Integrated Analog Front-End for Heart Rate Monitors and Low-Cost Pulse Oximeters

Check for Samples: AFE4400

FEATURES

- **Fully-Integrated Analog Front-End for Pulse Oximeter Applications:**
  - **Flexible Pulse Sequencing and Timing Control**
- **Transmit:**
  - **Integrated LED Driver (H-Bridge or Push/Pull)**
  - **95-dB Dynamic Range**
  - **LED Current:**
    - **Programmable to 75 mA with 8-Bit Current Resolution**
  - **Low Power:**
    - **100 µA + Average LED Current**
  - **Programmable LED On-Time**
  - **Independent LED2 and LED1 Current Reference**
- **Receive Channel with High Dynamic Range**
  - **13 Noise-Free Bits (0.1 Hz to 5 Hz)**
  - **Low Power: < TBD mA at 3.3-V Supply**
  - **Flexible Receive Sample Time**
  - **Flexible Transimpedance Amplifier with Programmable LED Settings**
  - **Integrated Digital Ambient Estimation and Subtraction**
- **Integrated Fault Diagnostics:**
  - **Photodiode and LED Open and Short Detection**
  - **Cable On/Off Detection**
- **Supplies:**
  - **Rx = 2.0 V to 3.6 V**
  - **Tx = 3.0 V or 3.6 V**
- **Package: Compact QFN-40 (6 mm × 6 mm)**
- **Specified Temperature Range: 0°C to +70°C**

APPLICATIONS

- **Low-Cost Medical Pulse Oximeter Applications**
- **Optical HRM**
- **Industrial Photometry Applications**

DESCRIPTION

The AFE4400 is a fully-integrated analog front-end (AFE) that is ideally suited for pulse oximeter applications. The device consists of a low-noise receiver channel with an integrated analog-to-digital converter (ADC), an LED transmit section, and diagnostics for sensor and LED fault detection. The AFE4400 is a very configurable timing controller. This flexibility enables the user to have complete control of the device timing characteristics. To ease clocking requirements and provide a low-jitter clock to the AFE4400, an oscillator is also integrated that functions from an external crystal. The device communicates to an external microcontroller or host processor using an SPI™ interface.

This AFE4400 is a complete AFE solution packaged in a single, compact QFN-40 package (6 mm × 6 mm) and is specified over the operating temperature range of 0°C to +70°C.

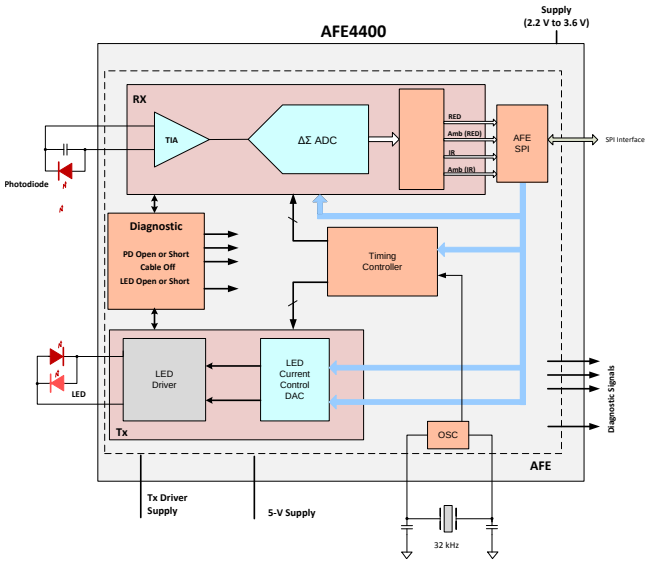

Figure 1. Block Diagram

PRODUCT PREVIEW

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PACKAGING INFORMATION

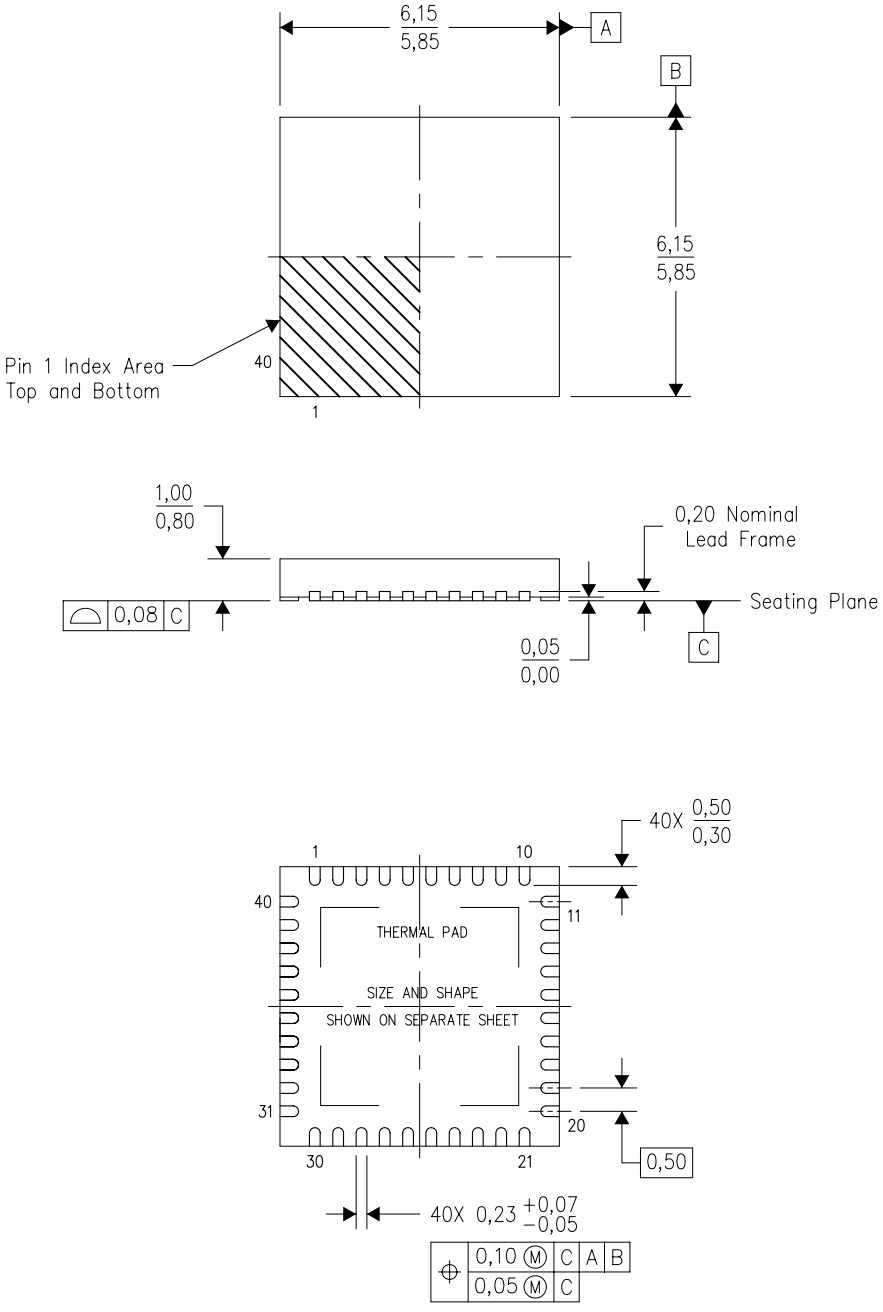
Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
AFE4400RHAR	PREVIEW	VQFN	RHA	40	2500	TBD	Call TI	Call TI	
AFE4400RHAT	PREVIEW	VQFN	RHA	40	250	TBD	Call TI	Call TI	

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

RHA (S–PVQFN–N40) PLASTIC QUAD FLATPACK NO–LEAD



Bottom View

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NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. QFN (Quad Flatpack No–Lead) Package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
F. Package complies to JEDEC MO–220 variation VJJD–2.

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