AFE80xx RF Sampling Transceiver

1 Features

- Request full data sheet
- AFE80xx versions:
  - AFE8000: 8 TX, 10 RX
  - AFE8004: 4 TX, 4 RX
  - AFE8010: 10 RX
- 12 GSPS RF Sampling DACs
- 4 GSPS RF Sampling ADCs
- Maximum RF signal bandwidth:
  - TX: 800 MHz (8 ch) or 1.2 GHz (4 ch)
  - RX: 800 MHz (8 ch) or 400 MHz (8 ch) + 800 MHz (2 ch)
- RF frequency range:
  - TX: 5 MHz to 7.125 GHz
  - RX: 100 MHz to 7.125 GHz
- Digital Step Attenuators (DSA):
  - TX: 40 dB range, 1 dB analog and 0.125 dB digital steps
  - RX/FB: 25 dB range, 1 dB step
- Single or dual-band DUC, DDCs
- 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 32.5 Gbps
  - 8b, 10b and 64b, 66b Encoding
  - 12 bit, 16 bit, 24 bit and 32 bit resolution
  - Subclass 1 multi-device synchronization
- Package:
  - 17 mm × 17 mm FCBGA, 0.8-mm pitch

2 Applications

- Radar
- Seeker front end
- Defense radio
- Tactical communications infrastructure
- Wireless communications test

3 Description

The is a high performance, wide bandwidth multi-channel transceiver, integrating eight RF sampling DACs and 10 RF sampling ADCs. Pin and programming compatible lower channel count versions (AFE8004 with 4TX and 4RX channels, AFE8010 with 10RX channels) are available to allow scalable system designs.

Each receiver (RX) chain includes a 25 dB range DSA (Digital Step Attenuator) followed by a 4 GSPS ADC (analog-to-digital converter). The 10 ADCs are connected to 8 receiver paths (1RX though 8RX) and 2 feedback paths (1FB and 2FB). The ADCs are identical between RX and FB but the digital down converter paths are different (the FB paths are capable of wider bandwidth and can be used as receivers). 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 single or dual digital down converters (DDC) provide up to 800 MHz of signal BW for 8 channels or 400 MHz for 8 channels in addition to 800 MHz for 2 channels.

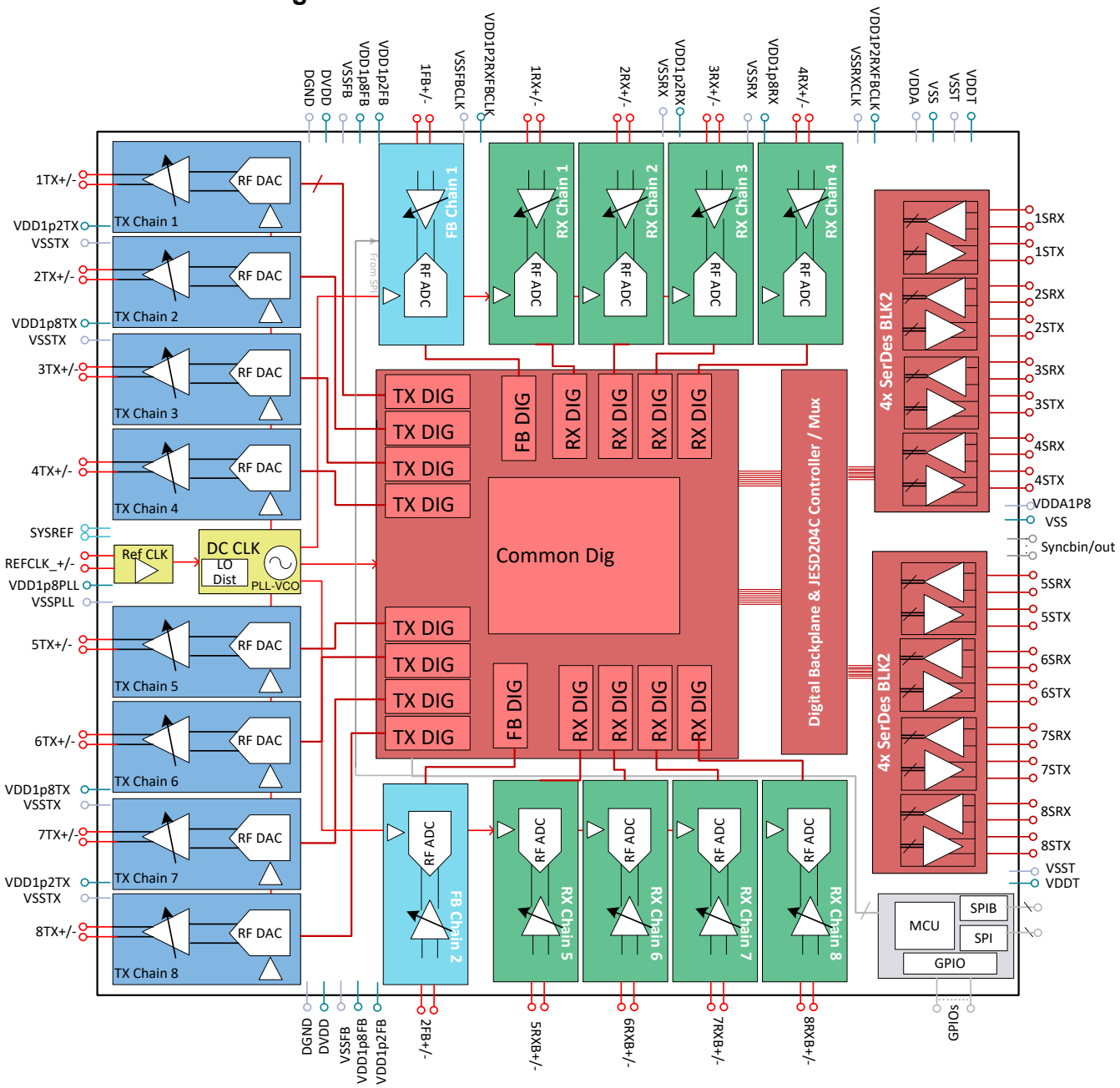
Each transmitter (TX) chain includes a single or dual digital up converter (DUC). Supporting up to 800 MHz signal bandwidth for eight channels or 1200 MHz for 4 channels. The output of the DUCs drives a 12-GSPS DAC (digital-to-analog converter) with a mixed mode output option to enhance 2nd Nyquist operation.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

Package Information

PART NUMBER	PACKAGE(1)	BODY SIZE (NOM)
AFE8004(2) AFE8010(2)	FC-BGA	17.00 mm × 17.00 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) Product preview

4 Functional Block Diagram



5 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.

5.1 Documentation Support

5.1.1 Related Documentation

5.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* 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.

5.3 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.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

5.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
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5.5 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.

5.6 Glossary

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

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.

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

(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.

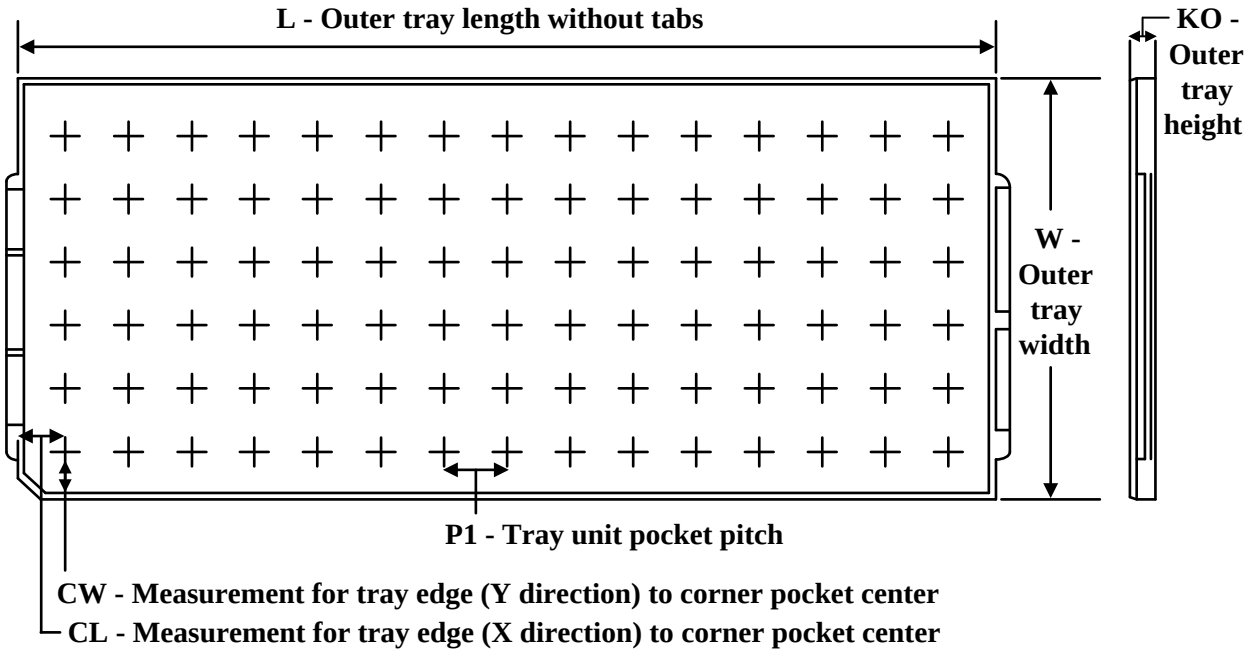
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

TRAY



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

*All dimensions are nominal

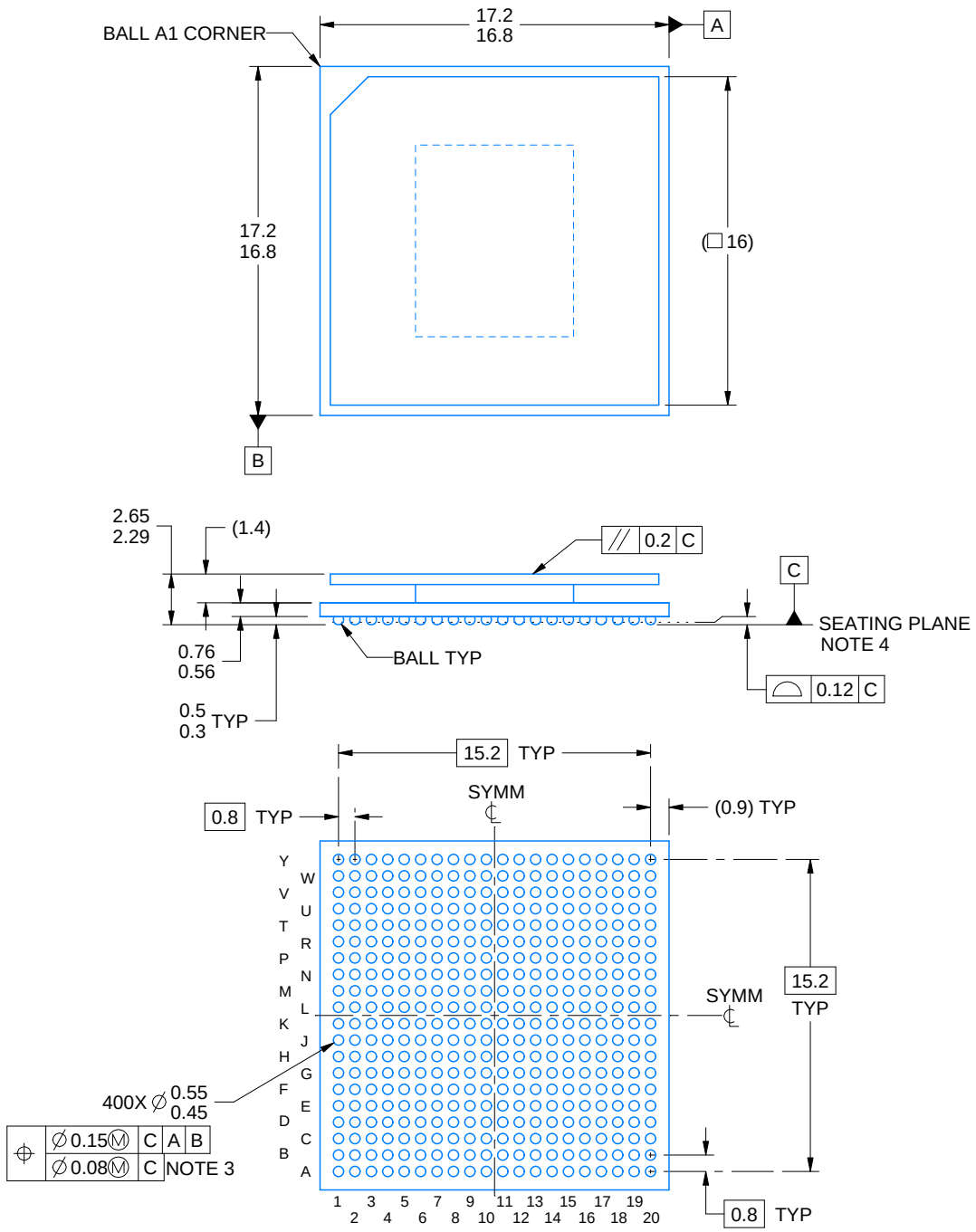
Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
AFE8000IABJ	ABJ	FCBGA	400	90	6 x 16	150	315	135.9	7620	19.5	21	19.2

PACKAGE OUTLINE

ABJ0400A

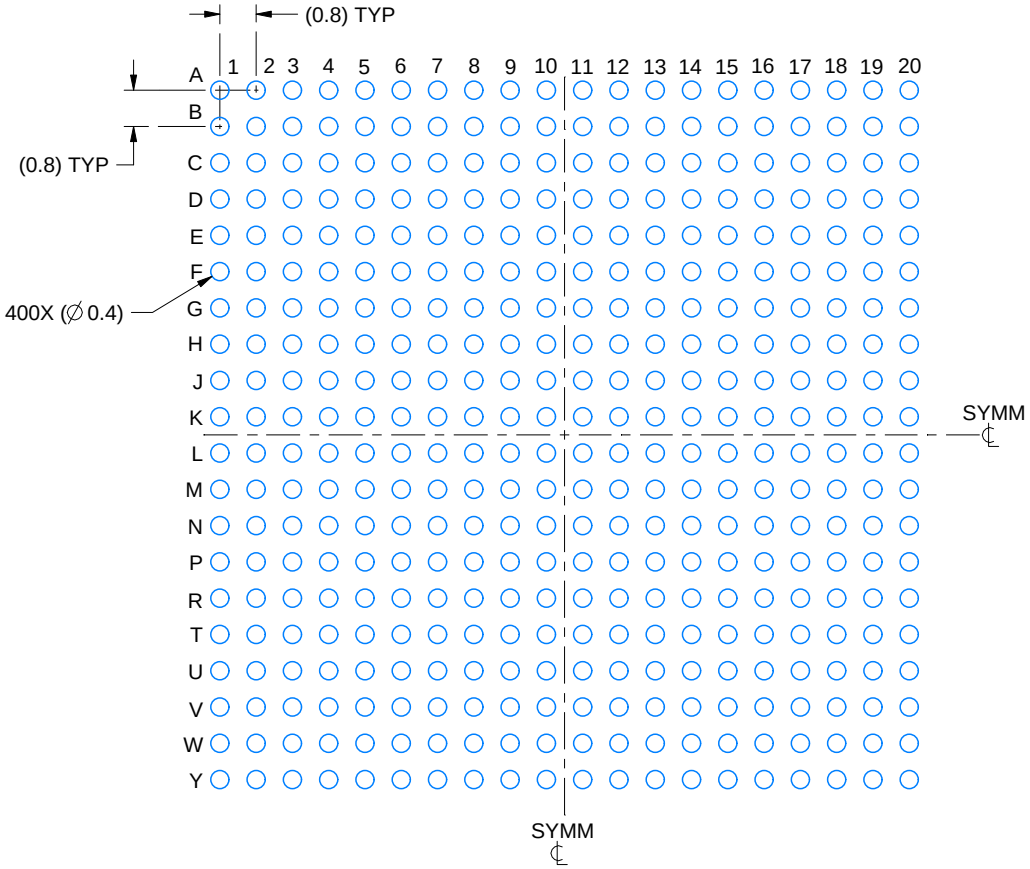
FCBGA - 2.65 mm max height

BALL GRID ARRAY

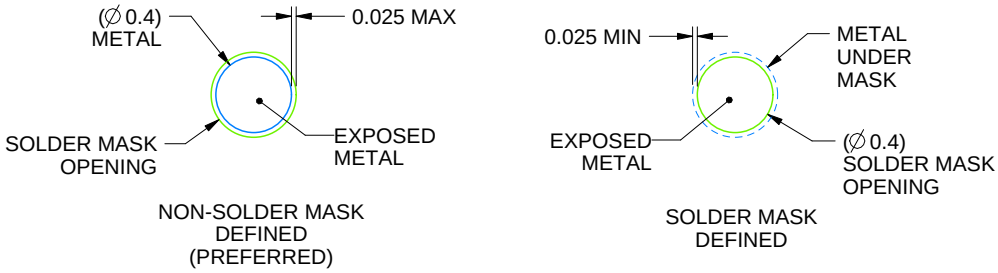


NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



SOLDER MASK DETAILS
NOT TO SCALE

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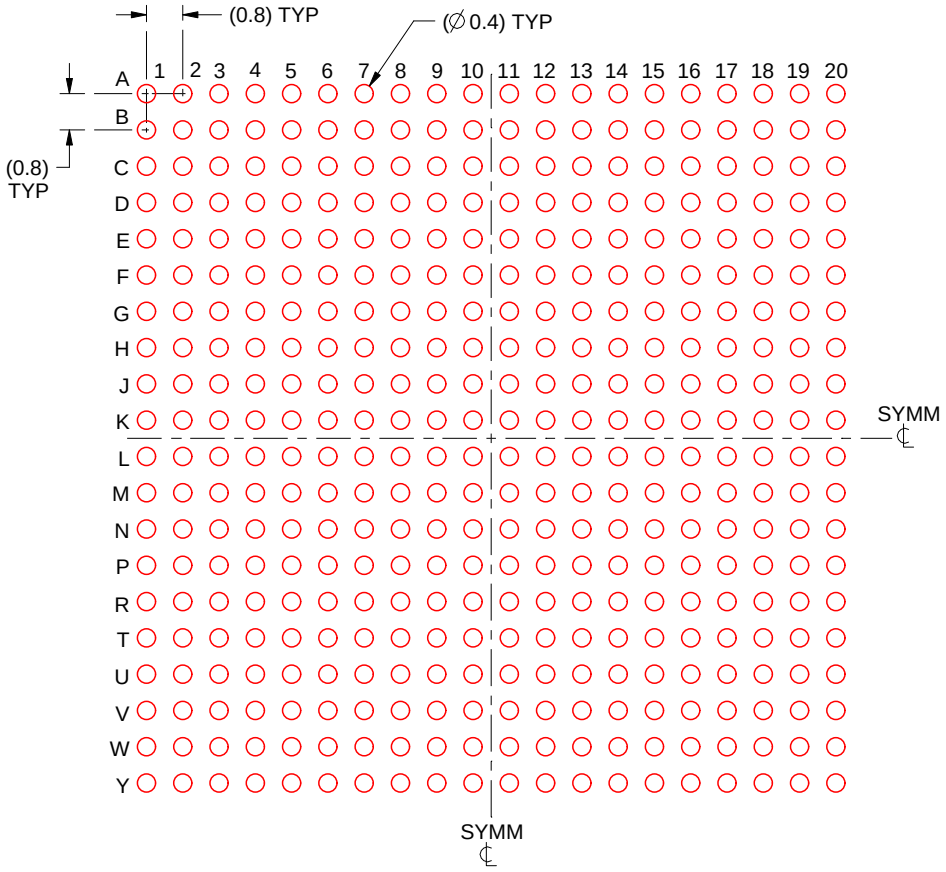
NOTES: (continued)

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).



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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