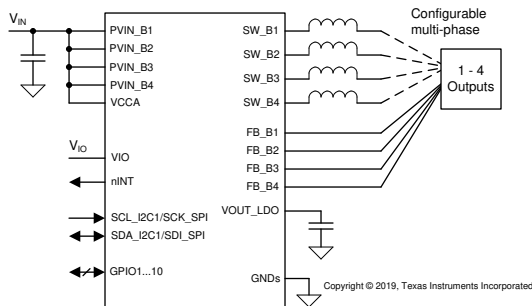


LP8764-Q1 具有集成开关的四相 20A 降压转换器

1 特性

- 具有符合 AEC-Q100 标准的下列特性：
 - 输入电压：2.8V 至 5.5V
 - 器件温度等级 1：-40°C 至 +125°C 环境温度范围
 - 器件 HBM ESD 分类等级 2
 - 器件 CDM ESD 分类等级 C4B
- 功能安全合规型
 - 专为功能安全应用开发
 - 有助于使 ISO 26262 系统设计符合 ASIL-D 要求的文档
 - 有助于使 IEC 61508 系统设计符合 SIL-3 要求的文档
 - 系统可满足 ASIL D 级要求
 - 硬件完整性高达 ASIL-D 级
 - 窗口式电压和过流监控器
 - 具有可选触发/Q&A 模式的看门狗
 - 电平或 PWM 错误信号监控 (ESM)
 - 具有高温警告和热关断功能的温度监测
 - 对配置寄存器和非易失性存储器的位完整性 (CRC) 错误检测
- 4 个高效直流/直流降压转换器：
 - 输出电压：0.3V 至 3.34V (多相位输出的电压为 0.3V 至 1.9V)
 - 最大输出电流：每相位 5A，四相配置最高可达 20A
 - 可编程输出电压压摆率：0.5mV/μs 至 33mV/μs
 - 开关频率：2.2 MHz 或 4.4 MHz
- 10 个可配置通用 I/O (GPIO)
- SPMI 接口支持多个 PMIC 同步
- 输入过压监控 (OVP) 和欠压锁定 (UVLO)



简化版原理图

2 应用

- 高级驾驶辅助系统 (ADAS)
- 前置摄像头
- 环视系统 ECU
- 远距离雷达
- 传感器融合
- 域控制器

3 说明

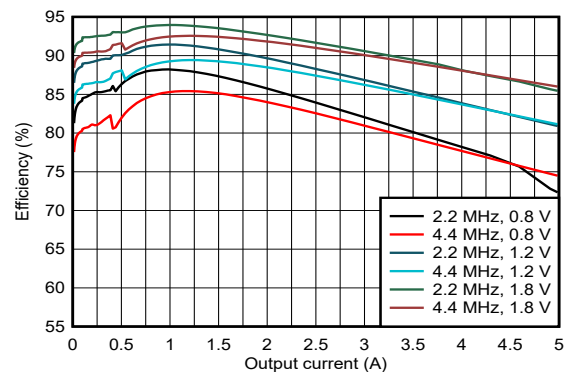
LP8764-Q1 器件旨在满足各种安全相关的汽车和工业应用中新型处理器和平台的电源管理要求。该器件具有 4 个直流/直流降压转换器内核，可配置为从 1 个四相输出到 4 个单相输出的五种不同相位配置。该器件设置可通过兼容 I²C 的串行接口或 SPI 串行接口进行更改。

自动 PFM/PWM (AUTO 模式) 操作与自动相位增加和相位减少相结合，可在较宽输出电流范围内更大幅度地提高效率。LP8764-Q1 器件支持对多相位输出的远程差分电压检测，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。开关时钟可以强制进入 PWM 模式，并且相位会交错。可以将开关与外部时钟同步并启用展频模式，以最大限度地降低干扰。

器件信息

器件型号	封装 ⁽¹⁾	本体尺寸 (标称值)
LP8764-Q1	VQFN-HR (32)	5.50mm × 5.00mm

- (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。



效率与输出电流间的关系 (单相)， $V_{IN} = 3.3V$



内容

1 特性.....	1	4.3 商标.....	3
2 应用.....	1	4.4 静电放电警告.....	3
3 说明.....	1	4.5 术语表.....	3
4 器件和文档支持.....	3	5 修订历史记录.....	3
4.1 接收文档更新通知.....	3	6 机械、封装和可订购信息.....	3
4.2 支持资源.....	3		

4 器件和文档支持

4.1 接收文档更新通知

要接收文档更新通知，请导航至 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。

4.2 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](#)。

4.3 商标

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4.4 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。

4.5 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。

5 修订历史记录

注：以前版本的页码可能与当前版本的页码不同

日期	修订版本	注释
November 2024	*	初始发行版

6 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可用的最新数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。有关此数据表的浏览器版本，请查阅左侧的导航栏。

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)
LP876411B4RQKRQ1	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 11B4-Q1
LP876411B4RQKRQ1.A	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 11B4-Q1
LP876411B5RQKRQ1	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 11B5-Q1
LP876411B5RQKRQ1.A	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 11B5-Q1
LP876429CFRQKRQ1	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 29CF-Q1
LP876440C0RQKRQ1	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 40C0-Q1
LP876440C0RQKRQ1.A	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 40C0-Q1
LP876441B1RQKRQ1	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	NIPDAU SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 41B1-Q1
LP876441B1RQKRQ1.A	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LP8764 41B1-Q1
LP876449CERQKRQ1	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 49CE-Q1
LP876459CDRQKRQ1	Active	Production	VQFN-HR (RQK) 32	3000 LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	LP8764 59CD-Q1

⁽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.

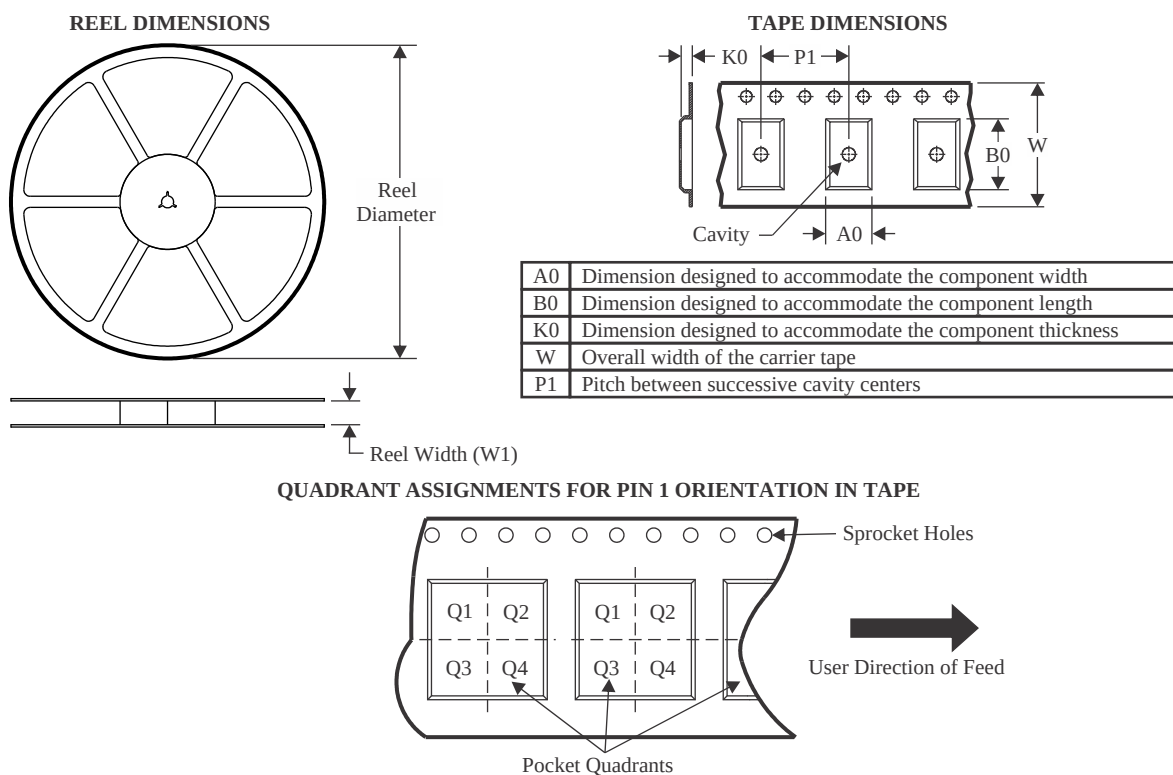
⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will 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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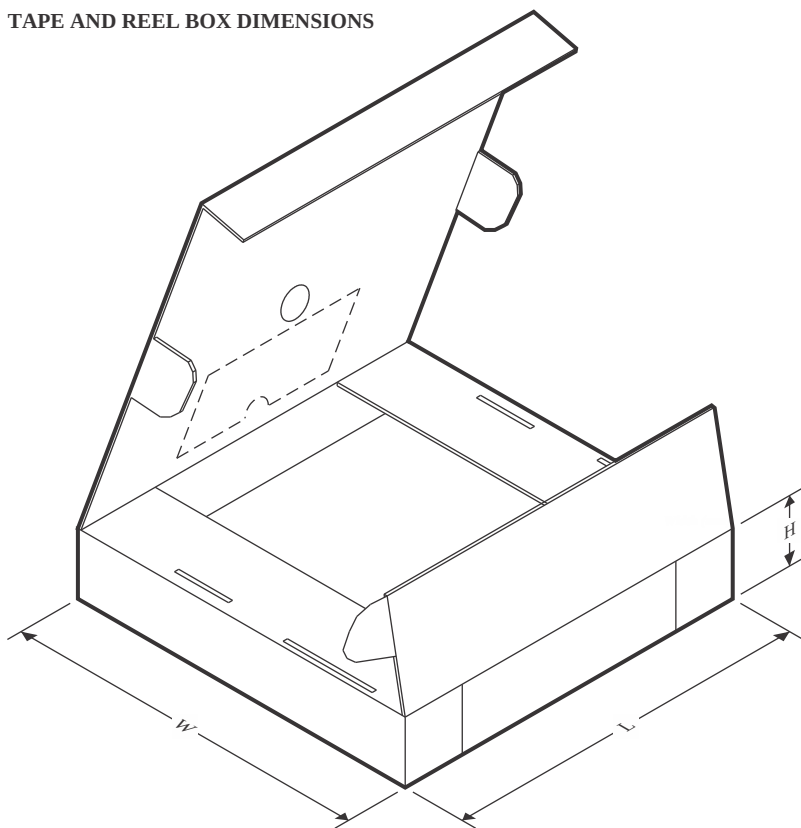
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION


*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
LP876411B4RQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.25	5.75	1.05	8.0	12.0	Q1
LP876411B5RQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.25	5.75	1.05	8.0	12.0	Q1
LP876429CFRQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.25	5.75	1.05	8.0	12.0	Q1
LP876440C0RQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.25	5.75	1.05	8.0	12.0	Q1
LP876441B1RQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.3	5.8	1.2	8.0	12.0	Q1
LP876441B1RQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.25	5.75	1.05	8.0	12.0	Q1
LP876449CERQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.25	5.75	1.05	8.0	12.0	Q1
LP876459CDRQKRQ1	VQFN-HR	RQK	32	3000	330.0	12.4	5.25	5.75	1.05	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LP876411B4RQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	38.0
LP876411B5RQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	38.0
LP876429CFRQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	38.0
LP876440C0RQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	38.0
LP876441B1RQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	35.0
LP876441B1RQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	38.0
LP876449CERQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	38.0
LP876459CDRQKRQ1	VQFN-HR	RQK	32	3000	367.0	367.0	38.0

GENERIC PACKAGE VIEW

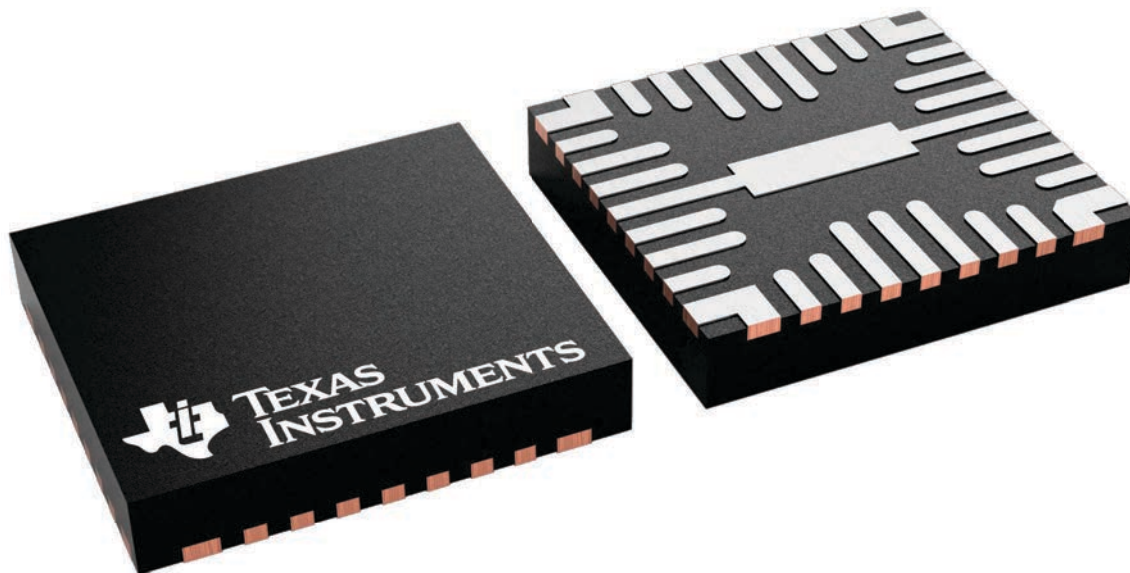
RQK 32

VQFN-HR - 1 mm max height

5 x 5.5, 0.5 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.



4225349/B

VQFN-HR - 1 mm max height

Top View:

- Overall width: 5.1 (4.9)
- Overall height: 5.6 (5.4)
- PIN 1 IDENTIFICATION: A shaded square area with a dot in the top-left corner.
- Pin pitch: 0.5 (0.45)
- Pin 1 ID (OPTIONAL): A small square feature on the bottom-left pin.
- Package center: PKG C

Side View:

- Maximum height: 1 (0.8)
- Standoff height: 0.05 (0.00)
- Seating Plane: Indicated by a horizontal line.
- Lead thickness: 0.08 (0.075)

Cross-Section A-A (TYPICAL):

- Lead thickness: 0.1 MIN
- Lead width: (0.05)

Bottom View:

- Pin 1 ID (OPTIONAL): A small square feature on the bottom-left pin.
- Pin pitch: 0.5 (0.45)
- Package center: PKG C
- Dimensions: 2X 4.15, 4X 0.5625, 4X 0.575, 24X 0.5, 8X 1.3 (1.1), 4X 0.975 (0.775), 4X 0.85 (0.65), 4X 0.425 (0.325), 4X 0.625±0.1, 26, 32, 0.7±0.1, 2.2±0.1, 33, 10, 13, 16, 17, 4X 0.85 (0.65), 6X 1.4 (1.2), 4X 0.95 (0.75), 28X 0.3 (0.2), 4X 0.45 (0.35), 4X 0.625±0.1.

Feature Callouts:

- SEATING PLANE
- (0.2) TYP
- 0.1 MIN
- (0.05)
- SECTION A-A TYPICAL

Material and Finish:

- Lead thickness: 0.08 (0.075)
- Lead width: 0.1 MIN
- Lead height: 0.05 (0.00)

Notes:

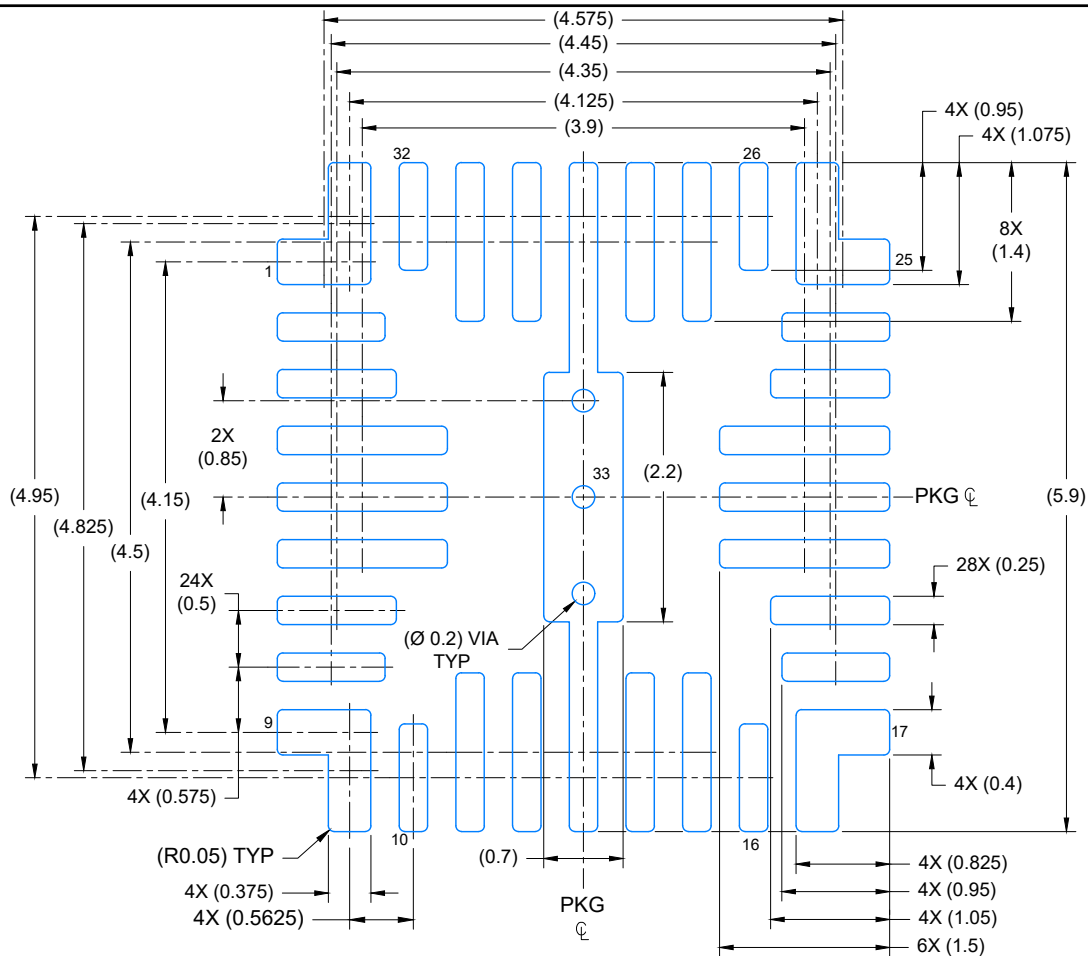
- 1 (0.8)
- 0.05 (0.00)
- 2X 4.15
- 4X 0.5625
- 4X 0.575
- 24X 0.5
- 8X 1.3 (1.1)
- 4X 0.975 (0.775)
- 4X 0.85 (0.65)
- 4X 0.425 (0.325)
- 4X 0.625±0.1
- 26
- 32
- 0.7±0.1
- 2.2±0.1
- 33
- 10
- 13
- 16
- 17
- 4X 0.85 (0.65)
- 6X 1.4 (1.2)
- 4X 0.95 (0.75)
- 28X 0.3 (0.2)
- 4X 0.45 (0.35)
- 4X 0.625±0.1

Legend:

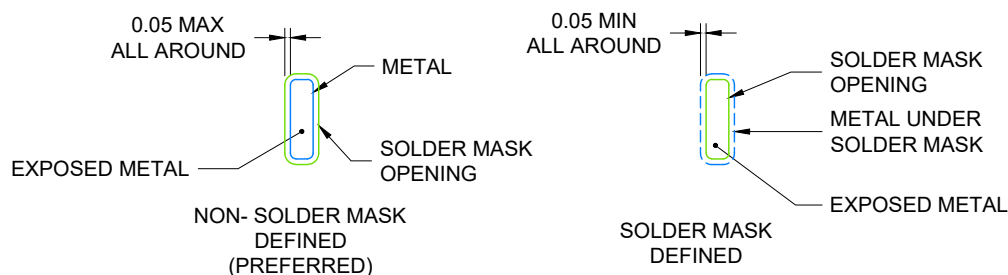
- 0.1 (M) C A B
- 0.05 (M) C
- 0.1 (M) C A B
- 0.05 (M) C
- 0.1 (M) C A B
- 0.05 (M) C

Part Number: 4225338/B 07/20

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
EXPOSED METAL SHOWN
SCALE: 15X



SOLDER MASK DETAILS
NOT TO SCALE

4225338/B 07/2020

NOTES: (continued)

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

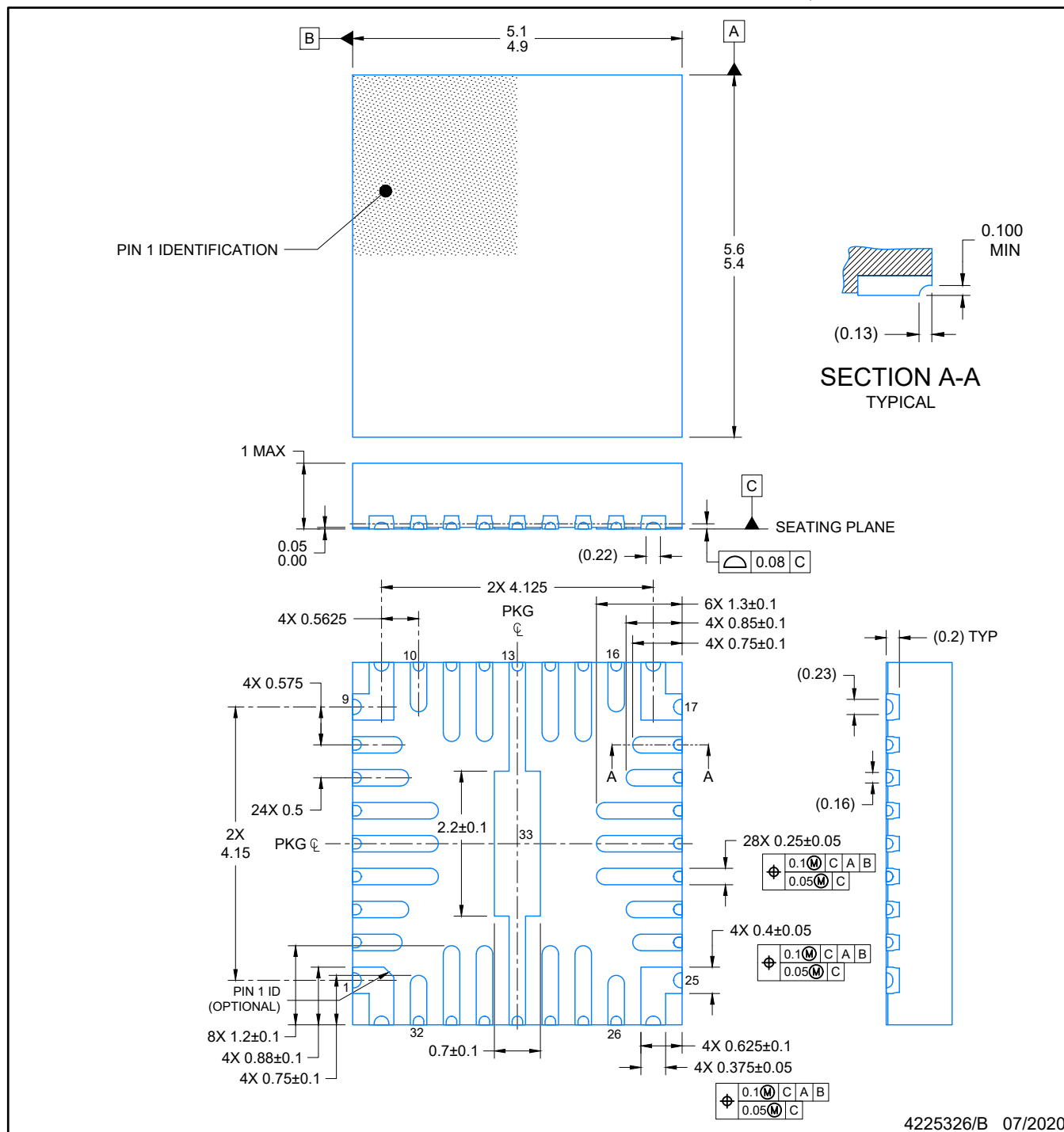
VQFN-HR - 1 mm max height

[illegible]

PIN 1,9,16 & 25: 93%; PIN 13& 29: 79%; PIN 33: 84%
SCALE: 15X

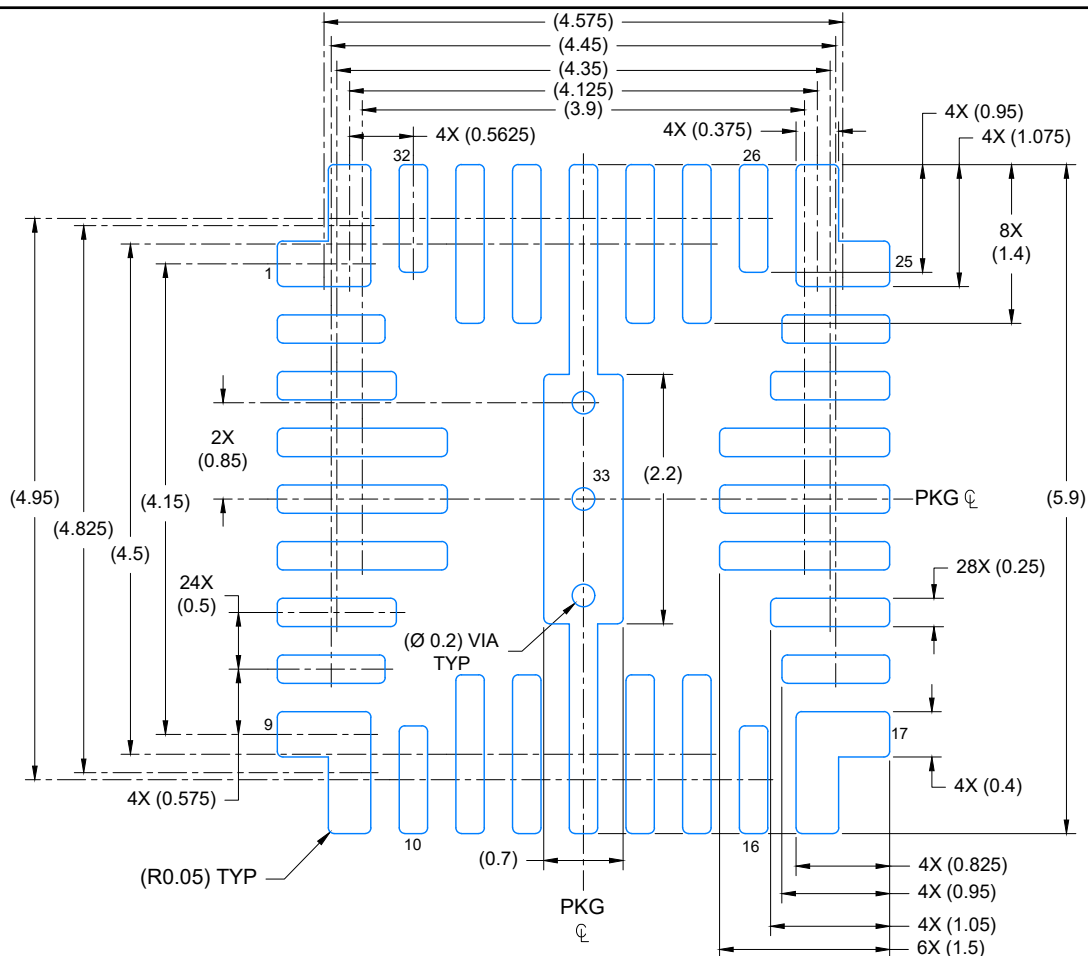
NOTES: (continued)

- 

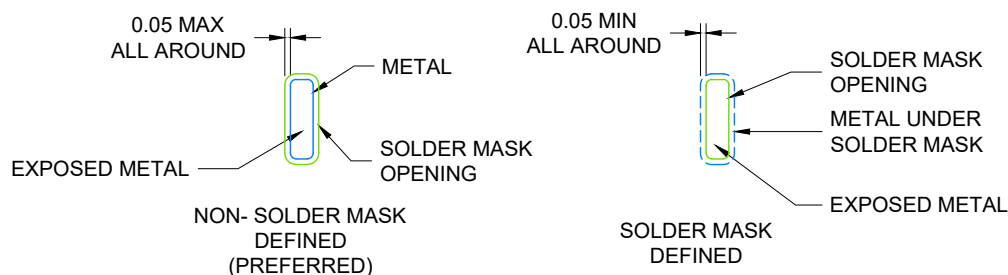


NOTES:

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

EXPOSED METAL SHOWN
SCALE: 15X

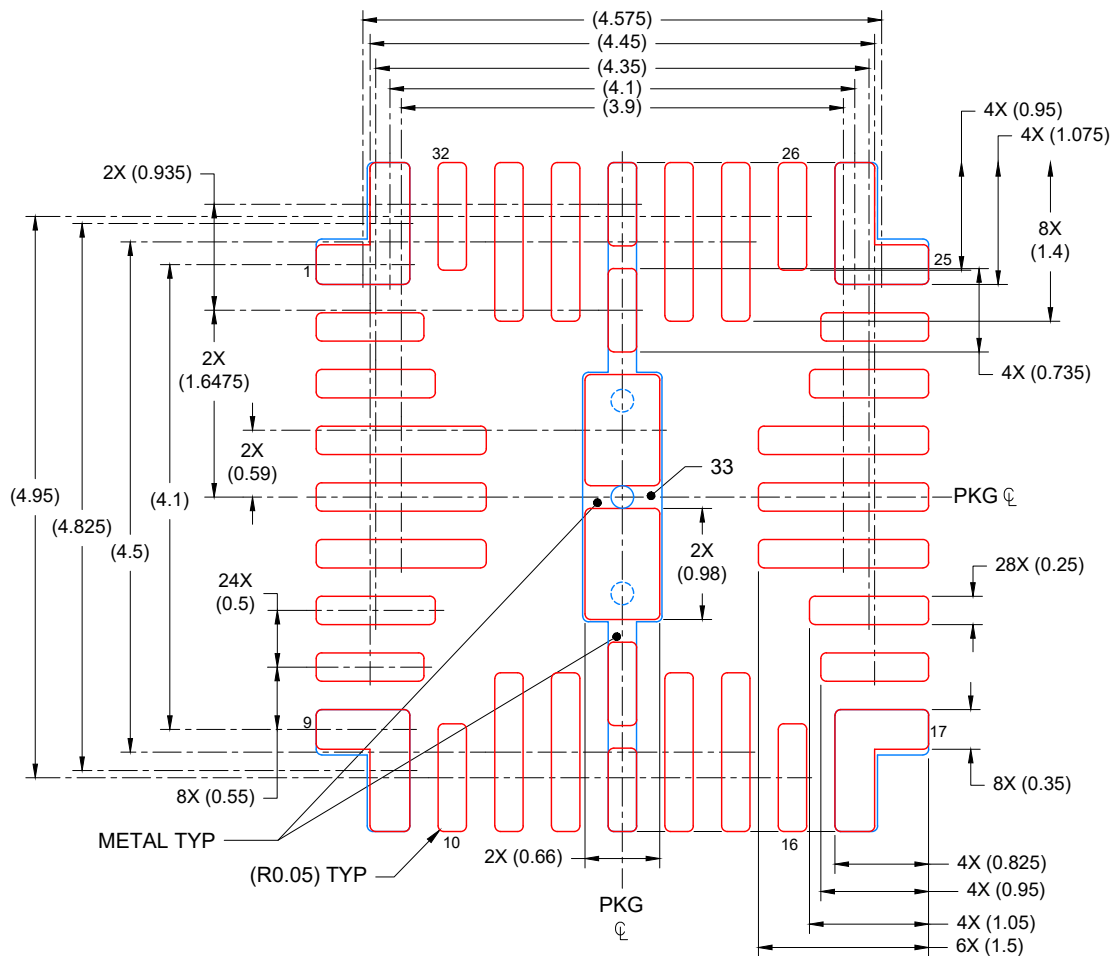
SOLDER MASK DETAILS

NOT TO SCALE

4225326/B 07/2020

NOTES: (continued)

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



SOLDER PASTE EXAMPLE
 BASED ON 0.1mm THICK STENCIL

PIN 1,9,16 & 25: 93%; PIN 13& 29: 79%; PIN 33: 84%
 SCALE: 15X

4225326/B 07/2020

NOTES: (continued)

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

重要通知和免责声明

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最后更新日期：2025 年 10 月