

AFE80xx 射频采样收发器

1 特性

- [申请完整数据表](#)
- AFE80xx 版本：
 - AFE8000 : 8 TX , 10 RX
 - AFE8004 : 4 TX , 4 RX
 - AFE8010 : 10 RX
- 12GSPS 射频采样 DAC
- 4GSPS 射频取样 ADC
- 最大射频信号带宽：
 - TX : 800MHz (8 通道) 或 1.2GHz (4 通道)
 - RX : 800MHz (8 通道) 或 400MHz (8 通道) + 800MHz (2 通道)
- 射频频率范围：
 - TX : 5MHz 至 7.125GHz
 - RX : 100MHz 至 7.125GHz
- 数字步进衰减器 (DSA) :
 - TX : 40dB 范围, 1dB 模拟和 0.125dB 数字步进
 - RX/FB : 25dB 范围, 1dB 步进
- 单频带或双频带 DUC、DDC
- 每链两个 NCO, 支持快速频率切换
- 通过在 TX 和 RX 之间快速切换来支持 TDD 操作
- 用于生成 DAC/ADC 时钟的内部 PLL/VCO
- DAC 或 ADC 速率下的可选外部 CLK
- 串行器/解串器数据接口：
 - JESD204B 和 JESD204C
 - 8 个高达 32.5Gbps 的串行器/解串器收发器
 - 8b/10b 和 64b/66b 编码
 - 12 位、16 位、24 位和 32 位分辨率
 - 子类 1 多器件同步
- 封装：
 - 17mm × 17mm FCBGA, 间距为 0.8mm

2 应用

- [雷达](#)
- [导引头前端](#)
- [国防无线电](#)
- [战术通信基础设施](#)
- [无线通信测试](#)

3 说明

AFE8000 是一款高性能、宽带宽、多通道收发器, 集成了 8 个射频采样 DAC 和 10 个射频采样 ADC。可提供引脚和编程兼容的低通道数版本 (具有 4TX 和 4RX 通道的 AFE8004、具有 10RX 通道的 AFE8010), 用于实现可扩展的系统设计。

每个接收器 (RX) 链包含一个 25dB 范围的 DSA (数字步进衰减器), 后跟一个 4GSPS ADC (模数转换器)。10 个 ADC 连接到 8 个接收器路径 (1RX 至 8RX) 和 2 个反馈路径 (1FB 和 2FB)。RX 和 FB 之间的 ADC 是相同的, 但数字下变频器路径不同 (FB 路径具有更宽的带宽, 可用作接收器)。每个接收器通道都有多个模拟峰值功耗检测器和数字峰值及功耗检测器, 可辅助进行外部或内部自主自动增益控制器, 另外还具有一个射频过载检测器, 用于提供器件可靠性保护。单频带或双频带数字下变频器 (DDC) 可提供高达 800MHz (8 通道), 或 400MHz (8 通道) 和 800MHz (2 通道) 的信号带宽。

每个发送器 (TX) 链包含一个单频带或双频带数字上变频器 (DUC)。支持高达 800MHz (8 通道) 或 1200MHz (4 通道) 的信号带宽。DUC 的输出驱动一个 12GSPS DAC (数模转换器), 通过混合模式输出选项增强在第二奈奎斯特区的运行。DAC 输出包括一个具有 40dB 范围以及 1dB 模拟和 0.125dB 数字步进的可选增益放大器 (TX DSA)。

封装信息

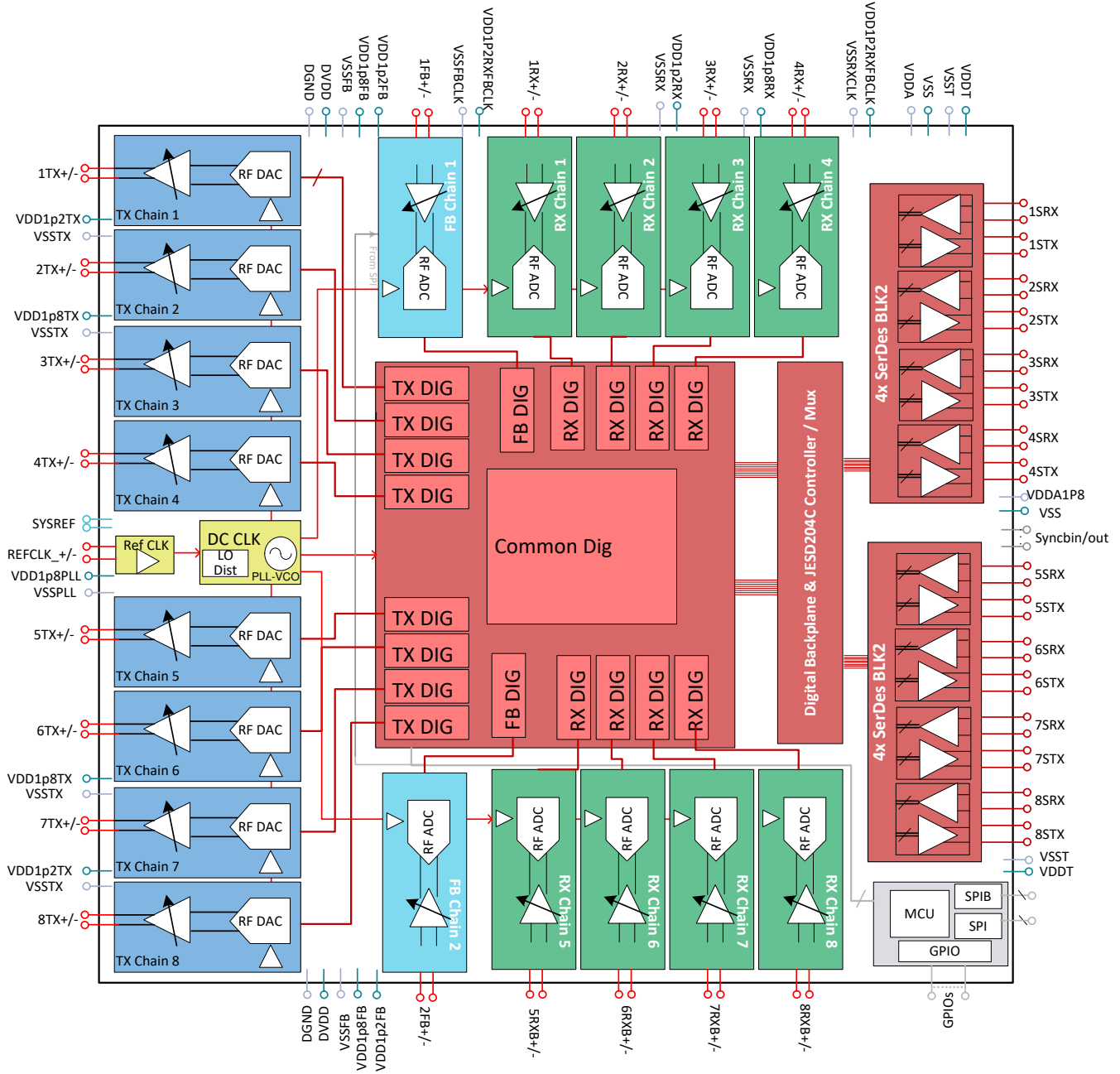
器件型号	封装 ⁽¹⁾	封装尺寸 ⁽²⁾
AFE8000 AFE8004 AFE8010	FC-BGA	17 mm × 17 mm

(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, 并包括引脚 (如适用)。



4 Functional Block Diagram



5 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from December 31, 2022 to June 14, 2023 (from Revision * (December 2022) to Revision A (June 2023))

Page

- 更改了封装信息表中的注释 2 从 AFE8004 和 AFE8010 器件中删除了产品预发布..... 1

6 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

6.1 Documentation Support

6.1.1 Related Documentation

6.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.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。

6.3 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》](#)。

6.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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6.5 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。

6.6 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。

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.

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
AFE8000IABJ	ACTIVE	FCBGA	ABJ	400	90	RoHS & Green	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE8000	Samples
AFE8000IALK	ACTIVE	FCBGA	ALK	400	90	Non-RoHS & Green	Call TI	Level-3-220C-168 HR	-40 to 85	AFE8000 SNPB	Samples
AFE8004IABJ	ACTIVE	FCBGA	ABJ	400	90	RoHS & Green	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE8004	Samples
AFE8004IALK	ACTIVE	FCBGA	ALK	400	90	Non-RoHS & Green	Call TI	Level-3-220C-168 HR	-40 to 85	AFE8004 SNPB	Samples
AFE8010IABJ	ACTIVE	FCBGA	ABJ	400	90	RoHS & Green	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE8010	Samples
AFE8010IALK	ACTIVE	FCBGA	ALK	400	90	Non-RoHS & Green	Call TI	Level-3-220C-168 HR	-40 to 85	AFE8010 SNPB	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.

OBSELETE: 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

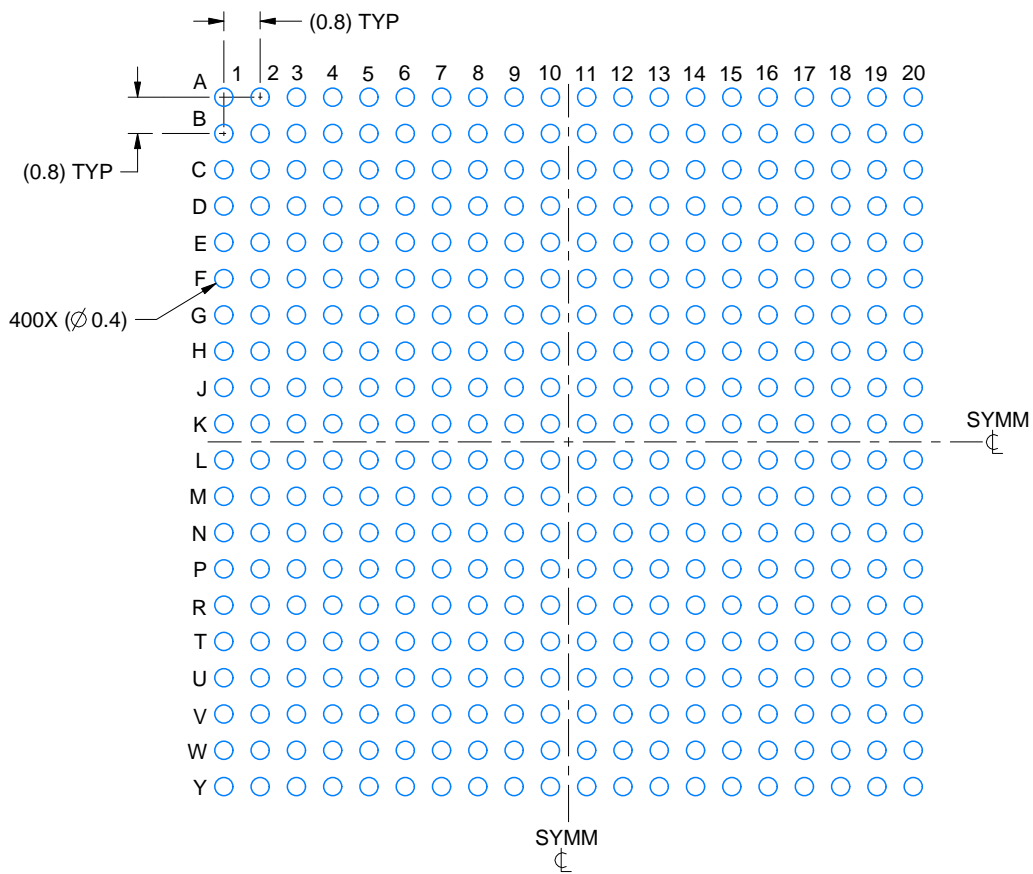
Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
AFE8000IABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8000IALK	ALK	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8004IABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8004IALK	ALK	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8010IABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8010IALK	ALK	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2

EXAMPLE BOARD LAYOUT

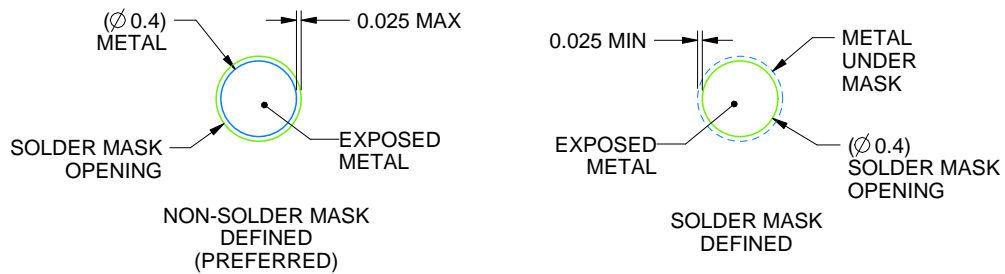
ABJ0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

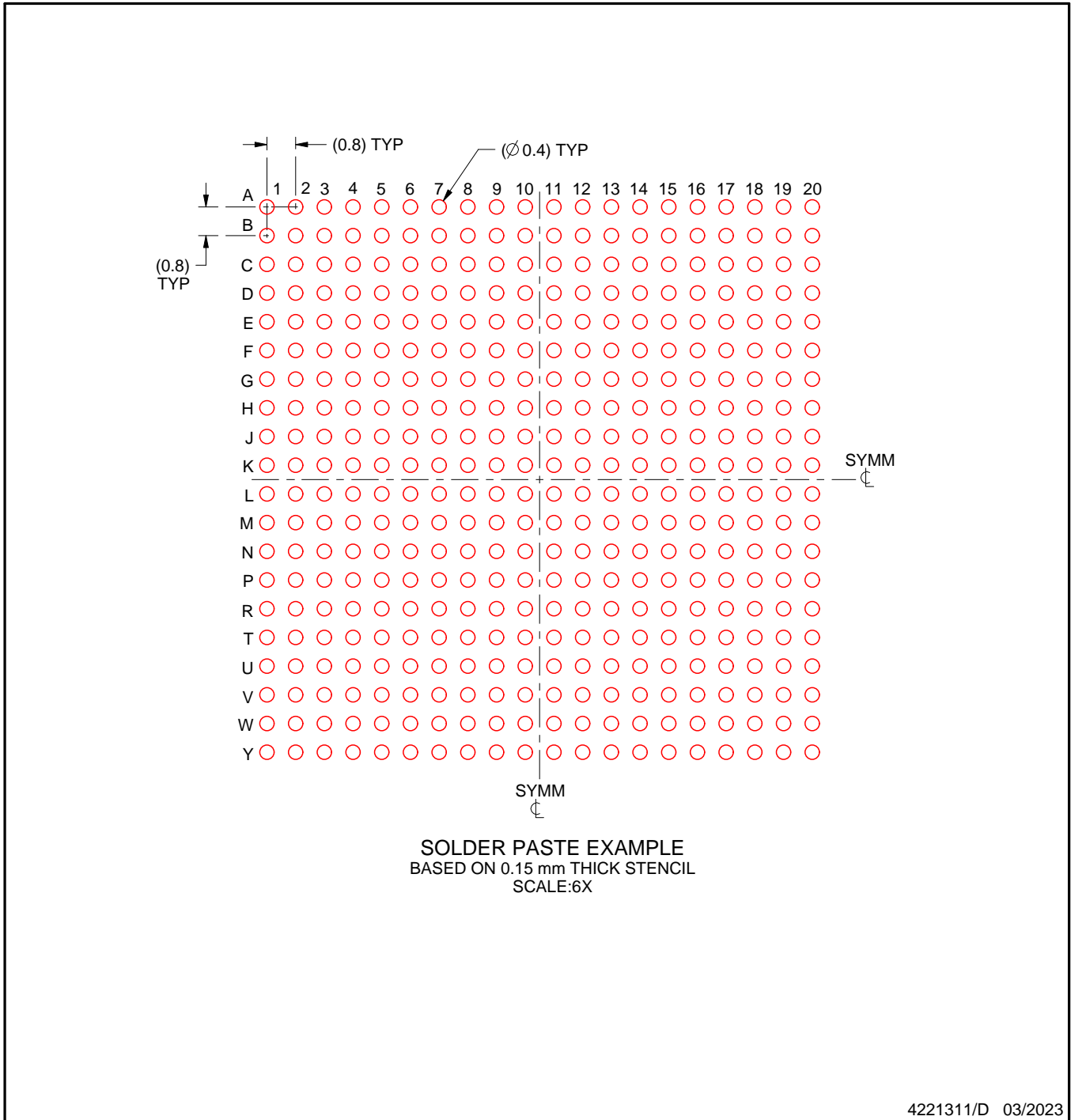
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SPRU811 (www.ti.com/lit/spru811).

EXAMPLE STENCIL DESIGN

ABJ0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



NOTES: (continued)

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

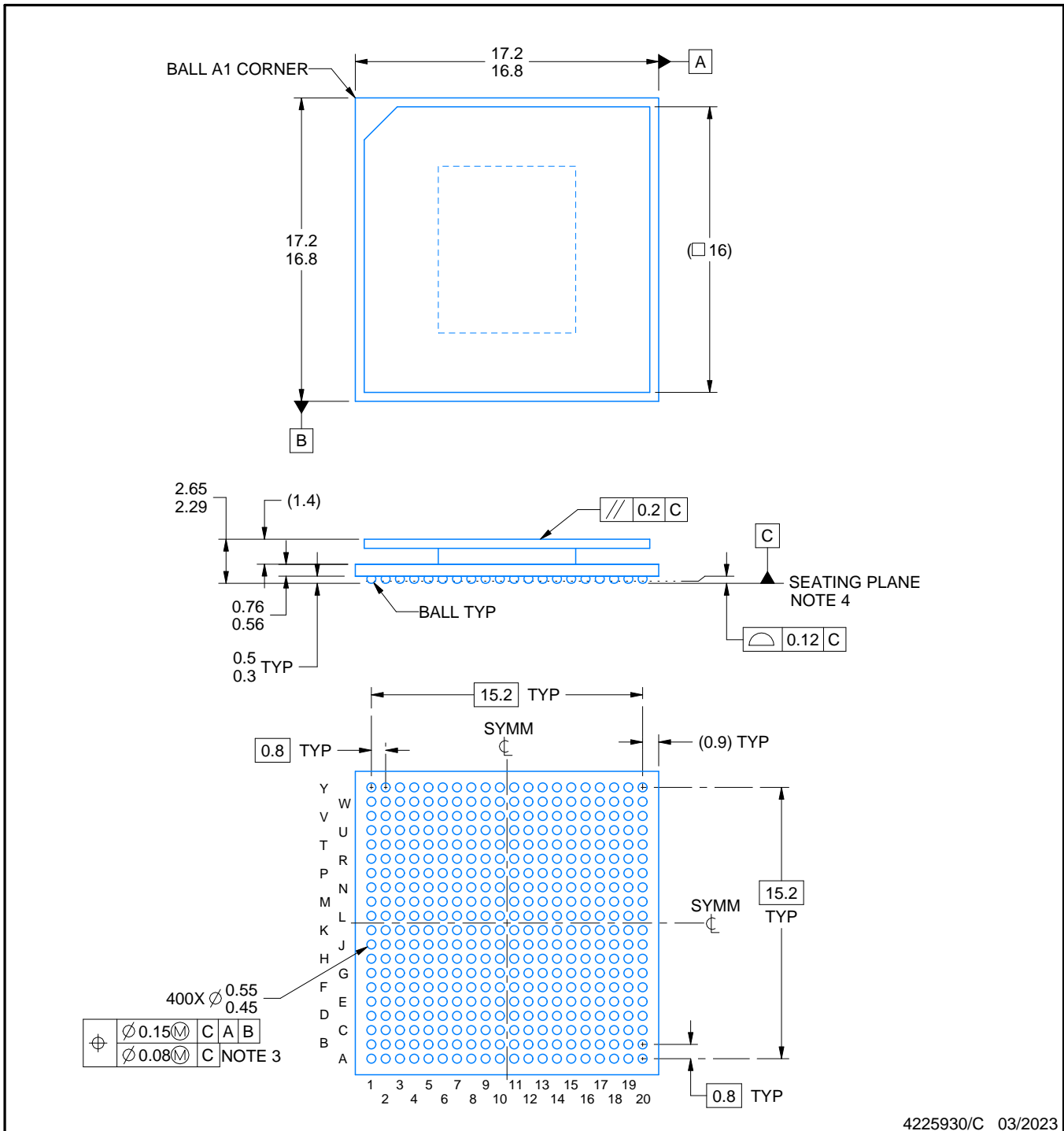
ALK0400A



PACKAGE OUTLINE

FCBGA - 2.65 mm max height

BALL GRID ARRAY



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NOTES:

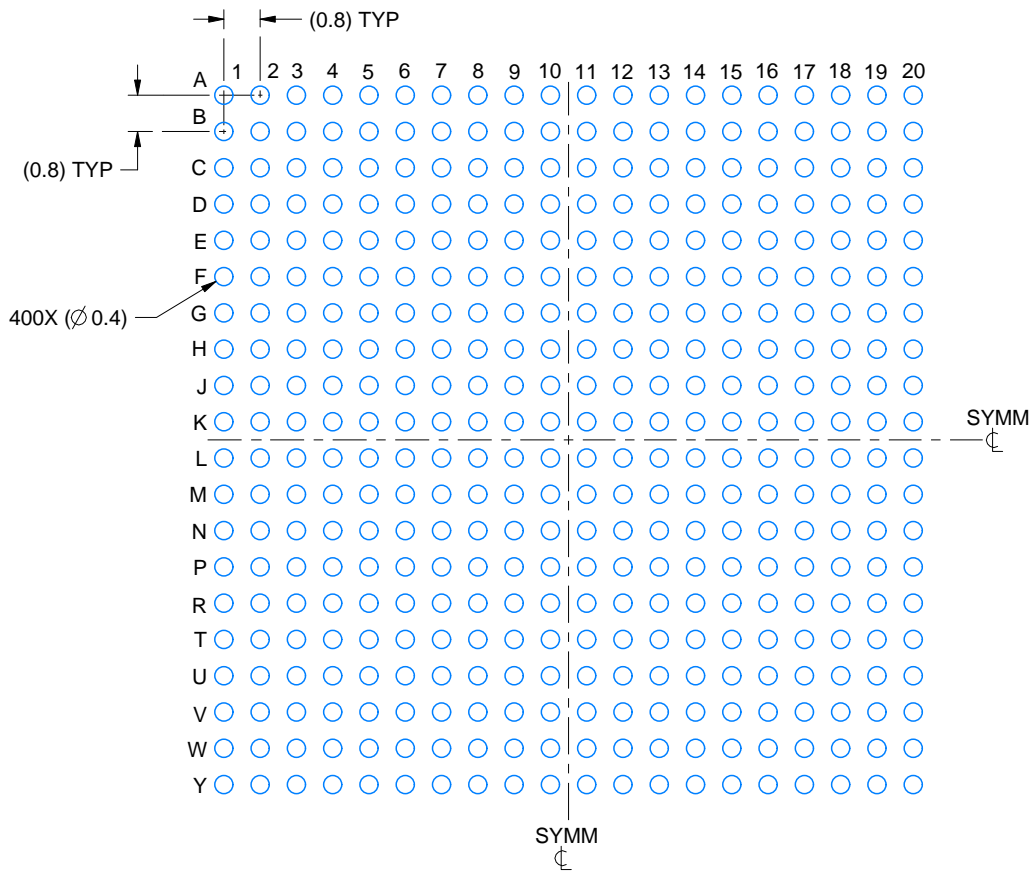
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Dimension is measured at the maximum solder ball diameter, parallel to primary datum C.
4. Primary datum 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).

EXAMPLE BOARD LAYOUT

ALK0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



SOLDER MASK DETAILS
NOT TO SCALE

4225930/C 03/2023

NOTES: (continued)

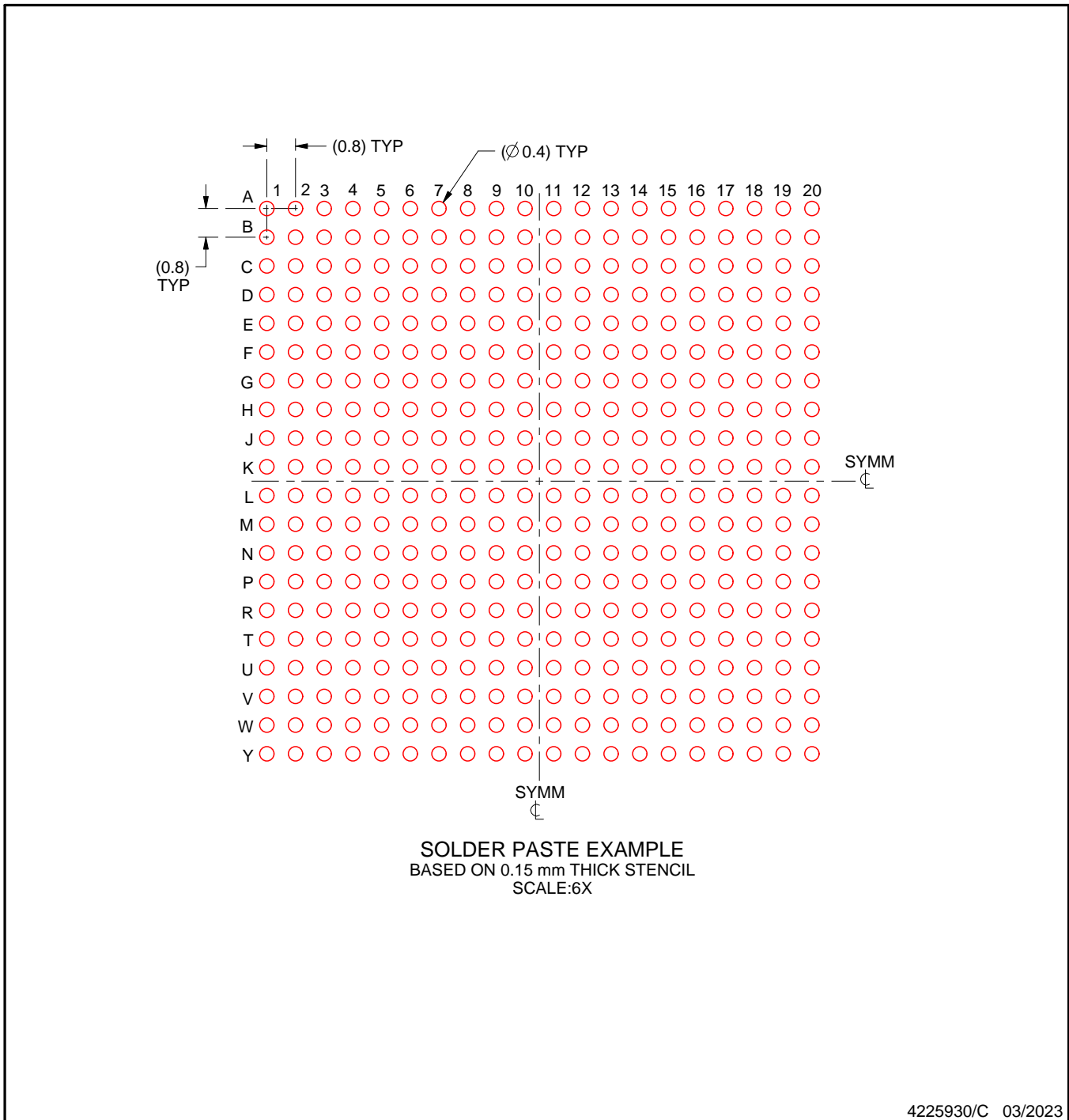
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EXAMPLE STENCIL DESIGN

ALK0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



NOTES: (continued)

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

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