具有 14 位、9GSPS DAC 和 14 位、3GSPS ADC 的AFE7444 四通道射频采样 AFE

1 特性

- 四通道、14 位 9GSPS DAC
  - 信号带宽高达 800MHz
  - 每通道 1个 DSA 调节输出功率
- 四通道、14 位 3GSPS ADC
  - 信号带宽高达 800MHz
  - NSD：–151dBFS/Hz
  - f_{IN} = 2.6GHz、–3dBFS 时的交流性能
    - SNR：55dBFS
    - SFDR：73dBc HD2 和 HD3
    - SFDR：91dBc（最严重毛刺）
  - 每通道 2 个 DSA 扩展动态范围
  - 射频和数字功率检测器
- 射频频率范围：10MHz 至 6GHz
- 快速跳频 < 1µs
- 接收数字信号路径：
  - 每个 ADC 连接双通道 DDC
  - 每个 DDC 有 3 个相位同调 32 位 NCO
  - 抽取率：3 倍至 32 倍
- 发送数字信号路径：
  - 每个带有 32 位 NCO 的 DAC 连接双通道 DUC
  - 插值率：8 倍至 36 倍
  - Sin(x)/x 校正和可配置延迟
  - 功率放大器保护 (PAP)
- JESD204B 接口：
  - 8 个高达 15Gbps 的收发器
  - 子类 1 多芯片同步
- 时钟：
  - 具有旁路选项的内部 PLL 和 VCO
  - 利用时钟分频器产生最高为 3GHz 的时钟输出
- DAC 功耗：9GSPS 时为 1.7W/ch
- ADC 功耗：3GSPS 时为 1.8W/ch
- 封装：17mm x 17mm FC BGA，0.8mm 间距

2 应用

- 通信设备和测试仪
- 宽带数字转换器和波形发生器

3 说明

AFE7444 是具有 14 位 9GSPS DAC 和 14 位 3GSPS ADC 的四路通道宽频带射频采样模拟前端 (AFE)。可在高达 6GHz 的射频下工作，此器件支持直接射频采样到 C 频带，无需其他频率转换阶段。密度和灵活性的改进实现了对高通道数、多任务系统的支持。

DAC 信号路径支持插值和数字上变频选项，提供高达 800MHz 信号带宽。差动输出路径包括支持输出功率调优的数字步进衰减器 (DSA)。

每个 ADC 输入路径包括一个双通道 DSA 和射频数字功率检测器。灵活的抽取选项提供数据带宽优化。

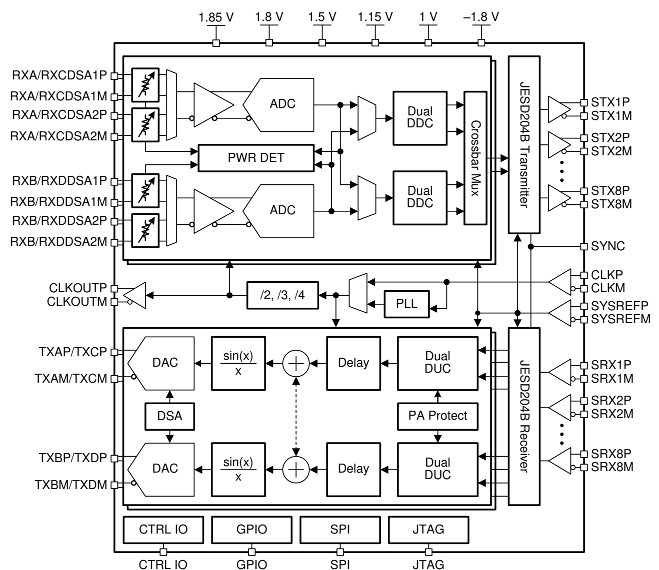
8 通道 (8 TX + 8 RX) 子类 1 兼容性 JESD204B 接口运行速度高达 15Gbps。可旁路片上 PLL 通过可选时钟输出简化时钟运行。

器件信息[(1)]

器件型号	封装	封装尺寸（标称值）
AFE7444	FCBGA (400)	17.00mm x 17.00mm

(1) 如需了解所有可用封装，请参阅数据表末尾的封装选项附录。

功能框图



本文档旨在为方便起见，提供有关 TI 产品中文版本的信息，以确认产品的概要。 有关适用的官方英文版本的最新信息，请访问 www.ti.com，其内容始终优先。 TI 不保证翻译的准确性和有效性。 在实际设计之前，请务必参考最新版本的英文版本。

4 修订历史记录

注：之前版本的页码可能与当前版本有所不同。

Changes from Original (October 2018) to Revision A **Page**

- 已更改 将状态从预告信息改为了生产数据 ... 1

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5 器件和文档支持

5.1 接收文档更新通知

要接收文档更新通知，请导航至 TI.com.cn 上的器件产品文件夹。单击右上角的*通知我* 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。

5.2 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商"按照原样"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》。

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设计支持 ***TI 参考设计支持*** 可帮助您快速查找有帮助的 E2E 论坛、设计支持工具以及技术支持的联系信息。

5.3 商标

E2E is a trademark of Texas Instruments.
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5.4 静电放电警告

ESD 可能会损坏该集成电路。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措施和安装程序，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。

5.5 术语表

SLYZ022 — *TI 术语表*。
这份术语表列出并解释术语、缩写和定义。

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的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如欲获取此数据表的浏览器版本，请参阅左侧的导航。

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
AFE7444IABJ	ACTIVE	FCBGA	ABJ	400	90	RoHS & Green	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE7444I	Samples
AFE7444IALK	ACTIVE	FCBGA	ALK	400	90	Non-RoHS & Green	Call TI	Level-3-220C-168 HR	-40 to 85	AFE7444IZ	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.

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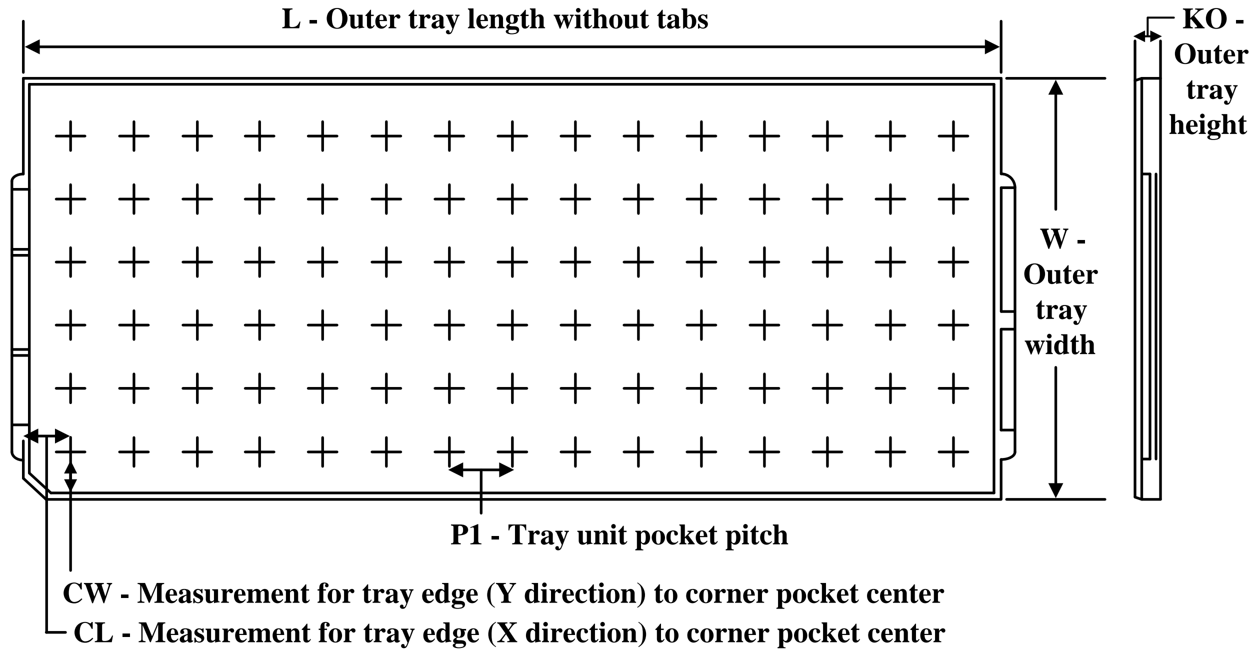
TRAY



Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
AFE7444IABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE7444IALK	ALK	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2

BALL A1 CORNER

17.2
16.8

A

17.2
16.8

(□16)

B

2.65
2.29

(1.4)

// 0.2 C

C

SEATING PLANE
NOTE 4

0.76
0.56

BALL TYP

0.12 C

0.5
0.3 TYP

15.2 TYP

0.8 TYP

SYMM

(0.9) TYP

Y W V U T R P N M L K J H G F E D C B A

SYMM

15.2
TYP

400X ∅ 0.55
0.45

∅0.15Ⓜ C A B
∅0.08Ⓜ C NOTE 3

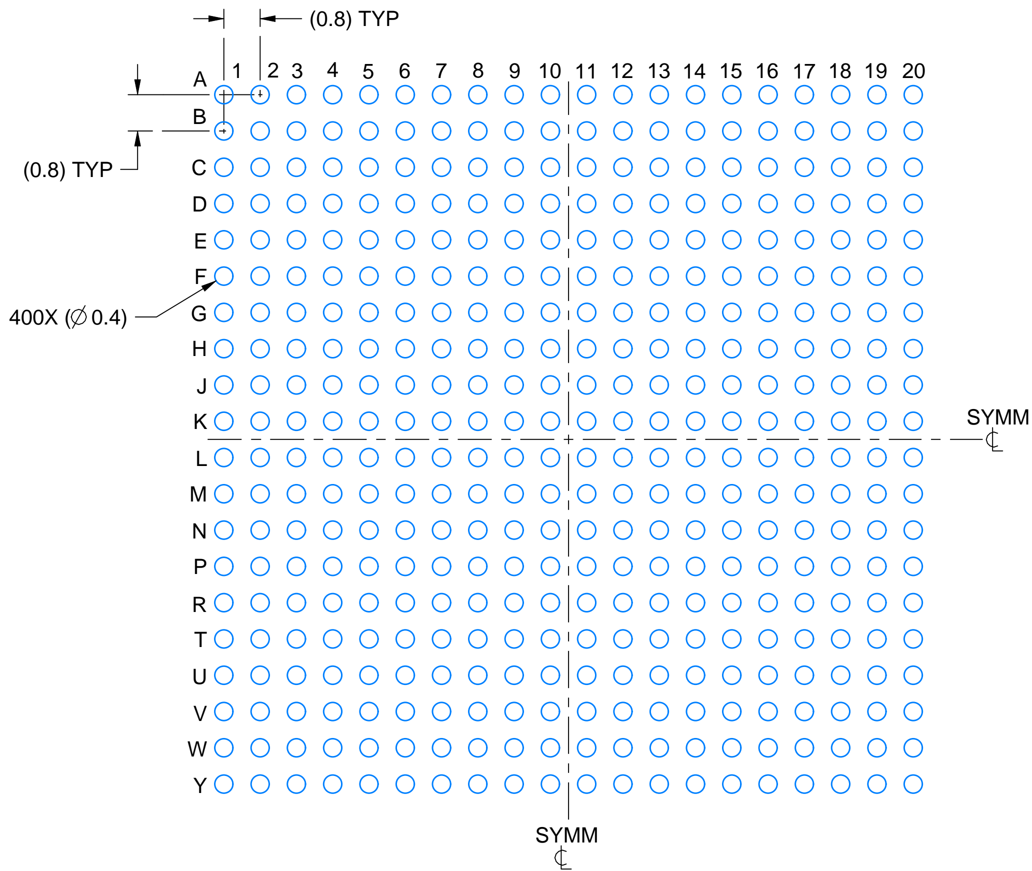
1 3 5 7 9 11 13 15 17 19
2 4 6 8 10 12 14 16 18 20

0.8 TYP

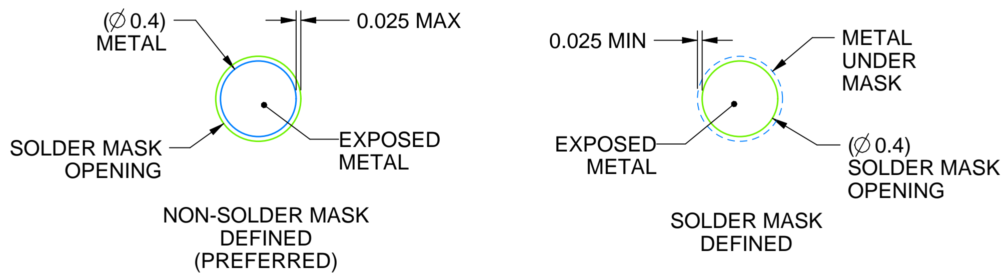
4225930/C 03/2023

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. Dimension is measured at the maximum solder ball diameter, parallel to primary datum C.
4. Primary datum C and seating plane are defined by the spherical crowns of the solder balls.
5. Pb-Free die bump and SnPb solder ball.
6. The lids are electrically floating (e.g. not tied to GND).



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X

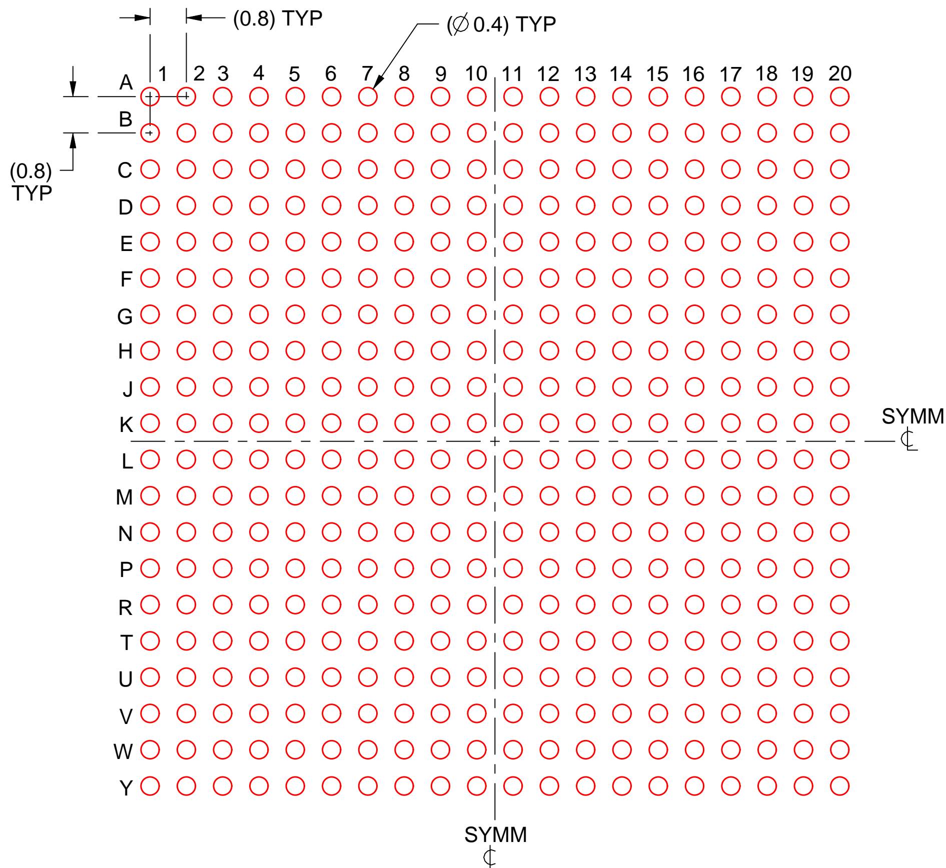


SOLDER MASK DETAILS
NOT TO SCALE

4225930/C 03/2023

NOTES: (continued)

7. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SPRU811 (www.ti.com/lit/spru811).



SOLDER PASTE EXAMPLE
BASED ON 0.15 mm THICK STENCIL
SCALE:6X

4225930/C 03/2023

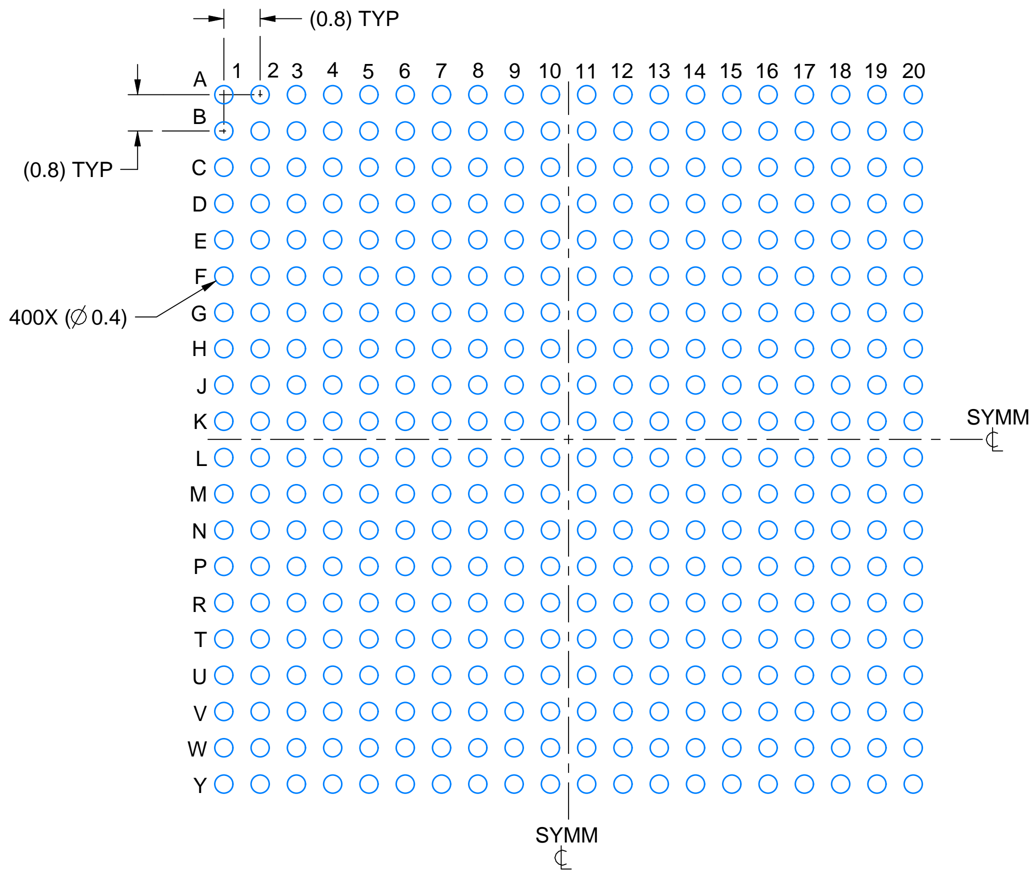
NOTES: (continued)

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

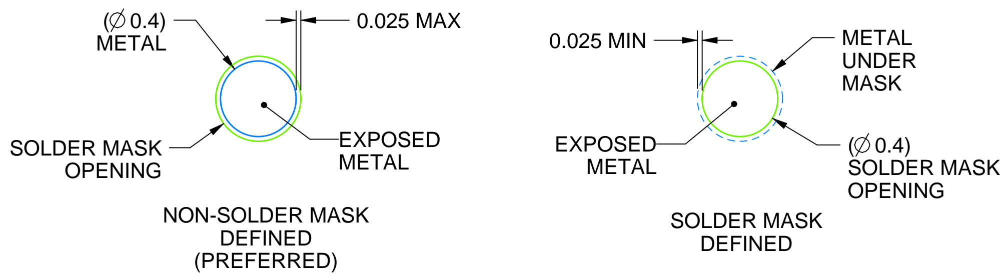
4221311/D 03/2023

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. Dimension is measured at the maximum solder ball diameter, parallel to primary datum C.
4. Primary datum C and seating plane are defined by the spherical crowns of the solder balls.
5. The lids are electrically floating (e.g. not tied to GND).



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



NON-SOLDER MASK
DEFINED
(PREFERRED)

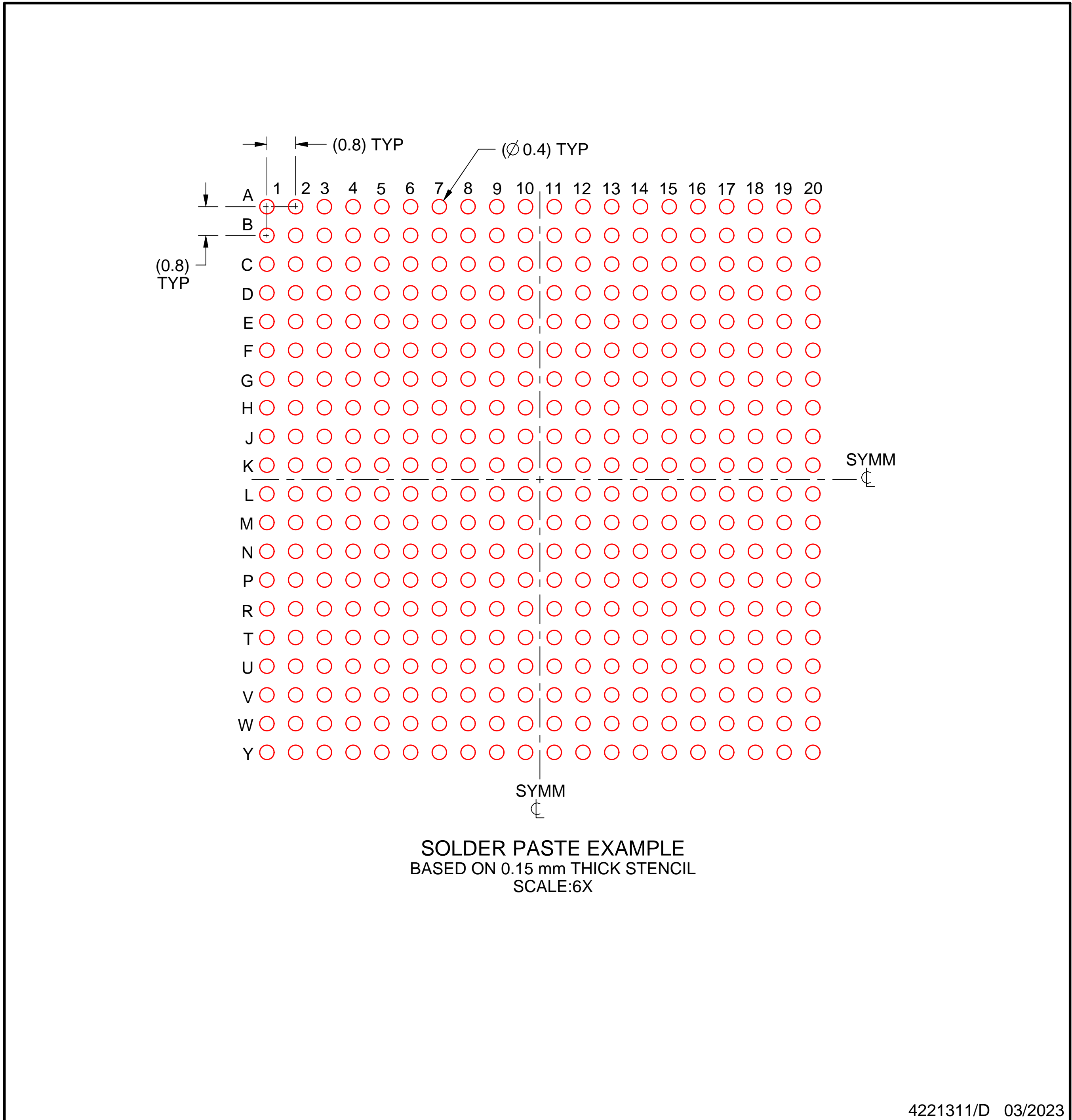
SOLDER MASK
DEFINED

SOLDER MASK DETAILS
NOT TO SCALE

4221311/D 03/2023

NOTES: (continued)

6. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
For more information, see Texas Instruments literature number SPRU811 (www.ti.com/lit/spru811).



NOTES: (continued)

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

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