采用扩展 I/O 的 FPC202 双端口控制器

1 特性

- 支持跨两个端口进行控制信号管理和 I2C 聚合
- 每个端口具有四个 LED 驱动器和 12 个通用 I/O
- 通用输出可用于驱动超过 4 个 LED（每个端口）
- 整合了多个 FPC202 器件，用于通过单个主机接口控制总共 28 个端口
- 无需使用分立式 I2C 多路复用器、LED 驱动器和高引脚计数 FPGA/CPLD 控制器件
- 通过处理接近端口的全部低速控制信号来降低 PCB 布线复杂性
- 可选 I2C（高达 1MHz）或 SPI（高达 10MHz）主机控制接口
- 从模块中自动预取用户指定的重要数据
- 广播模式允许对所有 FPC202 控制器的全部端口同步执行写操作
- 用于端口状态指示的高级 LED 功能，包括可编程闪烁和调光功能
- 可定制中断事件
- 单独的主机侧 I/O 电压：1.8V 至 3.3V
- 采用小型 QFN 封装，能够放置在 PCB 底部、端口下方

2 应用

- ToR/聚合/核心交换机和路由器
- 无线基础设施基带单元和远程无线电单元
- 网络接口卡 (NIC) 和主机总线适配器 (HBA)
- 存储卡和存储机架
- SFP、QSFP、QSFP-DD、OSFP、Mini-SAS HD 端口管理

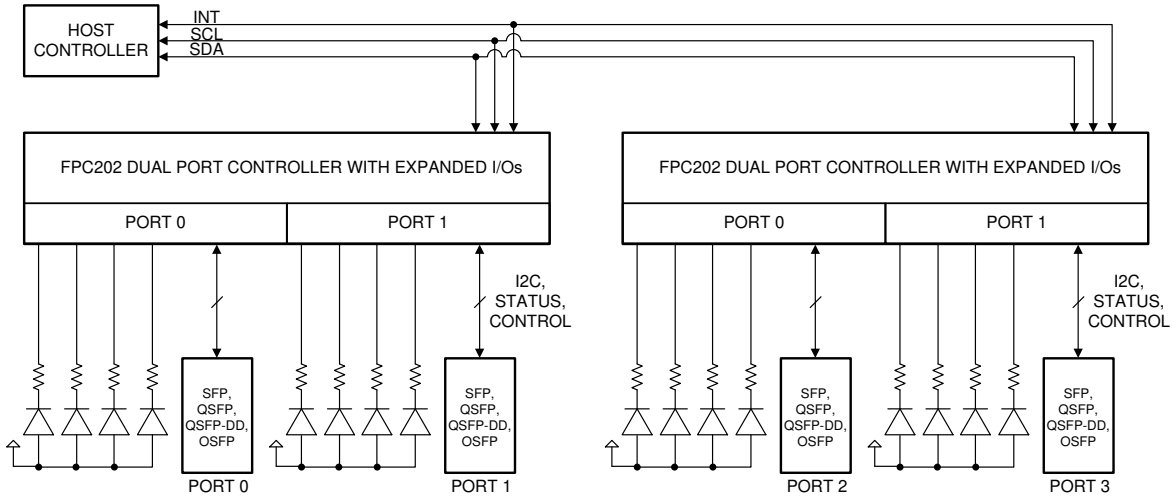
3 说明

FPC202 双端口控制器用作低速信号聚合器，适用于 SFP、QSFP 和 Mini-SAS HD 等通用端口类型。FPC202 能够跨两个端口聚合所有低速控制和 I2C 信号，并为主机提供一个易于使用的管理接口（I2C 或 SPI）。利用连接到主机的一个公共控制接口，可以在高端口数应用使用多个 FPC202。

器件信息(1)

器件型号	封装	封装尺寸（标称值）
FPC202	QFN (56)	5.00mm × 11.00mm

(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。



简化版方框图

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4 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

Changes from Revision * (December 2017) to Revision A (January 2023)	Page
• 更新了整个文档中的表格、图和交叉参考的编号格式	1

5 说明（续）

FPC202 所采用的设计允许将其放置在 PCB 底部、压合连接器下方，由此可简化布线。凭借这种本地控制端口低速信号的方法，可以使用 I/O 数更少的控制器件（FPGA、CPLD 和 MCU）并减少布线层拥塞，从而降低系统物料清单 (BOM) 成本。

FPC202 能够与标准的 SFF-8431、SFF-8436 和 SFF-8449 低速管理接口（包括连接每个端口的专用 100/400kHz I2C 接口）兼容。该器件还提供有其他通用引脚来驱动端口状态 LED 或控制电源开关。LED 驱动程序器具有便利的功能，例如可编程闪烁和调光功能。连接主机控制器的接口可在 1.8V 至 3.3V 的单独电源电压下运行，以支持低压 I/O。

对于每个端口，FPC202 总共具有四个 LED 驱动器、12 个通用 I/O 和两个下行 I2C 总线。利用这组扩展的 I/O，可以控制系统内的其他元件和功能。如果每个端口需要四个以上 LED，则通用输出可用于驱动更多 LED。

FPC202 可以从每个模块中用户指定的寄存器中预取数据，这样方便主机通过一个快速 I2C（速度高达 1MHz）或 SPI（速度高达 10MHz）接口来读取数据。此外，FPC202 还可以触发主机中断，提示某受控端口上发生了重要的用户可配置事件。这样一来，便无需再持续轮询模块。

6 Device Comparison Table

PART NUMBER	PORTS	LED DRIVERS PER PORT	GPIOs PER PORT	ACCESSIBLE DOWNSTREAM ADDRESSES
FPC202	2	4	12	All valid I2C addresses
FPC402	4	2	6	All valid I2C addresses
FPC401	4	2	6	MSA addresses: 0xA0, 0xA2

7 Device and Documentation Support

7.1 Documentation Support

7.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *FPC202 Programmer's Guide*
- Texas Instruments, *FPC401 Evaluation Module (EVM) User's Guide*

Click here to request access to these documents in the FPC202 MySecure folder.

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 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

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7.5 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。

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.

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
FPC202RHUR	ACTIVE	WQFN	RHU	56	2000	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 85	FPC2	Samples
FPC202RHUT	ACTIVE	WQFN	RHU	56	250	RoHS & Green	SN	Level-2-260C-1 YEAR	-40 to 85	FPC2	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.

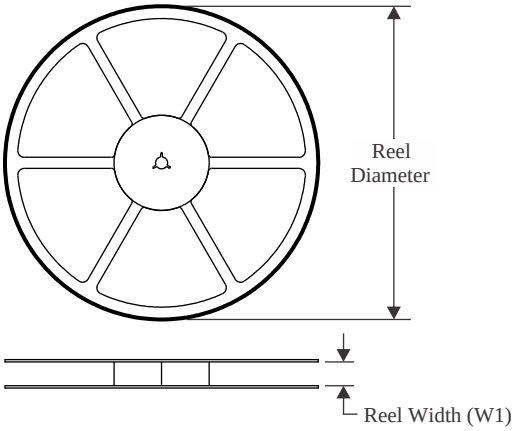
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

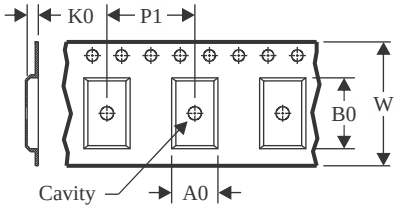
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

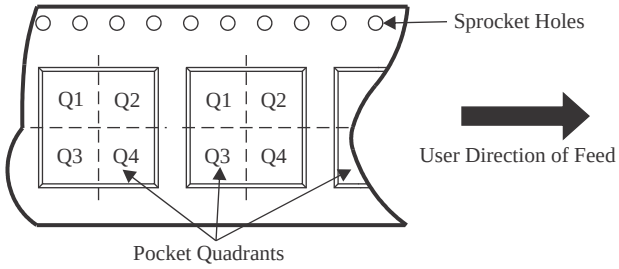


TAPE DIMENSIONS



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

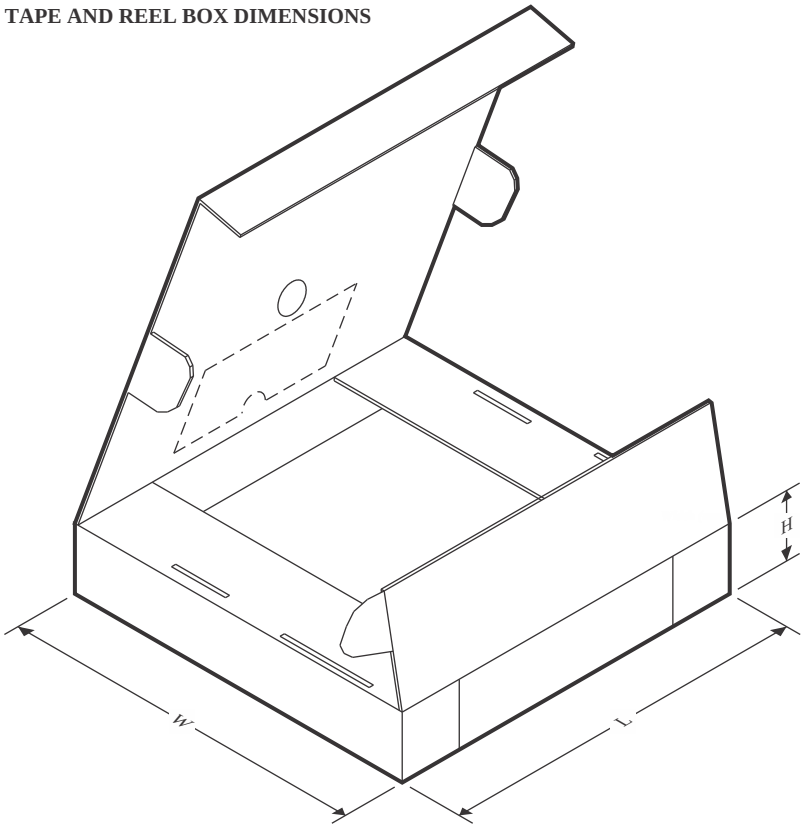
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
FPC202RHUR	WQFN	RHU	56	2000	330.0	24.4	5.3	11.3	1.0	8.0	24.0	Q1
FPC202RHUT	WQFN	RHU	56	250	178.0	24.4	5.3	11.3	1.0	8.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

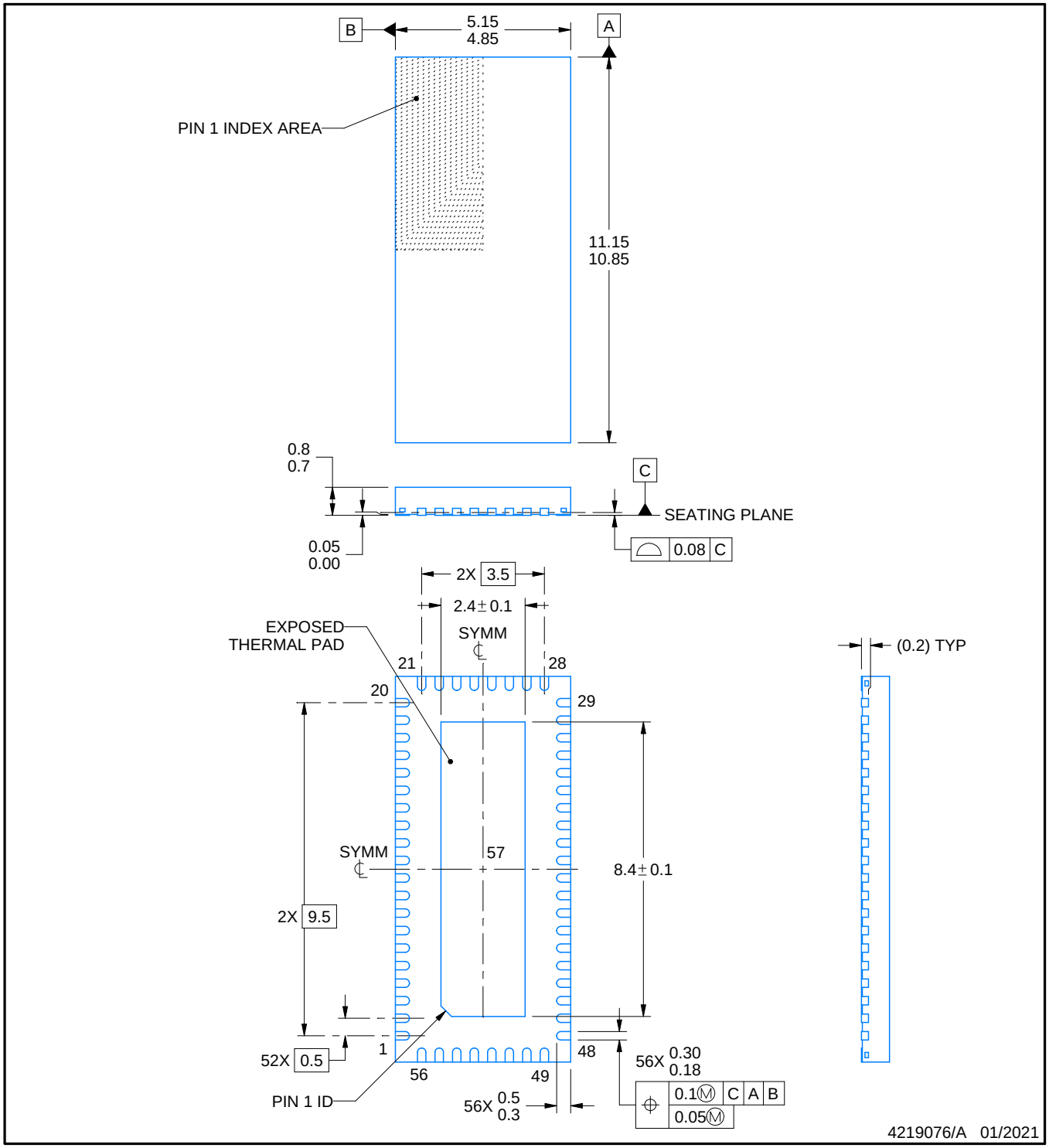
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
FPC202RHUR	WQFN	RHU	56	2000	367.0	367.0	45.0
FPC202RHUT	WQFN	RHU	56	250	213.0	191.0	55.0

PACKAGE OUTLINE

RHU0056A

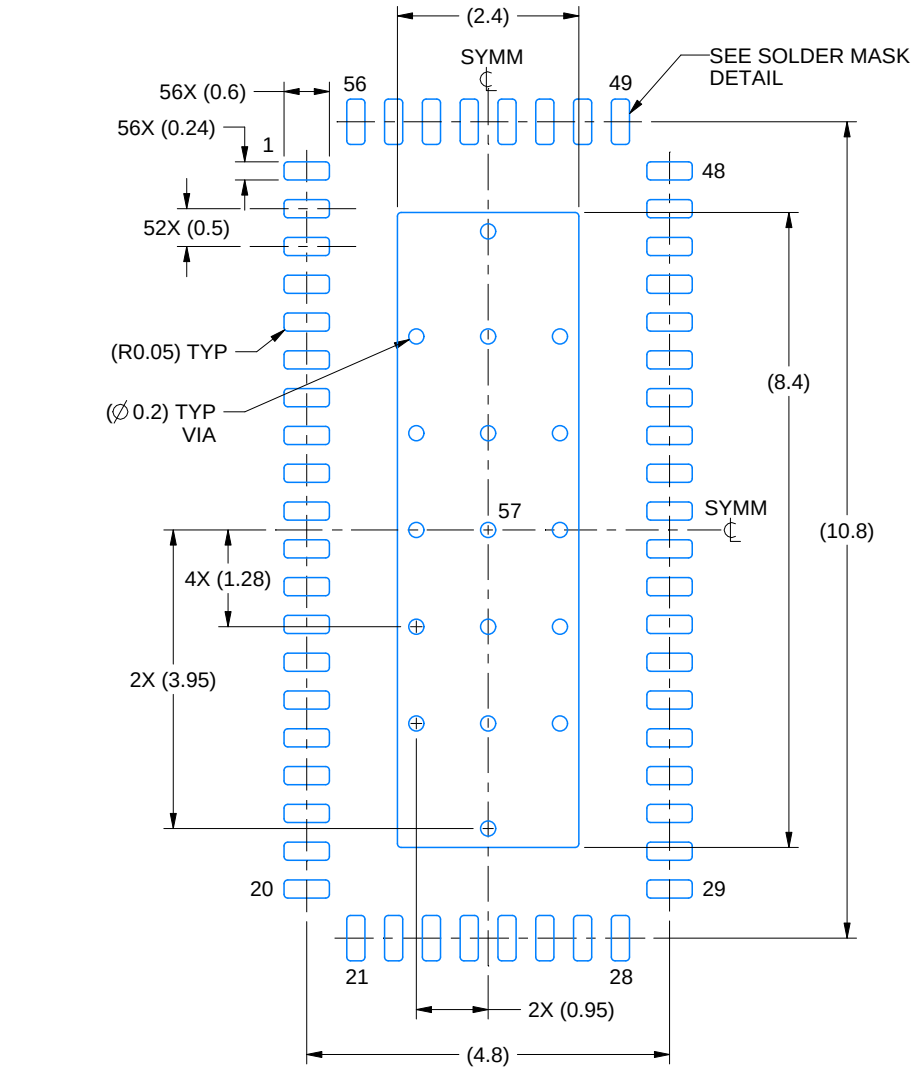
WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES:

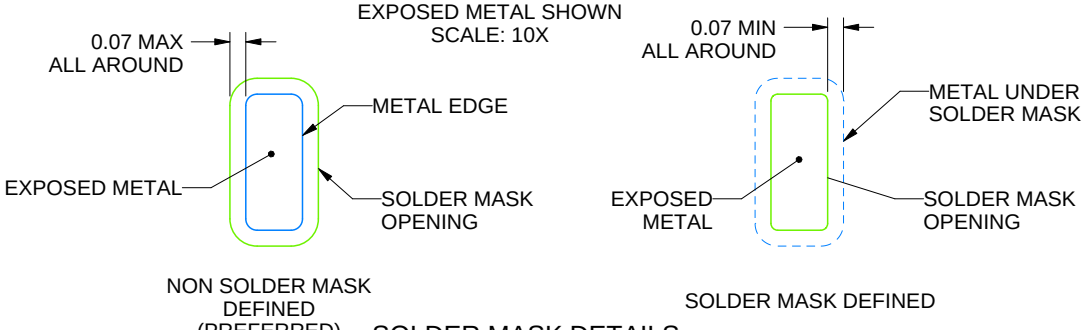
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.



LAND PATTERN EXAMPLE

EXPOSED METAL SHOWN

SCALE: 10X



SOLDER MASK DETAILS

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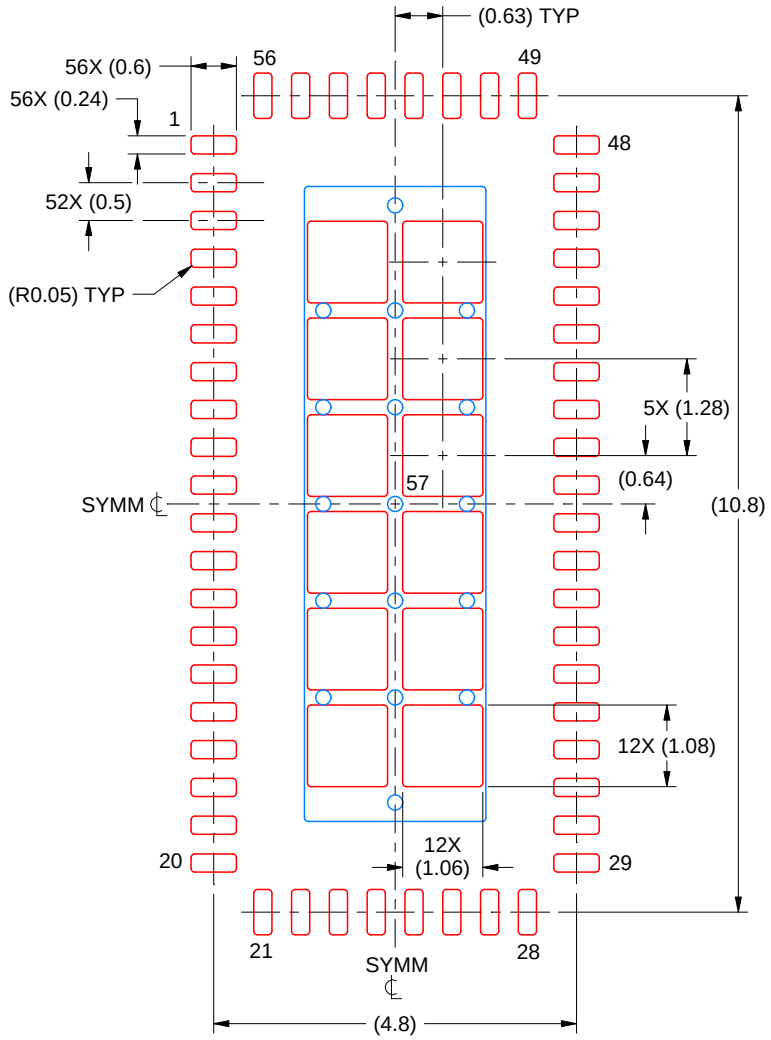
NOTES: (continued)

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 0.125 MM THICK STENCIL
SCALE: 10X

EXPOSED PAD 57
68% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE

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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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