AFE8190 16-Channel RF Transceiver with Feedback Paths

1 Features

- Sixteen RF sampling 12GSPS transmit DACs
- Sixteen RF sampling 5GSPS receive ADCs
- Quad RF sampling 5GSPS feedback ADCs
- Maximum RF signal bandwidth:
  - TX/FB: 800MHz.
  - RX: 600MHz
- RF frequency range: up to 7.2GHz
- Digital Step Attenuators (DSA):
  - TX: 39dB range, 1dB analog and 0.125dB digital steps
  - RX: 30dB range, 1dB step
  - FB: 25dB range, 1dB step
- Single DUC/DDCs per chain
- 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
- Digital Data Interface:
  - JESD204B and JESD204C
  - 16 SerDes transceivers up to 32.5Gbps
  - 8b/10b and 64b/66b Encoding
  - 12-bit, 16-bit, 24-bit and 32-bit resolution
  - Subclass 1 multi-device synchronization
- Package:
  - 23mm × 23mm 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 AFE8190 is a high performance, wide bandwidth multi-channels transceiver, integrating sixteen RF sampling transmitter chains, sixteen RF sampling receiver chains and four separate RF sampling 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, while the wide bandwidth capability makes the AFE8190 an excellent choice for multi-band 4G and 5G base stations.

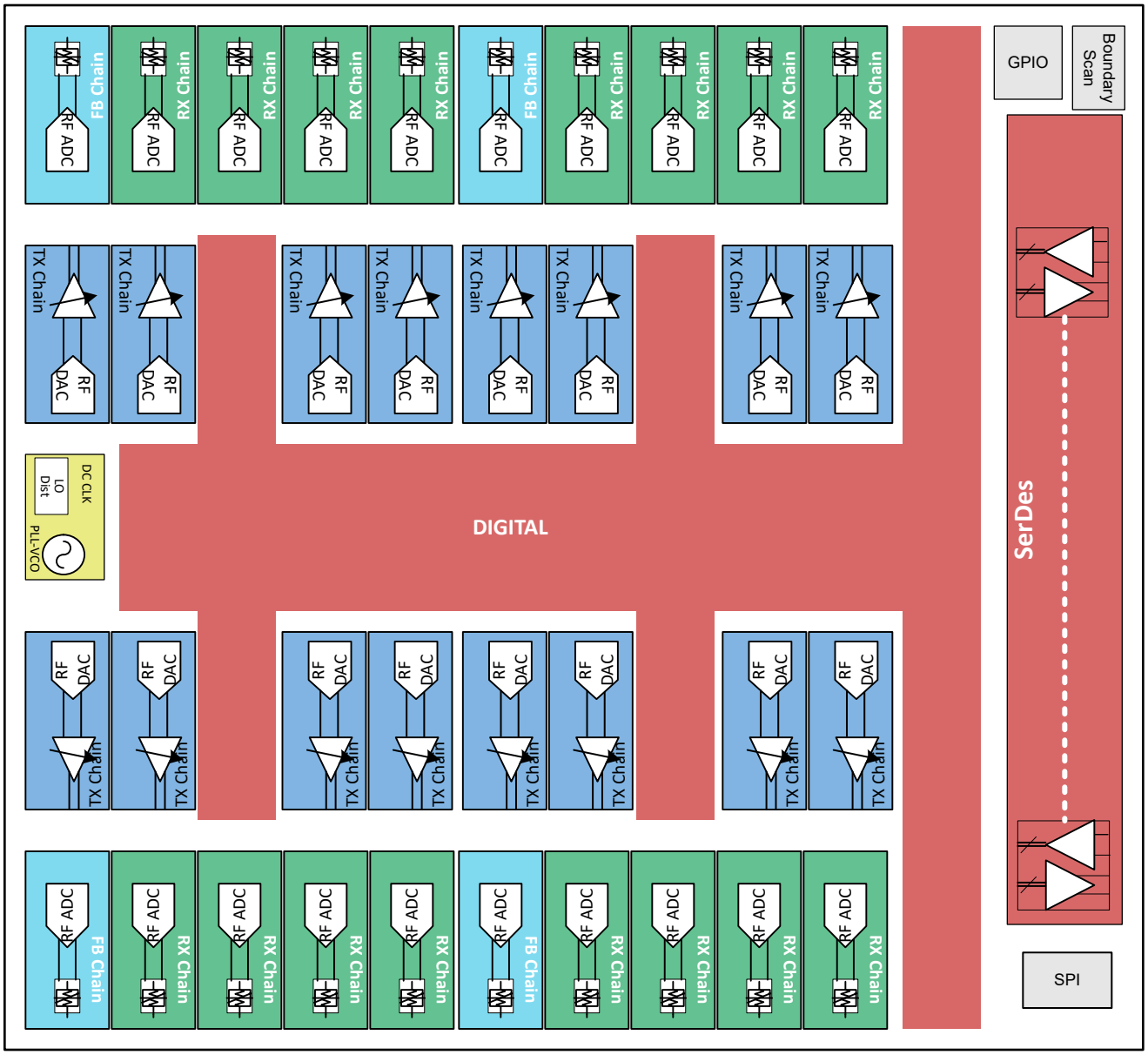
Each receiver chain includes a 30dB range DSA (Digital Step Attenuator), followed by a 5GSPS ADC (analog-to-digital converter). Each receiver channel has analog peak power detectors and digital peak and power detectors to assist an external or internal autonomous automatic gain controller, and RF overload detectors for device reliability protection. The single digital down converters (DDC) provides up to 600MHz of signal BW.

Each transmitter chain includes a digital up converters (DUCs) supporting up to 800MHz of signal bandwidth. The output of the DUCs 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 39dB range and 1dB analog and 0.125dB digital steps.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
AFE8190	AMJ (FCBGA, 784)	23mm × 23mm

(1) For all available packages, see Section 6.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Functional Block Diagram

Table of Contents

4 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.

4.1 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.

4.2 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.

4.3 Trademarks

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4.4 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.

4.5 Glossary

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

5 Revision History

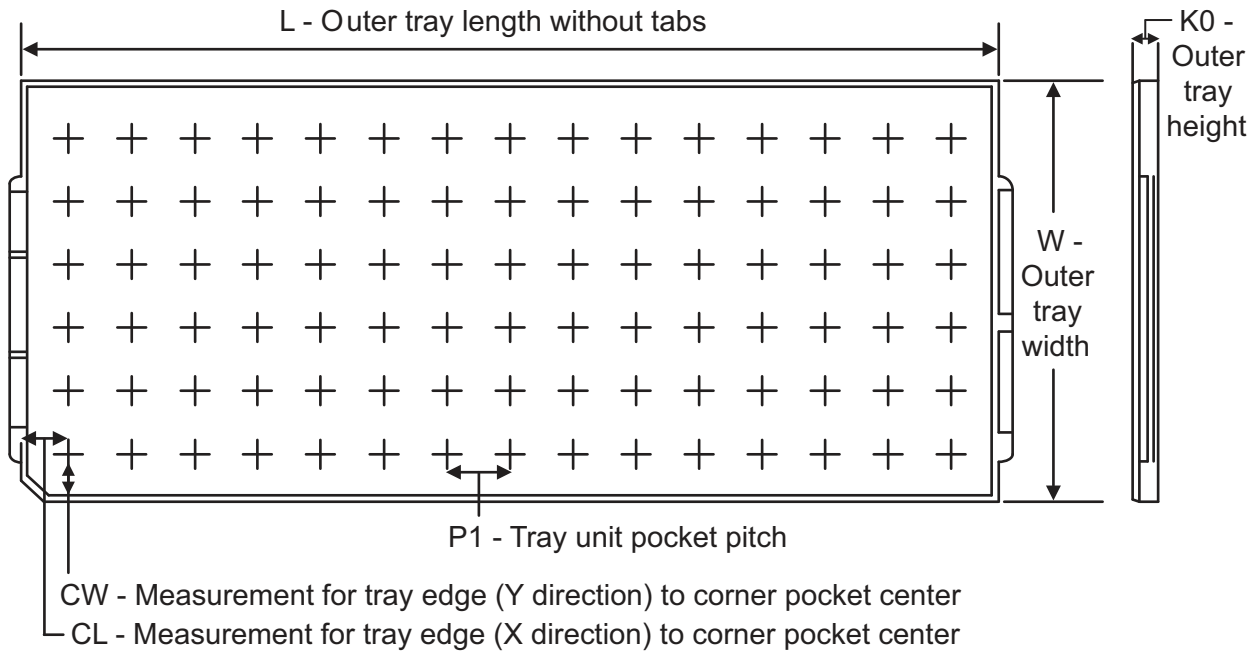
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

DATE	REVISION	NOTES
September 2024	*	Initial Release

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.

6.1 Tray Information

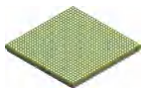


Chamfer on Tray corner indicates Pin 1 orientation of packed units.

Device	Package Type	Package Name	Pins	SPQ	Unit Array Matrix	Max Temp. (Deg C)	L (mm)	W (mm)	K0 (mm)	P1 (mm)	CL (mm)	CW (mm)
AFE8190IAMJ	FCBGA	AMJ	784	60	150	5 X 12	315	135.9	12.19	25.5	17.25	16.95

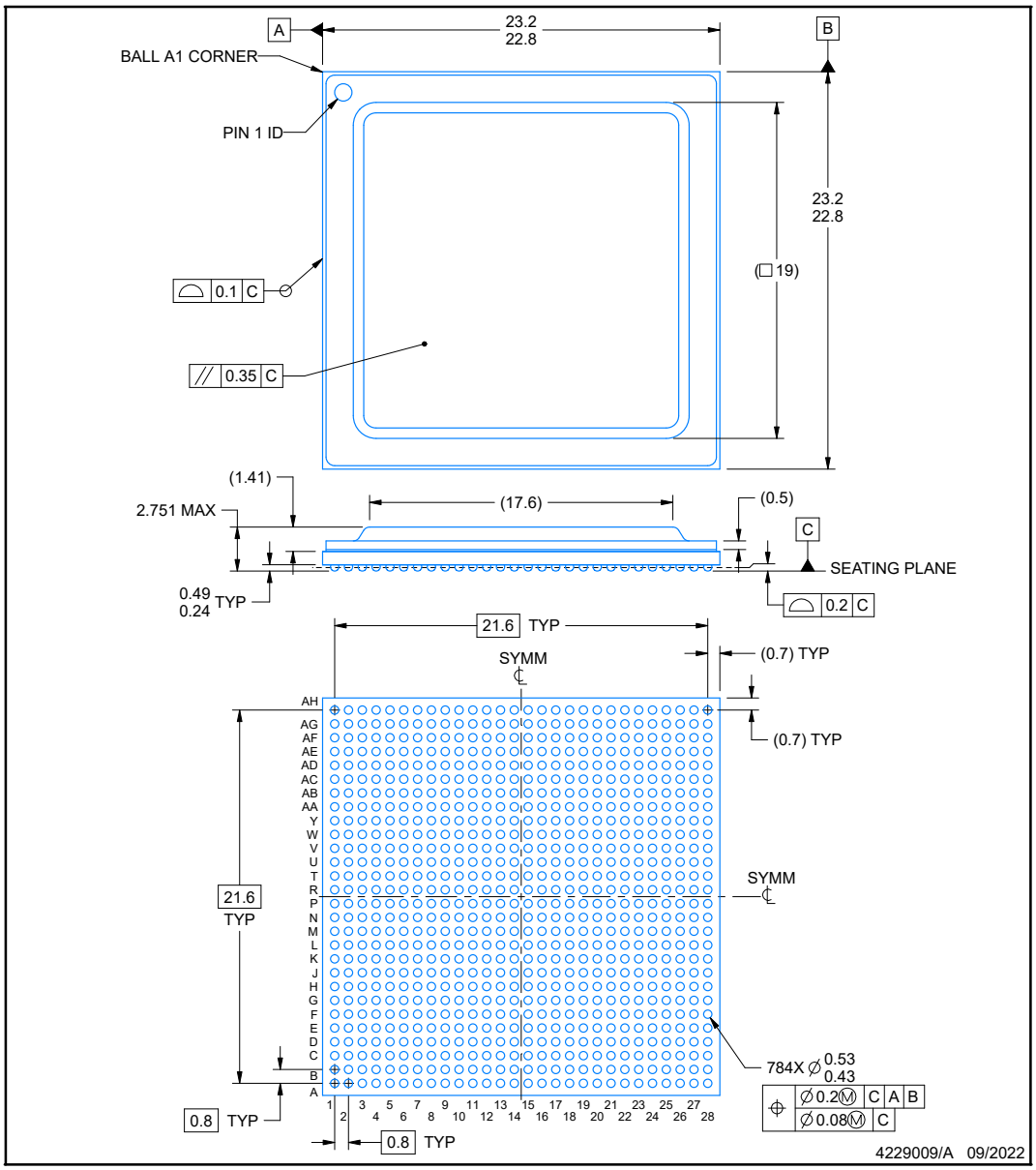
PACKAGE OUTLINE

AMJ0784A



FCBGA - 2.751 mm max height

FLIP CHIP BALL GRID ARRAY



NOTES:

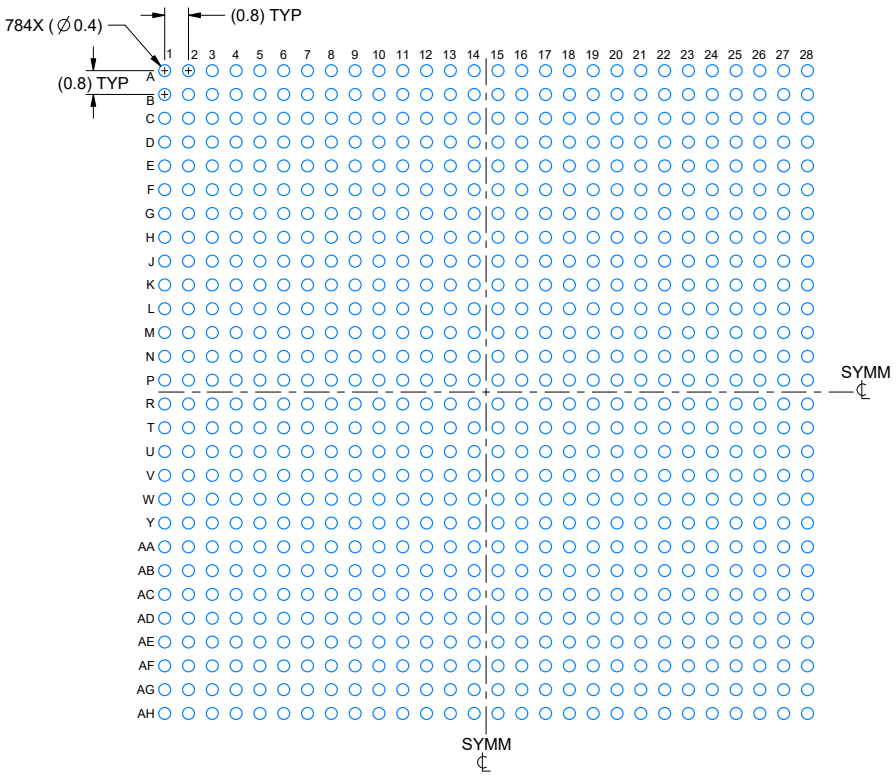
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

AMJ0784A

FCBGA - 2.751 mm max height

FLIP CHIP BALL GRID ARRAY



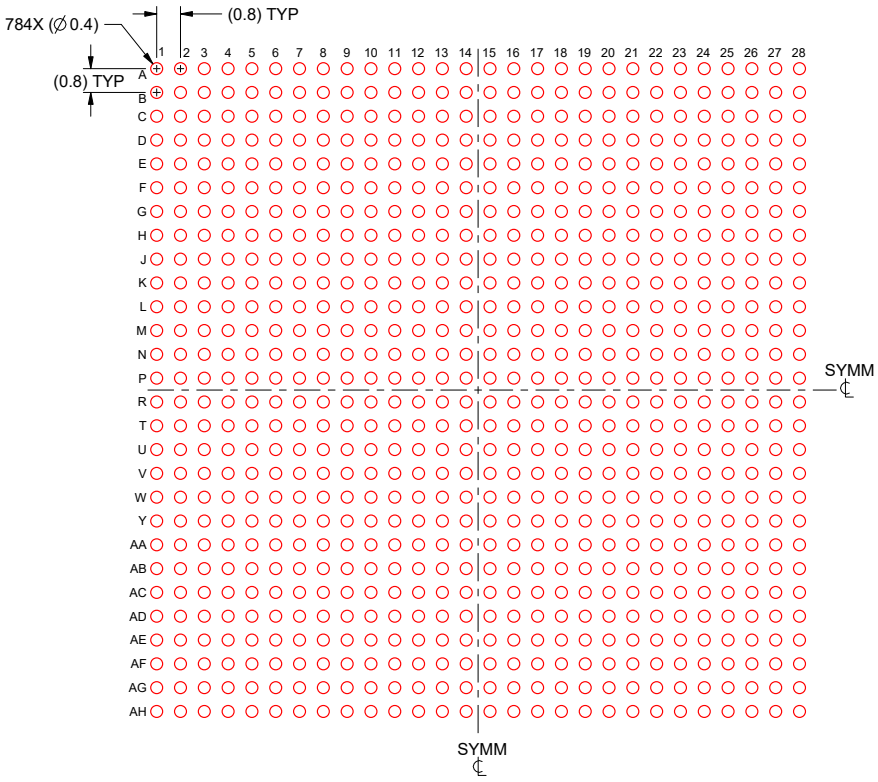
NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

AMJ0784A — **FCBGA - 2.751 mm max height**

FLIP CHIP BALL GRID ARRAY



SOLDER PASTE EXAMPLE
BASED ON 0.15 mm THICK STENCIL
SCALE:5X

4229009/A 09/2022

NOTES: (continued)

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

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)
AFE8190IAMJ	Active	Production	FCBGA (AMJ) | 784	60 | JEDEC TRAY (5+1)	Yes	SNAGCU	Level-3-260C-168 HR	-40 to 85	AFE8190

(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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Last updated 10/2025

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