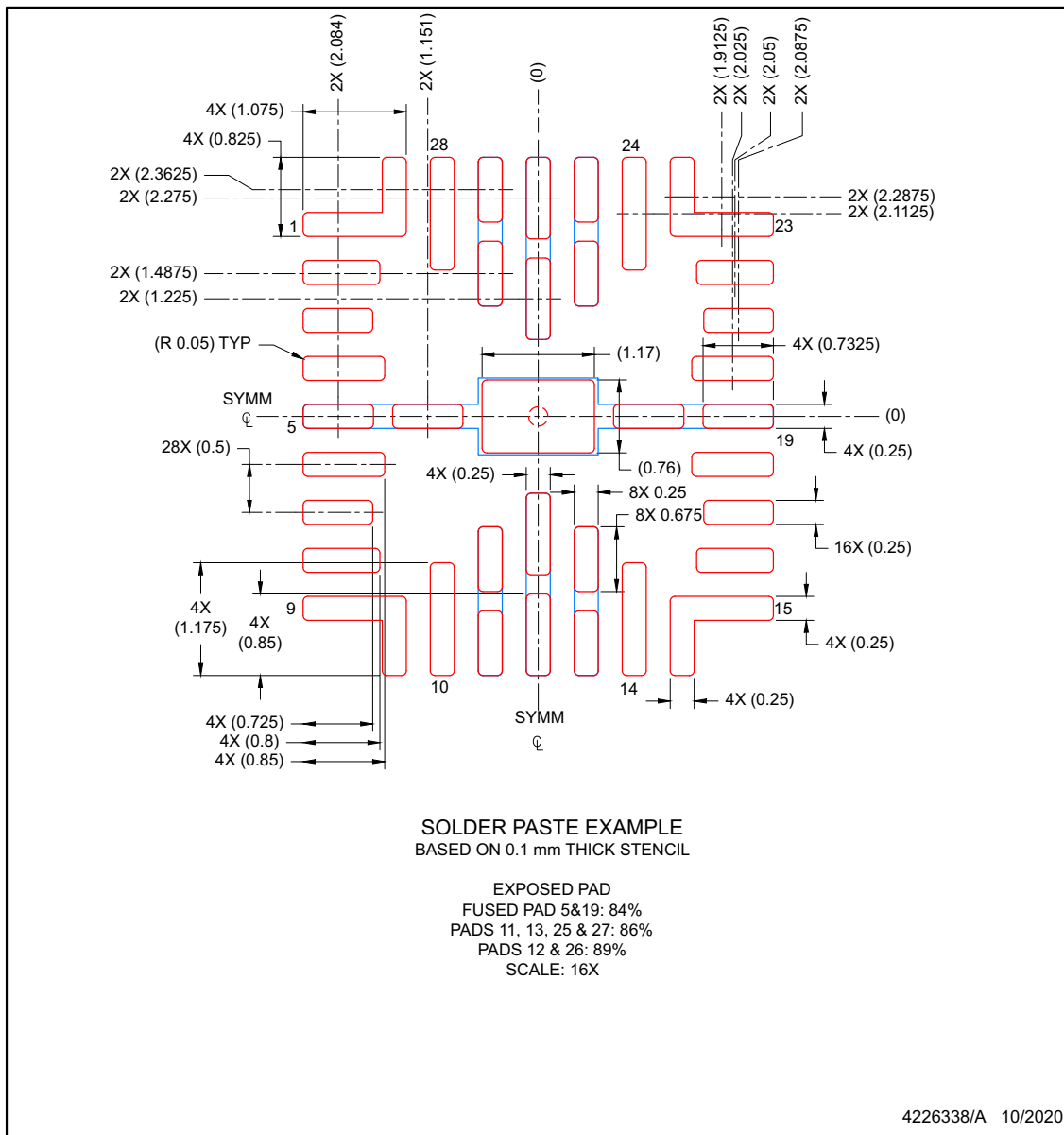
3. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).
4. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

**EXAMPLE STENCIL DESIGN**

**RXV0028A**

**VQFN-HR - 1 mm max height**

PLASTIC QUAD FLATPACK-NO LEAD



NOTES: (continued)

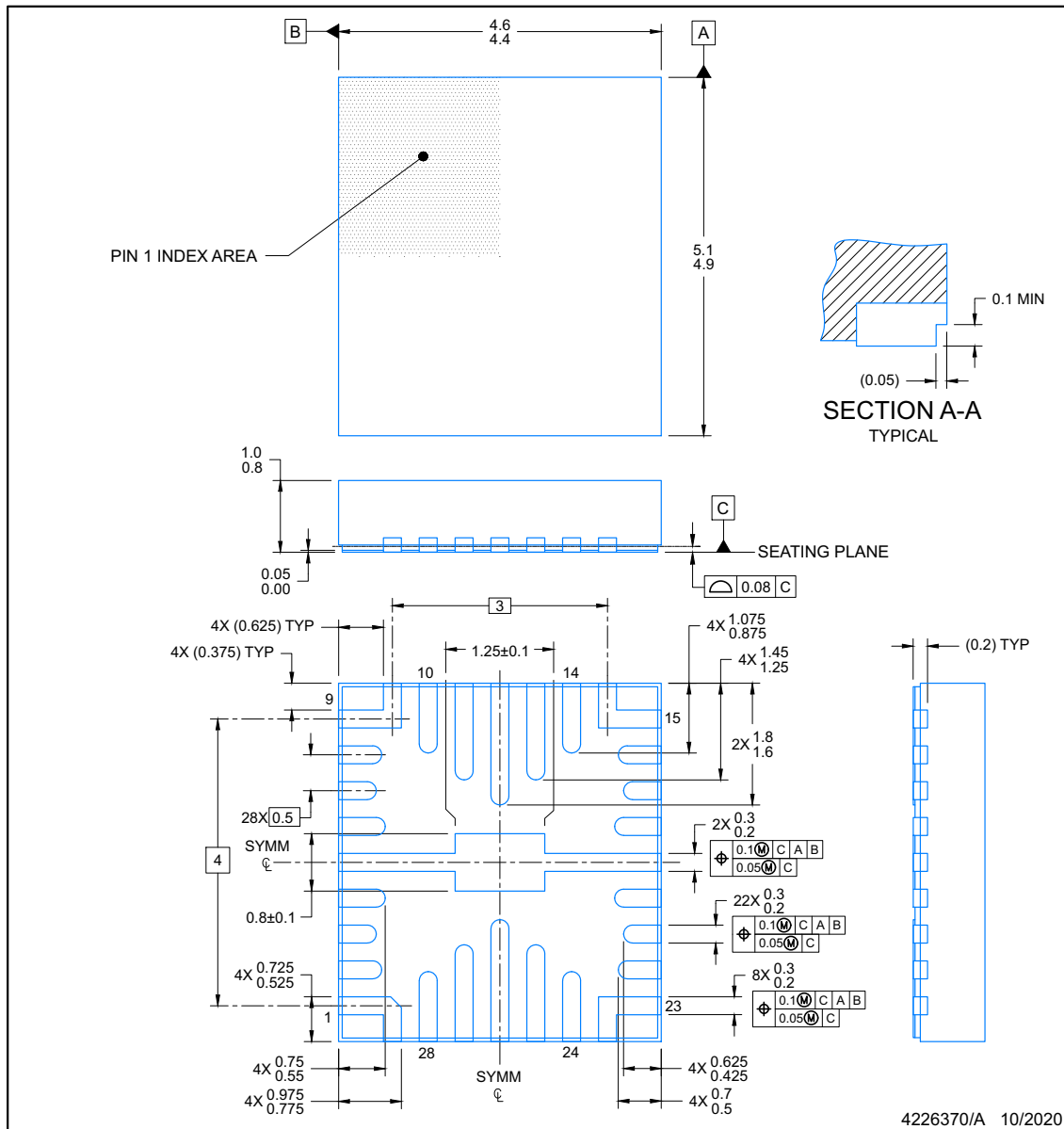
5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

**PACKAGE OUTLINE**

**RXV0028B**

**VQFN-HR - 1 mm max height**

PLASTIC QUAD FLATPACK-NO LEAD



NOTES:

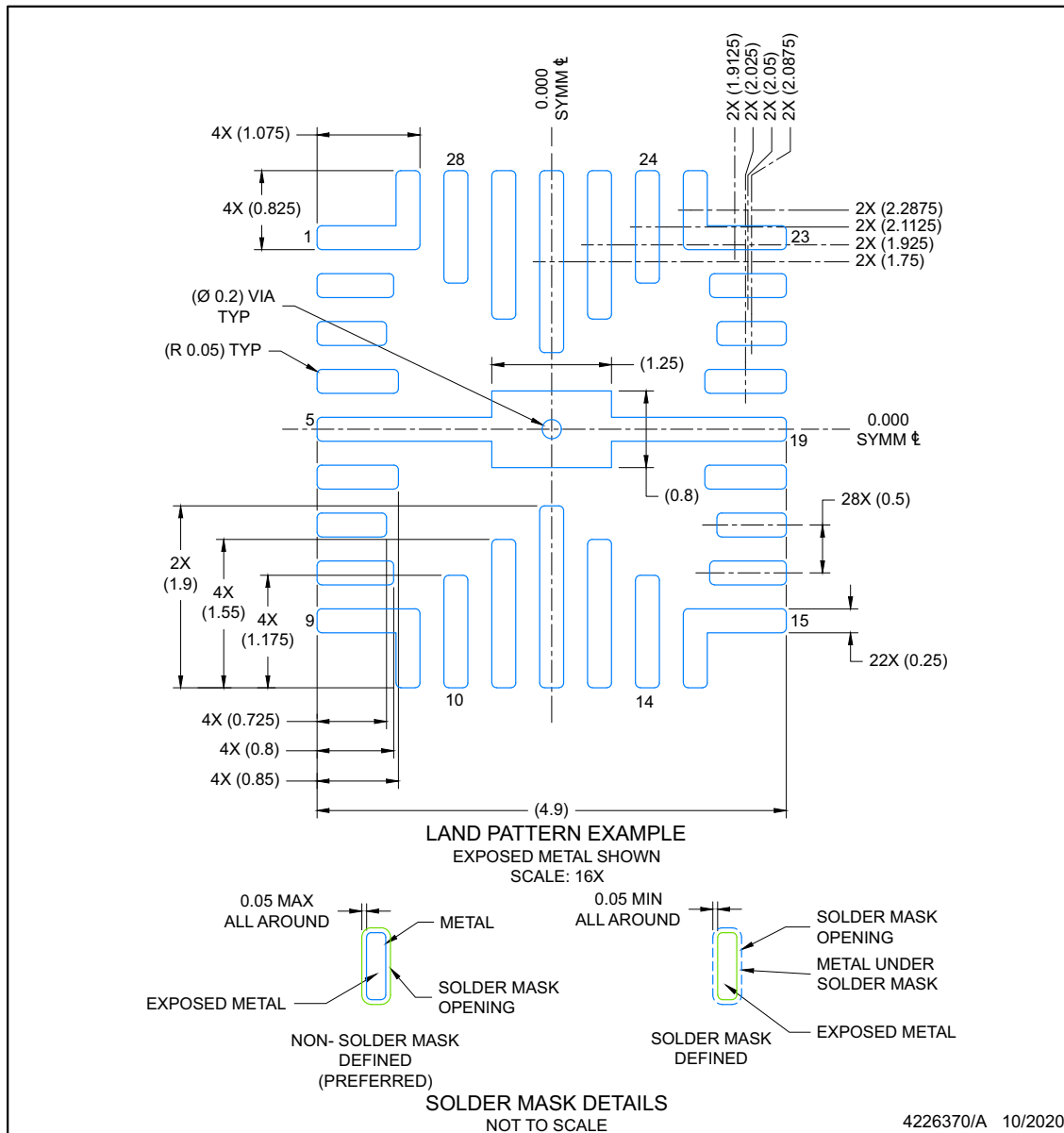
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

**EXAMPLE BOARD LAYOUT**

**VQFN-HR - 1 mm max height**

**RXV0028B**

PLASTIC QUAD FLATPACK-NO LEAD



NOTES: (continued)

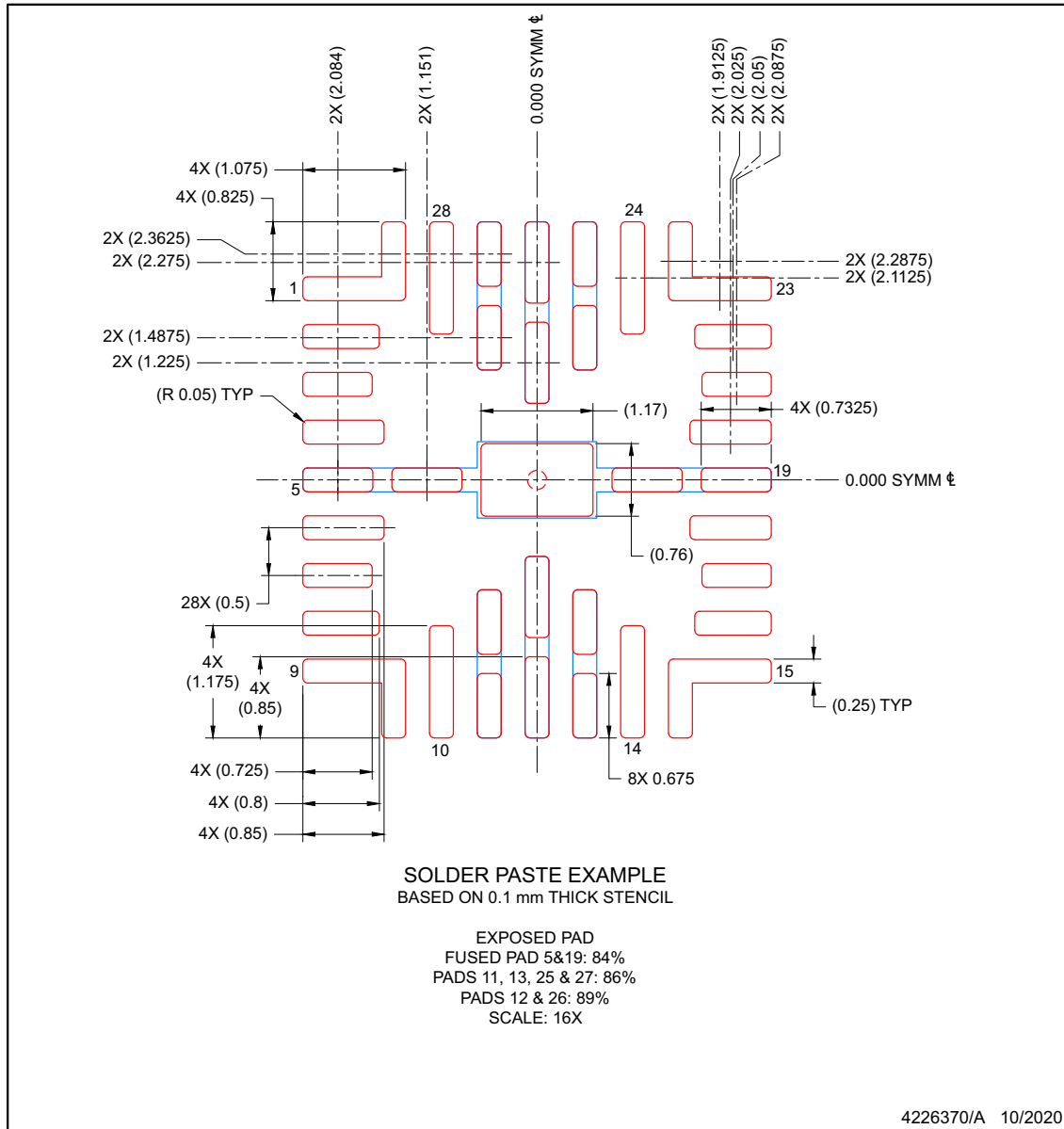
3. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/slua271](http://www.ti.com/lit/slua271)).
4. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

**RXV0028B**

**VQFN-HR - 1 mm max height**

PLASTIC QUAD FLATPACK-NO LEAD



NOTES: (continued)

5. 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“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、某特定用途方面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功能安全、信息安全、监管或其他要求。

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 产品的应用。严禁对这些资源进行其他复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。您应全额赔偿因在这些资源的使用中对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，TI 对此概不负责。

TI 提供的产品受 [TI 的销售条款](#) 或 [ti.com](#) 上其他适用条款/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。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

邮寄地址：Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

Copyright © 2022，德州仪器 (TI) 公司