

具有 12GSPS DAC 和 3GSPS ADC 的 AFE7950 4T6R 射频采样 AFE

1 特性

- 四通道射频采样 12GSPS 发送 DAC
- 四通道射频采样 3GSPS 接收 ADC
- 双通道射频采样 3GSPS 反馈 (辅助 RX) ADC
- 最大射频信号带宽：
 - 4TX 或 2FB : 1200MHz 或 2TX : 2400MHz
 - RX) : 1200MHz (无 FB)、600MHz (带 FB)
- 射频频率范围：
 - TX : 600MHz - 12GHz
 - RX/FB : 600MHz - 12GHz
- 数字步进衰减器 (DSA)：
 - TX : 40dB 范围, 0.125dB 步进
 - RX 或 FB : 25dB 范围, 0.5dB 步进
- 用于 TX 和 RX 的单频带或双频带 DUC/DDC
- 每个 TX/RX 和 FB 为 16x NCO
- 可选内部 PLL/VCO, 提供 DAC 或 ADC 采样率下的 DAC/ADC 时钟或外部时钟
- 串行器/解串器数据接口：
 - 可兼容 JESD204B 和 JESD204C
 - 8 个高达 29.5Gbps 的串行器/解串器收发器
 - 子类 1 多器件同步
- 封装 : 17mm × 17mm FCBGA, 间距 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

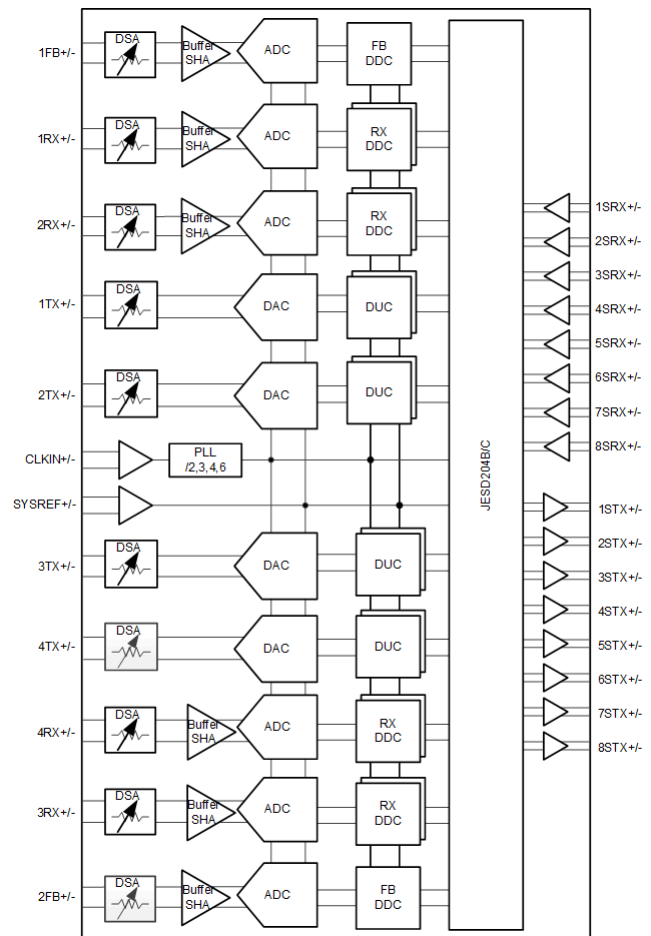
AFE7950 是一款高性能、高带宽、多通道收发器, 集成了四个射频采样发送链、四个射频采样接收链和两个射频采样反馈链 (总计六个射频采样 ADC)。此器件具有高达 12GHz 的工作频率, 支持直接在 L、S、C 和 X 频带频率范围内进行射频采样, 无需额外的频率转换。密度和灵活性提高后可支持高通道数、多任务系统。

TX 信号路径支持插值和数字上变频选项, 从而为四个 TX 提供高达 1200MHz 的信号带宽, 或者为两个 TX 提供高达 2400MHz 的信号带宽。DUC 的输出驱动 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 数字步进的可变增益放大器 (TX DSA)。

器件信息

器件型号	封装 ⁽¹⁾	封装尺寸
AFE7950	FC-BGA	17.00mm × 17.00mm

(1) 如需了解更多信息, 请参阅机械、封装和可订购信息。



功能方框图



4 说明 (续)

每个接收器链均包含一个 25dB 范围的数字步进衰减器 (DSA)，后跟一个 3GSPS 模数转换器 (ADC)。每个接收器通道都有多个模拟峰值功耗检测器和各种数字功耗检测器，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。灵活的抽取选项可为数据带宽提供高达 1200MHz 的优化（对于四条不带 FB 路径的 RX），或为带两条 FB 路径（每条 1200MHz 带宽）提供 600MHz 的优化。

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 Revision * (February 2021) to Revision A (August 2021)	Page
• 将数据表状态从 预告信息 更改为 量产数据.....	1

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](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。

6.2 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 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

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.

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
AFE7950IABJ	ACTIVE	FCBGA	ABJ	400	90	RoHS & Green	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE7950I	Samples
AFE7950IALK	ACTIVE	FCBGA	ALK	400	90	Non-RoHS & Green	Call TI	Level-3-220C-168 HR	-40 to 85	AFE7950 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.

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.

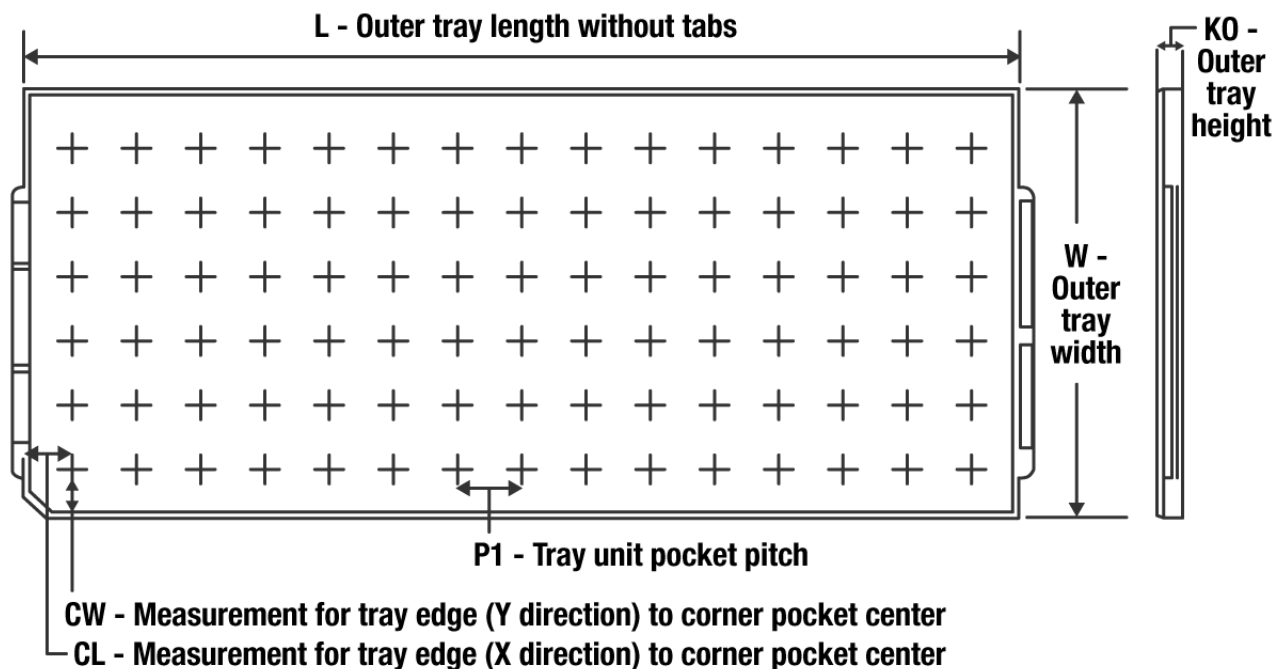
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(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.

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.

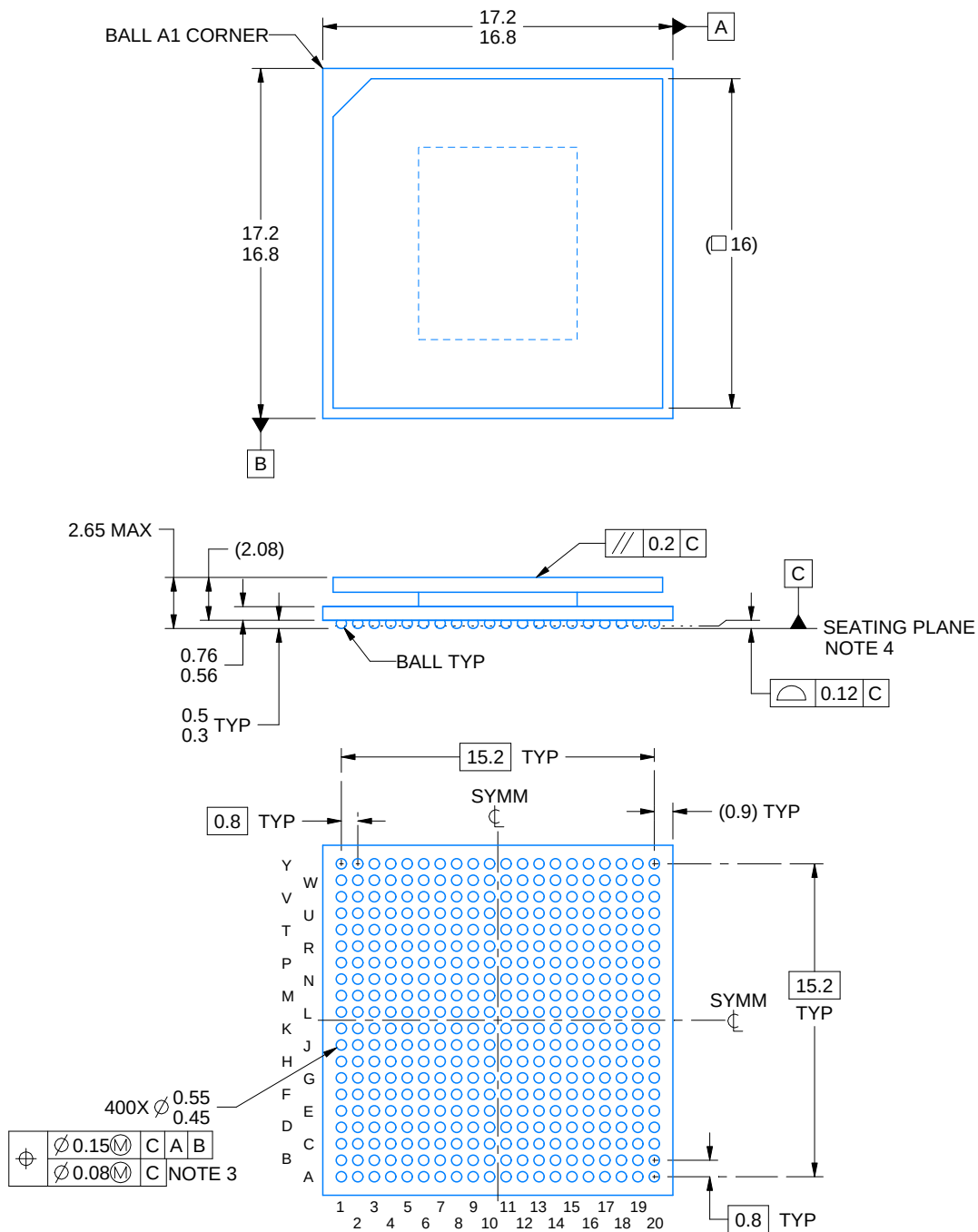
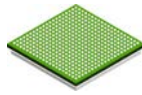
TRAY



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)
AFE7950IABJ	ABJ	FCBGA	400	90	6 x 16	150	315	135.9	7620	19.5	21	19.2
AFE7950IALK	ALK	FCBGA	400	90	6 x 16	150	315	135.9	7620	19.5	21	19.2



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NOTES:

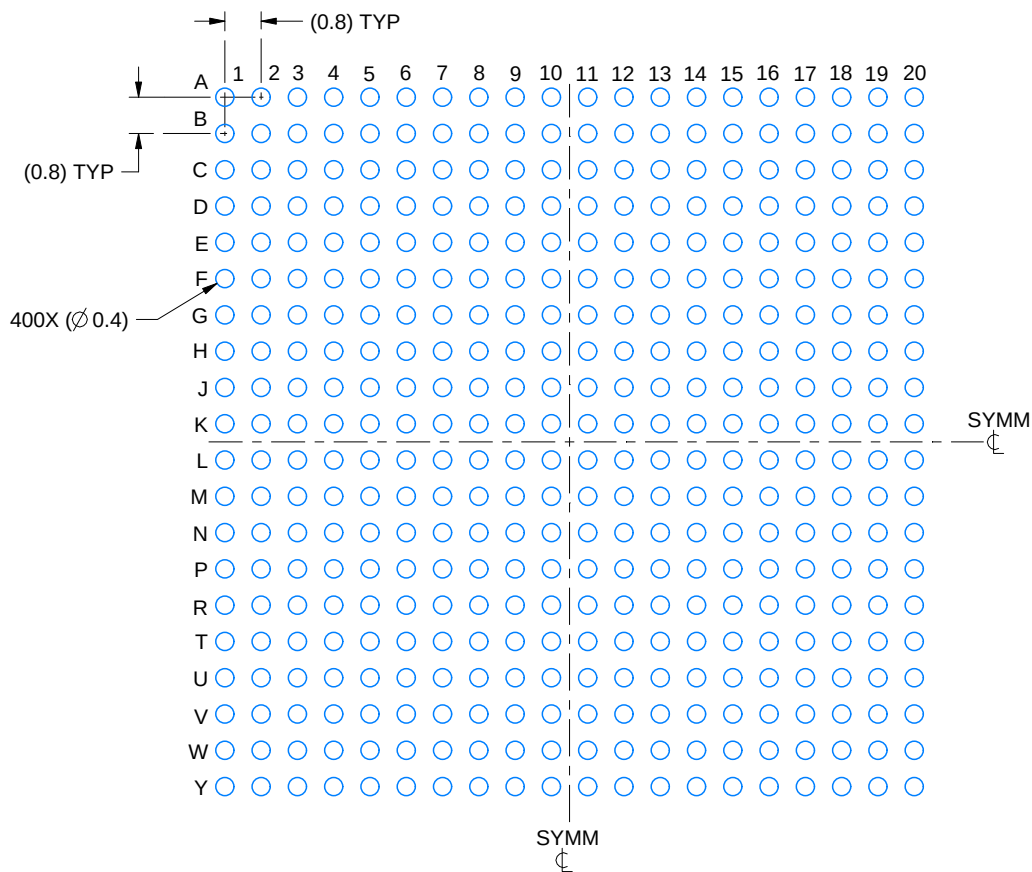
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Dimension is measured at the maximum solder ball diameter, parallel to primary datum C.
4. Primary datum C and seating plane are defined by the spherical crowns of the solder balls.
5. Pb-Free die bump and SnPb solder ball.

EXAMPLE BOARD LAYOUT

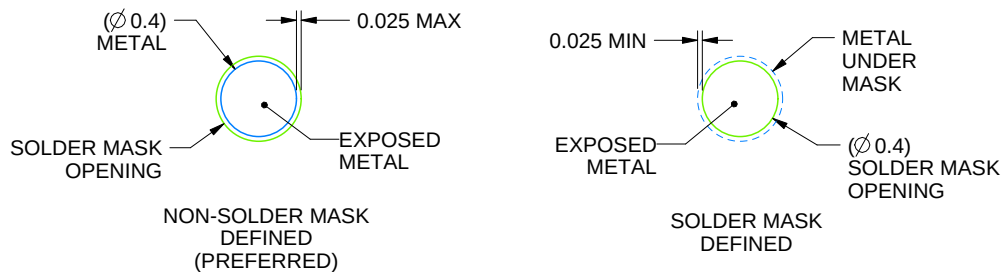
ALK0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



SOLDER MASK DETAILS
NOT TO SCALE

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NOTES: (continued)

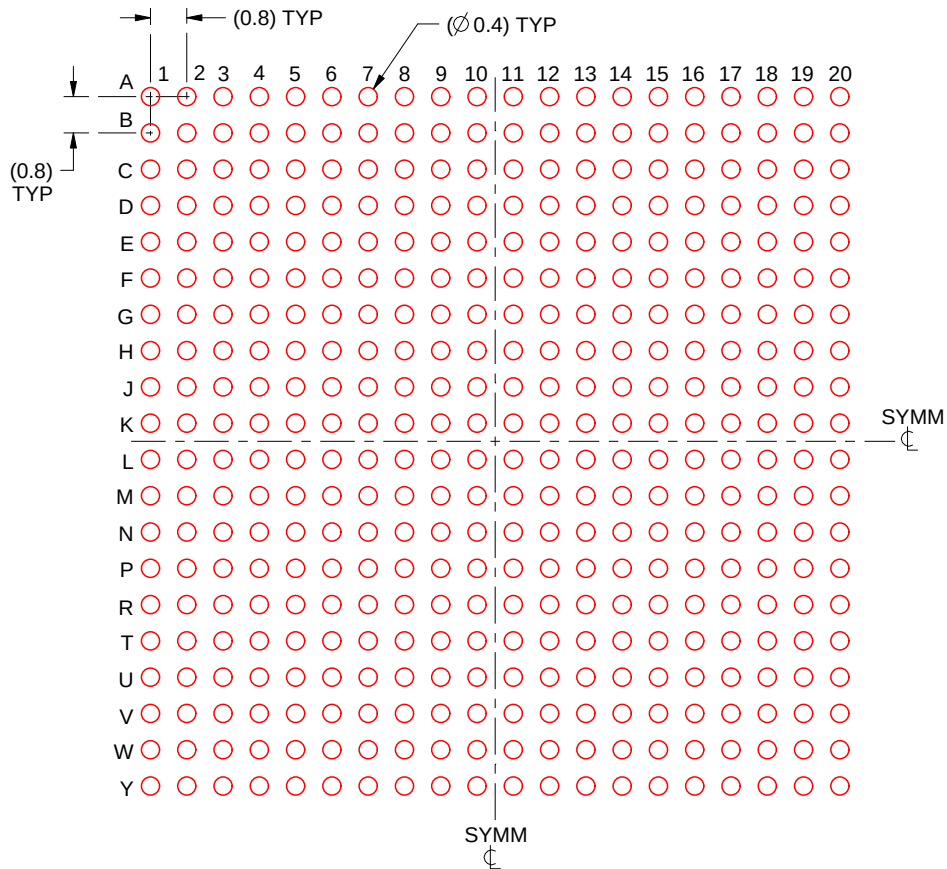
6. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SPRU811 (www.ti.com/lit/spru811).

EXAMPLE STENCIL DESIGN

ALK0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



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

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NOTES: (continued)

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

FCBGA - 2.65 mm max height

Technical drawing of a square plate with a grid of holes. The drawing includes three views: a top view showing overall dimensions (17.2/16.8) and a corner detail (BALL A1 CORNER), a side view showing thickness (2.65 MAX) and surface finish (0.2 C), and a front view showing the grid of 400 holes (20x20) with dimensions (15.2 TYP, 0.8 TYP, 0.55, 0.45) and a symmetry line. A table of hole diameters and a note are also present.

Top View Dimensions:

- Overall width: 17.2 (nominal), 16.8 (actual)
- Overall height: 17.2 (nominal), 16.8 (actual)
- Inner square hole: 16 (nominal)
- Corner detail: BALL A1 CORNER

Side View Dimensions:

- Thickness: 2.65 MAX
- Surface finish: 0.2 C
- Seating Plane: NOTE 4
- Radius: 0.12 C

Front View Dimensions:

- Grid size: 20x20 holes (400 total)
- Grid pitch: 0.55 (nominal), 0.45 (actual)
- Grid width: 15.2 TYP
- Grid height: 15.2 TYP
- Grid offset: 0.8 TYP
- Grid offset: 0.9 TYP
- Symmetry line: SYMM

Table of Hole Diameters:

Ø	Ø 0.15 (M)	C	A	B
Ø	Ø 0.08 (M)	C	NOTE 3	

Note 3:

400X Ø 0.55
0.45

Bottom View Dimensions:

- Grid width: 15.2 TYP
- Grid height: 15.2 TYP
- Grid offset: 0.8 TYP
- Grid offset: 0.9 TYP
- Symmetry line: SYMM

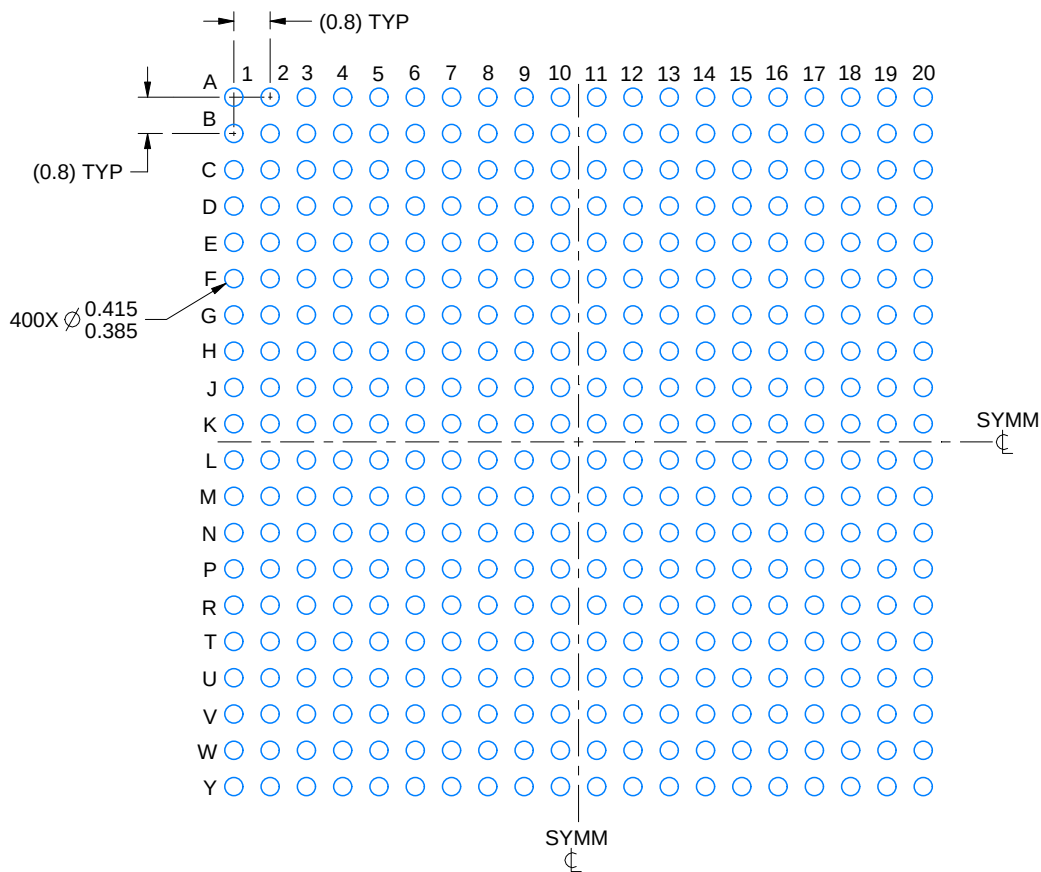
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
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EXAMPLE BOARD LAYOUT

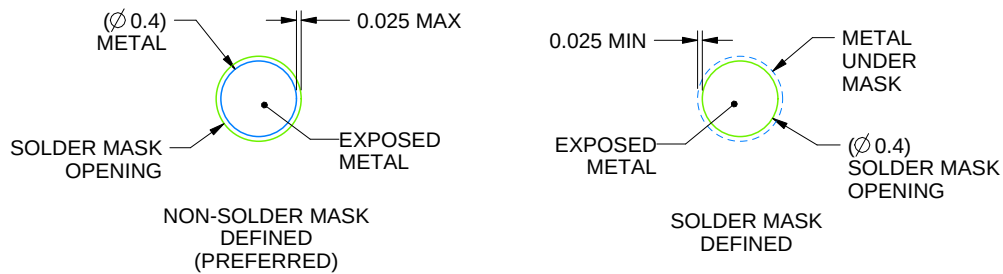
ABJ0400A

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)

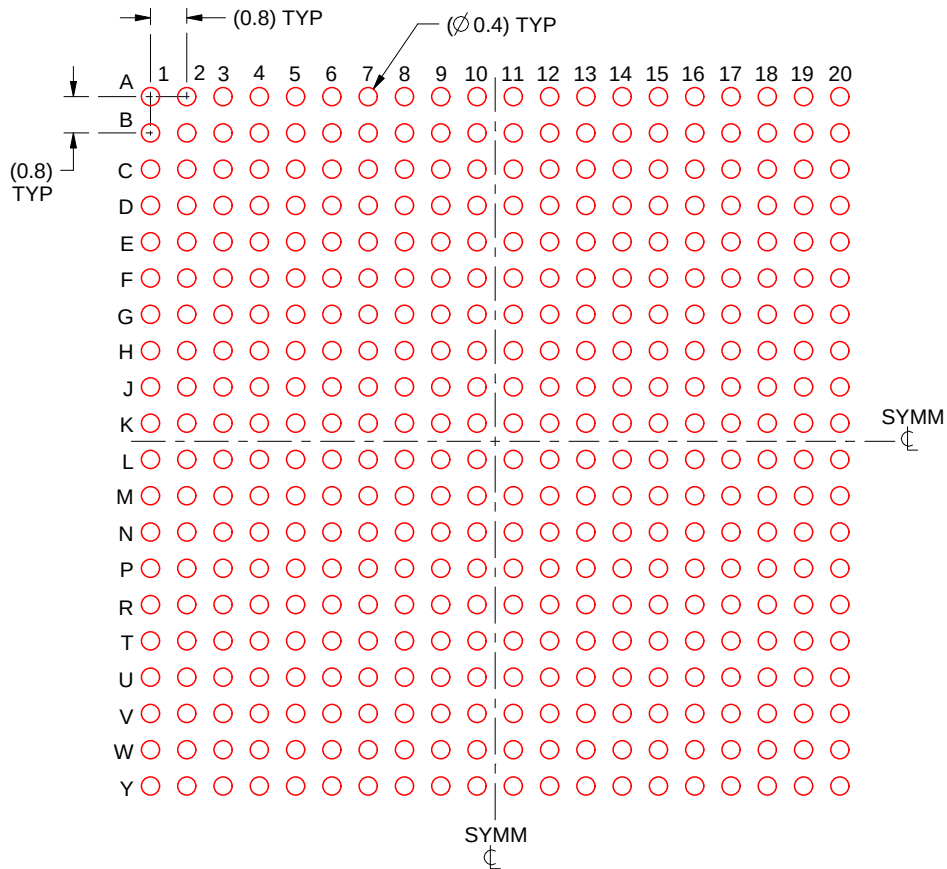
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SPRU811 (www.ti.com/lit/spru811).

EXAMPLE STENCIL DESIGN

ABJ0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



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

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NOTES: (continued)

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

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