TLC69699-Q1 适用于 TLC696xx-Q1 器件系列的汽车级 SPI 兼容型连接

1 特性

- 符合面向汽车应用的 AEC-Q100 标准
  - 1 级：–40°C 至 +125°C 环境温度
  - 器件 HBM 分类等级 H3A
  - 器件 CDM 分类等级 C5
- 功能安全型：
  - 可提供用于功能安全系统设计的文档
- 工作电压 V_{CC} 范围：2.5V 至 5.5V
- SPI 外设
  - 数据传输速率高达 20MHz
  - 支持多个外设和一个控制器
- 连续时钟串行接口 (CCSI) 控制器和外设
  - 数据传输速率高达 20MHz
  - 用于增强 EMI 性能的可编程时钟抖动
- 诊断
  - 开漏 FAULT 引脚
  - SPI 通信丢失检测
  - 用于 SPI 通信的 CRC
  - 连续时钟看门狗
  - CCSI 数据完整性
- 数据就绪中断指示数据可用性

2 应用

- TLC696x0/1/2/4/8-Q1 SPI 兼容型连接

3 说明

TLC69699-Q1 SPI 兼容型连接支持使用标准 SPI 控制器控制 TLC696xx-Q1 器件系列。该器件具有一个内部振荡器，用于生成 TLC696xx-Q1 器件系列所需的连续时钟。可以将抖动添加到连续时钟以增强 EMI 性能。传输的数据与连续时钟对齐，以保持 CCSI 接口的时序要求。

TLC69699-Q1 整合了 TLC696xx-Q1 菊花链和 TLC69699-Q1 内部的故障报告。向 TLC696xx-Q1 菊花链传输的寄存器和亮度数据受 TLC69699-Q1 的 CRC 保护。此外，数据线和连续时钟线均由 TLC69699-Q1 提供卡滞故障保护。

封装信息

器件型号	封装(1)	封装尺寸(2)
TLC69699-Q1	SOT-23-THN (14)	4.20mm x 2.00mm
	WSON (12) 可湿性侧面	3.00mm x 3.00mm

(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。
(2) 封装尺寸（长 × 宽）为标称值。

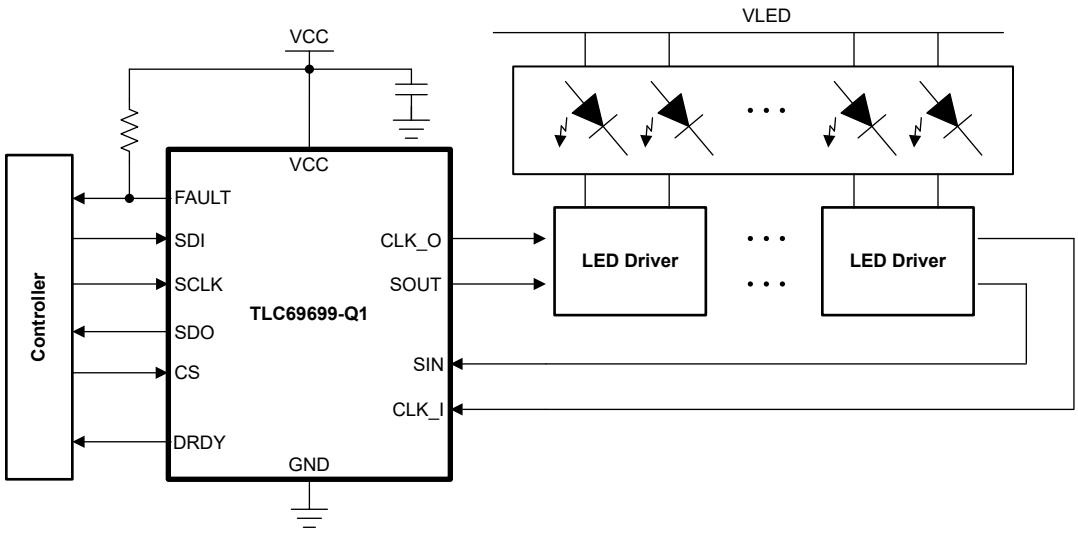


图 3-1. 典型应用图

本资源的原文使用英文撰写。 为方便起见，TI 提供了译文；由于翻译过程中可能使用了自动化工具，TI 不保证译文的准确性。 为确认准确性，请务必访问 ti.com 参考最新的英文版本（控制文档）。

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4 器件比较

表 4-1. 器件比较

器件型号	材料	封装
TLC69699-Q1	TLC69699QDYYRQ1	SOT-23-THN (14)
	TLC69699QDRRRQ1	WSON (12)

5 引脚配置和功能

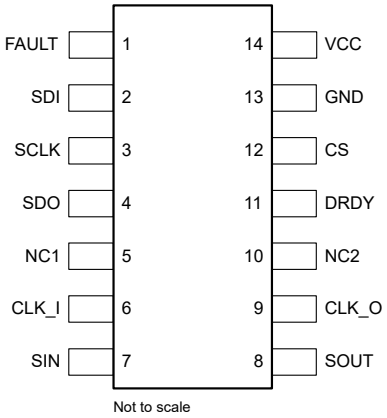


图 5-1. TLC69699-Q1 DYY 封装 14 引脚 SOT-23-THN 顶视图

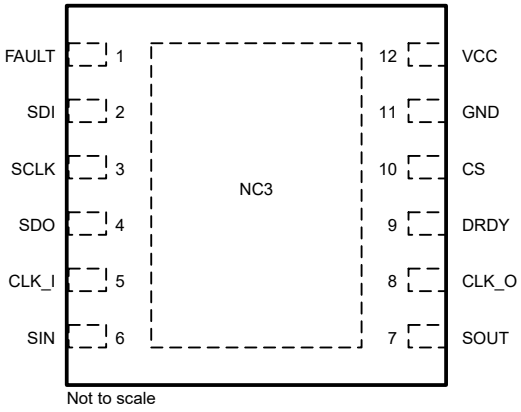


图 5-2. TLC69699-Q1 DRR 封装 12 引脚 WSON（带有外露散热焊盘）顶视图

表 5-1. 引脚功能

引脚			类型(1)	说明
名称	DYY 编号	DRR 编号		
FAULT	1	1	O	故障指示引脚
SDI	2	2	I	SPI 串行数据输入
SCLK	3	3	I	SPI 串行时钟输入
SDO	4	4	O	SPI 串行数据输出
NC1	5	-	NC	无连接。可用于信号路由。
CLK_I	6	5	I	CCSI 连续时钟输入
SIN	7	6	I	CCSI 串行数据输入
SOUT	8	7	O	CCSI 串行数据输出
CLK_O	9	8	O	CCSI 串行时钟输出
NC2	10	-	NC	无连接。可用于信号路由。
DRDY	11	9	O	数据就绪中断。
CS	12	10	I	SPI 片选
GND	13	11	G	接地引脚（必须接地）
VCC	14	12	P	VCC 电源输入
NC3	-	外露焊盘	NC	无连接。需要与除接地以外的任何信号进行电气隔离。

(1) I = 输入，O = 输出，G = 接地，P = 电源，NC = 无连接。

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6 器件和文档支持

TI 提供广泛的开发工具。下面列出了用于评估器件性能、生成代码和开发解决方案的工具和软件。

6.1 器件支持

6.2 文档支持

6.2.1 相关文档

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*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。

6.4 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。

6.5 商标

TI E2E™ is a trademark of Texas Instruments.
所有商标均为其各自所有者的财产。

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 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
2024 年 10 月	*	初始发行版

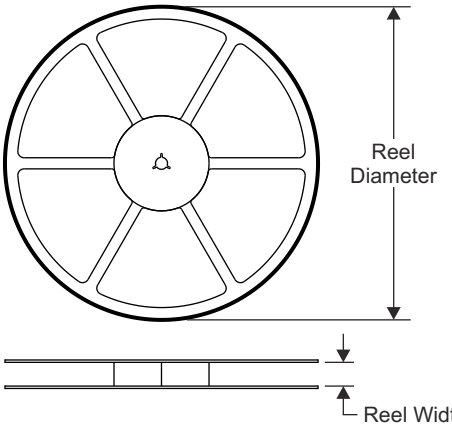
8 机械、封装和可订购信息

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。

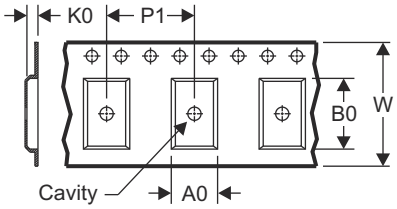
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8.1 卷带包装信息

REEL DIMENSIONS

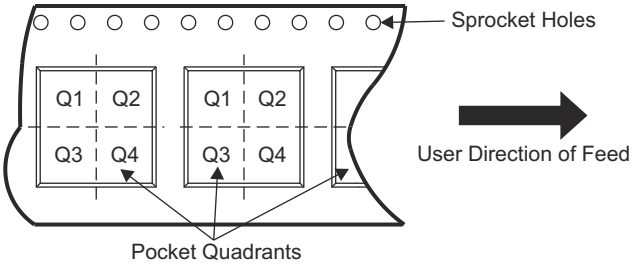


TAPE DIMENSIONS



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

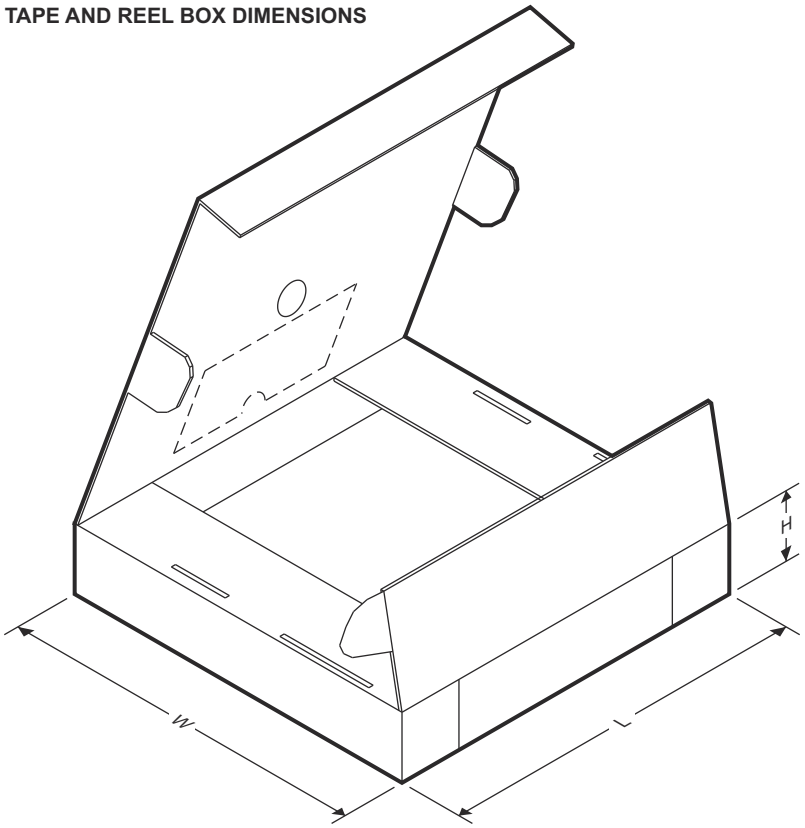
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



器件	封装类型	封装图	引脚	SPQ	卷带直径 (mm)	卷带宽度 W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1象限
TLC69699QDYYRQ1	SOT-23-THN	DYY	14									
TLC69699QDRRRQ1	WSON	DRR	12									

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TAPE AND REEL BOX DIMENSIONS



器件	封装类型	封装图	引脚	SPQ	长度 (mm)	宽度 (mm)	高度 (mm)
TLC69699QDYYRQ1	SOT-23-THN	DYY	14				
TLC69699QDRRRQ1	WSON	DRR	12				

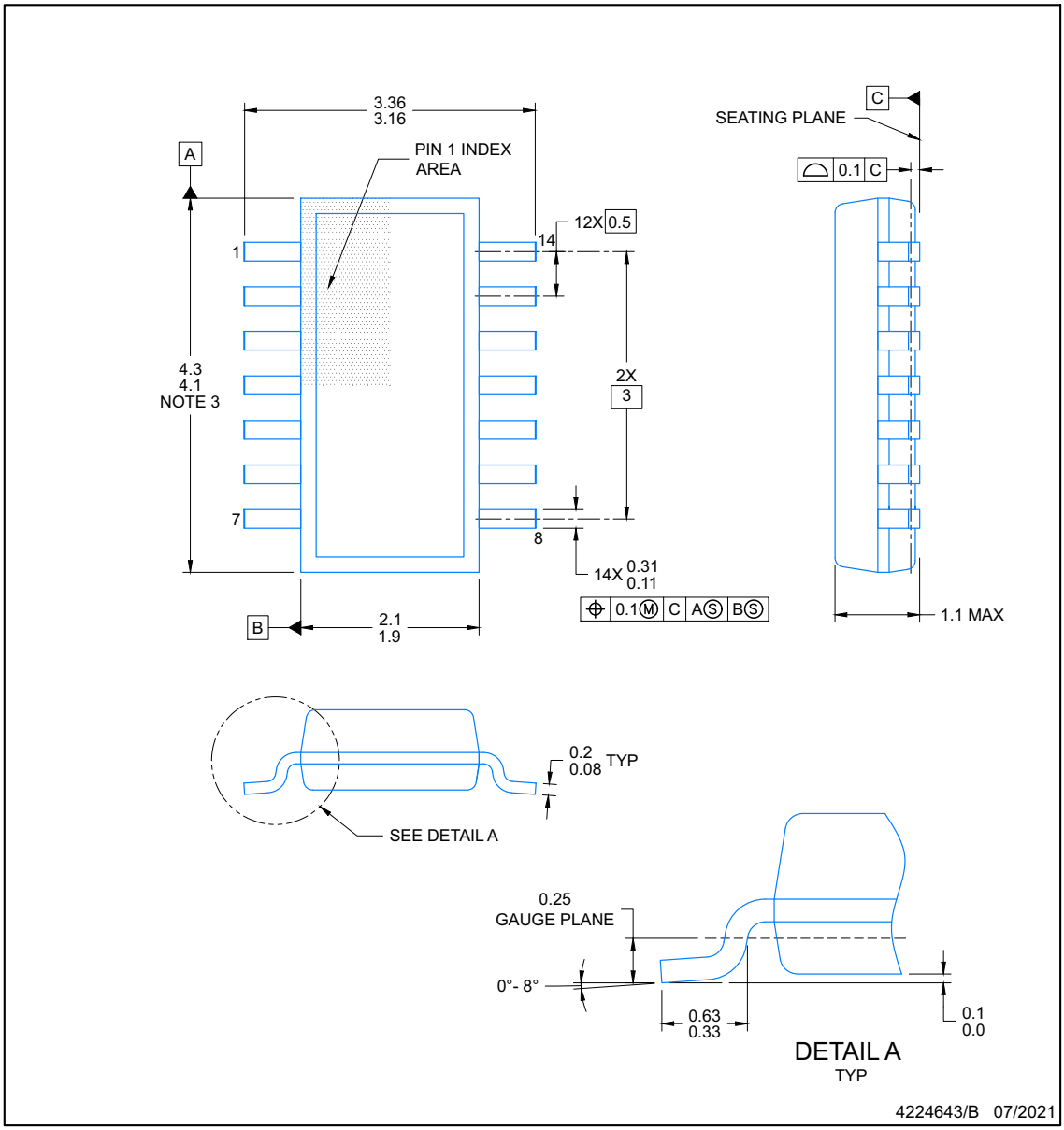
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8.2 机械数据

PACKAGE OUTLINE

DYY0014A **SOT-23-THIN - 1.1 mm max height**

PLASTIC SMALL OUTLINE



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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
5. Reference JEDEC Registration MO-345, Variation AB

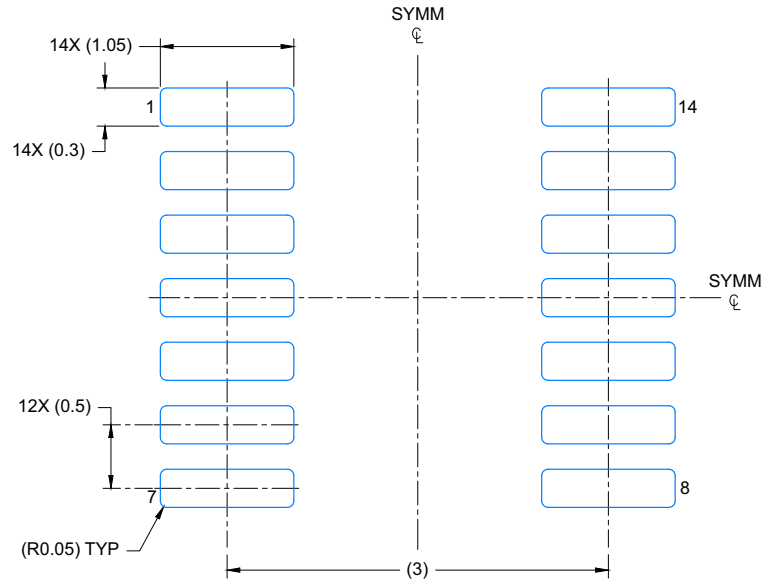
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EXAMPLE BOARD LAYOUT

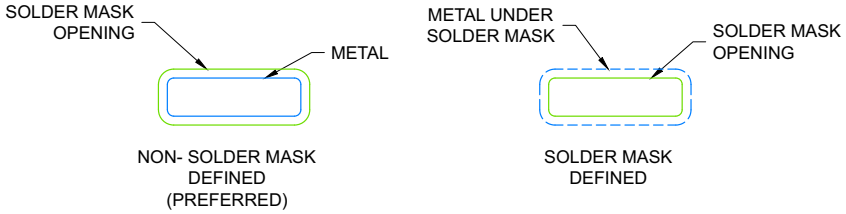
DYY0014A

SOT-23-THIN - 1.1 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



SOLDER MASK DETAILS

4224643/B 07/2021

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

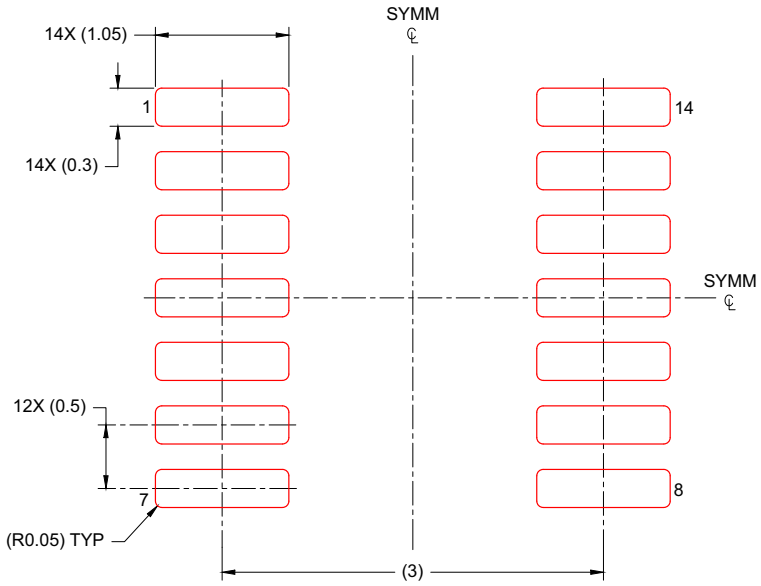
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EXAMPLE STENCIL DESIGN

DYY0014A

SOT-23-THIN - 1.1 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 20X

4224643/B 07/2021

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

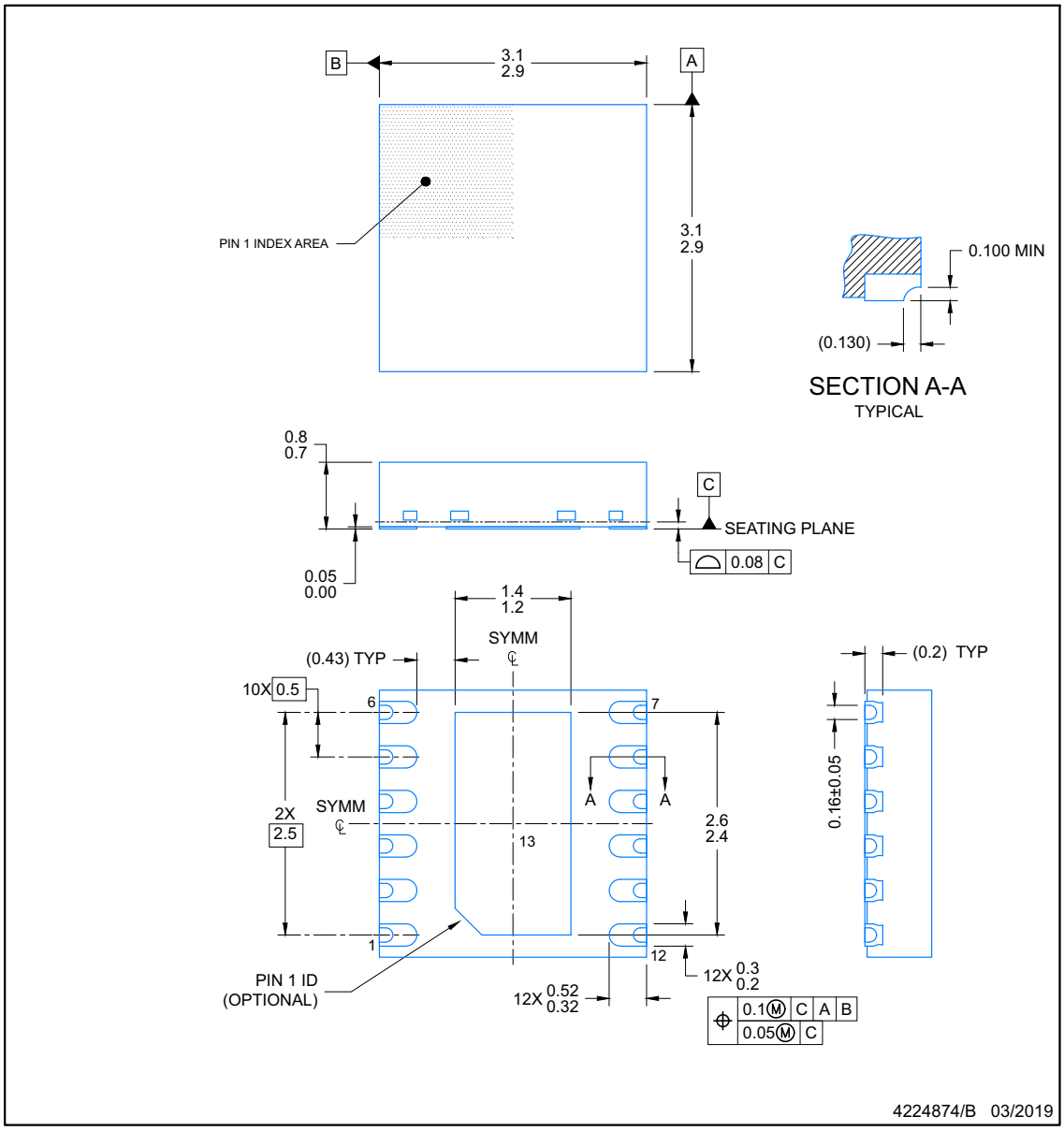
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PACKAGE OUTLINE

DRR0012E

WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- 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 optimal thermal and mechanical performance.

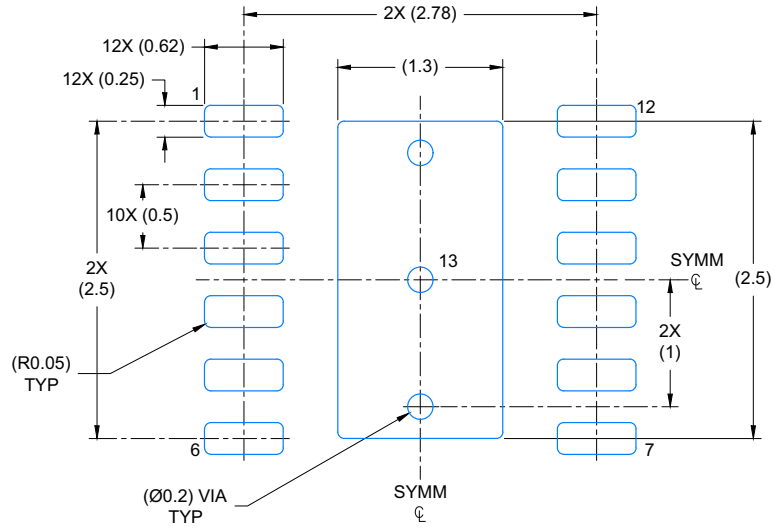
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EXAMPLE BOARD LAYOUT

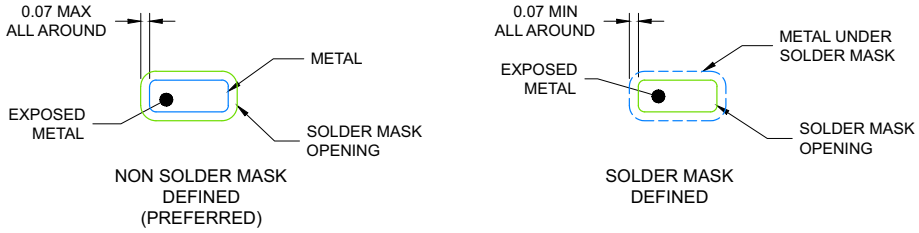
DRR0012E

WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



SOLDER MASK DETAILS

4224874/B 03/2019

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.

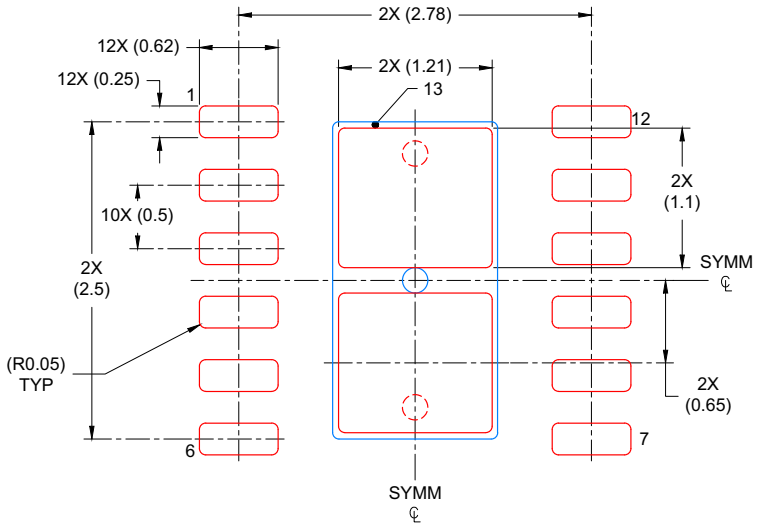
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EXAMPLE STENCIL DESIGN

DRR0012E

WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
82% PRINTED COVERAGE BY AREA
SCALE: 20X

4224874/B 03/2019

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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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)
TLC69699QDRRRQ1	Active	Production	WSON (DRR) | 12	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	9699NQ
TLC69699QDRRRQ1.A	Active	Production	WSON (DRR) | 12	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	See TLC69699QDRRRQ1	9699NQ
TLC69699QDYYRQ1	Active	Production	SOT-23-THIN (DYY) | 14	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	69699TQ
TLC69699QDYYRQ1.A	Active	Production	SOT-23-THIN (DYY) | 14	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	See TLC69699QDYYRQ1	69699TQ

(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.

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.

OTHER QUALIFIED VERSIONS OF TLC69699-Q1 :

- Catalog : TLC69699

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

GENERIC PACKAGE VIEW

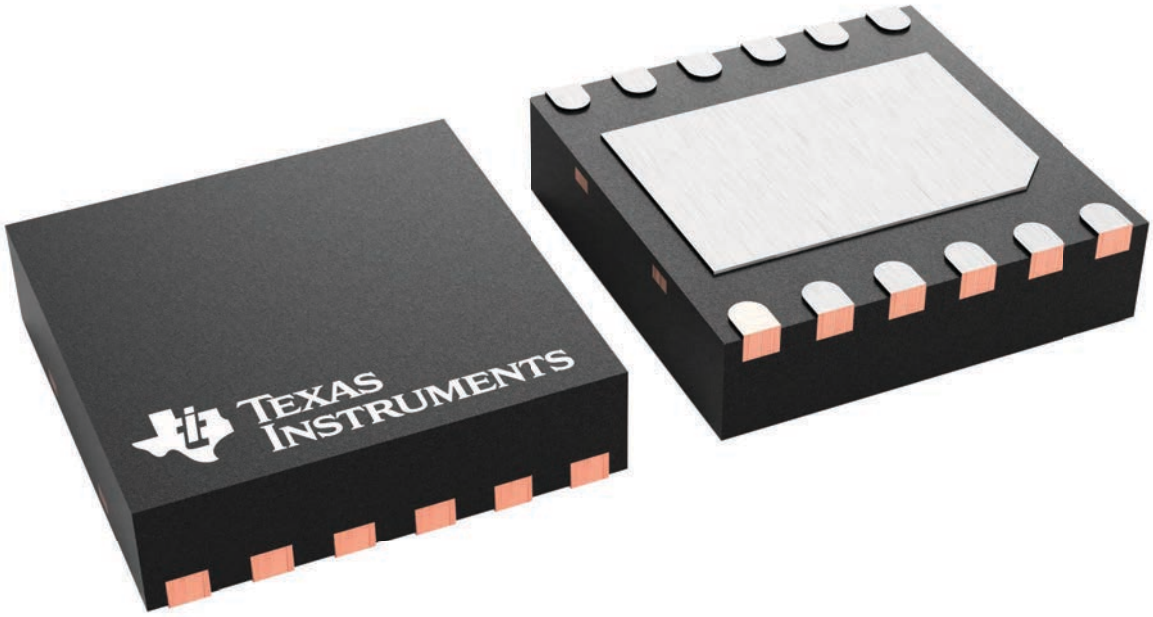
DRR 12

WSON - 0.8 mm max height

3 x 3, 0.5 mm pitch

PLASTIC SMALL OUTLINE - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



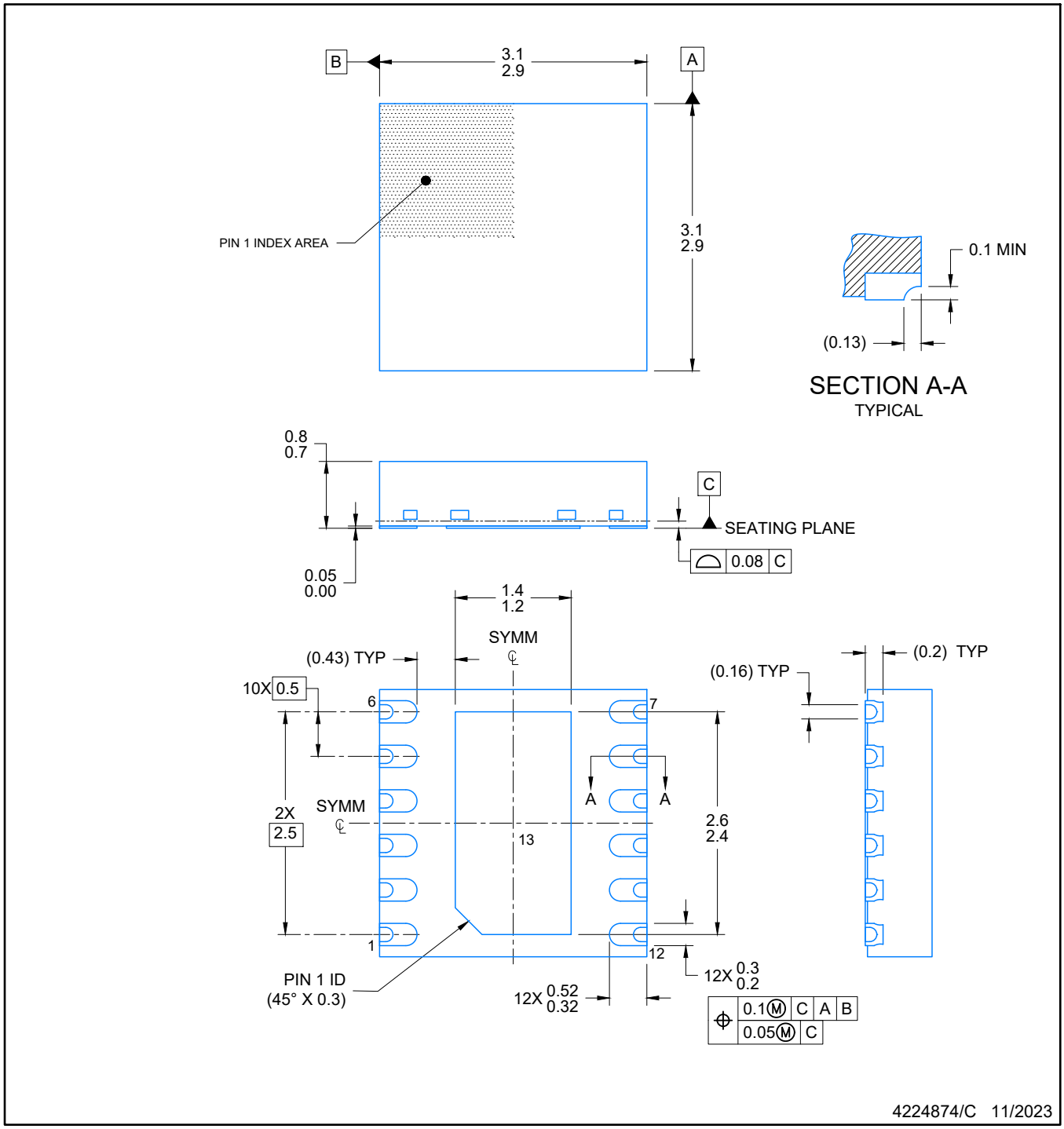
4223490/B

PACKAGE OUTLINE

DRR0012E

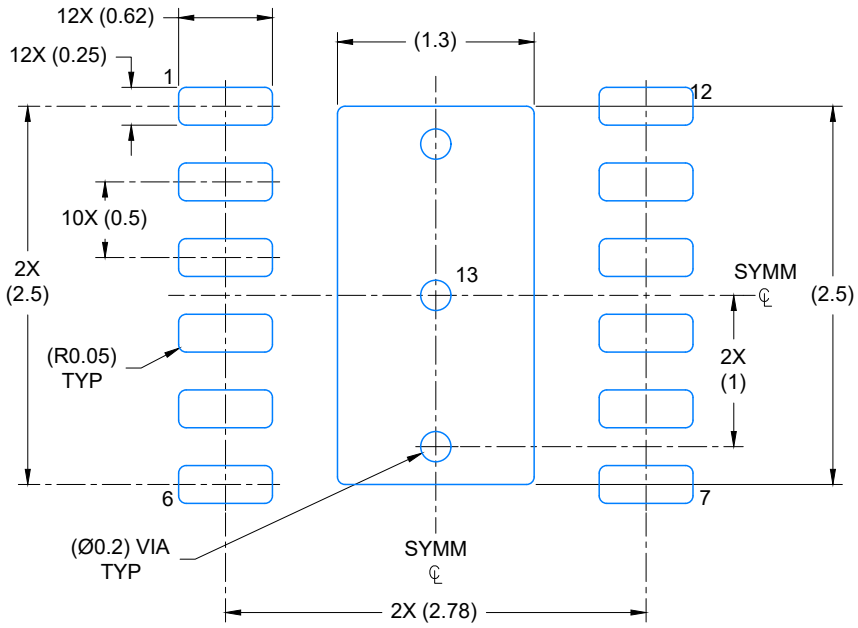
WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD

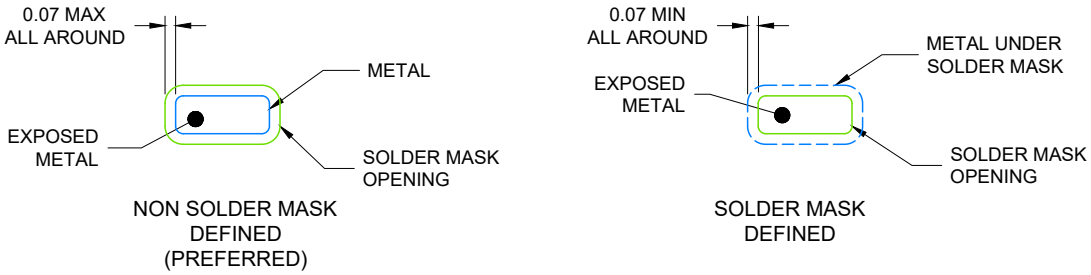


NOTES:

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 optimal thermal and mechanical performance.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X

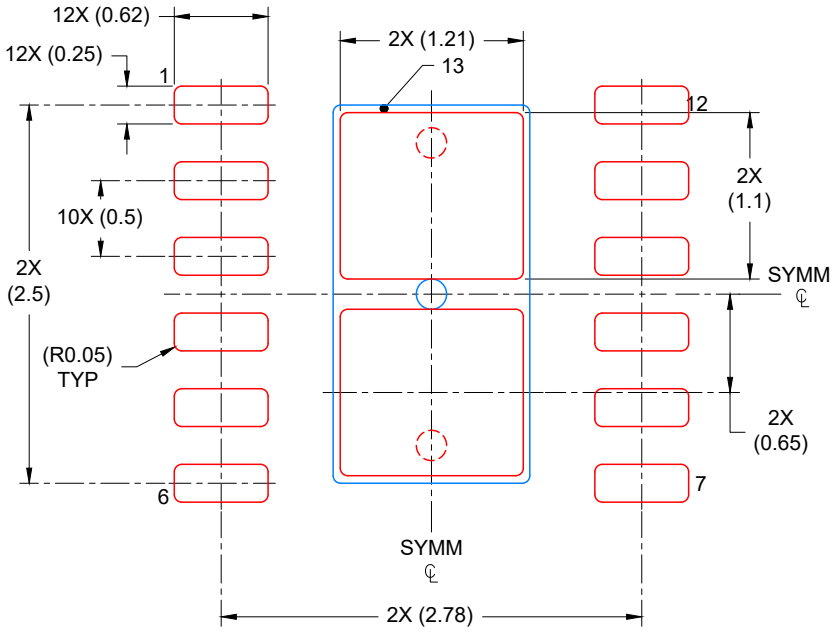


SOLDER MASK DETAILS

4224874/C 11/2023

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

EXPOSED PAD
82% PRINTED COVERAGE BY AREA
SCALE: 20X

4224874/C 11/2023

NOTES: (continued)

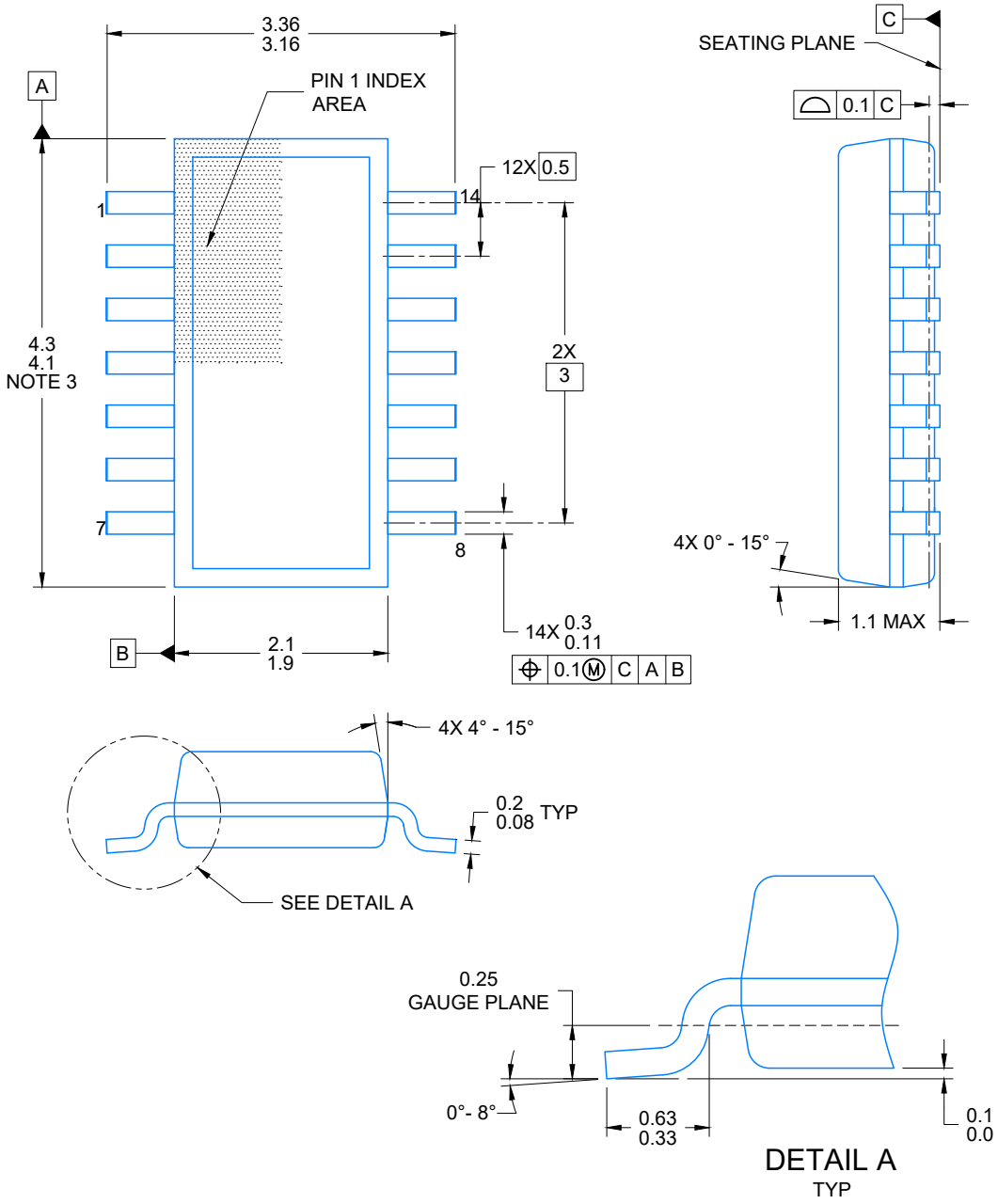
6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

PACKAGE OUTLINE

DYY0014A

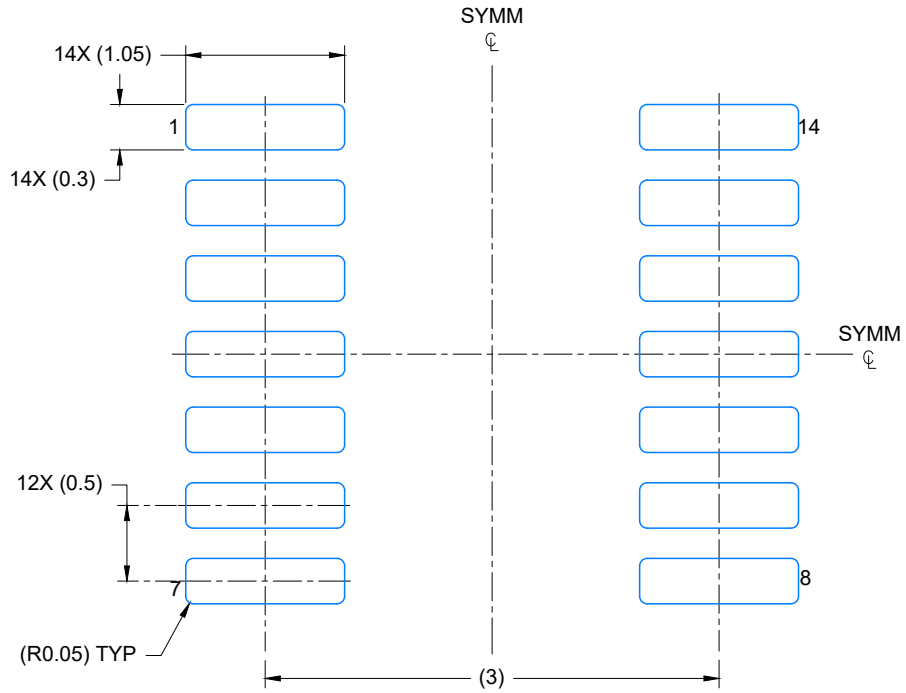
SOT-23-THIN - 1.1 mm max height

PLASTIC SMALL OUTLINE

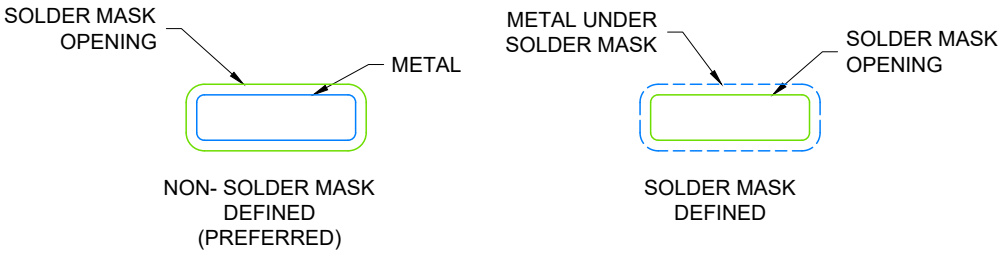


NOTES:

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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
5. Reference JEDEC Registration MO-345, Variation AB



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X

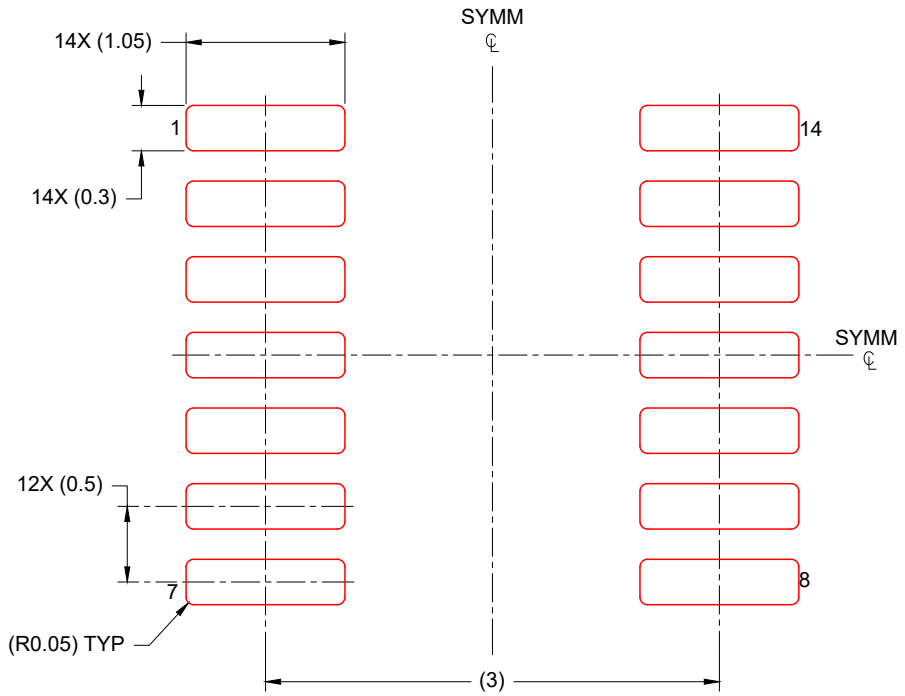


SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 20X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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