TEXAS INSTRUMENTS
TLC6983
ZHCSLN6 – DECEMBER 2020

具有超低功耗的 TLC6983 48x16 共阴极矩阵 LED 显示驱动器

1 特性

- 支持分立式 V_{CC} 和 $V_{R/G/B}$ 电源
  - V_{CC} 电压范围：2.5V - 5.5V
  - $V_{R/G/B}$ 电压范围：2.5V - 5.5V
- 48 个电流源通道，范围从 0.2mA 到 20mA
  - 通道间精度：±0.5%（典型值），±2%（最大值）；器件间一致性：±0.5%（典型值），±2%（最大值）
  - 低拐点电压：当 I_{OUT} = 5mA 时为 0.26V（最大值）
  - 3 位（8 级）全局亮度控制
  - 8 位（256 级）色彩亮度控制
  - 最大 16 位（65536 级）PWM 灰度控制
- 带 190mΩ $R_{DS(ON)}$ 的 16 个线路扫描开关
- 超低功耗
  - 低至 2.5V 的独立 V_{CC}
  - 超低 I_{CC}（低至 3.9mA），具有 50MHz GCLK
  - 智能省电模式
- 内置 SRAM 支持 1 至 32 路复用
  - 支持 16 路复用的单个器件可驱动 32 × 16 LED 或 16 × 16 RGB 像素
  - 支持 32 路复用的两个器件堆叠后可驱动 96 × 32 LED 或 32 × 32 RGB 像素
- 高速和低 EMI 连续时钟串行接口 (CCSI)
  - 仅三条总线：SCLK/SIN/SOUT
  - 具有双沿传输机制的外部 25MHz（最大值）SCLK（内部 50MHz）
  - 支持 40MHz 至 160MHz 范围 GCLK 的内部倍频器
- 经优化的显示性能
  - 去除上下重影
  - 低灰度增强
  - LED 开/短路/弱短路检测和消除

2 应用

- 窄像素间距 (NPP) LED 显示屏
- Mini/Micro-LED 产品

3 说明

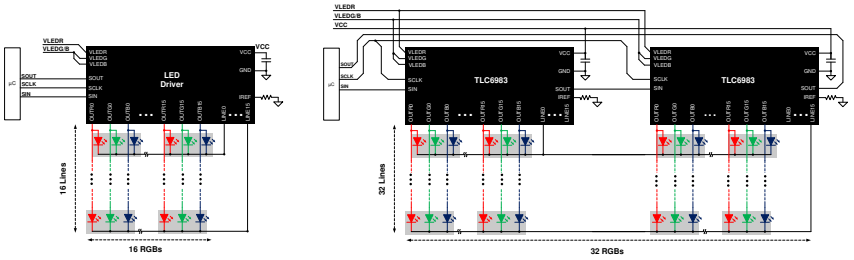
随着窄像素间距 LED 显示或 Mini/Micro-LED 产品的像素密度不断提高，我们迫切需要使用 LED 驱动器来应对各种关键挑战，即通过超高集成度满足严格的布板空间限制，通过超低功耗更大程度地降低系统级功耗，通过全新的接口实现高数据刷新率并减少 EMI 的影响，通过出色的显示性能满足不断增长的高显示质量的需求。

TLC6983 是高度集成的共阴极矩阵 LED 显示驱动器，有 48 个恒流源和 16 个扫描 FET。单个 TLC6983 能驱动 16 × 16 RGB LED 像素，两个 TLC6983 堆叠后可驱动 32 × 32 RGB LED 像素。为实现低功耗，该器件可通过其共阴极结构为红色、绿色和蓝色 LED 提供分立式电源。此外，通过超低的工作电压范围（Vcc 低至 2.5V）和超低的工作电流（Icc 低至 3.9mA），TLC6983 可显著降低运行功率。

器件信息

器件型号	封装(1)	封装尺寸（标称值）
TLC6983	VQFN (76)	9mm x 9mm
	BGA (96)	6mm x 6mm

(1) 如需了解所有可用封装，请参阅产品说明书末尾的可订购产品附录。



单器件或双器件可堆叠连接的 TLC6983

Table of Contents

4 Revision History

DATE	REVISION	NOTES
December 2020	*	Initial release.

5 Description (continued)

The TLC6983 implements a high speed dual-edge transmission interface to support high device count daisy-chained and high refresh rate while minimizing electrical-magnetic interference (EMI). The device supports up to 25-MHz SCLK (external) and up to 160-MHz GCLK (internal). Meanwhile, the device integrates enhanced circuits and intelligent algorithms to solve the various display challenges in Narrow Pixel Pitch (NPP) LED display applications and Mini / Micro-LED products: Dim at the fist scan line, Upper and downside ghosting, Non-uniformity in low grayscale, Coupling, and Caterpillar caused by open or short LEDs, which make the TLC6983 a perfect choice in such applications.

The TLC6983 also implements LED open/weak short/short detections and removals during operations and can also report this information to the accompanying digital processor.

6 Device and Documentation Support

6.1 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 *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。

6.2 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》。

6.3 Trademarks

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6.4 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。

6.5 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。

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

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
TLC6983RRFR	ACTIVE	VQFN	RRF	76	2000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 85	TLC6983	Samples
TLC6983ZXLR	ACTIVE	NFBGA	ZXL	96	2500	RoHS & Green	SNAGCU	Level-3-260C-168 HR	-40 to 85	TLC6983	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.

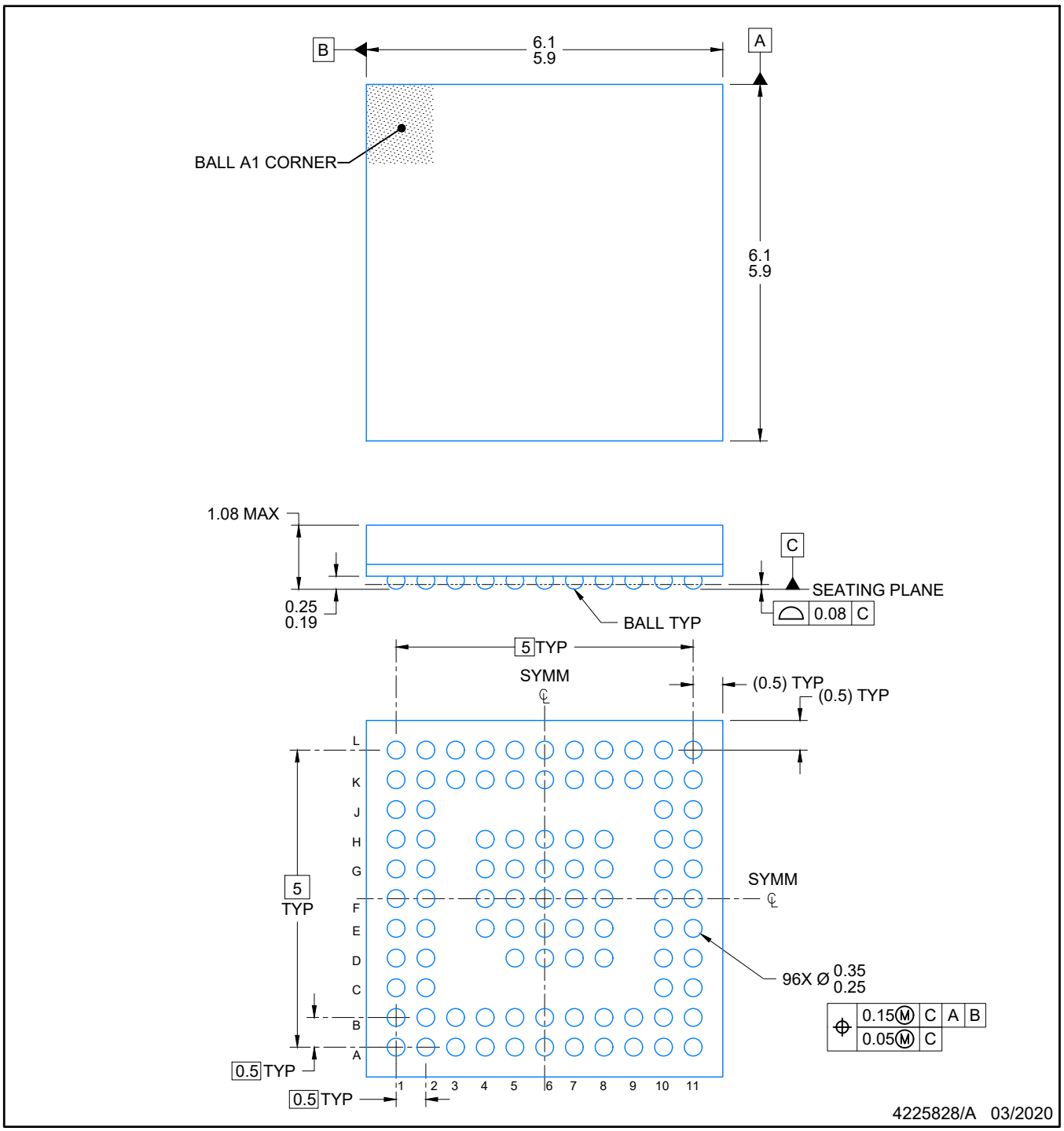
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

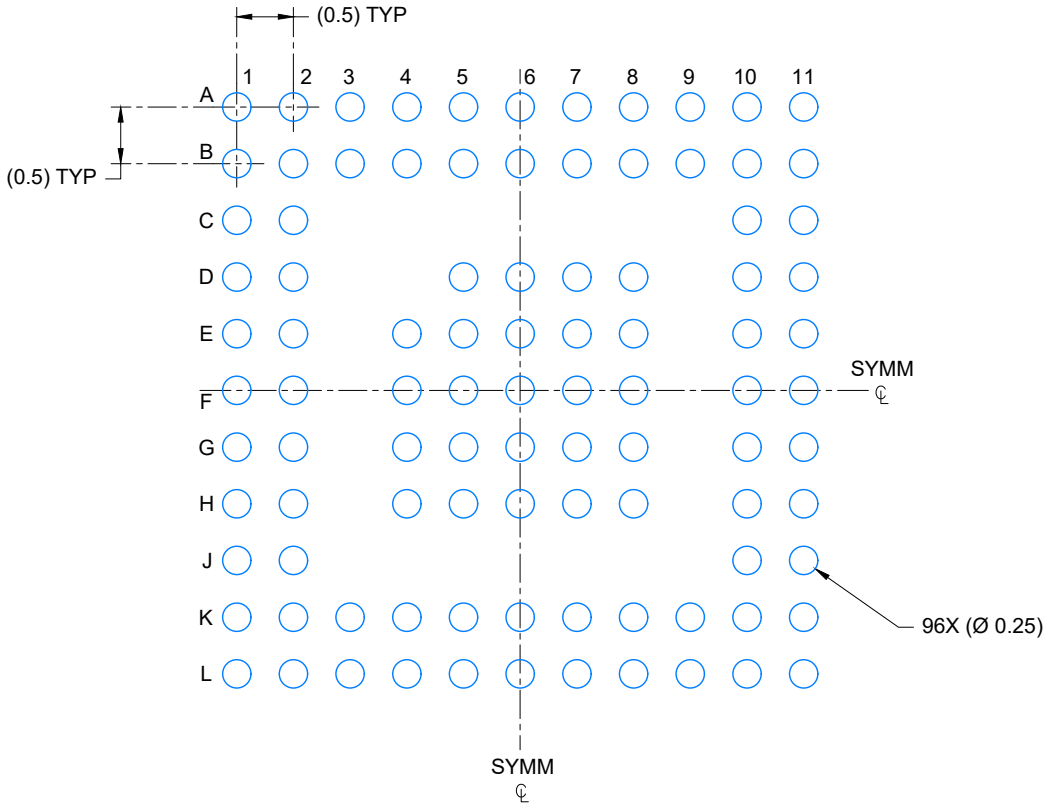
PLASTIC BALL GRID ARRAY



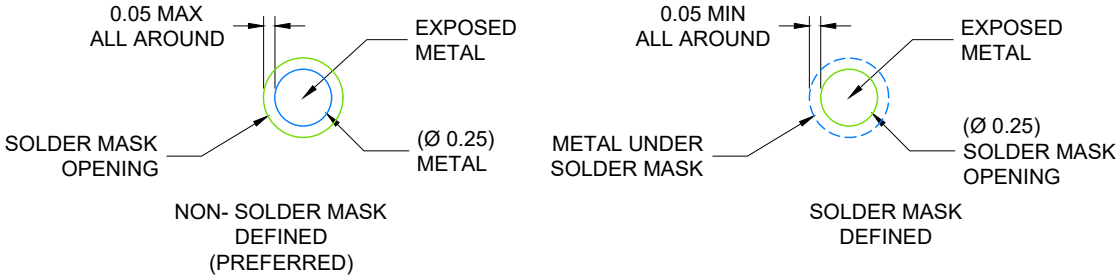
NOTES:

NanoFree is a trademark of Texas Instruments.

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

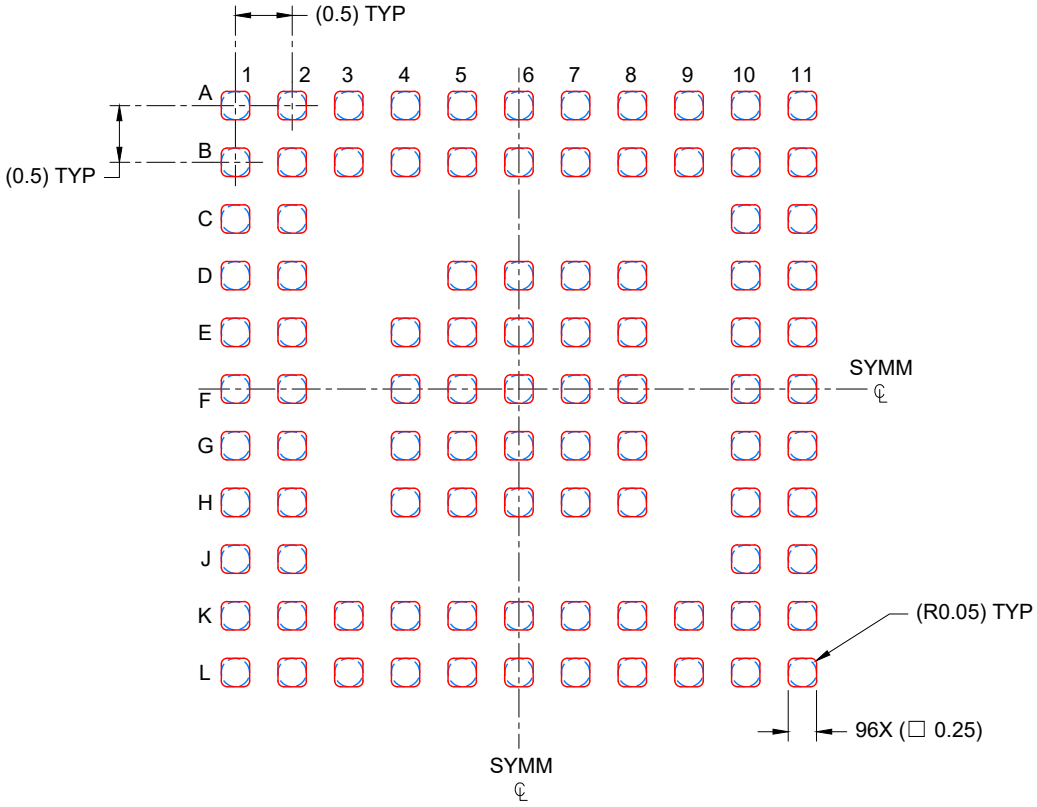


SOLDER MASK DETAILS
NOT TO SCALE

4225828/A 03/2020

NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. Refer to Texas Instruments Literature number SNVA009 (www.ti.com/lit/snva009).



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE: 15X

4225828/A 03/2020

NOTES: (continued)

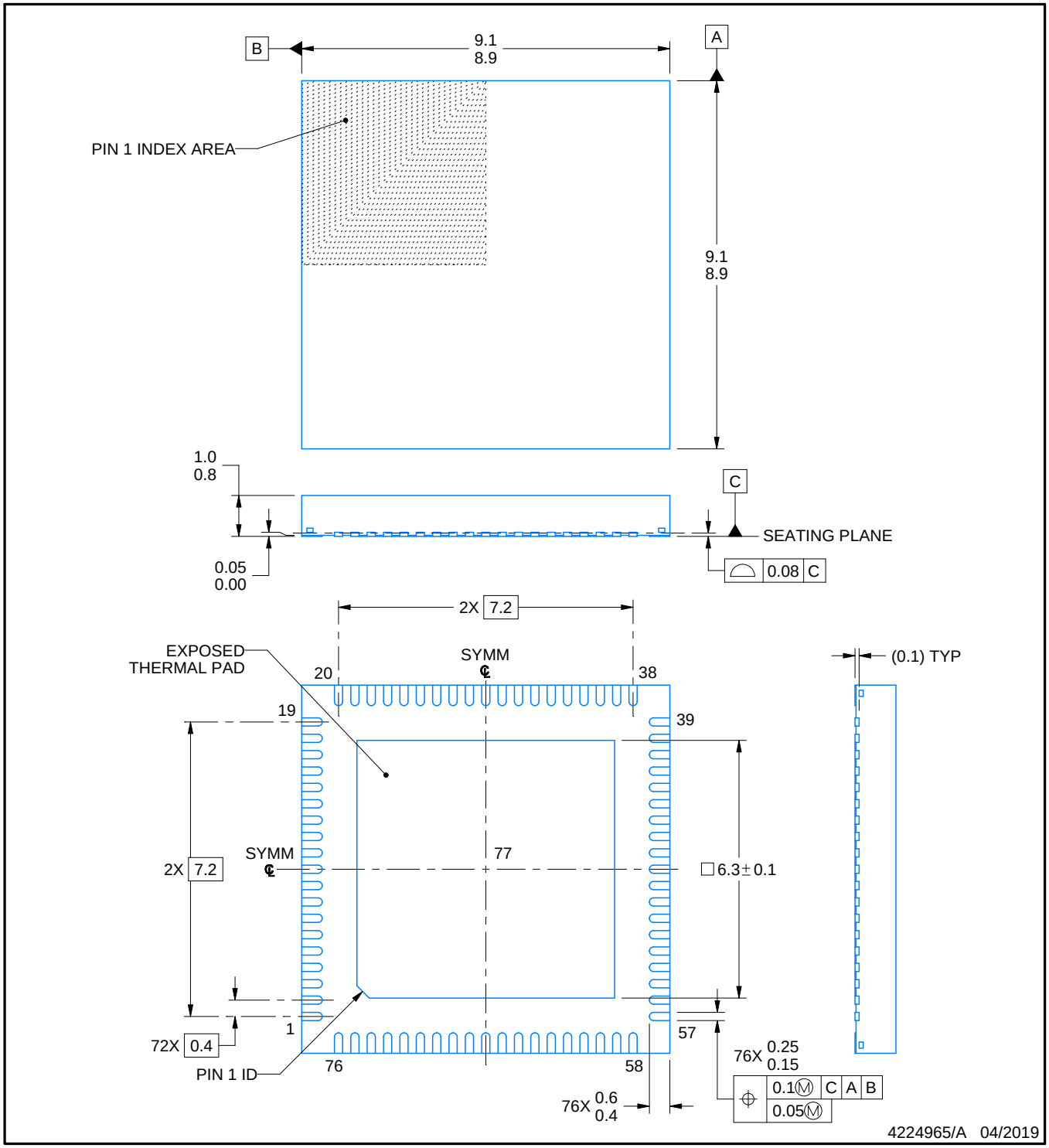
4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

PACKAGE OUTLINE

RRF0076A

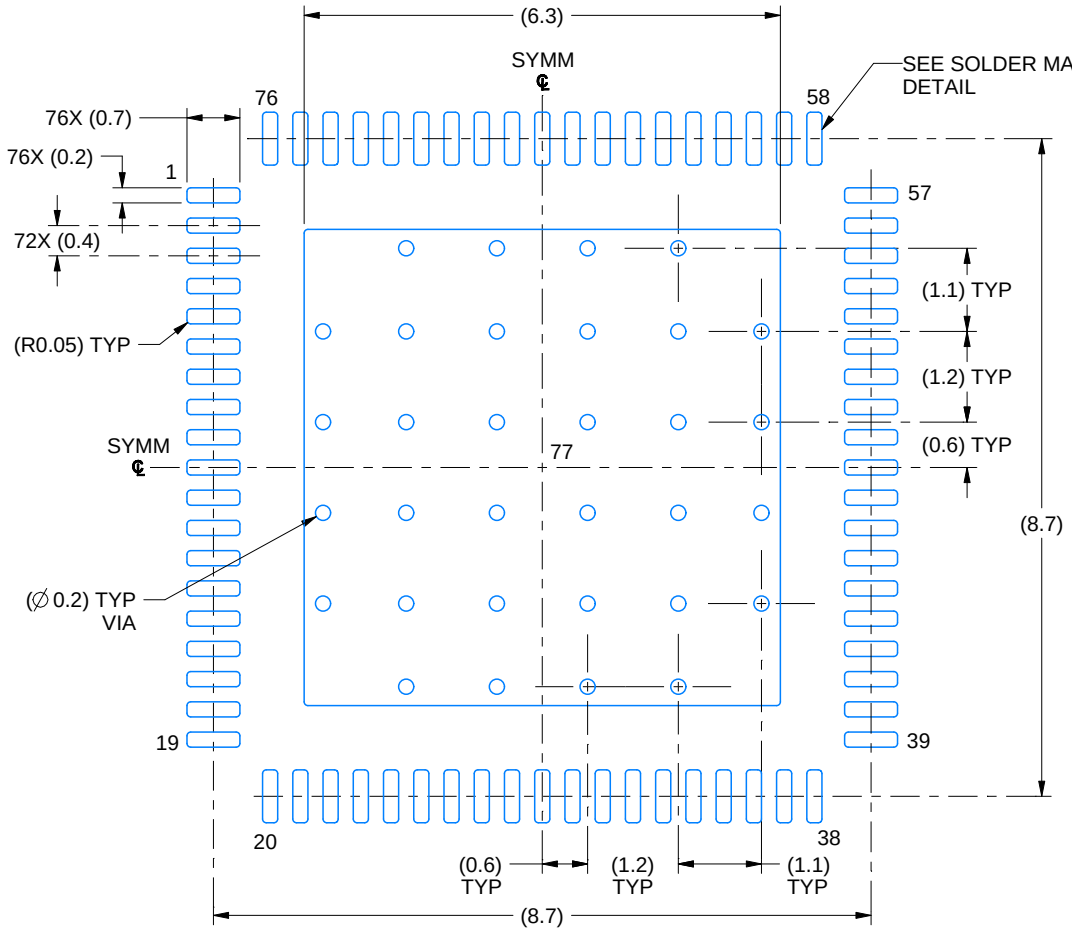
VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

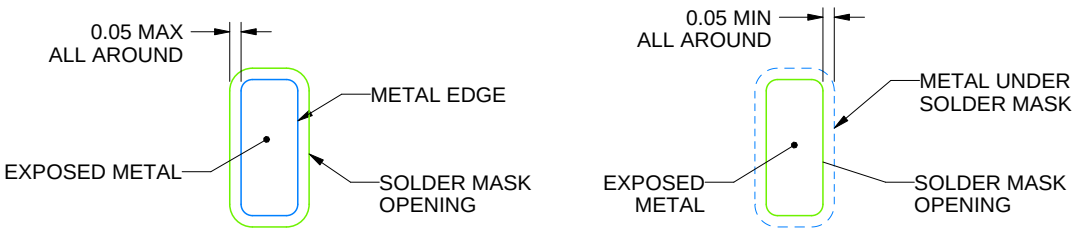


NOTES:

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: 10X



SOLDER MASK DETAILS

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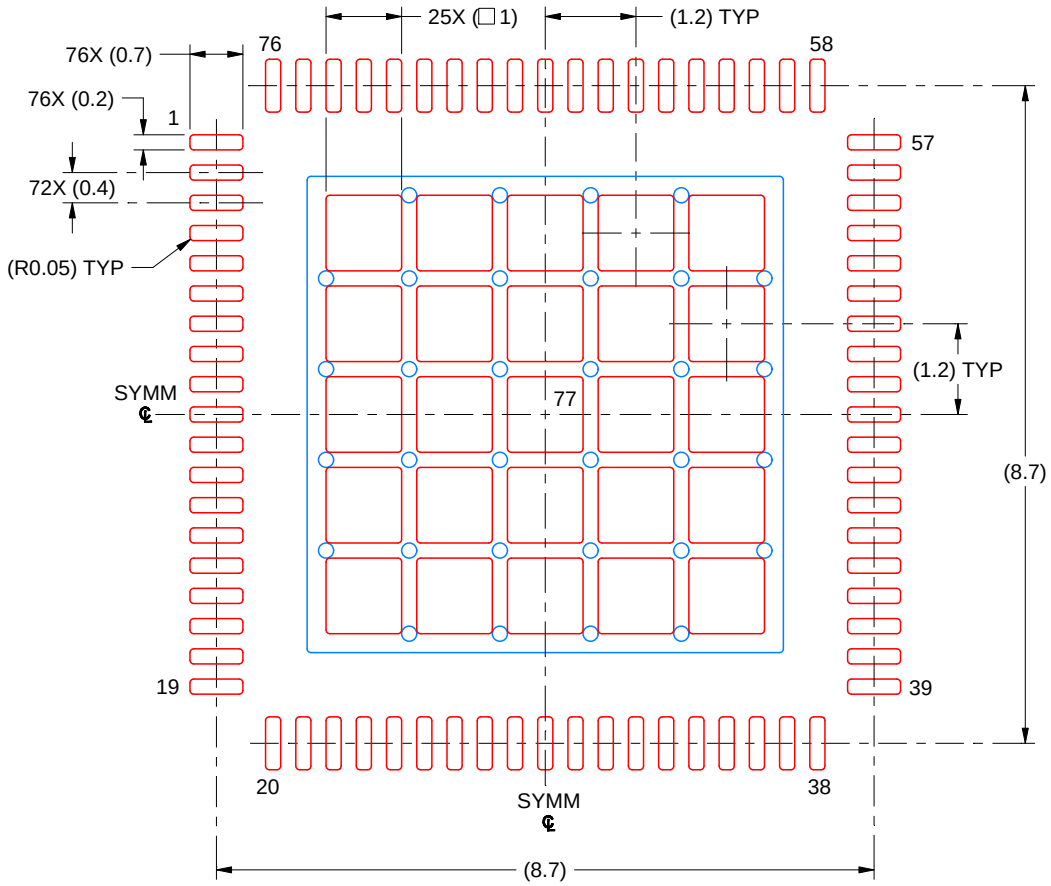
NOTES: (continued)

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 77
63% 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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