

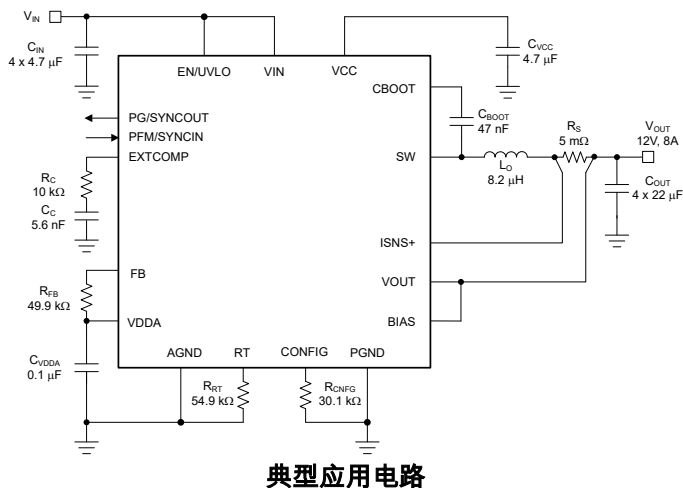
LM708x0-Q1 针对高功率密度进行优化的 80V、8A/6A/4A 汽车类高效降压转换器

1 特性

- 符合面向汽车应用的 AEC-Q100 标准：
 - 器件温度等级 1：-40°C 至 +125°C 环境温度范围
- 具有多功能降压控制器和稳健功率 MOSFET 的同步直流/直流转换器
 - 宽输入电压范围：4.5V 至 80V
 - 1% 精度、3.3V/5V/12V 固定或 0.8V 至 55V 可调输出电压
 - 双相控制，可以并联两个器件实现电流更高的应用
 - 关断模式电流：2.3μA
 - 空载睡眠电流：6.5μA
- 进行了优化，可满足低 EMI 要求
 - 有助于符合 CISPR 25 5 级标准
 - 引脚可选式 ±8% 双随机展频可降低峰值发射
 - 开关频率：200kHz 至 2.2MHz
 - 引脚可配置自动或 FPWM 运行
- 固有保护特性，可实现稳健的设计
 - 内部断续模式过流保护
 - 使能、电源正常和热关断
 - 内部或外部环路补偿
- 6mm × 6mm 热优化，符合 RoHS 标准，QFN-29 封装，具有无铅镀层

2 应用

- 工业：电机驱动（伺服/交流）、工厂自动化、非公路车辆和电动自行车



- 通信：WLAN、AAS 和 RRU
- 汽车：ADAS、信息娱乐系统与仪表组

3 说明

LM70880-Q1 是一款紧凑、易于使用的 4.5V 至 80V、超低 I_Q 同步直流/直流降压转换器，具有多功能降压控制器和一对功率 MOSFET，可在 3.3V、5V、12V 的固定输出电压或可调输出电压下提供高达 8A 的输出电流。

该转换器使用峰值电流模式控制架构，可实现简单环路补偿、快速瞬态响应和出色的负载和线路调节性能。一对 LM70880-Q1 转换器可设置为以交错模式（并联输出）运行，可实现精确的电流共享，适用于需要高达 16A 输出电流的应用。

LM70880-Q1 具有独特的双随机展频 (DRSS) 功能，该功能将低频三角调制与高频逐周期随机调制相结合，可在各种射频频带上提高 EMI 性能。

器件信息

器件型号	封装 ⁽¹⁾	封装尺寸 ⁽²⁾
LM70880-Q1	RRX (QFN, 29)	6mm × 6mm
LM70860-Q1 ⁽³⁾		
LM70840-Q1 ⁽³⁾		

- 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。
- 封装尺寸（长 × 宽）为标称值，并包括引脚（如适用）。
- 预发布信息（非预告信息）

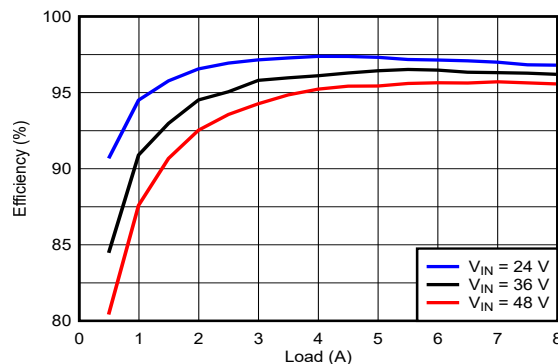


图 3-1. 典型应用电路和能效， $V_{OUT} = 12V$ ， $f_{sw} = 400kHz$



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4 Revision History

注：以前版本的页码可能与当前版本的页码不同

DATE	REVISION	NOTES
September 2023	*	Initial release

5 说明 (续)

LM70880-Q1 的其他特性包括可在轻负载条件下降低电流消耗的用户可选二极管仿真功能、用于故障报告和输出监控的开漏电源正常标志、精密使能输入、单调启动至预偏置负载、集成 VCC 辅助电源稳压器、2.75ms 内部软启动时间和带自动恢复功能的热关断保护。

LM70880-Q1 转换器采用 6mm × 6mm 热优化 29 引脚 QFN 封装。三个裸片连接焊盘 (VIN、SW 和 PGND) 提高了热性能和板级可靠性 (BLR)。

6 Device and Documentation Support

6.1 Device Support

6.1.1 Development Support

For development support see the following:

- For TI's reference design library, visit [TI Designs](#)
- TI Designs:
 - [ADAS 8-Channel Sensor Fusion Hub Reference Design with Two 4-Gbps Quad Deserializers](#)
 - [Automotive EMI and Thermally Optimized Synchronous Buck Converter Reference Design](#)
 - [Automotive High Current, Wide \$V_{IN}\$ Synchronous Buck Controller Reference Design Featuring LM5141-Q1](#)
 - [25W Automotive Start-Stop Reference Design Operating at 2.2 MHz](#)
 - [Synchronous Buck Converter for Automotive Cluster Reference Design](#)
 - [137W Holdup Converter for Storage Server Reference Design](#)
 - [Automotive Synchronous Buck With 3.3V @ 12.0A Reference Design](#)
 - [Automotive Synchronous Buck Reference Design](#)
 - [Wide Input Synchronous Buck Converter Reference Design With Frequency Spread Spectrum](#)
 - [Automotive Wide \$V_{IN}\$ Front-end Reference Design for Digital Cockpit Processing Units](#)
- Technical articles:
 - [High-Density PCB Layout of DC/DC Converters](#)
 - [Synchronous Buck Controller Solutions Support Wide \$V_{IN}\$ Performance and Flexibility](#)
 - [How to Use Slew Rate for EMI Control](#)

6.2 Documentation Support

6.2.1 Related Documentation

For related documentation see the following:

- User's guides:
 - Texas Instruments, [LM5141-Q1 Synchronous Buck Controller EVM](#)
 - Texas Instruments, [LM5143-Q1 Synchronous Buck Controller EVM](#)
 - Texas Instruments, [LM5146-Q1 EVM User's Guide](#)
 - Texas Instruments, [LM5145 EVM User's Guide](#)
- Application notes:
 - Texas Instruments, [Improve High-current DC/DC Regulator Performance for Free with Optimized Power Stage Layout Application Report](#)
 - Texas Instruments, [AN-2162 Simple Success with Conducted EMI from DC-DC Converters](#)
 - Texas Instruments, [Maintaining Output Voltage Regulation During Automotive Cold-Crank with LM5140-Q1 Dual Synchronous Buck Controller](#)
- Technical briefs:
 - Texas Instruments, [Reduce Buck Converter EMI and Voltage Stress by Minimizing Inductive Parasitics](#)
- White papers:
 - Texas Instruments, [An Overview of Conducted EMI Specifications for Power Supplies](#)
 - Texas Instruments, [An Overview of Radiated EMI Specifications for Power Supplies](#)
 - Texas Instruments, [Valuing Wide \$V_{IN}\$, Low EMI Synchronous Buck Circuits for Cost-driven, Demanding Applications](#)

6.2.1.1 PCB Layout Resources

- Application notes:
 - Texas Instruments, [Improve High-current DC/DC Regulator Performance for Free with Optimized Power Stage Layout](#)
 - Texas Instruments, [AN-1149 Layout Guidelines for Switching Power Supplies](#)
 - Texas Instruments, [AN-1229 Simple Switcher PCB Layout Guidelines](#)
 - Texas Instruments, [Low Radiated EMI Layout Made SIMPLE with LM4360x and LM4600x](#)

- Seminars:
 - Texas Instruments, [Constructing Your Power Supply – Layout Considerations](#)

6.2.1.2 Thermal Design Resources

- Application notes:
 - Texas Instruments, [AN-2020 Thermal Design by Insight, Not Hindsight](#)
 - [AN-1520 A Guide to Board Layout for Best Thermal Resistance for Exposed Pad Packages](#)
 - Texas Instruments, [Semiconductor and IC Package Thermal Metrics](#)
 - Texas Instruments, [Thermal Design Made Simple with LM43603 and LM43602](#)
 - Texas Instruments, [PowerPAD™ Thermally Enhanced Package](#)
 - Texas Instruments, [PowerPAD Made Easy](#)
 - Texas Instruments, [Using New Thermal Metrics](#)

6.3 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 [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。

6.4 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](#)》。

6.5 Trademarks

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6.6 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。

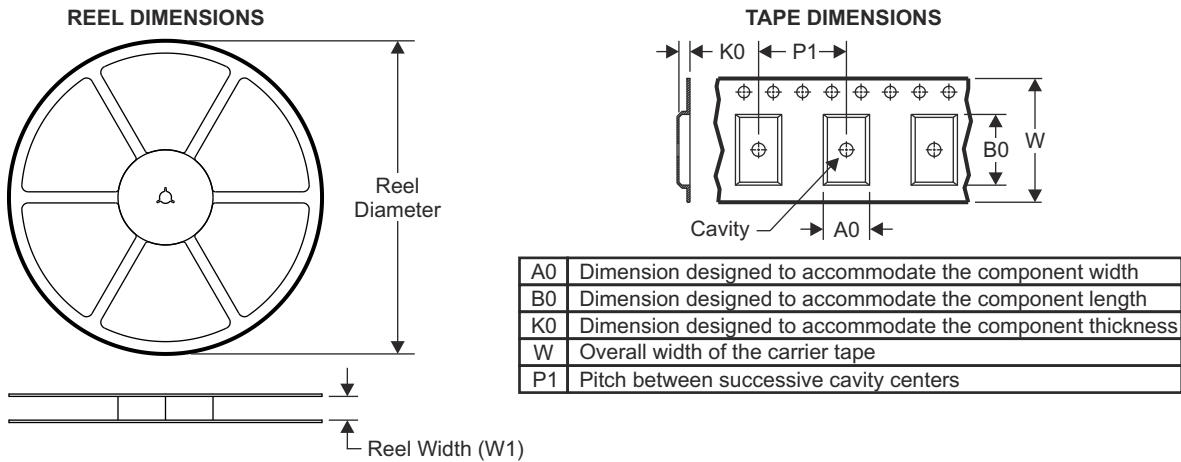
6.7 术语表

[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。

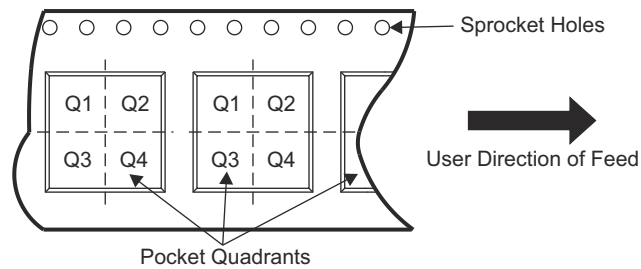
7 Mechanical, Packaging, and Orderable Information

The following pages show 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.

7.1 Tape and Reel Information



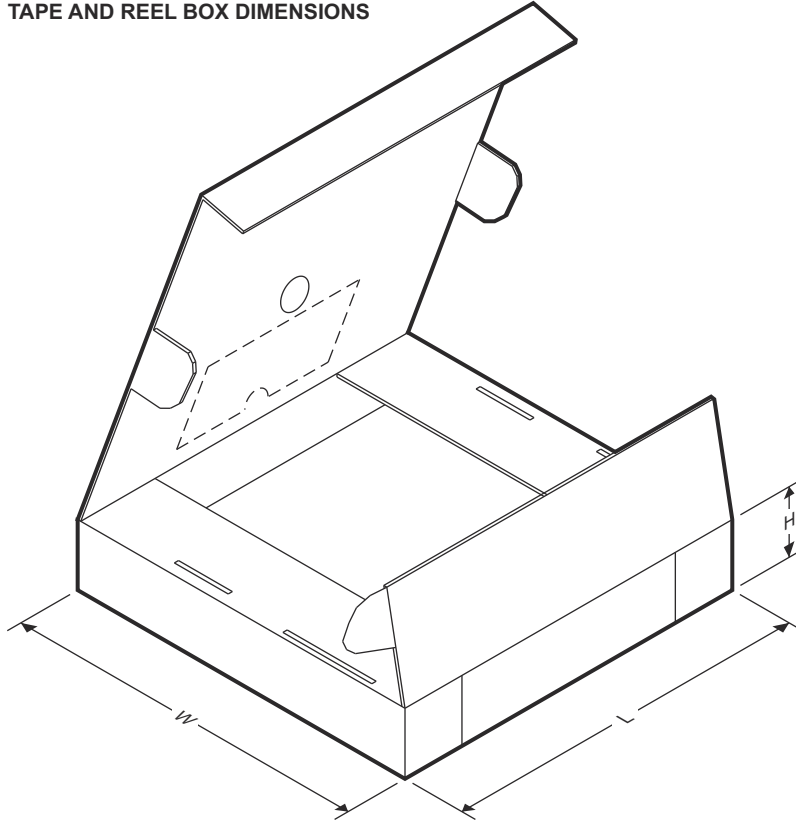
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



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
PLM70880RRXRQ1	QFN	RRX	29	3000	330.0	12.4	3.8	5.8	1.2	8.0	12.0	Q1

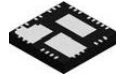
ADVANCE INFORMATION

TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
PLM70880RRXRQ1	QFN	RRX	29	3000	367.0	367.0	35.0

ADVANCE INFORMATION

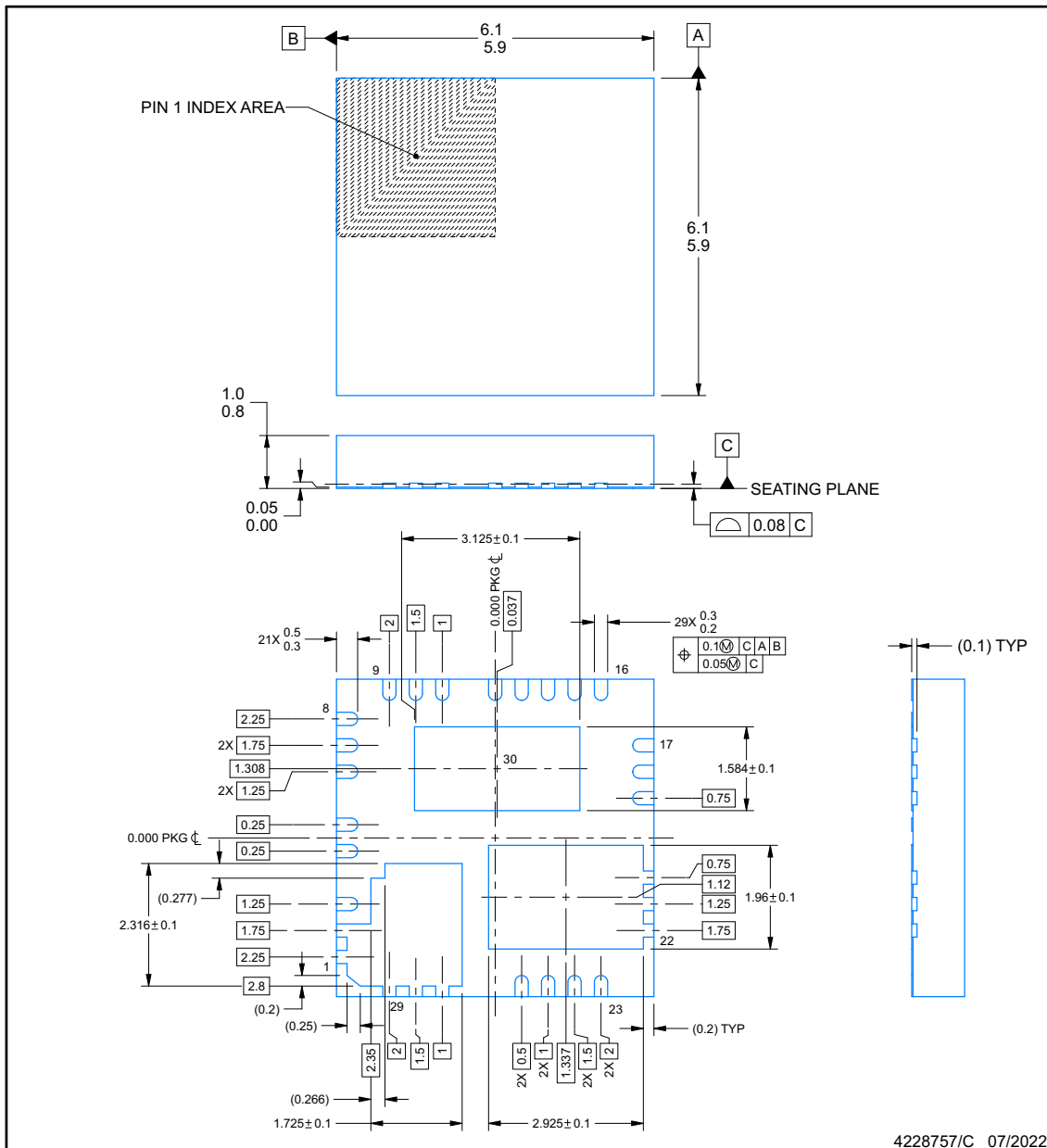


RRX0029B

PACKAGE OUTLINE
VQFN - 1.0 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

ADVANCE INFORMATION



NOTES:

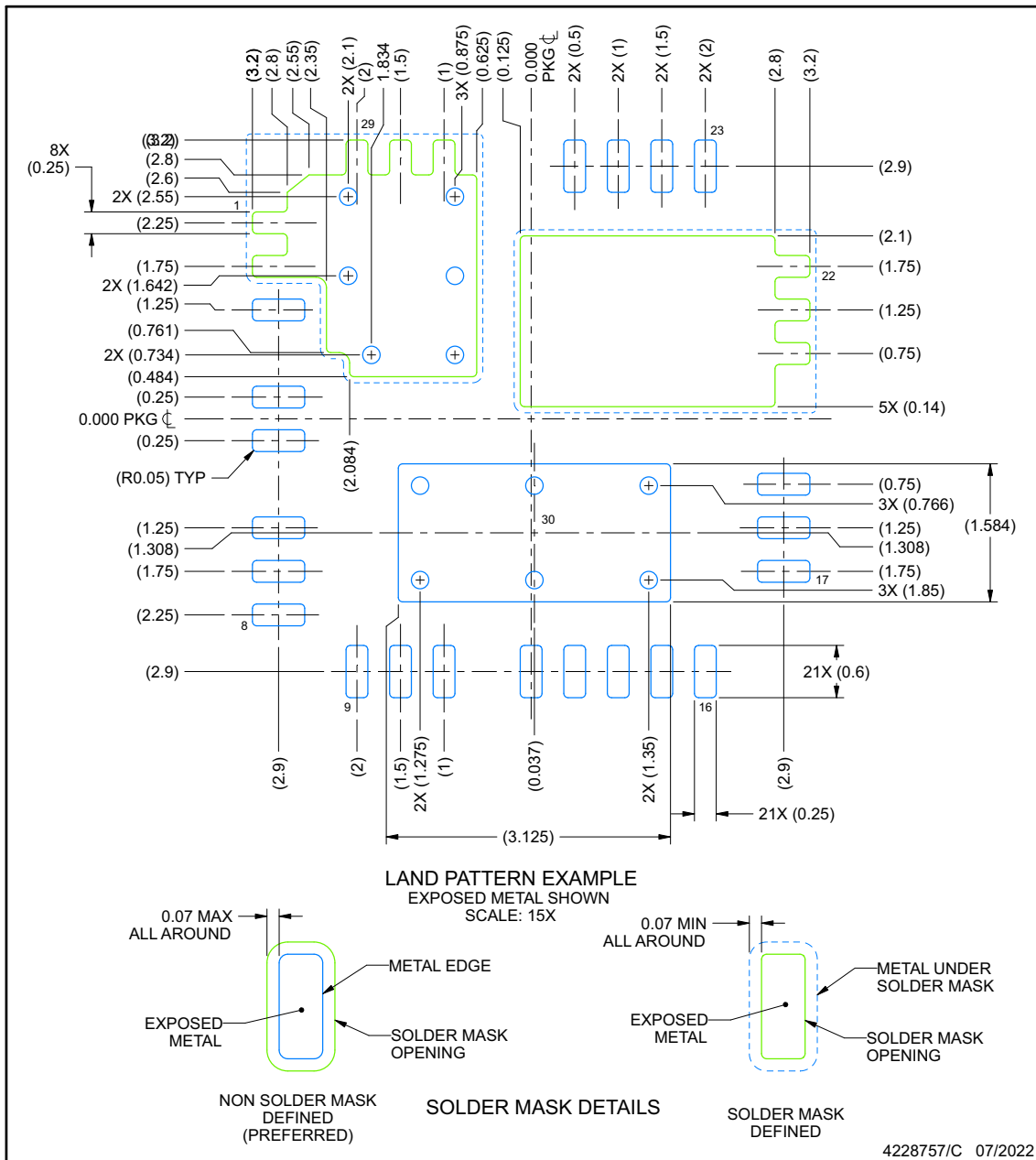
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

RRX0029B

VQFN - 1.0 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



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/sluea271).
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.

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)
LM70880QRRXRQ1	Active	Production	VQFN (RRX) 29	3000 LARGE T&R	ROHS Exempt	NIPDAU	Level-2-260C-1 YEAR	-40 to 150	70880Q1
LM70880QRRXRQ1.A	Active	Production	VQFN (RRX) 29	3000 LARGE T&R	ROHS Exempt	NIPDAU	Level-2-260C-1 YEAR	-40 to 150	70880Q1

(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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OTHER QUALIFIED VERSIONS OF LM70880-Q1 :

- Catalog : [LM70880](#)

NOTE: Qualified Version Definitions:

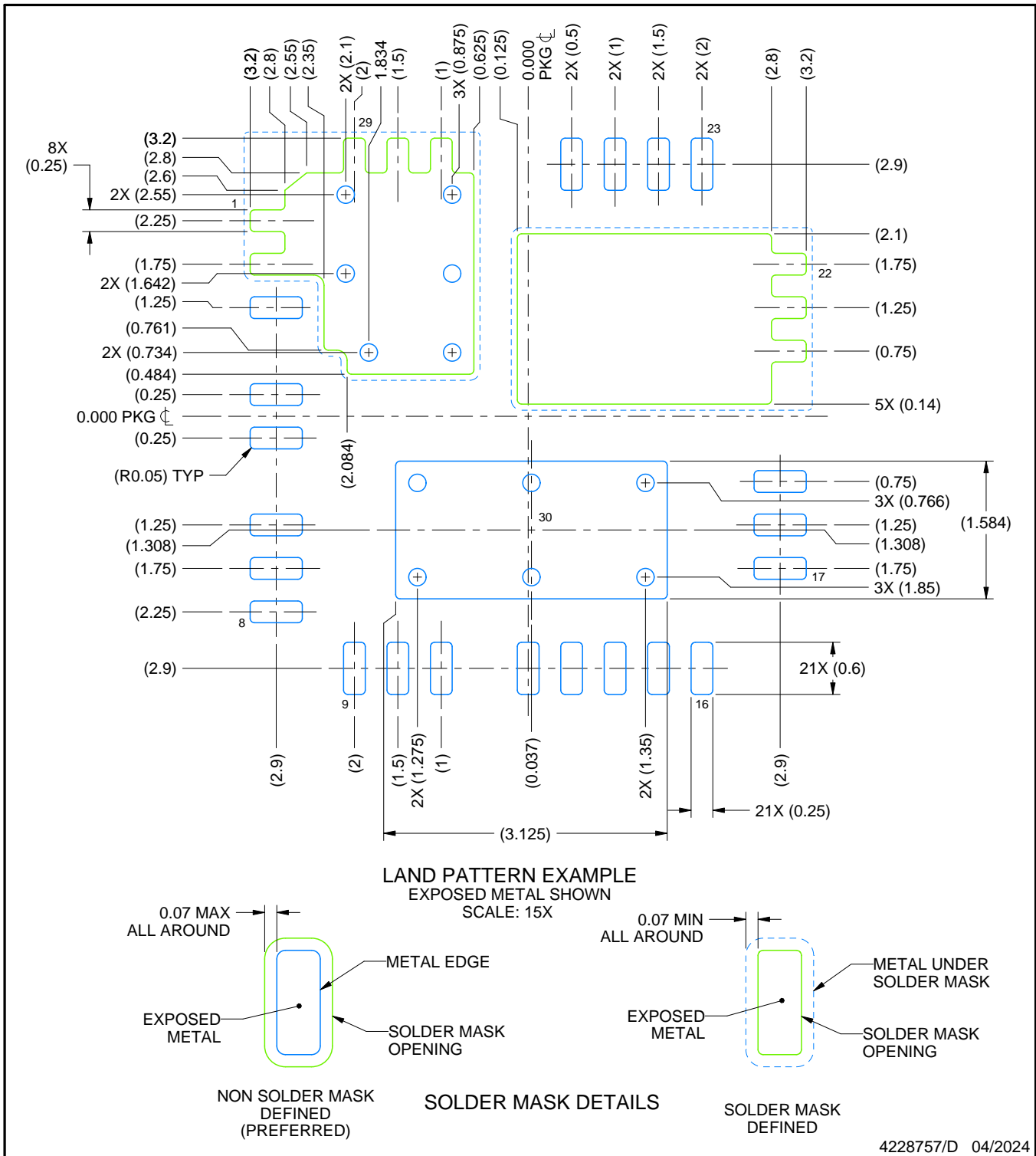
- Catalog - TI's standard catalog product

EXAMPLE BOARD LAYOUT

RRX0029B

VQFN - 1.0 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES: (continued)

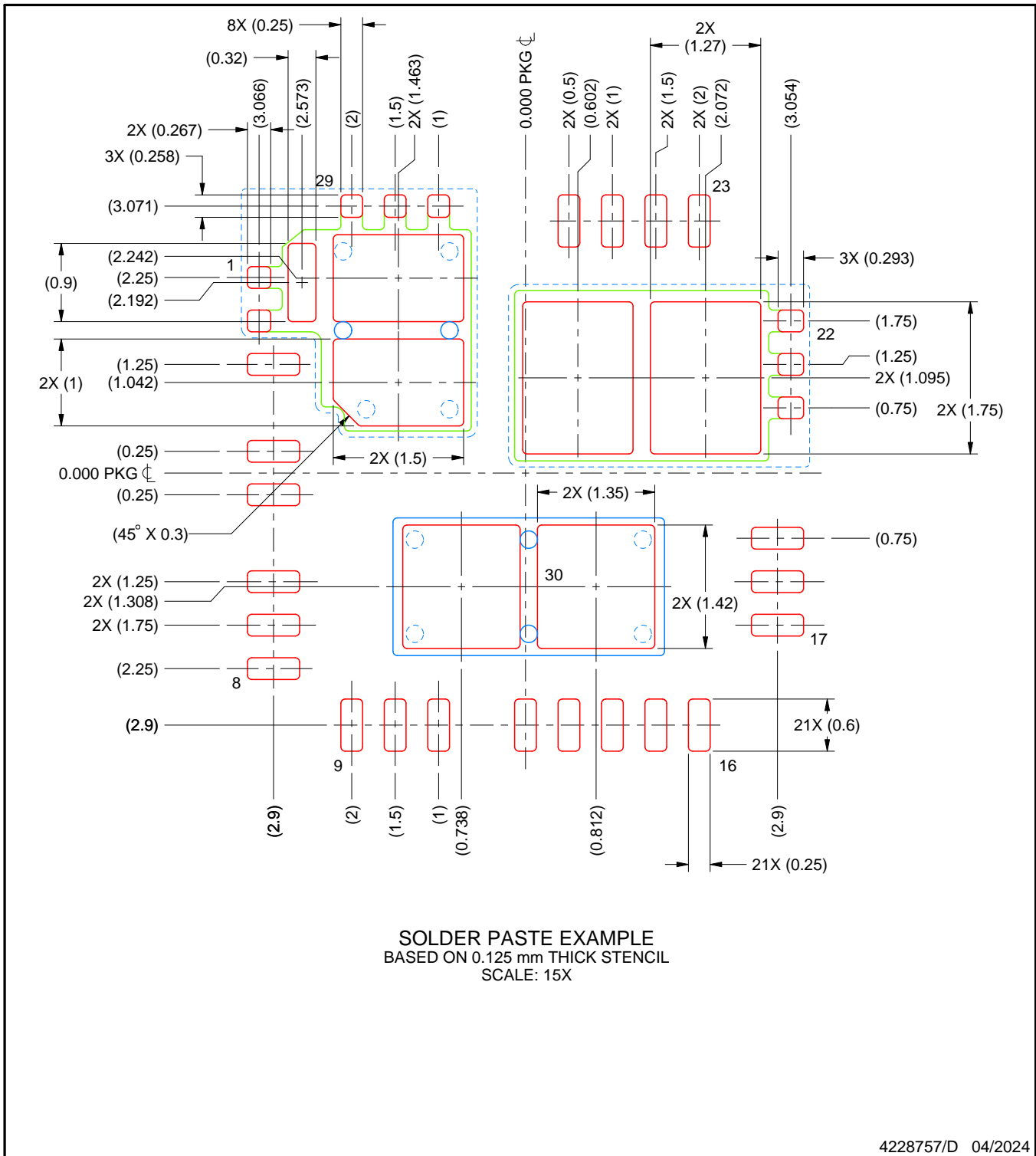
- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
- Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown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

EXAMPLE STENCIL DESIGN

RRX0029B

VQFN - 1.0 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



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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最后更新日期：2025 年 10 月