

AFE4300 Low-Cost, Integrated Analog Front-End for Weight-Scale and Body Composition Measurement

1 Features

- Weight-scale front-end:
 - Supports up to four load cell inputs
 - On-chip load cell 1.7-V excitation voltage for ratiometric measurement
 - 68-nVrms Input-Referred noise (0.1 Hz to 2 Hz)
 - Best-fit linearity: 0.01% of full-scale
 - Weight-scale measurement : 540 μ A
- Body composition front-end:
 - Supports up to three tetra-polar complex impedance measurements
 - 6-Bit, 1-MSPS sine-wave generation digital-to-analog converter (DAC)
 - 247.5- μ Arms, \pm 20% Excitation source
 - 0.1- Ω Measurement RMS noise in 2-Hz BW
 - Body composition measurement : 970 μ A
- Analog-to-digital converter (ADC):
 - 16 Bits, 860 SPS
 - Supply current: 110 μ A

2 Applications

Weight scales with body composition measurements

3 Description

The AFE4300 is a low-cost analog front-end incorporating two separate signal chains: one chain for weight-scale (WS) measurement and the other for body composition measurement (BCM) analysis. A 16-bit, 860-SPS analog-to-digital converter (ADC) is multiplexed between both chains. The weight measurement chain includes an instrumentation amplifier (INA) with the gain set by an external resistor, followed by a 6-bit digital-to-analog converter (DAC) for offset correction, and a circuit to drive the external bridge/load cell with a fixed 1.7 V for ratiometric measurements.

The AFE4300 can also measure body composition by applying a sinusoidal current into the body. The sinusoidal current is generated with an internal pattern generator and a 6-bit, 1-MSPS DAC. A voltage-to-current converter applies this sinusoidal current into the body, between two terminals. The voltage created across these two terminals as a result of the impedance of the body is measured back with a differential amplifier, rectified, and the amplitude is extracted and measured by the 16-bit ADC.

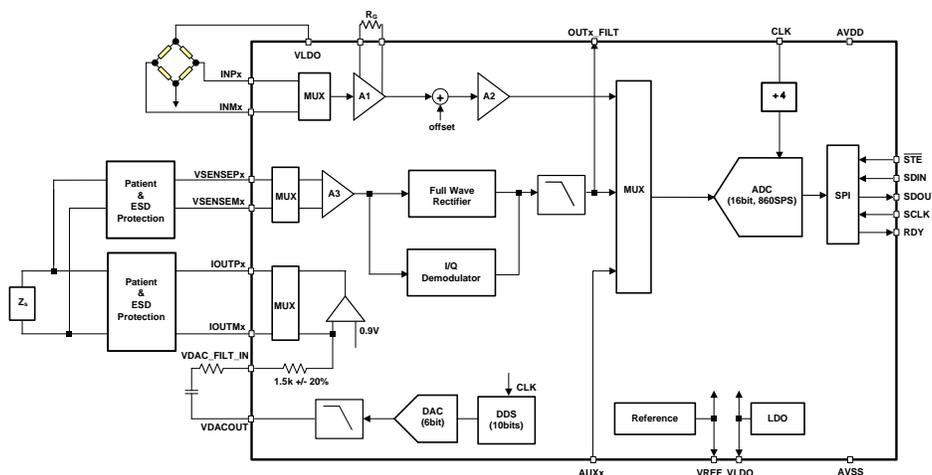
The AFE4300 operates from 2 V to 3.6 V, is specified from 0°C to +70°C, and is available in a LQFP-80 package.

Device Information⁽¹⁾

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------|-----------|---------------------|
| AFE4300 | LQFP (80) | 12.00 mm x 12.00 mm |

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

Functional Block Diagram



4 Device and Documentation Support

4.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* 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 Community Resources

The following links connect to TI community resources. Linked contents are 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](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

4.3 Trademarks

E2E is a trademark of Texas Instruments.
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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

[SLYZ022](#) — *TI Glossary*.

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

5 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/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| AFE4300PN | ACTIVE | LQFP | PN | 80 | 119 | Green (RoHS & no Sb/Br) | NIPDAU | Level-3-260C-168 HR | 0 to 70 | AFE4300 | Samples |
| AFE4300PNR | ACTIVE | LQFP | PN | 80 | 1000 | Green (RoHS & no Sb/Br) | NIPDAU | Level-3-260C-168 HR | 0 to 70 | AFE4300 | 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.

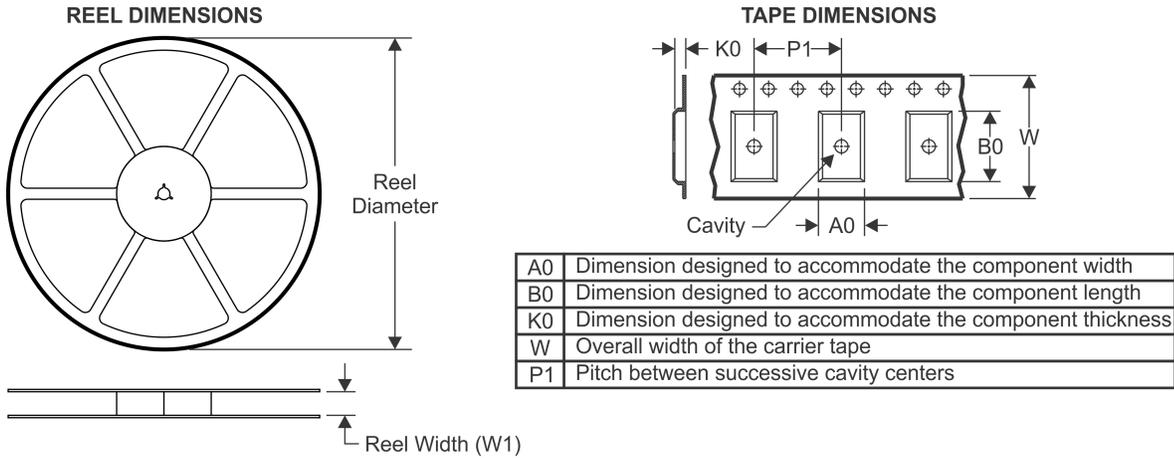
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

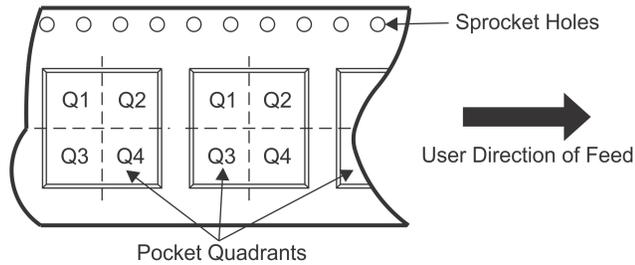
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TAPE AND REEL INFORMATION



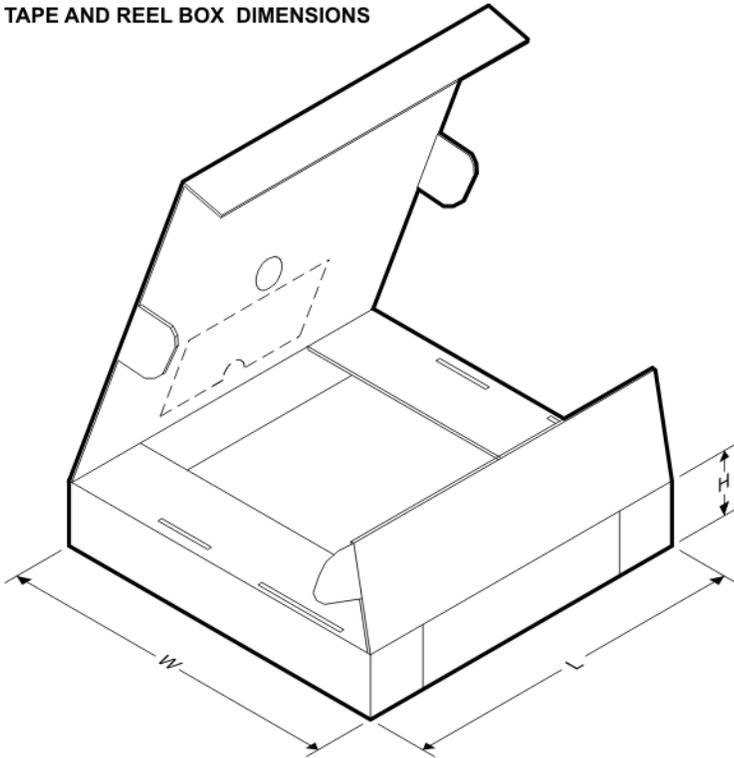
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| AFE4300PNR | LQFP | PN | 80 | 1000 | 330.0 | 24.4 | 16.0 | 16.0 | 2.0 | 24.0 | 24.0 | Q2 |

TAPE AND REEL BOX DIMENSIONS

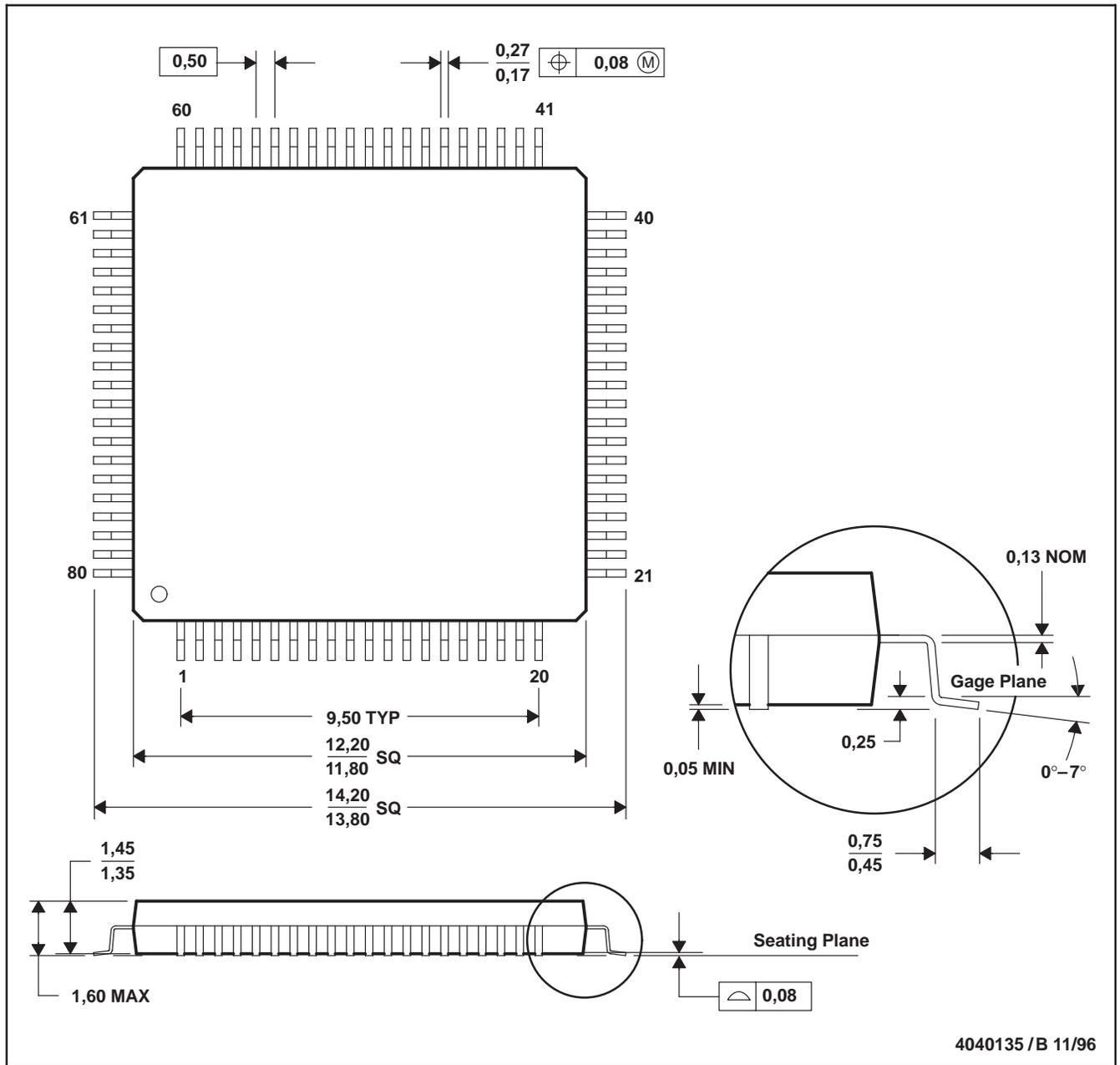


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| AFE4300PNR | LQFP | PN | 80 | 1000 | 367.0 | 367.0 | 55.0 |

PN (S-PQFP-G80)

PLASTIC QUAD FLATPACK



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-026

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