AFE8092 Octal-Channel RF Transceiver with Feedback Paths

1 Features

- Octal RF sampling 12GSPS transmit DACs
- Octal RF sampling 3GSPS receive ADCs
- Maximum RF signal bandwidth:
  - TX/FB: 800MHz
    - 1200MHz in 4-channel mode
  - RX: 600MHz
- RF frequency range: up to 6GHz
- Digital Step Attenuators (DSA):
  - TX: 40dB range, 1dB analog and 0.125dB digital steps
  - RX/FB: 31/25dB range, 1dB step
- Single DUC/DDC per chain
- Dual NCOs per chain for fast frequency switching
- Supports TDD operation with fast switching between TX and RX
- Internal PLL/VCO to generate DAC/ADC clocks
- Optional external CLK at DAC or ADC rate
- SerDes data interface:
  - JESD204B and JESD204C
  - 8 SerDes transceivers up to 32.5Gbps
  - 8b/10b and 64b/66b Encoding
  - 12-bit, 16-bit, 24-bit and 32-bit resolution
  - Subclass one multi-device synchronization
- Package:
  - 17mm × 17mm FCBGA, 0.8mm pitch

2 Applications

- Macro remote radio unit (RRU)
- Active antenna system mMIMO (AAS)
- Small cell base station
- Distributed Antenna Systems (DAS)
- Repeater

3 Description

The AFE8092 is a high performance, wide bandwidth multi-channel transceiver, integrating eight RF sampling transmitter chains, eight RF sampling receiver chains and two separate RF front end for the auxiliary chains (feedback paths). The high dynamic range of the transmitter and receiver chains allows generating and receiving 3G, 4G and 5G signals for wireless base stations, and the AFE8092 wide bandwidth capability is designed for multi-band 4G and 5G base stations.

Each receiver chain includes a 31dB range DSA (Digital Step Attenuator), followed by a 3GSPS ADC (analog-to-digital converter). Each receiver channel has analog peak power detectors and digital peak and power detectors to assist an external or internal autonomous automatic gain controller, and RF overload detectors for device reliability protection. The digital down converters (DDC) provides up to 800MHz of combined signal BW in 8-channel mode and 800MHz in 4-channel mode. In TDD mode, the receiver channel can be configured to dynamically switching between traffic receiver (TDD RX) and wideband feedback receiver (TDD FB), with the capability of re-using the same analog input for both purposes.

Each transmitter chain includes a digital up converter (DUC) supporting up to 800MHz combined signal bandwidth (1200MHz in 4-channel mode). The output of the DUC drives a 12GSPS DAC (digital to analog converter) with a mixed mode output option to enhance 2nd Nyquist operation. The DAC output includes a variable gain amplifier (TX DSA) with 40dB range and 1dB analog and 0.125dB digital steps.

The feedback path includes a 25dB range DSA driving a 3GSPS RF sampling ADC, shared with receiver chain, followed by a DDC with up to 800MHz bandwidth (1200MHz in 4-channel mode).

Package Information

PART NUMBER	PACKAGE (1)	PACKAGE SIZE(2)
AFE8092	(FCBGA, 400)	17.00mm × 17.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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4 Device and Documentation Support

4.1 Device Support

4.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

4.3 Support Resources

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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4.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
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4.5 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.

4.6 Glossary

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

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (October 2021) to Revision B (November 2024)	Page
• Removed 4GSPS ADC clock support	1
• Changed the *Device Information* table to *Package Information*	1

Changes from Revision * (May 2021) to Revision A (October 2021)	Page
• Added support for 4 channels wideband modes	1

6 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.

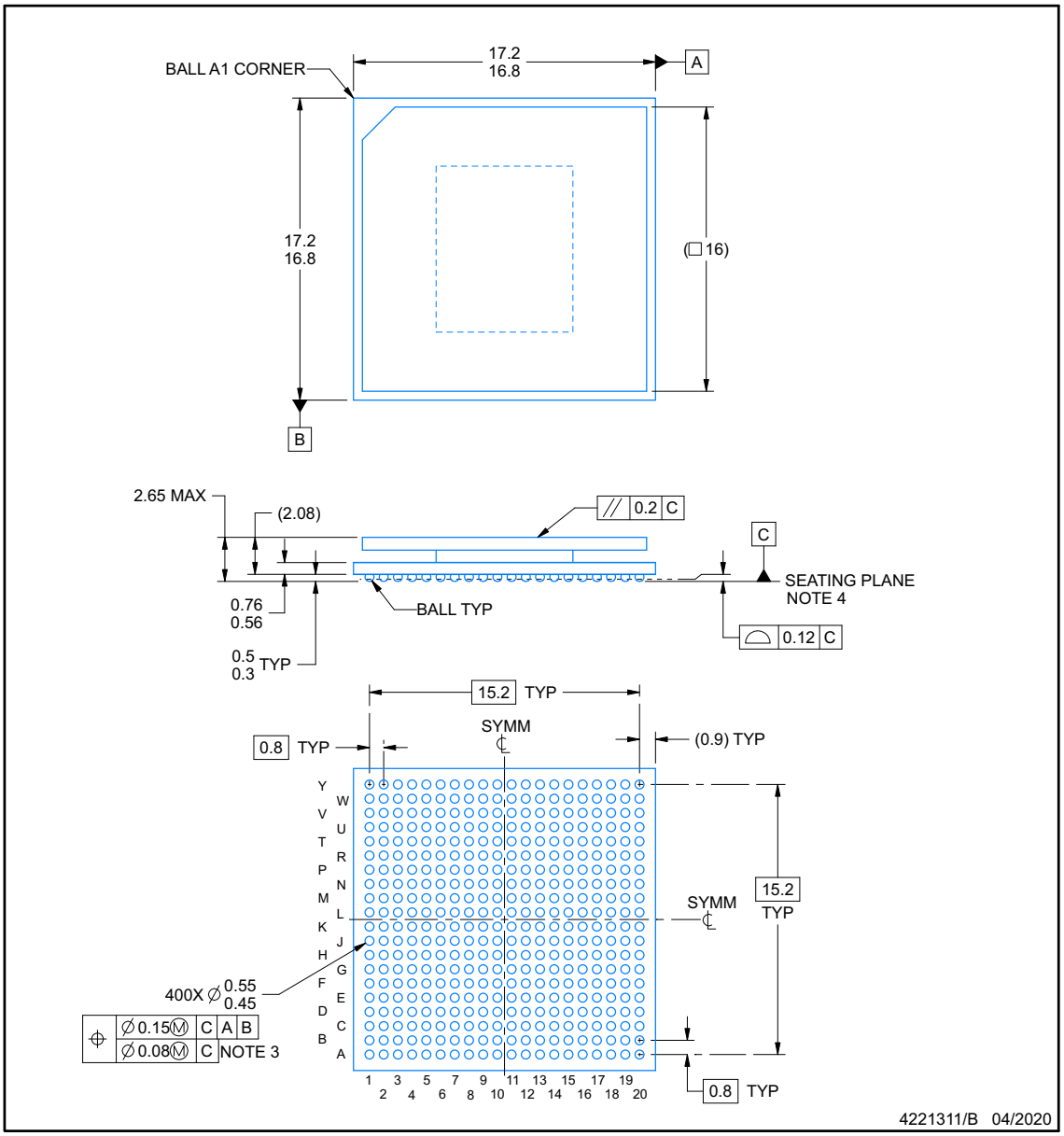
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PACKAGE OUTLINE

ABJ0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



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.

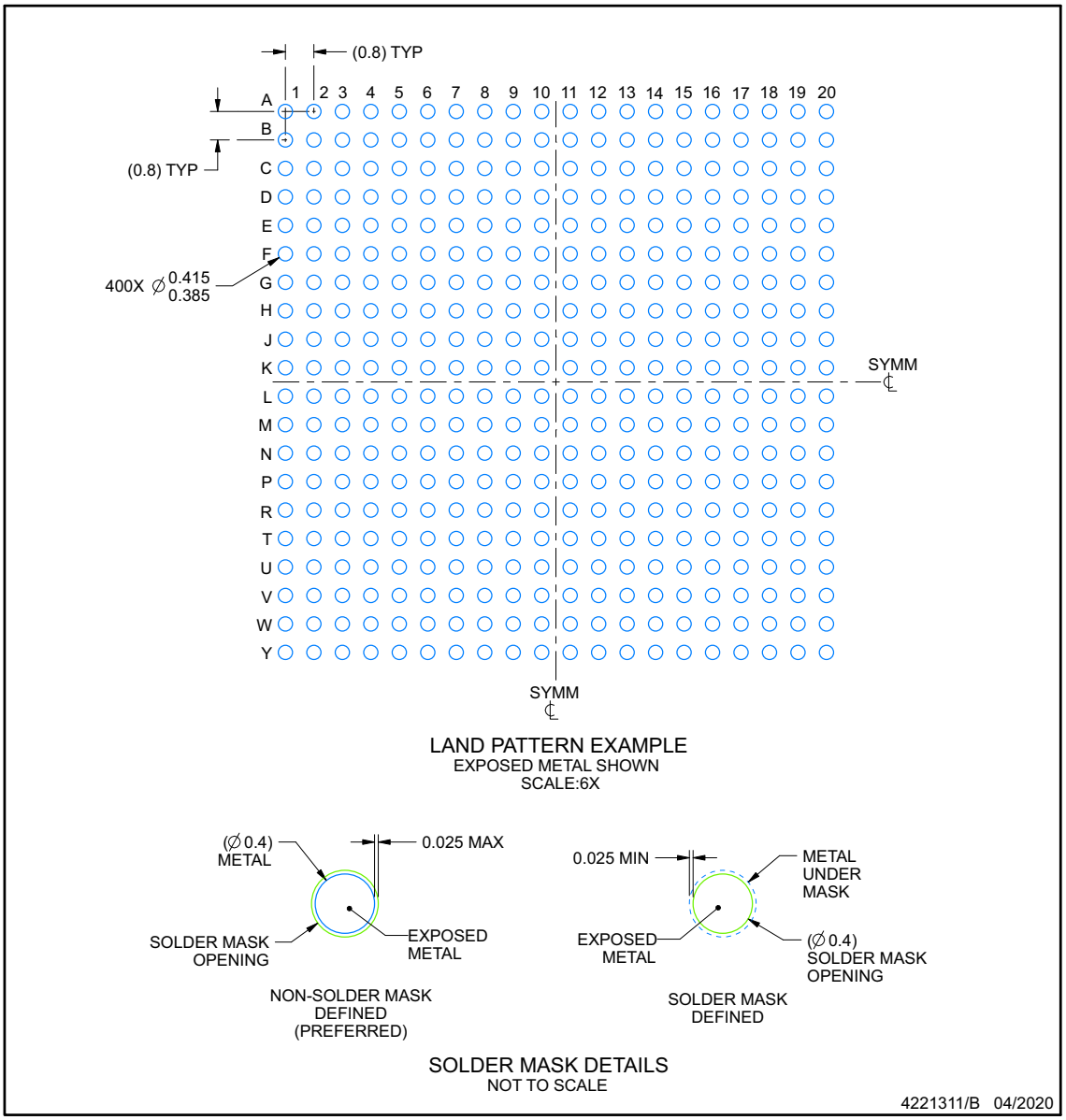
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EXAMPLE BOARD LAYOUT

ABJ0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



NOTES: (continued)

5. 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).

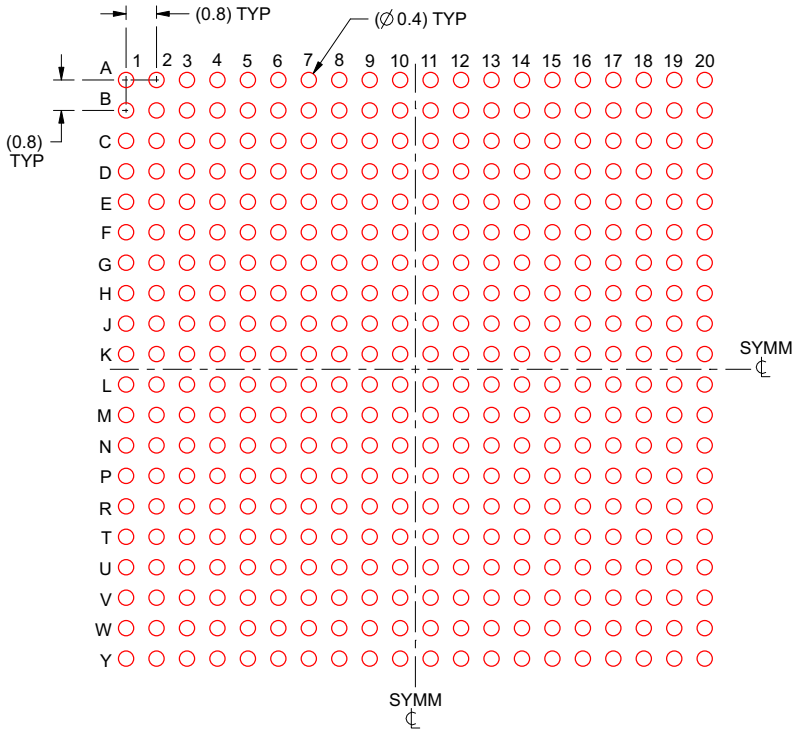
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EXAMPLE STENCIL DESIGN

ABJ0400A

FCBGA - 2.65 mm max height

BALL GRID ARRAY



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

4221311/B 04/2020

NOTES: (continued)

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

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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)
AFE8092HIABJ	Active	Production	FCBGA (ABJ) | 400	90 | JEDEC TRAY (5+1)	Yes	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE8092
AFE8092IABJ	Active	Production	FCBGA (ABJ) | 400	90 | JEDEC TRAY (5+1)	Yes	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE8092

(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.

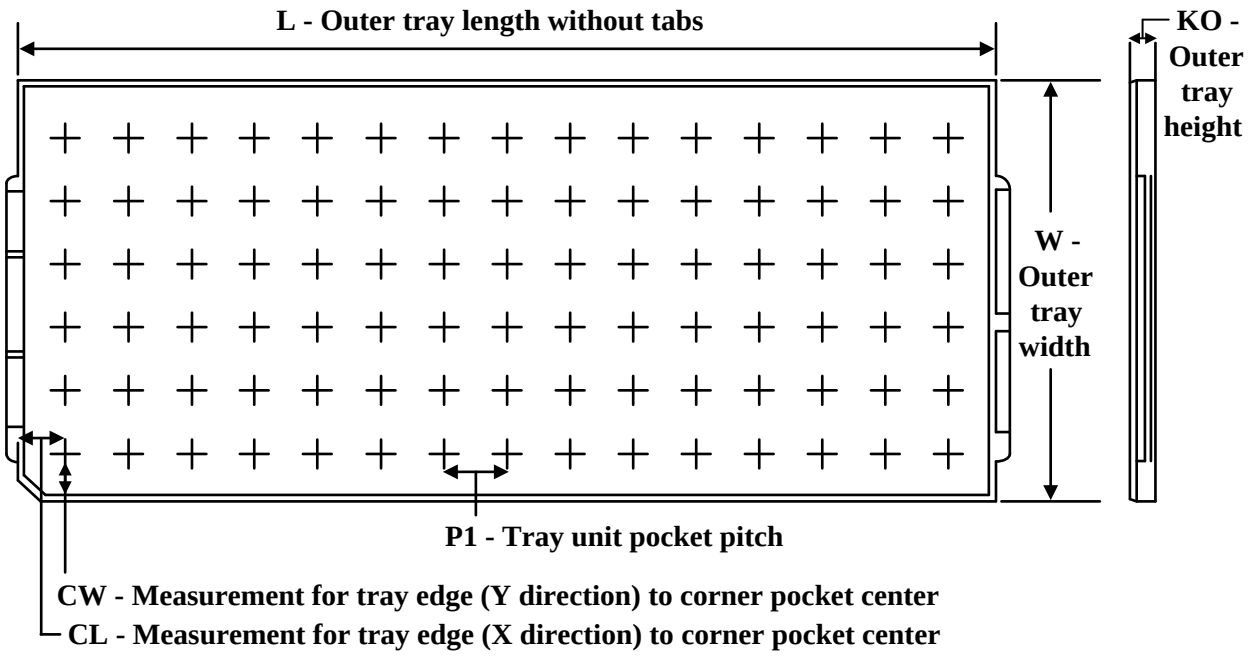
(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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.

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TRAY



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

*All dimensions are nominal

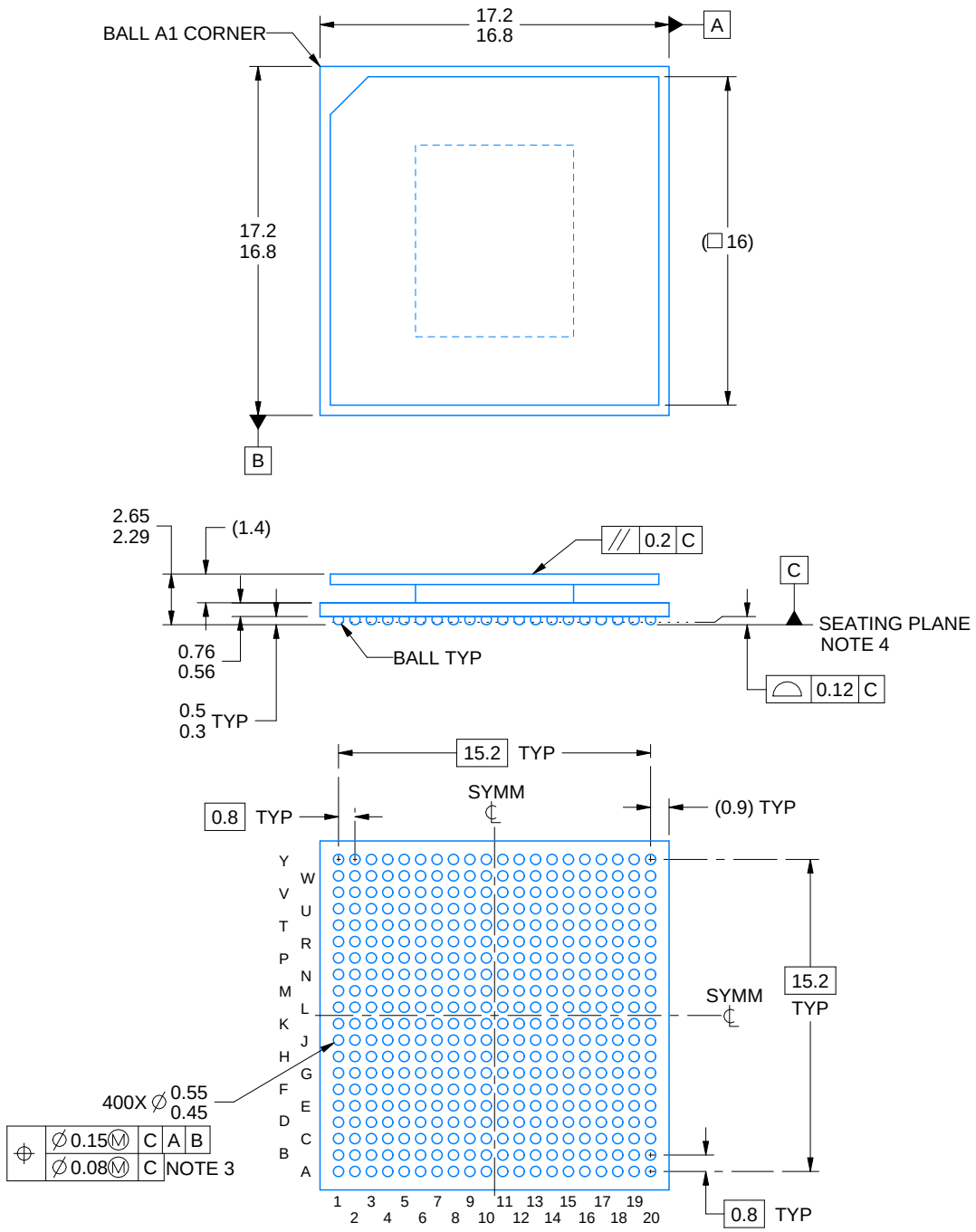
Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
AFE8092HIABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8092HIABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8092IABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2
AFE8092IABJ	ABJ	FCBGA	400	90	6 x 15	150	315	135.9	7620	19.5	21	19.2

PACKAGE OUTLINE

ABJ0400A

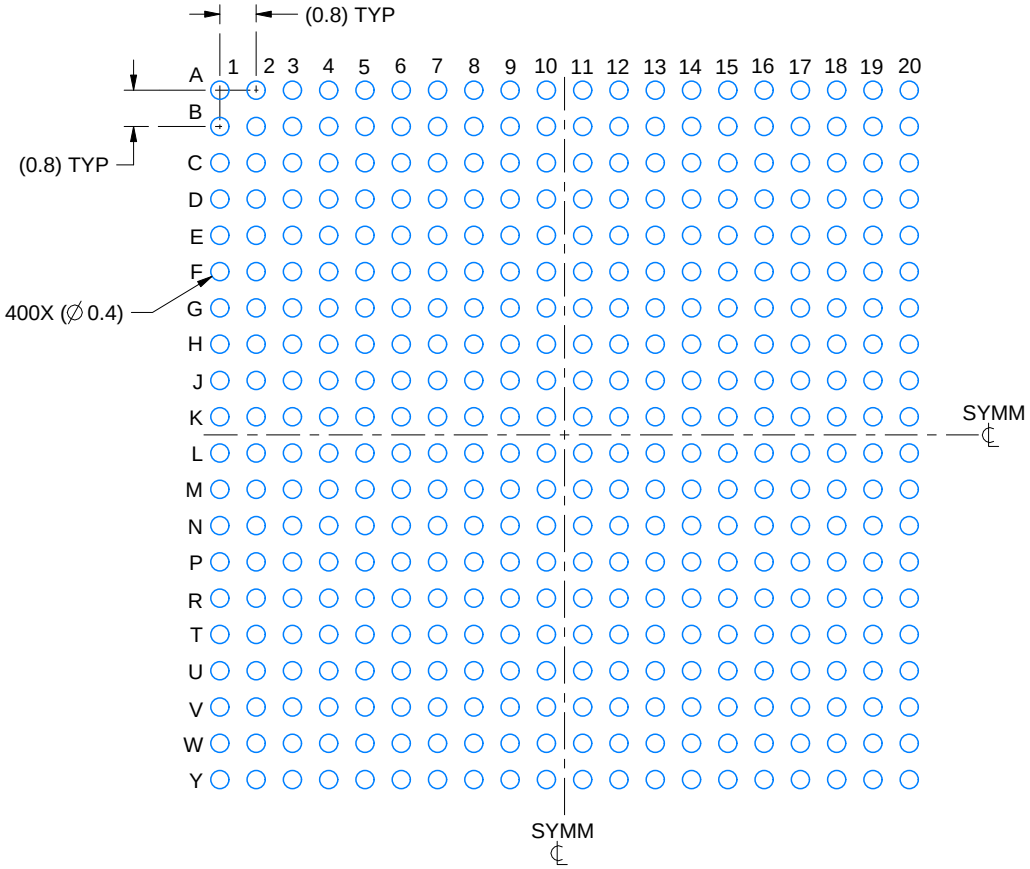
FCBGA - 2.65 mm max height

BALL GRID ARRAY

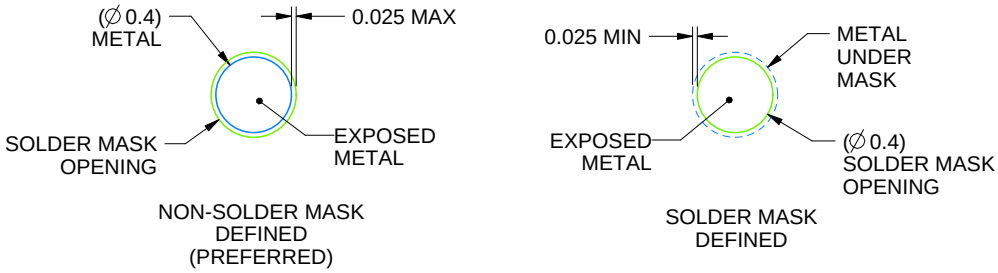


NOTES:

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

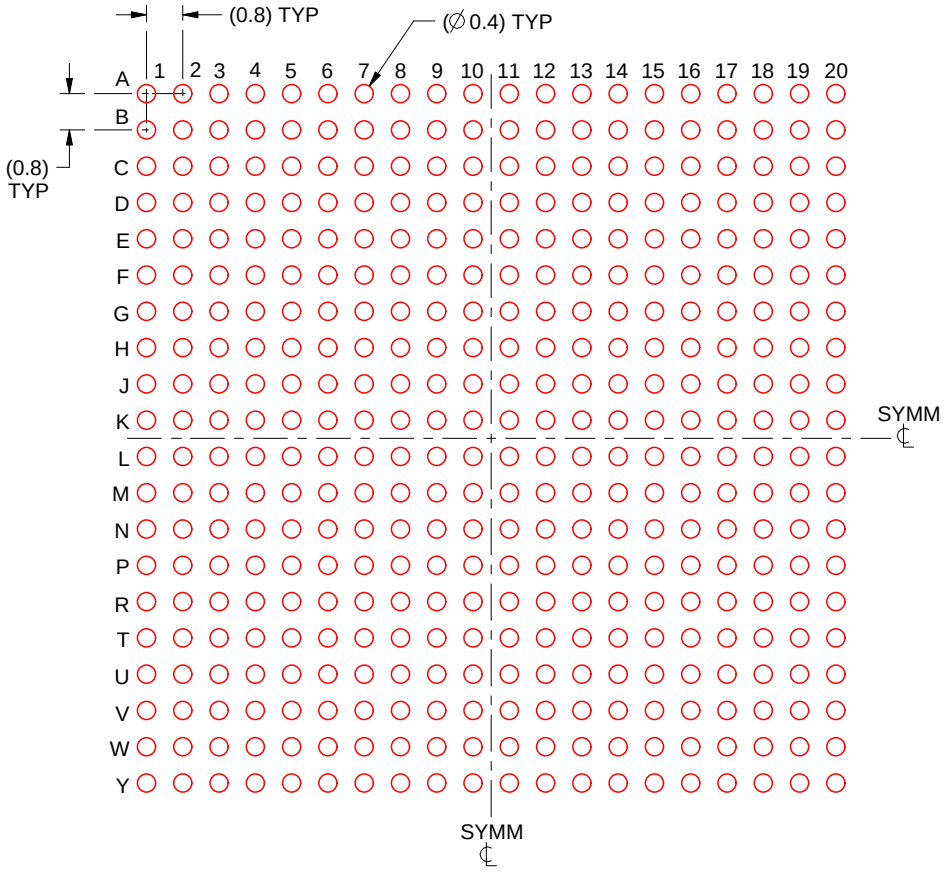


SOLDER MASK DETAILS
NOT TO SCALE

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).



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

4221311/D 03/2023

NOTES: (continued)

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

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