

## AFE7700 四通道通用射频收发器

### 1 特性

- 基于直接上变频架构的四路发送器：
  - 每个链的射频传输带宽高达 600MHz
- 基于 0-IF 下变频架构的四路接收器：
  - 每个链的射频接收带宽高达 200MHz
- 基于射频采样 ADC 的反馈链：
  - 射频接收带宽高达 600MHz
- 射频频率范围：600MHz 至 6GHz
- 用于 TX 和 RX LO 的四路宽带分数 N PLL 和 VCO
- 专门用于生成数据转换器时钟的整数 N PLL、VCO
- JESD204B 和 JESD204C 串行器/解串器接口支持：
  - 8 个高达 29.5Gbps 的串行器/解串器收发器
  - 8b/10b 和 64b/66b 编码
  - 16 位、12 位、24 位和 32 位格式
  - 子类 1 多器件同步
- 封装：17mm × 17mm FCBGA，间距 0.8mm

### 2 应用

- 相控阵雷达
- 国防无线电
- 无线通信测试
- 矢量信号收发器 (VST)
- 电子对抗战

### 3 说明

AFE7700 器件是一款高性能的多通道收发器，集成了四条直接上变频发送器链、四条直接下变频接收器链和两条宽带射频采样数字化辅助链（反馈路径）。发送器链和接收器链的高动态范围使高性能无线收发器系统得以实现。

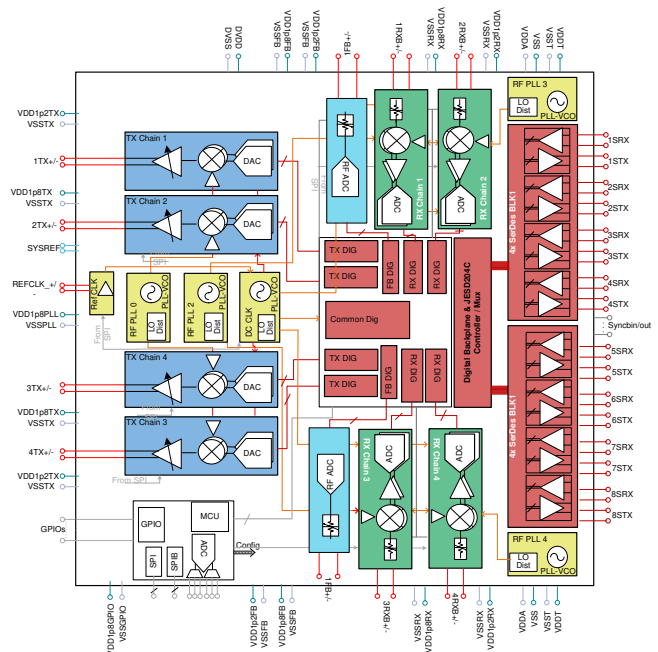
AFE7700 的低功率耗散和大规模通道集成特性使器件能克服多天线和相控阵系统的功率和尺寸限制。宽带和高动态范围反馈路径可以帮助发送器链中的功率放大器和 IQ 校正进行数字预失真 (DPD)。串行器/解串器的高速可减少传入和传出数据时所需的通道数。

器件信息<sup>(1)</sup>

| 器件型号    | 封装          | 封装尺寸（标称值）         |
|---------|-------------|-------------------|
| AFE7700 | FCBGA (400) | 17.00mm × 17.00mm |

(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。

AFE7700 方框图



## 4 说明（续）

AFE7700 的每个接收器链都具有一个 28dB 范围的数字步进衰减器 (DSA)，后跟一个宽带无源 IQ 解调器和一个基带放大器，此基带放大器具有集成式可编程抗混叠低通滤波器，用于驱动连续时间  $\Sigma\text{-}\Delta$  ADC。RX 链可接收高达 200MHz 的瞬时带宽 (IBW)。每个接收器通道都有两个模拟峰值功耗检测器和多个数字功耗检测器，可在接收器通道上辅助进行外部或内部自主 AGC，另外还具有一个射频过载检测器，可提供器件可靠性保护。集成式 QMC（正交不匹配补偿）算法能够持续监控和校正 RX 链 I 和 Q 不平衡不匹配的情况，无需注入任何专用信号或执行离线校准。

每个发送器链都具有两个 14 位、3Gsp/s IQ DAC，后跟一个可编程重建和 DAC 镜像抑制滤波器以及一个 IQ 调制器，用于驱动具有 39dB 范围增益控制功能的宽带射频放大器。TX 链集成了 QMC 和 LO 漏电消除算法，利用反馈路径来持续跟踪和更正 TX 链 IQ 不匹配和 LO 漏电的情况。

每条反馈路径均基于射频采样架构，并具有一个驱动 14 位 3Gsp/s 射频 ADC 的输入射频 DSA。直接采样架构提供了一个固有的宽带接收器链，并简化了 TX 链损失校准。反馈路径集成了两个独立的 NCO，可在两个观察到的射频输入带之间进行快速切换。

合成器部分集成了四路分数 N 射频 PLL，可产生四个不同的射频 LO，从而可支持最多两个不同的频带。每个频带可配置为两个发射器、两个接收器和一条反馈路径。

## 5 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 2019) to Revision A | Page |
|----------------------------------------------------|------|
| • 将器件状态从预告信息 更改为生产数据.....                          | 1    |

## 6 器件和文档支持

### 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.cn](http://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。

### 6.2 支持资源

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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### 6.3 商标

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### 6.4 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。

### 6.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 7 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。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| AFE7700IABJ      | ACTIVE        | FCBGA        | ABJ                | 400  | 90             | RoHS & Green        | SNAGCU                               | Level-3-260C-168 HR  | -40 to 85    | AFE7700                 | <a href="#">Samples</a> |
| AFE7700IALK      | ACTIVE        | FCBGA        | ALK                | 400  | 90             | Non-RoHS<br>& Green | Call TI                              | Call TI              | -40 to 85    | AFE7700<br>SNPB         | <a href="#">Samples</a> |

<sup>(1)</sup> 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.

<sup>(2)</sup> **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.

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

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

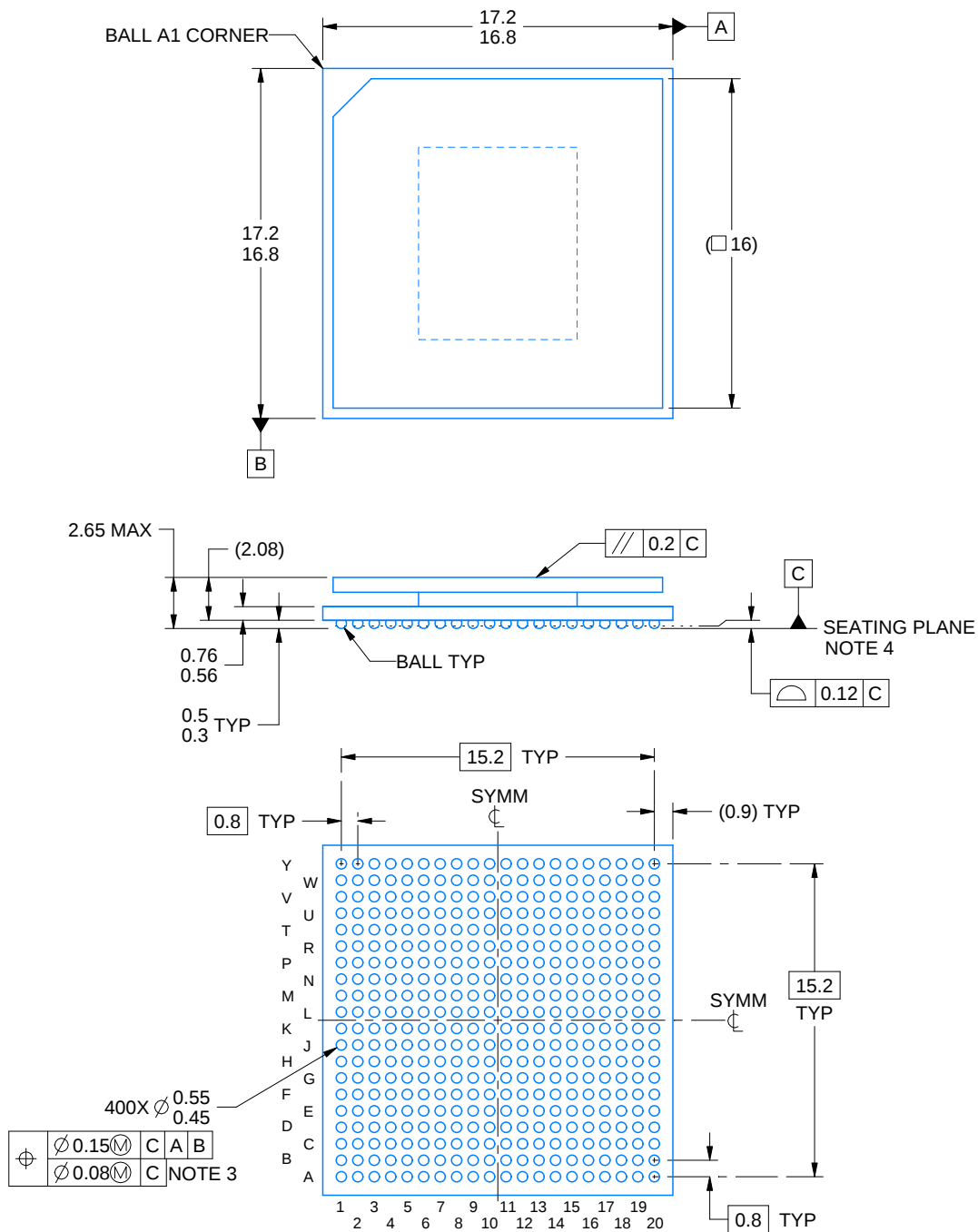
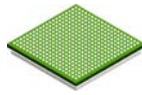
<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> 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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## NOTES:

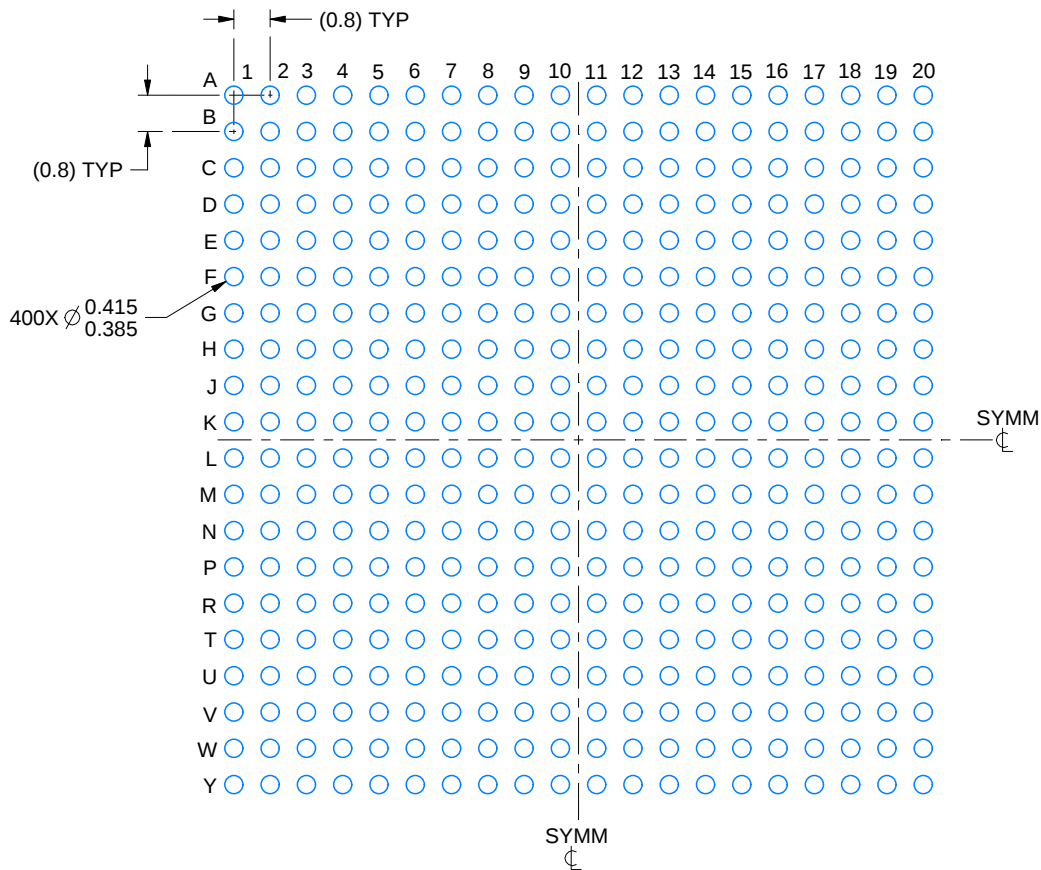
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Dimension is measured at the maximum solder ball diameter, parallel to primary datum C.
4. Primary datum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

# EXAMPLE BOARD LAYOUT

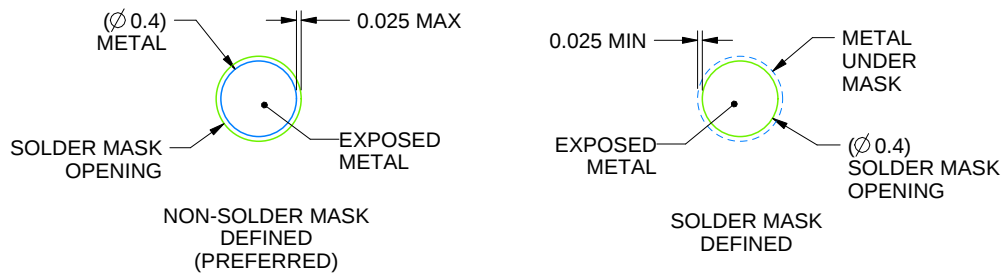
ABJ0400A

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)

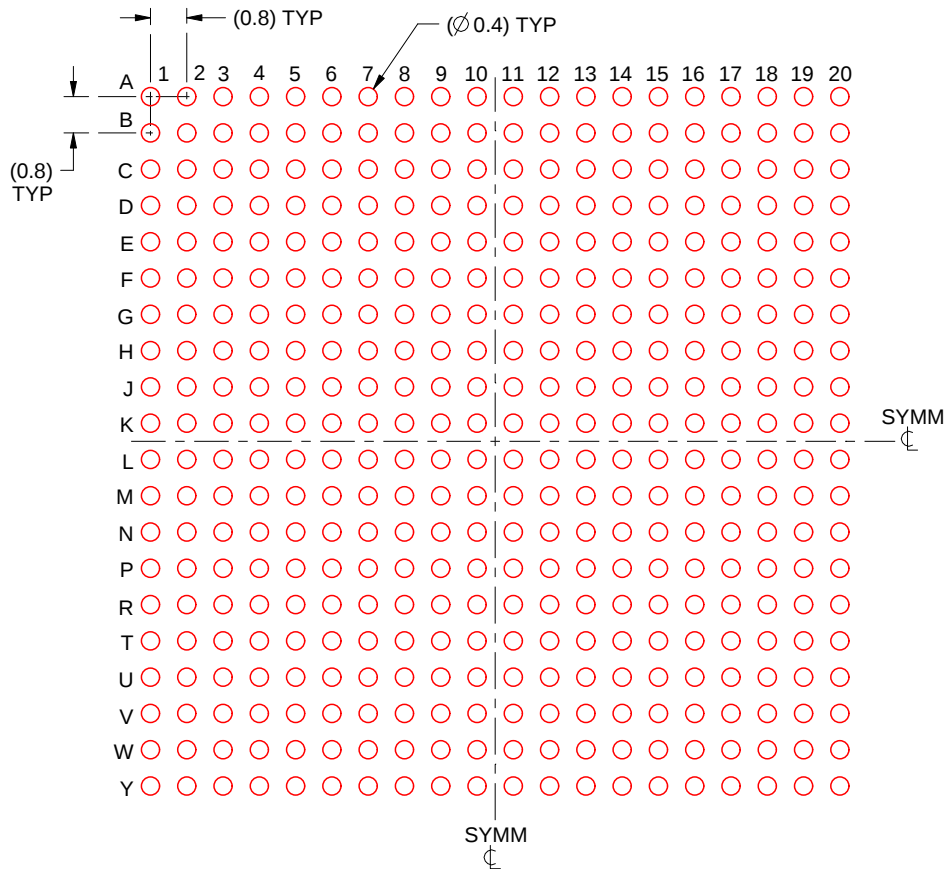
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SPRU811 ([www.ti.com/lit/spru811](http://www.ti.com/lit/spru811)).

# 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.



**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 square feature (16); a side view showing thickness (2.65 MAX) and surface finish (0.2 C); and a bottom view showing a 20x20 grid of holes (400X Ø 0.55/0.45) with symmetry lines and various dimension callouts (15.2 TYP, 0.8 TYP, etc.). A table of hole positions is provided at the bottom left.

|   |            |   |        |   |
|---|------------|---|--------|---|
| ⊕ | Ø 0.15 (M) | C | A      | B |
|   | Ø 0.08 (M) | C | NOTE 3 |   |

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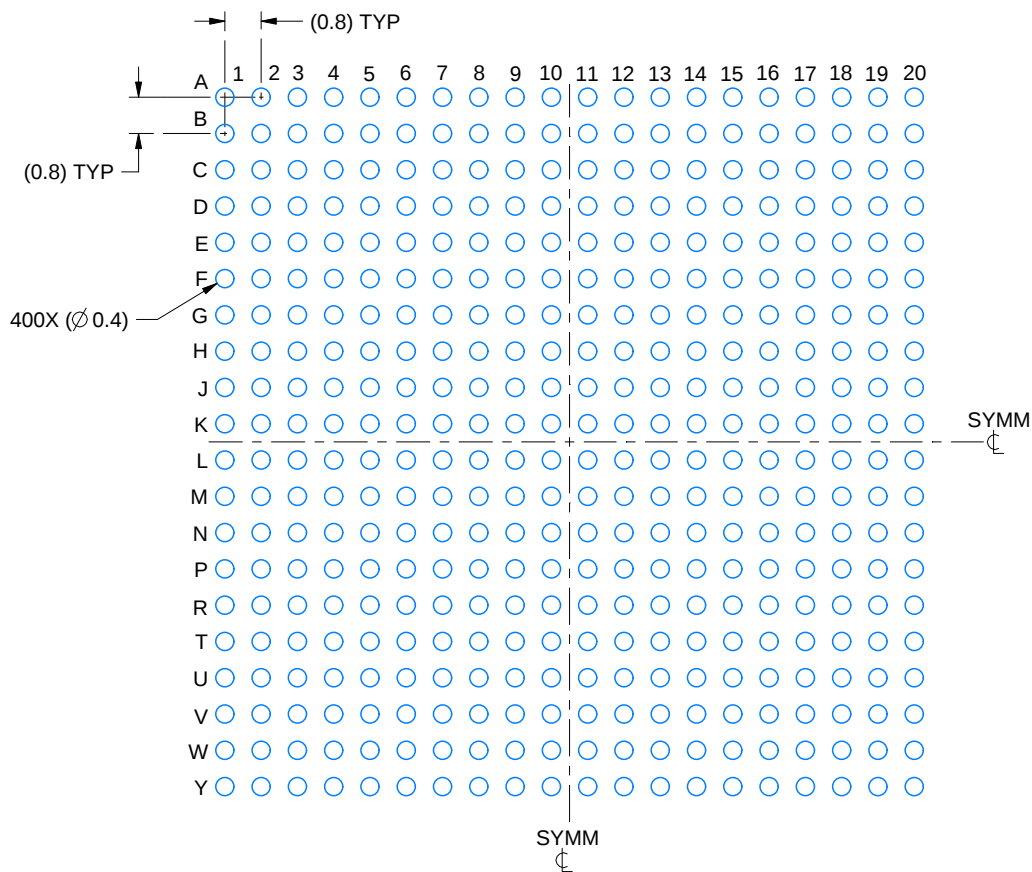
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Dimension is measured at the maximum solder ball diameter, parallel to primary datum C.
4. Primary datum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

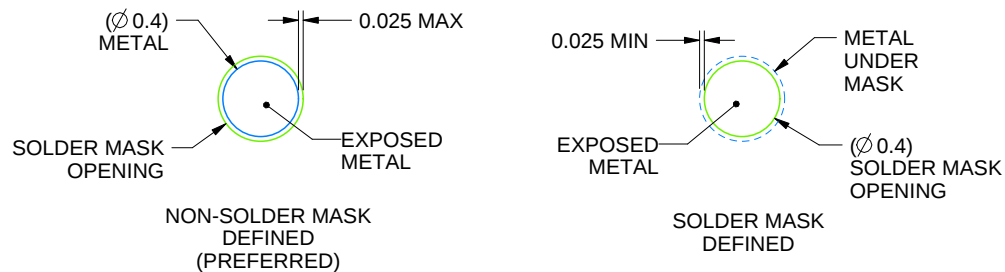
ALK0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:6X



SOLDER MASK DETAILS  
NOT TO SCALE

4225930/A 05/2020

NOTES: (continued)

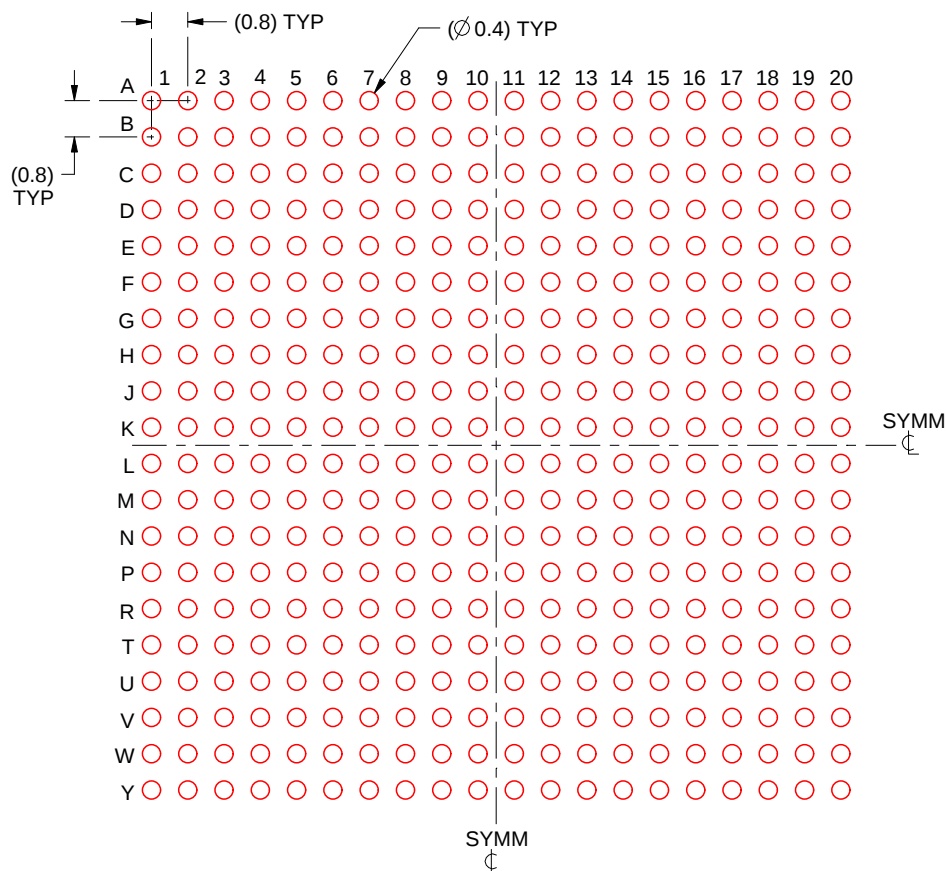
6. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SPRU811 ([www.ti.com/lit/spru811](http://www.ti.com/lit/spru811)).

# 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.

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